Panayiotis Vlamos   *Editor*

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To my son, Michail, who is always motivating me.

Preface

The **4th World Congress** on *Genetics, Geriatrics and Neurodegenerative Diseases Research* (**GeNeDis 2020**) focuses on the latest major challenges in scientific research, new drug targets, development of novel biomarkers, new imaging techniques, novel protocols for early diagnosis of neurodegenerative diseases, and several other scientific advances, with the aim of better and safe health aging. The increase in the average length of life leads to the development of various diseases in the elderly population. This volume focuses on the sessions from the conference on Geriatrics.

Corfu, Greece

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He has received many awards and has authored more than 250 papers in scientific journals and conference proceedings, as well as 16 educational books. BiHELab's goal is to help bridge the translation gap from data to models and from models to drug discovery and personalized therapy, promoting collaborations and developing novel approaches to biological and clinical problems, using high-performance computational methods.

Professor Panayiotis Vlamos is a pioneer at the evaluation, improvement, and application of digital and computational biomarkers, while he first introduced the notion of meta-biomarkers.

Stratification of Patients with Chronic Obstructive Pulmonary Disease Using Volatile Organic Compounds

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Abstract

Chronic obstructive pulmonary disease (COPD) is a common disease that causes long-term disability and death. Its natural history is punctuated by acute worsening of symptoms, called exacerbations, which are associated with increased mortality and hospitalization. In this work, we aim to stratify patients with COPD based on their risk for exacerbation; for this purpose, we employ non-invasive biomarkers, that is, volatile organic compounds (VOCs), acquired from the patients' exhaled breath coupled with their spirometry and age. We utilize a series of classification schemes with the best performing one achieving overall Accuracy = 93.5%. The yielded results are, therefore, encouraging and prompt for further investigation toward the utilization of VOCs in the management of COPD.

Keywords

Chronic obstructive pulmonary disease · COPD · Emphysema · Chronic bronchitis · Volatile organic compounds · VOCs · Exacerbation · Feature selection · Classification

1 Introduction

Chronic obstructive pulmonary disease (COPD) is chronic inflammatory disease-causing breathing difficulties; emphysema (damage to the air sacs of the lungs) and chronic bronchitis (long-term inflammation of the airways) comprise COPD pathophysiology causing a wide array of symptoms. The most common symptoms are cough, primarily productive, shortness of breath that is worse on exertion, therefore, causing limitation of physical activities and frequent respiratory tract infections. The predominant cause of COPD is tobacco smoking; however, air pollution and occupational exposure to certain chemicals and fumes increase the risk of developing COPD in smokers and non-smokers [14].

COPD poses a major health challenge from several perspectives; the symptoms of the disease that *are progressive* affect the day-to-day activities of the patients suffering from COPD leading to significant limitations and low quality of life. Subsequently, this also poses a significant load to their families especially in the last stages of the disease where the patients need more help with daily activities and self-care, coupled with the psychological burden. Moreover, COPD patients,

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especially in the late stages of the disease often suffer a spiral of infections and hospitalizations that impose considerable burden to the healthcare system overall. It should be highlighted that COPD is currently the fourth leading cause of death worldwide and in terms of cost is one of the most expensive conditions accounting for approximately 6% of the total annual healthcare budget in the European Union.

The course of the disease over time is marked by acute *worsenings* called exacerbations that are associated with increased hospitalizations, mortality and account for the greatest proportion of the total COPD burden on the healthcare system. Therefore, it is of utmost importance to identify the patients *that* are at high risk of having exacerbations and if possible identify early such events, in order to treat them early and/or adjust treatment to prevent future exacerbations. To this end, several risk stratification tools have been proposed in the literature featuring several biomarkers aiming to identify those patient subgroups that have higher risk for exacerbations, yet their utilization in clinical practice remains minimal.

Potential candidate biomarkers are volatile organic compounds (VOCs) that have been around for several years, but their utilization has been hampered by lack of standardization and validation. The exhaled breath consists of inorganic compounds (O_2, CO_2, and NO), nonvolatile organic compounds (isoprostane, leukotrienes, cytokines, and H_2O_2), and volatile organic compounds [4]. VOCs are the products of human metabolism and constitute a diverse group of carbon-based chemicals that are volatile at room temperature. VOCs are captured from the exhaled breath of patients and represent certain pathophysiological processes in the body. Moreover, the use and refinement of sensitive chemical methodologies such as gas chromatography and mass spectrometry have led to the capture and quantification of VOCs with considerable accuracy.

VOCs have been employed in a large number of studies and applications in healthcare and elsewhere. In the healthcare setting, VOCs have been used for the diagnosis of several conditions, for example, type II diabetes [7], Alzheimer's disease [13]; they have been associated with certain cancer types, such as breast cancer [1, 5], oral cancer [9], and lung cancer [2, 6, 10]. Due to the affinity of VOCs with the respiratory system, several applications have also been presented pertaining to pulmonary diseases. Specifically, [17] is a systematic review regarding the clinical use of VOCs especially in terms of diagnosis and monitoring in several respiratory-related diseases: asthma, COPD, cystic fibrosis, lung cancer, tuberculosis, mesothelioma, etc. The majority of studies focuses on asthma and lung cancer, and only sporadic applications in COPD exist; some exemplar applications are the following: discrimination between COPD patients and healthy nonsmokers [16], as well as between COPD patients undergoing exacerbation and stable COPD patients, differentiation between bacterial and viral infections in COPD patients [11].

In this study, we evaluated a decision support system utilizing VOCs as input aiming to stratify patients with COPD into two categories based on their risk of exacerbations. Based on their risk for exacerbation, patients can be managed more effectively, either by avoiding unneeded visits in low-risk patients or by monitoring more closely high-risk patients.

2 Materials and Methods

2.1 Study Design

In this study, we have enrolled 27 patients, all diagnosed with COPD of variable severity. From these patients, we have acquired breath samples using the RTubeVOC tubes. All samples have been collected during the steady state of the patients, none presenting any symptoms pertaining to an exacerbation. Moreover, during the same visit, spirometry was also performed. Each patient has been subsequently assigned as high or low risk, based on a composite index of their exacerbation history and higher blood eosinophil counts, both within the past year. Specifically, patients with two or more moderate/severe exacerbations and blood eosinophil count ≥300 cells/ μL were assigned in the high-risk group, whereas

Table 1 Characteristics of the two patient subgroups

Variable	High risk	Low risk
Age	69 (±2)	67.9 (±7.3)
Sex (male/female)	4/0	23/1
Eosinophils (cells/μL)	447.5 (±61.8)	185.2 (±101)
FEV1%	33 (±23.6)	52.5 (±15.5)
FVC %	48 (±20.3)	66.4 (±13.8)
FEV1/FVC	49.3 (±14.2)	59.7 (±9)
FEF25-75%	32.3 (±41.5)	29.4 (±16.9)
Exacerbations	3.3 (±1.4)	0.7 (±1)

the rest were assigned to the low-risk group. The specific characteristics of the two groups are shown in Table 1.

2.2 Data Extraction

The samples were collected with special RTubeVOC tubes. These tubes are strictly single-exhalation devices and use two single-direction valves to maintain the one-way flow throughout the breathing cycle as the person exhales through the mouthpiece. It has a capacity of 65 ml with the aim of expelling the first fractions of exhaled air and trapping the last fraction that is representative of the internal lung. It consists of the tube which is made of polypropylene, the spout made of polyethylene, the stoppers that serve to trap the air and prevent losses and are made of medical vinyl, the adjustment valve made of silicone rubber (FDA approved components) and from two interventions in the form of a ring with circular cross-section used to seal the connection to the tube. All patients exhaled through the tube for 6 s in order to collect the last part of the exhalation. Then the tube remains sealed in order to prevent alterations in the composition of the air sample.

Samples must be strictly processed within 2 h otherwise the volatile compounds are deposited on the walls of the tube resulting in significant losses. The adsorption of the VOCs to be analyzed is done by the solid phase micro-extraction method (SPME). For the adsorption, a fiber made from a combination of divinylbenzene/carboxene/polydimethylsiloxane (CAR/DVB/PDMS) and diameter 30/50 μm is used.

Before extracting VOCs, it is necessary to pre-process the fiber in order to clean it for avoiding impurities that may cause noise in the chromatogram. The pre-treatment of the fiber is done in the gas chromatography machine combined with mass spectrometer (Trace GC Ultra, Thermo Scientific-ISQ-Single Quadrupole-Thermo Scientific) with capillary column He (99.999%), which was selected as the carrier of gas and its flow rate was 2 ml/min that is going to be used for the analysis of samples as well. The pre-treatment stage includes heating the fiber to 200 °C for 2 h. After pre-treatment, the fiber is introduced into the sample through the adjustment valve. The system is sealed at the interconnection point with parafilm to minimize sample losses. The VOCs in the sample are adsorbed by the fiber for 37 min. Then the fiber is exposed to the gas chromatography machine injection system where the fiber-absorbed compounds are absorbed. In order for the VOCs to be absorbed, the temperature of the column is initially at 40 °C for 2 min. Then there is an increase in temperature from 7 °C/min to 200 °C and from that point the temperature rises 20 °C/min to 230 °C where it is kept for 3 min and maintaining the same rate, it reaches 270 °C and is kept there for 5 min. The total duration of the chromatographic analysis was 37 min. The temperature of the injection point was 200 °C and of the interface point was 285 °C.

For the formation of the ions of the analyzers, gas phase source of electron impact was used, and positive ionization took place. The voltage applied to accelerate electrons was 70 eV. The source temperature was 250 °C. The mass spectrometer consists of a simple tetrapolar mass analyzer (ISQ-Single Quadrupole-Thermo Scientific). The analysis was carried out with the function of the full scan and 0.5 s scan time. The range of mass area was 35–200 amu.

After the non-targeted GC/MS analysis, a chromatogram is received with peaks, which has different areas, retention times (rts), and heights corresponding to compounds. The raw data (area and rt) from the chromatograms were used for the subsequent analysis.

2.3   Data Preprocessing

The aforementioned procedure results in eight features that are used along with spirometry and age in the next steps of our methodology. Besides the small number of patients in our dataset, the most significant issue is the class imbalance. For this purpose, we applied Synthetic Minority Oversampling Technique (SMOTE) [3]. It should be highlighted that SMOTE is not applied a priori but as an intermediate step of the classification in order to avoid any bias. Next, we either employ the entire feature vector as is, or use two feature selection techniques, namely, Correlation-based Feature Selection [8] and the Wrapper algorithm [12]. Same as with the SMOTE algorithm, for bias purposes feature selection is applied as part of the classification process.

2.4   Classification

The resulting feature vectors are fed as input to a series of classification algorithms [15], specifically, Bayes Network (BN), Naive Bayes (NB), Artificial Neural Networks (ANN), Support Vector Machines (SVM), AdaBoostM1, Decision Tree (DT), and Random Forests (RF). All algorithms, both for preprocessing as well as for classification have been run using the Weka workbench (2017).

3   Methodology

Figure 1 depicts the steps followed in the methodology described in this work. Specifically, we employ a set of COPD patients that have been labeled as high and low risk based on their exacerbation propensity. Exhaled breath is captured from these patients and is subject to certain steps involving gas chromatography coupled with mass spectrometry in order to extract a set of meaningful features representing the VOCs in the patients' breath. The resulting VOCs along with each patient's spirometry and age comprise the feature vector that is used in the next steps of the methodology. Specifically, we deal with the class

imbalance in the dataset by applying the SMOTE algorithm and then feature selection is performed. Next, we perform supervised classification, aiming to discriminate between the patients of the two classes.

4   Results and Discussion

As mentioned previously, we have utilized the feature vector either unchanged, that is, without performing any sort of feature selection or we have applied feature selection using two popular algorithms, namely: CFS and Wrapper. Next, we utilized seven classification algorithms in order to discern the patients of the two classes. For evaluation purposes, we have calculated the following performance metrics: Sensitivity, Specificity, Accuracy, and AUC (area under ROC curve). The results gained with each of these classification schemes are shown in three consecutive tables; specifically, Table 2 shows the results obtained without performing feature selection, Table 3 contains the results obtained after applying the CFS algorithm for feature selection, and Table 4 shows the respective results yielded after applying the Wrapper algorithm.

The features maintained by the CFS algorithm are the following: Age, FVC %, Area 7_94, Area 14_63.

Since the Wrapper algorithm is tailored to the classification algorithm invoked, different feature sets are retained. Specifically, with Bayes Network the following features are maintained: FEV1 (L), FEV1%, FVC %, Area 7_94, Area 14_63; with Naive Bayes: Age, Area 7_94, Area 8_29, Area 14_63; with ANN: FEV1%, FVC %, FEV1/FVC, FEF25-75 (L), Area 9_36, Area 14_63; with SVM: Age, FEV1 (L), FVC %, FEV1/FVC, FEF25-75 (L), FEF25-75%, Area 10_77; with AdaBoostM1: Area 7_94, Area 10_77, Area 11_26; with Decision Tree: Area 7_94; and with Random Forests: FEV1%, FEF25-75 (L), Area 7_94.

We observe that the best performance is achieved when the entire feature vector is fed as input to the Naive Bayes algorithm, yielding overall Accuracy = 93.5% and AUC = 0.983.

Fig. 1 Flowchart of the proposed methodology
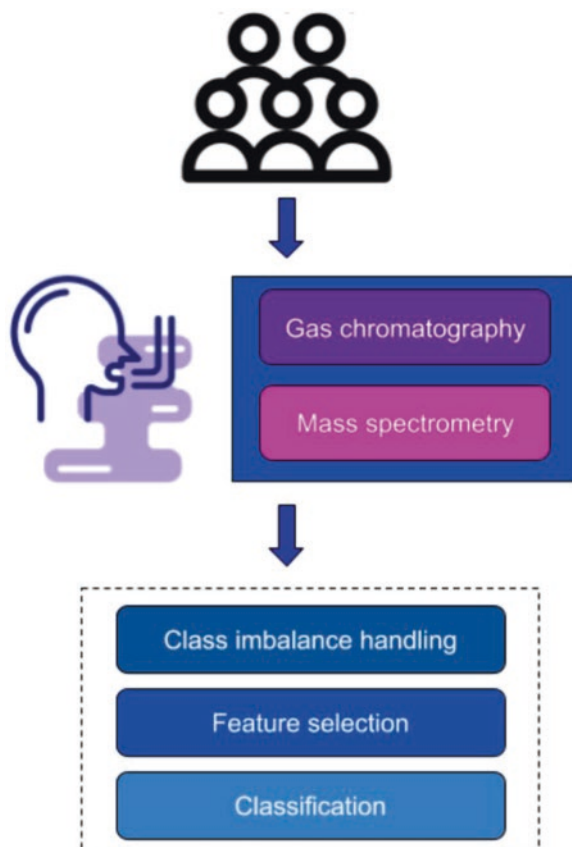
Table 2 Results obtained without performing feature selection

Classification algorithm	Accuracy (%)	Sensitivity (%)	Specificity (%)	AUC
Bayes Network	87	95.7	78.3	0.898
Naive Bayes	93.5	100	87	0.983
ANN	78.3	91.3	65.2	0.851
SVM	84.8	91.3	78.3	0.848
AdaBoostM1	87	95.7	78.3	0.934
Decision Tree	87	91.3	82.6	0.826
Random Forest	84.8	91.3	78.3	0.915

Table 3 Results obtained after applying the CFS algorithm for feature selection

Classification algorithm	Accuracy (%)	Sensitivity (%)	Specificity (%)	AUC
Bayes Network	84.8	87	82.6	0.886
Naive Bayes	89.1	100	78.3	0.904
ANN	60.9	65.2	56.5	0.628
SVM	54.3	39.1	69.6	0.543
AdaBoostM1	76.1	91.3	60.9	0.879
Decision Tree	82.6	91.3	73.9	0.821
Random Forest	76.1	87	65.2	0.914

Table 4 Results obtained after applying the Wrapper feature selection algorithm

Classification algorithm	Accuracy (%)	Sensitivity (%)	Specificity (%)	AUC
Bayes Network	80.4	87	73.9	0.881
Naive Bayes	87	95.7	78.3	0.960
ANN	76.1	69.6	82.6	0.864
SVM	76.1	78.3	73.9	0.761
AdaBoostM1	73.9	87	60.9	0.886
Decision Tree	82.6	87	78.3	0.880
Random Forest	82.6	87	78.3	0.938

Overall, the best results are obtained when no feature selection algorithm is applied. This is to be expected as the feature vector is relatively small and does not add significant complexity to the task under consideration. However, if the features pinpointed by the two algorithms are observed indifferent to the final outcome, we can see that the following features are more frequently maintained: FVC (%), Area 7_94, Area 14_63, FEV1 (L), FEV1%, and Area 10_77. Even though the results are quite encouraging, this can be partly attributed to the limited number of patients enrolled, leading to overtraining. Therefore, these preliminary results are yet to be validated with richer and more diverse patient sets.

It is important that all features used throughout the aforementioned methodology constitute non-invasive biomarkers that can be easily attained in an outpatient clinic. The standardization remains currently under fine-tuning but based on the obtained results, it could be an interesting and promising prospect.

5 Conclusion

In this chapter, we present a methodology utilizing non-invasive biomarkers for the identification of COPD patients that are at higher risk of having exacerbations over the course of the disease. Using VOCs coupled with spirometry, we developed a classification scheme that is able to pinpoint high-risk patients with significant accuracy. Nevertheless, further validation is needed in order to port this methodology in the clinical practice.

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Evidence-Based Leadership: A Study of Its Application to General Hospital of the Public Health System Through the Implementation Leadership Scale

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Abstract

Background: Evidence-based practice (EBP) is about integrating scientifically proven effective methods into clinical practice by healthcare professionals in the context of patient care. This approach is being studied extensively by the scientific community because of its positive effects on patients and on the health system. The aim of the study was to investigate the degree of implementation of evidence-based leadership in Greek public hospitals.

Methods: This is a cross-sectional study. The sample of the study consisted of 213 nurses who worked to two large public hospitals of Athens, Greece. The Implementation Leadership Scale (ILS) used for data collection. The SPSS v. 24. was used to analyze the data.

Results: Most of participants were females (89.7%), aged 31–40 years (38.5%), married (74.8%), were RN (68.1%), and had more than 10 years of work experience (63.9%). About half of participants (40.4%) supported that the head nurse has taken in a great extent the necessary measures to facilitate evidence-based clinical care, thus positively affecting its implementation. About one third of participants (35.2%) considered that their head nurses are well informed. The more knowledge nurses have about evidence-based clinical care, the greater their prevention ($r = 0.852$, $p < 0.05$) and the more persistent they are in implementing it despite any difficulties ($r = 0.796$, $p < 0.05$).

Conclusions: Knowledgeable, supportive, proactive, and persistent leadership positively influences the implementation of evidence-based practice. The hospital managers, and especially head nurses, are able to promote the implementation of evidence-based care.

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1 Introduction

Modern nursing focuses on providing more and more quality care to patients. Healthcare organizations operate with a view to meeting patients' needs and promoting health. In this context, there is an urgent need to study current research data in relation to practices that are more effective in patient care [7]. Evidence-based practice (EBP) is about integrating scientifically proven effective methods into clinical practice by healthcare professionals in the context of patient care. This approach is being studied extensively by the scientific community because of its positive effects on patients and on the health system. EBPs are associated with increased patient safety, improved clinical outcomes, reduced costs of medical care, and reduced relapses and fluctuations of health status of patients [4].

The investigation of the factors that influence the implementation of EBP highlights the great importance of the organization and its leadership. In healthcare organizations, leadership is responsible for the nursing practice and the quality of care provided to patients. In this context, leadership is approached as a key factor in the implementation, support and stay of the EBP within the nursing department. Nursing leaders influence this implementation through their knowledge, behaviors, decisions, and how they communicate with nurses [2, 3]. The influence that leadership has on EBP implementation is one of the research objects of the modern scientific community. This study can highlight the strengths and weaknesses of managers and lead to identifying solutions that can contribute to improving the services provided to patients [1].

2 Materials and Methods

2.1 Aim

The aim of this study was to investigate the degree of implementation of evidence-based leadership in Greek public hospitals.

Research questions:

- To what extent do hospital nurse managers influence the implementation of evidence-based care?
- To what extent do hospital nurse managers know evidence-based care [11]?
- To what extent does nurse managers' knowledge of evidence-based clinical care influence the prevention of difficulties in that type of care and their persistence in implementing it [13]?

2.2 Study Design

This is a cross-sectional study.

2.3 Participants

The sample of the study consisted of 213 nurses who worked to two large public hospitals of Athens, Greece (response rate = 85.2%).

2.4 Tools

The tool used to collect the data is the Implementation Leadership Scale (ILS), a self-report questionnaire developed by Aarons et al. [1] and assesses the leadership style of the supervisors/managers. The questionnaire has been translated in Greek language and has been validated in Greek population by Tsounis. The first part consists of six closed-ended questions related to gender, age, marital status, educational level, work experience, and the type of clinic/department in which the respondents work. The second part consists of four dimensions, namely, proactive leadership, knowledgeable leadership,

supportive Leadership, and perseverant leadership, where each dimension consists of three Likert-type questions (12 questions in total).

The reliability of the leadership's dimensions was high. In particular, the Cronbach's Alpha of proactive leadership dimension was 0.934, the Cronbach's Alpha of knowledgeable leadership dimension was 0.940, the Cronbach's Alpha of supportive leadership dimension was 0.940 and the Cronbach's Alpha of perseverant leadership dimension was 0.900. The total reliability of the ILS was found very high (Cronbach's Alpha = 0.971).

2.5   Statistical Analysis

The SPSS v. 24. Statistical package was used to analyze the data. More specifically, descriptive statistics used percentages, mean values, and standard deviations. Inductive statistics were then performed using t-test and one-way ANOVA analysis. In addition, the Pearson correlation coefficient was used. The significance level was set at 0.05.

3   Results

Table 1 presents the demographics and occupational characteristics of participants. Most of participants were females (89.7%), aged 31–40 years (38.5%), married (74.8%), were RN (68.1%), and had more than 10 years of work experience (63.9%).

3.1   Implementation Leadership Scale (ILS)

Table 2 presents the answers of participants to ILS. About half of participants (40.4%) supported that the head nurse has taken in a great extent the necessary measures to facilitate evidence-based clinical care, thus positively affecting its implementation. Head nurses have a significant influence on the implementation of evidence-based care, as they have developed a

Table 1 Demographics and occupational characteristics of patients

Variables	N	$\%$
Gender		
Males	22	10.3
Females	191	89.7
Age, years		
<30	18	8.5
31–40	82	38.5
41–50	75	35.2
>50	38	17.8
Marital status		
Married	154	74.8
Unmarried	52	25.2
Education level		
Secondary school	68	31.9
University/college	108	50.7
Master	37	17.4
Work experience, years		
<3	12	5.6
3–6	22	10.3
7–10	43	20.2
>10	136	63.9
Type of clinic		
Medical	102	47.9
Surgical	111	52.1

clear plan to facilitate it, removing any obstacles and making clear the requirements for the department to function smoothly (Table 3). About one third of participants (35.2%) considered that their head nurses are well informed. Nursing managers' knowledge of evidence-based clinical care varies from high to very high (Table 3).

The more knowledge nurses have about evidence-based clinical care, the greater their prevention ($r = 0.852$, $p < 0.05$) and the more persistent they are in implementing it despite any difficulties ($r = 0.796$, $p < 0.05$). The results of the correlations are presented in Table 4.

4   Discussion

In this study, the role of supervisors in relation to evidence-based clinical care was investigated. So, we used the ILS on nurses from two public hospitals in Athens. The results of the study showed that the majority of nurses feel that their supervisor/head nurse has developed to a large

Table 2 Answers of participants to ILS

	Not at all	Slight extent	Moderate extent	Great extent	Very great extent
Proactive leadership					
The supervisor has established clear	22	22	46	77	46
standards for implementation of EBP	(10.3%)	(10.3%)	(21.6%)	(36.2%)	(21.6%)
The supervisor has developed a plan to	23	20	32	84	54
facilitate EBP implementation	(10.8%)	(9.4%)	(14.6%)	(39.6%)	(25.5%)
The supervisor has removed obstacles	25	19	48	83	38
to implementation of EBP	(11.7%)	(8.9%)	(22.5%)	(39%)	(17.8%)
Knowledgeable leadership					
The supervisor knows what he/she is	16	19	26	63	89
taking about when it comes to EBP	(7.5%)	(8.9%)	(12.2%)	(29.6%)	(41.8%)
The supervisor is knowledgeable about	13	19	25	57	99
EBP	(6.1%)	(8.9%)	(11.7%)	(26.8%)	(46.5%)
The supervisor is able to answer staff	12	20	34	53	94
questions about EBP	(5.6%)	(9.4%)	(15.9%)	(24.9%)	(44.2%)
Supportive leadership					
The supervisor supports employee	17	15	23	64	94
efforts to use EBP	(8%)	(7%)	(10.8%)	(30%)	(44.2%)
The supervisor supports employee	12	17	20	69	95
efforts to learn more about EBP	(5.6%)	(8%)	(9.4%)	(32.4%)	(44.6%)
The supervisor recognizes and	14	21	18	72	88
appreciates employee efforts	(6.6%)	(9.9%)	(8.5%)	(33.8%)	(41.2%)
Perseverant leadership					
The supervisor perseveres through the	17	25	38	77	56
ups and downs of implementing	(8%)	(11.7%)	(17.8%)	(36.2%)	(26.3%)
The supervisor carries on through the	22	19	35	79	58
challenges of implementing EBP	(10.3%)	(8.9%)	(16.4%)	(37.1%)	(27.3%)
The supervisor reacts to critical issues	21	15	36	71	70
regarding implementation of EBP	(9.9%)	(7%)	(16.9%)	(33.3%)	(32.9%)

Table 3 Scores of perseverant leadership and knowledgeable leadership

Score	Not at all	Slight extent	Moderate extent	Great extent	Very great extent
Perseverant leadership	26	25	51	86	25
	(12.2%)	(11.7%)	(23.9%)	(40.4%)	(11.7%)
Knowledgeable leadership	16	22	34	75	66
	(7.5%)	(10.3%)	(16%)	(35.2%)	(31%)

Table 4 Pearson correlation

		Score proactive leadership	Score perseverant leadership
Score knowledgeable leadership	Pearson correlation	0.852	0.796
	Sig. (2-tailed)	0.000	0.000
	N	213	213

extent a clear plan to facilitate evidence-based clinical care, and has removed the obstacles of care to the same extent. These nurses' responses relate to preventive leadership. This finding is in line with those of other studies examining the factors that drive nurses to implement evidence-based practice. One of these studies is that of Melnyk et al. [10]. The results of the study

showed that nurses place great importance on the decision-making of their supervisors/head nurses. In particular, it was reported that nurses who evaluate that their supervisors have created the appropriate EBP decision-making climate, have positive attitudes about EBP and its implementation. Therefore, supervisors' preventive work is positively related to the provision of evidence-based care by nurses [10].

Furthermore, the results of our study indicate that the supervisors are well informed on relevant issues. In particular, we found that the majority of them are very aware of what evidence-based clinical care is, are able to provide any answer to it, and they know very well what they are talking about when it comes to such issues. Leaders' knowledge of EBP issues is one of the elements that is positively related to its application in clinical practice. What is being argued is that leaders trained in EBP are aware of the principles and how they are implemented and promote this observation in nurses [8]. The role of knowledgeable leadership in evidence-based care is also highlighted in the study by Aaron et al. [2, 3] that included healthcare professionals working on psychotropic drug release structures. In this study, the ILS questionnaire was used. The results of the study showed that the supervisors/managers of healthcare professionals are informed about the implementation of the EBP.

Another finding of this study concerns the supportive leadership of supervisors. We found that the majority of nurses' managers largely recognize employees' efforts to successfully implement clinical care while supporting their efforts to enhance their knowledge and thus the use of clinical-based care. The relationship between leadership support and EBP implementation is identified by the international scientific community. The meta-analysis of Gifford et al. [5] found that supportive behaviors and actions of leaders are positively related to the implementation of evidence-based care by healthcare professionals. More specifically, professionals who evaluate their supervisors/managers as supportive are more likely to apply EBP. Also, the implementation of supportive activities, such as short information and training courses by the

supervisors, also contribute positively to the implementation of the EBP. The results of the meta-analysis, as well as the results of this study, lead to the conclusion that supportive leaders make a positive contribution to evidence-based care.

With regard to perseverant leadership, nurses considered their supervisor sufficiently persistent in implementing clinical care despite any difficulties, trying to help overcome them and usually respond effectively to any problems. Perseverant leadership in providing evidence-based care is one of the elements associated with positive outcomes. According to Wike et al. [14], the perseverant leadership in adhering to EBP principles and carrying out projects based on it promotes the desire of healthcare professionals to take this direction in clinical practice. One study showed high supervisors' scores in relation to perseverant leadership [12]. This study was included healthcare professionals working in health organizations that hospitalize children and adults with behavioral problems. The results of this study are in line with ours and show that the nurses rated highly the perseverant leadership behavior of their head nurses/supervisors in the implementation of EBP.

In the last part of this research, three research questions were explored as to whether head nurses' influence the implementation of evidence-based care, the overall level of knowledge on relevant issues, and to what extent this affects the prevention of difficulties in this particular type of care, but also their persistence in applying it. Our results showed that the head nurses had largely taken the necessary steps to facilitate evidence-based clinical care, thus positively affecting its implementation, and also appeared to be equally well informed about these issues. This finding is in agreement with the Mandrou study [9] which also took place in Greece. In particular, the study included nurses from a private hospital in Athens and used the ILS questionnaire, as our study. The results of the study showed that the higher the scores on the leadership scale, the higher was the application of evidence-based care. This means that in both studies, nurses' positive assessment of

their supervisors leads to the application of evidence-based care principles in clinical practice.

To investigate the third research question, the Pearson correlation coefficient was applied, which revealed two significant differences. In particular, it appears that the higher the level of knowledge of supervisors in relation to evidence-based clinical care, the greater the precautionary measures they take and the more persistent they are in implementing it. The relationship between these factors is in agreement with the findings of the literature. The existence of these leadership items and the strong relationship between them is also highlighted by the study by Guerrero et al. [6]. In this study, qualitative and quantitative research methods were applied to a sample of professionals working in detox structures. The results of the study showed that the participants mentioned the great importance of these four leadership characteristics and how the existence of one reinforces the existence of the other. This means that the four scales of the questionnaire are in agreement with the literature findings and can work positively in understanding leadership's role in providing evidence-based care.

This research has some limitations that need to be taken into account in future research. The first limitation concerns the sample of the study, which consists of nurses only. It is suggested that future research be conducted with the involvement not only of nurses, but supervisors also. The second limitation of the study is related to the tool. The questionnaire used assesses only four dimensions of leadership. It is proposed the use of other tools of leadership behaviors to highlight the whole spectrum of leadership influencing evidence-based care delivery.

5   Conclusion

The aim of this study was to investigate the effects of leadership on nurses' evidence-based care. According to the results of the study, knowledgeable, supportive, proactive, and persistent leadership positively influences the implementation of evidence-based practice. In more detail,

nurses' evaluations show that head nurses have the necessary knowledge about EBP, support nurses in their implementation, have created the right climate for the implementation of their respective clinical practices, and are able to address problems when they occur. This means that hospital managers, and especially head nurses, are able to promote the implementation of evidence-based care.

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Greek Nurses' Perception of Hospital Ethical Climate: A Cross-Sectional Study

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Abstract

This study aimed to examine Greek nurses' perceptions about hospital ethical climate and to investigate the possible difference of those perceptions regarding their demographic and work-related characteristics. The cross-sectional study design was employed in this study in which 286 nurses and nurse assistants participated. Data were collected by a sheet containing demographic and work-related characteristics and the Greek version of the Oslons' Hospital Ethical Climate Scale. IBM Statistical Package for Social Sciences 25 was used in data analysis. Frequencies, means, percentages, and standard deviations summarized the data. For the statistical differences, parametric tests were performed. Independent Samples t and Pearson correlation analysis were used to determine the relationship between the ethical climate of the hospital and the nurses' characteristics. The p-values 0.05 were considered statistically significant. The mean age of the nurses was 44 years (SD: 8.5 years; range 24–66 years). The majority of them were women (77.3%). A percent of 57.7% of the sample was married. Most positive perceptions were concerning managers (4.01) following by peers (3.82), patients (3.69), hospitals (3.29) while the least positive perceptions of the ethical climate were concerning the physicians (3.16). The factors associated with hospital ethical perception were: working experience and responsible position. The highest score of ethical climate reported to managers subscale, while the minimum score was related to physicians. In general, Greek nurses reported positive perceptions regarding hospital ethical climate.

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The positive ethical climate is associated with a better working environment, fewer nurses' experience of moral distress, fewer chances for nursing turnover, high quality of nursing care, and fewer errors in nursing practice.

1   Introduction

Organizational climate is the "psychological atmosphere" of the organization's environment, as it is perceived and experienced by its members, and it appears to exert influence on their behavior. It is the feeling of comfort or disgust with the particular work environment and it motivates the conditions of high- or low-job satisfaction and performance. According to studies [1, 2], the organizational climate is the way members of the organization perceive and characterize the organizational environment. It is considered to be a set of measurable properties of the working environment that is directly or indirectly perceived by people who work in this environment and can influence their motivation and work-related behavior [3].

Organizational climate influences the decisions of the organization by creating certain types of beliefs about the kind of consequences that will result from various actions [4]. The ethical climate is defined as a common perception among the members of the organization regarding selfishness, charity, ethical principles, and the target (such as individual, group, society) of the ethical discourse within the organization [5, 6]. Generally, it identifies the ethical characteristics of the organizational environment that directly and indirectly influence the way things happen within an organization [7]. In particular, ethical climate incorporate employees' established ethical values, rules, attitudes, emotions, and behaviors. Indeed, different ethical climates can coexist within an organization, as long as a group of employees (in one department for example) work together for a period of time. The ethical climate is considered a subset of ethical organizational culture, which can promote employee altruism and establish it as part of that culture [8].

In healthcare delivery systems, the organizational climate has been associated with various factors that contribute to the quality of services, such as nursing and patient satisfaction and the willingness of members to improve the efficiency and effectiveness of the organization. Organizational climate and culture affect healthcare units and their efficiency, quality assurance, quality of patient care, efficiency and employee satisfaction, cooperation and relationships between the organization's internal and external customers, and the reputation of the hospital [9].

In nursing-specific literature, the organizational climate has been presented as nurses' perceptions of their workplace. Its basic dimensions are autonomy, nursing-rated status, nursing leadership strength, professional development and partnerships with executives, doctors, and colleagues [10]. The ethical climate has been considered to be a very crucial factor affecting nursing and nursing care and it has been associated among others with missed nursing care [11], nurses' wellbeing [12], moral distress [13], and nurses' job satisfaction [14].

Although the topic of ethical climate has been investigated in international literature and has been associated with various factors in the nursing profession [15], it is under-investigated in Greece. Only a few studies explore the topic and these are specialty-specific. A study [11] investigated the relationship between ethical climate and missed care among oncology nurses in Cyprus and concludes that there is an association between those two observed variables. There appears to be a gap in the literature concerning Greek nurses' perceptions on the ethical climate.

The purpose of this study was to investigate Greek nurses' perceptions on hospital ethical climate and the association between the ethical climate and demographic and work-related characteristics of Greek nurses.

2   Methods

2.1   Study Design and Sample

A descriptive, cross-sectional study was conducted among nurses working in two hospitals located in Athens, the capital city of Greece. A convenience sample was the most reliable and feasible way to collect data, in terms of participant accessibility and available financial and time resources. The questionnaires were distributed randomly to 300 nurses in two hospitals. A total of 286 questionnaires were completed (response rate 95.3%). The study was conducted between January and February 2020.

2.1.1   Instrument

The used instrument for this study was the Hospital Ethical Climate Survey (HECS) which measures hospital nurses' perceptions of the ethical climate in their workplace. The instrument was originally developed [16] in 1998 and was translated and validated for the Greek population [17] in 2018. For the use of the instrument in this study, the researchers requested official permission from the authors. In particular, HECS is a self-administered questionnaire consists of 26 items scored on a five-point Likert scale ranging from 1 to 5 (where 1 represented "almost never true" and 5 represented "almost always true"). The higher the value of the HECS score, the more positive the perception of the ethical climate. The questionnaire is divided into five subscales including nurses' relationships with peers, patients, managers, physicians, and the hospital.

Moreover, demographic and professional characteristics were collected such as gender, age, education level, work experience, and responsible position.

2.2   Data Analysis

IBM Statistical Package for Social Sciences 25 (SPSS) was used in data analysis. Frequencies, means, percentages, and standard deviations (SDs) summarized the data. For the statistical differences, parametric tests were performed. Independent Samples t-Test was used to find the statistically significant differences between the ethical climate of the hospital and nurses' responsible position. Pearson correlation analysis was used to determine the relationship between the ethical climate of the hospital and the nurses' work experience in the unit. The p-values of 0.05 were considered statistically significant.

2.3   Ethics

The study was approved by the Scientific Council of the two Hospitals. Participants, who met the criteria, gave their written consent and completed the questionnaire after being informed about the aim of the study. Healthcare professionals were informed that their anonymity will be protected, and that the safety of the material will be maintained. Finally, participants were informed that the results will be used only for research purposes and that they can withdraw from the study if they want.

3   Results

The mean age of the nurses was 44 years (SD: 8.5 years; range 24–66 years). The majority of them were women (77.3%). A percent of 57.7% of the sample was married and 53.9% had completed tertiary education (Table 1).

About half of the nurses were working in the general hospitals (57.7%), the mean of working experience was 15.6 (SD: 8.3). Nurses had an average of 6.5 years of work experience in the department. The majority had not a responsible position (68.2%) and they worked in shifts (Table 2).

Internal consistency was measured by calculating Cronbach's alpha reliability coefficient which was 0.916.

In Table 3, the descriptive statistics of the nurses' perceptions about the ethical climate in their work environment are presented. The questions with the lowest mean scores were

Table 1 Participant characteristics

	Frequency	Percentage
Gender		
Male	65	22.7%
Female	221	77.3%
Age group		
<35	43	15.0%
35–45	109	38.1%
46–55	118	41.3%
55+	16	5.6%
Family status		
Unmarried	91	31.8%
Married	165	57.7%
Divorced	26	9.1%
Widower	4	1.4%
Education level		
Primary	12	4.2%
Secondary	120	42.0%
Bachelor	110	38.5%
Master	44	15.4%

Table 2 Professional characteristics

	Frequency	Percentage
Hospital		
General	165	57.7%
Psychiatric	121	42.3%
Work experience		
1–10	84	29.4%
11–20	126	44.1%
20+	76	26.6%
Work unit		
Internal medicine	67	23.4%
Surgery	25	8.7%
Intensive care unit	45	15.7%
Psychiatric	78	27.3%
Outpatient	71	24.8%
Work experience in the department		
1–10	226	79.3%
11–20	49	17.2%
20+	10	3.5%
Responsible position		
Yes	91	31.8%
No	195	68.2%
Circular working hours		
Yes	172	60.1%
No	114	39.9%

"Physicians ask nurses for their opinions about treatment decisions" with a mean of 2.71 and "Hospital policies help me with difficult patient care issues/problems" with a mean of 2.92. On the other hand, the questions with the highest mean scores were "My manager listens to me talk about patient care issues/problems" with a mean of 4.06 and "My manager is someone I respect" with a mean of 4.33.

Most positive perceptions were concerning managers in which nurses scored the highest point. Issues related to the manager included helping and supporting the nurses in difficult decision-making situations, the manager's willingness to listen, nurses' confidence and respect for managers.

The next positive perceptions were concerning peers, patients, and hospital. Peer issues were related to colleagues' willingness to listen, collective help and the capability of colleagues. Patient issues included informing patients about their care, nurses' access to patients' records, and the ability of nurses to use elementary knowledge about patient care. Hospital issues included support provided by hospital guidelines, hospital mission, understanding of team members' feelings and values, feelings of freedom and challenge in order to find creative solutions, the freedom to practice nursing care in the right way.

The least positive perceptions of the ethical climate were related to physicians in which nurses scored the lowest point. Physicians' issues included mutual trust and respect between nurses and physicians, nurses' involvement in decision making and physicians' advice in clinical decision making (Fig. 1).

Moreover, the nurses' work experience in the unit was positively correlated with the subdimensions of HECS. The results show that the increase of years of work experience in the unit, increase the patients, hospital, and physicians' ethical climate, as well as the overall ethical climate (Table 4).

A statistically significant difference was found between the responsible position of nurses and

Table 3 Descriptive statistics of nurses' perceptions of the ethical climate in their work environment

	Mean	SD
Peers		
My peers listen to my concerns about patient care	3.63	1.01
My peers help me with difficult patient care issues/problems	3.86	0.89
I work with competent colleagues	3.78	0.90
Safe patient care is given on my unit	3.99	0.92
Patients		
Patients know what to expect from their care	3.42	1.02
Nurses have access to the information necessary to solve a patient care issue/problem	3.63	0.96
Nurses use the information necessary to solve a patient care issue/problem	3.86	0.81
Patients' wishes are respected	3.85	0.90
Managers		
When I'm unable to decide what's right or wrong in a patient care situation, my manager helps me	3.92	1.05
My manager supports me in my decisions about patient care	3.86	0.86
My manager listens to me talk about patient care issues/problems	4.06	0.90
My manager is someone I can trust	3.91	1.12
When my peers are unable to decide what's right or wrong in a particular patient care situation, I have observed that my manager helps them	3.97	0.93
My manager is someone I respect	4.33	0.86
Hospital		
Hospital policies help me with difficult patient care issues/problems	2.92	1.11
A clear sense of the hospital's mission is shared with nurses	3.07	1.11
I am able to practice nursing on my unit as I believe it should be practiced	3.30	0.99
The feelings and values of all parties involved in a patient care issue/problem are taken into account when choosing a course of action	3.29	1.01
Conflict is openly dealt with, not avoided	3.43	1.01
There is a sense of questioning, learning, and seeking creative responses to patient care problems	3.72	1.00
Physicians		
Nurses and physicians trust one another	3.28	1.05
Physicians ask nurses for their opinions about treatment decisions	2.71	1.12
I participate in treatment decisions for my patients	3.00	1.17

(continued)

Table 3 (continued)

	Mean	SD
Nurses and physicians here respect each other's opinions even when they disagree about what is best for the patient	3.28	1.07
Nurses and physicians respect each other	3.54	1.03
Nurses are supported and respected in this hospital	3.15	1.14

SD: Standard Deviation

sub-dimensions. Specifically, nurses holding a responsible position indicated more positive perception as far as hospital and physician's ethical climate (Table 5).

4   Discussion

The aim of this study was to investigate Greek nurses' perceptions on hospital ethical climate and its association with nurse's demographic and work-related characteristics. Regarding nurse's perceptions on hospital ethical climate, total score and individual subscales were scored above 2.5 that is considered to be the median of the theoretical range. Therefore, we can assume that Greek nurses have a positive perception of the hospital's ethical climate. The most positive perceptions were concerning to managers and peers and the lowest perception was regarding physicians. Only working experience and holding a responsible position (head nurses or office nurses) on the clinical department were associated with positive perceptions about the hospital ethical climate.

All means in subscales of hospital ethical climate and in the total score were above 2.5. This result indicates that Greek nurses' have a positive perception on their hospital ethical climate. According to our results, the mean of the HECS was 3.86 which is very similar to a recent study among 874 nurses working on elderly care [18]. In general, our finding is in line with several other studies reporting positive perceptions that nurses have on hospital ethical climate [19, 20]. On the other hand, recent studies in Iran reported poorer scores on nurses' perceptions of hospital ethical climate [14, 21] revealing cultural differences on
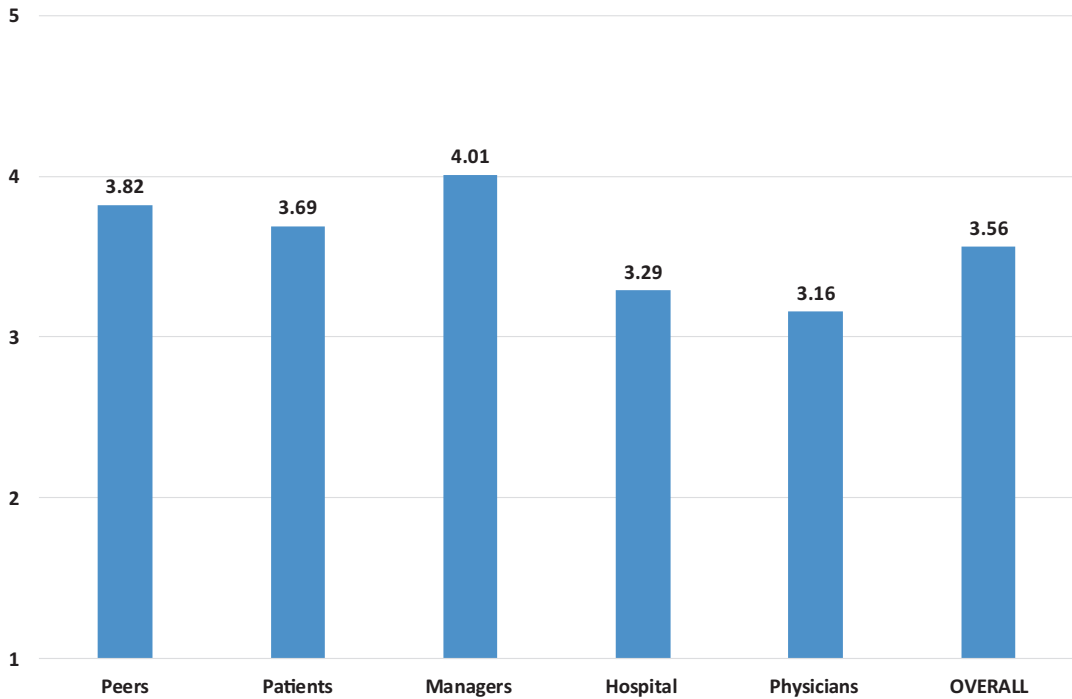
Fig. 1 Means of sub-dimensions of the HECS

Table 4 Correlation between nurses' work experience in unit and sub-dimensions of HECS

	Nurses' work experience in the department (in years)
Patients	0.133[a]
Hospital	0.144[a]
Physicians	0.135[a]
Overall	0.124[a]

[a]Correlation is significant at the 0.05 level (2-tailed)

the perceptions that nurses have on their working environment. The need and the value of cross-countries' comparative studies on nurse's perceptions about the organizational culture and ethical climate have been highlighted in previous studies related to ethical climate [22]. Positive perception of hospital ethical climate has been proven to be a significant factor influencing many aspects of the nursing profession. For example, researchers suggest that nurses who perceive a positive ethical climate are less likely to experience moral distress which affects nurses' clinical decision making [22, 23] as well as with medication administration errors [24]. Many studies indicate

ethical climate as a significant factor for nursing turnover [25]. More specifically, nurses, who perceive a negative ethical climate about their hospital, are more likely to decide not only to leave their position, but also to leave the profession as well. This finding highlights the importance of the perceived ethical climate in the healthcare setting and the necessity to implement strategies and interventions to promote and enhance positive nurses' perceptions on the hospital ethical climate.

Regarding the managers and peers, Greek nurses reported the highest values. This finding indicates a positive perception regarding those two aspects of the hospital ethical climate while on the other hand, the subscale Physician had the lowest score. This finding is consistent and reinforces findings from Greek and international studies which indicate positive perceptions to managers and peers [21, 26, 27]. The crucial role that managers have on creating and maintaining a healthy work environment for nurses has been highlighted in many studies. Also, managers tend to have a motivational role within the hospital

Table 5 Differences between nurses' responsible position and sub-dimensions of HECS

	Responsible position	Mean	SD	*p*-value
Hospital	Yes	3.41	0.63	0.037
	No	3.23	0.68	
Physicians	Yes	3.31	0.72	0.020
	No	3.09	0.75	

SD: Standard Deviation

setting among others, to deal and address issues such as conflict management and resolution, collaboration promotion, and personnel recruitment [28]. The positive effect that social and peer support has on nurses has also indicated in several studies across the life span of the nursing profession from undergraduate students to nurses' managers [29–33]. The positive effect of peer support is depicted in several aspects of the nursing profession life such as in maintaining health and wellbeing, in providing adequate nursing care and achieving better health outcomes for the patients [30, 34]. Many studies regarding nurses' perceptions about hospital ethical climate report very low scores on the subscale Physician [20, 24]. Healthcare provision as a team task demands both from nurses and physicians to have interpersonal, communication, and collaborative skills. Poor communication and collaboration could be attributed to factors such as job burnout, stressful and dementing work environment. In addition, poor communication and poor interprofessional collaboration may lead to adverse effects on nursing care and patients' health outcomes [35].

Finally, nurses' perceptions of ethical climate differed by working experience and if they had a responsible position such as head or office nurses and nurse managers. Similar results were reported in a cross-sectional quantitative study among Korean nurses where nurse managers and experienced nurses reported more positive perceptions on hospital ethical climate [24]. This can be attributed to the different tasks that nurses managers have since they usually address more organizational issues such as team coordination, sharing of responsibilities among the nursing staff and they do not usually have to deliver nursing care [36, 37]. Moreover, nurses' experience was associated with a more positive perception regarding ethical climate scales patients, hospital, and physicians. This finding is in agreement and rein-forces findings from previous studies which revealed the positive relationship of working experience and ethical climate [20, 38, 39]. This could be explained by the changes which take place in the way that nurses think, accept others and the effect that experience has on the management of patient care [40].

4.1 Limitations

This study was conducted in two hospitals in the Athens area. Even Athens is the capital city of Greece, the results cannot be generalized. In addition, participants completed the questionnaires during their shift and with the presence of other peers so the answers maybe have been affected.

5 Conclusion

According to the findings of this study, working experience and responsible position are the factors that are associated with the hospital ethical perceptions. Greek nurses seem to have a positive perception regarding their collaborative relationship with managers and less positive with the physicians. The positive ethical climate leads to a better working environment, less distress for healthcare professionals, high quality of nursing care, and fewer errors in nursing practice.

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Investigating the Main Causes of Conflicts and the Management Strategies That Are Used by Healthcare Professionals: The Case of General Hospital of Arta

Charalampos Platis, Thomas Christonasis, Pantelis Stergiannis, George Intas, and Petros Kostagiolas

Abstract

Background: Employees in healthcare systems are often conflict in the workplace due to the high-pressure environment and the diversity between different departments. The aim of the study was not only to investigate the main causes of creation of conflicts but also investigate conflict management strategies health professionals use in a public hospital.

Methods: This is a cross-sectional study. An anonymous questionnaire was used on a sample of 25 physicians and 95 nurses.

Results: Conflicts exist between colleagues and other professional groups. The most common management strategy is to avoid conflict, and second-place behavior such as compromise and negotiation for mutual benefit come along. The results of the organizational causes of conflicts have shown that important factors are the workload, the commands received by more than one supervisor, their reward, and the fact that their present work does not look like as what they had in mind about ideal work. Finally, the results on the causes related to employee expectations have shown that significant causes in this direction are the differences in the level of education, the unfair rewards among the various professional groups are that they do not have common professional expectations with other professional groups and that professional development is not related to their expectations.

Conclusions: The most popular proposals for conflicts solutions are nondiscrimination between the healthcare professionals, a fair approach to reward and punishment, communication and cooperation in the organization/hospital, establish a clear division of responsibilities, and establish professional management and the departments have to be autonomous.

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1　Introduction

Conflict, as an inherent phenomenon in people's lives, has been the subject of research in many scientific fields. However, a commonly accepted definition does not appear to exist even today. Marquis and Huston [14] define conflict as internal or external disagreement resulting from differences in ideas, values, or feelings between two or more people. The science of health service management has published a large number of articles in an attempt to analyze every aspect of conflict [1, 6].

Different values, inadequate or poor communication, interdependence coupled with deterioration have become some of the main sources of conflict. The consequences affect the organizational and nursing staff. Studies have shown that conflict is positively associated with psychological distress, high levels of emotional exhaustion, absence, and intention to quit a job. Financial losses can also be a result that can in turn lead to an organization even breaking up [1].

Conflicting presence is both desirable and necessary for personal as well as organizational creativity. Modern management believes that constructive conflict management helps improve the quality of decisions, stimulates creativity, and encourages interest. The positive effects on the ethical and psychological aspects of individuals and groups are undoubted, while resolving their conflicts makes them feel more integrated, adapted, and capable [1].

Critical medical conditions, that is, situations that involve extensive decisions about the life and death of a critical ill patient, are very difficult for healthcare professionals. In addition, discussing such critical decisions with critically ill patients is often impossible due to their incapacity, resulting in the increased need for optimal communi-

cation on these issues with the patient's relatives or legal representatives. Confidence in such situations is seriously questioned and conflicts can easily arise [3]. A recent study suggests that in almost two-thirds of cases, conflicts occur between physicians and patient's decision-makers [20].

Collaboration between a health team is important. In a medical environment, healthcare professionals must have the skills to be able to work continuously with other professions. Conflict is an inherent result of interdisciplinary teams. Unfortunately, conflicts have a negative impact on patient care, job satisfaction, and professional productivity [4]. Conflict management training is not usually a priority in health education, leading to ineffective management of interprofessional conflicts. Recently, there have been concerns about interpersonal conflicts in the workplace and their impact on the healthcare system and workers [18]. A variety of people, including physicians, nurses, colleagues, executives, and administrators, may have experienced conflict [5].

2　Materials and Methods

2.1　Aim

The aim of this study was to investigate the underlying causes and the conflict management strategies of healthcare professionals in a public hospital.

2.2　Study Design

This was a cross-sectional study.

2.3　Participants

The sample of the study consisted of 25 physicians and 95 nurses who worked at general hospital of Arta. The sample was selected using the convenience sampling technique.

2.4   Tools

A structured questionnaire was developed as a tool based on the research questions and on a questionnaire of similar research conducted in Greece [10]. The questionnaire used was divided into five sections. The first section consisted of five multiple-choice questions to investigate the demographic and occupational characteristics of the participants and whether they had ever been informed of workplace conflict issues. The second section consisted of four questions (answers Yes/No) to investigate (1) who the doctors and nurses were conflicting with, (2) the behavior they encountered in conflict situations, (3) whom they considered most appropriate as a judge, (4) the approach used by management to resolve conflicts at a personal or group level. The third section consisted of 14 questions on a 5-point Likert scale (1 = Not at all, 2 = Little, 3 = Moderate, 4 = Very much, and 5 = Too much) in order to list organizational factors that cause conflict in the hospital setting. The fourth section consisted of six questions on a 5-point Likert scale (1 = Not at all, 2 = Little, 3 = Moderate, 4 = Very much, and 5 = Too much) in order to list the factors causing conflict and related to employees' expectations. The fifth section consisted of one question and aimed to investigate the views/suggestions of physicians and nurses on possible ways in which workplace conflicts could be resolved.

2.5   Statistical Analysis

Statistical analysis was performed using SPSS software version 24 and significance level was set at $p = 0.05$. Descriptive statistics such as frequency (n) and percentage (%) and statistical test χ^2 were used to analyze the data.

3   Results

3.1   Demographic and Occupational Characteristics of the Sample

Table 1 presents the demographic and occupational characteristics of the participants. In total, 43.3% ($n = 52$) of the participants had received some conflict management information during their studies after high school. Of those who received information on conflict management issues, 34% ($n = 18$) received them while attending the university/college, 34% ($n = 18$) received them while attending a 2-year school and 13.2% ($n = 7$) received them during their postgraduate course.

3.2   Culture of Team in Relation to Conflicts

About half of physicians and nurses had a conflict with their colleagues in the past (45%), 49.2% ($n = 59$) of physicians and nurses reported having conflicted with other occupational groups, 34.2% ($n = 41$) had conflicted with their supervisors, 19.2% ($n = 23$) had conflicted with other colleagues, and 20.8% ($n = 25$) had been in conflict with hospital administrators. In addition, of those who reported having conflicted with other occupational groups, 71.2% ($n = 42$) conflicted with doctors, 76.3% ($n = 45$) conflicted with RN, 31.7% ($n = 32.2$) conflicted with healthcare assistants, and 52.5% ($n = 31$) had conflicted with administrators.

Of the sample, 47.5% ($n = 57$) of participants tried to avoid conflict, 28.3% ($n = 34$) tried to negotiate for mutual benefit with the opposite side, and 25.8% ($n = 31$) stated that they usually agreed. A smaller proportion of nurses and physicians reported that in case of a work-related conflict, they choose to claim victory ($n = 19$, 15.8%) or choose to accept the other's wish ($n = 3$, 2.5%). Finally, only 4.2% ($n = 5$) of participants turn to another person as a mediator for conflict resolution.

For judge in case of conflict, 42.5% ($n = 51$) of the participants would select a supervisor or senior manager, 32.5% ($n = 39$) would select the director, and 22.5% ($n = 27$) would select a colleague. A smaller proportion of nurses and physicians stated that in case of a work-related conflict, they would select the director physician ($n = 10$, 8.3%), one person from another profession ($n = 4$, 3.3%) or any individual ($n = 5$, 4.2%).

Table 1 Demographic and occupational characteristics of the sample

		n	%
Gender	Males	36	30%
	Females	84	70%
Work experience (years)	0–5	16	13.3%
	6–10	27	22.5%
	>10	77	64.2%
Type of job	Physicians	25	20.8%
	Registered nurses	37	30.9%
	Healthcare assistance	58	48.3%
Education level	Diploma/degree	72	72%
	Master	12	12%
	PhD	16	16%
	Director physician	8	40%
	Deputy director physician	1	5%
	Deputy director nurse	3	15%
Manager/senior manager	Head nurse	2	10%
	Deputy head nurse	2	10%
	Other	4	20%
	Total	20	16.7%

The results showed that 51.7% ($n = 62$) of the participants believe that managers choose to solve the problem while 41.7% ($n = 50$) think that managers choose to use existing legislation and regulations to solve the problem for healthcare professionals. Finally, a smaller percentage of physicians and nurses consider that managers choose an authoritarian approach ($n = 21$, 17.5%), a peace-based approach ($n = 16$, 13.3%), or a majority-based approach ($n = 5$, 4.2%).

3.3 Organizational Factors That Cause Conflicts

Most of the participants agree very or very much that their workload is greater than that of other occupational groups (83.4%, $n = 100$) and 72.3% ($n = 86$) of nurses and physicians recognize the possible orders received from more than one head nurse/director/manager as a very or very much important factor of workplace conflict. Similarly, a very large proportion of nurses and physicians supported that their payment is not sufficient to motivate them given their workload ($n = 79$, 65.8%) while 57.2% ($n = 68$) of nurses and physicians supported that their current job

does not look like at all or looks like a little with the impression they had of the ideal job.

In addition, the majority of nurses and physicians believe that accepting orders from more than one person severely affects their productivity ($n = 70$, 58.8%). Similarly, 54.2% ($n = 65$) of participants agree very or very much that they would be happier, quieter, and more productive if they worked in another profession than today. In addition, 45% ($n = 54$) of participants are very or very much satisfied at personal and professional level with the roles and tasks assigned to them, and 44.2% ($n = 53$) supported they feel very or very much autonomous and independent when making professional decisions. Finally, 40% ($n = 48$) of nurses and physicians reported that there are no or very few regulations that clearly define their duties and help them work efficiently and only 36.6% ($n = 44$) stated that the authority given to them is very or too much to carry out their duties.

3.4 Conflicting Factors Related to Employee Expectations

More than half of nurses and physicians (62.5%, $n = 75$) identify differences in education level as one very important factor that lead to communi-

cation problems between different occupational groups. In addition, 83.3% ($n = 100$) of nurses and physicians consider that there is no or little fair rewards between the various occupational groups and 70.9% ($n = 85$) of them consider that they receive no or little rewards depending on their performance. Finally, 46.3% ($n = 55$) of participants believe that they do not share perceived messages and professional expectations with other professional groups, 45.8% ($n = 49$) believe that hospital managers do not have the required degree of awareness for their contribution, and 40.9% ($n = 49$) supported that their career development was not in line with their expectations.

3.5 Suggestions for Resolving Hospital Conflict

Participants' most popular suggestions for dealing with hospital conflict events are (1) nondiscrimination, and management remaining neutral (19.2%), (2) fair rewards and punishment (14.2%), (3) to establish communication/cooperation in the hospital (12.5%), (4) establish a clear division of responsibilities (10.8%), and (5) establish professional management which controls everything and in which clinics are autonomous (11.7%).

Women (36.9%) were more likely to conflict with their supervisors than men (36.9% vs. 27.8%, $p < 0.05$). Men were more likely to think that their expectations of the hospital are related to the expectations/vision of the hospital than women (50% vs. 33.8%, $\chi^2 = 11.04$, $p = 0.026$). In addition, men were more likely to believe that regulations clearly define their tasks and help them work efficiently (50% vs. 25%, $\chi^2 = 10.45$, $p = 0.034$). Finally, men feel to a greater extent autonomous and independent when making professional decisions than women (66.7% vs. 34.6%, $\chi^2 = 18.58$, $p = 0.013$). A higher percentage of women believe that hospital management have no or little awareness of their contribution to health services compared to men (53.6% vs. 33.4%, $\chi^2 = 12.05$, $p = 0.017$). In addition, higher percentage of men believe that career development is related to their expectations compared to men (47.7% vs. 34.5%, $\chi^2 = 18.58$, $p = 0.000$).

3.6 Differentiation in Administrative Work Position

Between those who have an administrative work position and those who do not have, three statistically significant dependencies were observed related to who they conflict with and who they would choose as a judge. One concerned whether they conflict with colleagues ($\chi^2 = 8.73$, $p = 0.003$), the second concerned whether they considered a superior or senior executive to be a suitable for conflict judge ($\chi^2 = 4.977$, $p = 0.006$), and the third whether they consider the director as an appropriate person for conflict judge ($\chi^2 = 8.28$, $p = 0.004$). In more detail, it was found that those without an administrative position were more likely to conflict with their colleagues (administrator officers: 15%, healthcare professionals: 51%). In addition, higher percentage of healthcare professionals than administrator officers consider a manager or senior executive to be the most appropriate judge (47% vs. 20%), while higher percentage of administrators than healthcare professionals participants consider the director to be the most appropriate judge (60% vs. 27%).

Table 2 presents the differences that emerged between those with a management position and those with no management position in relation to organizational causes of conflict.

4 Discussion

Although there is no universal definition of conflict [8, 9], it can be described as "a process in which one party realizes that its interests are opposed or adversely affected by another" [11], p. 373. The conflict avoidance is almost impossible in a realistic environment. In fact, although there are multiple negative consequences of conflict there are also some benefits. This positive result is often overlooked. Society tends to give the term conflict a negative habit. For example, the word "war" is synonymous with conflict. Wars are often perceived as events to be avoided at all costs, but organizational conflicts will occur

Table 2 Significant differences in organizational causes of conflict between medical and nursing staff depending on whether they hold a manager position

		Manager position n (%)	No manager position n (%)	χ^2, p-value
How satisfied are you at personal and professional level with the roles and tasks assigned to you?	None	0	9 (9)	$\chi^2 = 19.97$, $p = 0.000$
	Little	0	20 (20)	
	Moderate	2 (10)	35 (35)	
	Very	7 (35)	14 (14)	
	Very much	11 (55)	22 (22)	
How much do your expectations of the organization relate to the expectations of the organization from you?	None	0	5 (5.1)	$\chi^2 = 18.1$, $p = 0.000$
	Little	1 (5)	31 (31.3)	
	Moderate	3 (15)	33 (33.3)	
	Very	7 (35)	11 (11.1)	
	Very much	9 (45)	19 (19.2)	
Do you think your earnings are good enough to motivate you given your workload?	None	2 (10)	52 (52)	$\chi^2 = 26.7$, $p = 0.000$
	Little	3 (15)	22 (22)	
	Moderate	10 (50)	24 (24)	
	Very	4 (20)	2 (2)	
	Very much	1 (5)	0	
Does your current job look like the impression you have of the ideal job for you?	None	0	32 (2)	$\chi^2 = 32.8$, $p = 0.000$
	Little	3 (15.8)	33 (33)	
	Moderate	2 (10.5)	15 (15)	
	Very	8 (42.1)	18 (18)	
	Very much	6 (31.6)	2 (2)	
Do you think you would be happier, quieter, and more productive if you were working in a different profession than today?	None	8 (40)	17 (17)	$\chi^2 = 15.1$, $p = 0.000$
	Little	6 (30)	10	
	Moderate	2 (10)	12 (2)	
	Very	3 (15)	26 (26)	
	Very much	1 (5)	35 (35)	
If you receive orders from more than one manager, does this negatively affect your productivity?	None	7 (35)	17 (17.2)	$\chi^2 = 14.2$, $p = 0.000$

Question	Response			Statistic
	Little	2 (10)	9 (9.1)	
	Moderate	6 (30)	8 (8.1)	
	Very	3 (15)	27 (27.3)	
	Very much	2 (10)	38 (38.4)	
Do you consider the power given to you is sufficient to carry out your duties?	None	0	15 (15)	$\chi^2 = 16.1, p = 0.000$
	Little	1 (5)	25 (25)	
	Moderate	21 (5)	30 (30)	
	Very	7 (35)	21 (21)	
	Very much	7 (35)	9 (9)	
How much do you think that the regulations clearly define your tasks and help you work efficiently?	None	1 (5)	23 (23)	$\chi^2 = 10.2, p = 0.000$
	Little	4 (20)	20 (20)	
	Moderate	3 (15)	30 (30)	
	Very	21 (5)	14 (14)	
	Very much	7 (35)	13 (13)	
To what extent are the resources distributed fairly between the departments/clinics?	None	0	18 (18)	$\chi^2 = 12.7, p = 0.000$
	Little	1 (5)	28 (28)	
	Moderate	8 (40)	27 (27)	
	Very	7 (35)	15 (15)	
	Very much	4 (20)	12 (2)	

more often and are expected by leaders. Repeated conflict avoidance leads to dysfunction and is often based on various fears such as rejection, anger, failure, and loss of relationships [11].

Leaders of organizations must address the issue of conflict in their workplaces. These leaders include those in healthcare. Healthcare professionals are often confronted with workplace conflicts due to the high-pressure environment and the diversity of stakeholders [5].

The aim of this study was to investigate the main causes of conflict and the strategies for managing conflicts in healthcare professionals in a public hospital. The results showed that about 5 of 10 physicians and nurses have conflicts with their colleagues, about 5 of 10 physicians and nurses have conflicts with other occupational groups while to a lesser extent conflicts happens between them and their supervisors, colleagues, or those with a lower educational level. Concerning how they behave in case of a conflict, it has been observed that the most common option is to avoid conflict, and behaviors such as compromise and negotiation for mutual benefit come second. In addition, regarding who they would choose as a judge in a conflict event, it was observed that the two most popular choices are the head nurse/director or the manager. Finally, a significant proportion of physicians and nurses believe that conflict management at personal or team level employs conflict resolution strategies or employs current healthcare laws and regulations. These results are in line with findings from other research that has shown that healthcare professionals use an avoidance and collaboration style when confronted with conflicts. Avoiding has been show to be more common in nurses [6, 12, 13, 19, 22]. In addition, it was found that a higher percentage of women than men conflict with colleagues and their superiors. In addition, higher percentage of nursing staff than physicians' conflict with colleagues and supervisors. In addition, it has been observed that higher percentage of medical staff choose the settlement as solution for conflicts [19]. Also, a higher percentage of nursing staff considers the head nurse or the manager as the most appropriate judge, while a higher percentage of medical staff considers the

director of physicians to be the most appropriate judge. Moreover, it was observed that the participants who were not supervisors were more likely to conflict with their colleagues and they considered a head nurse or manager to be the most appropriate judge. Controversially, higher percentage of the participants who were head nurses or directors consider the director of the clinic/department to be the most appropriate judge. Finally, those who have a postgraduate/doctoral degree are less likely to conflict with their colleagues or their supervisors.

Our study showed that the main organizational causes of conflict are workload, the orders they receive from more than one supervisor, the rewards, and the fact that their current job does not look like as they considered about the ideal job. Another cause of workplace conflict is the absence of regulatories. These results are similar with those found in the study of Almost [1] who listed the main causes of conflict and found that organizational factors such as organizational structure, job interdependence, and relative strength are the main causes of conflict. While the nature of causes such as working conditions, unfulfilled promises, poor hospital management, political and socioeconomic government policies, lack of opportunities for career development have been highlighted in many studies [7, 15–17, 21]. The results of the present study showed several differences between the medical and nursing staff. The medical staff was found to be more satisfied on personal and professional level than the roles and tasks assigned to them, recognizing to a greater degree that the workload is greater than workload of other professional groups. On the contrary, nursing staff recognizes to a greater degree as an important factor affecting their productivity negatively the fact that they receive orders from more than one supervisor/head nurse and lacking sufficient authority to perform their duties and feel less autonomous than medical staff. Also, the nurses believe that the allocation of resources is not done fairly between the hospital departments.

The results on the causes related to employees' expectations have shown that the main causes of conflicts are differences in education level, the fact that there are no or little fair rewards

between the different professional groups, that they have no common professional expectations with other professional groups, and that career development is not related to their expectations. The results of the present study are in line with those of Almost [1] who argued that the causes of conflict can be traced to individual characteristics such as inequalities in beliefs, values and behaviors, personality differences, educational status, and demographic inequalities such as age and gender, and interpersonal factors such as interaction, the ineffective communication, threats, mutual trust or mistrust, and personal dislike. While the causes of conflict arising from ambiguous responsibilities and job descriptions, incompatible roles, limited resources, unsatisfactory pay, stress and poor communication have been supported in the literature [2, 21].

5   Conclusion

Workplace conflicts in hospitals are common between the healthcare professionals. The workload, the commands that nurses receive by more than one head nurse, and the no fair reward are the main causes of conflicts. Finally, regarding how hospital conflicts can be tackled, it has emerged that the most popular proposals are (1) nondiscrimination between the healthcare professionals, (2) a fair approach to reward and punishment, (3) communication and cooperation in the organization/hospital, (4) establish a clear division of responsibilities, and (5) establish professional management and the departments have to be autonomous.

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Incidence of Deep Vein Thrombosis and Its Effect on Health-Related Quality of Life Among Nurses of Greek Public Hospitals: A Multicenter Study

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Abstract

Background: Vein thrombosis (VTE) is a collective term for deep vein thrombosis (DVT) and pulmonary embolism (PE). The aim of this study was to investigate the impact of DVT and its association with health-related quality of life among Greek nurses.

Methods: This is a multicenter descriptive correlation study. The sample of the study was nursing staff working in Greek public hospitals. The diagnosis of DVT was set by Hicks's clinical criteria.

Results: The study included 6304 nurses with a mean age of 47.4 ± 4.9 years. Diagnosed by a physician, DVT had 544 (8.6%) participants. The mean score of the overall dimension of physical health-related quality of life was 68.1 ± 21.9 and the overall score of mental health scale was 53.3 ± 10.4. The odds of DVT occurrence increased dramatically for female gender (CI: 27.76, 95% CI: 8.12–94.89, $p = 0.001$). Increased odds were found also for advanced age (CI: 1.21, 95% CI: 1.09–1.33, $p = 0.001$), advanced BMI (CI: 1.06, 95% CI: 1.02–1.10, $p = 0.001$), and smoking (CI: 2.72, 95% CI: 1.51–4.90, $p = 0.001$). Moreover, previous pregnancy (CI: 1.66, 95% CI: 1.21–2.29, $p = 0.002$), work experience (CI: 1.13, 95% CI: 1.03–1.23, $p = 0.008$), and Rhesus (CI: 2.55, 95% CI: 1.11–5.84, $p = 0.027$) were found to be risk factors for DVT.

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Conclusions: Nurses are potentially a professional group for developing deep vein thrombosis, and given the high incidence found in this study, as well as the lower proportion of nurses who were undiagnosed while meeting the clinical criteria of Hick, it is essential for nurses to check their lower extremities for DVT annually.

1 Introduction

Vein thrombosis (VTE) is a collective term for deep vein thrombosis (DVT) and pulmonary embolism (PE). Deep vein thrombosis is the formation of blood clots in the deep veins that can block venous blood flow. It occurs more frequently in the large veins of the lower limbs, but it can also occur in other parts of the body. The classic symptoms and signs of deep vein thrombosis are pain, edema, and redness affecting the extremities [33].

The annual incidence of venous thrombosis is estimated at more than 300,000–600,000 cases per year in the United States and more than 700,000 in six European countries [6]. The overall incidence of venous thrombosis has not changed significantly since the early 2000s despite efforts to improve the prevention of venous thrombosis in the hospital setting [1].

About 20% of all venous thrombosis events are classified as "induced" due to recent immobilization, trauma, surgery, or hospitalization. An additional 30% of venous thrombosis manifestations are associated with cancer, with the remaining 50% considered "non-induced." Additional independent risk factors for venous thrombosis development include increasing age, hospital or nursing home accommodation, active cancer, presence of central venous catheter or transdermal pacemaker, and recent preg-

nancy [6], obesity and poor physical fitness [13, 24], oral contraception and hormone therapy [5], and varicose veins [29].

The significance of the incidence of deep vein thrombosis is increased mortality, ranging from 8.6% to 10.6% at 30 days and from 23% to 24.2% in 1 year [4, 30] and reduced quality of life [31, 32].

2 Materials and Methods

2.1 Aim

DVT has been studied in various patient groups, but it has not been studied in health care professionals and especially nurses. Thus, the aim of this study was to investigate the incidence of deep vein thrombosis on the nursing staff of Greek hospitals and its impact to the health-related quality of life.

2.2 Study Design

This is a prospective cohort multicenter study.

2.3 Participants

The sample of the study was consisted of 6304 nurses of childbearing age who were working to Greek hospitals in public sector. The total number of nurses who work in public Greek hospitals according to Hellenic Regulatory Body is 35,000.

2.4 Tools

2.4.1 Diagnostic Criteria

A participant was considered to have deep vein thrombosis whether he was diagnosed with DVT by a clinician or whether he had three of more of the following (Hicks's clinical criteria): calf pain, calf sensitivity, temperature differences between lower limps, difference in diameter between calves about 1 cm and absence of any other medical condition to account for such signs [26].

2.4.2 Health-Related Quality of Life

Health-related quality of life was assessed using the SF-36 quality-of-life questionnaire. The SF-36 includes 36 questions to measure functional health and well-being from the patient's point of view. It is a practical, reliable, and valid physical and mental health tool that can be completed in 5–10 min. It is used only by adults (18 years of age and older) and applies to all diseases. For this reason, it is also characterized as a generic tool. The SF-36 assesses eight dimensions of health: physical functioning (10 items), physical pain (2 items), role limitations due to physical health problems (4 items), role limitations due to personal or emotional problems (3 items), emotional well-being (5 items), social function (2 items), energy/fatigue (4 items), and general perceptions of health (5 items). It also includes a self-assessment question about quality of health [27]. The SF-36 is available in more than 170 different languages. It has been translated and validated in Greek and has been used in a large number of studies conducted in Greece [2, 23].

2.5 Statistical Analysis

All statistical analyses were conducted using SPSS IBM statistics software, v. 22.0. χ^2 test or Fischer test and conditional logistic regression were performed to investigate the relationship between variables (risk factors) and DVT occurrence, taking into account the matching between cases and controls. For all tests, the significance level was set as 0.05.

3 Results

Characteristics of the 6304 nurses are shown in Table 1. Most of them were women (81.8%) and the mean age was 47.4 ± 4.9 years. The body mass index of participants was 26.1 ± 2.9 kg/m2 with minimum 18.01 kg/m^2 and maximum 37.31 kg/m^2. The work experience of the participants was 11.8 ± 5.4 years. A total of 2722 (43.2%) participants worked in clinics, 824

(13.1%) in primary care units, 750 (11.9%) in surgery clinics, 720 (11.4%) in emergency departments, 630 (10%) in laboratories, and 568 (9%) in intensive care units.

In total, 544 (8.6%) participants were diagnosed with deep vein thrombosis by a physician. More than 3 criteria of Hick, indicating a diagnosis of deep vein thrombosis, had 506 (8%) participants. Of these, 84 (16.6%) were not diagnosed with deep vein thrombosis. The clinical characteristics of participants are shown in Table 2.

The highest scores on health-related quality of life had the dimension of physical function (79.2 ± 28.9), physical pain (76.6 ± 36.7), and role limitations due to physical health problems (74.3 ± 38.1) and the lowest scores had the dimensions of role limitations due to personal or emotional problems (54.7 ± 16.7), the general perceptions of health (53.1 ± 13.9), and social function (49.9 ± 20.4). Participants who had been diagnosed with DVT had significantly lower scores on all dimensions of health-related quality of life than the others and especially to physical pain (4.9 ± 17.6 vs. 82.3 ± 30.5. $p < 0.05$), physical function (33.5 ± 16.9 vs. 83.5 ± 25.9, $p < 0.05$), social functioning (19.9 ± 23.9 vs. 52.7 ± 17.5, $p < 0.05$), energy/fatigue (27.9 ± 29.6 vs. 61.2 ± 15.1, $p < 0.05$), and physical scale (22.7 ± 13.2 vs. 72.4 ± 17.3, $p < 0.05$). The quality-of-life dimensions scores are shown in Table 3.

The odds of DVT occurrence (Table 4) increased dramatically for female gender ($p < 0.001$). Increased odds were found also for advanced age ($p < 0.001$), advanced BMI ($p < 0.001$), and smoking ($p < 0.001$). Moreover, previous pregnancy, work experience, and Rhesus were found to be risk factors for DVT (Table 4).

4 Discussion

Our analysis found incidence of DVT about 9%. Another important finding of this study is that approximately 17% of participants who met the Hick's criteria for diagnosis of deep vein thrombosis were not diagnosed with deep vein throm-

Table 1 Characteristics of the nurses ($N = 6304$)

	Variable	N	%
Gender	Male	1146	18.2
	Female	5158	81.8
Marital status	Married	4228	67.1
	Divorced	1054	16.7
	Unmarried	940	14.9
	Widows	82	1.3
Education level	Registered nurses	4016	63.7
	Master/PhD	1512	24
	Nurse assistances	776	12.3
Shift work		5708	90.5
Job position	Nurses	5884	93.3
	Head nurses	346	5.5
	Manager nurses	74	1.2
BMI	Normal	1794	28.5
	Overweight	4296	68.1
	Obese	214	3.4
Blood type	A Rhesus positive	1256	21.6
	O Rhesus positive	1142	19.6
	B Rhesus positive	1108	19
	A Rhesus negative	846	14.5
	B Rhesus negative	808	13.9
	O Rhesus negative	662	11.4
Smokers		2266	35.9
Exercise level	None	1476	23.4
	Mild	2334	37
	Medium	1668	26.5
	High	748	11.9
	Very high	78	1.2
Oral contraceptives		464	7.4
Oral anticoagulants		314	5

Table 2 Clinical characteristics of participants

Variable	N	%
Increased d-dimer levels	446	7.1
Ultrasound lower limps	1662	26.4
Other diagnostic examination for DVT	3666	58.2
Calf pain	1104	17.5
Calf sensitivity	2014	31.9
Temperature differences between lower limps	512	8.1
One centimeter difference in diameter between calves	304	4.8

bosis. However, due to the design of this study, the participants could not be monitored or referred to a specialist to examine and confirm the diagnosis of deep vein thrombosis. For this reason, it cannot be argued that the participants were ultimately diagnosed with deep vein thrombosis.

Only one study was found in the literature, which investigates the incidence of venous thrombosis in nursing staff and found that venous thrombosis develops 9.4 per 1000 nurses per year, a rate similar to the present study and significantly increased compared to the general population [26].

Table 3 Relationship of deep vein thrombosis to dimensions of quality of life among nurses

QoL dimensions	Total	DVT	No DVT	*p*-value
Physical functioning	79.2 ± 28.9	33.5 ± 16.9	83.5 ± 25.9	0.001
Physical pain	76.6 ± 36.7	4.9 ± 17.6	82.3 ± 30.5	0.001
Role limitations due to physical health	74.3 ± 38.1	51.1 ± 20.5	55.1 ± 16.3	0.001
Role limitations due to emotional problems	54.7 ± 16.7	47.9 ± 16.3	56 ± 13.7	0.001
Emotional well-being	55.3 ± 14.1	47.9 ± 16.3	56 ± 13.7	0.001
Social functioning	49.9 ± 20.4	19.9 ± 23.9	52.7 ± 17.5	0.001
Energy/fatigue	58.3 ± 19.2	27.9 ± 29.6	61.2 ± 15.1	0.001
General health	53.1 ± 13.9	26.6 ± 13.5	54.5 ± 13.2	0.001
Physical scale	68.1 ± 21.9	22.7 ± 13.2	72.4 ± 17.3	0.001
Mental scale	53.3 ± 10.4	39.6 ± 10.9	54.6 ± 9.4	0.001

Table 4 Odds of DVT cases by demographics, work, and clinical characteristics

Variable		OR	*p*-value
Gender, female vs. male	27.76	(8.12–94.89)	0.001
Age	1.21	(1.09–1.33)	0.001
Previous pregnancy	1.66	(1.21–2.29)	0.002
Work experiences, years	1.13	(1.03–1.23)	0.008
Rhesus	2.55	(1.11–5.84)	0.027
BMI, obese vs. normal and overweight	1.06	(1.02–1.10)	0.001
Smoking	2.72	(1.51–4.90)	0.001

One of the risk factors for thrombophlebitis found in our study was the female sex, which is in agreement with the literature [16, 38]. Venous thrombosis is predominantly a disease of advanced age [11, 14]. The incidence of DVT increases significantly with age, a result that was also found in the present study.

About one-third of the participants were smokers and nonsmokers were found to have a higher risk of thrombophlebitis. Studies in the literature investigating the association between smoking and the risk of thrombophlebitis have conflicting results. There are several possible explanations for the various findings. First, comorbidity can have an impact on risk assessments, as approximately 10% of smokers have various other smoking-related diseases [15]. The study of physicians' health came to similar conclusions with the present study, as smoking was associated with the risk of cardiovascular disease and stroke but not with the risk of thrombophlebitis [8]. In addition, the Iowa Women's Health Study found that current and former smokers were at increased risk of developing DVT alone, and that this relationship stemmed

from cancer that eventually caused thrombophlebitis [20]. Most of the studies that have found an association between smoking and thrombophlebitis have ruled out cases of cancer and/or myocardial infarction [12, 17, 28].

Second, smoking doses may explain the different effects. Most studies have found an increased risk of thrombophlebitis among heavy smokers [10, 12, 17]. The results from the DCH study showed that smoking doses in excess of 20 g of tobacco/day for women and 30 g of tobacco/day for men had a higher risk of thrombophlebitis than the lower doses of smoking [28]. Most studies that examined only smoking status concluded that smoking is not a risk factor for thrombophlebitis [9, 25], as was the case in the present study.

In this study, participants with a Rhesus blood group were twice as likely to have thrombophlebitis as those with a Rhesus negative. Similar results were found in a large prospective study [36]. Although some studies have shown an increased risk of thrombophlebitis predominantly in Group A blood [37], a similar risk was found in the present study for type A, AB, and B blood

compared to type O blood. This finding appears to support a protective role for type O blood, as opposed to a specific deleterious effect of either type A or type B. The protective role for type O blood may be partly explained by the differential survival of the circulating factor von Willebrand (vWF) and coagulation factor VIII in individuals with blood type O compared to those with non-blood type. In particular, individuals with blood O have approximately 25% lower circulating vWF levels than those with blood types A or B, and correspondingly lower levels of factor VIII, as vWF acts as a carrier molecule for factor VIII in the blood [7]. Given previously demonstrated correlations of vWF and factor VIII with the risk of thrombophlebitis, changes in vWF and factor VIII levels due to differences in ABC glycosylation may be partially responsible for the association of blood type [21].

The absence of exercise was found to be a risk factor for thrombophlebitis in this study. Immobilization is a well-recognized risk factor for thrombophlebitis, and many have suggested that sedentary lifestyle or lack of regular physical activity is associated with an increased risk of thrombophlebitis. However, the results reported so far have shown inconsistency. In a large prospective cohort study (Atherosclerosis Risk in Communities—ARIC), middle-aged men and women with moderate or high levels of physical activity had a 19–31% lower risk of developing VTE compared with those with low physical activity [34]. Similarly, in the Reasons for Geographic and Racial Differences in Stroke (REGARDS) study, participation in physical activity one to three times and more than three times a week was associated with a 30% and 41% lower risk of thrombophlebitis, respectively [22]. In the Million Women study, women with weekly physical activity were found to have a 4–34% lower risk of thrombophlebitis compared to inactive women [3]. Results from the Physicians' Health Study showed a higher risk for thrombophlebitis by increasing the weekly amount of vigorous physical activity [8]. Thus, in contrast to the potential benefits associated with low and moderate levels of physical activity, intense activity may be associated with an increased risk of thrombophlebitis.

So far, the relationship between objective assessment of fitness and the risk of thrombophlebitis has not received much attention. However, a high maximum aerobic workload (watt) per kilogram body weight in a bicycle test was reported to be associated with a lower risk of thrombophlebitis in men [39].

Deep vein thrombosis significantly impairs the physical health of patients causing pain and discomfort from loss of mobility, impaired functioning at work and at home, and psychological distress [31]. Participants who had been diagnosed with thrombophlebitis in the present study had a poorer quality of life. A study conducted in Sweden on adult women found that health-related quality of life was lower in women who had thrombophlebitis than those who did not, but the difference was not statistically significant. Quality of life was assessed, as in the present study, with the SF-36 questionnaire and the difference was in all dimensions [18].

Using EQ-5D-3L, it was found that health-related quality of life after an average follow-up of 5 years in 254 venous thrombosis patients was lower than in the general population. The difference was significant in all five items [32]. However, a meta-analysis in patients with a history of venous thrombosis, which included 14 studies by March 2016, showed that the dimension of physical and mental health was similar to the population patterns after ≥ 1 year. The meta-analysis showed that 1 year after an episode of venous thrombosis, the scores in both the general and specific dimensions of the disease were comparable to the general population [19].

Factors found to influence health-related quality of life are age, obesity, inactivity and recurrent thrombophlebitis [18]. Few studies have examined how quality of life after thrombophlebitis is influenced by socioeconomic factors and physical activity. In a Norwegian study assessing quality of life after pregnancy-induced thrombophlebitis, low levels of education were associated with a lower quality of life after a thrombophlebitis episode [35]. This result is consistent with that of the present study.

5   Conclusion

The term venous thrombosis includes both deep vein thrombosis and pulmonary embolism. This study is the first multicenter study to be conducted globally involving nursing staff. Very few studies exist in the literature regarding venous thrombosis in nursing staff and are single-centered.

The incidence of deep vein thrombosis diagnosed by a physician in this study was 8.6%, while 1.3% of participants according to Hick's criteria had deep vein thrombosis and were not diagnosed. The risk factors for deep vein thrombosis found in this study were female gender, increased age, the previous pregnancy, increased years of service, Rhesus positive blood group, increased body mass index, and smoking. Participants who had thrombophlebitis were more likely to have impaired physical function, role limitations due to personal or emotional problems, reduced emotional well-being, and reduced physical scale.

Nursing is a demanding profession in terms of physical and mental dimension. Nurses are forced to work under stressful psychological conditions, while the constant vigilance required by the profession results in continuous standing and straining of the lower leg veins. Nurses are potentially a professional team for deep vein thrombosis, and given the high incidence found in this study, as well as the lower proportion of nurses who were undiagnosed while meeting the criteria, it is necessary to have a working physician in each hospital. It is suggested to referral the nurses on a yearly basis as part of screening to check their lower extremities for deep vein thrombosis.

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Factors Affecting Anxiety and Depression in Caregivers of Hemodialysis Patients

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Abstract

Anxiety and depression have high levels in caregivers of patients on hemodialysis and are strongly associated with demographic factors. The aim of this study was to evaluate the factors affecting anxiety and depression in caregivers of hemodialysis patients. Four hundred and fourteen (414) caregivers (98 males and 316 females) participated in this study. Depression and anxiety were assessed by the Hospital Anxiety and Depression Scale (HADS), the State-Trait Anxiety Inventory (STAI), and the Beck Depression Inventory (BDI). Multinomial logistic regression was performed to estimate the factors being independently associated with anxiety and depression levels. Multiple linear regression was performed to estimate the factors being independently associated with Beck Depression Inventory and State-Trait Anxiety Inventory. From a total of 414 participants, 125 (30.2%) had depression and 215 (52%) had anxiety. The median age of respondents was 54.34 (43.9–66.28) years, with half of the sample's age ranging from 43.9 to 66.28 (IQR).

Depression and anxiety were significantly associated with parents or siblings, low level of education, increased caregivers' age, retirement, poor financial condition, having children, and comorbidities. In this study, a significant proportion of caregivers were found to have high levels of depression and anxiety. Thus, a formal screening can contribute to early diagnosis and treatment of depression and anxiety in caregivers of patients on hemodialysis.

1 Introduction

Hemodialysis patients usually have several comorbidities [1], physical, cognitive, and emotional impairment [2], loss of independency [3], as well as depression and anxiety [4, 5]. Thus, they frequently rely on their family members who turn out to be a valuable source of care [2].

Caregivers provide support to these patients mainly in activities of daily living, including personal care [6]. Furthermore, they offer meaningful help in transportation to dialysis centers or in managing dietary limitations [7]. However, there is growing awareness of the emotional burden of

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caregivers [8] since hemodialysis leads to financial problems, tension in their family relationships [9], loss of autonomy, difficulties in maintaining their job, and loss of education opportunities [10]. Thus, they frequently experience anger, as well as anxiety and depression [11]. As a consequence, caregivers are four times more likely to develop depression than noncaregivers and about three times more likely to seek treatment for anxiety disorders [12].

The aim of this study was to evaluate the factors affecting anxiety and depression in caregivers of hemodialysis patients.

2   Materials and Methods

The study sample included 414 caregivers from 24 hemodialysis units in Athens and Thessaloniki (Greece). Inclusion criteria were age over 18 years old and less than 85 years old, and ability to speak, read, and write in Greek. Exclusion criteria were previous treatment for depression, inadequate language skills, age over 85 years and less than 18 years old, cognitive dysfunction, and drug or alcohol abuse. The cognitive dysfunction was assessed by the clinical judgment made by the dialysis staff.

Participants were approached during the routine treatment of their patients and were provided with a verbal description of the study purpose and procedure, while they were asked to complete all the questionnaires at that time. All the caregivers used to accompany their patients to the hemodialysis center three to four times per week. We made sure that none of the participants had previously received treatment for depression.

Before collecting data, we obtained approval by the Ethics Committee of National and Kapodistrian University of Athens, Department of Medicine, 'Aretaieio' Hospital (Code number: B-126/02-07-2015). Participants were given a written consent form and were informed about the anonymity of the data, and that the data would be used only for research purposes; they could withdraw from the study if they wished and that their participation was voluntary. We collected data from June 2016 to February 2017.

2.1   Hospital Anxiety and Depression Scale (HADS)

The Hospital Anxiety and Depression Scale (HADS) was used to evaluate anxiety and depression. This scale was proposed by Zigmond and Snaith [13]. It includes 14 questions, of which seven evaluate the level of depression (questions 2, 4, 6, 8, 10, 12, and 14) and the other seven evaluate the level of anxiety (questions 1, 3, 5, 7, 9, 11, and 13). Patients are able to answer every question on a 4-point Likert scale from 0 to 3. Scores attributed to questions are summed separately for anxiety and depression. The total score of anxiety and depression level is between 0 and 21. Reliability and validity of HADS was high in the Greek population, and especially in patients with cancer in general hospital [14].

2.2   State-Trait Anxiety Inventory (STAI)

The creation of STAI started in 1964 by C.D. Spielberger and R.L. Gorsuch, and the form STAI X was issued in 1970 [15]. The review of the scale started in 1979 and the form STAI Y was adopted in 1985 [16]. The State Anxiety scale (STAI form Y-1) consists of 20 statements that evaluate how the respondent feels "right now, at this moment." The Trait Anxiety scale (STAI Form Y-2) includes 20 statements assessing how the respondent feels "generally." The evaluation is carried out on the basis of a four-step scale of the Likert type (1-2-3-4). Scores for both State Anxiety and Trait Anxiety scales can vary from a minimum of 20 to a maximum of 80. The State-Trait Anxiety Inventory form Y had high reliability and validity in Greek population [16].

2.3   Beck Depression Inventory (BDI)

Beck Depression Inventory (BDI) was created by Aaron Beck [17] and measures the degree of depression in adults. It includes 21 questions that measure the cognitive, emotional, behavioral,

and physical manifestations of depression. There is a four-dimensional Likert type scale from 0 to 3 for each question, ranging in intensity. After summing the scores of 21 questions, the total score ranges from 0 to 63. Higher total scores indicate more severe depressive symptoms. The BDI has been found to be a valid instrument of depression in patients undergoing hemodialysis [18] and had good reliability in the Greek population [19]. The use of the BDI scale is widely used in Greek population [20].

2.4 Data Analysis

Internal consistency for each questionnaire was evaluated with Cronbach's alpha indexes. The index range ranges from 0 to 1. Large values indicate a high degree of consistency between the questions of each scale. Categorical data are presented in absolute and relative (%) frequencies, while continuous data are presented with median and interquartile range (IQR), since normality of the data did not hold.

Normality was tested with the Kolmogorov-Smirnov criterion and graphically with Q-Q plots and did not hold. Nonparametric tests (Kruskal-Wallis, Mann-Whitney, and Spearman rho coefficient) were used to evaluate the association between caregiver's anxiety/depression and their characteristics, whereas χ^2 test of independence was used for the HADS scale. Multinomial logistic regression was performed to estimate the effect of factors being independently associated with anxiety and depression levels (HADS scale). As independent factors were entered in the models those that were significantly associated with anxiety/depression at univariate level. Results are presented with odds ratio (OR) and 95% confidence interval (CI).

Multiple linear regression was performed to estimate the factors being independently associated with BDI and STAI after testing for potential confounders. The results are presented with β-coefficients and with 95% CI. The observed level of significance was set to 5%. All statistical analyses were performed with SPSS version 22 (SPSS Inc., Chicago, IL, USA).

3 Results

A total of 414 (51.4%) out of 805 caregivers of patients on hemodialysis participated in the study. Caregivers' characteristics are presented in Table 1.

From a total of 414 participants, 125 (30.2%) and 215 (52%) had varying levels of depression and anxiety, respectively (Table 2).

The median of the HADS anxiety scores was 8 (4–11) and the HADS depression score was 5 (2–8) (Table 3). Cronbach's alpha values of the questionnaires range to very satisfactory levels (>0.8) indicating high consistency of patients' responses.

3.1 Association of Anxiety Scales with Caregivers' Characteristics

Parents or siblings had high levels of anxiety more frequently (52.4%) and a higher score at STAI scales (State: median 42.5, Trait: median 47) indicating higher anxiety than other caregivers. Similarly, caregivers with primary school education had higher scores at STAI scales (State: median 43, Trait: median 44) than those with secondary and post-secondary education. Likewise, caregivers with more than two children had more anxiety (STAI scales had higher scores). Pensioners also had higher STAI State scale (median 40). Caregivers who declared that they were in a bad financial situation had high levels of anxiety more frequently (40.9%) than those who declared a moderate situation (28.9%) and those who declared a good situation (16.7%). Moreover, caregivers in a bad financial situation had higher scores at STAI scales than those with moderate and good financial situation. Caregivers who had another disease had high levels of anxiety more frequently (32.8%) and higher scores at STAI scales. Lastly, age was positively significantly associated with STAI State score (rho = 0.116). An increase in caregivers' age indicates higher scores meaning higher anxiety (Table 4).

Table 1 Caregivers' characteristics (N = 414)

	N (%)		N (%)
Gender		*Occupation*	
Male	98 (23.7%)	Civil servant	30 (7.2%)
Female	316 (76.3%)	Private employee	73 (17.6%)
Nationality		Freelancer	35 (8.5%)
Greek	394 (95.2%)	Household	92 (22.2%)
Other	20 (4.8%)	Farmer	4 (1.0%)
Residence		Student	5 (1.2%)
Urban areas	374 (90.4%)	Unemployed	49 (11.8%)
Rural areas	40 (9.7%)	Pensioner	126 (30.4%)
Education		*Financial situation*	
Primary	67 (16.2%)	Bad	66 (15.9%)
Secondary	195 (47.1%)	Moderate	246 (59.4%)
Bachelor	126 (30.4%)	Good	94 (22.7%)
MSc-PhD	26 (6.3%)	Very Good	8 (1.9%)
Marital status		Perfect	0 (0.0%)
Single	67 (16.2%)	*Other disease*	
Married	301 (72.7%)	No	277 (66.9%)
Divorced	13 (3.1%)	Yes	137 (33.1%)
Widowed	9 (2.2%)	*Relation with patient*	
Living together	24 (5.8%)	Husband/ Wife	233 (56.3%)
Children		Parent	25 (6.0%)
No	115 (27.8%)	Children	105 (25.4%)
Yes	299 (72.2%)	Grand-children	4 (1.0%)
No. of children		Sibling	17 (4.1%)
1	93 (22.4%)	Other	30 (7.2%)

(continued)

Table 1 (continued)

	N (%)		N (%)
2	245 (59.2%)		*Median (IQR)*
>2	76 (18.4%)		
Living alone		*Age (years)*	54.34 (43.9–66.28)
No	387 (93.5%)		
Yes	27 (6.5%)		

Table 2 Description of the HADS scale categories

HADS scale	N (%)
Anxiety	
Low levels	199 (48.1%)
Moderate levels	100 (24.2%)
High levels	115 (27.8%)
Depression	
Low levels	289 (69.8%)
Moderate levels	78 (18.8%)
High levels	47 (11.4%)

3.2 Association of Depression Scales with Caregivers' Characteristics

Parents or siblings had high levels of depression more frequently (23.8%) than other caregivers and a higher score at the BDI scale (median 13) indicating higher levels of depression. Similarly, caregivers with primary education had higher scores at BDI (median 13) than those with secondary and post-secondary education (median 10 and 7 respectively), as well as high levels of depression more frequently (14.9%). Likewise, caregivers who had children had higher score at BDI, meaning higher depression (median 10) than caregivers who did not have (median 8). Pensioners also had a higher score at BDI (median 11) and high levels of depression more frequently (16.1%). Caregivers who declared that

Table 3 Scores' description

	No. of Q	Range	Median (IQR)	Cronbach's α
HADS				
Anxiety	7	0–21	8 (4–11)	0.847
Depression	7	0–21	5 (2–8)	0.832
BDI	21	0–63	9 (5–14)	0.867
STAI				
State Anxiety	20	20–80	37 (28–48)	0.944
Trait Anxiety	20	20–80	40 (32–49)	0.920

they were in a bad financial situation had high levels of depression more frequently (27.3%) than those who declared a moderate financial situation (9.8%) and those who declared a good financial situation (4.9%). Moreover, caregivers in a bad financial situation had higher score at BDI (median 13.5 vs. 9 and 7). Caregivers, who had other diseases, had high levels of depression more frequently (18.2%) and higher score at BDI (median 12). Finally, caregivers with high levels of depression were older (median age 64 years) and age was positively significantly associated with BDI score (rho = 0.237). Increased caregivers' age indicated higher scores meaning higher depression (Table 5).

3.3 Effects of Caregivers' Characteristics on Anxiety Questionnaires

Multinomial logistic regression and multiple linear regression were performed in order to estimate the effects of caregivers' characteristics on anxiety and depression scales, adjusted for potential confounders. Parents/siblings were 3.59 times more likely to show high levels of anxiety compared to low levels than husbands/wives (OR = 3.59, p = 0.002). Furthermore, parents/siblings had 7.45 and 6.29 points higher State and Trait Anxiety score, respectively, than husbands/wives (p = 0.005 and p = 0.007, respectively). Caregivers who had more than two children had 5.04 points higher STAI State score than caregivers with one child (p = 0.027). Caregivers with moderate financial situation were 61% less likely

to have high levels of anxiety than those with bad financial situation (OR = 0.39, p = 0.008). Similarly, caregivers with good economic status had 83% less chance to have high levels of anxiety than those with bad financial situation (OR = 0.17, p = 0.001). Furthermore, caregivers with moderate financial situation had 6.13 and 5.22 points lower State and Trait Anxiety score, respectively, than those with bad financial situation (p = 0.003 and p = 0.005, respectively). Likewise, caregivers with good finance had 10.88 points less State and Trait Anxiety score, respectively, than those with bad financial situation (p = 0.001, respectively). Caregivers who had other diseases had 3.15 and 3.43 points higher State and Trait scores, respectively (p = 0.049 and p = 0.013; Table 6).

3.4 Effects of Caregivers' Characteristics on Depression Questionnaires

Parents/siblings had 3.09 points higher BDI score than husbands/wives (p = 0.012). Caregivers with moderate financial situation or good financial situation were 69% and 89% less likely to have high levels of depression, respectively, than those with bad financial situation (OR = 0.31, p = 0.003 and OR = 0.11, p = 0.001, respectively). Furthermore, caregivers with moderate or good financial situation had 4.67 and 7.35 points lower BDI score, respectively, than those with bad financial situation (p = 0.001, respectively). Caregivers who had other diseases had 3.17 points higher BDI score (p = 0.001) (Table 7).

Table 4 Association of anxiety scales with caregivers' characteristics

	HADS (Anxiety levels)				STAI State Anxiety Median		Trait Anxiety Median	
	Low N (%)	Moderate N (%)	High N (%)	p-value	(IQR)	p-value	(IQR)	p-value
Gender				0.251		0.879		0.536
Male	54 (55.1%)	19 (19.4%)	25 (25.5%)		37.5 (27–47)		40.5 (29–49)	
Female	145 (45.9%)	81 (25.6%)	90 (28.5%)		37 (29–48)		40 (33–49)	
Relation with patient				**0.008**		**0.018**		**0.006**
Husband/Wife	120 (51.5%)	54 (23.2%)	59 (25.3%)		38 (29–48)		39 (31–49)	
Parent/Sibling	12 (28.6%)	8 (19.0%)	22 (52.4%)		42.5 (34–52)		47 (37–56)	
Children	48 (45.7%)	28 (26.7%)	29 (27.6%)		37 (28–45)		41 (34–47)	
Other	19 (55.9%)	10 (29.4%)	5 (14.7%)		33 (25–42)		34 (30–44)	
Residence				0.847		0.812		0.716
Urban areas	180 (48.1%)	89 (23.8%)	105 (28.1%)		37 (28–47)		40 (32–48)	
Rural areas	19 (47.5%)	11 (27.5%)	10 (25.0%)		39.5 (27.5–49)		40.5 (32–52)	
Education				0.748		**0.006**		**0.037**
Primary	30 (44.8%)	15 (22.4%)	22 (32.8%)		43 (34–49)		44 (36–50)	
Secondary	91 (46.7%)	51 (26.2%)	53 (27.2%)		36 (28–47)		40 (32–50)	
BSc-MSc-PhD	78 (51.3%)	34 (22.4%)	40 (26.3%)		35 (27–45.5)		38 (31–47)	
Marital status				0.642		0.915		0.378
Single	32 (47.8%)	16 (23.9%)	19 (28.4%)		36 (27–47)		42 (33–49)	
Married/Living Together	160 (49.2%)	77 (23.7%)	88 (27.1%)		37 (28–48)		39 (31–49)	
Divorced/Widowed	7 (31.8%)	7 (31.8%)	8 (36.4%)		37 (28–50)		44.5 (35–48)	
Children				0.686		0.142		0.370
No	59 (51.3%)	27 (23.5%)	29 (25.2%)		35 (27–47)		40 (30–48)	
Yes	140 (46.8%)	73 (24.4%)	86 (28.8%)		38 (29–48)		40 (32–49)	
No. of children				0.826		**0.032**		**0.050**
1	34 (50.7%)	16 (23.9%)	17 (25.4%)		35 (25–45)		38 (33–47)	
2	82 (46.3%)	45 (25.4%)	50 (28.2%)		38 (29–47)		41 (31–49)	
>2	24 (43.6%)	12 (21.8%)	19 (34.5%)		44 (32–52)		44 (35–52)	

				p-value			p-value			p-value
Occupation				0.524			**0.004**			0.151
Employee	70 (49.3%)	34 (23.9%)	38 (26.8%)		35 (26–45)			39.5 (30–46)		
Pensioner/Household	106 (48.6%)	48 (22.0%)	64 (29.4%)		40 (31–50)			41 (33–50)		
Student/Unemployed	23 (42.6%)	18 (33.3%)	13 (24.1%)		35 (27–46)			39.5 (34–49)		
Financial situation				**0.001**			**0.001**			**0.001**
Bad	17 (25.8%)	22 (33.3%)	27 (40.9%)		47 (36–54)			47 (40–59)		
Moderate	118 (48.0%)	57 (23.2%)	71 (28.9%)		37 (29–47)			41 (33–49)		
Good/Very good	64 (62.7%)	21 (20.6%)	17 (16.7%)		33 (26–40)			34.5 (28–41)		
Other diseases				**0.046**			**0.001**			**0.001**
No	145 (52.3%)	62 (22.4%)	70 (25.3%)		35 (27–45)			39 (31–47)		
Yes	54 (39.4%)	38 (27.7%)	45 (32.8%)		42 (32–52)			44 (34–52)		
Hypertension				0.609			0.109			0.186
No	172 (48.0%)	89 (24.9%)	97 (27.1%)		37 (28–47)			40 (31–48)		
Yes	27 (48.2%)	11 (19.6%)	18 (32.1%)		38.5 (29–51.5)			43.5 (33.5–53)		
Diabetes				0.099			0.232			0.515
No	186 (48.7%)	95 (24.9%)	101 (26.4%)		37 (28–47)			40 (32–48)		
Yes	13 (40.6%)	5 (15.6%)	14 (43.8%)		42 (30–51.5)			45.5 (30–50.5)		
	Med (IQR)	*Med (IQR)*	*Med (IQR)*	p-value	*Spearman Rho*		p-value	*Spearman Rho*		p-value
Age	56 (45–67)	53 (43–64)	53 (44–66)	0.706	0.116		0.019	0.030		0.547

Table 5 Association of depression scales with caregivers' characteristics

	HADS (Depression levels)				Beck	
	Low	Moderate	High		BDI	
	N (%)	N (%)	N (%)	p-value	Median (IQR)	p-value
Gender				0.175		0.323
Male	61 (62.2%)	23 (23.5%)	14 (14.3%)		8 (5–13)	
Female	228 (72.2%)	55 (17.4%)	33 (10.4%)		10 (5–14)	
Relation with patient				**0.017**		**0.001**
Husband/Wife	159 (68.2%)	44 (18.9%)	30 (12.9%)		9 (5–14)	
Parent/Sibling	22 (52.4%)	10 (23.8%)	10 (23.8%)		13 (8–17)	
Children	80 (76.2%)	19 (18.1%)	6 (5.7%)		8 (4–12)	
Other	28 (82.4%)	5 (14.7%)	1 (2.9%)		9.5 (5–13)	
Residence				0.499		0.573
Urban areas	258 (69.0%)	73 (19.5%)	43 (11.5%)		9 (5–14)	
Rural areas	31 (77.5%)	5 (12.5%)	4 (10.0%)		8.5 (4–13.5)	
Education				**0.020**		**0.001**
Primary	37 (55.2%)	20 (29.9%)	10 (14.9%)		13 (9–18)	
Secondary	138 (70.8%)	31 (15.9%)	26 (13.3%)		10 (5–14)	
BSc-MSc-PhD	114 (75.0%)	27 (17.8%)	11 (7.2%)		7 (4.5–11.5)	
Marital status				0.648		0.344
Single	51 (76.1%)	10 (14.9%)	6 (9.0%)		8 (5–15)	
Married/Living together	224 (68.9%)	62 (19.1%)	39 (12.0%)		9 (5–14)	
Divorced/Widowed	14 (63.6%)	6 (27.3%)	2 (9.1%)		10 (7–14)	
Children				0.229		**0.018**
No	87 (75.7%)	16 (13.9%)	12 (10.4%)		8 (5–14)	
Yes	202 (67.6%)	62 (20.7%)	35 (11.7%)		10 (5–14)	
No. of children				0.201		0.118
1	51 (76.1%)	11 (16.4%)	5 (7.5%)		8 (5–13)	
2	120 (67.8%)	37 (20.9%)	20 (11.3%)		10 (6–14)	
>2	31 (56.4%)	14 (25.5%)	10 (18.2%)		11 (6–19)	
Job				**0.008**		**0.001**
Employee	109 (76.8%)	26 (18.3%)	7 (4.9%)		8 (4–11)	
Pensioner/Household	138 (63.3%)	45 (20.6%)	35 (16.1%)		11 (6–16)	
Student/Unemployed	42 (77.8%)	7 (13.0%)	5 (9.3%)		8.5 (5–13)	
Financial situation				**0.001**		**0.001**
Bad	35 (53.0%)	13 (19.7%)	18 (27.3%)		13.5 (9–22)	
Moderate	169 (68.7%)	53 (21.5%)	24 (9.8%)		9 (5–14)	
Good/Very good	85 (83.3%)	12 (11.8%)	5 (4.9%)		7 (4–10)	
Other diseases				**0.001**		**0.001**
No	210 (75.8%)	45 (16.2%)	22 (7.9%)		8 (4–13)	
Yes	79 (57.7%)	33 (24.1%)	25 (18.2%)		12 (7–17)	
Hypertension				0.074		**0.002**
No	257 (71.8%)	64 (17.9%)	37 (10.3%)		9 (5–13)	
Yes	32 (57.1%)	14 (25.0%)	10 (17.9%)		11 (7–16.5)	
Diabetes				**0.005**		**0.030**
No	273 (71.5%)	71 (18.6%)	38 (9.9%)		9 (5–13)	
Yes	16 (50.0%)	7 (21.9%)	9 (28.1%)		13 (6.5–16.5)	
	Med (IQR)	*Med (IQR)*	*Med (IQR)*		*Spearman*	*p-value*
					Rho	
Age (in years)	53 (42–65)	58 (46–68)	64 (51–71)	**0.002**	0.237	**0.001**

Table 6 Effects of caregivers' characteristics on anxiety questionnaires

	HADS (Anxiety levels)				STAI			
	Reference category: Low levels				State Anxiety		Trait Anxiety	
	Moderate levels		High levels					
	OR (95% CI)	p-value	OR (95% CI)	p-value	β coef (95% CI)	p-value	β coef (95% CI)	p-value
Relation with patient								
Husband/Wife	Ref.cat.		Ref.cat.	**0.002**	Ref.cat.	**0.005**	Ref.cat.	**0.007**
Parent/Sibling	1.41 (0.54–3.71)	0.483	3.59 (1.62–7.95)		7.45 (2.32–12.59)		6.29 (1.72–10.85)	
Children	1.32 (0.73–2.37)	0.355	1.19 (0.66–2.12)	0.564	−1.05 (−5.6 to 3.51)	0.652	−0.43 (−3.97 to 3.11)	0.811
Other	1.23 (0.52–2.88)	0.638	0.55 (0.19–1.58)	0.267	−5.18 (−11.2 to 0.84)	0.092	−4.99 (−10.26 to 0.28)	0.063
Education								
Primary	–		–		Ref.cat.		Ref.cat.	
Secondary	–		–		−1.24 (−5.14 to 2.65)	0.531	−0.1 (−3.47 to 3.26)	0.951
BSc-MSc-PhD	–		–		−0.97 (−5.4 to 3.45)	0.665	−1.28 (−5.04 to 2.49)	0.504
No. of children								
1	–		–		Ref.cat.		Ref.cat.	
2	–		–		0.84 (−2.71 to 4.4)	0.641	1.25 (−1.88 to 4.38)	0.432
>2	–		–		5.04 (0.57–9.52)	**0.027**	3.67 (−0.27 to 7.61)	0.068
Occupation								
Employee	–		–		Ref.cat.		–	
Pensioner/Household	–		–		2.83 (−1.1 to 6.77)	0.157	–	
Student/Unemployed	–		–		−3.51 (−8.79 to 1.78)	0.193	–	
Financial situation								
Bad	Ref.cat.		Ref.cat.		Ref.cat.		Ref.cat.	
Moderate	0.39 (0.19–0.79)	**0.009**	0.39 (0.2–0.78)	**0.008**	−6.13 (−10.21 to 2.04)	**0.003**	−5.22 (−8.85 to 1.58)	**0.005**
Good/Very good	0.27 (0.12–0.62)		0.17 (0.08–0.4)		−10.88 (−15.61 to 6.14)		−10.88 (−15.07 to 6.68)	
Other diseases		**0.002**		**0.001**		**0.001**		**0.001**
No	Ref.cat.		Ref.cat.		Ref.cat.	**0.049**	Ref.cat.	**0.013**
Yes	1.6 (0.94–2.73)	0.080	1.48 (0.88–2.49)	0.141	3.15 (0.02–6.29)		3.43 (0.73–6.12)	
Age	–		–		−0.07 (−0.22 to 0.09)	0.411	–	

Table 7 Effects of caregivers' characteristics on depression questionnaires

	HADS (Depression levels)				Beck	
	Reference category: Low levels				BDI	
	Moderate levels		High levels			
	OR (95% CI)	*p*-value	OR (95% CI)	*p*-value	β coef (95% CI)	*p*-value
Relation with patient						
Husband/Wife	Ref.cat.		Ref.cat.		Ref.cat.	**0.012**
Parent/Sibling	1.53 (0.65–3.59)	0.331	2.4 (0.96–6.01)	0.061	3.09 (0.67–5.51)	
Children	1.17 (0.53–2.55)	0.701	0.53 (0.16–1.83)	0.318	−0.8 (−2.94 to 1.33)	0.460
Other	0.75 (0.26–2.17)	0.600	0.21 (0.03–1.78)	0.154	−0.2 (−2.92 to 2.53)	0.887
Education						
Primary	Ref.cat.		Ref.cat.		Ref.cat.	
Secondary	0.53 (0.26–1.09)	0.086	1.43 (0.57–3.6)	0.446	−1.74 (−3.87 to 0.39)	0.110
BSc-MSc-PhD	0.65 (0.3–1.42)	0.279	1 (0.34–2.96)	0.999	−2.27 (−4.6 to 0.06)	0.056
Job						
Employee	Ref.cat.		Ref.cat.		Ref.cat.	
Pensioner/Household	1.05 (0.51–2.17)	0.887	2.31 (0.81–6.55)	0.116	1.76 (−0.22 to 3.75)	0.082
Student/Unemployed	0.64 (0.25–1.61)	0.339	1.1 (0.28–4.27)	0.892	0.39 (−1.96 to 2.75)	0.742
Financial situation						
Bad	Ref.cat.		Ref.cat.	**0.003**	Ref.cat.	**0.001**
Moderate	0.93 (0.45–1.94)	0.848	0.31 (0.14–0.68)		−4.67 (−6.7 to 2.65)	
Good/Very good	0.41 (0.16–1.02)	0.056	0.11 (0.04–0.35)	**0.001**	−7.35 (−9.71 to 4.99)	**0.001**
Other diseases						
No	Ref.cat.		Ref.cat.		Ref.cat.	**0.001**
Yes	1.62 (0.92–2.87)	0.096	1.98 (0.98–4.02)	0.057	3.17 (1.56–4.78)	
Age	1.01 (0.98–1.03)	0.680	1 (0.97–1.04)	0.835	0.03 (−0.04 to 0.1)	0.408

4 Discussion

In this study, parents or siblings presented significantly high levels of anxiety and depression, which is consisted with a previous study [21]. It can be attributed to siblings' limitations in social life and their difficulties with dating and marriage [22], since they usually spend 3 days a week to accompany their patients to the dialysis center [23]. It is important to take into consideration that caregivers are more prone to have negative feelings toward their patients if they have no prior experience of the dialysis process and have high level of responsibility in the care of their patients [24].

Additionally, parents' anxiety and depression can be viewed in the context of their responsibilities. More specifically, family caregivers who live with their patients and provide care for a long period of time have a great responsibility for them [21]. Similarly, mother caregivers of children on peritoneal dialysis were found to be overloaded due to activities of the dialysis procedure [25]. The high prevalence of anxiety and depression among parents can also be attributed to behavioral changes of their children, such as irritability and depressive symptoms [1].

This study also showed that caregivers with primary school education had high levels of anxiety and depression, a finding that is consisted with a previous study conducted among caregivers of dialysis patients [23]. It has been found that caregivers usually delay their education due to the provision of care, which has a negative effect on their career and their financial condition [22].

This study also found that retired caregivers had high rates in depression and anxiety, a find-

ing that is congruent with a previous study conducted among caregivers [9]. Early retirement can be viewed in the context of unemployment since caregivers often face difficulties at work. More specifically, they frequently decrease or rearrange their working hours, take days off without pay, stop their job, or take early retirement in order to provide care to their patients [22].

It is important to take into consideration that caregivers of middle age are usually most worried about missed workdays, interruptions at work, and reduced productivity due to the caregiving process [11]. Similarly, it was found that 30% of the caregivers were unemployed since they used to spend about 50 h a week providing care to their patients [22].

This study also showed that caregivers with increased age had high scores of depression and anxiety. This finding is similar to a previous study that investigated caregivers' burden [11]. It can be assumed that old caregivers may suffer from health disorders which lead to higher perceived stress during the provision of care [26, 27].

5 Conclusion

The findings of this study suggest that a significant proportion of caregivers of patients on hemodialysis are particularly vulnerable to depression and anxiety. Thus, a formal screening can contribute to early diagnosis and treatment of depressive and anxiety disorders in caregivers of patients on hemodialysis. Additionally, the development of psychotherapy and pharmacological treatment can help caregivers reduce anxiety and depression and improve their general health well-being.

Conflicts of Interest The authors declare that they have no conflict of interest.

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Hand Grip Strength in Patients on Hemodialysis: An Observational Study

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Abstract

The objective of this study is to evaluate hand grip strength (HGS) in patients on hemodialysis and to investigate associated factors (anthropometric characteristics, body composition, and quality of life). An observational study of 60 patients in one hemodialysis center (Filoxenia Dialysis center, Aigio, Greece) was conducted. Measures of HGS were performed with a hydraulic dynamometer (Saehan Corporation, South Korea) on the non-fistula hand before the hemodialysis session. Demographic and clinical data (dialysis start date, comorbidities, and etiology of chronic kidney disease) were collected from the patients' medical charts. Body composition was determined by bioelectrical impedance analysis and calf circumference with inelastic tape. Quality of life was assessed via EuroQol (EQ-5D) questionnaire. Descriptive statistics were used for data analyses. The association between variables was calculated using Pearson's r correlation coefficients. The experimental design of this study was approved by the Ethics Committee of the Technological Educational Institute of Western Greece. A total of 54 patients (71.2 ± 10.9 years old, 24% diabetic, BMI of 26.34 ± 5.2) participated in this study (response rate 90%). The average duration of hemodialysis was 4.29 ± 6.36 years. The maximum HGS in the dominant was 19.19 ± 12.1 kg (female 12.04 ± 7.26 kg, male 21.82 ± 12.52 kg, $p < 0.001$). HGS was significantly correlated with age ($r = 0.5$; $p < 0.001$) and moderately correlated with gender ($r = 0.36$; $p = 0.008$), BMI ($r = 0.3$; $p = 0.03$), calf circumference ($r = 0.4$; $p = 0.03$), and quality of life ($r = 0.37$; $p = 0.006$). The use of handheld dynamometry could be a fundamental element of the physical examination of patients receiving hemodialysis, particularly if they are older adults.

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1   Introduction

Hand grip strength (HGS is a key measurement for the assessment and determination of several pathologies in medicine such as sarcopenia, frailty, and malnutrition [1–4]. HGS, a measurement of the maximal voluntary force of the hand/arm, has been described as a useful tool for assessing muscle function because it is a noninvasive, rapid, objective, and inexpensive procedure [5]. It has been considered a practical and reliable measure of skeletal muscle function in the general population and also in individuals with chronic kidney disease (CKD) [6].

Individuals with CKD, including non-dialysis-dependent CKD or dialysis-dependent end-stage renal diseases, experience high cardiovascular and all-cause mortality rates. Reduced muscle mass and strength are prevalent conditions in dialysis patients [7]. It is clear that muscle mass and strength are correlated with clinical outcomes, such as endocrine-metabolic changes, systemic inflammation, hypertension, and diabetes, which may decrease life expectancy [8]. Consequently, the use of simple, cheap, and feasible functional tests, such as the handgrip strength (HGS) test, is widely adopted in the literature as a clinical practice for the prediction of cardiovascular, renal, and mortality outcomes [8].

There are, to date, few studies that discuss associations of HGS measurement and clinical outcomes in patients with non-dialytic chronic kidney disease. Fewer studies have assessed HGS in patients using hemodialysis (HD) [6, 9, 10]. Stenvinkel et al. [9] identified a strong correlation between HGS and lean body mass, as assessed by dual-energy X-ray absorptiometry (DXA), in patients with CKD before the beginning of the dialytic therapy. A recent systematic review of 18 studies in populations submitted to hemodialysis and peritoneal dialysis has described associations of reduced HGS with dialysis and clinical and nutritional parameters [6]. Even though the HGS test was previously described as an independent predictor of mortality and renal outcomes in CKD patients, the association of different levels of HGS on various parameters in the HD population is not fully understood [6, 9]. Considering the importance of HGS for diagnostics and prognostic reasons, it seems important to further examine differences in HGS and to understand its associated risk factors in HD patients. Therefore, the aim of this study was to assess the HGS and to investigate the relationship of HGS with anthropometric characteristics and quality of life in Greek hemodialysis patients.

2   Materials and Methods

2.1   Study Design and Participants

The study was an observational analysis of 60 patients on HD treated at a private clinic (Filoxenia Dialysis Center) in Aigio, Greece, during the period from September to October 2019. Participants were eligible for inclusion if they were over 18 years of age, been on maintenance HD for at least 3 months before the study. Exclusion criteria included (a) pacemaker fitted, (b) medical or other musculoskeletal problems that could affect ability to complete objective assessments, and (c) body mass index (BMI) >50. Objectives of the study were explained to patients. A convenient sample of 54 hemodialysis patients (response rate 90%) of both genders agreed to participate in this study. The patients were assured that information obtained would be anonymous and confidential. All participants signed an informed consent form prior to their inclusion. The study protocol was approved by the Ethical Committee of the Technological Educational Institute of Western Greece.

2.2   Data Collection

Demographic and clinical data (dialysis start date, comorbidities, and etiology of chronic kidney disease) were collected from the patients' medical charts. The assessment procedure was carried out at the private clinic, "Filoxenia" Dialysis Center.

2.3 Measurements

All measurements were obtained immediately before the HD session by a trained researcher.

2.3.1 Body Composition Assessment

Height was measured with a wall stadiometer without shoes. Body weight was measured to the nearest 0.1 kg and height was measured to the nearest 0.1 cm. Measurements of height and weight were used to calculate body mass index (BMI) (kg/m^2). Body composition was determined using bioelectrical impedance analysis (BIA), with a Tanita BC-601 model body analysis monitor. Participants removed their socks, stood on two metallic electrodes on the floor scale barefoot, and held two metallic grip electrodes placed in the palm of their hands with their fingers wrapped around the handrails. Calf circumference were measured in centimeters with nonelastic tape with the participants in the upright position, with feet 20 cm apart and body weight equally distributed on both feet. Calf circumference was measured at the calf's greatest girth.

2.3.2 Hand Grip Strength Assessment

HGS was measured using a standard hydraulic hand dynamometer (Saehan, Seoul, Korea). In this observational study, HGS was measured in adult hemodialysis on the non-fistula hand before the session of HD. Before testing, the examiner demonstrated how to hold the handle of the dynamometer. At each patient, measurements were repeated three times with an interval of 5 s between measurements and the higher value was used for analysis. The patients were seated with the shoulders neutrally rotated and adducted, the forearm to be tested unsupported, elbow flexed at 90°, and wrist between 0° and 30° as recommended by the American Society of Hand Therapists and described in "The Nutrition UP 65 Study Protocol" [11]. HGS was expressed in kilograms (kg).

Quality of Life (QoL) was assessed via the Greek version of the EuroQoL 5-dimension (EQ-5D) questionnaire. The EQ-5D questionnaire records the level of self-reported problems according to five dimensions (Mobility, Self-care, Usual Activities, Pain/Discomfort, and Anxiety/Depression), with each dimension having three levels: no problems, some problems, and extreme problems [12].

2.4 Statistical Analysis

All statistical analyses were performed with the SPSS Statistics software package, version 20.0 (IBM Corporation, Armonk, NY, USA). Frequencies and percentages were calculated for the categorical variables, while continuous variables were expressed as means and standard deviations. Pearson's correlation coefficient was used to explore the relationship between HGS and the other variables. Pearson-r categorization was made according to Cohen [13] ($r = 0.10$ small, $r = 0.30$ medium, and $r = 0.50$ large) [13]. Statistical significance was accepted at p-value ≤0.05.

3 Results

A total of 54 patients (71.2 ± 10.9 years old, 34% diabetic, mean BMI of 26.34 ± 5.2) participated in this study (response rate 90%). The average duration of hemodialysis was 4.29 ± 6.36 years. The maximum HGS was 19.19 ± 12.1 kg (female 12.04 ± 7.2 kg, male 21.82 ± 12.52 kg, $p < 0.001$). Table 1 presents the characteristics of the participants.

A Pearson's correlation coefficient matrix for age, gender, anthropometric characteristics, and PA is presented in Table 2. In this study, HGS has strong correlation with age ($r = 0.5$; $p \leq 0.001$) and moderate correlation with the other anthropometric variables and QoL. The use of hand-held dynamometry could be a fundamental element of the physical examination of the patients receiving hemodialysis, particularly if they are older adults.

Table 1 Participants' characteristics

Variable	Total participants ($n = 54$)	Men ($n = 39$; 72.2%)	Women ($n = 15$; 27.8%)	p-value
	Mean ± SD			
Age (years)	71.2 ± 10.9	69.6 ± 11.2	75.3 ± 9.3	NS
Weight (kg)	73.9 ± 18.4	75.3 ± 19.4	70.2 ± 15.5	NS
Height (m)	1.66 ± 0.9	1.7 ± 0.09	1.5 ± 0.05	≥0.05
BMI (kg/m²)	26.3 ± 5.2	25.7 ± 5	27.8 ± 5.4	NS
Drugs (number)	8.8 ± 3.6	9.3 ± 4.7	7.5 ± 3.5	NS
Hand grip strength (kg)	19.1 ± 12.1	21.8 ± 12.5	12.04 ± 7.2	≥0.001
Fat mass (%)	26 ± 1.4	28.9 ± 8	17.7 ± 7	≥0.001
Calf circumference (cm)	34.3 ± 4.3	35 ± 4.3	32.5 ± 4.1	NS
Quality of life	7.98 ± 3.1	7.4 ± 2.2	9.3 ± 4.7	NS
	Number and percentage (%)			
Smoking				
Yes	12 (22.2%)	(%)	(%)	NS

Table 2 Pearson's correlation coefficient matrix for anthropometric characteristics, and QoL with HGS in HD patients

	Age	Gender	Height	Weight	BMI	Fat mass	Calf CC	QoL
HGS	$r = 0.5$	$r = 0.4$	$r = 0.3$	$r = 0.4$	$r = 0.35$	$r = 0.4$	$r = 0.4$	$r = 0.37$
($n = 54$)	$p \leq 0.001$	$p \leq 0.001$	$p \leq 0.05$	$p \leq 0.05$	$p \leq 0.05$	$p \leq 0.05$	$p \leq 0.05$	$p \leq 0.05$

HGS hand grip strength, *BMI* body mass index, *CC* circumference, *QoL* quality of life, *NS* nonsignificant differences

4 Discussion

To our knowledge, this is the first study to examine the HGS and factors associated with it among Greek hemodialysis patients. CKD has emerged as a global public health burden [14] affecting 10% of the worldwide population [8]. Muscle wasting is a common outcome in these patients [5]. The identification of useful, easily performed and inexpensive tools to assess clinical characteristics is essential in clinical practice for the large population of patients in hemodialysis. Since measure of muscle compartment is often difficult by traditional methods, measurement of HGS may be an appropriate strategy [14]. This study was designed to assess HGS and to determine the relationship between HGS, anthropometric characteristics, and QoL in patients on HD. HGS is a simple and reliable method with a good predictive clinical value for assessing muscle function of patients undergoing HD [5]. In this study, the HGS assessment was performed according to established guidelines [11]. Furthermore, the measurement was performed before the HD session. Only a few studies evaluating HGS in patients on HD have described the details of the

protocols used, which makes comparisons between results very difficult to perform. Specifically in subjects on HD, other factors such as day of assessment (dialysis or non-dialysis day) or period of assessment (before or after an HD session) may also influence the results [5]. In this study, HGS was performed on the dialysis day, before the HD session. The timing of the measurement should be taken into account in clinic practice as well as in further epidemiological and clinical studies because HGS may significantly decrease after the dialysis session in both males and females and in patients with both normal and low HGS [1, 15].

In this study, the mean value for HGS measurement was 19.1 ± 12.1 kg. Several studies have shown that dialysis patients are weaker than healthy subjects [16–18]. End stages of renal disease individuals have, commonly, high levels of physical inactivity that contribute to decrease functional capacity and decreased HS values [10]. Patients on HD presented a high prevalence of muscle strength loss as assessed by HGS. A loss of muscular strength begins in the pre-dialysis period, progresses along with the loss in kidney function, and increases morbidity [19].

Early detection of muscle strength loss may allow the implementation of appropriate therapeutic measures [5]. Results show that men had HGS mean values higher than women ($p \leq 0.001$). The results were consistent with the results of other studies conducted in healthy individuals [20, 21] and also dialysis patients [1, 22, 23].

There were moderate to strong correlations with HGS and age, fat mass, BMI, and calf circumference. The strongest correlation was with age ($r = 0.5$; $p \leq 0.001$). The loss of muscular strength and mass may occur earlier and more markedly in patients with CKD than in others of the same age [24]. The cause of this weakness has not been fully elucidated. In general, causes of muscle weakness can include loss of muscle mass, a decrease in the ability to generate force per unit mass or specific strength, a reduction in the capacity of the central nervous system to activate otherwise normal motor units, or a combination of these mechanisms. A potential cause of muscle atrophy may be aging [18].

Aging is associated with sarcopenia and increased CKD prevalence [25]. HGS is a diagnostic marker for sarcopenia. Diagnosis of sarcopenia is important, as it can lead to physical disability, low quality of life, falls, increased risk of fracture, and even death [25, 26]. Patients who lose muscle strength have also an increased risk of falling and fractures [27]. Therefore, CKD patients must undergo preventive measures and be assessed for the presence of sarcopenia at early stages, when the institution of therapeutic measures may be capable of reversing the process of muscle loss and thereby reduce the range of complications that can occur as a result of sarcopenia in renal patients.

Results also showed moderate correlations with HGS and QoL ($r = 0.37$; $p \leq 0.05$). QOL is significantly impaired in advanced CKD when compared to general population norms [28]. Deeper understanding of the factors affecting the quality of life in hemodialysis patients is useful to health professionals when developing individualized interventions based on their personal needs [29].

Results of this study and the estimation of HGS may serve as a support for decision-making and health interventions in patients on hemodialysis. Interventions, with the potential to increase HGS or otherwise address atrophy and to slow down physical decline and to improve QoL in people receiving maintenance dialysis, such as exercise programs, warrant further investigation [30].

This study had several limitations. First, the sample is small and was only from one hemodialysis center. Further multicenter studies with a larger sample size from different HD centers are required to investigate the relationship further. Second limitation is the absence of the analysis of other inflammatory variables (e.g., IL-6, IL-10, and TNFα), which could have allowed for more robust correlations with muscular strength [1, 8]. However, some researchers indicate that HGS does not appear to be influenced by hydration status and inflammation, unlike serum albumin, the most common nutritional marker used in patients on HD [5, 30]. Further studies should investigate the potential factors (inflammation, dialysis efficiency, etc.) influencing the HGS results in dialysis patients.

5 Conclusion

In summary, this study specifically identified the relationship between the HGS with age, gender, and anthropometric characteristics in Greek HD patients. Further studies are needed to standardize the techniques used for HGD\S, establishment protocols, and reference values to assist preventive measures of unfavorable outcomes in HD population. Further studies are also required to investigate the conclusive relationships among these variables.

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The Effect of Spirituality on Illness Perceptions in Patients Undergoing Hemodialysis

Spirituality and Health

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Abstract

The aim of this study was to assess the effect of spirituality on illness perceptions of Greek patients on hemodialysis. The cross-sectional study design was employed for this purpose. The sample comprised of 367 patients on hemodialysis. Data were collected via a three-part questionnaire consisting of a sheet containing demographic and clinical information, the Illness Perceptions Questionnaire, and the Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being Scale (FACIT-Sp-12). Data were processed with SPSS V.21, descriptive as well as inferential statistics were applied. The significant level was set at 0.05; 62.1% of the patients in the sample were men and 37.9% women. Their ages ranged from 18 to 92 years old, with an average of 61.80 years old. The findings of the research showed that the spirituality score both total and the subscales leads to a decrease illness perceptions score, meaning that patients perceive the disease as less threatening. The overall score of the Illness Perceptions Questionnaire was above the median, which means that patients perceive their condition as quite threatening. Overall, individual spirituality has a positive impact on the way patients perceive their condition.

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1   Introduction

The relation between spirituality and health has
been explored in various ways, both by health
professionals and theologians, in an ongoing
effort to investigate if there is a relationship
between these two parameters [1]. Spirituality
has been found and recognized to be an essential
source of support for the individuals as it pro-
vides emotional support and has a positive effect
on general health acting protectively by guiding
the adoption of specific health-related practices
[2].

Illness perceptions were found to be associ-
ated with various outcomes and health parame-
ters. Illness perceptions are the patients'
subjective cognitive beliefs about their symptoms
and illness and are based on the self-regulation
model [3]. According to this model, individuals
seek to understand the disease or the threat they
face due to the disease, by developing an under-
standing of what the disease is, what it means,
what its causes, its consequences, its duration,
and whether it can be cured or controlled. This
understanding or representation of the disease is
purely subjective as it is experienced [physical
symptoms and emotions] by the effects it may
have on social life and interaction with health
care providers [3, 4]. In a wide range of chronic
physical illnesses, such as cancer, rheumatoid
arthritis, and CKD, patients' perceptions play a
crucial role in explaining mental stress and qual-
ity of life, as both cross-sectional and longitudi-
nal studies suggest [5, 6].

The representation of the disease, as well as
perceptions of how individuals control over their
health and disease, varies greatly from person to
person, even if they face the same problem. Some
patients cope with problems more vigorously,
while others experience despair. People who feel
they have no control over their state of health are
more likely to develop anxiety and depression
than those who feel they control over the course
of their illness. It has been found that spiritual
and religious beliefs help someone to have inter-
nal control over their health and, thus, have a
positive effect on their mental health [7].

For many patients, spirituality and religiosity
are ways to manage their health problems.
Indeed, it has been found that people, who use
their religious beliefs positively, have better
health outcomes. Positive management based on
spirituality and religiosity involves attributing a
divine meaning to various stressful events, doing
the right things, and leaving the rest in the hands
of greater power. It, also, means seeking support
from a religious community and thinking of how
life is part of a higher spiritual power. In other
words, it involves seeking help within religion to
find a new direction to survive when the old
direction may no longer be viable. Finally, it
includes the effort with which spiritual support
can offer comfort to others [7, 8]. Indeed, a recent
study found that religious-coping strategies, dis-
ease representations, and quality of life in end-
stage renal disease (ESRD) were related to the
perceived duration of the disease, its impact, the
patients' sense of personal control, physical and
mental dimension [9]. In addition, the model of
common sense, based on Disease Perceptions,
relates to different treatment strategies and fur-
ther affects both outcomes and health-related
quality of life. Religious and spiritual practices in
the context of a chronic and life-threatening ill-
ness offer strength, empowerment, and control
[10]. The person is relieved of the emotional bur-
den of the illness, feel social support, a sense of
participation, and, finally, spiritual support
through a personal relationship with God. Also,
such practices facilitate the acceptance of the ill-
ness and help the patients maintain health, while
they ultimately, alleviate the fear and uncertainty
of death and facilitate self-acceptance [11].

A study [12] among renal disease patients
found that patients' spiritual and religious beliefs
were associated with low levels of disease bur-
den, increased levels of social support, as well as
lower levels of depression and better quality of
life. The authors emphasized that spiritual beliefs

and the way they react in adapting to illness and mental stress from it, deserve further investigation in the context of a biopsychological approach to the disease [12]. It is true that studies highlight the importance of the patient's perceptions of the disease, and outcomes. Indeed, researchers argue that perceptions and representations of the disease are the most important predictors of the disease, even more than the severity of the disease itself. According to a study [13] conducted in Colombia, patients suffering from chronic conditions, such as rheumatoid arthritis and renal disease, found that religious and spiritual beliefs have a positive effect on their perceptions of their condition. However, in a later analysis, it was found that only the emotional impact of the disease and its consequences can be related to the quality of life and mental health of these patients [14].

In another study [15] conducted in Ghanaian diabetic patients, meaning, perceptions, representations, and whether they experienced the disease as threatening to their well-being were identified as predictive factors for anxiety and depression. It is worth noting, however, that the most powerful factor was the one that refers to understanding the disease. This factor demonstrates that for the management of chronic physical illness health professionals should incorporate psychoeducation programs into health care delivery [16].

Regarding the ESRD, patients' perceptions of their disease appear to be related to the impact that renal replacement therapy has on their lives. In addition, a qualitative study investigating the relationship between disease representations and quality of life in patients with renal disease it was found that it is nurses who can better understand how patients perceive their disease and can help them adopt appropriate management strategies [17]. Studies have shown that people who feel they have control over their health and disease have a more optimistic outlook on treatment and have higher levels of self-efficacy, which may lead to better mental health [18].

Given that few studies among HD patients have investigated the above variables and the association between them, the purpose of this study was to investigate the effect of spirituality on perceptions of the disease in patients undergoing HD.

2 Material and Methods

2.1 Study Design

The study was a cross-sectional study involving patients with end-stage renal disease undergoing HD, the number of which is estimated to be around 10,500 in Greece. The sample consisted of 367 patients undergoing HD, who were randomly selected from six HD units in various geographical areas of Greece. A stratified random sampling procedure per unit was used in recruiting samples. The sample size is approximately 3.5% of the source population's patients. The inclusion criteria were the following: (i) age above 18, (ii) undergoing HD 3 times/week for at least 6 months, (iii) native language—Greek, (iv) ability to read and sign the consent form, (v) time-space oriented, (vi) not currently undergoing transplant procedures. Patients with mental or cognitive disorders were excluded from the study. The study was carried out at the following medical centers: HD Unit of West Attica MEDIFIL A.E. (Athens), Lamia General Hospital, Tripoli General Hospital, General Hospital of Chios Island, General Hospital of Athens "G. Gennimatas" and the University Hospital of Alexandroupolis.

2.2 Data Collection— Measurement Tools

The data were collected using the following research tools:

1. The Greek version of the Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being Scale (FACIT-Sp-12)—Functional Assessment in the Treatment of Chronic Disease—Spiritual Well-Being Scale [19, 20]. This is a scale created by Cella et al. (1993) and has been widely used to assess

spirituality in chronic patients. It is part of a larger evaluation tool that measures important functionality factors in patients with chronic disease. More specifically, it encompasses three subscales: the Meaning in life, Peace, and the sense of support and power derived from Faith. Each factor of spirituality comprises four 5-point Likert-type questions with 0 representing "not at all" and four representing "at most." Questions have been asked for the last 7 days. Larger scores represent greater spiritual well-being. The total sum of all responses provides information on general spiritual well-being. It is a valid tool with a high-reliability index (Cronbach's alpha 0.87).

2. The Brief Illness Perception Questionnaire (BIPQ) [21–23]. This is a nine-question questionnaire, which summarizes an initial 100-question scale and measures patients' perceptions of their condition. Of the nine questions, five assess the patient's cognitive perception of their condition (Consequences, Timeline, Personal Control, Treatment Control, and Identity), two assess their emotional perception (Concern and Emotions), one assesses the patient's degree of Understanding of the condition, and one asks the patient to indicate the Causes of the disease. All questions are scored from 0 to 10, except for the ninth, which is open and asks the patient to describe what he/she considers as the main causes of his illness. High scores on the eight questions indicate negative perceptions of the disease. It is a valid tool with a high-reliability index (Cronbach's alpha 0.91). In this study, the Greek version of the scale was used [24].

Finally, questions regarding demographic, social, and clinical information such as age, gender, marital status, duration of dialysis, and comorbidities were involved. Moreover, some additional information was gathered via the analysis of certain inquiries: (i) "How religious are you?" which included a four-point Likert scale answer ranging from 0–4, (0 = "not religious" 4 = to "high religious" (ii) "How close do you feel to God?" was a single-item question assessing connection to God requiring a four-point Likert scale answer ranging 0–4 (0 = "not close at all," 4 = "as close as I can be." Finally, the "Current Activity Level" was assessed in a four-point Likert scale ranging from 0–4, (0 = Normal activity, without symptoms, 1 = Some symptoms, but do not require bed rest during waking day, 2 = Require bed rest for less than 50% of waking day, 3 = Require bed rest for more than 50% of waking day, 4 = Unable to get out of bed.

2.3 Ethics

Permissions were obtained from the Greek authority of Personal Data Protection (Nr. No: UN/EX/4670–3/04-08-2016) for the conduct of the study, from Thessaly and Central Greece (No. 25223/23.12.2016) and the Scientific Council of Lamia General Hospital (No. 641/23.12.2016), by the sixth health region, Peloponnese, Ionian Islands, Epirus and Western Greece (No. 50910/22.12.2016) and the Scientific Council of Tripoli General Hospital "The Evangelist" (No. 18585/14.12.2016), the Scientific Council of the General Hospital of Chios (No. 9/15.02.2016), the Scientific Council of the Athens General Hospital "G. Gennimatas" (No. 7499/21.03.2016), the Scientific Council of the Evros University General Hospital (tenth Convention 19/12/16) and the "HD Unit of West Attica MEDIFIL A.E." (15.07.16). In all cases, oral and written information were provided to patients about the aims and purposes of the study, the confidentiality, anonymity of their answers, and their right to be interrupted at any time during the procedure. Finally, written consent was obtained from all participants.

2.4 Statistical Analysis

Statistical processing of empirical research material was performed with the software Statistical Package for the Social Sciences, 20.0 (S.P.S.S. Inc., Chicago, IL, USA), using the methods of descriptive and inferential statistics.

The descriptive analysis included the frequency distribution of the qualitative variables (absolute and relative% frequency) as well as estimates of the location and dispersion parameters of the quantitative variables (mean, standard deviation, median, maximum, and minimum). Normality tests were performed using the Kolmogorov–Smirnov criterion. Inferential analysis was performed to investigate the statistical model of multiple linear regression and to measure the regression coefficient b. Finally, in all tests carried out, the significance levels were unilateral, and the acceptable level of statistical significance was set at 5%.

3 Results

3.1 Characteristics of the Sample

Table 1 shows the distribution of the 367 HD patients regarding their sociodemographic and clinical characteristics. A percentage of 62.1% of the patients in the sample were men and 37.9% women. Their ages ranged from 18 to 92 years, with an average of 61.80 years (SD = 15.11).

The total score of the FACIT-Sp-12 Scale of Spirituality ranged from 3 to 47, with an average of 30.55 (SD = 8.22) and an average of 31.00. Both the mean and median values were greater

Table 1 Characteristics of the sample ($n = 367$)

	Characteristics	n	%
Gender	Females	228	62.1%
	Males	139	37.9%
Age (years)	Mean ± SD		61.80 ± 15.11
	Range		18–92
Place of residence	Urban area	247	67.3%
	Rural area	120	32.7%
Marital status	Married	217	59.1%
	Single	150	40.9%
Number of children	0	108	29.4%
	1–2	189	51.5%
	≥3	70	19.1%
	Mean ± SD		1.57 ± 1.41
Do you live alone?	Yes	86	23.4%
	No	281	76.6%
Educational level	Primary school	144	39.2%
	High school	160	43.6%
	University graduate	63	17.2%
Professional status	Employee	70	19.1%
	Unemployed	224	80.9%
Religion	Christian orthodox	352	95.9%
	Non-Christian	15	4.1%
How religious are you?	MEAN ± SD		2.56 ± 1.08
	Range		0–4
How close do you feel to god?	MEAN ± SD		2.54 ± 1.11
	Range		0–4
Years on HD	Mean ± SD		5.69 ± 5.25
	Range		1–26
Other health problems	Yes	193	52.6%
	No	174	47.4%
Current level of Spirituality	MEAN ± SD		2.46 ± 1.09
	Range		0–4

SD standard deviation

than the 24 values corresponding to the midpoint of the response scale (theoretical index range), indicating that the majority of patients displayed relatively high values of total spirituality. The mean of the individual dimensions of the scale was for "Meaning" 11.99 (SD = 3.27), "Peace" 9.26 (SD = 3.38), and "Faith" 9.30 (SD = 3.95). All dimensions of spirituality were averaged and median greater than 8 corresponding to the midpoint of the measurement scale of the responses (theoretical range of values). Compared to the highest average price was "Meaning" and the lowest "Peace" to "Faith."

The overall BIPQ Score ranged from 0 to 80 with a mean of 42.70 (SD = 13.41) and a median of 45.00. Both the mean and median values were slightly higher than the 40 values corresponding to the midpoint of the response scale (theoretical index range), indicating that the majority of patients had relatively high overall Disease values, that is, threatening view of the disease. The mean values of the individual dimensions of the Scale were for "Consequences" 7.37 (SD = 2.90), "Timeline" 9.03 (SD = 2.16), "Personal Control" 3.11 (SD = 2.61), "Therapeutic Control" 1.89 (SD = 2.26), "Identity" 5.63 (SD = 3.07), "Concern" 6.71 (SD = 3, 33), "Disease Understanding" 2.33 (SD = 2.47), and "Emotional Impact" 6.63 (SD = 3.29). In five of the eight dimensions of Disease Perceptions, patients expressed a particularly threatening view as they had a mean and median value above 5 which corresponds to the midpoint of the measurement scale (theoretical range of responses). Compared to the highest mean value was "Time Out" with "Consequences" and the lowest was "Understanding Disease" with "Therapeutic Control." The three most frequently cited factors were "consequence of another disease" (42.0%), "inadequate health control" (13.1%), and "poor nutrition and lifestyle" (12.0%). In contrast, the three factors with the least frequency were "environment" (6.8%), "medical error" (4.1%), and "consequence of medication" (4.1%).

The scales' internal consistency reliability was estimated using the Cronbach's Alpha coefficient. A value of alpha factor of 0.70 indicates the reliability of questions on a scale to be very good. Cronbach's Alpha coefficients were $a = 0.82$ for the FACIT-Sp-12 Scale of Spirituality and $a = 0.75$ for the BIPQ Disease Scale, which demonstrates the very good internal consistency of the questions asked.

3.2   Spirituality and Illness Perceptions Relationship (Multivariate Analysis)

Tables 2, 3, and 4 illustrate the multivariate investigation of the relationship between the BIPQ Scale and the FACIT-Sp-12 Scale of HD patients. The multivariate analysis incorporated the characteristics of patients with Disease Perceptions at the significance level of 0.25 from the bivariate analysis. The statistical test shows that the following increase in the spirituality score at both the whole and the subscale levels leads to a decrease in the perceptions score for the disease, meaning that patients perceive the disease as less threatening.

The multivariate statistical test of the effect of Spirituality (FACIT-Sp-12 Scale) on Disease Perceptions (BIPQ Scale) of patients, by neutralizing their characteristics, revealed the following:

The "Consequences" dimension was negatively affected by both total Spirituality ($\beta = -0.100$, $p < 0.001$) and all its dimensions, namely "Meaning" ($\beta = -0.219$, $p < 0.001$), "Peace" ($\beta = -0.2253$, $p < 0.001$), and "Faith" ($\beta = -0.092$, $p = 0.011$). Both the overall Spirituality and its dimensions were not affected by the dimension of Time. Both the overall Spirituality ($\beta = 0.089$, $p < 0.001$) and the "Meaning" ($\beta = -0.207$, $p < 0.001$) and "Peace" ($\beta = -0.1156 < 0.001$). A marginally negative effect, at the 10% level, of "Faith" was also noted ($b = -0.076$, $p = 0.070$).

Both the Total FACIT-Sp-12 ($\beta = -0.078$, $p < 0.001$) and all its dimensions, namely "Meaning" ($\beta = -0.1186$, $p < 0.001$) and "Peace" ($\beta = -0.195$) were negatively affected by the "Therapeutic Control" dimension ($p < 0.001$) and "Faith" ($\beta = -0.062$, $p = 0.036$). Both the total FACIT-Sp-12 ($\beta = 00.100$, $p < 0.001$), the

Table2 Multiple linear regression (enter method) with Dependent Scale for Disease Scale "BIPQ" and independent variables Scale of Spirituality "FACIT-Sp-12 Scale" as study determinant and patient characteristics [a] ($n = 367$)

	Consequences		Timeline		BIPQ	
					Personal control	
	β (SE)	p-value	β (SE)	p-value	β (SE)	p-value
FACIT-Sp-12						
Meaning	−0.219	<0.001	−0.016	0.667	−0.207	<0.001
	(0.045)		(0.036)		(0.044)	
Peace	−0.253	<0.001	−0.026	0.474	−0.156	<0.001
	(0.043)		(0.036)		(0.044)	
Faith	−0.092	0.011	0.029	0.406	−0.076	0.070
	(0.036)		(0.034)		(0.042)	
Total FACIT-Sp-12	−0.100	<0.001	−0.002	0.905	−0.089	<0.001
	(0.018)		(0.016)		(0.019)	

β corrected regression coefficient, *SE* standard error
[a] The multivariate model incorporated the characteristics of patients from the bivariate analysis with significance level at its level. 0.25

Table 3 Multiple linear regression (enter method) with Dependent Disease Scale "BIPQ" and independent variables' Spiritual Scale "FACIT-Sp-12 Scale" as study determinant and patient characteristics [a] ($n = 367$)

	BIPQ					
FACIT-Sp-12	Therapeutic control		Identity		Concern	
	β (SE)	p-value	β (SE)	p-value	β (SE)	p-value
Meaning	−0.186	<0.001	−0.207	<0.001	−0.135	0.014
	(0.037)		(0.051)		(0.055)	
Peace	−0.195	<0.001	−0.211	<0.001	−0.284	<0.001
	(0.036)		(0.049)		(0.053)	
Faith	−0.062	0.036	−0.090	0.056	−0.044	0.399
	(0.030)		(0.047)		(0.053)	
Total FACIT-Sp-12	−0.078	<0.001	−0.100	<0.001	−0.088	<0.001
	(0.015)		(0.022)		(0.023)	

β corrected regression coefficient, *SE* standard error
[a] The multivariate model incorporated patient characteristics from the bivariate analysis with a significance level of 0.25

Meaning ($\beta = 00.207$, $p < 0.00$) and the Peace ($\beta = -0.211$, $p < 0.001$) were negatively affected by the Identity dimension. A marginal negative effect, at the 10% level, of "Faith" was also noted ($b = -0.090$, $p = 0.056$). Both the overall Spirituality ($\beta = -0.088$, $p < 0.001$), the "Meaning" ($\beta = -0.135$, $p = 0.014$) and "Peace" ($\beta = -0.2284 < 0.001$) were negatively affected by the "Concern" dimension. Both the overall Spirituality ($\beta = -0.077$, p < 0.001) and the "Meaning" ($\beta = -0.206$, $p < 0.001$) and "Peace" ($\beta = -0.132$, $p = 0.002$) were negatively affected by the "Understanding Disease" dimension. The "Emotional Impact" dimension had a negative effect on both total FACIT-Sp-12 ($\beta = -0.114$, $p < 0.001$) and all its dimensions, namely "Meaning" ($\beta = -0.204$, $p < 0.001$), "Peace" ($\beta = -0.2287 < 0.001$) and "Faith" ($\beta = -0.102$, $p = 0.041$). Finally, the "Total BIPQ" had a negative effect on both total FACIT-Sp-12 ($\beta = -0.775$, $p < 0.001$) and all its dimensions, namely "Meaning" ($\beta = -1.543$, $p < 0.001$), "Peace" ($\beta = -1.718$, $p < 0.001$), and "Faith" ($\beta = -0.676$, $p = 0.001$).

Table 4 Multiple linear regression (enter method) with Dependent Scale for Disease Scale "BIPQ" and independent variables Scale of Spirituality "FACIT-Sp-12 Scale" as study determinant and patient characteristics [a] (*n* = 367)

					BIPQ		
		Understanding		Emotional impact		Total BIPQ	
		Disease					
	FACIT-Sp-12	β (SE)	*p*-value	β (SE)	*p*-value	β (SE)	*p*-value
Meaning		−0.206	<0.001	−0.204	<0.001	−1.543	<0.001
		(0.042)		(0.051)		(0.206)	
	Peace	−0.132	0.002	−0.287	<0.001	−1.718	<0.001
		(0.042)		(0.050)		(0.194)	
Faith		−0.046	0.250	−0.102	0.041	−0.676	0.001
		(0.040)		(0.050)		(0.197)	
Total FACIT-Sp-12		−0.077	<0.001	−0.114	<0.001	−0.775	<0.001
		(0.019)		(0.022)		(0.086)	

β corrected regression coefficient, *SE* standard error

[a] The multivariate model incorporated patient characteristics from the bivariate analysis with a significance level of 0.25

4   Discussion

This study aimed to assess the illness perceptions of HD patients and the effect of spirituality on the illness perception among these patients. HD patients perceive their disease as threatening and face the burden of its consequences. According to the results, spirituality has a positive effect on how HD patients perceive their condition, as it was indicated by multivariate analysis. More specifically, regression analysis revealed that the subscales Peace, Meaning, and total spirituality can decrease negative illness perception, while faith seems to have less effect on the illness perception of these patients.

The results of this study are in agreement with and reinforce the already established perceptions that HD patients perceive their condition as potentially threatening, which complicates both the outcomes of the disease and its management [25]. According to researchers, illness perceptions are associated with mental and physical outcomes [26, 27]. In addition, there is evidence that specific illness perceptions [particularly its consequences and duration] are predictive factors for mental disorders, such as depression [28]. According to a recent meta-analysis, negative perceptions about the effect of the disease on its identity and severe emotional response may lead to anxiety, depression, and poor quality of life. On the other hand, personal control is associated with a better quality of life and lower levels of anxiety and depression [28].

According to our results, age, having children, the existence of another health problem, and the current level of activity have emerged as predictors after being introduced into one of the regression models. According to a study [26] which included 535 HD patients, several demographic factors are associated with illness perceptions, both as a whole and at the level of individual subscales. Finally, regarding the causes of the disease, according to our results, most patients believe that renal disease is the result of another disease [42.0%] and is, mainly, due to poor health control [13.1%] followed by malnutrition, or lifestyle, which ranks third with 12.0%. These findings are in contrast to other studies related to perceptions of ESRD, which support that anxiety and stress are the etiological factors of ESRD in these patients [29].

According to the results of the study, the dimensions of spirituality Meaning, and Peace, as well as the overall spirituality negatively affect almost all dimensions of the Illness Perceptions Questionnaire. In particular, negative effects were observed in the following elements: Consequences of dimensions, timeline, personal control, Treatment Control, Identity, Concern, Emotions, Understanding of the disease, and overall perception of the disease. The dimension "Belief" only negatively affects the following dimensions of the Disease Perception questionnaire: Control, Consequences, Emotions, Understanding of the disease, and overall percep-

tion of the disease. Finally, no dimension of spirituality was found to be related to time. It is worth noting that these relationships were calculated taking into account demographic data.

Literature allows us to conclude that spirituality could and does have a positive impact on the lives of patients with ESRD, helping them manage and adjust to the emotional impact of their illness and empower them to cope with the difficulties posed by the disease [30–33]. The results of this study come to confirm these hypotheses. It is a fact that many people, when are faced with great difficulties and stressful events, turn to faith and spirituality to find peace and security [31]. In a study [8], which included 274 patients undergoing HD, it was found that patients with high levels of religiosity and spirituality had a better understanding of their illness, perceived their illness less as years went by, had more sense of personal control and considered that the disease has less impact.

Finally, according to others [30], spirituality is a predictive factor for psychological adjustment to ESRD in patients. In addition, in other chronic and life-threatening diseases, such as breast cancer, patients seem to find strength through their spiritual beliefs to be able to adapt to the disease and cope with the stress of diagnosing this kind of disease [34, 35].

However, this study has some limitations, a major disadvantage of which is its cross-sectional design, which does not give us insight into the evolution of spirituality and its effect over time. In addition, data were collected during HD sessions, and, thus, there were some external variables such as noise, interruptions, and room temperature, which may have had some influence on the answers given. On the other hand, the main asset of this study is that the HD Units, in which the study was conducted, were from multiple regions of Greece (North Aegean Sea, Peloponnese, Thrace, Thessaly, and Attica—Athens). Also the fair sample size ($n = 367$) considering the total population ($n = 10,500$) allows the authors to generalize the results.

5 Conclusion

In this study, findings were added to perceptions of ESRD patients and the effect of spirituality on them, for which the literature is limited. For many people, religion and spirituality are central concepts in their lives. These axes should be taken into account when designing care for these patients, as there is sufficient evidence in the literature to support this. The results of this study add to our knowledge of the perceptions of HD patients, as existing data are limited. In general, the role of perceptions of the disease is a growing area of interest and early intervention is important in these perceptions, as patients will be able to develop positive strategies to manage their illness and improve psychosocial outcomes.

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Validation of the STOP-Bang Questionnaire in Greek Patients Suffering from Obstructive Sleep Apnea

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Abstract

Obstructive sleep apnea (OSA) is a sleep disorder with high prevalence and significant health consequences. The aim of this study was to validate the STOP-Bang Questionnaire, a widely used screening tool for OSA besides polysomnography, in Greek patients. A hundred and two (102) patients with OSA, aged [mean (SD)] 59.16 (8.53) years, and 102 healthy adults, aged [mean (SD)] 54.67 (9.36) years, were assessed. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated for different cut-off values. The Epworth Sleepiness Scale (ESS) was also used to examine predictive validity. Patients with OSA showed higher scores than healthy controls ($p < 0.001$). The resulting specificity, sensitivity, PPV, and NPV were 98%, 60%, 71%, 97%, (cut-off 3), 96%, 81%, 84%, 95% (cut-off 4), and 86%, 97%, 97%, 88% (cut-off 5), respectively. This study has demonstrated that the Greek version of STOP-Bang can be used in the clinical setting to differentiate patients with OSA from healthy individuals with high accuracy and at low cost.

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1   Introduction

Obstructive sleep apnea (OSA) is a sleep disorder with high prevalence and significant health consequences that frequently goes undiagnosed in as many as 80% of patients [1]. Timely diagnosis of OSA is important, as, if left untreated, it has significant health and financial implications for both the patient and the healthcare system. OSA has been associated with increased perioperative complications, including morbidity and mortality, and impaired quality of life [1, 2]. Polysomnography, the gold standard method for the diagnosis of OSA, is an expensive procedure, not accessible for patients in all geographic locations and for all economic backgrounds [3].

The STOP-Bang Questionnaire was developed for the purpose of screening individuals for OSA. The questionnaire collects information on the following 8 variables: loud snoring, tiredness, observed apnea, blood pressure, body mass index (BMI), age, neck circumference, and gender. The initials of these items form the acronym of the STOP-Bang [1, 4, 5]. The higher the score, the greater the probability for the individual to be suffering from moderate-to-severe OSA.

Although initially the questionnaire was designed to include only the STOP items, the use of cut-offs for anthropometric and demographic variables, including BMI (greater than 30 kg/m^2), neck circumference (over 40 cm), and age (older than 50 years) to screen for moderate and severe OSA, simplified the application of the questionnaire [6]. It is a fairly short questionnaire, easy to complete, that can be incorporated into a sleep medicine care setting [1].

Several studies have demonstrated the usefulness of this questionnaire in clinical practice. In a validation study with 746 participants, a STOP-Bang score between 5 and 8 successfully identified patients with a high probability of having moderate-to-severe OSA [7]. Therefore, it has been proposed that this questionnaire can be used for patient stratification. Moreover, in a study of 4770 individuals, comparison among the Epworth Sleepiness Scale (ESS), STOP, and the STOP-Bang Questionnaire demonstrated better performance of STOP-Bang in terms of sensitivity, but

not specificity, in identifying those with moderate-to-severe or severe sleep-disordered breathing (SDB) [8]. High sensitivity is a significant property of this questionnaire, because it ensures that clinicians will not miss cases due to false negative screening results, which could result in exacerbation of the undiagnosed condition over time.

The aforementioned finding has been replicated in a small study of 47 previously undiagnosed adults, where, compared to the ESS, the STOP-Bang Questionnaire was also shown to be more successful at correctly identifying patients with OSA and SDB, although the ESS had higher specificity [9]. According to a meta-analysis [3], the STOP-Bang Questionnaire is suitable for use in surgical and sleep clinic populations, due to its higher methodological quality and ease of use.

The STOP-Bang Questionnaire has also been validated in specific subpopulations, such as the obese and morbidly obese patients. Its sensitivity was found to be high (88%) at identifying severe OSA using a cut-off score of 4, and it also demonstrated high specificity (85%) for a cut-off score of 6 [10]. However, the questionnaire may perform poorly in some populations, as shown in a study of a sample of veterans, where its sensitivity was acceptable at lower scores, but as the score increased above 6, sensitivity decreased, making the questionnaire inadequate for the diagnosis of OSA [11].

The aim of this validation study was to develop the Greek version of the STOP-Bang Questionnaire and report its psychometric properties in the Greek population.

2   Patients and Methods

Permission to validate the STOP-Bang Questionnaire was obtained from the original authors through online communication via e-mail. The questionnaire was then translated to Greek by two bilingual individuals separately, and then the two translations were compared in order to examine congruence. Any disagreements that occurred were resolved between the translators in order to obtain the final Greek version.

2.1   Patients and Processes

The study was carried out at the Centre for Sleep Study in the Evagelismos Hospital in Athens, Attica, in Greece. The sample of this study was recruited from a large randomized controlled trial (RCT), in which patients who visited a sleep clinic were randomized to a non-pharmacological intervention or to standard care (submitted for publication). The Ethics Committee of the Evagelismos Hospital reviewed the protocol and gave permission. The study duration was from 1 September 2016 to 31 October 2017.

Given that the validation study was part of a larger RCT, the same inclusion and exclusion criteria were applied. Patients were included in the study if they aged over 30 years, were able to speak Greek, and were residing in Attica at the time the study took place. Exclusion criteria included the diagnosis of any psychiatric condition (according to patient self-report), use of psychiatric or hormonal medication (according to patient self-report), pregnancy, and a history of myocardial infarction (MI) or stroke.

Patients were informed about the purpose of the study and their right to withdraw at any time, and they signed a consent form before enrolment. They were given the questionnaires in pen and paper form. Patients were then asked to undergo a polysomnography study supervised by a technician and performed overnight in the facilities of the clinic, in order to confirm the diagnosis of OSA.

Healthy study participants (not diagnosed with OSA) were randomly chosen to participate if they were over 30 years old. They were also informed about the study and their rights. Healthy participants also signed the informed consent form.

2.2   Questionnaires

The STOP-Bang Questionnaire, a short demographic questionnaire, and the Epworth Sleepiness Scale (ESS) were given to the participants for completion. The demographics questionnaire was developed for the purpose of this study by the researchers.

The ESS is a self-report tool that measures the subjective experience of sleepiness in adults. There are eight questions in the scale describing different situations in which people may find themselves falling asleep. Participants scored each situation (e.g., watching television) based on the likelihood of falling asleep, ranging from 0 to 3 (0 being the lowest and 3 being the highest likelihood of dozing off). All responses are added to obtain a total score. A total score of 10 or higher indicates that the participant experiences abnormally high sleepiness during the day. It has been validated in the Greek population [12].

2.3   Psychometric Properties of the STOP-Bang Questionnaire

Regarding the diagnostic properties of the tool, the scores of healthy participants and OSA patients were compared in a 2x2 table to establish the specificity and sensitivity, as well as the negative and positive predictive values (NPV and PPV, respectively). Convergent validity was assessed by estimating the correlation between the STOP-Bang score and the total score of ESS. Internal consistency was also assessed.

2.4   Statistical Analysis

Sample characteristics are presented in mean and standard deviation (SD) or absolute and relative frequencies. Internal consistency was assessed with Cronbach's alpha. Correlations were calculated using Pearson r. The analyses were performed using the SPSS v23 (Chicago IL).

3   Results

Participants included 102 healthy adults and 102 patients with OSA (total $n = 204$). All study participants found the Greek STOP-Bang Questionnaire easy and quick to complete, and none of them asked for clarifications. Participants' characteristics are presented in Table 1.

Table 1 Study participants' characteristics

Characteristics	Healthy participants	Participants with OSA
	$N = 102$	$N = 102$
Female sex	53 (52 %)	63 (62 %)
Age	54.67 (9.36)	59.16 (8.53)*
BMI	22.65 (3.16)	27.47 (3.59)

Results are presented as mean (SD) *$p < 0.001$
OSA obstructive sleep apnea, *BMI* body mass index

More participants in the OSA group versus the healthy participant group were females (62% versus 52%, respectively). Age was significantly ($p < 0.001$) higher in the OSA patients (age range 38–89 years) than the healthy participants (age range 33–69 years). The body weight range was 54–134 kg and 52–120 kg, respectively.

Distributions of responses to the STOP-Bang questions are presented in Table 2.

The total score ranged between 2–8 in OSA patients and 0–6 in healthy participants. The mean score values differed significantly with higher scores in the OSA patients than the healthy participants (6.13 vs. 2.13, $p < 0.001$). The biggest differences were noted in the items STOP 2 (experience of fatigue and sleepiness during the day) and STOP 3 (being observed to choke, gasp, or stop breathing while being asleep). The Bang items 1 and 3 referring to BMI and neck circumference had the largest between-group differences. Patients had a mean ESS score of 10.08 (SD 3.04, range 2–18). Reliability coefficient Cronbach's alpha was good ($\alpha = 0.788$). The correlation between the ESS score and the STOP-Bang score was weak but statistically significant (Pearson's $r = 0.250$, $p < 0.05$).

The contingency tables are shown in Tables 3, 4, and 5 for a STOP-Bang cut-off of 3, 4, and 5, respectively.

The resulting specificity for a cut-off of 3 was 98%, sensitivity was 60%, and the PPV and NPV were 71% and 97%, respectively. With a cut-off score of 4, specificity was 96%, sensitivity was 81%, and the PPV and NPV were 84% and 95%, respectively. Finally, specificity for a cut-off of 5 was 86%, sensitivity was 97%, and the PPV and NPV were 97% and 88%, respectively.

4   Discussion

In this study, we performed a validation of the Greek version of the STOP-Bang Questionnaire using a sample of patients diagnosed with OSA and healthy participants. Findings showed that the Greek version of the STOP-Bang could be used as a screening tool for OSA, as it can discriminate between healthy people and OSA patients with high accuracy.

The STOP-Bang Questionnaire was easy to use. Patients with OSA were slightly older compared to the healthy participants. The mean total STOP-Bang score was significantly higher for patients with OSA. Between-group differences were particularly large for STOP question 2, regarding daytime fatigue, STOP question 3, regarding gasping or not breathing while asleep, and Bang items with respect to BMI and neck circumference. As expected, the mean ESS score was also elevated for patients with OSA, compared to healthy participants. Good consistency was confirmed with Cronbach's alpha, and correlation with total ESS score was statistically significant, confirming validity. However, the correlation was found to be weak. This may be because the ESS specifically measures sleepiness levels during the daytime. Although the STOP-Bang has items that measure the presence of daytime sleepiness, it does not focus entirely on this symptom, as it also measures other characteristics consistent with OSA (e.g., loud snoring), as well as anthropometric parameters. It is, therefore, a more generic measure, whereas the ESS is more specific and focused.

In order to ensure high specificity while maintaining acceptable sensitivity, the STOP-Bang Questionnaire could be used for screening with a cut-off score of 4. The high sensitivity and speci-

Table 2 Distributions of positive responses to STOP-Bang items, total score, and risk level in healthy and OSA participants

STOP-Bang items	Healthy participants	Participants with OSA
STOP 1 (*n*, %)		
YES	50 (49)	98 (96)
STOP 2 (*n*, %)		
YES	0 (0)	94 (92.2)
STOP 3 (*n*, %)		
YES	0 (0)	93 (91.2)
STOP 4 (*n*, %)		
YES	14 (13.7)	73 (71.6)
Bang 1 (*n*, %)		
YES	32 (31.4)	80 (78.4)
Bang 2 (*n*, %)		
YES	64 (62.7)	79 (77.4)
Bang 3 (*n*, %)		
YES	5 (4.9)	50 (49)
Bang 4 (*n*, %)		
YES	52 (51)	57 (55.9)
STOP-Bang score (mean, SD)	2.13 (1.39)	6.13 (1.45)*
STOP-Bang risk level (*n*, %)		
Low	60 (58.8)	2 (2)
Moderate	39 (38.2)	12 (11.8)
High	3 (2.9)	88 (86.3)

*p < 0.001
OSA obstructive sleep apnea

Table 3 Contingency table for a STOP-Bang cut-off score of 3 against polysomnography-confirmed diagnosis

	OSA patient	Healthy participant	Total
STOP-Bang ≥3	100	41	141
STOP-Bang <3	2	61	63
Total	102	102	204

OSA obstructive sleep apnea

Table 4 Contingency table for a STOP-Bang cut-off score of 4 against polysomnography-confirmed diagnosis

	OSA patient	Healthy participant	Total
STOP-Bang ≥4	98	19	117
STOP-Bang <4	4	83	87
Total	102	102	204

OSA obstructive sleep apnea

Table 5 Contingency table for a STOP-Bang cut-off score of 5 against polysomnography-confirmed diagnosis

	OSA patient	Healthy participant	Total
STOP-Bang ≥5	88	3	91
STOP-Bang <5	14	99	113
Total	102	102	204

OSA obstructive sleep apnea

ficity found in this study is comparable to previous studies validating this questionnaire in other languages [7, 10, 13].

4.1   Strengths and Limitations

The sample size of the study is adequate, whereas the confirmation of OSA diagnosis by a trained clinician with the use of polysomnography is a significant strength. Moreover, the translation of the questionnaire was performed by two individuals. A limitation is that the STOP-Bang was not tested for its ability to reliably diagnose OSA in a sleep clinic-only sample, but in a sample of patients and healthy participants, therefore we cannot attest to its ability to discriminate between OSA and other sleep disorders, that may share similar symptoms and are hard to discern. Future studies could focus on validating the Greek STOP-Bang in specific subpopulations that may be at higher risk for OSA, including obese or morbidly obese patients. Using the STOP-Bang as a screening tool in such populations could be a parsimonious alternative solution to the costly and often unavailable diagnostic process of polysomnography (e.g., rural populations without access to a sleep clinic).

In conclusion, this validation study has demonstrated that the Greek STOP-Bang can be used for screening in clinical settings, as it discerns patients with OSA from healthy individuals with high accuracy. This may be especially beneficial in low-resource settings and could be used in OSA research for participant screening. We recommend that it is further validated in specific clinical populations to attain widespread use in a variety of clinical settings.

Conflicts of Interest The authors declare no conflicts of interest with respect to this chapter.

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The Role of Pythagorean Self-Awareness Intervention in Obstructive Sleep Apnea. A Randomized Controlled Trial

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Abstract

Obstructive sleep apnea (OSA) is a chronic disease causing daytime sleepiness and poor sleep and life quality. So far, its repercussions on psychological health have been poorly addressed in the available literature. The aim of this study was to investigate the effect of a cognitive-based stress management technique, called the Pythagorean Self-Awareness Intervention (PSAI), in patients with OSA. In this randomized controlled (parallel usual care group) trial with a 1:1 allocation ratio, patients in the intervention group (N = 30, 59.7 ± 9.4 years old, 15 females) received PSAI for 8 weeks along with continuous positive airway pressure (CPAP) treatment, while patients in the control group (N = 30, 58.9 ± 9.3, 22 females) received CPAP alone. The primary endpoint included OSA symptoms. Secondary endpoints were sleepiness, sleep quality, depression-anxiety-stress, and affect. All 30 patients in the intervention group showed 100% compliance with PSAI. There was a statistically significant reduction in OSA symptoms in the intervention group

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compared to the control group ($p = 0.021$). With regard to secondary endpoints, there were statistically significant improvements in sleep quality ($p = 0.001$) and positive ($p = 0.001$) and negative affects ($p < 0.001$) in the PSAI group versus controls. No side effects were reported by the patients. PSAI may be useful as a complementary tool for the management of patients suffering from OSA. Larger randomized controlled trials are required to validate the results of this study.

1   Introduction

Sleep apnea or obstructive sleep apnea (OSA) syndrome is a medical condition characterized by repetitive episodes of apneas associated with complete or partial upper airway obstruction. The pathogenesis of OSA involves genetic, anatomical, and lifestyle factors (e.g., smoking, alcohol) [1]. In principle, the disease causes daytime sleepiness, poor sleep quality, and continuous physical, cognitive, and mental exhaustion. Symptoms of OSA, in turn, increase patients' psychological distress and impair their social life [1]. Notably, OSA has also been associated with increased risk for cardiovascular disease (e.g., atherosclerosis, stroke, heart attack) and cognitive impairment [2].

The core treatment for OSA is continuous positive airway pressure (CPAP). However, it is widely accepted that the multifaceted consequences of OSA in patients' lives warrant more comprehensive adjunct treatments [3, 4]. So far, interventions have focused on cognitive-based psychotherapy and lifestyle counseling which have been attested with promising results for OSA symptoms and associated disorders (e.g., obesity) [3, 4]. To our knowledge, there is no evidence for the role of cognitive-

based stress management in OSA. As such, in this study, we assessed the effect of a cognitive-based stress management technique, called the Pythagorean Self-Awareness Intervention (PSAI), in patients with OSA. PSAI has been previously implemented in patients with insomnia, multiple sclerosis, and mild cognitive impairment showing beneficial effects on sleep, cognitive function, and psychological health of these patients [5–7]. PSAI is a simple and self-administered, after proper education, stress management method, built upon the premises of Pythagorean philosophy [5, 6]. It is presumed that the intervention aids OSA treatment through stress reduction and psychological improvement. As such, the primary endpoint of this trial was OSA symptomatology. Secondary endpoints included sleepiness, quality of sleep, and psychological health, the latter addressed as a proof of concept for PSAI.

2   Methods

This was a randomized controlled (parallel usual care group) trial with a 1:1 allocation ratio. Outpatients diagnosed with OSA in the Evangelismos Hospital (Athens, Greece) were recruited in this study between September 2016 and September 2017. Evangelismos is a tertiary healthcare hospital and a referral center for OSA. The inclusion criteria were definite diagnosis of OSA (polysomnography or home sleep apnea testing in the prior 6 months documenting the presence of OSA as indicated by an apnea-hypopnea index-AHI > 15 events/h where less than 20% of apneas were central), age between 30 and 70 years, and fluency in Greek. The exclusion criteria were previous major psychiatric disease, pregnancy, hormonal therapy, history of cardiovascular disease (e.g., stroke or heart attack), and concurrent use of other stress management techniques. Eligibility was assessed by physicians.

This study received ethical approval from the hospital's ethical committee, as was consistent

with the declaration of Helsinki. All patients gave their written informed consent.

The intervention group received the 8-week PSAI intervention along with CPAP. The PSAI was practiced twice per day in a quiet place at home (112 home sessions). At bedtime, each individual followed three cognitive processes. First, he/she recalled every daily event in the exact time sequence that it happened. To facilitate recall, events were categorized as follows: diet, physical exercise, sleep, and interpersonal contacts. In the next step, each selected experience was critically appraised using three questions: "Is what I have done wrong? Is what I have done right? What have I omitted that I ought to have done?" The individual was advised to remain detached from any emotional burden and contemplate on the performed actions. Hence, through positive (rejoice) and negative (reprimand) self-reinforcement, the individual was asked to set specific goals for the next day in the morning practice, after recapitulating the previous night's results, without repeating the procedure. PSAI was taught and encouraged by experienced healthcare professionals (AM and CD) in eight weekly 1-hour group sessions. All participants were administered diaries to record PSAI practice at home. All patients in the study (i.e., intervention and control groups) received CPAP masks as part of usual care.

Measurements included validated questionnaires administered at baseline and at the end of 8 weeks. The primary outcome was OSA symptoms assessed by the STOP-Bang questionnaire [8]. Secondary endpoints included sleepiness, sleep quality, depression-anxiety-stress, and affect, evaluated by the Epworth Sleepiness Scale (ESS) [9], the Pittsburgh Questionnaire (PSQI) [10], the Depression, Anxiety, Stress Scale (DASS-21) [11], and the Positive and Negative Affect Schedule (PANAS) [12], respectively. Adverse events were recorded by the researchers during and at the end of the follow-up by using open questions.

The sample size was determined only by the available eligible patients during the recruitment period. The researchers chose not to record the number of patients that were assessed for eligibility. The main reason was that patients were referred to the researchers by different physicians and at various times per week due to constant changes in the hospital's schedule. Researchers were not blind to the treatment assignment. A computerized random number generator was used to allocate patients in the two groups in blocks of 10 patients. There was a randomization concealment for the recruiting physicians.

Sample characteristics are presented as means (±standard deviations) and frequencies. Baseline group comparisons were made using Mann–Whitney U-test and exact Pearson's chi-square test. Group comparisons for the rates of outcome change after 8 weeks were made using mixed linear models with random intercept (to account for the random effect of each participant in the model) after adjusting for age and gender. Group by time interaction is interpreted as the adjusted mean difference of outcome change in the intervention group relative to the control group. Observed rates of outcome change are also presented. The level of significance was set at $p \leq 0.05$. The analyses were performed using SPSS version 22.0 (Chicago, IL).

3   Results

Sixty participants were enrolled in the study, and there were no dropouts. All 30 patients in the intervention group returned their PSAI diaries confirming 100% compliance. Baseline characteristics are presented in Table 1. There were no statistically significant differences between the intervention (PSAI) group and the control group at baseline.

As shown in Table 2, there was a statistically significant reduction in OSA symptoms in the intervention group compared to the control group ($p = 0.021$) post-intervention. With regard to secondary endpoints, there were statistically significant improvements in sleep quality ($p = 0.001$) and positive ($p = 0.001$) and negative affects

Table 1 Sample baseline data ($N = 60$)

Characteristics	Control Group ($n = 30$)	Intervention Group ($n = 30$)	p [a]
Female [b]	22 (73.3%)	15 (50.0%)	0.110
Age [c]	58.9 (9.3)	59.7 (9.4)	0.757
Higher education [b]	13 (43.3%)	13 (43.3%)	0.296
BMI [c]	32.3 (4.5)	31.8 (4.9)	0.763
Smoker [b]	3 (10%)	4 (13.3%)	0.715
Symptoms of OSA	4.87 (1.46)	5.43 (1.25)	0.105
Sleepiness	12.17 (3.20)	10.13 (4.57)	0.064
Quality of sleep	7.55 (3.41)	7.83 (3.16)	0.755
Depression	12.60 (11.46)	12.93 (12.76)	0.953
Anxiety	8.74 (7.91)	9.11 (9.42)	0.958
Stress	13.23 (8.39)	14.30 (10.27)	0.886
Positive affect	35.00 (9.15)	33.90 (8.83)	0.484
Negative affect	21.53 (6.88)	22.47 (7.99)	0.756

[a] Mann–Whitney test for numerical values and exact Pearson's chi-square for categorical ones
[b] N (%)
[c] Mean (SD)

Table 2 Results of linear mixed models for the study's outcomes ($N = 60$)

	Intervention Group ($N = 30$) [a]	Control Group ($N = 30$) [a]	Group × Time ± SE [b]	p value [b]
Symptoms of OSA	-3.0 ± 1.05	-2.27 ± 0.83	-0.59 ± 0.25	0.021 *
Sleepiness	-5.83 ± 4.59	-2.83 ± 9.41	-2.57 ± 2.06	0.215
Quality of sleep	-3.83 ± 3.23	1.33 ± 5.94	-5.17 ± 1.41	0.001 *
Depression	-7.28 ± 12.08	-5.78 ± 6.22	-0.50 ± 2.72	0.853
Anxiety	-4.40 ± 9.98	-3.56 ± 4.21	0.07 ± 2.16	0.975
Stress	-6.92 ± 10.60	-5.96 ± 4.87	-0.60 ± 2.38	0.801
Positive affect	3.11 ± 6.03	-1.90 ± 4.30	5.21 ± 1.49	0.001 *
Negative affect	-5.89 ± 10.03	4.23 ± 4.50	-10.13 ± 2.19	<0.001 *

[a] Values represent means ± standard deviations for the observed outcome changes during follow-up (last measurement minus baseline one)
[b] B coefficient ± standard error derived from the mixed linear effect models using random intercept and after adjusting for age and gender. By coding the control group and baseline time as zero, group x time represents the mean outcome change in the intervention group relative to the control group across follow-up. OSA: Obstructive Sleep Apnea
* Level of significance $p \leq 0.05$

($p < 0.001$) in the PSAI group versus controls. No side effects were reported by the patients.

4   Discussion

In this study, the PSAI group experienced a reduction in OSA symptoms and improvement of sleep quality and psychological affect. The results of this study pertain to middle-aged overweight/obese OSA patients seeking help in tertiary healthcare centers with no previous or concurrent major cardiovascular or psychiatric diseases. To our knowledge, this is the first study using PSAI in sleep apnea patients; therefore, direct comparison with other studies is not possible. However, the improvement of affective parameters is in line with previous findings on the effectiveness of cognitive behavioral therapy (CBT) in patients with sleep disorders and provides a proof of concept for PSAI [13–15]. The resemblance of PSAI with CBT is striking. PSAI, like CBT, is an introspective method targeting to amend a dysfunctional situation or idea. However, classical CBT is readily available to only a small fraction of the population, whereas PSAI can be

practiced at home, after a short period of appropriate training.

Study limitations include the lack of blinding and the small sample size. Also, measures were self-administered subjective inventories. Finally, there is always the chance that patients in the intervention group misreported on the PSAI diaries.

In conclusion, this study presents for the first time an advantageous role of PSAI in OSA patients. Larger randomized controlled trials are needed to confirm the findings of this study.

Conflicts of Interest The authors declare no conflicts of interest with respect to this article.

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Tissue Characterization in Cardiology: Moving Beyond Function

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Abstract

Cardiovascular Magnetic Resonance (CMR) offers accurate and highly reproducible tissue characterization, beyond cardiac function. Late gadolinium enhancement (LGE), although represents a noninvasive biopsy for fibrosis quantification, it is unable to detect diffuse myocardial disease. Native T1 mapping and extracellular volume fraction (ECV) are able to provide important information about processes involving both myocardial cells and interstitium that otherwise cannot be identified. Changes in myocardial native T1 mapping reflect cardiac diseases such as acute coronary syndromes, myocardial infarction, myocarditis, diffuse fibrosis, systemic disease such as cardiac amyloidosis, all presented with high T1 and Anderson-Fabry disease and siderosis, presented with low T1 mapping. The ECV, an index generated by native and postcontrast T1 mapping, introduces a new way to measure the cellular and extracellular interstitial matrix (ECM). ECV has a prognostic value equal to Left ventricular ejection fraction (LVEF); however, LVEF underscores the interstitial matrix. This myocyte-ECM dichotomy has important implications for identifying therapeutic targets that are of great value for heart failure (HF) treatment. Furthermore, T2 mapping is superior compared with myocardial T1 and ECM for assessing the activity of myocarditis in recent-onset HF. These indices will affect significantly the clinical decision making. However, there is still lack of multicenter studies and community-wide approach including MRI vendors, clinicians, fundings, softwares, and contrast agent manufacturers.

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1 Introduction

There is an increasing interest in Cardiology
to penetrate to the "heart of the matter" of
cardiovascular diseases with the hope to be
more efficient in early diagnosis/treatment.
In this context, Cardiovascular Magnetic
Resonance (CMR) offers accurate and highly
reproducible measurements. CMR, through
the assessment of late gadolinium enhance-
ment (LGE), gave to Cardiology the great
opportunity of noninvasive biopsy for fibro-
sis quantification. LGE can give information
about the underlying replacement fibrosis
and is related to prognosis and response to
treatment [1–5]. However, LGE requires
regional differences in the signal intensity
between normal and abnormal myocardium
and is unable to detect diffuse myocardial
disease [6]. Recent advances in CMR allow
more reliable tissue characterization, based
on the absolute quantifiable differences in
recovery rates of longitudinal magnetization
using T1 mapping [7, 8]. The T1-based indi-
ces include native T1, which reflects myocar-
dial disease involving the myocyte and
interstitium without the need for gadolinium,
T1 postcontrast mapping and extracellular
volume fraction (ECV), which is a direct
gadolinium-based measurement of the size of
the extracellular space, reflecting only inter-
stitial disease [9]. ECV dichotomizes the
myocardium into a cellular and an interstitial
component, expressed as volume fractions.
Native and postcontrast T1 measurements
allow the routine noninvasive measurement
of ECV.

2 Clinical Value of New CMR Indices

2.1 Native (Noncontrast) T1

The native (noncontrast) T1 measurement of
myocardium allows the noninvasive detection of
biologically important phenomena that provide
early diagnosis and potentially influences the
decision for early treatment. It can also detect
important pathophysiologic processes, related to
excess of water as in edema [9, 10], protein
deposition [11, 12], and other T1-altering sub-
stances, such as lipid [13, 14] or iron (hemor-
rhage, siderosis) [15], without the use of
gadolinium, and therefore, it can be also used in
patients with impaired renal function.

Changes of myocardial native T1 mapping
reflect cardiac diseases, such as acute coronary
syndromes, infarction, myocarditis, diffuse fibro-
sis, and cardiac amyloidosis that are presented
with high native T1 [16]. On the contrary,
Anderson-Fabry disease and siderosis are pre-
sented with low native T1 [17]. By including
native T1 mapping in a CMR scan, we can reveal
various pathologies such as area at risk in acute
coronary syndromes [9, 10, 18], global myocar-
ditis without preclinical cardiac involvement,
iron overload, Fabry disease, and cardiac amyloi-
dosis [11, 13, 19]. Native T1 mapping can be
influenced by various pathologic processes, and
therefore, it should be interpreted cautiously with
regard to the clinical background [10, 20].

2.2 Postcontrast T1 Mapping and ECV

After administration of a contrast agent,
myocardium-containing fibrosis demonstrates
prolonged wash-out of gadolinium, related to an
increased distribution within the scar area [21].
An increased concentration of gadolinium relaxes
the adjacent protons much faster than usual,
causing T1 shortening, which is expressed as an

area of high signal intensity on LGE images [22]. However, the extent of collagen deposition within the myocardium varies depending on the type and severity of the cardiac disease. Focal scarring refers to an area of replacement fibrosis that is detected through LGE imaging. However, diffuse, interstitial fibrosis at histopathologic analysis cannot be detected by LGE.

T1 mapping overcomes these limitations by measuring the intrinsic T1 time of the evaluated tissue. As expected, precontrast enhancement T1 time in normal myocardium is longer compared with postcontrast T1 time. This is due to the small amount of residual gadolinium in the interstitium, which has a relaxing effect [23] and is amplified by the increased volume of retained gadolinium in patients with diffuse fibrosis and even more in patients with regional scarring. In controls, normal postcontrast myocardial T1 times are reported to be 340–579 msec, while in patients with cardiac disease are reported to be 250–580 msec. Postcontrast T1 mapping with a threshold of 392 msec or less (mean plus three standard deviations) was reported to have sensitivity and specificity of 100% and 95%, respectively, in patients with chronic myocardial infarction [20].

The ECV in the myocardium may be calculated from the concentration of extracellular contrast agent in the myocardium relative to the blood in a dynamic steady state according to the following equation:

$$ECV = \left(1 - \text{hematocrit}\right)\frac{\left(1 / \text{T1myopost} - 1 / \text{T1myopre}\right)}{\left(1 / \text{T1bloodpost} - 1 / \text{T1bloodpre}\right)}$$

The ECV introduces an important new sensitive index regarding the distribution of the cellular (dominated by myocyte mass) and extracellular interstitial matrix (extracellular matrix in the interstitium [ECM]) compartments. Alterations in these compartments occur during various pathophysiologic processes [10]. Early data showed that ECV has a prognostic value equal to LVEF [20, 21]. However, LVEF underestimates the clinical importance of the interstitial matrix. This fact may have serious implications for iden-

tifying distinct therapeutic targets, such as the fibroblasts versus the myocytes that are of great value for heart failure (HF) [22]. In the absence of amyloid or edema, expansion of the myocardial collagen volume fraction is responsible for most ECM expansion [24, 25] that leads to mechanical [26–28], electrical [29–32], and vasomotor dysfunction [33]; these represent key parameters of cardiac vulnerability [34] and diminish tolerance to ischemic insults [35–37].

Fibrosis is considered as a final common pathway of many myocardial diseases [38–40]. Although LGE provides important diagnostic and prognostic information [2, 41–46], T1 mapping and ECV may have an advantage over LGE for quantifying the degree of ECM or interstitial expansion. Furthermore, LGE cannot quantify the extent of ECM expansion [4, 47–52], due to pathologic processes, where the differences between normal and abnormal myocardium are less distinct. Furthermore, ECV has better correlation with outcomes than LGE in nonischemic cardiomyopathy, and may provide additive value beyond age, gender, renal function, myocardial infarction extent, ejection fraction, and HF stage [53–58] (Figs. 1, 2, and 3).

2.3 T2 Mapping

STIRT2-Weighted (T2W) magnetic resonance imaging pulse sequences have been used to differentiate acute from chronic infarction and identify acute myocarditis. However, T2W sequences have suffered from various problems including (a) signal intensity variability caused by phased array coils, (b) high signal from slow-moving ventricular blood that can mimic and mask elevated T2 in the subendocardium, (c) motion artifacts, and (d) the subjective nature of T2W image interpretation, unless it is expressed as T2 signal of myocardium versus T2 signal intensity of skeletal muscle (normal value <1.9).

T2 mapping technique can accurately and reliably detect areas of myocardial edema without the limitations of qualitative T2W imaging and is superior compared with standard CMR parame-
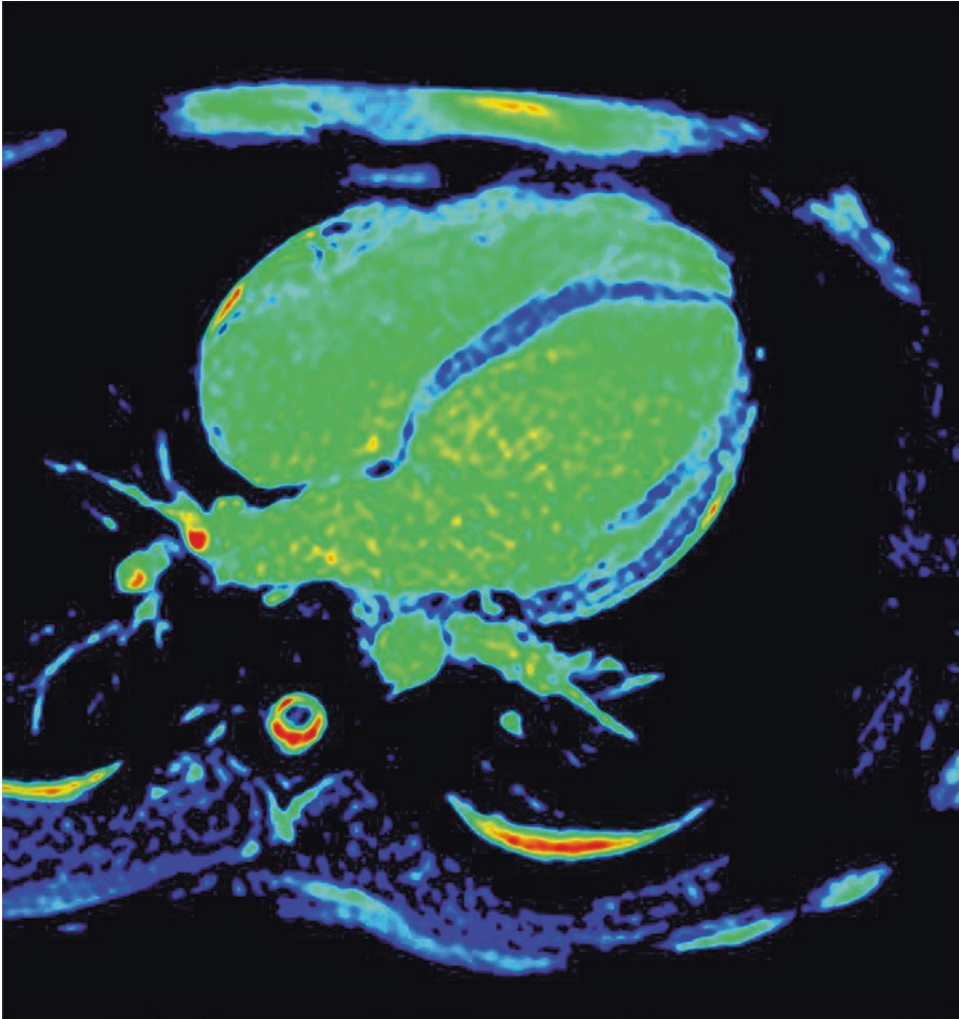
Fig. 1 Native T1 mapping in myocarditis

ters, global myocardial T1 mapping, and ECV for assessing the activity of myocarditis or cardiomyopathy carriers with recent-onset HF [59] (Fig. 4).

In conclusion, native, postcontrast T1 mapping, T2 mapping, and ECV provide important information about processes that otherwise cannot be detected. These indices will affect significantly the clinical decision-making/early treatment. At present, they appear robust enough for the early diagnosis of many diseases. However, there is still a lack of multi-center studies and community-wide approach including MRI vendors, clinicians, fundings, softwares, and contrast agent manufacturers, and therefore, more research is required before a large-scale application for clinical decision-making can be recommended.
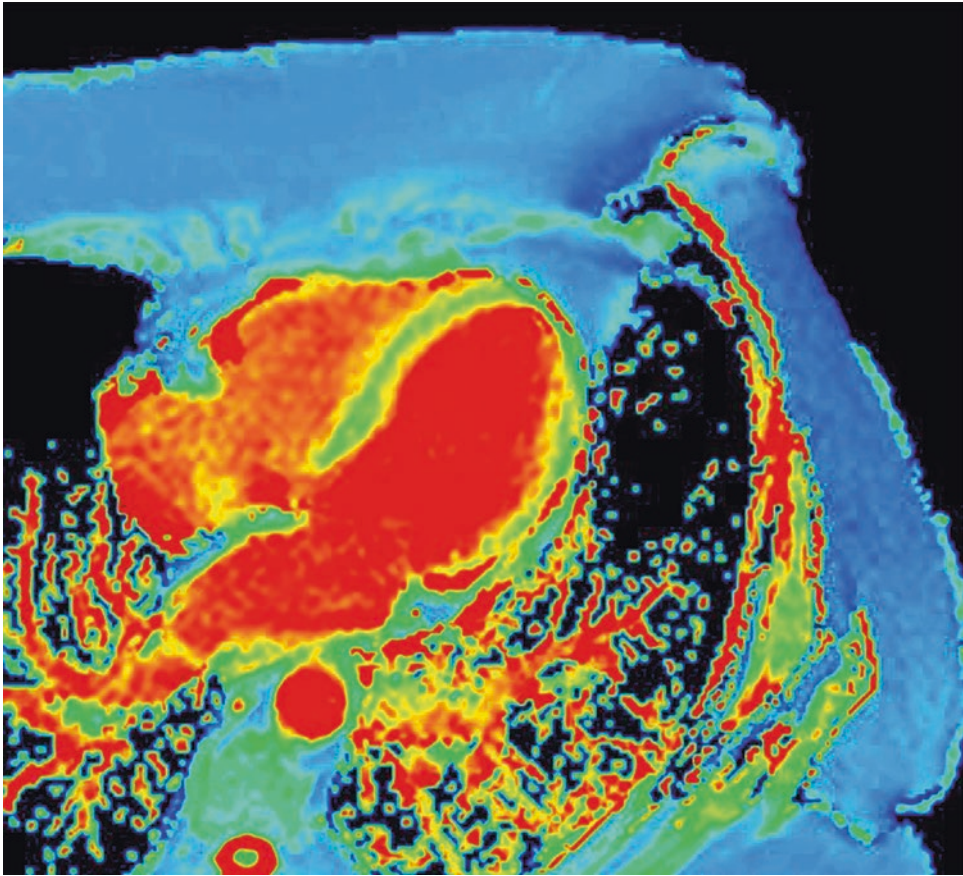
Fig. 2 Takotsubo disease
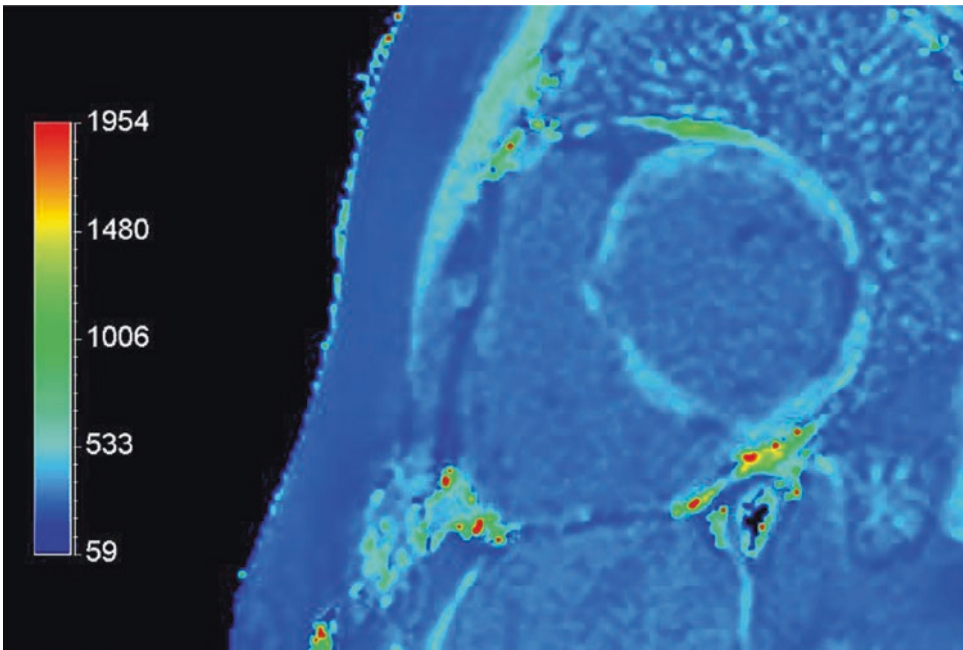
Fig. 3 Systemic sclerosis
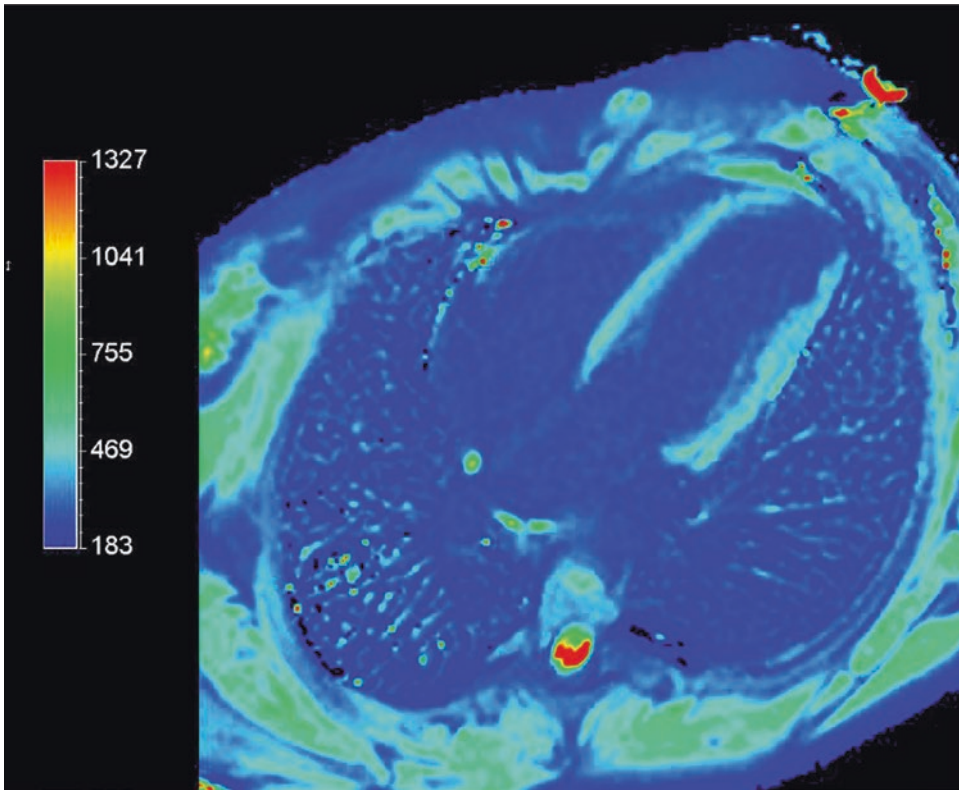
Fig. 4 Native T1 mapping with apical abnormalities in a patient with apical noncompaction and recent onset HF

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Psychiatric Care in Acute Care Units with Locked Doors: Nursing Care Providers' Perceptions and Experiences

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Abstract

Social distancing and the recent lockdown due to COVID-19 have increased the feeling of disconnection, isolation, and suffering in vulnerable individuals and have brought forward questions regarding locked acute care psychiatric units that cannot be answered by the literature. In Greece, there is no available research on how locked ward environments are perceived and experienced by mental health professionals. The aim of the present study is to illuminate nursing care providers' perceptions of psychiatric care in units with locked doors. Fifteen nursing care providers were interviewed and inductive content analysis was employed to explore their experiences of working in locked psychiatric acute care units. Negative and positive feelings about door locking did not appear to match the specific system of practice. Some participants described how locked doors influenced their professional role by placing emphasis on control rather than care while others regarded locked doors as a symbolic way of therapeutic boundary setting. Participants had positive experiences when they perceived their working environment as caring. The therapeutic benefits of locked doors were prominent when locked doors were perceived as "invisible."

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1   Introduction

The recent COVID pandemic has caused tremendous anxiety, trauma, and grief in the global population [26]. The experience of lockdown appeared to be a source of stress, anxiety, and loss which in turn may have long-lasting emotional and functional consequences for some vulnerable individuals [11]. Similarly, psychiatric care in locked wards influences patients greatly. They may feel confined to a prison-like environment, hopeless or depressed and may become unnecessarily passive and dependent on staff or nervous, frustrated, and aggressive [5, 13, 19]. Feelings of resentment often fuel non-cooperation, and erode patients' self-esteem through social exclusion and stigmatization [19]. On the other hand, the locked door may keep patients safe by preventing them from leaving the ward, provide staff members with the necessary control to manage the ward efficiently and be a relief for significant others who know that patients are cared for and unable to abscond.

Overall, locked wards regulate the ability of both voluntary and involuntary patients to leave psychiatric units, although this may be contrary to the current Mental Act Code of Practice of a country [25]. Furthermore, door locking practice appears to be an emotive issue that attracts strong moral valuations [1, 16] and polarization as to whether it constitutes an entry to an era of re-institutionalization or an efficient security measure of modern units which—despite being locked—are considerably permeable and show little evidence of institutionalization [25]. Door locking is associated with some decrease in absconding [21] but also with increases in conflict, self-harm, and medication refusal [3]. In a review of 11 studies on locked wards, van der

Merwe et al. [25] concluded that there is an urgent need for research to determine the real effects of locked doors in inpatient psychiatry.

In Greece, there is no research available in relation to locked ward environments or beliefs, judgments, and experiences of door locking policies. Furthermore, there is no research illuminating nursing care providers' experiences of working in locked wards. The aim of the present study is to describe nurses' experiences and perception of acute psychiatric care in a locked environment.

1.1   The Greek Context

In Athens, acute psychiatric inpatient care is provided by two public psychiatric hospitals, a university research hospital, and psychiatric departments in general hospitals. The latter has been developed, following a large-scale reform effort that started in the mid-1980s in Greece after special funding by the European Community (EC) in order to assist the de-institutionalization process. The percentage of involuntary admissions in the two public psychiatric hospitals is alarmingly high (i.e., more than 60%) while in the psychiatric inpatient units of general hospitals it is considerably lower [8, 9, 24]. Both voluntary and involuntary hospitalization may take place every time in a different hospital—the hospital which is on call service on the specific day according to the weekly program of the National Health Service. In light of the incomplete de-institutionalization process in the country, the shortage of community mental health services and the fragmented and uncoordinated provision of primary psychiatric care [8, 22], patients and carers have limited access to a full range of interventions and receive little information about existing services and their use [6, 24]. Consequently, the Greek system's incapacity to deal with serious and enduring mental illnesses increases dramatically the heavy burden on acute care inpatient units.

Door locking practice varies considerably between psychiatric units and it is determined

by hospital policy at least to some degree. Within the stream of innovative efforts transforming psychiatric services in other European countries, the wards of the first State Psychiatric Hospital opened in 1947 to allow its patients to walk freely within its grounds and later in the outside world [10]. By contrast, the wards of the University Hospital and the second public psychiatric hospital of Athens are permanently locked, with the exception of one ward (out of ten) which operates with open doors. Some psychiatric departments in general hospitals are locked, whereas others remain open at all times, except at night for security. There may be also security staff on a 24-h basis in some psychiatric departments. Finally, as regards other containment methods, compulsory intramuscular medication, physical and mechanical restraint are used more frequently in Athens than in other European countries ([2, 4, 17, 23]).

2 Methods

2.1 Study Design

A case study design of a public psychiatric hospital operating mostly with a locked door policy and a qualitative approach were selected for their potential to elicit a richer discussion of participants' experiences over quantitative research.

2.2 Participants and Procedure

Purposive sampling was used to approach nursing care providers who provide services to psychiatric patients in locked wards. Participants' age ranged from 29 to 51 years (mean 41 years) while their clinical experience ranged from 1 to 30 years (mean 15.5 years). Twelve participants (80%) had a degree in Nursing, while three had completed a 2-year technical education as nurse assistants. Ethical approval was obtained from the Scientific Counsel of the hospital. Ground rules around disclosures, respect for participants' privacy and anonymity were also discussed with the participants prior to participation.

An introductory question (What are the advantages and disadvantages of the locked door practice for your nursing care?) generated lively discussions about nursing care providers' experiences of working in locked wards. This was followed by further questions: What are the advantages and disadvantages of the locked door practice for your patients? What were your first impressions of working in a locked ward when you started working? Have your feelings or the way you think changed since then? A closing question invited participants to offer a description of the impact of their working experience on them (How do you think working in a locked ward affected you over time?) as well as recommendations that may support their work in the future. Questions were open-ended, with probes facilitating rich accounts.

2.3 Analysis

As regards qualitative data, inductive content analysis was used to explore nurses' experiences of acute inpatient psychiatric care in locked wards following the principles of conventional content analysis [15]. The steps implicated in this process include: (a) reading repeatedly data to achieve holistic understanding, (b) deriving codes using the exact words that capture key concepts, (c) attaching labels to emerging codes, (d) organizing codes into subcategories and categories, (e) developing a tree diagram which organizes codes, subcategories, and categories into a hierarchical structure, (f) developing definitions of codes and categories, and g) identifying key themes emerging from categories. To ensure the credibility of findings, consensus was reached among three researchers.

3 Results

Nursing care providers' experiences varied greatly among wards. Two overarching themes describe their experiences and perceptions of working in locked acute care environments: (a) perceiving the working environment as therapeu-

Table 1 Themes, categories, and subcategories

Themes	Categories	Subcategories
The therapeutic environment	Benefits of locked doors for nurses	Safety Control Significant others' gratitude
	Locked doors as invisible	Limit setting Meaningful staff-patient interactions Patients' feelings of safety and peacefulness
	Perceived negative aspects of care in locked units for nurses	Loss of nursing role Stigma Increased responsibility Ethical strife Compassion fatigue
The non therapeutic environment	Perceived negative aspects of care in locked units for patients	A strong impression of "prison like" environment Lack of trust Conflict and aggression incidents Stigmatizing attitudes towardpatients Dependence on others and disempowerment

tic and (b) the nontherapeutic environment. Overall, four categories and 16 subcategories emerged regarding their perceptions and feelings during their working experiences in locked psychiatric acute care units (Table 1).

3.1 Theme 1: Perceiving the Working Environment as Therapeutic

The therapeutic benefits of locked doors appeared to be the central organizing element of participants' experiences in some locked units while locked doors appeared to be "invisible" when the locked unit was experienced as a caring environment.

3.1.1 Category 1: Benefits of Locked doors for Nurses

This category comprised three subcategories: (a) safety, (b) control, and (c) significant others'

gratitude. Many participants reported that they felt particularly safe when working in a locked building, as they knew it would be difficult for patients and visitors to bring dangerous objects or psychoactive substances inside the clinic, due to strict surveillance at the entrance of the ward.

> Everyday life is safer because it is not easy for a patient to bring any dangerous object into the clinic, which is controlled by the nursing staff. (N1)

> ... I know that everything is under control and so I feel relief and security. (N6).

For many nursing providers, a locked door is tantamount to better control of the ward. In addition, door locking contributed in their work becoming easier, quieter, and less stressful.

> The good thing about locked doors is that I am comfortable and I am not worried that a patient with dementia or mental retardation will leave without my permission, since unfortunately there can be no constant supervision. (N7)

> When the door is locked, it is easier and safer to control the large number of patients and their activities. I will hardly lose a patient from my eyes. (N12)

It is very important for participants that relatives approve of the way the clinic works and they are, therefore, more likely to be supportive and cooperative as regards their family member's treatment and recovery. According to some interviewees, the acceptance of the rules set by the clinic by relatives satisfies and relieves the nurses who are so eager to help their patients.

> I get great satisfaction even with a small 'thank you' from a relative. (N13)

> Our patients' relatives are relieved to know that their own people are locked in a protected area and agree that this will help them overcome or even regulate their illness. (N15)

3.1.2 Category 2: Locked Doors as Invisible

This category comprised three subcategories: (a) limit setting, (b) meaningful staff-patient interactions, and (c) patients' feelings of safety and peacefulness.

Several participants reported that limit setting is one of the most important parts of patients' treatment as well as being fundamental in a successful coexistence between patients and nurses. The practice of locking the door helps a lot in cultivating limit setting and promoting responsible, sensible, and prudent decision making. Physical boundaries enable the patient to internalize the importance of limit setting and self-control in his/her recovery. According to participants, patients rarely admit that they feel safe in the locked ward and that they do not suffocate. However, it is a fact that many patients have stated that they feel protected and safe behind bars and locked doors, whether the danger that threatens them is another patient, or an unwanted relative, or a symptom of their illness. The gradual attainment of trust within therapeutic relationships contributed to perceiving the environment as primarily caring instead of "locked."

> Sometimes patients who have been here longer seek the locked ward because they feel safe... Some do not even want to go to the courtyard for a walk. Others get upset when relatives visit them and ask us not to let them see them. They want to be alone for a while and I think this isolation works well. (N11)

3.2 Theme 2: The Nontherapeutic Environment

3.2.1 Category 1: Perceived Negative Aspects of Care in Locked Units for Nurses

This category comprised four subcategories: (a) loss of nursing role, (b) stigma, (c) increased responsibility, and (d) compassion fatigue.

Several participants emphasized that their role is altered and undermined to that of security personnel in a locked ward. They constantly feel that they are engaged in tasks which are not listed among their professional duties and this disappoints them as the therapeutic relationship with the patient is lost.

> I am just losing my role as a nurse and I often work as a guard. When on the one hand I advise patients and on the other I bully or punish them by tying

them up, how can I establish a therapeutic relationship with them? Our role is constantly undermined and not being recognized by the rest of the interdisciplinary team. (N4)

> There is no staff. We are nurses and police men and prison staff. You try as much as we can for a therapeutic relationship but often it is not achieved. It is not possible that the patient sees you as a nurse when you do all this at the same time. (N11)

Furthermore, the impact of door locking on their work is intense. They reported that nursing care is so often interrupted that the practice of door locking is regarded mostly a highly boring task by nurses and nurse assistants rather than a therapeutic tool.

> We have the responsibility of 'open-close' whenever anyone wants to get in or out of the department so we end up doing things that do not fit into our role. (N3)

> However, every now and then I have to open and close the door as if I were a guard. This situation not only burdens my work, which I have to interrupt at regular intervals, but also alters my image in patients. (N7)

Some of the nurses underlined the stigma toward them contrary to the public opinion that the stigma is mainly experienced by the psychiatric patients. So the society not only does not understand the offer of their work, despite the degraded conditions of the time but often characterizes them as "guardians." Most nurses agreed that symptoms of compassion fatigue are related to the atmosphere of the working environment. Many stressed the importance of the integrity of a professional's personality in order to cope with the difficult situation that he/she often has to face.

> We are neither police, nor guards, nor do we behave like that! But society has already formed a bad opinion of us and ignores our effort to help these people. (N1)

> Society does not recognize our work and stigmatizes us just as it stigmatizes the patients who try to reintegrate in community after discharge from the psychiatric hospital. For some reason the whole world sees us as ruthless people, imprisoning patients and mistreating them. (N14)

Several interviewees pointed out that the door locking policy creates additional responsibilities

related to ward surveillance which are further increased by low staffing levels. Furthermore, some participants believed that they should be twice as careful as the nurses in an open ward since the legal procedures in a possible patient escape are stricter for locked wards.

> I have additional responsibilities. I have to lock every door behind me, control who enters and who leaves, and what each one carries on it. I have to extremely careful because bureaucracy is great. I am a nurse, a guard and a policeman at the same time. (N2)

> It is a great responsibility and not an easy task to manage so many patients when the area of the hospital is so large. In case of an escape the first thing to do is to search all areas of the hospital, on foot, by ambulance or any other way. If you make sure that the patient is inside the hospital area you need to send an escape message to the police. (N9)

3.2.2 Category 2: Perceived Negative Aspects of Care in Locked Units for Patients

This category comprised five sub-categories: (a) a strong impression of "prison-like" environment, (b) lack of trust, (c) conflict and aggression incidents, (d) stigmatizing attitudes toward patients, and (e) dependence on others and disempowerment.

According to participants, patients often liken the locked ward to a prison. Patients admitted involuntarily are usually more negative with the locked ward describing feelings of imprisonment which in combination with their vulnerable psychiatric condition creates tensions and often makes them more aggressive. Furthermore, patients have less trust in nurses and even when this happens it takes a long time to be established. Apart from the suspicion that is characteristic of psychiatric patients, this situation is aggravated by the practice of door locking that makes nurses bad in the eyes of patients.

> In order to build a therapeutic relationship, you have to gain their trust and this is done slowly. It is very difficult to do this when they already have a negative image of you. (N11)

Some of the nurses pointed out that one of the disadvantages of locked wards is patients' resig-

nation and dependency. They emphasize that when patients have care on a 24-h basis their recovery is hindered. Treatment not founded on cooperation prevents patients from taking responsibility for themselves. Some nurses also mentioned another disadvantage of the locked ward, which mainly concerns the lack of creative engagement of the patients, resulting in lazy behavior and inactivity. Lack of activities in the ward in combination with the suffocating atmosphere is reported to affect both staff and patients. Tension in the atmosphere due to confinement is a common phenomenon according to participants. This intensity causes discomfort to patients, who react aggressively to others, resulting in increased rates of arousal and rates of violence.

> Patients also need to be involved in activities, they cannot lie down all day, nor watch TV all the time, it is not good for their mood or health. (N10)

> Patients do not see the locked door as a remedy, all this confinement raises their tension and they become aggressive. (N10)

3.3 Suggestions for Improvement

Suggestions for improvement included staffing levels, support from managers, clinical supervision, and employment of security personnel so as to ensure that nurses are burdened with the locking and unlocking demands on unit entrance.

> Without wanting to, I become the 'bad guy' and I lose the trust of my patients when I have to lock them up and I have to restrain them. It would be right and wise to clarify the responsibilities of the nurse from those of security staff. (N2)

4 Discussion

The aim of this study was to illuminate nursing care providers' experiences in locked acute psychiatric environments. Present findings suggest that participants had positive experiences when they felt that they were working in a therapeutic environment and negative experiences when they

perceived their working environment as nontherapeutic. Participants' positive experiences resemble those of nurses in a phenomenological study of locked acute care environment which describes a physical and a spiritual closeness between staff members and patients which gives the latter peace. It appears that an overall positive ward atmosphere in a rich social environment, caring and respectful informal interactions and openness between mental health professionals and patients can cultivate a sense of freedom in an acute psychiatric care unit and render it "permeable" [7, 25].

On the other hand, overcrowded locked units were described by several participants as a "prison" like environment in which aggression incidents, a great distance in therapeutic relationships, and a suffocating atmosphere bring to mind recollections of old-style mental hospitals (asylums) which functioned merely in a custodial care model [1, 7, 25]. Similarly, the time-consuming task of locking and unlocking the door caused much frustration to nursing care providers in some locked units. Other research demonstrates that nurses are burdened with the door locking needs of a ward and also report enhanced responsibilities related to door locking policy [13]. Furthermore, the use of coercive measures causes adverse emotional and psychological impact on both staff and patients [12, 20].

As regards the limitations of the present study, the sample was drawn at one psychiatric hospital only and, therefore, may not be representative of nursing care providers in Greece in general. Furthermore, interviews with nurses with sustained exposure to psychiatric practice in other hospitals, would allow comparison of perceptions and experiences which would not be influenced by professional socialization processes at one particular hospital. Finally, the fact that other characteristics of wards' culture were not included constitutes another limitation of the present research. Nevertheless, due to the pivotal position of this hospital in the Greek mental healthcare system, these data are indicative of the processes and underpinnings of acute psychiatric care in Greece and thus, they are of high relevance on a national level as well.

Participation in this study offered an opportunity to nursing care providers to review the advantages and disadvantages of door locking policies in psychiatric wards and share their experience. Lack of understanding of the advantages and disadvantages of door locking and containment practices on the acute care environment and the recovery process may limit nurses' ability to interact in a meaningful and safe way with mental health patients and their families [1, 25]. In contrast, acknowledgment of the advantages and disadvantages of psychiatric practices may help professionals in developing a more realistic view of practice and avoid polarization between a romanticized view of care and resignation so as to become involved with patients instead of limiting contact by a collective withdrawal at the nurses' station [14].

Bowers et al. [3] stress the importance of clear and consistent ward rules and collective articulation of the overt and implicit ideology asserted by staff's behavior in order to avoid providing an inconsistent and disrespectful service to patients. Furthermore, articulation of the overall ideology as well as the purpose of the ward and what it offers to patients should be done in the context of the team who share the burden of face-to-face contact with challenging patients [3]. If nurses experience ethical dilemmas related to their practice then there is a clear need to cultivate and retain a critical and analytical attitude toward the system they operate articulated at a team level. Clinical supervision may support mental health nurses at an individual and team level in this challenging task. According to Lanara [18], serving the suffering patient as a person in a complex society constitutes a difficult intellectual and spiritual achievement and requires heroism, passion for social justice, and zeal for righteousness in dealing with internal and external barriers to care and build a strong professional identity.

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Researching Nursing Students' Attitudes toward Mental Health Practice: Cultural Adaptation and Validation of the Greek Version of the Acceptability of Locking the Door Questionnaire in Acute Psychiatric Care

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Abstract

The present article describes the cultural adaptation and validation of the Greek version of the Acceptability of Locking the Door Questionnaire and aims to determine students' preference regarding mental health nursing as a possible career choice. The linguistic adaptation of the original instrument was performed according to the most recent guidelines and it was then administered to 274 third-year nursing students. Results support the validity and reliability of the instrument, which can be used to assess effectively the attitudes of the intended population. Sixty per cent of students considered mental health nursing as a possible career choice. Research on students' attitudes appeared to be a strategy of creating the space for lively discussions among them and capturing their interest in mental health education and practice. Theoretical preparation and clinical placements of mental health nursing students should incorporate strategies to improve their perceptions of working in mental health settings.

Keywords

Validity · Reliability · Cultural adaptation · Mental health nursing education · Attitudes · Locked doors · Open doors · Acute psychiatric care

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1   Introduction

During the last two decades, the main author worked as a mental health nursing clinical educator at the Psychiatric Hospital "Dromokaition,"

which was the first psychiatric hospital to be built in Athens, Greece in 1887 and operated with open doors since 1947 [9]. At the same time, she was employed at the Psychiatric Hospital of Attica which operated mostly with locked doors and was situated only two miles away from the previous hospital. Therefore, she used to be astonished at the fact that many mental health professionals, including psychiatrists, were not aware of the different practices used at the two hospitals in relation to door locking.

Generally, locked wards regulate the ability of both voluntary and involuntary patients to leave psychiatric units, although this may be contrary to the current Mental Act Code of Practice of a country [21]. Furthermore, door locking practice appears to be an emotive issue which attracts strong moral valuations [2, 18] and polarization as to whether it constitutes an entry to an era of re-institutionalization or an efficient security measure of modern units which—despite being locked—are considerably permeable [21]. Bowers et al. [5] constructed the Acceptability of Locking the Door Questionnaire (ALDQ) drawing on the work of Haglund et al. [11, 12]. They administered the ALDQ questionnaire in 61 psychiatric in-patient wards in the UK and found that staff scores varied mostly between wards rather than within wards which supports the homogeneity of staff attitudes in the same ward [4].

On the other hand, research on the attitudes of undergraduate nursing students toward mental health nursing has shown that mental health is one of the least preferred areas of nursing for a potential career while students perceive mental health clinical placements as particularly difficult and stressful [8, 14, 23]. To address such difficulties and challenges, as well as to cultivate critical thinking skills, nursing educators have proposed several evidenced-based strategies such as consumer participation, debate-based learning, reflective journaling, role playing, and other experiential psychoeducational and pedagogical methods [1, 10, 14, 16]. Research on students' attitudes cultivates their self-awareness [19] and satisfies the need for evidence-based approaches in nursing education [20].

Accurate research is founded on the availability of valid and reliable measures. The validity and reliability of the Acceptability of Locking the Door Questionnaire have not been examined in Greece so far. The aim of the present study was, therefore, twofold:

- to provide cultural adaptation and validation evidence for the Greek version of the Acceptability of Locking the Door Questionnaire (Acceptability of Locking the Door Questionnaire-Greek).
- to determine students' preference regarding mental health nursing. Students who considered mental health nursing as a possible career choice were expected to be interested in the process of shedding light into their own attitudes toward mental health nursing practice.

2 Methods

2.1 Process of Translation and Adaptation of the Instrument

According to the guidelines of the WHO (WHO. int) on the achievement of different language versions of an original questionnaire that are conceptually equivalent in each of the target countries/cultures, the translation process should focus on cross-cultural and conceptual and not on linguistic/literal equivalence [24]. Overall, the instrument should be equally natural and acceptable and should practically perform in the same way as the original one (WHO.int). To achieve this goal, we applied forward-translations and back-translations and followed strictly the WHO guidelines for cross-cultural adaptation.

Two translators conducted the forward and backward translations of the instrument from the original English version of ALDQ to a Greek version and vice versa. A mental health nurse whose mother tongue was Greek but was also knowledgeable of the English-speaking culture and an independent translator, whose mother tongue was American. The second translator was a teacher of secondary education from Pennsylvania, USA, living permanently in Greece. The translators

were advised to aim at the conceptual equivalent of a word or phrase, not a word-for-word translation, that is, not a literal translation and strive to be simple, clear, and concise in formulating a question. Then, a bilingual (in English and Greek) five-member expert panel with experience in the cultural adaptation of instruments was convened by the first author in order to identify and resolve inadequate expressions/concepts of the forward translation. Discrepancies were discussed and consensus was reached. Finally, the questionnaire was pretested to achieve the final version of the ALDQ in Greek.

2.2 Participants and Educational Approach

Data collection was performed in June 2017. A total of 274 students who attended the Module of Mental Health Nursing were recruited consecutively on the basis of their clinical placements' records. The module was compulsory and included 4 h of theory and clinical practice of 10 h weekly for 13 weeks. During their clinical placement, students prepared two group assignments (up to 700 words each). These assignments were written by three to five students and focused on debatable mental health practice issues such as involuntary admission, containment methods, and door locking practices. Debate-based learning has been shown to produce positive learning outcomes in comparison to traditional university knowledge [1]. Group assignments were also requested to represent all participants' opinions and incorporate as many advantages and disadvantages of a clinical approach as possible in an attempt to trigger the process of reflection through which students acquire knowledge. The process was expected to strengthen students' teamwork abilities and capture at the same time their interest on mental health issues. Furthermore, in this way, students were motivated to discuss with mental health staff on various mental health clinical practices and collect different views around them. Finally, group assignments were presented to other students in order to improve declarative and argumentative abilities.

2.3 Clinical Placements

Clinical placements of students who participated in the present study were provided by three psychiatric hospitals—two public psychiatric hospitals and a university research hospital—and four psychiatric departments in general hospitals. Door locking practice varies considerably between psychiatric units and it is determined by hospital policy at least to some degree. Within the stream of innovative efforts transforming psychiatric services in other European countries, the wards of the first State Psychiatric Hospital opened in 1947 to allow its patients to walk freely within its grounds and later in the outside world [9]. By contrast, the wards of the abovementioned university hospital and the second public psychiatric hospital of Athens are permanently locked, with the exception of one ward (out of ten) which operates with open doors. As regards the psychiatric departments in general hospitals which provided clinical placements to participants of the present study one is permanently locked, whereas three remain open at all times, except at night for security.

2.4 Instruments

The Acceptability of Locking the Door Questionnaire (ALDQ) is a 34-item self-assessment questionnaire constructed by Bowers et al. [5] drawing on the work of [11, 12]. It includes 18 items regarding the impact of locking the door on patients, seven items on the impact of locking the door on staff, three items regarding the impact of locking the door on people coming into the ward and six items parallel to the Attitude of Containment Method Questionnaire (ACMQ) [3, 6]. According to Bowers et al. [6], the Attitude of Containment Method Questionnaire (ACMQ) items included in the ALDQ allow the rating of the acceptability, efficacy, safety for patients, safety for staff, dignified for staff and preparedness to use items to be compared to other datasets of patients and staff parallel ratings of other containment methods such as seclusion, manual restraint, coerced medication, etc. All ratings

were via a five-point Likert scale, ranging from strongly disagree (1) to strongly agree (5). Permission to use the Acceptability of Locking the Door Questionnaire for the purposes of the present study was obtained from Professor Bowers. Socio-demographic characteristics (e.g., gender, age, and area of residence) and other students' characteristics were also collected for all participants. Moreover, participants were asked to give a yes/no answer to the following two questions: (a) "would you like to work in a psychiatric unit if you were offered a post?" and (b) "would you like to acquire a Mental Health Nursing Specialization in the future?"

2.5   Ethical Considerations

Students participated in the study on a voluntary basis and had their anonymity preserved. All participants were informed of their rights to refuse or to discontinue their participation, according to the ethical standards of the Helsinki Declaration of 1983. The Ethical Committee of the University of West Attica approved the study protocol. All participant students signed an informed consent.

2.6   Statistics

In order to assess the construct validity of the ALDQ-Greek, we performed principal component analysis (PCA) and investigated its convergent and divergent validity. PCA with varimax rotation was employed to investigate the factor structure of the ALDQ-Greek. The Kaiser-Meyer-Olkin value was calculated and Bartlett's Test of Sphericity was carried out to examine if the data were suitable for PCA. However, only the 28 items regarding the impact of the locked door on patients, staff, and visitors were subjected to PCA using SPSS-23. The six items parallel to ACMQ were excluded from the PCA as they were excluded in the original validation of ALDQ by its developers [4]. After all, these items assess the overall opinion of respondents on six domains, that is, acceptability, efficacy, safety for patients, safety for staff, dignified for staff and preparedness to use door locking practice rather

than its impact. Additionally, the item convergent validity of the ALDQ-Greek was evaluated by examining the correlations between the total score of each subscale and its item scores. Convergent and divergent validity were investigated in comparison to ACMQ.

The reliability of ALDQ-Greek was evaluated by assessing the instrument's internal consistency. Internal consistency was assessed with Cronbach's α coefficient. In addition, the version of Cronbach's α "if item deleted" was calculated for each item. The Cronbach's α values were characterized as follows: 0.00–0.25, negligible; 0.26–0.49, low; 0.50–0.69, moderate; 0.70–0.89, high; and 0.90–1.00, excellent.

The following categories of Pearson's r values were used for interpretation: 0.00–0.19, very weak correlation; 0.20–0.39, weak correlation; 0.40–0.69, moderate correlation; 0.70–0.89, strong correlation; and 0.90–1.00, very strong correlation.

3   Results

The modal age group was under 25 years old and 15% were male (see Table 1). Sixty per cent would like to work in a psychiatric acute care unit if they were offered a post. Forty-seven per cent would like to acquire a Mental Health Nursing Specialization in the future (see Table 1).

Regarding PCA, the Kaiser-Meyer-Olkin value was 0.8743, exceeding the recommended value of 0.6 and the Bartlett's Test of Sphericity was statistically significant indicating the suitability of data for this analysis. PCA with varimax rotation revealed the presence of five factors with eigenvalues exceeding 1.

Factor scores were calculated based on all items loading greater than 0.5. The five-factor solution (Table 2) explained 93% of variance:
- Factor 1 brought together adverse effects: increased adverse feelings for patients such as depression, frustration, constraint, and low self-esteem (items 2, 5, 7, 8, 9, 10, 12, 14, 17, 18, 20, 33).
- Factor 2 consisted of patient safety benefits: increased safety through reduction in access

Table 1 Demographic characteristics of the participants

Variables	Mean	SD	N
Age	22.81	4.76	274
Sex			N (%)
Male			42 (15.3%)
Female			132 (84.7%)
Desire to work in mental health			165 (60.2%)
Desire to acquire a mental health nursing			130 (47.4%)
Specialization			

Table 2 Principal component analysis with varimax rotation

Questions	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Makes patients feel trapped	0.6054				
Makes patients feel safe and secure				0.5375	
Relieves patients from responsibility for themselves				0.5160	
Hinders patients' recovery	0.5166				
Makes patients calm and relaxed				0.5452	
Increases the likelihood of patients being aggressive	0.6858				
Makes patients feel desperate to escape	0.7453				
Makes patients feel worthless or rejected	0.6395				
Makes patients more dependent on staff	0.5136				
Stops patients from going out to obtain drugs		0.6251			
Makes patients feel hopeless or depressed	0.7502				
Keeps the general public safe from disturbed patients			0.7248		
Prevents patients from taking responsibility for themselves	0.5004				
Makes patients irritable, angry, or frustrated	0.7430				
Makes patients feel they are not trusted	0.6333				
Makes staff feel more in control			0.5639		
Hardens staff feelings and make them Uncaring	0.5093				
Makes staff more relaxed and less anxious			0.6655		
Creates extra work for the staff					0.5546
Makes staff more strict and over controlling					0.5118
Makes staff feel safer from complaints,			0.5563		
Inquiries, or litigation					
Frees up staff for other work			0.5164		
Keeps patients safe by stopping just anyone coming in		0.5069			
Makes the ward unwelcoming to visitors	0.5042				
Helps to keep drugs and/or alcohol off the ward		0.6689			
Var Exp	46%	15%	14%	11%	7%

to drugs/alcohol and protection from unwanted visitors (items 11, 13, 32, 34).

- Factor 3 brought together staff benefits: diminished staff anxiety and increased sense of confidence and control (items 19, 21, 24, 25).
- Factor 4 included patient comforts: makes patients feel safe and secure, calm and relaxed (items 3, 4, 6).
- Factor 5 brought together cold milieu elements: increased staff workload, hardening of staff feelings, and authoritarianism (items 22, 23).

Overall, our PCA confirmed the multidimensional structure and the number of factors of ALDQ-Greek despite small differences in item allocations (assigning items to a different factor)

Table 3 Convergent validity of the ALDQ-Greek

	ACMQ	P-value
	r	
F2	0.394	0.000
F3	0.223	0.000
F4	0.503	0.000

Table 4 Divergent validity of the ALDQ-Greek

	ACMQ	P-value
	r	
F1	−0.585	0.000
F5	−0.205	0.000

and retainment. In our study, item-22 ("creates extra work for staff") was included in Factor 5 in contrast to the original structure incorporating this item into Factor 1. Nonetheless, both factors express negative aspects of the impact of door locking on patients and therapeutic milieu, respectively, in sharp contrast to Factors 2, 3, and 4 which constitute positive aspects of the door locking practice. Furthermore, three items (1, 15, 16) were not retained in the PCA due to loadings less than 0.5 (ranging from 0.261 to 0.432).

As mentioned above in Sect. 2.6., the ACMQ which consists of six items assessing staff attitudes toward locked doors (i.e., a. acceptability, b. efficacy, c. safety for patients, d. safety for staff, e. dignified for staff, and f. preparedness to use) constitutes a suitable measure in order to evaluate the convergent and divergent validity of ALDQ. Factors depicting positive attitudes toward door locking practice (Factors 2, 3, and 4) were positively correlated to ACMQ as expected ($r = 0.394$ for Factor 2, $r = 0.223$ for Factor 3, $r = 0.503$ for Factor 4) implying sufficient convergent validity (Table 3). Factors depicting negative attitudes toward door locking practice (i.e., Factor 1 and Factor 5) were negatively correlated to ACMQ as expected ($r = −0.585$ and $r = −0.205$, respectively) implying sufficient divergent validity (Table 4).

The item convergent validity of the ALDQ-Greek showed that all item intercorrelations for all item pairings were moderate to strong. Pearson's r

Table 5 Convergent validity of the Acceptability of Locking the Door Questionnaire (item-total score correlations)

	Pearson's r
Adverse effects	
2	0.65
5	0.636
7	0.677
8	0.745
9	0.727
10	0.623
12	0.759
14	0.637
17	0.717
18	0.732
20	0.543
33	0.565
Patient safety benefits	
11	0.698
13	0.658
32	0.676
34	0.773
Staff benefits	
19	0.685
21	0.763
24	0.734
25	0.691
Patient comforts	
3	0.778
4	0.757
6	0.780
Cold milieu elements	
22	0.843
23	0.811

All correlations were significant at the 0.01 level (two-tailed)

ranged from 0.563 to 0.747 for adverse effects, from 0.658 to 0.773 for patient safety benefits, from 0.685 to 0.763 for patient comforts from 0.757 to 0.780 and for cold milieu elements from 0.811 to 0.843 (Table 5). This supports the notion that all the items within each subscale of ALDQ-Greek are related to the same construct.

As regards the internal consistency of the ALDQ-Greek assessment, Cronbach's α coefficients for each item indicated mostly high internal consistency. The overall Cronbach's α was 0.711 ranging from 0.688 to 0.717 with individual items deleted (Table 6).

Table 6 Item analysis of the Acceptability of Locking the Door Questionnaire

Items	Mean (SD)		Cronbach's α if item deleted
1	3.52	(0.88)	0.705
2	3.80	(0.80)	0.710
3	2.99	(0.81)	0.711
4	2.94	(0.85)	0.701
5	2.83	(0.93)	0.718
6	2.67	(0.81)	0.714
7	3.58	(0.94)	0.714
8	3.46	(0.92)	0.705
9	3.09	(0.99)	0.707
10	3.43	(0.99)	0.703
11	3.87	(0.96)	0.693
12	3.26	(0.86)	0.704
13	3.02	(1.1)	0.690
14	3.15	(0.89)	0.705
15	3.51	(0.90)	0.704
16	3.19	(0.89)	0.711
17	3.64	(0.80)	0.703
18	3.51	(0.85)	0.707
19	3.91	(0.80)	0.692
20	2.79	(0.96)	0.708
21	3.31	(0.94)	0.699
22	3.07	(1.02)	0.709
23	3.27	(0.92)	0.706
24	3.32	(0.93)	0.688
25	2.76	(0.90)	0.699
26	3.02	(0.84)	0.712
27	3.09	(0.85)	0.711
28	2.78	(0.92)	0.717
29	3.18	(0.92)	0.695
30	3.31	(0.90)	0.699
31	2.79	(1.07)	0.713
32	3.41	(0.97)	0.698
33	2.94	(1.04)	0.708
34	3.62	(1.05)	0.700

4   Discussion

This study comprises the first published data on the cultural adaptation and validation of the ALDQ-Greek. According to the findings, the ALDQ-Greek is a valid tool for the assessment of attitudes toward door locking practices in acute psychiatric care. Our principal component analysis confirmed the five-factor structure of the original questionnaire. Our results are encouraging in terms of the item convergent validity and the reliability of the scale because all the items were related to the total score and Cronbach's α values were considerably high.

Our PCA of the attitude items generated a similar outcome to previous factor analysis of the items in the UK population [4, 5] despite the fact that the scale was created a decade ago, in a different country, within a different social context and delivered to mental health nurses, patients, and visitors. Moreover, the subscales identified in this study comprised similar constructs to those identified in the original ALDQ.

Participation in this study allowed student nurses to gain awareness about the advantages and disadvantages of door locking policies in psychiatric wards. It also provided an opportunity to review and criticize traditional door locking methods employed in acute care wards. Lack of understanding of the advantages and disadvantages of door locking and containment practices on the acute care environment and the recovery process may limit nurses' ability to interact in a meaningful and safe way with mental health patients and their families [2, 21]. In contrast, acknowledgment of the advantages and disadvantages of psychiatric practices may help young professionals in developing a more realistic view of practice and avoid polarization between a romanticized view of care and resignation so as to become involved with patients instead of limiting contact by a collective withdrawal at the nurses' station [15].

As regards students' preference regarding mental health nursing, 60% considered mental health nursing as a possible career choice while almost half of them expressed a desire to acquire mental health nursing specialization. These impressive results verify students' interest in the process of shedding light into their own attitudes toward mental health nursing practice although they are considerably higher than those reported in the literature which, in sharp contrast, suggests that mental health nursing constitutes an unpopular career choice for many students [13, 14, 17]. Nonetheless, there have been reports of increased interest in mental health in some programs [13, 22]. In a review of quasi-experimental studies on the influence of nursing education on the atti-

tudes of students toward mental health nursing, Happell and Gaskin [13] conclude that students tended to have more favorable attitudes when they have received more hours of theoretical preparation and longer clinical placements and recommend that educators should incorporate strategies to improve student's perceptions of working in mental health settings. In the present study, increased hours of theoretical and clinical education together with debate-based group assignments may account for their high interest in mental health. Furthermore, research on students' attitudes appeared to be a strategy of creating the space for lively discussions among them and capturing their interest in mental health education and practice.

4.1 Limitations

The present study was limited by its relatively small sample size and the lack of a wider variety of mental healthcare student groups. Furthermore, the lack of test-retest data limits our ability to provide evidence regarding the reliability of the ALDQ-Greek over time. It could also be beneficial to retest participants over longer periods of time so as to examine attitudinal changes, although this was beyond the scope of the study.

4.2 Implications for Nursing Education and Practice

Bowers et al. [7] stress the importance of collective articulation of the overt and implicit ideology asserted by staff's behavior in order to avoid providing an inconsistent and disrespectful service to patients. If nurses' attitudes are influenced by the process of professional socialization then there is a clear need to cultivate and retain a critical and analytical attitude toward the system they operate. The ALDQ-Greek constitutes a valid and reliable instrument for assessing and shedding light into students' attitudes toward door locking practices. High-quality self-report measures are necessary in evidence-based nursing education

and practice. Furthermore, debate-based learning approaches and research into students' attitudes to mental health practices may support mental health student nurses at an individual and team level in the challenging field of mental health.FundingThe project was funded by the University of West Attica.

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Compliance of Bronchial Asthma Patients' with the Mediterranean Diet

Compliance with the Mediterranean Diet in Asthma Patients

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Abstract

Introduction: Asthma is considered the most common chronic disease that affects survival and quality of life. An astringent regulatory factor of asthma is the Mediterranean diet. Nutrition, however, seems to be of great importance in the onset and outcome of the disease as many ingredients and eating habits

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that may improve or exacerbate the condition of the patient.

Purpose: The present study aimed to investigate dietary habits in patients with bronchial asthma and their compliance with the Mediterranean diet.

Material and methods: The study included 60 patients with bronchial asthma, 47 women (71% of the total) and 17 men (28.3%). All patients completed a questionnaire with sociodemographic questions, a medical history (years of diagnosis, exacerbations, hospitalizations, medication), and spirometry results (FEV1, FVC, FEV1/FVC, PEF, FEF25-75). Asthma control was evaluated with the Asthma Control Test (ACT). Conformity to the Mediterranean diet was assessed using the MEDLIFE index (Mediterranean lifestyle) questionnaire. Statistical analysis of the data was done using the SPSS 23.0 statistical package by applying the Inductive Analysis, which included the Pearson correlation coefficient (r), the t-test for independent samples, and the variance analysis (one-way ANOVA).

Results: There was a significant negative correlation of last year hospitalizations with the MEDLIFE questionnaire scale

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($r = -0.522$, $p = 0.009$) and a significant negative correlation of last year's exacerbations with the ACT scale. We observed a significant negative correlation of hospitalizations in the last year with the ACT scale ($r = -0.505$, $p = 0.012$) and a significant statistical relationship of long acting β2 agonist + steroid with the MEDLIFE scale ($p = 0.046$).

Conclusion: The level of compliance with the principles of the Mediterranean diet leads to a reduction in hospitalization. The optimal asthma control is associated with a reduction of exacerbations and asthma control is associated with reduced hospitalizations. Those receiving beta2 + steroid show higher levels of compliance with the principles of the Mediterranean diet.

Keywords

Asthma · Mediterranean diet · Antioxidants · Dietary habits

1   Introduction

Asthma is considered one of the most prevalent chronic diseases that affect both survival and quality of life. Over the past four decades, the prevalence of the disease has shown a rapid increase in developed countries. Many explanations have been proposed for this phenomenon, and many factors play an important role in its occurrence with the most decisive being genetic predisposition, allergic sensitivity, and lifestyle [1]. In recent years, one of the regulatory factors of asthma controls which has been evaluated by the scientific community includes the Mediterranean diet [2].

One of the factors associated with asthma is the shift to a Western lifestyle and behaviors, which include, among others, changes in diet such as low intake of fruits, vegetables, and whole grains [3]. A diet change observed in the UK in 1994 with reduced fruit and vegetable consumption, showed that consumption of a western diet resulted in increased prevalence of asthma [4]. In a recent French study of 34.776 French adults, the data showed that men with healthier diet behaviors were 30% less likely to have asthma symptoms, while healthy dietary patterns among women lead to a reduction in asthma symptoms by 20%. Additionally, participants who ate healthy had fewer asthma symptoms and better control of asthma suggesting that diet may play a role in asthma control [5].

Clinical and epidemiological studies have suggested the significance of Mediterranean diet in the prevention and in the outcome of complex diseases [6]. The specific dietary pattern of the Mediterranean diet is low in saturated fat (SAFA) and contains high amounts of carbohydrates and fiber in addition to a daily consumption of olive oil. The Mediterranean diet is associated with increased consumption vegetables [7]. The Mediterranean Diet is internationally recognized as a model of healthy diet and is associated with a lower prevalence of asthma in the Mediterranean countries compared to populations in America and Northern Europe. A part of this difference can be explained by changes in diet over the last decades such as reduced dietary intake of antioxidants from fruits and vegetables and the changes in fatty acids intake. The disturbance in the balance between active oxygen radicals and the body's protective antioxidant mechanisms is recognized as one of the main parameters of the chronic inflammatory process of asthma [8]. Few clinical studies have examined the relationship between Mediterranean diet and asthma in adults. A small, randomized study showed that adherence to a Mediterranean diet was associated with no significant improvements in lung function and asthma control [9].

2   Purpose

This study aims at investigating the eating habits of male and female patients with bronchial asthma and the degree of their compliance with the Mediterranean diet as assessed by the MEDLIFE questionnaire.

3   Materials and Methods

This is a descriptive correlation study with cross-sectional design. The study involved patients with bronchial asthma seen in the Outpatient

Asthma Clinic of the University Hospital of Larissa, Greece. The study sample consisted of a total of 60 patients with bronchial asthma. Exclusion criteria were concomitant diagnosis of COPD and/or other pulmonary disease and unwillingness to participate in the study. Convenience sampling was applied.

3.1 Data Collection and Research Tools

Data collection was carried out from October 2018 to January 2019. Data were collected using a fully structured and self-administered questionnaire. Patient participation was voluntary and anonymous, ensuring all ethical standards were being upheld. A total of 70 questionnaires were distributed and 60 were fully filled and returned.

The questionnaire used in this research consisted of three parts as follows:

- *Part one:* A questionnaire with information on medical history and sociodemographic characteristics. In addition, information on asthma history was collected (years of asthma diagnosis, frequency of asthma episodes, number of asthma exacerbations during the last 12 months, asthma-related hospitalizations during the last 12 months, pharmacological treatment, asthma drug classes such as biologic agents, antileukotrienes, corticosteroids, β2-agonists, steroids, and inhaled anticholinergics).
- *Part two:* The Asthma Control Test (ACT) which comprises five questions regarding aspects of asthma control over the last four weeks. A score of 5 indicates that the patient has inadequately controlled asthma, while the highest score, 25, indicates complete control of asthma [2].
- *Part three:* The Mediterranean Lifestyle index (MEDLIFE), previously a questionnaire consisting of 28 elements. The first part includes 15 questions related to food consumption, the second part includes 7 items regarding traditional dietary habits, and the third part includes 6 questions relating to physical activity, rest, and

social interaction habits. Each question is scored either 0 or 1. The score for the overall index ranges from 0 which indicates low adherence, to 28 which indicates highest adherence to the Mediterranean dietary pattern [10].

3.2 Statistical Data Analysis

The collected data were analyzed using SPSS software, version 23.0 for Windows to obtain descriptive and inferential statistics. Inferential statistics which was used to examine the relationship among variables included the Pearson correlation coefficient (r), the independent-samples t-test and the one-way ANOVA test. A *p*-value <0.005 was considered statistically significant.

4 Results

4.1 Demographic and Clinical Characteristics of the Sample

Table 1 represents the sociodemographic and clinical characteristics of the participants. The majority of the sample were women (71.7%) and 28.3% were men. Participants' ages ranged from 17 to 84 years and the average age of the overall sample was 61. 58 years (±13.66). Of the participants, 63.3% were nonsmokers, 13.3% were active smokers, and 23.3% were as ex-smokers. The average pys was 16.91 (±11.84). Mean years of diagnosis of asthma were 13.23 (±11.15) years. Mean number of exacerbations during the last year was 2.46 (±2.6) with mean hospitalizations due to asthma of 1.75 (±1.15). The average FEV1 was 2.11 (±0.84), mean FVC was 2.79 (±1.08), and mean FEV1/FVC was 0.75 (±0.83), ranging from 0.51 to 0.88.

Regarding patient's medical treatment, the following were observed: 48% of the drugs were combination of inhaled corticosteroids and long acting β agonists (LABA), 24% were inhaled anticholinergics, 7% were inhaled short acting β2 agonists (SABA), 7% were oral steroids, 6% were biological agents, 5% were antileukotrienes drugs, and 3% were inhaled steroids.

Table 1 Demographic and clinical characteristics of the sample

Table 1. Demographic and clinical characteristics of the sample	
Parameter	*n (%) or mean±SD (range)*
Male/Female	17/43 (28.3/71.7)
Age (years)	**61.58 ± 13.667 (17-84)**
Smoker/Non-smoker/Ex smoker	8/38/14(13.3/63.3/23.3)
PYS	**16.91 ± 11.84 (1–48)**
Years of diagnosis of asthma	**13.23 ± 11.15 (1–40)**
Number of asthma exacerbations during the last year	**2.46 ± 2.61**
Hospitalizations due to asthma in the past year	**1.75 ± 1.152 (1–5)**
FEV$_1$	**2.12±0.84 (0.95–4.95)**
FVC	**2.80±1.08 (1.5–6.19)**
FEV$_1$/FVC	**0.767±0.83 (0.51–0.88)**
PEF	**5.85±2.51 (2.21–13.04)**
FEF$_{25-75}$	**1.88±0.97 (0.43–5.32)**
PYS: pack-years, FEV1: Forced expiratory volume in 1 sec, FVC: Forced expiratory vital capacity, PEF: Peak expiratory flow, FEF$_{25-75}$: mean Forced expiratory flow between the 25% and 75% of the FVC.	

The mean value of the MEDLIFE index was 14.77 (±2.53), with a range from 9 to 19 and median 15. The mean value for the ACT questionnaire was 17.58 (±3.45) with a range from 9 to 24 and median 18.

4.2 Correlation of MEDLIFE Index and Asthma Control Test (ACT) Questionnaire with Sociodemographic Characteristics of the Sample

There seems to be a statistically significant negative correlation between number of hospitalizations and MEDLIFE index ($r = -0.522$, $p = 0.009$), which suggests that increasing the level of compliance with the principles of the Mediterranean diet leads to a reduction in hospitalizations. As expected, we observed a statistically significant negative correlation between exacerbations and ACT score ($r = -0.539$, $p < 0.001$). A statistically significant negative correlation between the number of hospitalizations and ACT score ($r = 0.505$, $p = 0.012$) was observed. The analysis did not show any statisti-

cally significant correlation when assessing the relationship between age and MEDLIFE index or ACT questionnaire. Finally, no statistically significant correlation was found between pack-years, years of diagnosis, and number of asthma exacerbations during the last year with the MEDLIFE index and ACT score.

4.3 Correlation of Sample Characteristics with MEDLIFE Index and Asthma Control Test (ACT)

No statistically significant correlation is present between gender and smoking habit and the MEDLIFE and ACT scale (Table 2).

4.4 Correlation of MEDLIFE Index with Pulmonary Function Testing

We observed no statistically significant relationship emerges between MEDLIFE index and spirometry results (Table 3).

Table 2 Correlation of sample characteristics with MEDLIFE index and Asthma Control Test (ACT)

Sample characteristics			MEDLIFE index	Asthma Control Test (ACT)
Gender	Mean	Male (*n*=17)	15.18	18.35
		Female (*n*=43)	14.60	17.28
	*t**		0.787	1.089
	p value		0.434	0.280
Smoking habit	Mean	Smoker (*n*=8)	14.25	16.00
		Non- smoker (*n*=38)	14.53	17.39
		Ex-smoker (*n*=14)	14.77	19.00
	*F***		1.339	2.167
	p value		0.270	0.124

* Values refer to mean ± standard deviations and t-test results ** Values refer to mean ± standard deviations and analyzes results

Table 3 Correlation between MEDLIFE index and parameters measured in spirometry

	MEDLIFE index	
	Pearson's *r*	**P value**
FEV$_1$	0.002	0.987
FEV$_{1\% \, pred}$	−0.054	0.681
FVC	0.045	0.735
FVC$_{\% \, pred}$	−0.035	0.791
FEV1/FVC	−0.093	0.478
PEF	−0.087	0.511
PEF$_{\% \, pred}$	−0.147	0.261
FEF$_{25-75}$	−0.107	0.417
FEF$_{25-75\% \, pred}$	−0.086	0.515

FEV1: Forced expiratory volume in 1 sec, FVC: Forced expiratory vital capacity, PEF: Peak expiratory flow, FEF25-75: mean Forced expiratory flow between the 25% and 75% of the FVC.

4.5 MEDLIFE Index Association with Pharmacological Treatment

A statistically significant relationship was observed between the combination of steroids and LABA with the levels of the MEDLIFE scale ($p = 0.046$) (Table 4). Specifically, those taking LABA and steroids show higher levels of compliance with the principles of the Mediterranean diet than those who do not receive these drugs.

4.6 MEDLIFE Index Association with Asthma Control Test

There is no statistically significant correlation of the MEDLIFE scale with ACT levels.

5 Discussion

According to current literature, diet appears to be one of the factors contributing to bronchial asthma. Several important conclusions emerge

Table 4 Correlation between MEDLIFE index and pharmacological treatment

Types of treatment medications			MEDLIFE index
Inhaled Corticosteroids	Mean	No	14.89
		Yes	12.33
	t^*		1.740
	p value		0.087
Inhaled long acting b2-agonists	Mean	No	14.90
		Yes	13.88
	t^*		1.073
	p value		0.288
Inhaled long acting b2-agonists and Steroids	Mean	No	13.22
		Yes	15.04
	t^*		−2.042
	p value		**$p=0.046$**
Inhaled Anticholinergic Agents	Mean	No	14.71
		Yes	14.85
	t^*		−0.211
	p value		0.833
Antileukotrienes	Mean	No	14.76
		Yes	14.80
	t^*		−0.031
	p value		0.976
Oral Steroids	Mean	No	14.94
		Yes	13.43
	t^*		1.507
	p value		0.137
Biological Agents	Mean	No	14.70
		Yes	15.29
	t^*		−0.575
	p value		0.568

* Values refer to mean ± standard deviations and t-test results

from our study examining the compliance with the Mediterranean diet of patients with bronchial asthma. We observed a statistically significant negative correlation between the number of hospitalizations during the last year and the MEDLIFE index, which suggests that increasing the level of compliance with the Mediterranean diet leads to a reduction in hospitalizations for asthma. As expected, we demonstrated a statisti-cally significant negative correlation between exacerbations during the last year and ACT scale, as well as the number of hospitalizations during the last year and ACT results, indicating that an improvement in asthma control is associated with a decrease in the number of hospitalizations. A statistically significant relationship was also found between the combination of LABA with steroids and MEDLIFE score with patients

receiving LABA and steroids presenting higher levels of compliance with the principles of the Mediterranean diet.

Asthma is an inflammatory disease of the respiratory system associated with inflammation of the airways. One of the main parameters of the chronic inflammatory process of asthma is the disturbance of the balance between the active oxygen radicals and the protective antioxidant mechanisms of the organism. In contrast, the Mediterranean diet with a high intake of vegetables and fruits has anti-inflammatory properties. As asthma has been associated with low levels of antioxidants, diet appears to significantly affect its onset [8, 11]. In the same context, vitamin D levels have been positively associated with lung function and negatively associated with asthma as evidenced by the rate of exacerbations and asthma treatment [12]. Patients with low asthma control have a greater incidence on both hospitalization and emergency department visits while higher intake of vegetables and fruits can have a positive impact on asthma risk and control [11].

Barros et al. examined the association of the Mediterranean diet with the control of asthma [13]. The researchers concluded that patients with better disease control as assessed by symptoms, respiratory function and exhaled NO, had significantly better compliance with the Mediterranean diet model than those who did not have good disease control. High compliance with the Mediterranean diet reduced the risk of uncontrolled asthma by 78%. Barros et al. suggested that high adherence to the Mediterranean diet with the consumption of fresh fruits and nuts resulted in better control of asthma in adults. Our results are in accordance with the aforementioned data. Seaton et al. noted that dietary changes were followed by an increase in atopic diseases and an increase in the prevalence of asthma in the UK. The researchers observed a decrease in the consumption of vegetables and especially green vegetables and potatoes and showed that a western type diet (with the main feature of reducing the body's intake of antioxidants) has increased the population's susceptibility to asthma, resulting in large increases in allergies and asthma prevalence [4].

The role of diet in asthma treatment has been previously studied. Treatment with high doses of vitamin C can help patients increase the antioxidant protection of the respiratory system and by lowering histamine levels. In particular, it prevents the secretion of histamine by white blood cells and increases the detoxification of histamine [14]. In clinical trials, it has been found to protect against asthma when administered concomitantly with other antioxidants, whereas the effect of single vitamin C administration did not have the same potent effect [15]. In steroid-resistant patients, supplementation with vitamin D enhances the ability of regulatory T-lymphocytes to secrete interleukin-10 (IL-10) in response to steroids. Studies have confirmed that reduced vitamin D levels are associated with a reduced steroid response [16, 17]. There is some research linking elevated levels of vitamin E in plasma to a reduced incidence of asthma and decreased levels of immunoglobulin E (IgE) antibodies. It has been found to have a protective effect on the onset of asthma when coadministered with other antioxidants [18]. Research has shown that vitamin A and β-carotene have a beneficial effect on exercise-induced asthma in only 1 week of administration of these vitamins either in their natural form or as a dietary supplement [19]. It has recently been shown that supplementation of fish oil rich in Ω3 polyunsaturated fatty acids (PUFA), reduces airway narrowing, drug use and pro-inflammatory production of mediators. These findings are provocative and suggest that dietary supplementation of fish oil (Ω3 fatty acids) may be a viable treatment or adjunctive therapy for asthma and exercise-induced bronchoconstriction [20].

5.1 The Relation Between Compliance to the Mediterranean Diet and the Spirometry Results

The present study found no statistically significant relationship between MEDLIFE index and spirometry results. Some studies previously reported that the Mediterranean diet had no specific effect

on lung function, while others have shown an improvement in FEV1 in subjects receiving a supplement containing fruit and vegetable concentrate, fish oil, and probiotics when compared to those receiving a placebo [9, 11]. In a 12-week study, 38 adults with bronchial asthma were allocated to high-intervention, low-intervention, and control groups. The intervention groups adopted a Mediterranean diet and were provided with written advice from a dietitian and vouchers for the purchase of foods. Small but consistent improvements were seen in quality of life and spirometry among the intervention group, although statistically, no significant improvement was observed in the spirometry results [9].

5.2 Correlation of Compliance with the Mediterranean Diet with Asthma Control

The present study does not show any statistically significant relationship between the scale of the MEDLIFE questionnaire and the levels of the ACT test, suggesting that the patients' compliance with the principles of the Mediterranean diet does not affect asthma control. Few clinical studies have examined the relationship between the Mediterranean diet and asthma in adulthood. A small randomized study showed that adherence to the Mediterranean diet did not have significant improvements in lung function and asthma control [9]. As mentioned above, Barros et al. suggested high adherence to the Mediterranean diet results in better control of asthma in adults [13]. Fruit and vegetable intake may also have a positive effect on asthma control [11].

A study of 287 young adults and 96 controls aged 9 to 16 years found that those who were nutritionally closer to the Mediterranean diet had a reduced risk of asthma. Children whose mothers had a higher educational level were less likely to have asthma, while children whose mothers had a lower educational level had no protective effect, thus showing that the higher the educational level the better compliance with the model of the Mediterranean diet. No association was

found between FEV1, asthma control, atopy, and the Mediterranean diet [21].

5.3 Limitations

There are limitations in this study. Due to the small sample of patients, the asthma control was also low. Patients with good control were limited, so they are not representative of the general population. The age range was limited. Patient follow-up time was not sufficient to possibly detect consistent answers to each question. Moreover, information such as medication was stated by themselves or by the attendants and thus there may be a revocation error.

6 Conclusion

In the present study, we found that the level of compliance with the principles of the Mediterranean diet is not correlated with asthma control and spirometry values. On the other hand, we found that compliance with the Mediterranean diet reduces hospitalizations for asthma patients and may be a factor that significantly affects the severity and outcome of bronchial asthma. The results of various studies on the influence of Mediterranean dietary pattern on asthma are contradictory, so further studies related to this topic need to be undertaken. The Mediterranean diet and the Mediterranean lifestyle in general could be included in medical instructions as a supplement to the medication.

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Nurses' Experiences of Psychiatric Care in Acute Care Units with an Open Door Policy

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Abstract

Social distancing and the recent lock down due to COVID-19 has increased the feeling of disconnection, isolation, and suffering in vulnerable individuals and has brought forward questions regarding open acute care psychiatric units that cannot be answered by the literature. In Greece, there is no available research on how open ward environments are perceived and experienced by mental health professionals. The aim of the present study was to illuminate nurses' experiences of working in a public psychiatric hospital which traditionally operates with open doors. Eleven nursing care providers were interviewed, and thematic analysis was employed to explore their experiences of working in locked psychiatric acute care units. Participants described nursing care in units with an open door policy as "acceptance," "availability of staff," "real respect for the person," "ensuring patients' rights," "listening to the person," and "negotiation and not imposition." Trust in therapeutic relationships was perceived as greatly dependent on the trust being given to patients indirectly by the open door policy. Being trusted enhanced patients' self-determination and self-confidence leading to their empowerment. Containment of an acute mental health crisis

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took place through medication and meaningful discussions with patients and significant others rather than locking the door of the unit. Overall, meaningful care led to professional emancipation, but compassion fatigue narratives emphasized the need for continuous education, support and clinical supervision as necessary support for mental health nurses in a system of mental health provision often reduced to the point of crisis.

1   Introduction

Social distancing and the recent lock down due to COVID-19 have increased the feeling of disconnection and the perception of social exclusion and the related feelings of isolation and suffering in vulnerable individuals [5]. The experience of lockdown appeared to be a source of stress, anxiety, and loss which in turn may have long-lasting emotional and functional consequences for some vulnerable individuals [4]. On the other hand, the period of agitation and mental health crisis constitutes a time point that necessitates the outmost of availability, the most careful listening, communication, exchange and negotiation, that is, staying close to the person, rather than distancing from the person, at the very moment of crisis, the moment of the most extreme expression of suffering enhanced by limiting personal contact and relation.

Despite an international focus on reducing all coercive or restrictive methods in psychiatric practice, research on open wards is very limited and focuses mostly on the success of treatment in terms of absconding, aggression, and coercive measures rates [19, 20, 26] and does not illuminate the perceptions and experiences of staff members, patients, and relatives. In Greece, open door practice varies considerably between psychiatric units and it is determined by hospital

policy and directors of psychiatric units at least to some degree. Within the stream of innovative efforts transforming psychiatric services in other European countries, the wards of the first State Psychiatric Hospital opened in 1947 to allow its patients to walk freely within its grounds and later in the outside world [16]. By contrast, the wards of the University Hospital and the second public psychiatric hospital of Athens are permanently locked, with the exception of one ward (out of ten) which operates with open doors. Some psychiatric departments in general hospitals are locked, whereas others remain open at all times, except at night for security. There may be also security staff on a 24-h basis in some psychiatric departments. Finally, as regards other containment methods, compulsory intramuscular medication, physical and mechanical restraint are used more frequently in Athens than other European countries ([6, 10, 21]; [28]).

In Greece, there is no research available in relation to open ward environments or beliefs, judgments, and experiences of open door policies. Furthermore, there is no research illuminating nurses' experiences of working in open wards. The aim of the present study is to describe nurses' experiences and perception of acute psychiatric care in an open ward environment.

The Greek Context

In Athens, acute psychiatric inpatient care is provided by two public psychiatric hospitals, a university research hospital and psychiatric departments in general hospitals. The latter have been developed, following a large-scale reform effort that started in the mid-1980s in Greece after special funding by the European Community (EC) in order to assist the deinstitutionalization process. The percentage of involuntary admissions in the two public psychiatric hospitals is alarmingly high (i.e., more than 60%) while in the psychiatric inpatient units of general hospitals it is considerably lower [13, 15, 27]. Both voluntary and involuntary hospitalization may take place every time in a different hospital—the hospital which is on call service on the specific day according to the weekly program of the National Health Service. In light of the incom-

plete deinstitutionalization process in the country, the shortage of community mental health services and the fragmented and uncoordinated provision of primary psychiatric care [13, 25], patients and carers have limited access to a full range of interventions and receive little information about existing services and their use [12, 27]. Consequently, the Greek system's incapacity to deal with serious and enduring mental illnesses increases dramatically the heavy burden on acute care inpatient units.

2   Methods

Study Design

A case study design of a public psychiatric hospital operating mostly with an open door policy and a qualitative approach were selected for their potential to elicit a richer discussion of participants' experiences over quantitative research.

Participants and Procedure

Purposive sampling was used to approach nursing care providers who provide services to psychiatric patients in open wards. Participants' age ranged from 40 to 54 years (mean 46 years) while their clinical experience ranged from 13 to 28 years (mean 18.8 years). All participants (100%) had a degree in nursing. Ethical approval was obtained from the Scientific Counsel of the hospital. Ground rules around disclosures, respect for participants' privacy, and anonymity were also discussed with the participants prior to participation.

An introductory question (What are the advantages and disadvantages of the open door policy for your nursing care?) generated lively discussions about nurses' experiences of working in open wards. This was followed by further questions: What are the advantages and disadvantages of the open door policy for your patients? What were your first impressions of working in an open ward when you started working? Have your feelings or the way you think changed since then? A closing question invited participants to offer description of the impact of their working experience on them (How do you think working in an open ward affected you over time?) as well as recommendations that may support their work in future. Questions were open-ended, with probes facilitating rich accounts.

Analysis

In our attempt to understand the richness of the data and to interpret the "social reality" of participants, a thematic analysis [3] was employed to explore the nurses' experiences of working in open wards. The process of analysis included open coding, creating categories, and abstraction. To ensure the credibility of findings, three researchers read independently the transcripts and consensus was reached on the identified themes, subthemes, and analysis of group dynamics. Confirmability of results was enhanced by data (space and person) triangulation [2] and researcher triangulation. A reflective approach entailed thinking through any preconceptions about the data and any preliminary understandings borne out by the data [1].

3   Results

Nurses' experiences varied greatly among wards. Overall, 4 themes and 14 subthemes emerged regarding their perceptions and feelings during their working life in open psychiatric acute care units (Table 1).

Theme 1: Perceived advantages of open doors for patients

This category comprised three categories: (a) sense of freedom, (b) enhanced socialization, (c) communication and trust, and (d) therapeutic atmosphere

During the interviews, participants had the opportunity to talk about their patients, to describe the latters' feelings and thoughts. They tried to describe their working life in an open ward through personal experiences and stories. Nurses describe how patients perceive their care, how they respond, and what their needs are by taking on the role of an advocate. They emphasized that in open wards patients are given the opportunity to make choices about their care

Table 1 Themes and subthemes

Themes	Subthemes
Perceived advantages of open doors for patients	Feeling of freedom
	Enhanced socialization
	Communication and trust
	Therapeutic atmosphere
Benefits of open doors for nurses	Reduction of workload related to patients' autonomy
	Ensuring nursing role
	Increased self-awareness
	Reduces the likelihood of patients being aggressive
Disadvantages of care in open units for nurses	Compassion fatigue
	Fear of being subjected to litigation
	Lack of patient control by nurses
Perceived negative aspects of care in open units for patients	Increased risk to patient safety
	Increased use of restrictive measures
	Limited patient activities

ried out through communication. As patients interact with nurses, they discuss their needs and realize they have several options. They feel the nurse close to them, a supporter helping in treatment completion and not an obstacle. They believe that the nurse will listen to them, be interested and help.

> Because of the freedom of movement, I believe that a two-way relationship of trust is created between the patient and the nurse. The patient thinks that the nurse shows me confidence to go out for a walk, I will trust him/her too. It all works therapeutically. (N7)

Several participants reported that an open ward provides better living conditions for the patient, as it offers a calm therapeutic environment without tension. The hospital was likened to a "small village."

> There is less tension and whining in open wards. The patient is calmer and has a better mood. (N1)

> There is no tension in the ward and there are less quarrels between the patients. (N10)

since they can leave at any time. In essence, they feel free to decide for themselves. According to the nursing staff, this feeling of freedom works therapeutically as it contributes to patients' motivation for change. Patients feel independent and decide for themselves the course of their treatment in collaboration with the nurse.

> In the open wards, the patient is free to stay here because he wants to, because he likes the therapeutic context. He stays here because he trusts us and wants us to help him. (N5)

Participants emphasized that contact with the world and socialization with patients from other departments works therapeutically for patients and contributes to their good mental health and faster discharge from the hospital. Trust in therapeutic relationships is greatly dependent on the trust being given to patients indirectly by the open door policy. Being trusted enhanced patient's self-determination and self-confidence leading to their empowerment. The open door policy enhances patients' morale since the open door meant for them that they are trusted and that they are able to preserve their dignity as much as possible. Treatment is car-

Theme 2: Benefits of open doors for nurses

This category comprised three categories: (a) reduction of workload due to patient autonomy, (b) ensuring therapeutic role, (c) conflict reduction, and (d) increased self-awareness

Participants reported that in open wards the patients maintain their independence, which results in less burden for nurses from additional duties. Furthermore, the patient's freedom in the hospital area helps the nurse to work in a better and calmer environment. Patient's good mood is also beneficial for nurses as the latter favor the maintenance of a healthy working environment.

> For the nurses, the good thing is that you are not obliged to take care of the patients 24 hours a day, as long as they have autonomy and finally because when the patient is calm, the nurse is calm too. These behaviors go hand in hand. When nurses work in a calm environment, their attitude towards patients changes. (N10)

> As for nurses in the open wards, they are more relaxed and much calmer. There is no much noise. It's more peaceful. You do not have the noisy voices of thirty patients in a room stunning your head. (N4)

In addition, many nurses reported that in the open wards they felt "real nurses" and not "prison guards." In this way, the therapeutic framework is maintained with patients and nurses working together and gradually building therapeutic communication.

> In the open ward the nurse does not feel bad. You do not feel like a prison guard, you feel like a nurse… You are free, you can communicate with your patients and work better. (N2)

Nurses claim that the open door is a factor that helps maintain a good climate and calmness. Patients having the opportunity to leave the ward and take a walk in the courtyard or talk to other patients are discharged while reducing tension and irritability in the ward. As the nurses emphasized, this contributes in reducing the number and intensity of conflicts between the patients and facilitates better communication with nurses.

> If the departments were locked, I think there would be more violence. Patients feel free. Getting off the unit and socializing helps them to regulate their emotions. (N8)

> The patients feel free, they are given the opportunity to choose, the tension in the ward does not accumulate and there are no quarrels between patients. (N10)

Several participants reported that through mental health nursing in open units they gradually gained self-awareness within a particular sociopolitical context. Typically, they believe that they have become better professionals and better parents in their families. Through daily work they understood their needs and their limits. Limits are also necessary in the treatment of the patients. Limit setting in an open ward requires communication as well as to develop the ability to set limits without becoming distant and authoritarian.

> Work has made me calm, I do not get angry, I try to see the positive in everyday life. (N1)

> You have to be on top of things, to be up-to-date. You have to understand what concerns the patients in order to understand them. The above knowledge helps (Ramadan, drugs, immigration, jihadists) are tools of communication with patients. You have to evolve as a human being with u up-to-date knowl-

edge of religions, culture, politics and even football or zodiac signs. Through these communication tools you come close to the patient, he trusts you and you help him. (N2)

Theme 3: Disadvantages of care in open units for nurses

The interviewees described the disadvantages of treating patients in an open ward as well as the difficulties faced by nursing staff on a daily basis: (a) compassion fatigue, (b) lack of patient control by nurses, (c) fear of being subjected to litigation, (d) easy access to illegal substances, and (e) Tension due to relatives' rejection of open door policy.

Participants had the opportunity to describe their life inside and outside the hospital from the moment they first started working to the point of data collection. Frustration, tension, and compassion fatigue were words that they used during the interviews.

> I have cared for so many patients, so much fatigue, so much frustration has made me reach my limits. After so many years I have become stricter. In the first years I was more innocent, I did not know how I would be affected by work. But fatigue is cumulative. (N9)

Several nurses stressed that one of the most important disadvantages of the open ward is the lack of control. Patients after morning care have the opportunity to leave their rooms and engage in activities of their choice. Nurses refer to these times of the day as "blind spots" as they do not know where the patients are. It takes a considerable amount of effort and therapeutic communication skills to convince the patient on the benefits of not leaving the unit.

> In open wards, there is a great danger for the nursing staff, the patient may get lost, escape, find drugs or alcohol and the nurse is responsible for all this… In the open ward there is a large volume of work in terms of control. (N1)

> Nurses feel insecure… you have to convince the patient and not impose yourself on them when patients have the opportunity to leave. This requires great mental strength and abilities. In addition, the patient may be lost or endangered and then the nurse is accused of negligence. The environment is not considered safe. (N2)

Many nurses emphasize that they felt exposed by the legal framework because they are considered accountable and burdened with lengthy legal proceedings that affect them in both their professional and personal lives.

> The bad thing about open wards is the fear of litigation. If the patient leaves for his own reasons we are accountable. It is very frustrating to run to the court or sit down and explain to relatives that the department is open and if the patient wants to leave, he leaves. (N4)

> We are not protected by any legal framework, not even by the Nurses Association and I would like this to be emphasized! We are exposed. (N9)

Furthermore, the import of psychoactive substance users constitutes a considerable burden on the nursing work and appeared to provoke intense negative reaction to participants. Almost all participants claimed that relatives prefer locked wards mainly because they fear for their own safety. The relatives want their family member to have a decent treatment, but they will hardly accept that the patient has the opportunity to leave the hospital. This was the main reason for conflict with the patient's family. When a patient does not return to the ward a vicious circle begins, a frustrating process of accountability in which relatives accuse nursing staff of irresponsibility and indifference. In addition, according to participants the relatives do not understand the therapeutic framework of an open ward.

> The disadvantage of the open ward is that for better or worse the patient can get away and then you have to deal with relatives who blame you. (N7)

> In an open ward, it makes sense that you cannot be everywhere. When the patient leaves, you do not have the responsibility, regardless of the fact that the family throws the responsibilities on you. (N8)

> As for the family, everyone wants it locked. They think they should be limited, they think this is the healing part. They do not want to leave, run away or become dangerous. (N5)

Theme 4: Perceived negative aspects of care in open units for patients

The following are the disadvantages of open door for patients: (a) substance misuse and (b) inadequate patient activity during treatment.

Participants stressed that an open ward environment entails higher risks for a patient's accident, injury, use of psychoactive substances, and absconding.

> A patient may have uncontrolled contact with delinquent individuals who are holding him/her back in his/her treatment. (N9)

Inadequate patient activity during hospitalization is reported as a major disadvantage in patient's recovery. Nurses report that there are not enough activities for patients during their treatment in the unit. Low staff levels and inadequate staff education on working with groups contribute to low levels of patients' activities. However, in the open wards, the patient has the opportunity to socialize with other patients during the day. Socialization works therapeutically and the contact with other patients covers to some extent the lack of activities and occupational therapy.

> There are no appropriate structures, adequate occupational therapy and activities for the patients. Patients cannot get well only by coffee, cigarettes and TV. They are bored, they want to leave. This hinders their treatment and recovery because it pushes the patient to escape. (N10)

4   Discussion

The aim of this study was to illuminate nurses' experiences in open acute psychiatric environments. Present findings suggest that nursing care in an open door policy means "acceptance," "availability of staff," "real respect of the person," "ensuring rights," "listening to the person," "caring, first of all, for the patient and not for the illness," "understanding and responding to needs of the person," "individual therapeutic plan,"

"negotiation and not imposition." Participants described a sense of freedom which appeared to be "therapeutic." Nurses' and patients' good mood contributed to the latter's cooperative and positive attitude in being helped and ultimately their recovery. Indeed, patient-nurse therapeutic relationships are recognized as an essential aspect of psychiatric care in open units [11], in which, therapeutic space and boundaries are set through dialogue, negotiation, and therapeutic agreements ([30]; [31]; [14]).

In this context, physical and medication restraint were deemed as necessary due to significant staff shortages while fear of litigation, conflict with relatives, difficulty in ward control, and import of psychoactive substances constituted the main disadvantages of participant working environment. Literature shows alarming high levels of physical and mechanical restraint in Athens which appear to be related to the considerably high rates of involuntary hospitalization and coercion during the admission process in comparison to other European countries ([6, 10, 21]; [28]). Thus, despite the innovative opening of the wards of the first State Psychiatric Hospital in 1947 [16] which managed to afford the passage of time, the lack of coordination among mental health services, relatives' limited knowledge on illness management and access to services, moderate implementation of the pertinent legislation, staff shortages, poor training of mental health professionals on negotiating treatment with patients, scarcity of intensive intervention modalities contribute to the high rates of involuntary hospitalization and use of coercive containment measures [6, 21, 27].

Furthermore, several participants emphasized that the import of psychoactive substances was a major disadvantage of care in open units since dealing with intoxicated patients constituted a very demanding task. Further disadvantages mentioned included tension in nurse-relatives interactions. Many nurses mentioned that relatives were often openly critical of the open door policy and felt that their significant other was not cared properly in open units. Research demonstrates that nurses require specific training and guidance on supporting substance using patients [8] and that use of coercive measures causes adverse emotional and psychological impact on both staff and patients [17, 24]. As regards, family formal and informal interactions with staff in open units, great effort is put into the involvement and empowerment of patients' families, and much time is dedicated to inform accompanying persons, family members, and/or friends about ward rules [14] avoiding perhaps, with such a proactive approach, tension and alliance issues which may render family involvement a challenging and sometimes overwhelming task for mental health nurses ([29]; [7]).

As regards, the limitations of the present study, the sample was drawn at one psychiatric hospital only, and therefore may not be representative of nursing care providers in Greece in general. Furthermore, interviews with nurses with sustained exposure to psychiatric practice in other hospitals, would allow comparison of perceptions and experiences which would not be influenced by professional socialization processes at one particular hospital. Finally, the fact that other characteristics of wards' culture were not included constitutes another limitation of the present research.

Participation in this study offered an opportunity to nurses to review the advantages and disadvantages of open door policy in psychiatric wards and share their experience. Lack of understanding of the advantages and disadvantages of containment practices on the acute care environment and the recovery process may limit nurses' ability to interact in a meaningful and safe way with mental health patients and their families [9]. In contrast, acknowledgement of the advantages and disadvantages of common practice may help professionals in developing a more realistic view of psychiatric care and avoid polarization between a romanticized view of care and resignation so as to become involved with patients instead of limiting contact by a collective withdrawal at the nurses' station [18].

Finally, the findings of this study indicate the need for the development of educational and supportive interventions to support mental health nurses to cope with the emotional content of their work. Organizational support and a supportive

workplace culture are crucial to enable psychiatric nurses to talk about their feelings of frustration especially during the early stages of their career. Mentorship and clinical supervision provided regularly on a long-term basis constitute a holding environment for personal disclosures which helps professionals to step back and reflect on their communication and interactions [23]. Continuous education may empower addiction nurses in actualizing their role. Care during the emotionally laden moments of acute psychiatric treatment may be a source of suffering, anguish, and stress for mental health nurses but also an arena of personal maturity and self-actualization. According to Lanara [22], serving the suffering patient as a person in a complex society constitutes a difficult intellectual and spiritual achievement and requires heroism, passion for social justice and zeal for righteousness in dealing with internal and external barriers to care and build a strong professional identity.

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Validation of the Greek Version of Hedonic, Eudaimonic, and Extrinsic Motives for Activities (HEEMA) Instrument

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Abstract

Hedonia and eudaimonia are motivating forces through which individuals pursue well-being. The latter is a multidimensional concept, while hedonia and eudaimonia, both of which are realized through the reward system of the brain, are known to influence each other. Researchers have shown that specific extrinsic values (e.g., material wealth, power over other

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people, etc.) are associated with a sense of "good life" and may influence both hedonia and eudaimonia. The HEEMA (Hedonic, Eudaimonic, and Extrinsic Motives for Activities) scale was developed to evaluate all three ways of seeking well-being, hedonia, eudaimonia, and extrinsic values, in both a healthy and unhealthy fashion. The purpose of this study was to assess the psychometric properties of the HEEMA scale in a sample of 225 Greek individuals. Participants filled the HEEMA, SWLS, MLQ, Self-Esteem questionnaire, DASS-21, MHC-SF, and Big Five Inventory, anonymously. Reliability and validity indices of the scales were satisfactory (Cronbach's α were 0.734, 0.811, and 0.843 for the hedonic, eudaimonic, and extrinsic motives subscales, respectively). Indicatively, the study showed a positive correlation between aspects of well-being and positive emotions, satisfaction with life, sense of meaning and purpose, as well as with specific personality traits, while negative correlations were found between eudaimonic orientation and depression.

Keywords

Hedonia · Eudaimonia · Well-being · HEEMA scale · Motives

1   Introduction

Peoples' approaches to fulfillment have attracted an expanding group of well-being researchers. The World Health Organization (WHO) defines mental health as a state of well-being, in which every individual apprehends her or his own potential, maintains the ability to cope with the stresses of life, works productively and fruitfully, and makes a contribution to her or his community [1]. There is a growing interest in the ways that people search for and achieve well-being [2]. Contemporary literature has mainly studied two ways of seeking fulfillment: hedonic and eudaimonic pursuits [3].

Classical philosophers, including Aristippus, considered "hedonia" a form of maximizing positive affect and comfort, while diminishing distress and pain [4]. Thus, hedonia can lead to vitality and relief from negative affect. The term regards the subjective experiences of pleasure, but not the sources from which it is obtained [5].

The origins of the term "eudaimonia" can be traced to the writings of the classic Greek philosopher Aristotle. Eudaimonia can be conceived as the actualization of one's personal "daimon" or spirit [2, 6]. In other words, eudaimonia is a process toward the development of one's best potential, achievement of personal growth in a virtuous manner and, finally, accomplishments of her or his aims in life [5, 7]. Pursuit of eudaimonia is a path to personal excellence and authenticity, while the individual is required to coordinate his or her actions with his or her values [8]. Hence, pursuit of eudaimonia has been proven important for building a sense of meaning in life [9, 10].

Hedonia and eudaimonia are defined as orientations of personal motives that organize an individual's actions toward her or his intensions and life choices [2, 11]. What an individual can really control in life are choices and goals, given that no one can ensure the outcomes and the emotions that may arise during the process [12]. Hedonic pursuits are strong sources of well-being in the immediate moment [3]. In contrast, eudaimonic pursuits promote individual well-being in perspective, and support the building of other peoples' well-being. These pursuits could, thus, be conceived as an "investment" for the future, while both types of orientation have been related to satisfaction with life.

In an overview of the concepts mentioned above, Huta and Ryan [4] underline the vital need of pursuing hedonia, as much as eudaimonia. A number of studies have shown that those who seek both, have higher levels of well-being than people who seek only one or the other [4, 13]. Hence, those who pursue both, demonstrate higher scores on mental health measures. Thus, whereas hedonic and eudaimonic motives serve different aspects of well-being, they are equally essential for achieving it. Hedonia contributes to

self-regulation, promotes positive and minimizes negative affect [4], and allows the individual to disengage from negative concerns.

Eudaimonia, on the other hand, is important for building the feeling of having a meaningful life. The pursuit of eudaimonia relates to a superior purpose beyond the self, being inspired, and feeling connected with the self or living in accordance with the ancient Greek adage of "know thyself." Furthermore, empirical findings support that pursuit of eudaimonia is correlated with a more positive effect on the surroundings, including friends, relatives, and the broader social environment [2]. However, there are some common outcomes arising from these different forms of approaching well-being: maximizing of satisfaction with life, increasing the subjective feeling of vitality, and reinforcing self-esteem [2]. Recent evidence highlights a broad overlap between the genes that influence hedonia and those that influence eudaimonia [14]. As hedonia and eudaimonia seem to serve inter-related roles in life, well-being should be perceived as a multidimensional phenomenon [15]. In fact, the distinction between these two happiness concepts may have strong roots in philosophy, but lacks sufficient experimental support. Thus, it may form an ethical rather than a scientific argument [16].

Various researchers have suggested that well-being is linked to sociodemographic factors and personality characteristics. As far as age and educational status are concerned, younger adults with less education tend to show lower hedonic and eudaimonic well-being. Conversely, midlife and older adults with higher educational levels are more likely to have an optimal sense of well-being [17]. With respect to personality traits, hedonia relates more to excitement-seeking and gregariousness, as measured by the extraversion scale of the NEO Personality Inventory Revised [2]. Eudaimonia, on the other hand, correlates better with introversion, nonconformism, preference of solitude, peace and quiet, and assertiveness, while according to Big Five Model, increased extraversion—as the counterpart of neuroticism—and enhanced conscientiousness differentiate people with high from people with

low hedonic and eudaimonic well-being combined [17].

The existence of other concepts that have been linked to hedonia and eudaimonia cannot be ignored. Researchers have identified—among other exterior motives—specific extrinsic values (e.g., material wealth, power over other people, social image, social status, popularity), which have been associated with the "good life" [18, 19]. However, people with high extrinsic motives, such as these, may be less authentic and might pursue this third "good life" set of goals, even if this process correlates negatively with well-being.

The HEMA Scale [4] was developed to assess hedonia and eudaimonia as orientations and give the opportunity to study the potential correlations between them. There are three versions of HEMA: trait, state, and situational. The instructions can be adapted as needed in each case. Generally, it focuses on hedonic elements, such as pursuit of pleasure and comfort, and eudaimonic elements, such as excellence, authenticity, and flourishing [2]. The hedonic scale could be divided into two dimensions: hedonic enjoyment and hedonic comfort motives [20]. Recent evidence confirmed that the correlations between hedonic enjoyment motives and hedonic comfort motives were not high. As a result, the concepts are not considered homonymous [21]. Apart from this division, the latest version of the scale HEEMA (Hedonic, Eudaimonic, and Extrinsic Motives for Activities) attempts to assess all three ways of seeking well-being, both healthy and unhealthy *vis-a-vis* extrinsic orientations. Whereas this scale is an *See* Hedonic, Eudaimonic, and Extrinsic Motives for Activities (HEEMA) instrument easy to administer instrument that is applicable for both clinical and research purposes, its psychometric properties in a Greek community sample have not been examined.

Consequently, the objective of this study was to validate the HEEMA Scale in a sample of Greek citizens. Specifically, the aim was to provide data regarding internal structure and reliability (means, standard deviations, variances, Cronbach's α) and factorial structure, as well as

relations with specific criteria, such as life satisfaction, subjective happiness, self-esteem, feeling of meaning in life, positive and negative affect, stress-related dysphoria, anxiety, depression, emotional well-being, and personality characteristics in terms of criterion validity. To our knowledge, there has been no study of the psychometric properties of HEEMA in the Greek language.

2　Methods

2.1　Participants

The data of this study were collected during July and August 2019. The sample consisted of 225 native Greek speaker adults from the general population, who completed the questionnaires.

2.2　Procedures

First, the research team was authorized by Dr. Huta to validate the HEEMA in the Greek population. Consequently, the English version of the HEEMA was translated into Greek by two researchers of the team, fluent in English, with the translation-back translation method [22]. Disagreements were resolved through a consensus meeting. Parts of the data were collected online through REDCap, a secure web application (REDCap 8.5.2- © 2019 Vanderbilt University). After logging onto the survey's website, participants were directed to a webpage, where they could read a brief description of the research protocol and complete the series of questionnaires. It is notable that participants were first reassured that their responses would be collected anonymously. No identifying data from the participants (e.g., email addresses) were requested.

2.3　Measures

2.3.1　Demographics
The following sociodemographic variables were included: sex, birth year, marital status, domestic status, presence of children (and

number, if present), area of residence, educational status, care-giving (yes or no), employment, and satisfaction with their annual income.

2.3.2　Hedonic, Eudaimonic, and Extrinsic Motives for Activities (HEEMA)
The HEEMA asks participants to rate 15 specific intentions they typically approach their activities with, on a 7-point Likert Scale (1 = not at all, 7 = very much). There is an extra item (16), which is optional and used by researchers when they wish to assess hedonia comfort and hedonia pleasure separately. This item was excluded from this study after the statistical analyses. In particular, the instructions to the trait version, which were adapted in Greek, were the following: "To what degree do you *typically* approach your activities with each of the following intentions, whether or not you actually achieve your aim?". The hedonic orientation scale consists of two subscales: the hedonic pleasure orientation subscale, which includes items 4, 6, 9 (e.g., "seeking enjoyment?") and the hedonic comfort orientation subscale, which includes items 1, 7, and the optional item 16 ("seeking to have things comfortable?"). The eudaimonic orientation scale is composed of items 2, 3, 5, 8, 10 (e.g., "seeking to develop a skill, learn, or gain insight into something?"), while building on their previous work, the authors included five additional items (11–15) creating the category of extrinsic orientations, as described by self-determination theory researchers [19]. Extrinsic motives incorporate material wealth, status, power, fame, and popularity. In other words, this category represents also the unhealthy ways through which some people may pursue well-being.

2.3.3　Satisfaction with Life Scale (SWLS)
The SWLS includes five items, which examine the overall level of the individual's satisfaction with life [23]. Respondents answer in a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree) (e.g., "in most ways, my life is close to my ideal"). The total

score emerges from the sum of the items and the possible range of scores is between 5 and 35. We employed the Greek version of the scale [24], which has demonstrated good psychometric properties (Cronbach's α = 0.830).

2.3.4 Rosenberg Self-Esteem Scale (RSES)

The RSES [25] is a one-dimensional scale, which focuses on the perceptions that an individual has of her or his own value. The questionnaire consists of 10 questions evaluating both positive and negative graded statements. It has been translated in many languages, and the Greek version of the instrument has shown high reliability and efficient internal consistency [26]. In this study, a validated Greek version was used [27], with a Cronbach's α of 0.833 for the total sample.

2.3.5 Meaning of Life Questionnaire (MLQ)

The MLQ [28] was used to examine how well the respondents felt their lives had meaning. It consists of two subscales, the Presence of and the Search for Meaning. The respondents are asked to rate 10 items on a 7-point scale from "Absolutely True" to "Absolutely Untrue" (e.g., "my life has a clear sense of purpose"). The study of Pezirkianidis et al. provides empirical support for the validity and reliability of the Greek version of the MLQ. The Cronbach's α for the presence of meaning subscale was 0.848, while for the search for meaning subscale it was 0.861 [29].

2.3.6 Positive and Negative Affect Scale (PANAS)

Ten positive (e.g., happy, satisfied) and ten negative (e.g., upset, hostile) emotional adjectives are included in PANAS [30]. The scale is a widely used measure of well-being with satisfactory validity and reliability. The modified Likert-type scale used ranges from 1 (very slightly or not at all) to 5 (extremely). The Cronbach's α scores in this study were 0.846 and 0.768 for the negative and positive subscale, respectively.

2.3.7 Depression, Anxiety, and Stress Scale (DASS)

The DASS-21 is a short form of a 42-item self-administered instrument [31], which principally measures anxiety and depression in the general population. It comprises three scales, each of which assesses seven different symptoms, such as dysphoria and lack of interest (Depression Scale, Cronbach's α = 0.903), somatic symptoms, and subjective experience of anxious affect (Anxiety Scale, Cronbach's α = 0.874), difficulty in relaxing, and irritability (Stress Scale, Cronbach's α = 0.899). Research findings have shown that the Greek DASS-21 can be used as a reliable and valid scale [32, 33].

2.3.8 Mental Health Continuum-Short Form (MHC-SF)

The MHC-SF [34], is a 14-item questionnaire, measuring emotional well-being, which is associated with life satisfaction, positive affect, and absence of negative emotions, as well as social well-being, which consists of social contribution, integration, actualization, acceptance and coherence, and psychological well-being, including six items: self-acceptance, environmental mastery, positive relationships with others, personal development, autonomy, and purpose in life. The respondents are asked to recall the past month and rate on a 6-point Likert scale (0–5) the frequency of well-being experiences. The MHC-SF demonstrated good internal consistency in most nonclinical samples [34], with Cronbach's α 0.899 in this study.

2.3.9 Big Five Inventory (BFI)

This inventory [35] examines the five domains of personality (openness, agreeableness, neuroticism, extraversion, and conscientiousness). The BFI is a self-report instrument with 44 short phrases describing characteristics of personality. The participants are asked to express their agreement to the items using a Likert-type scale (from 1-totally disagree- to 5-totally agree). This tool has been widely used in the Greek population [36]. This study, using the Greek version of the BFI, has shown that Cronbach's α was: extraversion 0.657, agreeableness 0.718, conscientiousness 0.773, neuroticism 0.839, and openness 0.711.

2.4 Statistical Analyses

The data collected were analyzed using the Statistical Package for the Social Sciences vol. 25 (SPSS Inc., Chicago, IL). Descriptive analyses were used to estimate frequencies (%), means and standard deviations (SD) of qualitative variables and quantitative variables (i.e., age, well-being-related characteristics, etc.), respectively. Furthermore, exploratory factor analyses (EFA) were performed to reveal the dimensions of the HEEMA questionnaire. EFA principal component method was based on eigen values greater than 1. For the extraction of a factor, the varimax method was used and for the retainment of the factor, factor loadings had to be greater than 0.3. Bartlett's test of Sphericity was used to assess the adequacy of correlation between items. The Kaiser-Meyer-Olkin (KMO) statistic was used to assess sample sufficiency, while the internal consistency of the identified factors was examined by Cronbach's α. Spearman's correlations were performed to test overlap between factors. A value >0.85 indicates a strong overlap. Lastly, the scores of each factor were calculated and assessed for associations with other measurements of the study. Due to the skewed distribution of the quantitative variables, the nonparametric tests Mann-Whitney and Kruskall Wallis, were used to evaluate differences between the HEEMA subscales and other qualitative variables, while for quantitative variables, Spearman's rho correlation coefficient was used. The level of significance p was <0.05.

3 Results

The main sociodemographic characteristics of the sample are presented in Table 1.

Demographic data showed that males were 94 and females 131, with a mean age 33.00 years (SD = 8.69). More than half of the sample was in a relationship (36.6%) or married (18.2%), followed by single (40.2%). The vast majority

Table 1 Sociodemographic and well-being-related characteristics of the study's sample ($N = 225$)

Sociodemographic characteristics		Well-being-related characteristics	
Females N (%)	131 (58.2)	Mean SWLS total score (SD)	22.97 (5.62)
Mean age in years (SD)	33.03 (8.69)	Mean Self-Esteem total score (SD)	20.08 (4.56)
Married N (%)	41 (18.2)	Mean MLQ presence score (SD)	23.69 (5.41)
Living alone N (%)	143 (63.6)	Mean MLQ search score (SD)	23.84 (6.04)
Having children N (%)	34 (15.1)	Mean PANAS positive score (SD)	36.41 (5.57)
Caregivers N (%)	12 (5.3)	Mean PANAS negative score (SD)	24.59 (7.17)
Tertiary education N (%)	192 (85.3)	Mean DASS-21 anxiety score (SD)	6.64 (8.59)
Full-time employed N (%)	127 (56.4)	Mean DASS-21 depression score (SD)	9.64 (9.82)
Mean satisfaction of the annual income (SD) (0 = Not at all, 4 = Very much)	2.05 (0.966)	Mean DASS-21 stress score (SD)	13.34 (10.12)
		Mean MHC-SF total score (SD)	40.06 (11.43)
		Mean BFI extraversion score (SD)	27.03 (4.47)
		Mean BFI agreeableness score (SD)	35.01 (4.87)
		Mean BFI conscientiousness score (SD)	32.24 (5.62)
		Mean BFI neuroticism score (SD)	23.29 (6.39)
		Mean BFI openness (SD)	36.64 (5.47)

SD standard deviation, *SWLS* Satisfaction with Life Scale, *MLQ* Meaning of Life Questionnaire, *PANAS* Positive and Negative Affect Scale, *DASS* Depression, Anxiety, and Stress Scale, *MHC-SF* Mental Health Continuum (short form), *BFI* Big Five Inventory

of the participants (84.9%) did not have children and were not caregivers of people with special needs (94.7%). Most of the participants had an MSc or PhD (45.5%) or a bachelor's degree (40.2%). Some of them had graduated from an institute of vocational education (9.8%), and only a small percentage had received primary (0.4%) or secondary (4.0%) education only.

Descriptive statistics of the well-being-related measures used in this study, namely SWLS, Self-Esteem, PANAS, DASS-21, MHC-SF, and BFI are also presented, for completeness.

The results of the principal component analysis (PCA) of the 15 items of HEEMA with orthogonal rotation (varimax) are shown in Table 2.

The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis (KMO = 0.828). Bartlett's test of Sphericity of $x^2(105) = 1411.02$, $p < .001$, demonstrated that correlations between items were large enough to allow PCA. The determinant was zero, indicating lack of excessive correlations between items. The results confirmed three major components, which had eigen values greater than Kaiser's criterion of 1 and, in combination, explained 58.8% of the variance. The average of communalities extracted was 0.59. This was below the Kaiser criterion of 0.6 to be accurate. The items comprised three components, indeed: "Hedonic Orientation," "Eudaimonic Orientation," and "Extrinsic Orientation." Cronbach's α internal consistency criterion analysis was performed, to examine the test's reliability. According to the results, the scale proved to be reliable. Specifically, Cronbach's α for each principal component was larger than 0.7 (Table 2).

In Table 3, descriptive characteristics of each subscale, along with the observed values of the range, are presented. It is noticeable that the dispersion of calculated scores relative to the possible range of scores was sufficient.

Table 4 displays the correlations between three subscales. The correlations between the subscales were low and there was no overlap (rho = 0.304–0.520). More specifically, all sub-

Table 2 Rotated factor loadings of the principal components analysis (PCA) for 15 eudaimonic, hedonic, and extrinsic motives for daily activities (N = 225)

Items: To what degree do you *typically* approach your activities with each of the following intentions, whether or not you actually achieve your aim?	Eudaimonic motives	Hedonic motives	Extrinsic motives
Seeking relaxation?		0.723	
Seeking to develop a skill, learn, or gain insight into something?	0.825		
Seeking to do what you believe in?	0.665		
Seeking pleasure?		0.854	
Seeking to pursue excellence or a personal ideal?	0.521		
Seeking enjoyment?		0.756	
Seeking to take it easy?		0.753	
Seeking to use the best in yourself?	0.631		
Seeking fun?		0.718	
Seeking to contribute to others or the surrounding world?	0.716		
Seeking to have lots of money and nice possessions?			0.563
Seeking to have high status and prestige?			0.839
Seeking power and dominance over others?			0.824
Seeking to be admired and well-known?			0.884
Seeking to be popular and have an attractive social image?			0.776
Eigen values	**1.345**	**2.416**	**5.059**
% of variance	**8.966**	**16.109**	**33.729**
Cronbach's alpha	**0.734**	**0.811**	**0.843**

scales were significantly positively correlated with each other, indicating that, generally, people who pursue hedonia through their daily activities,

Table 3 Descriptive characteristics of the three subscales of HEEMA

	Items	Range	Mean	SD	Minimum	Maximum
Eudaimonic orientation scale	5	5–35	28.34	4.185	5	35
Hedonic orientation scale	5	5–35	27.71	4.722	5	35
Extrinsic orientation scale	5	5–35	18.41	6.157	5	35

HEEMA Hedonic, eudaimonic, and extrinsic motives for activities

Table 4 Correlations (Pearson's rho) between HEEMA subscales

	Eudaimonic orientations	Hedonic orientations	Extrinsic orientations
Eudaimonic orientations	1	0.520**	0.305**
Hedonic orientations	0.520**	1	0.304**
Extrinsic orientations	0.305**	0.304**	1

**Correlation is significant at the 0.01 level (2-tailed)

seek eudaimonia as well. Additionally, hedonic and eudaimonic motives of individuals, seem to correlate positively with extrinsic values, in order to form an optimal status of well-being.

Table 5 demonstrates meaningful associations between the HEEMA subscales and other study variables. In summary, women had significantly higher mean hedonic and eudaimonic scores than men, while age, marriage, or educational status did not seem to correlate significantly with any of the three components. Unemployed individuals showed significantly lower extrinsic motives ($p = 0.039$) than people who had a job. As expected, hedonic and eudaimonic motives' subscales were positively associated with satisfaction with life, meaning of life presence score, and mental health continuum total score. Unlikely, all three HEEMA subscales correlated negatively with self-esteem score. A positive association was found between positive emotions and all HEEMA subscales ($p < 0.001$). Extrinsic motives were significantly positively correlated with MLQ search score and negative emotions. Only eudaimonic orientation was negatively associated with depression. As far as Big Five Inventory is concerned, the dimensions of agreeableness, conscientiousness, and openness showed a statistically significant positive correlation with the eudaimonic subscale (all $p < 0.001$), whereas hedonic and extrinsic motivations were associated with extraversion ($p = 0.036$ and < 0.001, respectively).

4   Discussion

This study provides support for the reliability and validity of the HEEMA scale in a sample of the general population in Greece. According to the results, scale's items have satisfactory psychometric properties. The results showed that marital, work or educational status do not affect the types of motives, even though other studies have demonstrated opposite findings [37]. The demographic variable that appears to influence orientations is sex. Age was linked negatively only with eudaimonic motives; however, this fact can be attributed to the young mean age of the sample ($M = 33.03$ years). The results for hedonic orientation could be different in older-aged individuals, given that factors, such as personal growth and self-realization, can change over time and have an impact on well-being aspects.

To further examine the validity of the scale, the study used as criteria other variables, so as to evaluate convergent and divergent validity. It was hypothesized that hedonic and eudaimonic motives would correlate positively with Satisfaction with Life Scale scores, positive emotions and self-esteem and negatively with negative Emotions, Stress, Depression, and Anxiety (DASS-21), and also positively with the Meaning in life (MLQ) and MHC-SF. Regarding extrinsic orientation, no specific hypothesis was made, in view of the fact that literature on this domain and its association with the aforementioned concepts is limited. Researchers have come to the conclusion that extrinsic considerations blunt hedonic

Table 5 Associations between HEEMA subscales and other study measurements

Variables	Categories	Mean eudaimonic orientations (SD)	Mean hedonic orientations (SD)	Mean extrinsic orientations (SD)
Gender	Females	28.92 (3.49)	28.39 (4.32)	18.48 (6.23)
	Males	27.50 (4.94)	26.79 (5.15)	18.37 (6.13)
	p-value	0.035*	0.017*	0.922
Age	Spearman's rho	−0.143	−0.120	0.001
	p-value	0.033*	0.074	0.983
Marital status	Unmarried no relationship	28.57 (3.98)	27.60 (4.11)	18.43 (6.20)
	Unmarried in a relationship	28.45 (3.73)	28.67 (4.28)	19.40 (6.06)
	Married	28.12 (5.22)	26.56 (6.32)	17.34 (6.09)
	Divorced	26.45 (4.95)	26.55 (4.16)	14.82 (5.86)
	p-value	0.624	0.123	0.082
Education	Secondary or lower	28.50 (4.20)	28.70 (5.44)	15.10 (5.30)
	Tertiary	28.33 (4.20)	27.71 (4.66)	18.57 (6.18)
	p-value	0.998	0.433	0.106
Work status	Employed	28.35 (4.39)	27.97 (4.70)	18.80 (6.07)
	Unemployed	28.29 (3.37)	26.87 (4.57)	16.84 (6.38)
	p-value	0.724	0.129	0.039*
SWLS score	Spearman's rho	0.249	0.179	0.047
	p-value	<0.0001*	0.007*	0.483
	Spearman's rho	−0.285	−0.165	−0.097
	p-value	<0.0001*	0.013*	0.147
MLQ presence score	Spearman's rho	0.253	0.136	0.038
	p-value	<0.0001*	0.042*	0.570
MLQ search score	Spearman's rho	0.390	0.102	0.232
	p-value	<0.0001*	0.128	<0.0001*
PANAS positive score	Spearman's rho	0.486	0.247	0.269
	p-value	<0.0001*	<0.0001*	<0.0001*
PANAS negative score	Spearman's rho	−0.012	0.012	0.197
	p-value	0.854	0.856	0.003*
DASS-21 anxiety score	Spearman's rho	−0.013	0.014	−0.009
	p-value	0.843	0.839	0.898
DASS-21 depression score	Spearman's rho	−0.222	−0.119	0.031
	p-value	0.001*	0.074	0.639
DASS-21 stress score	Spearman's rho	−0.059	−0.021	0.077
	p-value	0.374	0.758	0.248
MHC-SF score	Spearman's rho	0.359	0.168	0.103
	p-value	<0.0001*	0.012*	0.125
BFI extraversion score	Spearman's rho	0.160	0.140	0.239
	p-value	0.016	0.036*	<0.0001*
BFI agreeableness score	Spearman's rho	0.259	0.096	−0.113
	p-value	<0.0001*	0.151	0.092
BFI conscientiousness score	Spearman's rho	0.328	0.093	−0.021
	p-value	<0.0001*	0.166	0.756
BFI neuroticism score	Spearman's rho	−0.093	−0.017	0.096
	p-value	0.166	0.795	0.150
BFI openness score	Spearman's rho	0.235	0.153	0.111
	p-value	<0.0001*	0.021*	0.097

* $P < 0.05$

pleasure and impair genuine connection to an activity [18, 38]. However, contrary to expectations, extrinsic motives correlated positively to hedonic and eudaimonic motives. Likewise, unlike other research carried out in this area [21], self-esteem was negatively correlated with both hedonic and eudaimonic orientation, a fact that was quite surprising. Further research should be performed in order to investigate thoroughly the relations between these factors.

It is notable that this study failed to split hedonia into the following two components: hedonic comfort and hedonic pleasure [10]. This could be attributed to the exclusion of the 16th optional item and should be considered a limitation. Probably, a larger sample size could accomplish this division [11].

Regarding personality dimensions, specifically conscientiousness and agreeableness had an impact on eudaimonic orientation, given that a large body of literature has demonstrated personality to be a potent predictor of well-being [17]. Openness to experience refers to the depth and originality of an individual's attitude toward new experiences, so it was expected to correlate positively with mainly eudaimonic motives. These dimensions have been also linked to life satisfaction [39]. Finally, extraversion correlated positively with social interactions; hence, in this study, it was associated with extrinsic orientation, as was anticipated.

As stated above, it is plausible that a number of limitations might have influenced the results obtained, and these should be addressed in future research. First, the majority of the individuals in the sample, 85.3%, were of tertiary education. Second, the study was conducted mostly in an urban population. Individuals of a lower educational status or countryside residents were underrepresented. Another limitation was the relatively young mean age of the sample. Nevertheless, these limitations do not undermine the importance of the findings. Thus, this research verifies the data of previous validation studies.

In conclusion, the HEEMA Scale-Greek Version can be used as a reliable and valid psychometric tool for the measurement of well-being orientations in the Greek population. Further work is

needed to establish the psychometric properties of the scale in broad and culturally diverse Greek population samples. Future research regarding the validation of the HEEMA scale in the Greek population could target more specific positive psychology measures, while also investigating the differences between people of different age, educational background, or employment groups, regarding their motives for daily activities.

Conflict of Interest The authors declare no conflicts of interest.

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Event-Related Rumination Inventory: A Validation Process in the Greek Language

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Abstract

Rumination has been identified as a negative psychological response of women diagnosed with breast cancer. The aim of the present study was to validate the Event-Related Rumination Inventory (ERRI) in Greek women with breast cancer. Sixty female patients with newly diagnosed breast cancer were included in the study. The ERRI questionnaire was translated with the back–forward procedure. Sociodemographic, anthropometric, and medical parameters were also assessed. The principal component analysis resulted in the following two-factor solution: (1) intrusive thoughts and (2) positive outcome. All subscales showed satisfactory internal consistency and variance, relative to theoretical score ranges. Subscale scores and the total score were significantly correlated with post-traumatic growth, distress, depression, and anxiety, demonstrating good criterion validity. Associations with patients' sociodemographic and medical characteristics, such as the stage of the disease and the

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type of treatment, were also identified. The Greek version of the ERRI provides valid and reliable measures of rumination when administered to women with breast cancer.

1 Introduction

Breast cancer (BC) is the commonest type of cancer and the second cause of cancer-related deaths in women worldwide [1].

In addition to the high incidence and mortality of the disease, breast cancer poses a severe psychological burden to the patient. Breast cancer has been associated with high levels of distress and significant impairment of the quality of life of the patients [2]. Rumination is a style of repetitive thinking of the stimuli (traumatic events) that cause distress and impact the psychological status of the individual [3]. Rumination of traumatic events has been associated with high levels of distress, depression, and anxiety [4, 5]. Negative cancer-related rumination has been associated with post-traumatic stress disorder (PTSD) in patients with breast cancer [6].

The Event-related Rumination Inventory (ERRI), developed by Cann and colleagues [7], was created to measure two styles of ruminative thinking: the intrusive and the deliberate rumination. The first is about thoughts which are not initiated by the patient, while the second is about thoughts which are initiated by the patient. The ERRI was originally validated in two samples of college students with respect to the traumatic events they had gone through, to predict the association of rumination with distress and post-traumatic growth (PTG). The results of the validation of the ERRI showed that it has valid psychometric properties and is strongly correlated with distress and PTG [7].

The aim of this study was to validate the ERRI in the Greek language in female patients with breast cancer on active therapy.

2 Materials and Methods

2.1 Study Procedure

This study was carried out as a part of the first author's (TS) thesis in the postgraduate course "Science of Stress and Health Promotion" of Medical School, of the National and Kapodistrian University of Athens in Greece. The validation of the questionnaire was part of an 8-week stress management randomized controlled clinical trial and it was delivered before the initiation of the intervention.

2.2 Participants

The study sample was selected randomly, using an online random number generator database (www.random.org). Patients diagnosed with BC were recruited by TS through cooperation with the Hematology-Oncology Unit of the Fourth Department of Internal Medicine of the National and Kapodistrian University of Athens in Greece at the Attikon University Hospital. The study was approved by the Institution's Scientific and Ethics Committee and all patients signed an informed consent prior to participation.

The inclusion criteria were the following:

1. Age over 18 years
2. Histological diagnosis of breast cancer
3. ECOG (Eastern Cooperative Oncology Group) Status 0–2
4. Current active treatment; chemotherapy (CMT), radiotherapy (RT), hormonal therapy (HT)

The exclusion criteria were the following:

1. Dementia
2. Manifestation of psychiatric disorder during the previous 6 months which debars communication with the investigator and participation in the study (e.g., psychotic episode)
3. Current treatment with psychotropic medications such as antipsychotics, anxiolytics, or antidepressants
4. Illiteracy of the Greek language

5. Hearing or visual problems interfering with the patient's participation in the study
6. Systematic practice of stress management techniques during the previous 6 months (e.g., expressive writing)

Sociodemographic, Anthropometric, and Medical Variables

Sociodemographic, anthropometric, and medical variables were recorded for each study participant for the validation purposes. These variables included age, marital status (unmarried/married/divorced/widowed), cohabitation status (living alone/living with somebody else), number of children, educational status (primary or secondary/tertiary/master or PhD), occupational status (working/not working), income satisfaction (not at all, a little, moderate, a lot), and smoking status (current/former/never), which were self-reported. Other variables included disease stage (I/II/III/IV), time elapsed from diagnosis (months), number of chemotherapy cycles, radiotherapy (yes/no), hormonal therapy (yes/no), weight, and height, which were retrieved from participants' medical records.

2.3   Study Instruments

The ERRI consists of 20 items with responses ranging from 0 (not at all) to 3 (often). Its score is calculated in total, as well as for its two subscales, the intrusive rumination (10 items) and the deliberate rumination (10 items). All the items of the intrusive rumination subscale are negatively worded, while items of the deliberate subscale are positively worded. Higher scores reflect higher rumination levels.

The ERRI original questionnaire was translated in Greek by two different native Greek speakers (TS, AK) with additional excellent knowledge of the English language. Then the two forms of translation were compared and combined into one. The Greek translation was then translated back in English by a third person who is a native English speaker with expertise in Greek language. Finally, comments and possible modifications were discussed [8].

The Greek version of ERRI was administered to each participant to assess the rumination of the responder with respect to a traumatic event.

Based on previous findings, rumination is significantly correlated with levels of distress [9] and also the levels of intrusive and deliberate rumination can have impact on the percentage of PTG each individual may experience after a traumatic event [10].

Therefore, for criterion validity assessment, the "Post-Traumatic Growth Inventory" (PTGI) and the "Hospital Anxiety and Depression Scale" (HADS) [11] were also administered to each study participant. The PTGI is based on the extended version of the PTGI, previously developed by Tedeschi and Calhoun [12], with equivalent properties. It includes 10 items with responses ranging from 0 to 5 and assesses the trauma-related growth of the responder. All of its items are positively worded. Higher scores represent higher growth. Previous research has demonstrated satisfactory psychometric properties of the PTGI in Greek cancer patients [13]. The version used in the present study was developed through a back–forward translation process, as indicated in the previous literature [8]. The HADS assesses depression (7 items) and anxiety (7 items) in a total of 14 questions. Scoring for each item ranges from 0 to 3 and the total score displays the total level of distress of the individual. In this study, the Greek version of the HADS was used, which has been developed and standardized in the general population [14].

2.4   Validation Procedure

Descriptive analyses were used to calculate the means, standard deviations (SD), minimums, maximums, and absolute and relative frequencies (%). Principal component analysis (PCA) was used to identify the factors from the ERRI. Bartlett's test was used to assess whether the correlation between items was adequate whereas a determinant value was calculated to assess unwanted over-correlation of items (determinant should be close to zero). The Kaiser–Meyer–Olkin (KMO) statistic was used to assess sample

adequacy. The appropriate numbers of derived factors were identified using the scree plot (looking for inflexion points) and Kaiser's criterion of eigenvalues greater than 1 (given that our sample was large, the criterion was valid for an average of communalities greater than 0.6). Loadings of each item on derived factors were maximized using the orthogonal varimax rotation. Items with loadings above 0.3 were examined as candidate components of the corresponding factor. Cronbach's alpha values were calculated to assess internal consistency of the identified factors. The scores of each factor were calculated and assessed for meaningful associations with the other measurements of the study. The level of significance p was 0.05. Statistical analyses were performed using the SPSS for Windows (version 21.0) statistical software (SPSS Inc., Chicago, IL, USA).

3   Results

Of the 63 patients included in the sample of the questionnaire validation, 3 did not deliver any initial measurements; therefore, 60 responses were included in the validation process.

Study participants' sociodemographic, anthropometric, and medical characteristics are shown in Table 1. Results of the PCA of the 20 items with orthogonal rotation (varimax) are presented in Table 2. The Kaiser–Meyer–Olkin measure verified the sampling adequacy for the analysis (KMO = 0.9) and all KMO measures for individual items were >0.505, above the acceptable limit of 0.5. Bartlett's test of sphericity $x^2(190) = 1513.404$, $p < 0.001$, indicated that correlations between items were sufficiently large to perform PCA. The determinant was 1.81 indicating possible excessive correlations since it was not quite close to zero. Three components had eigenvalues greater than Kaiser's criterion of 1 and in combination explained 65.008% of the variance. The average of communalities was 0.65, above the Kaiser's criterion of 0.6 to be accurate. The scree plot supported the choice for the selection of two components according to the inspection of inflexion points, which explained

59.66% of the variance. Since the initial questionnaire contains two subscales, two components were also retained for final analysis. The

Table 1 Sociodemographic, anthropometric, and medical characteristics of study participants

Variables		Patients ($N = 60$)
Age, mean (SD)		59.4 (12.6)
Age group, N (%)	18–45	3 (5)
	45–64	33 (55)
	65+	24 (40)
Marital status, N (%)	Single	3 (5)
	Married	45 (75)
	Divorced	7 (11.7)
	Widow	5 (8.3)
Cohabitation status, N (%)	Living with someone	51 (85)
	Living alone	9 (15)
Maternity, N (%)	Yes	52 (86.7)
	No	8 (13.3)
Educational level, N (%)	Primary school	23 (38.3)
	Junior high school	10 (16.7)
	Senior high school	11 (18.3)
	Private university or college	5 (8.3)
	Public university	8 (13.3)
	Postgraduate studies	3 (5)
Occupation, N (%)	Public section employee	3 (5)
	Private section employee	6 (10)
	Teacher or professor	5 (8.3)
	Unemployed	9 (15)
	Other job	22 (36.7)
	Retired	15 (25)
Income satisfaction, N (%)	Not at all	18 (30)
	A little	15 (25)
	Moderate	24 (40)
	A lot	3 (5)
BMI, mean (SD)		27.2 (5.2)
Smoking, N (%)	Yes	16 (26.7)
	No	37 (61.7)
	Ex-smoker	7 (11.6)
Years of smoking, mean (SD)		26.2 (12.1)
Number of cigarettes per day, mean (SD)		18.1 (11.5)

Table 1 (continued)

Variables		Patients (N = 60)
Disease stage, N (%)	I	12 (20)
	IIa	12 (20)
	IIb	4 (6.7)
	IIIa	12 (20)
	IV	20 (33.3)
Mastectomy, N (%)	Left or right breast	51 (85)
	Both breasts	6 (10)
	No	3 (5)
Medical treatment, N (%)	CMT	30 (50)
	HT	1 (1.7)
	RT	1 (1.7)
	Other	3 (5)
	CMT & RT	9 (15)
	CMT&RT&HT	2 (3.3)
	CMT & HT	5 (8.3)
	No therapy	9 (15)
Menstrual status, N (%)	Pre- or perimenopausal	5 (8.3)
	Menopausal	55 (91.7)
PTG score, mean (SD)		30.4 (13.0)
HADS score, mean (SD)	Anxiety	6.0 (4.1)
	Depression	8.8 (3.2)
	Distress	14.9 (6.1)
ERRI score, mean (SD)	Intrusive thoughts	13.2 (8.4)
	Deliberate thoughts	14.7 (7.7)
	Total	27.9 (14.6)

SD standard deviation, *BMI* body mass index, *CMT* chemotherapy, *RT* radiotherapy, *HT* hormonal therapy, *PTG* Post-Traumatic Growth, *HADS* Hospital Anxiety Depression Scale, *ERRI* Event-Related Rumination Inventory

clusters of items, according to factor loadings (>0.3), within the two components, were interpreted as "Intrusive thoughts" and "Positive outcome".

Table 3 presents the mean (SD) scores of each ERRI subscale along with the theoretical and observed values of the range. It is evident that there was a good dispersion of calculated scores in our sample relatively to the possible range of scores.

Table 4 describes the correlations between the ERRI subscales. Specifically, the subscale of "Positive outcome" was negatively correlated with the subscale of "Intrusive thoughts," indicat-

Table 2 Rotated factor loadings of the principal components analysis for 20 items assessing rumination (N = 60)

Items	Intrusive thoughts	Positive outcome
1. "I thought about … mean to"	0.81	
2. "Thoughts about … thinking about them"	0.89	
3. "Thoughts about… able to concentrate"	0.82	
4. "I could not keep … entering my mind"	0.85	
5. "Thoughts, memories … want them"	0.85	
6. "Thoughts about … my experience"	0.72	
7. "Reminders of the … my experience"	0.76	
8. "I found myself … what had happened"	0.79	
9. "Other things … about my experience"	0.71	
10. "I tried not to think … from my mind."	0.77	
11. "I thought about … my experience"		0.73
12. "I thought about … with my experience"		0.67
13. "I forced myself … my experience"	0.55	
14. "I thought about … of my experience"		0.70
15. "I thought about … about the world"		0.76
16. "I thought about … for my future"		0.51
17. "I thought about … my experience"		0.72
18. "I forced myself … the event"	0.50	
19. "I deliberately … had affected me"	0.58	
20. "I thought about … what happened"	0.59	
Eigenvalues	9.61	2.32
% of variance	48.06	11.59

ing that the least the individual thought that had benefited from the traumatic experience of cancer diagnosis the more the intrusive thoughts about the diagnosis. That did not seem to be the case in reverse. Notably, the subscale of "Intrusive thoughts" displayed positive correlation with the

Table 3 Descriptive characteristics of the two subscales and the total score of the Event-Related Rumination Inventory

	Number of items	Range	Mean	SD	Minimum	Maximum
"Intrusive thoughts"	10	27	13.24	8.4	0	27
"Positive outcome"	5	15	8.18	4.3	0	15
Total score	15	42	21.4	10.9	0	42

Table 4 Correlations (Pearson's rho) between the ERRI subscales

	"Intrusive thoughts"	"Positive outcome"
"Intrusive thoughts"	0.88	0.46
"Positive outcome"	−0.46	0.88

ERRI Event-Related Rumination Inventory

subscale of "Positive outcome," indicating that higher levels of intrusive thoughts were associated with stronger belief of positive outcomes from the experience of the cancer diagnosis.

Tables 5 and 6 present the ERRI subscales and the total score according to participants' characteristics, respectively. Significant associations can be summarized as follows:

1. Women of older age noticed more positive outcomes from their diagnosis.
2. Single and divorced women showed higher levels of intrusive thoughts.
3. Women of junior high school education level scored higher in both ERRI subscales.
4. Teachers or professors also scored higher than women of other professions, in both subscales.
5. Women with a moderate level of satisfaction toward their income thought of less positive outcomes of their medical condition in comparison with women that were not at all satisfied with their income.
6. Women diagnosed with stage I breast cancer thought of more positive outcomes and made less intrusive thoughts than women of higher breast cancer stages.
7. Women without mastectomy thought of more positive outcomes from their medical experience than women who had undergone partial or total mastectomy.
8. Women who underwent combined treatment (chemotherapy, radiation, and hormonal therapy) had more intrusive thoughts.
9. The scores of PTGI were highly correlated with the positive outcome of the diagnosis of breast cancer.
10. Anxiety was highly correlated with intrusive thoughts.

4   Discussion

This study describes the validation of the Event-Related Rumination Inventory in a Greek clinical sample of adult women diagnosed with breast cancer.

The results of the validation process showed that for the BC women studied, the ERRI should better adjust to two subscales with a total of 15 out of the 20 questions, according to the results of the PCA. The first subscale in the initial English questionnaire included questions which assess both intrusive and deliberate thoughts. This subscale was named "Intrusive thoughts" in the Greek ERRI version, due to the fact that some of the items included in the "Deliberate thoughts" subscale of the initial questionnaire did not display such meaning in the Greek language. That could be a result of social differences between the American and the Greek culture, in the way deliberate and intrusive thoughts are stated. The process of validation usually brings such cultural

Table 5 Participants' ERRI subscales, and other sociodemographic, anthropometric, and medical characteristics

Variables	Categories	Intrusive thoughts Mean (SD)	Positive outcome Mean (SD)
Age		45.6 (16.6)	50.0 (14.2)
Age group	18–45	12.0 (9.8)	12.0 (4.3)
	45–64	13.4 (8.6)	8.7 (4.2)
	65+	11.9 (8.5)	7.5 (4.3)
Marital status	Single	16.6 (5.6)	6.6 (2.5)
	Married	13.4 (7.9)	8.3 (4.2)
	Divorced	15.2 (11.0)	10.8 (3.4)
	Widow	2.6 (3.9)	7.2 (6.6)
Cohabitation status	Living with someone	13.0 (8.4)	8.1 (4.4)
	Living alone	11.8(9.5)	10.3 (3.4)
Maternity	Yes	13.39 (8.7)	8.35 (4.5)
	No	9.62 (6.3)	9.37 (3.2)
Educational level	Primary school	10.9 (8.8)	8.6 (4.6)
	Junior high school	18.6 (8.8)	10.6 (3.2)
	Senior high school	12.6 (6.6)	7.1 (4.3)
	Private university or college	9.5 (5.5)	8.5 (4.5)
	Public university	14.8 (10.1)	8.0 (5.0)
	Postgraduate studies	12.0 (5.6)	8.0 (2.8)
Occupation	Public section employee	17.3 (13.4)	9.6 (6.1)
	Private section employee	10.5 (7.2)	9.6 (3.0)
	Teacher or professor	18.2 (8.4)	9.4 (4.3)
	Unemployed	13.1 (8.1)	9.7 (4.2)
	Other job	13.4 (8.1)	8.0 (4.3)
	Retired	10.0 (7.7)	7.3 (4.7)
Income satisfaction	Not at all	13.2 (8.4)	9.7 (4.1)
	A little	9.0 (7.4)	7.5 (4.2)
	Medium	16.2 (8.6)	7.9 (4.1)
	A lot	5.5 (7.7)	6.0 (8.4)
BMI		13.9 (9.8)	18.8 (6.7)
Smoking	Yes	13.5 (7.9)	9.1 (4.2)
	No	12.7 (9.1)	7.9 (4.4)
	Ex-smoker	14.1 (8.0)	10.2 (4.1)
Years of smoking		12.5 (12.5)	16.7 (13.1)
Number of cigarettes		4.7 (14.0)	8.9 (12.1)
Disease stage	I	9.6 (9.6)	9.6 (3.2)
	IIa	10.7 (8.1)	7.4 (4.4)
	IIb	17.5 (6.7)	6.7 (5.4)
	IIIa	12.6 (9.2)	7.0 (4.4)
	IV	14.2 (7.2)	9.5 (3.7)
Mastectomy	Left or right breast	12.8 (8.9)	7.9 (4.2)
	Both breasts	13.9 (8.2)	10.0 (2.4)
	No	9.0 (0.0)	14.0 (0.0)

Table 5 (continued)

Variables	Categories	Intrusive thoughts Mean (SD)	Positive outcome Mean (SD)
Medical treatment	CTM	10.9 (6.8)	7.7 (4.2)
	HT	5.0 (−)	2.0 (−)
	RT	27.0 (−)	13.0 (−)
	Other	10.0 (8.6)	5.3 (4.7)
	CMT & RT	16.6 (7.0)	11.2 (2.3)
	CMT & RT & HT	24.5 (0.7)	10.5 (4.9)
	CMT & HT	17.7 (3.9)	6.5 (5.5)
	No therapy	10.2 (10.9)	9.7 (3.4)
Menstrual status	Pre- or perimenopausal	12.8 (9.3)	8.4 (4.7)
	Menopausal	12.4 (8.7)	8.1 (4.5)
PTG		17.2 (13.1)	22.1 (11.6)
HADS	Anxiety	7.5 (7.9)	2.1 (5.1)
	Depression	4.8 (7.2)	0.5 (4.3)
	Distress	1.2 (7.3)	6.5 (6.0)

ERRI Event-Related Rumination Inventory, *BMI* body mass index, *CMT* chemotherapy, *RT* radiation therapy, *HT* hormonal therapy, *PTG* Post-Traumatic Growth, *HADS* Hospital Anxiety Depression Scale

differences on the surface and this is the reason for the cross-cultural adaptation that takes place during the translation of the items [15].

The second subscale of the validated questionnaire consisted of items that would assess the positive outcome that a patient would experience after breast cancer diagnosis. Therefore, the second subscale of the Greek ERRI version was named "Positive outcome" because it included items which assess whether an individual would think of the benefits this experience could encounter. These benefits could be considered to assess similar aspects as PTG. Besides, rumination levels have been shown to affect growth levels in the literature [10].

The small number of participants for the validation process is one of the study's main limitations. According to general rules for the implementation of validation, an adequate sample size would be that of 150 participants [16]. Additionally, the initial ERRI was developed with a sample size of 323 participants [7]. Therefore, the current study could be considered

a pilot attempt for validating a Greek version of ERRI in BC women, as several studies have conducted pilot validation of screening tools and questionnaires for cancer patients [17–20]. Another limitation is that no test–retest reliability assessment was performed due to the fact that this validation study was part of an interventional study; thus, any subsequent measurements could be possibly affected by the intervention. To conclude, rumination is a psychological entity studied in clinical populations bearing a traumatic event such as breast cancer patients [3]. The identification of rumination could lead to a more effective awakening of means to confront the psychological burden in these patients [21]. Determining and monitoring the psychological aspects of the disease may provide some relief of physical symptoms and could also spare health care resources in the long term. The validation of the ERRI in the Greek language could help health professionals identify rumination levels and provide the appropriate support to breast cancer patients in need.

Table 6 Participants' total score of ERRI and other sociodemographic, anthropometric, and medical characteristics

Variables	Categories	ERRI score Mean (SD)
Age		37.1 (18.4)
Age group	18–45	24.0 (13.5)
	45–64	22.25 (10.9)
	65+	19.5 (9.6)
Marital status	Single	23.3 (7.0)
	Married	21.8 (9.9)
	Divorced	26.1 (13.0)
	Widow	9.8 (5.8)
Cohabitation status	Living with someone	21.1 (10.8)
	Living alone	22.2 (9.1)
Maternity	Yes	21.75 (11.0)
	No	19.0 (5.8)
Educational level	Primary school	19.5 (10.0)
	Junior high school	29.2 (11.2)
	Senior high school	19.8 (8.1)
	Private university or college	18.0 (8.8)
	Public university	22.8 (13.8)
	Postgraduate studies	20.0 (8.4)
Occupation	Public section employee	27.0 (19.0)
	Private section employee	20.1 (8.3)
	Teacher or professor	27.6 (9.2)
	Unemployed	22.8 (11.8)
	Other job	21.4 (9.8)
	Retired	17.4 (10.0)

(continued)

Table 6 (continued)

Variables	Categories	ERRI score Mean (SD)
Income satisfaction	Not at all	22.9 (10.3)
	A little	16.5 (8.0)
	Medium	24.2 (11.3)
	A lot	11.5 (16.2)
BMI		5.5 (12.1)
Smoking	Yes	22.6 (8.8)
	No	20.7 (11.5)
	Ex-smoker	24.3 (9.8)
Years of smoking		3.0 (13.3)
Number of cigarettes		4.7 (14.6)
Disease stage	I	19.3 (12.1)
	IIa	18.2 (10.4)
	IIb	24.2 (6.1)
	IIIa	19.6 (12.3)
	IV	23.7 (9.8)
Mastectomy	Left or right breast	20.7 (11.4)
	Both breasts	23.9 (9.6)
	No	23.0 (0.0)
Medical treatment	CMT	18.6 (9.3)
	HT	7.0 (−)
	RT	40.0 (−)
	Other	15.3 (13.3)
	CMT & RT	27.8 (6.1)
	CMT & RT & HT	35.0 (4.2)
	CMT & HT	24.2 (8.5)
	No therapy	20.0 (12.5)

(continued)

Table 6 (continued)

Variables	Categories	ERRI score Mean (SD)
Menstrual status	Pre- or perimenopausal	21.2 (12.4)
	Menopausal	20.5 (11.1)
PTG		8.9 (12.8)
HADS	Anxiety	15.7 (10.0)
	Depression	13.1 (9.4)
	Distress	7.0 (9.0)

ERRI Event-Related Rumination Inventory, *BMI* body mass index, *CMT* chemotherapy, *RT* radiation therapy, *HT* hormonal therapy, *PTG* Post-Traumatic Growth, *HADS* Hospital Anxiety Depression Scale

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The Job Rotation of Nursing Staff and Its Effects on Nurses' Satisfaction and Occupational Engagement

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Abstract

Introduction: Job rotation in nursing staff involves moving workers from one department to another to increase their qualities in all areas.

Aim: Investigating the effects of job rotation of nursing staff on employee satisfaction and occupational engagement.

Methodology: A total of 211 nurses took part in the study. A structured questionnaire with closed-ended questions was used to collect the data. The questions used were based on previous research tools. The data analysis was performed with the SPSS statistical package v.24.0.

Results: The results regarding the correlation of job rotation, job satisfaction, and occupational engagement show that job rotation is positively related to occupational engagement and job satisfaction of nurses. The overall attitude of nursing staff toward job rotation is neutral, and they express moderate to neutral professional satisfaction, moderate degree of vigor and absorption, and moderate-to-high degree of dedication. Regarding the correlation of job rotation, job satisfaction, and occupational engagement with the demographic characteristics of nurses, it was found that the gender and years of work of nurses are not the factors that affect job satisfaction, occupational engagement, and job rotation. On the contrary, it was found that the age of nurses is a factor that only affects their work satisfaction, nursing education is a factor that only affects nurses' occupational engagement, and job position is a factor that affects nurses' occupational engagement and job rotation.

Conclusions: The results highlight the importance of job rotation of nursing staff in their professional satisfaction and occupational engagement.

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1   Introduction

The purpose of managers is to improve the performance and productivity of organizations based on a capable workforce and a modern and carefully designed work environment [10]. In this context, managers are involved in "work planning." The planning involves integrating the needs of an individual with the needs of the organization. Extending employee responsibility for planning, control, and decision-making is linked to meeting the organization's operational efficiency needs [10]. Jobs should be designed to increase employee motivation and satisfaction [28].

Job rotation is a method of job planning that can increase motivation, improve organizational performance, and develop new horizons in employees' attitudes, perceptions, and skills. It is a method associated with organizational effects such as job satisfaction, quality, productivity, and reduced costs [28]. It is also a means of enhancing employees' engagement and involvement in the organization's goals by playing an important role in job satisfaction. Satisfied employees who are active, motivated, and informed can accomplish these goals [2].

Healthcare professionals' job satisfaction is a major issue due to its impact on patient satisfaction and quality of healthcare [14]. It is closely related to health outcomes and is an indicator of quality of care [25]. Healthcare facilities that, in recent years, are characterized by staff shortage, the increased use of healthcare services, and the increased workload are leading nurses to low levels of job satisfaction [23]. Nurses with low levels of job satisfaction were found to be distancing themselves from their patients and their nursing duties, resulting in low quality of care. One of the current and foremost challenges for healthcare managers is to increase job satisfaction in order to achieve better results for the organization in terms of productivity and employee engagement [11].

Increasing job satisfaction and occupational engagement are vital in order for nurses to remain in the profession. Nurses' limited satisfaction leads to turnover either by quitting their job or looking for another department or workplace [23]. The strategies need to be identified in nurses' personal progress by developing their different capabilities [21]. Job rotation allows employees and the organization to explore different tasks and to discover the work they find most efficient, thereby satisfying their needs and encouraging them to stay committed to their profession [13].

2   Materials and Methods

2.1   Aim

The aim of this study is to investigate the effects of job rotation of nursing staff on employee satisfaction and occupational engagement.

2.2   Study Design

This is a cross-sectional study.

2.3   Participants

The study population consisted of 211 nurses and assistant nurses (response rate: 91.7%) from a large public hospital in Northern Greece.

2.4   Tools

A structured questionnaire with closed-ended questions was used to collect the data. More specifically, the questionnaire consists of four sections. The first section describes the sociodemographic characteristics of the participants. The second section contains six questions that are answered on a Likert-type scale (1 = strongly disagree to 5 = strongly agree) in order to assess nurses' attitude toward nursing staff rotation practice [6]. The third section contains 14 questions that are answered on a Likert-type scale (1 = very dissatisfied to 7 = very satisfied) in order to assess nurses' job satisfaction. The questions are based on the assessment

tool of job satisfaction of Warr et al. [31]. The fourth section contains nine questions that are answered on a Likert-type scale (1 = never to 7 = always) in order to assess nurses' occupational engagement. The questions used are based on Schaufeli and Bakker's [29] Utrecht Occupational Engagement Scale (UWES) short form.

2.5   Statistical Analysis

The statistical package SPSS, v.24.0 was used for the statistical analysis of the data. The statistical methods we used were *t*-test, one-way analysis of variance (ANOVA), and Pearson correlation.

3   Results

Table 1 presents the sociodemographic data of participants.

3.1   Job Rotation

More than half of participants (56.4%, *n* = 119) had rotation experience more than once, and 24.2% (*n* = 51) of nurses had rotation experience only once. In contrast, 19.4% (*n* = 41) of the nurses stated that they had not moved to another job in the past. Table 2 presents the nurses' views on the rotation process. Nurses had a neutral attitude toward job rotation as the mean of the overall dimension was 3.17 ± 0.83 on a scale ranging from 1 to 5.

3.2   Job Satisfaction

With regard to intrinsic satisfaction factors, nurses are moderately satisfied with the safety of their work (5.24 ± 1.56), while they are moderately satisfied with their immediate supervisor (5.00 ± 1.48) and their colleagues (4.79 ± 1.42). In addition, nurses were neutral in their satisfaction with working conditions (3.99 ± 1.48) and working hours (4.08 ± 1.62). Finally, nurses were less satisfied with the working relationships between managers and their employees (3.70 ± 1.60) and with the type of management (3.60 ± 1.62). Overall, nurses were found to have moderate to neutral intrinsic satisfaction (4.17 ± 1.19).

Regarding extrinsic satisfaction factors, nurses are moderately to neutrally satisfied with the magnitude of the responsibilities given to them (4.73 ± 1.46) and the ability to use their skills (4.65 ± 1.57). In addition, nurses expressed uncertainty about their satisfaction with the free-

Table 1 Sociodemographic data of participants

	Variable	*N*	%
Gender	Male	24	11.4
	Female	187	88.6
Age (in years)	<40	14	6.6
	41–50	100	47.4
	>51	97	46
Marital status	Married	177	83.9
	Unmarried	34	16.1
Education level	Secondary school	115	54.5
	University/college	72	34.1
	Master	16	7.6
	Other	8	3.8
Work experience (in years)	<10	11	5.2
	>11	200	94.8
Work position	Head nurse	13	6.2
	Nurse	80	37.9
	Nurse assistance	118	55.9

Table 2 Descriptive results for the five statements intended to assess nurses' attitudes toward job rotation

	Strongly disagree	Disagree	No agree No disagree	Agree	Strongly agree
I believed that job rotation is a type oftraining	13 (6.3%)	11 (5.3%)	46 (22.1%)	111 (53.4%)	27 (13%)
Job rotation expands my knowledge and skills in other areas	8 (3.8%)	12 (5.7%)	30 (14.4%)	111 (53.1%)	48 (23%)
I am willing to accept job rotation now	53 (25.7%)	60 (29.1%)	40 (19.4%)	35 (17%)	18 (8.7%)
I think job rotation is an excellent system	22 (10.7%)	42 (20.4%)	73 (35.4%)	54 (26.2%)	15 (7.3%)
Overall, I like the job rotation	25 (12.1%)	56 (27.2%)	58 (28.2%)	52 (25.2%)	15 (7.3%)

dom to choose their own way of working (4.30 ± 1.54), with the variety of their work (4.48 ± 1.52), with the recognition they receive for their performance (3.92 ± 1.65), and with the attention given to their suggestions (3.93 ± 1.56). Finally, nurses expressed moderate dissatisfaction with their chances of being promoted (3.17 ± 1.64). Overall, nurses were found to have moderate to uncertain extrinsic satisfaction (4.34 ± 1.00).

3.3   Occupational Engagement

Nurses regularly feel overwhelmed with energy (4.27 ± 1.42) and regularly feel energized and powerful when working (4.24 ± 1.41), and sometimes, they feel they are at work when they get up in the morning (3.77 ± 1.59). Nurses report a moderate degree of vigor (4.09 ± 1.268), indicating that nurses have moderate levels of energy and mental toughness during work. In addition, they have moderate levels of willingness to strive and persevere even when they face adversity.

Nurses are regularly excited about their work (4.17 ± 1.46) and regularly feel that their work inspires them (4.10 ± 1.55), while they often feel proud of their work (5.31 ± 1.54). Nurses report moderate to high levels of dedication (4.53 ± 1.312). Essentially, nurses express moderate to high levels of importance, enthusiasm, and pride in their work.

Nurses regularly feel completely absorbed in their work (4.52 ± 1.44) and regularly feel that

their work is overwhelming (4.24 ± 1.59). While they sometimes feel happy when they work out intensively (3.74 ± 1.65), nurses report moderate absorption (4.17 ± 1.301). Essentially, nurses express moderate levels of absorption and concentration in their work.

The age influences nurses' job satisfaction (intrinsic factors $p < 0.05$ and extrinsic factors $p < 0.05$), but not occupational engagement ($p > 0.05$) and job rotation ($p > 0.05$). In particular, increasing age increases nurses' intrinsic and extrinsic satisfaction (Table 3).

Education is a factor that affects nurses' occupational engagement (vigor $p < 0.05$, dedication $p < 0.05$, and absorption $p < 0.05$), but not job satisfaction ($p > 0.05$) and job rotation ($p > 0.05$). Nurses with a higher level of education were found to have higher vigor, dedication, and absorption than those with a lower level of education (Table 4).

Job position is a factor that influences nurses' occupational engagement (vigor $p < 0.05$ and absorption $p < 0.05$) and job rotation ($p < 0.05$), but does not influence job satisfaction ($p > 0.05$). Head nurses have a higher absorption and a more positive attitude toward rotation compared to nurses and nurses' assistants (Table 5).

Table 6 presents the results regarding the relationship between job rotation, job satisfaction, and occupational engagement. The results show that nurses' attitudes toward job rotation are positively related to the three dimensions of occupational engagement and are positively related to both dimensions of job satisfaction.

Table 3 Comparison of job rotation, job satisfaction, and occupational engagement relating to nurses' age

Variable/age, years	<40	41–50	>51	*p*-value
Intrinsic satisfaction	3.8 ± 1.3	3.99 ± 1.27	4.41 ± 1.05	0.021
Extrinsic satisfaction	4.17 ± 0.91	4.15 ± 0.93	4.56 ± 1.05	0.014

Table 4 Comparison of job rotation, job satisfaction and occupational engagement relating to Nurses' education level

Variable/education level	Secondary	College	University/master	*p*-value
Vigor	3.86 ± 1.21	4.31 ± 1.19	4.55 ± 1.54	0.009
Dedication	4.32 ± 1.23	4.72 ± 1.29	4.92 ± 1.61	0.037
Absorption	3.93 ± 1.23	4.48 ± 1.31	4.39 ± 1.43	0.012

Table 5 Comparison of job rotation, job satisfaction, and occupational engagement relating to nurses' job position

Variable/job position	Head nurse	Nurse	Nurse assistant	*p*-value
Vigor	5.05 ± 1.20	4.23 ± 1.26	3.90 ± 1.23	0.003
Absorption	5.13 ± 1.42	4.31 ± 1.32	3.97 ± 1.23	0.004
Job rotation	3.89 ± 0.44	3.21 ± 0.76	3.05 ± 0.87	0.001

4   Discussion

The results of this study show that over half of the nurses had experience of rotation more than once and agree that job rotation is a type of training, while the majority of them agree or strongly agree that job rotation expands their knowledge and skills in other fields. This may indicate a change in perceptions of skills and an increase in acceptance of job rotation [7]. However, despite the importance of the system, about half of the participants disagreed or strongly disagreed with being willing to accept job rotation at this stage. These results highlight the way employees respond to change. This way is influenced by both the individual perceptions of each employee and the organizational context in which the change takes place. This was supported by Pinhatti et al. [26] in their research, who attributed the response of individuals to change, lack of communication, and participation in such decisions. Another reason for the lack of willingness to change jobs may be the lack of incentives in the public sector. According to Delpasand et al. [9], public sector workers tend to remain stable to their work position. Finally, a smaller percentage of nurses agreed that job rotation is an excellent system, and they agreed that they like job rotation. Overall, the results show that nurses have a neutral attitude toward job rotation.

Regarding the nurses' satisfaction, there was a moderate satisfaction with the intrinsic factors such as their direct supervisor and their colleagues, while they were less satisfied with the relationship between the style of management and the employees in the organization. The role of leadership, interpersonal relationships, and communication are also found to be important in job satisfaction [4].

Analysis of nurses' responses to extrinsic factors revealed that they are moderately to neutrally satisfied with the range of responsibilities they are given and the ability to utilize their knowledge and skills. In many studies, the development of initiative and creativity appeared to be an important factor in satisfaction, while the small range for developing responsibility and autonomy generated dissatisfaction [12, 19]. Another element of the survey that affects employees' satisfaction is their uncertainty whether their performance is recognized and whether attention is given to their suggestions. Finally, the nurses expressed moderate dissatisfaction in case the chances of promotion were low. The lack of attitudes creates dissatisfaction [19].

All of the above may also lead to a lack of interest in joining the rotation system. This is also supported by the findings of the Mohan and Gomathi [24] research, which showed a positive correlation between interest in job rotation and

Table 6 Results of correlations between job rotation, job satisfaction, and occupational engagement

		Vigor	Dedication	Absorption	Intrinsic satisfaction	Extrinsic satisfaction	Job rotation
Vigor	r	1	0.786	0.695	0.445	0.447	0.263
	p		0.000	0.000	0.000	0.000	0.000
	N	211	211	211	211	211	202
Dedication	r	0.786	1	0.763	0.365	0.410	0.221
	p	0.000		0.000	0.000	0.000	0.002
	N	211	211	211	211	211	202
Absorption	r	0.695	0.763	1	0.305	0.334	0.371
	p	0.000	0.000		0.000	0.000	0.000
	N	211	211	211	211	211	202
Intrinsic satisfaction	r	0.445	0.365	0.305	1	0.838	0.121
	p	0.000	0.000	0.000		0.000	0.086
	N	211	211	211	211	211	202
Extrinsic satisfaction	r	0.447	0.410	0.334	0.838	1	0.126
	p	0.000	0.000	0.000	0.000		0.075
	N	211	211	211	211	211	202
Job rotation	r	0.263	0.221	0.371	0.121	0.126	1
	p	0.000	0.002	0.000	0.086	0.075	
	N	202	202	202	202	202	202

personal development of nurses in hospitals in Vellore region, India. Likewise, Campion et al. [5] reported that nurses with high interest in this practice believe that they will have high chance of evolving in the organization. Jarvi and Uusitalo [16] also reported in their study that learning new objects is considered important by the employee by indicating willingness for job rotation when it supports their career development.

Concerning the effects of occupational engagement, the nurses appeared to have a moderate level of energy and mental toughness during work. In addition, they were found to have moderate levels of willingness to strive. Dedication from the analysis of nurses' responses revealed that nurses regularly feel excited about their work and regularly feel that their work inspires them, while they often feel proud of their work. The absorption dimension showed that nurses regularly feel completely absorbed in their work, and they regularly feel overwhelmed from their work.

Results in relation to demographics, in particular the variable "age," found that it influences job satisfaction, but not occupational engagement and job rotation. Concerning job satisfaction, the results showed that nurses over 51 years are more satisfied. This is also consistent with the findings of Lu et al. [22], where age and years of work experience were positively correlated with both job satisfaction and engagement. The same result is supported by the majority of studies according to Tsouni and Sarafis [30], suggesting that this may be related to the fact that over time results in increased experience and, therefore, better adaptation to work. Research has also shown that, as employees grow older and gain work experience, they tend to be slightly more satisfied with their job, while the new employees tend to be less satisfied due to higher expectations [27].

The work experience of nurses is not a factor that has been shown to affect job satisfaction, occupational engagement, and job rotation. However, Campion et al. [5] report a negative relationship between work experience and age with job rotation, explaining that new employees to the job are more interested in acquiring new skills than older employees. Concerning job sat-

isfaction, findings from Al-Aameri's [1] study in public hospitals in Riyadh, Saudi Arabia, showed that older nurses were more satisfied and more engaged than younger. In the study of Lambraki et al. [19], work experience was found to have positive correlations with job satisfaction. The authors also noted that many studies indicate that age and years of work experience are negatively associated with satisfaction and are related to emotional exhaustion. The same result is supported by Bellali et al. [3], reporting that age and years of work experience are factors that cause occupational burnout.

Although age was not found to affect job rotation, we found that a large percentage of participants is not willing to move to another department/clinic, which could be explained by the fact that about half of participants in the study were aged 41–50 years and the rest ones were 51 years and older. Jarvi and Uusitalo [16] support that age is not an obstacle to maintaining activity in working life; however, the desire for diversity decreases with time, especially when approaching retirement age. This may explain the lack of interest in changing department/clinic and learning new methods.

Another variable examined is educational level, which appears to be a factor affecting nurses' occupational engagement but not job rotation. More specifically, nursing MA students express higher vigor and higher dedication, while MA nurses and TE nurses exhibit greater absorption compared to AM. This indicates an effort and persistence of the staff as well as an absorption in their work, which may be due to more training opportunities and the ability to advance and occupy higher positions than the PRs who appear to have less enthusiasm for the project. Although educational attainment in research did not appear to affect job satisfaction, a study by Hu and Liu [15] showed that in China, nurses with higher professional qualifications and opportunities to participate in training programs have higher levels of job satisfaction. In contrast, Lu et al. [20] report in their article that higher education nurses exhibit lower levels of job satisfaction, which is noteworthy as they are the most educated personnel in the nursing workforce and

future leadership in the organization. The same result was reached by Karanikola et al. [18], who in their survey of public and private mental health services in Greece report the low level of job satisfaction of TE nurses compared to their colleagues in terms of the recognition they received.

Research findings in this area have shown that the job position is a factor influencing nurses' occupational engagement and job rotation but not job satisfaction. In particular, the head nurses appear to be more positive about job rotation practice, which is in line with the findings of Jarvi and Uusitalo [16], where senior employees were more positive about rotation. They also show greater absorption in their work, thus demonstrating greater professional engagement. This may be due to the particular vigor and perseverance they have to show in their work because of their responsibility.

Regarding the research results of the correlation between job rotation, job satisfaction, and occupational engagement, we found that job rotation was positively related to occupational engagement and to nurses' job satisfaction. In contrast to Dinis and Fronteira [11], who concluded that this Job rotation practice appears not to be a key factor for job satisfaction as employees are satisfied with other dimensions such as having positive leadership, most studies agree with our results [13]. Specifically, the study of Chen et al. [7] showed a positive relationship between job rotation and job satisfaction of nurses, which positively influenced their engagement to stay and work in the organization. The same researchers support that job rotation provides employees opportunities for learning and enables them to meet new challenges and explore different tasks in order to discover their work that is most efficient and, thus, increases their job satisfaction. The job rotation can, therefore, motivate nursing staff to expand their professional knowledge by increasing their satisfaction and organizational engagement but also reducing nurses' professional burnout.

In addition, Jorgensen et al. [17] believe that job satisfaction and learning skills are consequences of job rotation. Similarly, Cosgel and Miceli [8] reported job rotation as the best method to increase job performance and satisfaction. Indeed, Hsu et al. [14] concluded that occupational engagement is a key factor in predicting nurses' job satisfaction, while a strong positive relationship appears between nurses' satisfaction and organizational engagement [1].

5   Conclusions

In summary, this study concludes that job rotation is positively related to both professional engagement and job satisfaction of nurses. Their overall attitude toward job rotation is neutral, expressing moderate to neutral occupational satisfaction, as well as moderate degree of vigor, moderate to high degree of dedication, and moderate degree of absorption. Regarding the relationship between job rotation, job satisfaction, and occupational engagement with nurses' demographic characteristics, it was found that nurses' gender and years of work experience are not factors affecting job satisfaction, occupational engagement, and job rotation. On the contrary, it was found that nurses' age is a factor that affects only nurses' job satisfaction, nurses' education level is a factor that affects only nurses' professional engagement, and job position is a factor that influences nurses' professional engagement and job rotation. The positive correlation found between job rotation and nurse's satisfaction indicates that this practice is a good strategy that can mobilize nursing staff and expand their professional knowledge by increasing their satisfaction and professional engagement.

Managers can use the job rotation system and improve healthcare professional's performance not only to increase job satisfaction and engagement but also to increase the efficiency of the organization. However, it is important to be applied by a systematic way by clarifying the goals and benefits, ensuring the transparency of this process and giving nurses opportunities to make suggestions in the process so that they can reduce their resistance to this practice. Job rotation requires careful planning, communication with the employee, motivation, the right attitude, establishing clear and basic rules, supervision and subsequent evaluation, and evalua-

tion of effectiveness. By adopting this measure, the hospital can use it as a tool for evaluating the employee's experience in the promotion process, but at the same time demonstrating that this system is objective and fair.

Since job rotation, especially in nurses, has not been studied in our country so far, this study which is being conducted for the first time in a hospital could contribute to future studies in order to investigate the role of job rotation in the wider system of nurses' professional development. The questions would be about employee's motivation and how the rotation should be linked to formal reward mechanisms.

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The Burden on Carers with Multiple Sclerosis

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Abstract

Background: The family members of patients with multiple sclerosis (MS) are called to become carers, playing a vital and difficult role in supporting the patients in their daily life. The aim of this study was to investigate the extent of the multidimensional burden on the carers of multiple sclerosis.

Methods: Data were collected from 111 carers with MS patients. The survey was conducted in Patras General Hospital.

Results: According to the research findings, the multidimensional burden of carers is proportional to the severity of the patient's condition. In particular, the majority of patients were in a good kinetic state, so the carers examined felt gentle with a moderate burden. On both scales, Zarit and BAKAS, it was observed that the age of the caregiver, the type of care he provides, and the patient's dependence on him increase the feeling of the burden. Positive results from care improve the caregiver's relationship with the patient, his self-esteem, and his ability to cope with stress. According to the F-COPES scale, it is observed that the relationship between the caregiver and the patient is responsible for accepting the problem; the greater the caregiver's age, the higher the percentage of those seeking help from doctors, social services.

Conclusions: The burden on carers is indisputable; support from family members, social and economic support, and education may mitigate the burden of care.

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1 Introduction

Multiple sclerosis (MS) is a disease that affects the central nervous system, with gradual, unpredictable, and continuous progression. It creates enormous physical, social, and psychological impacts on the individual and his/her family members who are called to become carers [3]. It

is a fact that families or individuals living with MS are called upon to deal with various types of needs and care that they did not anticipate and which they have to manage for years or decades. New therapies may partly slow the progression of the disease. The life expectancy of people with MS is reduced by about 10 years compared to non-patients, meaning they can live for several years developing severe disabilities, accompanied by comorbidities, with problems other than the nervous system. The long course of the disease allows the caregiver to prepare for and adapt to new roles that are different from those such as cancer or other neurological dysfunctions that have a shorter course. In addition, caring can also be beneficial as it allows the carer to feel good about themselves, to learn new skills, in addition to strengthening family relationships [2, 15].

In the USA, more than 44 million people provide informal care to their family members or friends. The value of this informal care is estimated at 375 billion dollars or twice the cost of formal home care. However, 30% of patients with MS need care because of their disability, while 80% of this care is provided by informal carers [9].

The consequences for the caregiver are biological, mental, and socioeconomic, which, of course, have an inextricable relation to his or her previous state of health, socioeconomic status, and degree of social support. It has been shown that caring causes chronic stress for the caregiver, disruption to family relationships, work, social status, change or even loss of identity, and change of life in general. The level of anxiety is related to the patient's disability level, cognitive impairment, problematic behavior, as well as the type, intensity, and timing of care provided, age, caregiver-patient relationship, and sex [4, 15].

Negative bodily effects due to care are less pronounced than psychological ones. Research has shown that carers exhibit reduced adherence to medical guidelines for their own health, eating poor quality nutrition, resulting in health disor-

ders and even physical illness and death [15]. Physical illnesses caused by care may be hypertension and other cardiovascular diseases, diabetes mellitus, and weak immune system [4, 15]. Another research indicates that carers are at increased risk of being exhausted and burnout, sleeping disorders, immune system weakness, and delayed wound healing [15].

However, apart from the negative effects of provided care, there are positive aspects through this experience that are associated with lower levels of depression and better self-reported health [6]. Carers feel that by learning to help, they learn to appreciate every moment of their lives, as well as discovering their potential. Finally, time with the patient contributes to the deepening of their relationship, as well as increased appreciation among family members [1]. According to other surveys for carers, providing care increases self-esteem, provides lessons to be able to cope with difficult situations, yet assures that the recipient is well cared for [14].

2   Materials and Methods

2.1   Aim

The aim of this study was to investigate the extent of the multidimensional burden on carers of patients with multiple sclerosis.

2.2   Study design

This is a cross-sectional study.

2.3   Participants

The sample of the study consisted of 111 family carers (response rate = 92.5%) of patients with MS. Data collection took place from February 2019 to April 2019.

2.4 Tools

2.4.1 BAKAS Caregiving Outcome Scale (BCOS)

The BCOS scale measures carers' perceptions of the extent to which their lives have changed from providing care to a patient. This tool has been translated into Greek and validated for the Greek population by Govina et al. [8]. The questionnaire consists of 16 questions measuring changes in social functioning, subjective well-being, and physical health.

2.4.2 The Zarit Burden Interview

The Zarit Burden Interview has been translated, validated, and used in various countries in America and Europe. It consists of 22 questions and four dimensions, which are role intensity, personal tension, relationship deprivation, and care management. The overall score is the sum of the reactions in the individual points. Higher scores are indicative of a greater burden on the caregiver, with a maximum value of 88 [12].

2.4.3 Family Crisis Oriented Personal Evaluation Scales (F-COPES)

The F-COPES scale is used to help identify problem-solving and behavioral strategies adopted by a family when faced with a problem or crisis. It is developed by McCubbin et al. [10]. The questionnaire has been translated into Greek and validated for the Greek population by Gouva et al. [7]. The scale consists of 30 questions and includes 5 family crisis response scales, namely, Acquiring Social Support, Reframing, Seeking Spiritual Support, Mobilizing Family to Acquire and Accept Help, and Passive Appraisal. A high score on a scale also implies a more frequent use of the strategy or problem-solving approach.

2.5 Statistical Analysis

The statistical analysis was carried out using IBM SPSS 21.0 statistical package. Mean and standard deviation were used for the descriptive analysis of the quantitative variables, while frequencies and percentages were used for the descriptive analysis of the categorical variables. The t-test and one-way ANOVA analysis were used to compare variables. The significance level was set at 0.05.

3 Results

The demographics of the sample is presented in Table 1. Most of the patients with MS were ambulatory (70.3%), while 15.3% used a wheelchair and 14.4% are on bed. About one-third of the patients were spouses (34.3%) and 24.3% were their kids. The majority of the sample provide care to a patient with MS for more than 5 years (36%), followed by those who provide care for a period between 1 and 2 years and 2-3 years (18% and 11.7%, respectively).

Regarding the type of care, 36.9% of the participants provide physical/personal care to patients, such as washing and dressing, 33.3% provide emotional and psychological support (e.g., company), and 22.5% help with housework and patient transportation. About 38.7% of carers supported that the person they provide care for depends very much on them, while the percentage of participants who stated patients feel little or no dependence on them varies between 18% and 12.6%, respectively. Finally, the majority of carers consider it is their duty to care for the patient (85.6%).

3.1 BCOS/BAKAS Scale

Table 2 presents the mean score of each BCOS/ BAKAS scale question. The Cronbach α internal consistency coefficient of the questionnaire is 0.951 which indicates excellent internal consistency. The highest score was obtained by the participants' relationship with the patient (4.55).

Table 1 Demographics of patients and carers

Variables		Patients		Carers	
		N	%	N	%
Gender	Females	71	64.0	84	75.7
	Males	40	36.0	27	24.3
Age	<25 ετών	6	5.4	5	4.5
	26–30 ετών	5	4.5	2	1.8
	31–40 ετών	15	13.5	22	19.8
	41–50 ετών	21	18.9	41	36.9
	51–60 ετών	40	36.0	34	30.6
	>60 ετών	24	21.6	7	6.3
Marital status	Married	67	60.4	74	66.7
	Unmarried	24	21.6	21	18.9
	Divorced	6	5.5	7	6.3
	Widow	14	12.6	9	8.1
Educational level	Primary/secondary school	54	48.6	15	13.5
	High school	25	22.5	35	31.5
	University/college	29	26.1	11	9.9
	Other	3	2.7	5	4.5
Working status	Employee	41	36.9	66	59.5
	Pensioner	40	36.0	21	18.9
	Unemployed	11	9.9	13	11.7
	Student	5	4.5	6	5.4
	Household	14	12.6	5	4.5
Income	<7000 €	24	21.6	24	21.6
	701–15,000 €	42	37.8	45	40.5
	15,000–25,000 €	21	18.9	22	19.8
	>25,000 €	8	7.2	6	5.4
	None	16	14.4	14	12.6

Table 2 Results of BCOS/BAKAS scale

	Mean	Std. deviation
Self-esteem	4.28	1.30
Physical health	3.54	1.70
Time for family activities	3.16	1.47
Ability to cope with stress	3.72	1.59
Relationship with friends	3.45	1.58
Future outlook	3.33	1.65
Level of energy	3.59	1.50
Emotional well-being	3.23	1.30
Roles in life	3.42	1.67
Time for social activities	3.04	1.42
Relationship with family	3.61	1.32
Financial well-being	3.31	1.36
Relationship with patient	4.55	1.42
Physical functioning	3.50	1.61
General health	3.35	1.33
Overall, how much your life has changed as a result of patient care?	3.43	1.61
Total mean score	52.22	17.44

Positive results include carers' ability to cope with stress (3.72). The lowest scores were recorded for the time spent by carers for social activities with friends (3.04) and for family activities (3.16), as well as for carers' financial well-being and future prospects (3.31 and 3.33, respectively).

Older carers are more burdened than carers belonging to the younger age groups (37.71 vs. 74.75, $p = 0.049$). Individuals caring for ambulatory patients with MS had a higher mean score than those caring for patients using wheelchairs or were on bed (57.8 vs. 41.75 and 39.53, $p = 0.001$). Concerning the type of care, carers providing physical/personal assistance are more burdened than carers providing patients with psychological support or assisting them with their housework and transportation (41.82 vs. 57.88 and 59.28, $p = 0.001$). Carers providing care to patients who were highly dependent on them had significantly higher scores than carers who provided care to patients with moderate and low dependence (43.90 vs. 56.19 and 61.61, $p = 0.001$).

3.2 Zarit Scale

The Cronbach α internal consistency coefficient of the Zarit scale was found to be 0.953. The highest score was found for the personal intensity scale (14.31 ± 8.58), followed by role intensity (11.01 ± 5.36), relationship deprivation (7.36 ± 4.38), and care management (3.37 ± 1.95). The overall scale score was 36.10 ± 18.46, indicating a mild to moderate burden. About one-third of the participants (36.7%) had a mild to moderate burden of caring for patients, 23.9% had no or minimal burden, and 28.4% had a moderate to severe burden. The proportion of carers who were severely burdened is only 11%.

Individuals caring older patients (>60 years) feel more tired than those caring younger patients (<60 years) (19.3 ± 8.3 vs. 11.3 ± 8.9, $p = 0.011$). A significantly higher burden was found on carers of patients who were on bed compared to ambulatory patients (19.7 ± 46.9 vs. 12.4 ± 31.9, $p = 0.001$), those who provided physical care in relation to others (18.8 ± 46.4 vs. 7.2 ± 14.6, $p = 0.001$) and those who were highly dependent in relation to others (19.7 ± 47.4 vs. 7.5 ± 15.7, $p = 0.001$).

3.3 F-COPES Scale

The Cronbach α internal consistency coefficient of the F-COPES scale is 0.835 which indicates excellent internal consistency. Reframing (29.9 ± 4.9) and acquiring social support (25.4 ± 6.9) subscales achieved higher score, while mobilizing family to acquire/accept help (15.5 ± 2.9), seeking spiritual support (13.1 ± 4.7), and passive appraisal (12.9 ± 3.1) subscales achieved lower score. The overall scale score was 99.9 ± 12.8.

The overall score on the Zarit scale is negatively correlated with the overall score on the BCOS/BAKAS scale. This indicates that the greater burden of caring for patients with MS results in worse carers' lives. In addition, a statistically significant negative correlation was found between the overall Zarit score and the F-COPES score, which means that carers who are more burdened do not adopt strategies to help them deal with and resolve their problems. On the contrary, this negative relationship between the two variables shows that carers who experience a high burden of caring for their own people maintain a more passive attitude toward the problem they are facing (Table 3).

4 Discussion

The aim of this study was to investigate and evaluate the multidimensional burden of carers with MS. The majority of the sample consists of carers aged 41–50, married, high school graduates, employees, and had annual income 701–1500 €. A similar survey in the USA reports that the majority of carers are women with an average age of 49.2 years [5]. Similarly, a survey in Greece reports that the average age of carers is 51.7 years, with basic level of education, and most of them are women [13].

Table 3 Correlations between BCOS/BAKAS, Zarit, and F-COPES

		BCOS/BAKAS	Zarit	F-COPES
BCOS/BAKAS	Pearson Correlation	1	−0.217	0.176
	Sig. (2-tailed)		0.025*	0.075
	N	111	111	111
Zarit	Pearson Correlation	−0.217	1	−0.568
	Sig. (2-tailed)	0.025*		0.000**
	N	111	111	111
F-COPES	Pearson Correlation	0.176	−0.568	1
	Sig. (2-tailed)	0.075	0.000**	
	N	111	111	111

$* p = 0.05, ** p = 0.01$

The mean score of the overall BCOS/BAKAS score is 52.22 which indicates a moderate burden on carers' lives from providing care to a patient with MS. The study by Fekete et al. [6] found that the burden on the caregiver commensurate with the patient's overall condition. The poor physical and mental health of the patient has a negative impact on the caregiver. High scores are attributed to participants' relationship with caring patients, followed by carers' self-esteem and their ability to cope with stress. These high scores are among the positive outcomes of caring and show that caring for loved ones has improved carers' relationship with patients, improved carers' self-esteem, and their ability to cope with stress.

Low scores are recorded for all four subscales on the Zarit scale, which means that carers experience a mild to moderate burden on patient care. However, the age group to which the patients belong appears to affect the average score of carers both on the subscale of personal tension and relationship deprivation and on the overall Zarit score. The factors found to influence the mean score of the scale are the kinetic status of patients, the type of care provided, and the dependence of patients on the caregiver, data that have been investigated and are in agreement with other studies [11, 12, 16].

The high dependency of patients on carers increases caregiver's burden by recording high mean scores across all subscales of the Zarit scale as well as overall scale score. The burden on carers is milder in cases where the patient dependency relationship is moderate/low and not at all.

Similar to our study, Fekete et al. [6], in their study in Switzerland, report that caregiver burden is inextricably linked to the patient's psychosomatic health. In particular, the research was conducted in carers of people with neurological problems and reduced mobility.

In our study, 56.4% of the sample receives support/advice from their relatives, 74.8% have accepted the health problem of their loved ones and cope it in a positive way, 65.2% have faith in God, 77.5% stated that they seek help to social services/family doctors or people who have the same problem in order to get advice about their family difficulties, while 64.9% address the problem with a passive attitude.

This study found that carers who provide care to their child seek greater social support than carers of brides/grooms and friends/neighbors. The bride/groom category scores the lowest on both the aid acceptance dimension and the overall F-COPES scale [1]. Finally, carers who see it as their duty to care for patients record statistically significantly higher scores on social support, redesign, and spiritual support factors than those who do not.

5   Conclusions

MS, for both the patient and the caregiver, has huge and multidimensional effects. It is a fact that researchers around the world have not given such an emphasis and interest, have not met the challenges, characteristics, and needs of carers, whether they are informal or professional. As a

result, the burden is not recognized and, over time, becomes more stressful, causing poor quality of life. Physical and mental exhaustion, and reduced leisure time, lead carers to social isolation. Friendships and social bonds relax while limiting leisure time. The financial cost for the family is increased as it includes medicines, medical visits, and items that help the patients in their daily living.

Educating and informing carers is just as important as helping. Information about the disease and the patient's dependence on the caregiver will help both of them to cope with the new situation. The carers can receive specific information, advice, and emotional support that will reduce their ignorance and fear.

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Attitudes of the General Population Regarding Patient Information for a Chronic and Life-Threatening Disease: A Cross-Sectional Study

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Abstract

Background: The form of communication developed between the physician and the patient and between the physician and the patient's close relatives builds the foundation for the process of announcing unpleasant news, which is related to the diagnosis of chronic disease. The aim of this study was to investigate the attitudes of the general population regarding the information of patients for a chronic and life-threatening disease.

Methods: It is a cross-sectional study. An anonymous questionnaire was used on a sample of 350 people.

Results: The 95.1% of participants considered that patients have the right to be fully informed about their health status and that the physician has the right to be informed. The 90.3% of the respondents argued that patients differ in their preferences. Totally, 60.3% of participants agreed that all patients would like to know the bad news about their health, while 44.5% argued that patients do not want to hear bad news about their health, and 32.3% believed that patients should be protected from the announcement of bad news. The majority of respondents (95.6%) were informed by the physician about their or their relevant chronic disease.

Conclusions: The general population is of the opinion that patients should be informed about their health status. Due to the fact that each patient responds differently to the announcement of the unpleasant news, the respondents replied that the announcement of the unpleasant news should be personalized and carried out by the physician.

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1   Introduction

Over the centuries, society has adopted a different
attitude toward one's health. This has been the
result of many factors, such as the reduction of
illiteracy and easier access to free education, reli-
gion, culture, and increased trade relations between
states. Chronologically, before the Middle Ages,
sickness was considered a bad thing, the punish-
ment sent by some higher power. This belief was
linked to the magicians, who were trying to solve
the disease by nonmedical means. After the indus-
trial revolution, medical science was first intro-
duced in developed countries as the main science
concerned with human health. Modern medicine,
structured with health systems that make access to
health services easier for the majority of the popu-
lation, is a product of industrial society. The char-
acteristics of the health sector due to industrial
culture are the establishment of university hospi-
tals where research is carried out as well as the
teaching of medical science, programs for the pre-
vention and promotion of population health, and
rates of unvaccinated population. Individual dis-
eases are eliminated, while at the same time the
pharmaceutical science manufactures active sub-
stances to combat patients. This has had a positive
effect on reducing the mortality rate and increasing
the life expectancy of the general population [4].

Among the physician-patient communication
models, Roter et al.'s [10] is the most dominant.
The form of communication developed between
the physician and the patient and between the
physician and the patient's close relatives builds
the foundation for the process of announcing
unpleasant news, which in the present study
relate to the diagnosis of chronic disease [2]. The
"SPIKES" protocol [1, 5, 11], similar to the
"ABCD" protocol [9], sets out the basic steps the
physician is relying on to announce unpleasant
news. A thesis found that 95.9% of the general

population reported that information should vary
from patient to patient. Also, the physician mak-
ing the announcement should have specialized
communication skills as 55.8% place special
emphasis on them [7].

2   Materials and Methods

Aim
The aim of this study was to investigate the atti-
tudes of the general population regarding the
information of patients for a chronic and life-
threatening disease.

Study design
This is a cross-sectional study.

Participants
The sample of the study consisted of 350 adults
who lived in West Attica (response rate = 87.5%).

Tools
In this study, a questionnaire consisting of 12
questions was used. The first 8 questions refer to
the demographic data of the participants (gender,
age, marital status, income, place of residence,
and educational level), 2 questions focus on the
diagnosis of chronic disease and whether the
respondent or his/her person has been diagnosed
with chronic disease, as well as who was informed
of the diagnosis; 1 question consisting of 6 sub-
questions focuses on the dissemination of
unpleasant news to cancer; and 1 question con-
sisting of 25 sub-questions focused on the physi-
cian's communication gentle. The questionnaire
resulted from a combination of the questionnaires
of Loge et al. [6] and Parker et al. [8] and a model
of the World Health Organization [12].

Statistical Analysis
Kolmogorov-Smirnov test and regularity charts
were used to check the normal distribution of
quantitative variables. The independent variables
were demographic and clinical characteristics,
while the dependent variables were ratings of truth
disclosure, truth-telling, personalized information,
content, support, and facilitation. Student's t-test

was used to investigate correlations between two variables. Multivariate analysis was then performed with the dependent variable on the ratings to determine the independent role of each variable in the ratings. Thus, multivariate analysis eliminated possible confounding effects. When >2 independent variables resulted statistically significant at the level of 0.2 ($p < 0.2$) in the bivariate analysis, multivariate linear regression with dependent variable ratings was applied. In this case, the method of multiple linear regression with backward stepwise linear regression was applied. Regarding multiple linear regression, coefficients b (beta coefficients), corresponding 95% confidence intervals, and p values are presented [3]. The two-sided level of statistical significance was set at 0.05. Data analysis was performed with IBM SPSS 21.0 (Statistical Package for Social Sciences).

3   Results

Demographics
The demographic characteristics of the participants are presented in Table 1. The age of the participants was 32.6 ± 11.2 years. Among the healthcare professionals, 20 were nurses, 7 were doctors, 4 were doctor assistants, and 6 were other healthcare professionals.

Clinical Features
Totally, 7.1% of participants were diagnosed with a life-threatening disease. Of these, 40.9% had cardiovascular disease, 18.2% cancer, 31.8% HIV, and 9.1% multiple sclerosis. Almost everyone was informed about their diagnosis by doctors (95.6%). Also, 42% of the participants had a close relative who was diagnosed with a life-threatening disease. Most participants were informed about their close relative's diagnosis by doctors (61.6%) and family members (36.2%). The patient was mostly informed by physicians (80.5%) and then by family members (10.4%).

Announcing Unpleasant News in Cancer
Totally, 95.1% of participants agreed that patients have the right to be fully informed about their health status and the doctor is obliged to inform them; 60.3% of the participants agreed that all patients want to know unpleasant news about their health; 44.5% of the participants agreed that patients do not want to hear the unpleasant news about themselves; 32.3% of the participants agreed that patients should be protected from unpleasant news; 90.3% of participants agreed that patients differ in their preferences for the information they want to receive; and 96.8% of the participants agreed that it takes time to digest and adapt to the unpleasant news.

The descriptive results for the 3 scales for announcing unpleasant news in cancer are presented in Table 2. According to the mean values of the 3 scales, participants preferred personalized information first, then truth disclosure, and finally truth-telling. Totally, 13.4% of the participants supported that their attitude toward the unpleasant news would change if they or a close relative had another chronic and life-threatening disease; 48% supported they did not know how to respond; 38.6% supported their attitude would not change; 26.3% supported they would change their attitude to multiple sclerosis, 25.9% to cardiovascular disease, 17.5% to renal failure, and 17.5% to other diseases and mainly to cancer.

Informed by Doctor
The participants' responses to informing by a doctor in case of cancer are presented in Table 3. The 25 items in Table 3 generate 3 scales. The Cronbach's alpha internal consistency coefficient for the "content" scale was 0.89, for the "support" scale was 0.85, and for the "facilitation" scale was 0.73, indicating excellent reliability of the questionnaire. According to the mean values of the 3 scales, participants placed greater emphasis on content (4.2 ± 0.5), followed by facilitation (3.5 ± 0.6) and support (3.4 ± 0.8).

Dependent Variable: Truth Disclosure Rating
Unemployed patients preferred disclosing the truth more than the working patients. Participants who found it more important to facilitate information in case of cancer were more likely to disclose the truth. The above variables account for 6% of the variance of the truth disclosure rating. Table 4 presents the results of multivariate linear regression.

Table 1 Demographics of participants

	Variable	N	%
Gender	Males	127	36.3
	Females	223	63.7
Marital status	Unmarried	250	71.4
	Married	90	25.7
	Divorced	6	1.7
	Widowed	4	1.1
Children		81	23.3
Education level	Primary school	11	3.1
	Secondary school	95	27.1
	College/university	166	47.4
	Master	78	22.3
Profession	Student	36	10.4
	Unemployed	40	11.6
	State employee	69	19.9
	Private employee	183	52.9
	Freelance	18	5.2
Healthcare professionals	Yes	37	10.6
	No	311	89.4
Family income (€)	<700	157	44.9
	700–1500	143	40.9
	>1500	50	14.3
Residence	Village	6	1.7
	Town	10	2.9
	City	334	95.4

Table 2 Descriptive results for the 3 scales for announcing unpleasant news to cancer

Scale	Mean	SD	Min	Max
Revealing the truth	6.1	1.1	2	8
Hiding the truth	4.7	1.3	2	8
Personalized information	6.8	1.0	2	8

Dependent Variable: Hiding Truth Rating

Participants who found it more important to support information in case they were ill with cancer preferred to hide the truth. The above variable interprets 11% of the variance of the truth hiding rating. Table 4 presents the results of multivariate linear regression.

Dependent Variable: Personalized Rating

Women were more likely to prefer personalized information than men. Participants who had been diagnosed with some years of a life-threatening disease were more likely to prefer personalized information than those who had not been diagnosed with some years of a life-threatening disease. Participants who found it more important to sup-

port information in case they were ill with cancer preferred more personalized information. The above variables account for 7% of the variability of the personalized rating. Table 4 presents the results of multivariate linear regression.

Dependent Variable: Content Rating

Women considered the content of the information more important if they had cancer than men. Higher-income participants considered information content more important if they were ill with cancer than lower-income participants. Participants living in the city considered the content of the information more important if they were ill with cancer than participants living in a village/town. Participants who had been diagnosed with some years of life-threatening disease considered the information content to be more important if they had been diagnosed with cancer than those who had not been diagnosed with some years of life-threatening disease. Participants who preferred the disclosure of the truth considered the information

Table 3 Participants' answers about being informed by the doctor in case they are diagnosed with cancer

	Mean	SD	Min	Max
1. Be informed in detail about the results of my medical examinations.	4.2	0.8	1	5
2. The doctor has to be wait for me to complete all my medical examinations before informing me.	3.8	0.9	1	5
3. The doctor will suggest me the best treatment.	4.4	0.7	2	5
4. The doctor will describe in detail my treatment options.	4.4	0.7	3	5
5. The doctor will inform me of all the treatment options.	4.2	0.7	3	5
6. The doctor informs me of new experimental treatments.	3.9	0.9	1	5
7. The doctor informs me of the prognosis of my illness.	4.0	0.8	2	5
8. The doctor gives me information about my illness.	4.2	0.7	3	5
9. Have the doctor be honest about the seriousness of my condition?	4.3	0.7	1	5
10. The doctor tells me how the illness can affect my daily activities.	4.1	0.9	1	5
11. Feeling confident in the doctor's abilities and skills.	4.4	0.7	1	5
12. The doctor is up to date on the research data on my illness.	4.3	0.7	2	5
13. The doctor has to make time for me to ask all the questions I want.	4.2	0.7	2	5
14. The doctor has time to answer my questions fully.	4.1	0.8	1	5
15. The doctor tells me about the support services available (e.g., psychologist, social worker) at the hospital.	3.7	1.0	1	5
16. The doctor informs me of support services (e.g., psychologist, social worker) available in the community.	3.6	0.9	1	5
17. The doctor informs my family members about the diagnosis of my illness.	3.4	1.0	1	5
18. The doctor informs my family members about the prognosis of my illness.	3.4	1.0	1	5
19. The doctor informs me in a private place (e.g., office).	3.5	1.1	1	5
20. The doctor should have planned the time to spend informing me (e.g., not interrupting us).	3.6	0.9	1	5
21. The doctor looks me in the eyes when informing me.	3.4	1.0	1	5
22. The doctor answers my questions directly to me.	3.9	0.8	1	5
23. Notify me not only of the doctor but also of other health professionals (e.g., nurse, psychologist).	2.9	1.1	1	5
24. To be informed by the doctor in the presence of my own persons.	2.9	1.1	1	5
25. I want to be informed because it will help me manage my illness.	4.1	0.8	1	5

The increase in prices indicates a greater importance for the participants

Table 4 Multivariable linear regression

Dependent variable	Independent variable	b	95% CI for b	p-value
Revealing the truth	Unemployed vs. employed	0.4	0.1–0.6	0.011
	Facility rating	0.3	0.1–0.5	0.013
Hide the truth	Support rating	0.5	0.4–0.7	<0.001
	Women vs. men	0.3	0.1–0.6	0.001
Personalized information	Diagnosed with a chronic and life-threatening illness	0.6	0.2–1.0	0.002
	Support rating	0.2	0.1–0.4	0.001
	Women vs. men	0.1	0.03–0.2	0.016
Content rating	Income	0.1	0.02–0.2	0.015
	Accommodation in town in relation to village/town	0.3	0.1–0.6	0.011
	Diagnosed with a chronic and life-threatening illness	0.6	0.2–1.0	0.002
	Rating scale of "revealing the truth"	0.1	0.05–0.2	<0.001
Support rating	Age	0.01	0.001–0.01	0.032
	Rating scale of "revealing the truth"	0.2	0.1–0.3	<0.001
Facility rating	Age	0.01	0.001–0.012	0.038
	Rating "hide the truth"	0.1	0.03–0.14	0.002
	Rating scale of "revealing the truth"	0.1	0.08–0.19	<0.001
	Personalized information rating	0.1	0.01–0.14	0.023

content more important in case of cancer. The above variables account for 10% of the content rating variability. Table 4 presents the results of multivariate linear regression.

Dependent Variable: Support Rating

Older participants found it more important to support information in case they became ill with cancer than younger participants. The participants who preferred to hide the truth considered it more important to support the information in case they got cancer. The above variables account for 12% of the variability of the personalized rating. Table 4 presents the results of multivariate linear regression.

Dependent Variable: Facilitation Rating

Older participants found it more important to facilitate information in case they became ill with cancer than younger participants. The participants who preferred to hide the truth considered it more important to facilitate information in case they got cancer. Participants who preferred the disclosure of the truth considered it more important to facilitate information in case of cancer. Participants who preferred personalized information considered facilitating information more important in case of cancer. The above variables account for 9% of the conve-

nience rating variability. Table 4 presents the results of multivariate linear regression.

4   Discussion

This study focuses on the general population's attitude toward informing patients about a chronic and life-threatening disease. The fact that the literature referring to the general population's attitude toward patient information is limited, as the majority of research focuses on a specific population's attitude, whether it be the patient population or the population of healthcare professionals, lends to this study the stigma of originality.

This study used a research tool that highlights and identifies the three main pillars as options to inform patients about a chronic and life-threatening disease. It is about revealing the truth through the announcement of unpleasant news to the patient, about concealing the truth, that is, the choice of never informing the patient about their health status, and finally, about personalized information by informing the patient by the physician or other healthcare professional.

In this study, out of the 350 participants, 95.1% share the view that patients have the right to be fully informed about their health status and

that the physician has the right to inform them, and 90.3% supported that patients differ in their preferences for the information they wish to receive. This response coincides with the truth disclosure model combined with the personalized information model, with the lead physician informing patients. Specifically, for the global assessment of the survey, the final percentages were correlated with demographic and socio-political factors to examine whether factors such as gender, age, marital status, education, work, and income influenced the general population's preferences for informing patients about a chronic and life-threatening disease.

Of the respondents, 63.7% were women and 36.3% were men. Women have shown a greater desire for personalized information than men. Also, those who had been diagnosed with chronic and life-threatening disease supported personalized information compared to those who had not been diagnosed or had any close relatives diagnosed. It is also worth noting that the facilitation rate for revealing the truth and personalized information was also higher in the case of cancer. Also, 42% of those surveyed, almost half, had their close relative who was ill or had a chronic illness. Totally, 95.6% were informed about the diagnosis of chronic disease by a physician, which confirms the obligation to inform by the physician and the need for further specialization of physicians in announcing unpleasant news.

In the area of economic-income criteria, the unemployed showed a higher preference for the model of revealing the truth than the interviewed workers. Respondents who had a higher income had a higher rate of preference for personalized information. Conversely, low-income respondents found that they had a lower rate of preference for personalized information.

The result of the survey is also confirmed by Papadopoulou's study conducted in Northern Greece in 2010, according to which 95.9% of the respondents chose the personalized information model as they felt that each patient's preferences were different about how he/she wishes to be informed for a chronic and life-threatening disease.

5   Conclusions

In conclusion, the general population is of the opinion that patients should be informed about their health status, but because each patient responds differently to the announcement of the unpleasant news, the respondents supported that the announcement of the unpleasant news should be personalized and carried out by the doctor. The majority of participants argued that patients differed in their preferences and that women were more likely to seek personalized information than men. They considered it very important to be informed in detail of the results of their laboratory and diagnostic tests; they wanted the doctor to state all available treatment options and to choose the best one for the patient. They wanted the doctor to be honest, to trust his/her skills and abilities, and to inform them in a specific area so that they would not be bothered by third parties. The involvement of healthcare professionals in specialized areas, such as psychologists and social workers, is very important as the general population considers the contribution of these available support services to be of paramount importance for the patient's transition from ignorance to the most painless and smooth stage possible. The announcement of unpleasant news is very stressful for young people. The usefulness of supportive health services is not only about informing patients but also about familiarizing them with the patient's relatives.

All of the above can be the basis for health policymakers. In particular, it would be fruitful for medical schools to develop physicians' skills in informing patients, informing patients' relatives, and how physicians can communicate with respect to each individual's preferences about his health. The training of physicians should not be interrupted by the acquisition of the basic qualification; on the other hand, continuous training of physicians with seminars, certifications, and lifelong learning programs that further develop physicians' skills related to patient information is needed. Complementary seminars could also be held within the healthcare unit of the physician on the initiative of the regional health directorate.

Health policymakers are well positioned to develop the pillar of supportive health services both within and outside healthcare units. The above proposal could be implemented by targeting more organic psychologists and social workers in healthcare providers (primary, secondary, and tertiary health services). At the local level, districts and municipalities, with the contribution and guidance of the health district, could institute instruments aimed primarily at providing psychological support not only to the general population but also to the 1-year-old and life-threatening population. The above helps to manage the new situation, especially after announcing the unpleasant young people, by patients and their relatives so that they can smoothly integrate their daily lives into the needs posed by the chronic illness.

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Assessment of Healthcare Professionals' Knowledge and Awareness on Aspects Related to Ionizing Radiation Examinations in Athens, Greece

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Abstract

Background: Healthcare professionals involved with ionizing radiation must have sufficient knowledge of its effects on the human body in order to avoid potential risks for both patients and themselves. The aim of this study was to estimate the knowledge and awareness of healthcare professionals about the hazards of radiological examinations on their health and on their patients.

Methods: This is a cross-sectional study, and the data collection was carried out with a self-administered questionnaire. The study group included a total of 210 individuals from different professional groups: nurses, doctors, medical technicians, radiologists, and other staff working in different clinics that use radiation in their work. The study was carried out in a large hospital in Athens, Greece.

Results: The study population consisted of 210 subjects aged 44.7 ± 9.1 years. In a total of 23 questions, participants answered correctly to 6.4 ± 2.6 questions. The factors for predicting the correct responses were male gender ($\beta = -1.034$, $p = 0.004$), frequency of contact with imaging examinations of patients requiring ionizing radiation ($\beta = 0.496$, $p = 0.007$), participation in any educational process ($\beta = -0.918$, $p = 0.014$), the number of published articles on radiation protection ($\beta = 0.720$, $p = 0.001$), and knowledge of the principle of ALARA ($\beta = -0.391$, $p = 0.001$).

Conclusions: It is proposed to include a radiation protection course in the total healthcare professionals' undergraduate curricula in order to address the current knowledge gap in clinical practice.

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1 Introduction

The primary purpose of an application that requires X-rays is to achieve the best image quality using the minimum dose (principle ALARA). However, the acceptable dose limits for both patients and healthcare professionals are in some cases exceeded by the unnecessary use of X-rays in diagnostic applications/examinations [24]. As a result, the potential and damaging effects of ionizing radiation on both the general population and healthcare professionals are increasing the likelihood of cancer. The degree of effects depends on the type of radiation and the exposure time [9]. The potential effects of exposure to radiation may be short term or long term, and lesions can emerge not only in the first but also in the next generations [15].

Radiation protection is considered necessary, and healthcare professionals should be knowledgeable to be able to move in the clinics safely and to protect both the patient and their selves [14]. The knowledge of radiation protection is not always included in the curriculum of basic education of each healthcare professional. So, the information and the sensitivity of healthcare professionals are not the same [1, 13, 20, 23]. Consequently, healthcare professionals are not aware of the dangers arising from the use of ionizing radiation [14], and due to bad practices, they endanger both patients and themselves exposure to ionizing radiation. Doctors who order examinations with ionizing radiation tend to underestimate the actual doses and potential risks of patients who refer to [5].

2 Materials and Methods

2.1 Aim

The aim of this study was to estimate the knowledge and awareness of healthcare professionals about the hazards of radiological examinations on their health and on their patients.

2.2 Study Design

It is a cross-sectional study and was conducted in a large hospital in Athens, Greece.

2.3 Participants

Healthcare professionals who use ionizing radiation in their daily clinical practice (doctors, nurses, radiologists, and technologist/technicians from all departments, including routine X-ray imaging, angiography, coronary angiography, CT, magnetic resonance imaging—MRI, ultrasound—US, fluoroscopy, endoscopy unit, operating theatres) and healthcare professionals who are in contact with ionizing radiation occasionally and not daily were invited to participate in the study. Out of 300, 210 accepted the invitation (response rate 70%). After explaining the aims of the research and obtaining the consent forms, participants were asked to fill out the questionnaire. The participants also were informed that the results would be used only for a scientific study.

2.4 Tools

A self-administered questionnaire was given to healthcare professionals and asked to fill and return it within one week. The questionnaire included demographic data of participants, questions about radiation protection, radiation doses that result from radiological examinations, and radiation-induced cancer risk. Questions in general radiation protection section were selected to evaluate the general knowledge and standards about radiation, ionizing and non-ionizing radiation types, knowledge about dose optimization, susceptibility to radiation damage, tissues more susceptible to injury from ionizing radiation, and diseases caused by radiation damage. Questions in radiation dose section included the safe dose of ionizing radiation in radiologic examinations, the average background radiation to which a person is subjected annually, the average effective dose for a standard chest X-ray for adults, and the

average effective radiation dose for a standard chest CT scan for an adult. Moreover, participants were asked to estimate the chest X-ray equivalent doses for radiological applications that are commonly used. The questions were adopted from the previously published questionnaires [1, 5, 20]. The validity of the instrument was checked by a committee of 3 physicians and 2 other experts in medicine and radiation. They reviewed the content, the clarity, and the relevance of the items.

2.4.1 Ethics

Confidentiality and anonymity were maintained according to the regulations mandated by the Research Ethics Committee of the hospital, in accordance with the Declaration of Helsinki. The investigators did not provide any individual information to a third party.

2.5 Statistical Analysis

Statistical analysis was performed using the IBM SPSS Statistics v. 21.0. The results were expressed in mean and standard deviation for the quantitative variables and in number and percentage for the categorical variables. The value of $p \leq 0.05$ was considered as being statistically significant.

3 Results

The study population consisted of 210 participants aged 44.7 ± 9.1 years. The clinical practice/experience of the participants was 18.7 ± 9.8 years. The demographic and the work characteristics of the sample are shown in Table 1.

Sixty-eight respondents (32.4%) were exposed to ionizing radiation several times a day, 63 (30%) several times a week, 61 (29%) several times a month, while 18 (8.6%) were not exposed to ionizing radiation. The first thought that participants reported on hearing the word "radiation" was Chernobyl (63.8%), cancer treatment (49.5%), Hiroshima (59.5%), and X-ray imaging (51.4%). The participants supported that the

doses resulting from the use of ionizing radiation to perform diagnostic imaging tests may increase the likelihood of cancer risk in the future (6.5 ± 2.5, where 1 means none and 10 too high).

Participants' responses to questions about the biggest sources of radiation in daily life, health risks of most concern, the most worrisome sources of "radiation exposure," health risks caused by radiation exposure, and radiological examinations in patients with the possibility of being pregnant are shown in Table 2.

The respondents reported that they would be concerned a lot, if they learned that they or their spouse was pregnant following a radiation examination (7.9 ± 2.5), and they supported that they would be a little concerned if their child or young nephews/nieces were required to undergo a radiological diagnosis (4.1 ± 2.5) or treatment (6.9 ± 2.6). Also, the participants believe that the dose resulting from the use of ionizing radiation in common radiological examinations is quite safe (6.2 ± 2.3).

The most famous patients' radiation protection measures that participants identified were lead aprons (92.9%) and shields (86.2%). The respondents increased distance from the source of radiation (86.2%) more than they did other personal protective equipment, and only 77.6% used lead aprons. However, 112 (53.3%) participants used the special protection room and 56 (26.7%) were standing at a distance of 5 m or more from the source point without protection (Table 3).

Table 4 shows that participants supported that the most sensitive organs to radiation are the thyroid glands (89.5%), the gonads (88.6%), and the bone marrow (73.8%), while the less sensitive organs are the lungs (51.9%) and the stomach (41.9%).

According to Table 5, only 10% of the participants knew that the radiation dose from 1 plain abdominal radiography exam is equal to that from 50 to 99 posterior–anterior chest X-rays; 15.7% knew that the radiation dose from 1 head CT is equal to that from 200 to 299 chest X-rays; and 63.3% indicated correctly that abdominal ultrasound scan has no radiation dose (Table 5).

Table 1 Personal and work characteristics ($N = 210$)

	Variable	N	$\%$
Gender	Males	91	43.3
	Females	119	56.7
Marital status	Married	147	70
	Unmarried	63	30
Educational level	University/College	100	47.6
	High School	47	22.4
	Primary School	9	4.3
	Master/PhD	54	25.7
Profession	Nurses	82	39
	Doctors	66	31.4
	Technicians	40	19
	Other	22	10.5
Department/Clinic	Radiology	75	35,7
	Operating room	51	24.3
	Clinics/Emergency	44	21
	ICU	40	19

Totally, 30 (14.3%) respondents answered correctly to the question about the approximate mean annual dose (active dose) in mSv that population is exposed to natural sources of radiation (2.4 mSv). Also, 42 (20%) participants supported correctly that the approximate radiation dose (active dose) in mSv resulting from a chest X-ray is 0.02–0.04 mSv, and 39 (18.6%) participants supported correctly that the active dose resulting from a thoracic CT is 3–9 mSv.

The participants supported that they would like to learn more about safety measures relating to ionizing radiation (8.9 ± 1.8; min 1 and max 10) and to safe dose of radiation (9.1 ± 1.8; min 1 and max 10). The total mean score of correct answers ($N = 24$) was 7.8 ± 2.8 ranging between 1 and 17. The factors that were found to predict the total score of current answers were the frequency of use of ionizing radiation ($p = 0.007$, $b = 0.496$, 95% CI: 0.138–0.853), the participation in any course concerning radiation protection ($p = 0.014$, $b = 0.918$, 95% CI: 0.861–1.342), the number of published articles ($p = 0.001$, $b = 0.720$, 95% CI: 0.407–1.033), and the knowledge of the ALARA principle ($p = 0.001$, $b = 3.391$, 95% CI: 2.997–3.549).

4   Discussion

This study is the first to be conducted in Greece to assess the attitudes and knowledge of doctors and other healthcare professionals about the radiation protection and dangers of ionizing radiation for both patients and the staff. We found that only one-third of the participants had attended a radiation protection seminar. Although this percentage is small, it is ultimately much larger than what has been reported in the literature.

In Saudi Arabia, 28.5% of participants had attended a radiation protection seminar [13]; in Egypt, 11.2% of the participants [1]; in Ethiopia, 10.5% of the participants [21]; and in Palestine, 30.7% of the respondents [5]. All of these studies highlight the lack of knowledge of healthcare professionals about the dangers posed by radiological examinations to patients and staff.

The knowledge of healthcare professionals was associated with attending seminars. Participation in any radiation education process, as well as the published articles read by the participants on radiation protection, increased the likelihood of correct answers. Similar results were found in the studies of Zewdneh et al. [21] and Madrigano et al. [12] who reported that those who had received official training on ionizing

Table 2 Participants' responses to questions

Questions	Responses (%)
The biggest sources of radiation in our daily life	
Medical services at hospitals	97.6
Cosmic rays	86.2
Rocks and soil	85.2
Food intake	75.2
Building, including concrete and other building materials	74.3
Air travel	73.3
Nuclear power plant	40
Health risks of most concern	
Environmental pollution	97.6
Obesity (overweight)	96.7
Stress	96.2
Smoking (cigarettes)	95.7
Alcoholic beverages	95.2
HIV	95.2
X-ray and CT applications	91
Surgery	88.6
The most worrisome sources of "radiation exposure"	
Radiological treatments	96.7
X-ray and CT applications	93.8
Nuclear waste	93.8
Nuclear facilities	92.4
Nuclear terrorism and nuclear weapons	91.4
Health risks caused by radiation exposure	
Cancer	96.7
Genetic disorders	95.7
Infertility	95.2
Life shortening	93.3
Skin disorders	91.4
Growth retardation in children	89.5
Cataract	88.1
Hair loss	84.8
Radiological examinations in patients with the possibility of being pregnant	
Radiological examinations should be justified by doctor	52.8
Never perform radiologic examination	30
10-day rule	41.9
Whenever the patient wants to	29.5

Table 3 Participants` responses to questions about the risk of radiation

Questions	Responses (%)
Aware of ALARA principle	24.8
Know any published articles on radiation hazards	59
Identify patient's radiation protection measures	
None	3.3
Lead aprons	92.9
Shields	86.2
Distance from the source of radiation	82.4
Time of exposure	68.6
Collimation of the radiation beam	58.1
Protection policies and personal protective equipment	
Increasing distance from X-ray device	86.2
Lead aprons	77.6
Minimal procedure time	71
Thyroid shields	67.6
Eyeglasses	20.5
Lead gloves	15.2
Distance from radiological device without protection during the procedure (meter)	
Use of special protection room	53.3
5 m	26.7
2 m	16.7
1 meter	1.9
Do not care about radiation	1.4

radiation are more aware of the risks they pose than those who did not have any training. Much of this knowledge is gained through multidisciplinary clinical meetings, conferences, academic and research activities.

The sample of this study did not only include healthcare professionals who are directly in contact with ionizing radiation. There was a large percentage of participants who were working in other departments, and this is believed to be an important reason not only for low levels of knowledge found about ionizing radiation but also for low attendance rates of seminars and courses.

The knowledge and practices of doctors toward exposure to radiation are poor [1, 20]. The doctor must have knowledge about radiation protection in order to be properly protected and to protect patients and other healthcare professionals. Only 11% of doctors have received radiation safety training, and only 20% of them have read about radiation safety in Egypt [1]. A higher percentage of respondents (55%) attended a training program in Europe [18] on radiation safety and even higher (82.6%) in Poland [4].

Table 4 Participants' knowledge about the relative sensitivity of body organs to radiation

Estimated sensitive level[a]	1		2		3		4		Don't Know	
	N	%	N	%	N	%	N	%	N	%
Thyroid glands	2	1	3	1.4	**34**	**16.2**	154	73.3	17	8.1
Gonads	1	0.5	5	2.4	54	25.7	**132**	**62.9**	18	8.6
Bone marrow	4	1.9	18	8.6	**47**	**22.4**	108	51.4	33	15.7
Skin	6	2.9	**35**	**16.7**	78	37.1	61	29	30	14.3
Bladder	3	1.4	41	19.5	**70**	**33.3**	54	25.7	42	20
Breast	6	2.9	43	20.5	**58**	**27.6**	65	31	38	18.1
Lungs	5	2.4	59	28.1	**56**	**26.7**	53	25.2	37	17.6
Stomach	13	6.2	66	31.4	**55**	**26.2**	33	15.7	43	20.5

[a]Participants rank the radiation sensitivity of organs from 1 (lowest) to 4 (highest). Bold indicates the correct answer

Table 5 Participants' knowledge of chest X-ray equivalents for each type of radiological examination

Single chest X-ray equivalents	0	10–49	50–99	100–199	200–299	300–499	500–600
Plain abdominal radiography	23.3%	55.7%	**10%**	9.5%	0.5%	0.5%	0.5%
Extremity angiography	4.3%	22.4%	27.6%	16.7%	14.3%	**7.6%**	7.1%
Head CT	0.5%	17.1%	29.5%	21%	**15.7%**	9%	7.1%
Thoracic CT	1.9%	15.7%	26.2%	20.5%	18.1%	**9.5%**	8.1%
Abdominal and pelvic CT	1.9%	15.2%	21.9%	21%	17.1%	11%	**11.9%**
Voiding cystourethrogram	7.1%	28.1%	27.6%	**19%**	9.5%	6.7%	1.9%
Abdominal ultrasound scan	**63.3%**	23.8%	5.2%	4.3%	1.4%	1.4%	0.5%
Thyroid isotope scan	15.7%	**27.6%**	15.7%	13.3%	10.5%	11.4%	5.7%
Brain MRI	**56.2%**	17.1%	4.8%	7.1%	4.3%	4.3%	6.2%

Bold indicates the correct answer

Concerning the frequency of exposure to ionizing radiation, 29% of participants responded several times a month, 30% several times a week, and 32.4% several times a day. In one study, 37.5% of the participants reported exposure to ionizing radiation more than three times a week [1]. In another study in a urology clinic in 20 different European countries, 72.5% of healthcare professionals reported exposure to ionizing radiation more than 3 times per week [18].

There is a lack of information from healthcare professionals about the sources of radiation exposure. Most of the respondents in our study consider cosmic rays as the biggest source of radiation in their daily lives, as well as medical services in hospitals. This finding is in line with the literature on cosmic radiation and disagrees with medical services [13]. Only 20% of the respondents in our study were able to correctly respond to the average annual dose in mSv that

the population is exposed to natural sources of radiation. The corresponding rate of a similar study was 7.6% [20].

In this study, the protection measures that participants used more were increased distance from the source of radiation and lead aprons, while lead glasses and lead gloves were the measures they used less. In contrast to our results, in Egypt, it was found that doctors use lead aprons more than other protective measures, and little more than half used lead gloves [1]. In another study, the use of body and thyroid protective measures was high, while no one used lead glasses and gloves [4].

In a study by Kuwait nurses working in a radiology department, it was found that most of the participants were unaware of the radiation protection measures and were also unaware of the radiation-related risks. When they noticed their lack of knowledge, they said they were worried

about radiation and would like to know more about the health risks associated with exposure to radiation [2]. Similarly, in this study, the participants raised their concern about the impact on exposure to ionizing radiation, as almost all of them would like to know more about the protective measures and the effects of exposure to ionizing radiation.

The lack of knowledge on safety issues associated with ionizing radiation has been reported extensively in the literature [1, 4, 5, 10, 12, 13, 18, 20]. This lack of knowledge means that healthcare professionals cannot effectively protect themselves or their patients against ionizing radiation.

X-ray and CT scan in body areas other than the abdomen and the pelvis expose the embryo to minimal doses of radiation, and in cases where such examinations include the abdominal and pelvic region, the radiation dose rarely exceeds 25 mGy. The absolute risk for effects on the fetus is small for doses up to 100 mGy and minimum for doses <50 mGy. CT scan is not forbidden for pregnant patients, particularly in some clinical conditions such as multi-injured or pulmonary thromboembolism. Whenever possible, diagnostic methods known to be harmless for the fetus, such as ultrasound and MRI, should be prioritized [3].

In this study, one-third of the participants reported that there should never be any radiological examination carried out in a pregnant woman and half of the respondents supported the opposite. This result is in accordance with the literature [20]. In the same study, it was reported that only 8.7% believe that radiological examinations can be made in pregnant women with the first 10-day rule. In our study, this percentage was particularly high (41.9%).

The ALARA principle includes the core of the radiation protection philosophy and its knowledge as an assessment of the level of knowledge of healthcare professionals [11]. In the current study, only one to four participants were aware of the ALARA principle, which indicates a serious lack of knowledge of safety issues in radiology. In a study carried out on 163 doctors from 6 different specialties in Palestine, the knowledge rate

of this principle was significantly lower than that found in this study (6.1%) [5], while the rate was very high in pediatricians (48%) because of the increased sensitivity that physicians have due to young age of patients [6, 19].

Healthcare professionals should be able to compare radiation doses associated with various forms of medical imaging and express effective doses in terms of chest X-ray equivalents. The benefit of this knowledge is that healthcare professionals, as well as patients and their relatives, can perceive the size of radiation exposure and understand the associated risks [7]. In our study, only few participants correctly recognized the correct dose of different radiation examinations compared to chest X-ray equivalent. It is noteworthy that, in both this study and the literature, a large proportion of respondents supported that MRI and ultrasound emit ionizing radiation [5, 16, 20].

In this study, one of the five participants responded correctly for the active radiation dose resulting from a chest X-ray and a chest CT. In the United Kingdom, 22–24% of doctors knew the correct dose of an adult chest X-ray [17]. On the other hand, there is a study in the literature where none of the participants knew the correct dose [16]. In Germany, 59% of the participants were aware of the radiation dose in adult chest X-ray, and only 5% underestimated it [6]. In Turkey, 41.4% of all participants underestimated radiation doses [22], while in China, none of the non-radiologists were aware of the dose of radiation, and 77% of them underestimated the dose of radiological examinations [10]. Underestimation of the radiation dose means that healthcare professionals are not aware of the dangers of radiation and are less cautious when ordering or performing radiation examinations in their patients, which in turn can be unnecessarily exposed to ionizing radiation [18].

An important issue in clinical practice is the effect of exposure to ionizing radiation. In this study, almost all participants identified cancer, infertility, genetic disorders, decreased life span, hair loss, skin disorders, and cataracts as an effect. This percentage is much higher than in other studies [5, 19].

In addition, in our study more than half of the participants reported that they had read published article(s) in scientific or professional journals concerning the risks associated with ionizing radiation. Similar percentages have been reported in the literature with rates ranging from 46% [5] to 48% [19]. The increased percentage found in our study is believed to be due to the wide use of the internet and ease of access to information through medical databases.

In this study, in a total of 23 questions of knowledge, the participants answered correctly to 6.4 questions, that is, about 28%. In a study in Egypt, the average rate of knowledge was 56.5% [1]. In Australia, the average doctors' knowledge of radiation exposure from the diagnostic examinations ordered in the Emergency department was 40% [8].

4.1   Limitations of the Study

This study has some limitations. It does not take into account the duration of the seminars. Instead, it simply asks the participants whether they have attended a seminar or not. Furthermore, the data collection was done with a self-referencing questionnaire, making it difficult to validate the knowledge and awareness of the participants in the medical radiological report.

Another limitation of this study is that the questionnaire was given to participants by the researcher himself. In such cases, participants may overlap in some answers. Also, this study includes only one large hospital in Greece, and therefore, the generalization of findings in other clinical environments may be limited.

5   Conclusions

A finding of this study is that a small percentage of healthcare professionals have attended a radiation protection seminar or course, and this is consistent with literature in various countries around the world, such as Saudi Arabia, Egypt, Ethiopia, and Palestine, highlighting the knowledge gap and the need to educate healthcare professionals

about the negative effects of ionizing radiation. Also, in this study, it was found that attending seminars and reading scientific articles on radiation protection increased the probability of correct answers, which is consistent with the literature, emphasizing the importance of formal education in ionizing radiation.

Insufficient knowledge of healthcare professionals can alter the expected benefits in terms of risk and may affect medical decisions. The limited knowledge of healthcare professionals about ionizing radiation leads to increased exposure of them and patients than the allowed radiation doses. Therefore, this study emphasizes the need to inform all healthcare professionals about ionizing radiation. Explanation of the effects of radiation should be considered vital by any healthcare professionals, along with efforts to maximize basic radiation protection.

It is proposed to carry out training courses to improve basic knowledge and raise awareness of the biological effects of radiation on healthcare professionals and patients. Finally, it is proposed to include a radiation protection course in the healthcare professionals' undergraduate curricula in order to address the current knowledge gap in clinical practice.

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Medication Errors and Their Correlation with Nurse's Satisfaction. The Case of the Hospitals of Lasithi, Crete

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Abstract

Background: Medication errors have been recognized as a real problem for all health systems worldwide and are the most common category of nursing errors. The aim of this study was to investigate the prevalence of medication errors and their correlation with the job satisfaction of nurses.

Method: A prospective cross-sectional study was carried out and the sample of the study consisted of 189 nurses. To investigate medication errors, an anonymous structured questionnaire of 34 questions was used and Job Satisfaction Survey (JSS) questionnaire was used to measure job satisfaction. The IBM SPSS 25.0 program was used for statistical analysis of the data.

Results: 63.0% of nurses have been errors in the administration of medication, more often by the wrong time of administration (34.4%), missed dose (22.8%), and wrong dose (21.7%). The likelihood of an error is similar in all shifts, its devaluation is a non-reference reason, and if reported to a greater frequency in the attending physician. A significant difference in the frequency of errors was found only in the marital status and the job, while under the working conditions no significant variation was recorded. Job satisfaction is statistically significantly low for financial earnings and high for the management supervision. Based on the findings, the correlation between total job satisfaction and medication errors was not significant.

Conclusions: Nursing medication errors continue to happen. Continuing education, formal recording, and improvement of working conditions could help prevent and minimize errors and at the same time increase the job satisfaction of nurses.

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1   Introduction

Most people, at some period in their lives, will need to take medications for diagnostic, preventive, or therapeutic purposes. The continuing evolution of the health sciences has a direct impact on both the increase in life expectancy and on the quality of life and ability of the individual to coexist with the disease, a condition largely achieved by drug administration. However, medication can cause serious or even irreparable damage if administered incorrectly [1].

The administration of medicines, for whatever reason, is intended to have a beneficial effect on the health of the recipient or even on the prevention of the disease. On several occasions, however, the opposite effect has been observed with negative consequences making it a serious public health issue and a subject of studies in all developed countries. According to Beuscart et al. [2], studies in the USA have shown that in approximately 10% of inpatients occur serious errors, with 60% of them involving medication [2].

The management of medicines is an integral and one of the most important responsibilities of nurses having the responsibility of their proper administration. However, medication errors are a real problem associated with many factors [3]. Human errors are often in clinical practice but are usually underestimated resulting in limited knowledge of the types and consequences of errors in nursing practice. This limits the ability to gain experience from errors and to improve the quality and safety of nursing care [4].

Medication errors are the most common category of nursing errors, and over the last two decades the debate over medication errors has been constantly expanding due to their immediate impact on both patient safety and the quality of health care services and the enormous financial burden they cause in health systems [5].

The lack of a formal system of recording and statistics in the Greek health system regarding the errors and their consequences is responsible for the lack of an objective estimation of the magnitude of the problem in Greece [6]. However, stud-

ies in other countries show the problem and its effects on both patients and health systems. In the USA, for example, it is estimated that about 98,000 deaths are recorded each year from hospital errors, more than those from traffic accidents, breast cancer, and AIDS [7], and another study by the US Institute of Medicine has shown that 7000 deaths per year happen due to medication-related errors [8].

2   Materials and Methods

2.1   Aim

The aim of this study was to investigate the prevalence of medication errors and their correlation with the job satisfaction of nurses.

2.2   Study Design

It is a perspective cross-sectional study and was conducted in all hospitals in Lasihi, Crete, Greece.

2.3   Participants

The sample of the study consist of 189 RNs and nurses assistances (response rate: 77.8%) who worked at hospitals of Lasithi and especially at General Hospital of Agios Nikolaos, General Hospital of Ierapetra and all the decentralized units of the General Hospital of Ierapetra.

2.4   Tools

An anonymous structured questionnaire consisting of 34 questions, including demographics, was used to investigate the errors that occurred when administering the medication. It was created by Mitsis et al. [6] using questionnaires from similar subject studies conducted in Europe and the USA. The questionnaire was validated in the Greek population [6]. This tool includes ques-

tions about working conditions, nursing management, and nurses' attitudes for medication errors.

The Job Satisfaction Survey (JSS) questionnaire of Spector (1985) was used to measure nurses' job satisfaction. The JSS includes 36 questions and has been validated in the Greek population. The JSS consists of 36 questions and 10 subscales. The score for each subscale ranges from 4 to 24 while the total score ranges from 36 to 216. A higher score indicates more satisfaction.

2.5   Statistical Analysis

IBM SPSS 25.0 statistical software was used for statistical analysis. Frequency distributions of the characteristics of the participants were calculated. Frequencies and percentages were calculated on the subscales of job satisfaction. The nonparametric Spearman method was used to correlate job satisfaction subscales with participants' characteristics. Student t-test method was used to assess the levels of job satisfaction in relation to errors as well as x^2 for participants' characteristics and working conditions. The Friedman method between job satisfaction scales also used to identify a possible difference in participants' job satisfaction. The significance level was set at 0.05.

3   Results

The demographics data of patients are presented in Table 1. Totally 189 subjects, age 44.1 ± 8.9 years and mean working experience 19.8 ± 13.9 years were included in the study.

3.1   Working Conditions

The majority of nurses (77.8%, $n = 147$) have shift work. Most of them (77.8%, $n = 147$) reported that medication administration was not electronically controlled. Also, 165 (87.3%) subjects stated that there is significant absence of nursing record and official reporting. However, more than half of participants (68.8%, $n = 130$) stated that nursing protocols are applied during the medication administration process.

Totally, 81% of participants answered that continuing education programs are rarely or never implemented in their organization. More than half of the nurses (68.3%) stated that the workload in the department they work in is "large" or "very large" (45.5% and 22.8%, respectively) and 57.1% of nurses supported that they experience burn out. More than half of the participants (52.4%) consider staffing in their department to be inadequate (moderate or poor)

Table 1 Participant's demographics

		Variables	*N*	%
Gender	Males	15	7.9	
	Females	174	92.1	
Education level	Secondary school	72	38.1	
	University/college	103	54.5	
	Master	14	7.4	
Marital status	Married	127	67.2	
	Unmarried	36	19	
	Divorced	26	13.8	
Children	Yes	144	76.2	
Job position	Director	3	1.6	
	Head nurse/supervisor	20	10.6	
	Nurse	166	87.8	

Table 2 Type of medication error management by head nurses and nurses

| | Head nurses | | Nurses | | |
Type of management	N	%	N	%	*p*-value
Discussion	179	94.7	158	83.6	
Indifference	2	1.1	8	4.2	
					<0.001
Reprimand	6	3.2	21	11.1	
Understanding	1	0.5	1	0.5	
I do not know	1	0.5	1	0.5	

while levels of cooperation with colleagues and physicians are very satisfactory (90% and 93%, respectively). Most participants are satisfied with the management of their supervisors (29% consider it excellent, 43.4% very good, and 20.1% good).

In most cases (79.3%), nurses' attention when administering medication is diverted from various extrinsic factors such as mobile phones or patient and attendant questions (14.8% always, 36.5% very often, and 28% often). In addition, most of the participants (92.1%) check the medical instructions for correctness before they are performed (36% always, 25.4% very often, and 30.7% often).

3.2   Error Management

Of the total sample, 61.4% of participants stated that they rarely have been errors for medication over the past 12 months, 37% answered never and 1.6% often. More than half (60.8%) of participants answered that they had never been indicated with a medication error in the past 12 months, 37% rarely and 1.6% often. The wrong time of administration (34.4%), the dose omission (22.8%), the wrong dose (21.7%), the error drug (16.9%), the wrong patient (8.5%), the wrong drug dissolution (7.4%), the wrong route of administration (7.4%), and the overdose (2.6%) were the types of medication errors. Almost half of the participants (48.1%) believe that medication errors can occur at any time, while some other stated that there is higher probability to make medication errors in night shifts (12.7%), morning shifts (7.9%), and afternoon shifts (4.8%).

The Table 2 presents the way nurses and head nurses/supervisors address the medication errors. Most of head nurses and nurses prefer discussion (94.7% and 83.6%, respectively). The main feeling of the nurses after realizing their error is guilt (70.4%) and anger (16.9%). The reasons that encourage nurses not to report their error are mainly because they believe that they are not important (35.4%), because they are afraid of the negative comments (27%) and the possible penalties (18%). A large percentage (76.8%) of participants consider the existence of a formal error recording system to improve the quality of nursing care provided. Although the recording of errors was considered by most as necessary, the results showed that almost half (48.2%) of them believed that the likely consequence would be individual liability.

3.3   Job Satisfaction Survey

Table 3 presents the score of the nine subscales of the JSS questionnaire. Greater satisfaction was found with supervision and less with pay (20.2 ± 3.5 and 8.7 ± 4.0, respectively). Also, great satisfaction was found with coworkers (18.1 ± 3.5) and nature of work (18 ± 3.6) and less with communication (16.2 ± 3.4), operating conditions (13.2 ± 2.7), contingent rewards (12.2 ± 3.5), fringe benefits (11.4 ± 2.9), and promotion (11.1 ± 3.9).

Table 3 presents, also, the correlations of medication errors over the last year with the nine subscales of JSS. The level of job satisfaction of participants with the promotion probabilities was moderate to low for the two subgroups (11.6 ± 4.1 and 10.3 ± 3.6, *p* < 0.05). Nurses who made med-

Table 3 Mean ± SD of values of subscales of Job Satisfaction Survey

Subscales	Total	Medication error	No error	p-value
Pay	8.7 ± 4.0	8.8 ± 4	8.7 ± 4.1	0.918
Promotion	11.1 ± 3.9	11.6 ± 4.1	10.3 ± 3.6	0.026
Supervision	20.2 ± 3.5	20 ± 3.7	20.6 ± 3.2	0.327
Fringe benefits	11.4 ± 2.9	11.5 ± 2.9	11.2 ± 2.9	0.491
Contingent rewards	12.2 ± 3.5	12.4 ± 3.7	11.8 ± 3.1	0.266
Operating conditions	13.2 ± 2.7	13.1 ± 2.7	13.4 ± 2.9	0.518
Coworkers	18.1 ± 3.5	18.2 ± 3.4	18.1 ± 3.7	0.911
Nature of work	18 ± 3.6	17.8 ± 3.6	18.2 ± 3.7	0.459
Communication	16.2 ± 3.4	15.8 ± 3.4	16.8 ± 3.2	0.049
Total satisfaction	129.1 ± 14.5	129.1 ± 14.7	129 ± 14.2	0.953

ication errors were found to have a lower rating on the communication subscale than those who did not make errors (15.8 ± 3.4 vs 16.8 ± 3.2, $p = 0.049$). Regarding the other subscales and overall satisfaction, no statistically significant difference was found between those who made medication errors and those who did not.

4   Discussion

The present study is the first to investigate the prevalence of medication errors in hospitals of Crete, Greece. The sample of the study was representative of the total number of nurses in the three hospitals surveyed (response rate 77.8%). The aim of the study was to investigate the frequency, type and causes of errors, and their relationship with nurses' job satisfaction.

Errors are an undeniable reality in the daily clinical practice of nurses. The results showed that the nurses identified that they had made an error medication during the last year (63%). The result is consistent with many studies that showed various percentages. A study with 661 nurses at 7 hospitals in Attica found that 78.4% of the participants had made an error while 81% of them were on medication [9]. Similarly, 91.5% of nurses in 8 public ICUs and 3 private hospitals in Athens in 2012 stated that they had made medication error [6] while in a study involving 5112 nurses in hospitals of the Japanese capital, 79.3% were found to have made a medication error [10]. Results of studies in the USA, Ethiopia, Brazil, and Iran also reported similar high error rates

(70%, 71%, 67%, and 64.55%) by nurses confirming the existence of the problem [11, 12]. The results of a recent study at a Turkish university hospital did not differ significantly with the rate of medication errors by nurses being 81.8% [13].

The largest error rate in the present study was the incorrect administration time (34.4%), following the missed dose (22.8%) and the wrong dose (21.7%). The same result showed a systematic review of 17 studies from 11 Southeast Asian countries, highlighting incorrect timing, omission, and incorrect dose as the most commonly reported types of medication errors [14]. The wrong administration time was confirmed by the study of Zarea et al. [15] as the most frequent medication error (55.6%) of nurses too. The wrong time of administration was also found by a Mitsis et al. [6], although in a larger rate (34.7%) the wrong time was given. From many other studies, the result of the present study confirms the type of most common errors such as that of [16] in which the wrong time of administration was the most important error (24.0%) followed by the wrong dose (16.8%). A large multinational study by Valentin et al. [17] in 113 ICUs in 27 countries found that the most frequent errors were the wrong administration time and the omission. However, it is not in line with a large study in Attica hospitals where the most common error was found to be the wrong drug [9].

We, also, found that the likelihood of error is the same at any time of the day for the nurses involved, indicating that they were not affected by the particularities of each shift. This result is

inconsistent with most studies that investigated this topic. Studies by Karga [9] and Damvakakis [18] indicate that most errors occur in the morning hours when increased patient care activities occur and the workload is greater. In the study of Kim et al. [19] errors are mainly observed during the day while in the study by Bolandianbafghi et al. [20] refers to the night shift, respectively.

Error reporting was found to be primarily reported to the physician at 61.9%. This finding could be explained by the fear of nurses reporting their error to their supervisors in the event of penalties and the anxiety about patient safety since the physician may intervene immediately if necessary to address the consequences of the error. This finding is consistent with the study by Dirik et al. [13] in which nurses first reported their error to the doctor.

The main feeling that nurses experience when they commit a medication error was found to be guilt. This finding points to the psychological burden nurses face while performing their work and their share of responsibility for the safety of patients and the positive outcome of their health. Similar studies have highlighted the negative impact of making errors on the psychology of healthcare professionals with a greater sense of guilt [6, 21, 22].

Although at a rate of 21.7% it was stated that an error would never be concealed, the underestimation of the error ("not important to report") to a significant degree (35.4%), the negative comments from colleagues (27.0%), and the penalties (18.0%) are real obstacles to reporting the error. These are n line with the study of Kreckler et al. [23] that supported that it is more likely to report the error if a fault does occur. However, this practice may involve risks because the level of knowledge of the nurse who makes the error may not be able to judge its severity. Dirik et al. [13] also report negative comments and fear of consequences as reasons for concealment, while most studies focus mainly on fear of penalties that inhibit error reporting [11, 15, 22, 24, 25].

A literature review has concluded that the causes of medication error are related to the combination of individual and systemic factors such as level of knowledge and work experience,

commitment to work and conscientiousness, lack of staff, burnout, absenteeism, absence incomplete control etc. [12, 26–29]. A literature review of 26 studies in 11 countries from 4 continents, including a multinational study in 27 countries, also highlights the contribution of individual and systemic factors to error. Nurses' characteristics and work experience have emerged as important issues as well as high workload and individual work arrangements [30]. The results of the above studies are in line with the views of the participants in this study found to recognize in addition to the system's responsibility, their personal responsibility for the safe administration of medicines while believing that a formal error recording system would contribute to improved nursing care.

There was no found statistically significant difference between the non-medication errors and the working conditions of the participants in our study. The errors appeared to be independent of working hours and the existence of a formal recording system, even with the workload and degree of burnout that would be expected to be associated. This finding is in contrast to other studies linking occupational exhaustion [6] and the high workload and lengthening of working hours [31] to increased medication errors.

The present study did not show a significant relationship between the errors made and the characteristics of the participants, such as gender, age, level of education, and work experience. This finding is in line with other studies that did not show a similar relationship [32]. In contrast, another study found a relationship with gender, with men making more errors than women [33], while another reported that errors occur more frequently by younger nurses, 20–30 years old [34]. Bolandianbafghi et al. [20] also record more errors at younger ages. The marital status, however, appeared to have a statistically significant effect on the quality of nurses' work. Given that employees' personal lives are inevitably linked to the full spectrum of their activities, family, and personal problems appear to have a negative impact on job performance, with 84.6% of divorced individuals found to have made at least one medication error. A study partially agrees

with this result by attributing the largest proportion (86.1%) of causing errors to "personal neglect" [35]. The job position, also, seemed to differentiate the incidence of errors with supervisors reporting a greater percentage of their error than nurses. However, the question arises: Have the answers been honest? Or are always recognized all the errors that happen? As it is already reported, fear of penalties, in many cases prevents nurses from reporting their errors while the lack of a commonly accepted definition of error may make it difficult to identify [11, 13, 15, 22, 24, 25].

The overall satisfaction of the study nurses was found to be at medium levels. The lower salary scoring could be justified by the prolonged economic crisis of the last decade with the freezing of increased salaries, tax increases, and cuts in benefits. A similar result, with great dissatisfaction with financial rewards, is found in other studies in Greece [36, 37] while a large multinational study by Aiken et al. [38], in which Greece also participated, showed that nurses' greatest dissatisfaction was related to their rewards as well as educational and development opportunities. Lower satisfaction with pay was also noted by Delobelle et al. [39] in South Africa. The highest satisfaction for the nurses in this study was the relationship with management, demonstrating that positive interaction with managers contributes to employee well-being. This finding is in line with Papazafiropoulou's [40] study in which nursing was the main factor for nursing control and supervision while the lowest was for salaries. It therefore appears that the ability of supervisors to communicate effectively with nurses, with respect to their views and particular needs, is an important measure of satisfaction for nurses [41].

Although management satisfaction was found to have the highest percentage overall, the correlations of participants' characteristics seemed to vary in individual parameters. Older adults and those with more work experience seem to be less satisfied with management than younger ones, while those with children and no responsibilities are more likely to be satisfied with their supervisors. Higher educational level appears to be nega-

tively associated with satisfaction with current procedures. This finding could be justified by the multifaceted division of nursing science that makes it a multitask profession with distinct roles in clinical practice, especially in smaller hospitals. On the contrary, those who do not hold a position of responsibility (no supervisors) are satisfied with the current procedures, demonstrating that the less the responsibilities of the work, the more satisfaction is increased by the procedural context and nature of the work.

Finally, the results of our study showed that there was no significant difference in job satisfaction among nurses who made errors and those who did not make. By exception, satisfaction with the promotion prospects was found to be lower for nurses who did not make an error and satisfaction with the level of communication found to be lower for nurses who have made a medication error. In general, it appears that the overall satisfaction of study nurses is not significantly related to medication errors. The same conclusion was found by the study of Bolandianbafghi et al. [20] in a sample of 170 nurses at a hospital in Iran. Although it was not statistically significant, the increased satisfaction resulted in a reduction in errors.

5   Conclusions

The issue of medication errors concerns all healthcare systems internationally, mainly because it is a crucial parameter for patient safety and for the financial burden they incur. Many studies to date have explored the issue from various views and in relation to many factors, individual, social, organizational, but all converge on the same objective: safe drug delivery, safe, and quality nursing care. "To err is human," however, is a characteristic of human to learn from his errors and correct them. Although the contribution of official recording systems to error reduction have not been documented at present, it is believed that formal recording of medication errors would add additional knowledge, experience, and alertness for nurses. In addition, systematic implementation of continuing education

programs would help to improve nurses' knowledge and skills.

Employee satisfaction is a cornerstone of any organization's successful operation. The present study did not show a statistically significant association between overall job satisfaction with making errors. However, high workload and job burnout were recorded for most participants and dissatisfaction with individual views of work such as financial reward and opportunities for promotion. These factors greatly contribute to reduced job satisfaction. Consequently, improved working conditions, fair rewards, and continuing education are thought to contribute to increasing nurses' satisfaction and quality health services.

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Health-Related Quality of Life and Living Costs of HIV-Infected Patients

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Abstract

Aim: The aim of this study was the evaluation of health-related quality of life (HRQoL) of HIV-infected patients and the effect of their illness in their living costs.

Material and Method: This is a cross-sectional study and the study sample, which was a sample of convenience, included 98 HIV-infected patients from March to May 2019 at the General Oncology hospital "Oi Agioi Anargyroi" in Greece. The main tools of the survey were the Greek version of the MOS-HIV and a questionnaire used for measuring rehabilitation costs in trauma patients adjusted for the needs of the this study.

Results: A total of 98 patients were inducted in our study aged 49.3 ± 11.3 years, most of them males (68.3%). HRQoL was assessed in 11 individual dimensions. The highest score was found in the dimensions of role functioning (73.47 ± 36.93), physical functioning (72.53 ± 26.65), and social functioning (71.63 ± 32.3). Regarding the patients' living costs over the last month due to their illness, the highest burden comes from other expenses (152.4 ± 179.5), services provided by a psychologist (142.8 ± 170.6) and medical visits (142.8 ± 170.6).

Conclusions: As the HIV infection is characterized as a chronic disease, the economic cost due to the illness needs to be studied as it affects the extent to which an HIV-infected patient can access medical care and meet emerging needs. Therefore, future research should focus in the economic dimension of the illness in relation with the quality of life of these patients and their relatives, so that new health policies may arise.

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Keywords

Caregivers · Health-related quality of life · HIV-infected patients · Income · Living costs

1   Introduction

In cases of chronic diseases, the measurement of health-related quality of life (HRQoL) is particularly useful. Since human—and especially medical—research is at the heart of human research, it becomes fundamental to investigate not only the stages of a disease and the efficacy of a treatment or drug, but also the changes that all bring about in the lives of people or their environment. Based on research findings, researchers are able to better assess the progress of a disease or its impact on patients' lives and to intervene accordingly. One such case is the HIV infection. Initially, it can be said that, as expected, HIV-positive patients have lower HRQoL than the rest of the population. However, relative to time, a significant increase in HRQoL has been observed between the time before the application of anti-retroviral therapy and thereafter [1].

The results of the estimation of HRQoL depend largely on the various clinical symptoms that patients present, whether they are due to the disease, or the treatment regimens in the form of side effects (anxiety, anorexia, insomnia, nausea, confusion, etc.), and the degree of the compliance of patients to their treatment. In addition, psychological and social factors should not be excluded from the study of the HRQoL of these patients [2].

The aim of this study was the evaluation of health-related quality of life (HRQoL) of HIV patients and the effect of their illness at their living costs.

2   Materials and Methods

This is a cross-sectional study and the study sample, which was a sample of convenience, included 98 HIV-infected patients from March to May 2019 at the General Oncology hospital "Oi Agioi Anargyroi" in Greece.

2.1   Tools

The main tools of the survey were the Greek version of the MOS-HIV and the Questionnaire conducted by Stergiannis et al. [3] which was adjusted for the needs of this study.

The MOS-HIV questionnaire was designed in 1987 at the Johns Hopkins University in Baltimore and was one of the first measuring tools for HIV-infected patients. It is widespread and is often used to measure clinical trial results or health-related quality of life in HIV-infected patients [2, 4]. The reliability and validity of the Greek translation of the questionnaire have been certified [5]. The MOS-HIV questionnaire consists of 35 questions exploring 10 different dimensions of QoL: general quality of life, pain, physical functioning, functional role, mental health, social role, cognitive function, energy/fatigue, health risks, and general health. At the same time, information on demographic and social data and clinical parameters is collected. It does not take long (about 5 min) to fill it, so it is easy to use and therefore preferred by researchers.

The second questionnaire was specifically designed to investigate changes in the cost of living of HIV-infected patients due to the disease. As this parameter has not been investigated in Greece, the formulation of the questionnaire was based on previous research measuring the rehabilitation costs of trauma patients [3].

2.2   Statistical Analysis

SPSS for Windows (version 21) statistical software was used for statistical analysis. The statistical analysis included descriptive statistics. The frequencies and percentages of the qualitative variables were calculated, and mean values and standard deviations were calculated on the quantitative variables (mean ± standard deviation).

3   Results

The sample of the study consisted of 98 patients aged 49.3 ± 11.3 years. The characteristics of patients are shown in Table 1.

Health-related quality of life was assessed in 11 individual dimensions. The Cronbach's an index was found to be 0.947 which indicates a high relevance and reliability of the questionnaire. The highest score was found in the dimensions of role functioning (73.47 ± 36.93), physical

Table 1 Social-demographic data of patients

Variables	N	%
Gender		
Males	76	77.5
Females	22	22.5
Education level		
None	11	11.2
Basic	15	15.3
Primary	28	28.6
Secondary	44	44.9
Marital status		
Unmarried	51	52
Married	23	23.5
Divorced-Widows	24	24.5
Children	59	60.2
Monthly family income (euro)		
0–500	23	23.5
501–1000	40	40.8
1001–1500	18	18.4
1501–2000	17	17.3
Financial allowance	78	79.6
Employed	67	57.1
Unemployed	31	31.6
Employment Status		
Complete	31	31.6
Partial	19	19.5
Unemployed	31	31.6
Retired	17	17.3
Workplace		
Public sector	7	14
Private sector	43	86
Insurance fund		
Public	81	82.7
Private	2	2
Other	15	15.3

Table 2 Descriptive characteristics of the MOS-HIV scales

	Mean	SD
Physical functioning	72.53	26.65
Pain	69.84	32.78
General health	54.89	25.41
Vitality	57.14	22.73
Social functioning	71.63	32.3
Mental health	53.59	20.88
Role functioning	73.47	36.93
Cognitive functioning	69.23	25.64
Quality of life	64.03	23.01
Health distress	67.29	29.87
Health transition	58.98	26.33
Physical health summary score	71.87	27.03
Mental health summary score	60.74	19.76

functioning (72.53 ± 26.65), and social functioning (71.63 ± 32.3), while the lowest score was found in dimensions of mental health (53.59 ± 20.88), general health (54.89 ± 25.41), and vitality (57.14 ± 22.73). The descriptive characteristics of the MOS-HIV scales are shown in Table 2.

Table 3 presents the days that patients and caregivers were absent from their work and the cost they lost from their absence.

Table 4 shows the burden of patients' living costs in the last month due to their illness. The highest burden comes from other expenses (152.4 ± 179.5), services provided by a psychologist (142.8 ± 170.6), and medical visits (142.8 ± 170.6). Costs from social worker services were minimal. Hospital admission costs were reported by five (14.7%) patients, while other costs were reported by nine (29%) patients.

Women were absent from work significantly more days during the previous semester than men (19.8 ± 24.8 versus 3.1 ± 4.8 days, $p = 0.002$). Patients working scored significantly higher on the dimensions of physical function, physical pain, general health, social functioning, mental health, role functioning, quality of life, and health concern than the unemployed. In contrast, working patients compared to the unemployed scored significantly higher on the summary of physical health and on the summary of mental health (Table 5).

4 Discussion

In this study, an attempt was made to assess the HRQoL of a group of HIV-infected patients, who were regularly monitored by doctors at the Special Infections Unit of the General Oncology hospital "Oi Agioi Anargyroi" in Greece. The main purpose of the research was to find data on the change in HRQoL of HIV-infected patients in Greece due to the illness and the additional costs needs arising. Such information is scarce on Greek data and could be important for future research.

We evaluated HRQoL of the patients, according to their responses to a specially

Table 3 Days of absence from work and lost income of patients and caregivers

Variable	Mean	SD	Min	Max
How many days were you absent from your work during the previous semester?	7.1	13.5	0	60
How much money did you lose because of your absence from work?	90.4	185.8	0	600
How many days has your family member been absent from work over the past six months to care for you?	6.4	29.4	0	150
How much money did you lose because of this absence from his work?	136.4	467.6	0	2000

Table 4 Costs due the disease

Variable		Mean	SD	Min	Max
Medical visits	*N*	1.6	1.8	0	10
	Cost	85.9	125.1	0	600
Psychologist's services	*N*	2.4	6.9	0	36
	Cost	142.8	170.6	0	500
Social worker services	*N*	0.2	0.8	0	4
	Cost	0	0	0	0
Drugs	*N*	3.4	3.3	0	15
	Cost	35.3	31.4	0	150
Pharmaceutical material	*N*	0.8	1.6	0	5
	Cost	53.8	102.1	0	300
Caregiver services	*N*	0.1	0.3	0	1
	Cost	8	17.9	0	40
Movements	N	1.6	3.3	0	20
	Cost	29.4	37.1	0	200
Friends visits	*N*	0	0	0	0
	Cost	4	8.9	0	20
Phone calls	*N*	4.5	7.1	0	20
	Cost	43.3	61.6	0	200
Admission	*N*	0	0	0	0
Other expenses	Cost	152.4	179.5	0	500

formulated MOS-HIV questionnaire, in 11 dimensions. Although most respondents rated their HRQoL positively, the results of the study showed that HRQoL varies by gender, by the patient's relationship status, by his work status, by his income, his level of education, and the age at which the disease was diagnosed. Recent studies have also shown the value of HRQoL in relation to patient compliance to treatment. HIV-infected patients with higher levels of compliance to their antiretroviral treatment have a significantly better HRQoL [6].

Catalan et al. [7] found that most HIV-infected patients rated their HRQoL positively, with better QoL (total score and most domains) being strongly associated with being a man, in a relationship, working, especially with higher level of income, at a higher level of education, and being diagnosed with the disease after the age of 40. Furthermore, multivariate analysis showed that not being on benefits was and being partnered was strongly associated with better HRQoL [7].

Other researchers studied HIV-infected patients aged 50 to 75 years, most of them men, while in our study we did not limit the sample by

Table 5 HRQoL dimensions of working patients vs unemployed

Variable	Employed	Unemployed	P
Physical function	86.1 ± 18.1	63.1 ± 26.8	0.001
Physical pain	79.6 ± 29.4	64.7 ± 32.9	0.029
General health	68.7 ± 20.5	45.1 ± 23.9	0.001
Social functionality	81.1 ± 26.7	67.1 ± 33.4	0.035
Mental health	60.4 ± 20.9	48.5 ± 18.9	0.006
Role functioning	92.3 ± 18.3	59.8 ± 41.6	0.001
Quality of life	70.5 ± 21.4	59.8 ± 23.5	0.028
Health concern	76.3 ± 23.4	62.2 ± 32.3	0.024
Summary of physical health	84.7 ± 19.7	63.6 ± 27.7	0.001
Summary of mental health	67.8 ± 17.4	55.8 ± 19.4	0.003

age. They found strong relationship between HRQoL and gender, having children, working, religion, time of diagnosis, adverse effects, treatment interruption, viral load counts, hospitalization, dependence for daily activities, and the use of drugs [8].

Another study focused on pain, while in our study we examined all dimensions of HRQoL. These researchers found that low HRQoL was correlated with pain in all evaluated domains. They concluded that the level of pain is a negative impact on the quality of life of people with HIV/AIDS [9].

A study conducted in India showed that HRQoL is strongly decreased in HIV-infected patients [10]. Although their sample consisted only by women, while the sample of our study consisted by both men and women, their results agree with the results of our research. Poor HRQoL in HIV-infected patients was also found in another study in Nepal, in which the researchers pointed out that attention should be given when addressing the mental health care needs of these people [11].

A recent study showed that the HIV stigma was significantly correlated with psychological variables, social support, and HRQoL. The findings of this study showed that psychosocial interventions reduce HIV-related stigma, address psychological disorders, and build social support to improve HRQoL for people living with HIV [12].

In the second part of our research regarding the cost of living of HIV-infected patients, it was not possible to compare it with other data in Greece or abroad, as we did not find similar studies conducted in the past. Overall, it was observed that there were burdens on patients' lives with the greatest damage coming from other costs, visits to a psychologist, followed by the burden of loss of income due to absence from work, both for patients and for carers.

4.1 Limitations

The main limitations of this study are the relatively small sample size and the fact that the study was conducted in only one hospital. These limitations prevent the investigation of correlations between various research parameters and especially demographic and personal data referring to similar studies.

5 Conclusion

As the HIV infection is characterized as a chronic disease, the economic cost due to the illness needs to be studied as it affects the extent to which an HIV-infected patient can access medical care and meet emerging needs. The extension of life expectancy makes it important to keep track of costs, as there is no cure for the HIV so far. Costs may vary, but they cannot be zeroed. Therefore, research should focus in the economic dimension of the illness in relation with the quality of life of these patients and their relatives, so that new health policies may arise.

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Evaluation of Anxiety and Depression in Women Undergoing Mastectomy in Greece

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Abstract

Background: To determine the levels of depression and anxiety in women undergoing mastectomy and to investigate the factors related to the onset of anxiety and depression on the eve of the surgery.

Methods: This is a prospective observational study. The sample of the study consisted of 82 women with breast cancer who are going to undergo surgery. The assessment of patient anxiety and depression was done with the HADS anxiety and depression hospital scale.

Results: The study sample was 82 patients aged 56.8 ± 12.9 years. Most of them were married (68.3%), had children (87.5%), were Greek (93.6%), Orthodox Christians (97.4%), housewives (28%), and retired (23.2%). In total, 70 (85.4%) participants would be subjected to single mastectomy and 12 (14.6%) both of them. More than half of respondents (51.9%) smoked, while 32.7% consumed alcohol. 51.2% had pathological stress levels and 31.7% pathological levels of depression. Participants with abnormal levels of anxiety were significantly younger ($p < 0.05$), smoked at a significantly lower rate ($p < 0.05$), and made significantly fewer cigarettes per day ($p < 0.05$). Participants with abnormal levels of depression were significantly younger ($p < 0.05$), significantly more "other" ($p < 0.05$) and "other" ($p < 0.05$) and had a significantly higher educational level ($p < 0.05$).

Conclusions: The factors found to affect participants stress levels were young age, reduced smoking rates, and the smallest number of cigarettes per day, while the factors found to affect participants' levels of depression were the young age, the other ethnicity except for Greek, the other religion except Christianity, and the highest educational level.

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Keywords

Anxiety · Breast cancer · Depression · Mastectomy

1 Introduction

The survival rates of women with breast cancer have improved significantly in recent decades due to improvements in screening and treatments [1, 2]. Studies are focusing on the mental health aspects of breast cancer, examining various symptoms of stress, while frequently reported symptoms in women with breast cancer are anxiety, depressive symptoms, sleep disorders, fear of relapse, and poorer quality of life [3, 4]. Mental health concerns are widespread in the diagnosis, surgery, and recurrence of the disease [5].

The aim of this study was the evaluation of the anxiety and depression levels in women undergoing mastectomy in Greece and to investigate the factors related to the onset of anxiety and depression the day before surgery.

2 Materials and Methods

This is a cross-sectional study and the study sample, which was a sample of convenience, included 82 women with breast cancer undergoing mastectomy from February to August 2017 at the General Oncology hospital "Oi Agioi Anargyroi" and the Oncology Hospital "Agios Savas" in Greece.

2.1 Tools

The main tool of the survey was the Hospital Anxiety and Depression Scale (HADS) which is known in Greece as the Anxiety and Depression Scale at the General Hospital. It has been used in many countries worldwide for the purpose of assessing anxiety and depression in general hospital patients, with very good assessment results. HADS was created by Zigmond and Snaith in 1983. The purpose of HADS was to provide clinical researchers with a practical, easy-to-use, and reliable tool for assessing anxiety and depression. It should be noted that HADS is a tool of assessment, not of diagnosis. Its purpose is to identify

those general hospital patients who need more systematic psychiatric assessment and care [6, 7].

HADS is a questionnaire completed by the examiner that consists of 14 items, each of which has 4 possible answers (0–3). It is designed to assess anxiety (HADS-A) and depression (HADS-D) (7 items for each condition, ranging from 0 to 21). It is important to note that depression investigations do not include questions about physical symptoms (such as insomnia, anorexia, weight loss, fatigue), which are very common in general hospital patients [6, 7].

For the study needs we also recorded age, marital status (single, married, divorced, divorced, married, widowed), nationality, religion, if they have children, number of children, occupation, educational level, permanent residence, smoking, and alcohol consumption.

2.2 Statistical Analysis

SPSS for Windows (version 21) statistical software was used for statistical analysis. The statistical analysis included descriptive statistics. The frequencies and percentages of the qualitative variables were calculated and mean values and standard deviations were calculated on the quantitative variables (mean ± standard deviation). The second part of the analysis included the results of simple correlations (bivariate analysis). T-test was performed between two variables that followed a normal distribution, whereas a Man–Whitney test was performed if two continuous variables did not follow a normal distribution. When more than two variables were compared, ANOVA analysis was performed if normal distribution was followed and Kruskal–Wallis test was performed if continuous variables were not normal distribution. Also among the qualitative variables we conducted X^2. In all tests performed, significance level (p) was set at 0.05. Thus, all values less than or equal to 0.05 ($p \leq 0.05$) were considered statistically significant. The regularity check was performed by the Kolmogorov–Smirnov statistical test.

3   Results

The sample of the study consisted of 82 patients aged 56.8 ± 12.9 years. The characteristics of patients are shown in Table 1.

In total, 70 (85.4%) participants would undergo a single mastectomy and 12 (14.6%) undergo bilateral mastectomy. More than half of the participants (51.9%) were smokers, while 35.4% had never smoked. Also, the average number of cigarettes smoked per day was 15.1 ± 8.4 and the average smoking time was 26.1 ± 11.7 years.

Alcohol consumption was referred by 32.7% of participants, while of those who reported not drinking alcohol, with 86% of them never consumed alcohol and 14% consumed and then stopped at some time. Also, of those who consumed alcohol, only 5.3% did so on a daily basis and 94.7% occasionally. Table 2 shows participants' smoking habits as well as data on alcohol consumption.

About half of the participants (48.8%) had normal stress levels, 21.7% had pathological, and 19.5% borderline pathological levels. Furthermore, 68.3% of the sample had normal levels of depression, 18.3% pathological, and 13.4% marginal pathological levels.

Participants undergoing a single mastectomy were significantly older (57.5 ± 13.1 vs. 50.3 ± 11.5 years, $p < 0.05$) with significantly lower educational level (2.6 ± 1.4 vs. 3.5 ± 1.2, $p < 0.05$) with respect to the rest. Furthermore, participants undergoing bilateral mastectomy smoked significantly more cigarettes per day (19.8 ± 10.8 vs. 14 ± 7.5, $p < 0.05$), had significantly more stress (8.9 ± 3.1 vs. 7.3 ± 2.5, $p < 0.05$) and depression (7.3 ± 5.5 vs. 5.4 ± 4.6, $p < 0.05$). The results of the correlations are presented in Table 3.

Participants with pathological stress levels were significantly younger ($p < 0.05$), smoked at a significantly lower rate ($p < 0.05$), and smoked significantly fewer cigarettes per day ($p < 0.05$). Also, participants with normal levels of stress were significantly older ($p < 0.05$) and signifi-

Table 1 Social-demographic data of patients

Characteristics	n	(%)
Age	56.8 ± 12.9	
Family status		
Single	10	(12.2%)
Married	56	(68.3%)
Divorced	5	(6.1%)
Separated	2	(2.4%)
Widows	9	(11%)
Children	70	(87.5%)
N children	2.3 ± 0.8	
Nationality		
Greek	73	(93.6%)
Other	5	(6.4%)
Religion		
Greek Orthodox	76	(97.4%)
Other	2	(2.6%)
Profession		
Private employees	11	(13.4%)
Public servants	15	(18.3%)
Freelancers	6	(7.3%)
Pensioners	19	(23.2%)
Unemployed	8	(9.8%)
Housewives	23	(28%)
Educational level		
Primary school	22	(26.8%)
High school	12	(14.6%)
Lyceum	27	(32.9%)
University	11	(13.4%)
Technological institute	8	(9.8%)
Postgraduate	2	(2.4%)
Permanent residence		
Rural (<3.000 residents)	9	(11%)
Semi urban (3.000–10.000 residents)	6	(7.3%)
Urban (>10.000 residents)	67	(81.7%)

Table 2 Smoking and alcohol consumption habits

	n	(%)
Smoking		
Smokers	41	(51.9%)
Never smoked	29	(35.4%)
Cigarettes per day	15.1 ± 8.4	
Years of smoking	26.1 ± 11.7	
Years of smoking cessation	10.9 ± 9.1	
Alcohol		
Alcohol consumption	38	(65.4%)
Frequency of alcohol consumption		
Daily	2	(5.3%)
Occasionally	36	(94.7%)
Never	43	(52.4%)

Table 3 Correlations regarding the type of mastectomy

	Single mastectomy	Bilateral mastectomy	*p*-value
Age (years)	57.5 ± 13.1	50.3 ± 11.5	0.041
Educational level (1 = primary school, 6 = postgraduate)	2.6 ± 1.4	3.5 ± 1.2	0.049
Cigarettes/day	14 ± 7.5	19.8 ± 10.8	0.038
Anxiety	7.3 ± 2.5	8.9 ± 3.1	0.029
Depression	5.4 ± 4.6	7.3 ± 5.5	0.007

Table 4 Correlations regarding participants' anxiety levels

	Normal	Borderline pathological	Pathological	*p*-value
Age (years)	61.3 ± 13.9	57.3 ± 11.7	54.6 ± 12.8	0.026
Smoking	61.2%	45.3%	26.8%	0.047
Cigarettes/day	19.1 ± 10.3	15.2 ± 9.8	13.4 ± 7.6	0.019

cantly more likely to smoke ($p < 0.05$). An increase in anxiety levels is associated with a decrease in participants' age and smoking habits. The results of these correlations are presented in Table 4.

Participants with pathological levels of depression were significantly younger ($p < 0.05$), significantly more of "other" ethnicity ($p < 0.05$) and of "other" religion ($p < 0.05$), and had significantly higher educational level ($p < 0.05$). Participants with normal levels of depression were significantly older ($p < 0.05$), were all Greek (100%) and Christian Orthodox (100%), and had significantly lower levels of education ($p < 0.05$). The results of these correlations are presented in Table 5.

4 Discussion

Our study included 82 women aged 57 years who were mainly married, had children, were of Greek nationality and Christian Orthodox. About half were smoking and one third were consuming alcohol.

In this study, about half of the participants had abnormal levels of anxiety. In agreement with the results of this study, Baek et al. [8] reported that 56.4% of patients had anxiety after being diagnosed with breast cancer. Similarly, Ng et al. [9] found that 50.2% of women with a diagnosis of breast cancer had abnormal levels of preoperative anxiety. Hegel et al. [10] found that the prevalence of anxiety was 41%, which is comparable

to the percentages found in this study. Factors found to influence participants' anxiety levels were younger age, reduced smoking rates, and lower number of cigarettes per day.

In this study, 31% of the sample had abnormal levels of depression. Factors found to influence participants' depression levels were young age, ethnicity other than Greek, religion other than Christianity, and greater educational attainment.

Burgess et al. [11] reported that up to 50% of women with breast cancer have high levels of discomfort with more than 30% of women diagnosed with preoperative depression, anxiety, or both. Depression is more common in patients with breast cancer. Women with depressive breast cancer were less active in seeking treatment, had more severe symptoms, poorer response to systemic treatment, longer recovery times, and poor outcome [12, 13]. Other researchers have suggested that stress is a more prevalent psychological problem in breast cancer. Patients with breast cancer face uncertainty about the progression of the disease, concern about possible relapse, and fear of physical discomfort [14]. All of these feelings contribute to increased levels of anxiety. In fact, both depression and anxiety have been shown to have significant adverse effects on the quality of life of breast cancer patients [15].

In this study, patients' depression levels were lower than those of anxiety. Depression in cancer patients is complex and involves many aspects. It includes a variety of mood disorders and clinical symptoms. In addition to the classic symptoms of

Table 5 Correlations regarding participants' depression levels

	Normal	Borderline pathological	Pathological	p-value
Age (years)	59.8 ± 13.1	56.1 ± 13.1	53.4 ± 13.5	0.014
Nationality (other)	0	0	100%	0.001
Religion (Christian Orthodox)	0	0	100%	0.002
Educational level (1 = primary school, 6 = postgraduate)	2.5 ± 1.3	3.2 ± 1.2	3.5 ± 1.9	0.047

depression, such as low mood, low energy, poor concentration, loss of interest, low self-esteem, feelings of guilt, sleep and appetite disorders, and despair, there are features that are often not expressed, such as physical and mental symptoms. Informal symptoms such as anger, irritability, and hostility are also often neglected in assessing depression [16]. This gap often leads to a sub-diagnosis of depression in breast cancer.

In this study, patients' psychological distress was related to religiosity. Specifically, patients who believed in a religion other than Christianity had increased levels of depression. In the study by Paredes and Pereira [17], psychological distress in patients with breast cancer was positively related to spirituality, but was not a significant predictor. Similarly, religiosity in spouses of women with breast cancer has been found to reduce levels of anxiety and depression [18]. Spirituality perceptions favor and reinforce the meaning of life, acceptance of struggles and difficulties as part of a structured belief system, with a positive influence on emotional well-being and anxiety [19]. Spirituality in general has been reported to benefit mental health [20, 21]. On the other hand, there are studies that have not found a correlation between spirituality and mental health [22, 23].

This study also found that younger age was associated with increased levels of anxiety and depression. In the literature, however, the effects on age influence are mixed. Some studies did not find a significant correlation between psychological distress and age [24, 25], while others concluded that younger age was a predictive factor for the occurrence of psychological distress [17, 26, 27]. This may be due to the fact that younger women are more pressured to adopt a positive attitude toward their illness, which can translate into more demanding cognitive processing and hence greater perception of benefits [26]. Boyle

et al. [28] analyzed patterns of anxiety and depression at different ages and concluded that there was no relationship between development and perceived threat in younger women.

4.1 Limitations

The main limitations of this study are the relatively small sample size and the fact that the study was conducted in only two hospitals. These limitations prevent the investigation of correlations between various research parameters and especially demographic and personal data referring to similar studies.

5 Conclusion

The factors found to affect stress levels of women with breast cancer undergoing mastectomy were young age, reduced smoking rates, and the smallest number of cigarettes per day, while the factors found to affect levels of depression of women with breast cancer undergoing mastectomy were the young age, the other ethnicity except for Greek, the other religion except Christianity, and the highest educational level.

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The Effect of Emotional Intelligence on Caring Behaviors Among Psychiatric Nurses in Greece

Emotional Intelligence and Caring Behaviors in Mental Healthcare

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Abstract

The effect of emotional intelligence in the field of mental health is of particular interest, as it is an intensely emotional field. The nursing staff has as an object the healthcare of people with mental problems, where emotions and their management are key factors. The purpose of this study was to investigate the levels of emotional intelligence and caring behaviors among mental health nurses as well as the correlation between these variables. In this cross-sectional study, 191 nurses com-

pleted the tools Trait Emotional Intelligence Questionnaire-Short Form (TEIQue-SF) and the Caring Behaviors Inventory-24 scale (CBI-24) for assessing the degree of emotional intelligence and caring behaviors, respectively. Demographic and job characteristics were recorded. Results: The results showed that the majority of participants were female and the average age was 44.69 years. According to the total but also the individual scoring of the TEIQue-SF, emotional intelligence was found to be at a relatively high level (total mean: 4.92) and was associated directly

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($r = 0.448$, $p < 0.001$) with the frequency of caring behaviors of the CBI-24 which was found to be at a fairly high level (total mean 5.08). The study findings showed that as the overall emotional intelligence increased, the frequency of occurrence and the importance of behavioral behaviors increased.

Keywords

Emotional intelligence · Mental health nurses · Caring · Caring behaviors · Nursing

1   Introduction

Contemporary interest in the field of emotional intelligence in the workplace, business, and science areas emerged mainly after Goleman's definition according to which emotional intelligence is "the competence to recognize, understand and use one's own and other people's emotions in a way that leads to an effective or exceptional personal and social performance" [1]. Emotional intelligence includes a set of cognitive and social skills and abilities which are expressed in the emotional content of statements [2] and are related to individuals' characteristics as well as the ability to combine emotion with intelligence [3]. This chapter adopts the view of Petrides and Furnham [4], who highlight that emotional intelligence "is a personality trait and is defined as a cluster of behavioral dispositions and self-perceptions related to an individual's ability to identify, process, and use emotionally charged information." In general, the subject of emotional intelligence has permeated a wide range of scientific fields, including the health sector. Emotional intelligence is considered that it may improve the quality and effectiveness of healthcare provided.

Compared to other sectors, the healthcare sector has special features and a high level of difficulty as it is an emotionally charged field. Nursing science is focused on providing nursing care, health promotion and protection, and rehabilitation in critical conditions. Therefore, the main task of nurses is healthcare where emotions are an essential component. Especially in the hospital setting, nurses need to have psychological

reserves as they are in daily contact with a multitude of different emotions including feelings associated with pain, distress, sadness or relief, joy, and hope. Nurse–patient interaction is the cornerstone of nursing practice. Understanding, recognizing, and managing of emotions are key priorities in the nursing practice [5]. Emotional intelligence plays an important role in the formation of successful human relationships and is essential for the development of a therapeutic nurse–patient relationship [6]. Within the scope of their professional duties, nurses are required to manage intense emotional states experienced by patients who feel vulnerable and weak against illness [7]. Nurses must have a professional sensitivity to identify patients' weaknesses while at the same time they must be able to differentiate their emotions from those of patients [8].

In the nursing field, emotional intelligence has been the subject of many studies. Based on the research's content and results, the explored topics include the effect of emotional intelligence on nursing practice, on quality of care, on nurses' stress levels, and mental health. Dimensions of emotional intelligence are related to nurses' willingness to stay in the same profession and to positive outcomes for patients [9]. Also, emotional intelligence was positively related to nurses' job performance, health organizations' performance, and improved clinical outcomes [9, 10]. Studies [11] indicated a positive correlation between the quality of healthcare and emotional adjustment while emotional intelligence is one of the most important determinants of quality of care [12].

Over the last years, a range of Greek studies has explored the role of emotional intelligence in all areas of nursing practice. Most Greek nurses were found to have an adequately high level of emotional intelligence [13]. The fields of emotional intelligence can provide effective ways of professional practice and intervention [3]. Hospital nurses come first in self-awareness, social awareness, and cognitive thinking, which affect the quality characteristics of the care they offer [14].

The care provided by the nurse is a multidimensional and complex concept and is defined as the mental, psychological, spiritual, and physical energy supply in order to meet the patients' needs and promote their well-being [15]. In the nursing

literature, there is no consensus among nurses about the concept of care except for its separation into technical (medical supplies) and emotional (interpersonal) dimensions [16, 17]. In the process of nursing care, the interpersonal dimension of care plays a central role. Patients and nurses interact, share experiences, differentiate, and negotiate. Therefore, communication between nurses and patients is bidirectional and takes place within a relationship which is defined as a therapeutic relationship [18].

The impact of emotional intelligence on nurses' caring behavior is not fully clear, even emotional intelligence is considered to influence nurses' behaviors [19], increase moral intelligence, and improve the quality of nursing care [6]. According to a recent quantitative study in Malaysia which examined the relationship of emotional intelligence and caring behavior among 550 nurses working in public hospitals, only nurses' emotional self-control had an impact on caring activities, on the information shared with the patients and on clinical decision making [20]. These results were similar to other studies regarding the effect of emotional intelligence on nurses' caring behaviors suggesting that this impact must be evaluated with caution since the mentioned relationship is a complex issue [21].

The effect of emotional intelligence on mental healthcare has been also suggested. Mental health nurses must be able to manage and monitor both their own emotions and those of others in order to establish and maintain a therapeutic relationship with their patients [22]. In this way, the importance of the development of emotional intelligence in mental healthcare will be highlighted. Even though emotional intelligence has been found to have a positive effect on mental healthcare, especially in communication and interpretation of emotions as well as in the moral provision of nursing care [8], research data on the relationship between emotional intelligence and caring behaviors are conflicting.

Based on the above, the purpose of this research was to investigate the emotional intelligence and caring behaviors of nurses working on mental health structures and the correlation of emotional intelligence and caring behaviors.

2   Methods

2.1   Study Design and Sample

A cross-sectional study was performed in a sample of nurses and assistant nurses employed in the Psychiatric Hospital of Thessaloniki and its external wards. Thessaloniki is the second capital city of Greece. The inclusion criteria were: (i) be nurses or assistant nurses for at least 1 year. Students of nursing schools were excluded. The sampling method applied was that of convenience sampling. A total of 210 questionnaires were distributed and 191 were received back (response rate 91%).

2.2   Instrument

The research instrument consisted of three parts:

1. The Trait Emotional Intelligence Questionnaire-Short Form (TEIQue-SF). The Greek version of the TEIQue-SF, which has been validated by Petrides and Furnhman [23], was used to assess the degree of emotional intelligence. The TEIQue-SF consists of 30 questions while the answers are given on a 7-point Likert scale ranging from 1 (Strongly disagree) to 7 (Strongly agree). In 15 questions, the rating is reversed. The TEIQue-SF Scale according to its rating gives four sub-scales (factors, dimensions), as follows: (a) well-being, (b) self-control, (c) emotionality, and (d) sociability. The score of the total scale and sub-scales is calculated by adding the individual responses. The scale has been used in several studies in Greece with good internal consistency (Cronbach's Alpha 0.89) [24], in Poland [25] and the Netherlands [26].
2. The Caring Behaviors Inventory (CBI). The Greek version of the Caring Behaviors Inventory-24 (CBI-24) was used to investigate care behaviors [27]. The CBI-24 consists of a total of 24 questions and the answers are given on a 6-point Likert scale rating from 1 (Never) to 6 (Always). Reverse-rated questions do not exist. The CBI-24 yields four sub-scales (factors, dimensions), as follows: (a) Assurance of human (b) Knowledge and skills (c) Respect

to the patient, and (d) Connectedness with the patient. The total score and the sub-scales scores are calculated by adding the individual answers. Higher score values indicate a higher frequency of occurrence and the importance of caring behavior. The internal consistency of the Greek version is very good (Cronbach's Alpha 0.92) [27]. The original version was constructed by Wolf et al. [28] consisted of 42 items while the short version CBI-24 has been used in several studies [29].

3. Finally, nurses were provided a questionnaire with sociodemographic and occupational characteristics namely gender, age, marital status, number of children, educational level, postgraduate qualifications, years of employment, and mental health specialty certification.

2.3 Data Analysis

Statistical analysis was performed using the software package SPSS 19.0 for Windows using the methods of descriptive and inferential statistics. Specifically, the descriptive analysis included the frequency distribution of the variables (absolute and relative [%] frequency) as well as estimates of the location and dispersion parameters of the quantitative variables (mean, standard deviation, median, maximum, and minimum). Inductive analysis to investigate possible correlations included Pearson's correlation coefficient (r) and multiple linear regression. The significance levels were bilateral and the acceptable level of statistical significance was set at 5%.

2.4 Ethics

The researchwas conducted in accordance with the ethical standards of the Helsinki Declaration (1964). Data were collected using an anonymous, fully structured, and self-administered questionnaire. Participants were given oral information about the aim of the study, and how to complete the questionnaire. Nurses voluntarily agreed to participate in the study and signed an information and consent form ensuring that the appropriate research ethical standards are being followed.

3 Results

Table 1 shows the individual characteristics of the nursing staff. A percentage of 29.8% were male and 70.2% female (Table 1).

The internal consistency reliability of the Care Behavior Questionnaire-24 (CBI-24) specified by the coefficient Cronbach's alpha which was $\alpha = 0.94$ for the total scale, (value >0.70), thus indicating very good internal consistency of the questions of the overall scale. Regarding the four subscales of the scale, the coefficient alpha ranged from 0.79 to 0.88.

Regarding the four subscales of TEIQue-SF, the coefficient alpha ranged from 0.50 to 0.71, indicating moderate to very good consistency of the subscale questions. The mean score for the whole TEIQue-SF was 4.92 (SD = 0.60), while the well-being (5.12) and emotionality (5.01) had the highest mean score for the four TEIQue-SF scales followed by self-control (4.75) and finally sociability (4.63). For both the whole TEIQue-SF score and its subscales, the mean and median scores were greater than 4, which is the midpoint of the scale of responses indicating that the majority of the nursing staff of the sample reported high values of emotional intelligence (Table 2).

Regarding the correlation of the TEIQue-SF with the CBI-24, data showed that as the overall emotional intelligence scale of nursing staff increased, so did the frequency and importance of the total CBI-24 and its dimensions subscales (Table 3).

A multiple linear regression analysis was performed to explore the effect of emotional intelligence on caring behaviors among mental health nurses. The regression coefficients (β) for TEIQue-SF subscales scores in CBI-24 domains scores, after controlling for sociodemographic and work-related characteristics, are illustrated in Table 4.

Table 1 Mental health nurses' characteristics (*N* = 191)

Characteristics		*N*	*%*
Gender	Male	57	29.8
	Female	134	70.2
Age (years)	≤39	38	19.9
	40–49	107	56.0
	≥50	46	24.1
	Mean ± SD	44.69 ± 6.41	
Marital status	Single	36	18.8
	Married/cohabitation	132	69.1
	Divorced/widowed	23	12.0
Number of children	0	59	30.9
	1–2	114	59.7
	≥3	18	9.4
Educational level	High school	99	51.8
	University/Technical university	92	48.2
Postgraduate degree	Yes	13	6.8
	No	178	93.2
Working experience in nursing (years)	1–10	29	15.2
	11–20	78	40.8
	≥21	84	44.0
	Mean ± SD	19.50 ± 6.82	
Mental health specialization	Yes	72	37.7
	No	119	62.3

SD standard deviation

Table 2 CBI-24 (Greek version) and TEIQue-SF (Greek version) scales in mental health nurses (*N* = 191)

Scales and domains	Factor ranking	Mean ± SD	Range	Cronbach's Alpha
CBI-24				
Assurance	1	5.22 ± 0.56	3.50–6.00	0.88
Knowledge and skills	2	5.21 ± 0.61	2.60–6.00	0.82
Respectful	3	5.04 ± 0.62	3.50–6.00	0.83
Connectedness	4	4.80 ± 0.67	3.00–6.00	0.79
Overall CBI-24		5.08 ± 0.54	3.58–6.00	0.94
TEIQue-SF				
Well-being	1	5.12 ± 0.83	2.50–7.00	0.71
Self-control	3	4.75 ± 0.75	3.00–7.00	0.50
Emotionality	2	5.01 ± 0.65	3.38–6.63	0.56
Sociability	4	4.63 ± 0.82	2.17–6.67	0.67
Overall TEIQue-SF		4.92 ± 0.60	3.67–6.43	0.84

CBI-24 Caring Behaviors Inventory, *TEIQ-SF* Trait Emotional Intelligence Questionnaire-Short Form, *SD* standard deviation

The results showed that all trait emotional intelligence dimensions were significantly positively associated with all caring behaviors domains, which means that the higher the mental nurses' emotional intelligence, the higher their caring behaviors.

4 Discussion

From the descriptive analysis of the TEIQue-SF, the results showed that the majority of the nursing staff on the sample had relatively high levels

Table 3 Correlation between CBI-24 dimensions and TEIQ-SF-30 subscales

	TEIQue SF-30				
	Well-being	Self-control	Emotionality	Sociability	Overall TEIQue-SF
CBI-24					
Assurance	0.302***	0.305***	0.401***	0.204**	0.402***
Knowledge and skills	0.297***	0.251***	0.330***	0.187**	0.347***
Respectful	0.368***	0.312***	0.381***	0.282***	0.430***
Connectedness	0.325***	0.294***	0.364***	0.244**	0.397***
Overall CBI-24	0.365***	0.331***	0.420***	0.259***	0.448***

Pearson's correlation coefficient (r)
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Table 4 Multiple regression results with CBI-24 dimensions as dependent variables and TEIQ-SF-30 subscales as independent, adjusted for sociodemographic and work-related characteristics of psychiatric nurses

TEIQ-SF-30										
	Well-being		Self-control		Emotionality		Sociability		Overall TEIQue-SF	
CBI-24	β (SE)*	*p*-value	β (SE)*	*p*-value	β (SE)*	*p*-value	β (SE)*	*p*-value	β (SE)*	*p*-value
	0.205	<0.001	0.234	<0.001	0.327	<0.001	0.146	0.003	0.371	<0.001
Assurance	(0.046)		(0.051)		(0.058)		(0.048)		(0.062)	
										7
Knowledge and Skill	0.213	<0.001	0.200	<0.001	0.289	<0.001	0.137	0.010	0.339	<0.001
	(0.050)		(0.056)		(0.064)		(0.053)		(0.069)	
Respectful	0.278	<0.001	0.259	<0.001	0.360	<0.001	0.209	<0.001	0.444	<0.001
	(0.050)		(0.057)		(0.065)		(0.053)		(0.068)	
Connectedness	0.257	<0.001	0.259	<0.001	0.358	<0.001	0.197	0.001	0.432	<0.001
	(0.055)		(0.062)		(0.070)		(0.057)		(0.075)	
	0.234	<0.001	0.235	<0.001	0.333	<0.001	0.170	<0.001	0.393	<0.001
Overall CBI-24	(0.044)		(0.049)		(0.055)		(0.046)		(0.059)	

SE Standard Error
*Regression coefficient (standard error) adjusted for sociodemographic and work-related characteristics

of emotional intelligence. The findings are in line with the results of other Greek surveys of health workers that confirm the existence of a relatively high emotional intelligence [3, 30]. The subscale "Well-being" of TEIQue-SF shows the highest rate [5, 12] and is referred to attributes associated with the mood of the person. Strong emotional well-being helps to make people optimistic, positive-minded, happy, and full. It helps individuals to deal effectively with problems, to high levels of self-esteem and efficiency at work [26]. The self-esteem (sub-factor of wellness), that a mental health nurse has, is very important to be effective at work. It helps nurses to cope with stress in a highly stressful environment and enhances their ability to communicate construc-

tively with the patient and build a therapeutic relationship [31–33].

The subscale emotionality of the TEIQue-SF concerns to traits that refer to an individual's ability to perceive and express feelings. Individuals with high emotionality create and maintain close relationships with their surroundings, and stand out for their ability to understand the other's position, that is, empathy [26]. The high level of emotionality (5.01) and especially nurses' empathy is considered to be particularly positive, as in psychiatric nursing is the basic prerequisite that defines the framework within which the nursing–patient relationship is structured and determines the quality of care. Empathy is a particularly important feature for mental health

nurses because it involves anticipating, recognizing, and meeting the needs of others [34].

The subscale self-control of TEIQue-SF refers to the characteristics associated with the control of a person's feelings, behavior, and desires. The mean of the scale (4.75) is particularly important for the mental health field. People with strong self-control can effectively manage their impulses and desires and respond to pressures and stress [26]. These findings are particularly important as mental health nurses often experience intense interpersonal involvement with both aroused patients and relatives. Factors which may limit self-control are the lack of staff and the high workload especially in the acute departments where the majority of participants of this study work. The results highlight an important stressor that is the subject of many studies [35].

The subscale sociability of TEIQue-SFrefers to traits of interpersonal development and management of emotions. Specifically, sociability concerns the management within the social context of relationships and the social influence of an individual. People with high sociality are good listeners and communicate with clarity and confidence [26]. The findings are positive (4.63) particularly in the field of mental health, where active listening is a necessary component and skill of constructive communication and contributes to the development of a therapeutic relationship [33]. Moreover, therapeutic communication encourages the patient to try out ways of communication and behavior that will lead to psychological development and maturity [36].

From the descriptive analysis of the CBI-24, the results showed that the majority of the nursing staff had fairly high rates of behavioral care. The highest value (5.22) is shown in the subscale Assurance of CBI-24. This scale shows that all the actions needed to relieve symptoms of the disease, such as drug administration, responsiveness, and interest are the priorities of the nursing staff.

The results of the knowledge and skills subscale are considered to be particularly important as the specific subscale (mean: 5.21) except for the application of treatment (medication) and the

handling of equipment (which does not exist in psychiatric departments) includes the ability of nurses to inspire trust and to handle personal data confidentially. Both confidentiality and trust are essential prerequisites for establishing a therapeutic relationship [37]. The overall high score on the respect subscale (mean: 5.04) is of particular importance and interest as it is directly related to emotional intelligence, attentive listening, patient support, and the understanding of emotions (empathy). All of these elements define the context of the therapeutic relationship [31, 36, 37]. The results of the subscale (4.80) Connectedness are of particular importance as they relate to key components of the therapeutic relationship, such as therapeutic time, patient empowerment, counseling, patience, and patient involvement in the nursing care plan [38].

The results from the correlation of the scale of emotional intelligence TEIQue-SF with the behavioral care CBI-24 of nursing staff showed that as the overall emotional intelligence of the nursing staff increased, the frequency of occurrence and importance of all dimensions as well as the overall care behavior increased. In addition, according to the results of multiple linear regression, the dimensions of emotional intelligence are predictive factors of nursing staff caring behaviors exerting a positive effect on them. Based on the results, emotional intelligence is directly related to the frequency of caring behaviors that include an attentive listening, the patience, the responsibility, the sensitivity, the respect, and the recognition of patients as individual [38]. These results are in line with research findings according to which the use of emotional intelligence can provide effective professional practice and intervention [3].

Empirical research argues that emotional intelligence enhances staff effectiveness by prioritizing the subjective assessment of patients [39]. According to the another study [19], emotional intelligence can influence nurses' behaviors toward patients. These behaviors are determined by psychological and sociocultural factors, and, consequently, can influence the

quality of healthcare provided. Also, nurses with a well-developed emotional intelligence can identify the factors associated with improving the quality of patient care [9, 40].

4.1 Limitations

This study was conducted in a hospital in the Thessaloniki area so the results cannot be generalized. In addition, participants completed the questionnaires during their shift and factors such as noise and workload may have an impact on the answers.

5 Conclusion

Due to the nature of their work, mental health nurses spend more time with their patients than their colleagues who work in other areas of healthcare. Therefore, emotional-interpersonal care is primarily the object of their work. The interpersonal relationship which is developed between the nurse and the patient differs from the social and personal relationship and is defined as a therapeutic relationship. Emotional intelligence relates to personal traits such as self-awareness, emotionality, self-control, and communication skills all of which are essential ingredients vital to establish a therapeutic relationship. All of the above characterize a person as emotionally intelligent and are the essence of psychiatric nursing care.

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Investigating Nursing Leadership in Intensive Care Units of Hospitals of Northern Greece and Its Relationship to the Working Environment

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Abstract

Introduction: The relationship between leadership and the work environment has been studied by many authors at the organization level, but not specifically in intensive care units (ICUs). The aim of this study was to investigate the possible relationship between the work environment and nursing leadership in intensive care units.

Methodology: This is a correlation study. The study population consisted of nurses and nursing assistants with at least 6 months of experience in ICUs of Northern Greece hospitals. Data were collected using the Greek version of the Practice Environment Scale of the Nursing Work Index (PES-NWI) and the Multifactor Leadership Questionnaire (MLQ). Statistical analysis of data was done with IBM SPSS v. 22.0.

Results: A total of 64 nurses aged 43.6 ± 6.4 years were included. In the work environment, the dimensions of nursing staff competence (2.4 ± 0.6) and relationships between nursing staff and physicians (2.4 ± 0.6) were higher, and the dimensions of nursing staff involvement in decision-making in hospital (2.3 ± 0.6), nursing authorities on the quality of healthcare (2.2 ± 0.6), and supervisor abilities and support to nursing staff (2.2 ± 0.6) had the lowest score. The highest scores on the leadership questionnaire were personalized interest (2.6 ± 0.8), and exceptional management (passive) (2.6 ± 0.9).

Conclusions: The work environment was not related to nursing leadership. Nurses need individual development plans that include the type of knowledge, skills, attitudes, and values required for leadership. In this context, continuing training centers play an important role because they are responsible for training and developing leaders who are fit for work in intensive care.

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1   Introduction

The work environment of the nurses in the intensive care unit (ICU) is characterized by the complex acuity of patients [1]. Changes in practice, new treatments and technological developments can be overwhelming for both nurses and patients. Providing care in an ICU is going to be affected by environmental conflicts, contradictions, doubts, and ambiguities [2].

Nurses are human beings with basic needs that must be met before providing therapeutic levels of care for prolonged periods [3]. Therefore, the impact of the work environment on the effectiveness of the nurse working in the ICU needs to be carefully evaluated. A healthy working environment of critical care nurses is vital to the outcome of patients [1, 4, 5]. Nursing impacts on 30-day mortality of mechanically ventilated-older adult patients showed that patients with better nursing working environments showed a 30-day mortality reduction of 11% compared to those treated in worse working environments [4].

According to the AACN, the six key standards that a healthy work environment must have are true collaboration, effective decision making, appropriate staffing, meaningful recognition, and authentic leadership [5, 6]. Based on the standards, AACN assesses the work environment of intensive care nurses through online surveys. Research on the work environment of ICU nurses began for the first time in 2006 after the standards were published, later in 2008, and more recently in 2013. The survey includes three questionnaires, the Critical Elements of a Healthy Work Environment survey—one a 32-question Likert-type questionnaire, the belief—statements scale with 4-point response options ranging from strongly disagree (1) to strongly agree (4) and a series of 62 questions examining aspects of the working environment such as perceptions of qual-

ity of care of patients, staffing and work done, job and career satisfaction and career plans, and a 29-question questionnaire requesting demographics for the participant and the organization in which nurse works. Overall, the results of the intensive care nurses' work environment survey show that the health of working conditions in ICUs has declined since 2008 and the collaboration between nurses, nurses and physicians, front-line nurse managers, and managers needs to be ensured a healthy job [5].

2   Materials and Methods

2.1   Aim

The aim of this study was to investigate the possible relationship between the work environment and nursing leadership in intensive care units.

2.2   Study Design

This is a cross-sectional study.

2.3   Participants

The study population consisted of nurses and nursing assistants with at least 6 months of work experience in ICUs. This criterion was set to ensure that participants had the minimum experience in ICU that is required for a proper assessment. This study was performed in ICUs of hospitals in Northern Greece. ICUs are medical and surgical and provide care to adult patients.

2.4   Tools

2.4.1   Greek Version of Practice Environment Scale of the Nursing Work Index (PES-NWI)

The PES-NWI questionnaire includes 31 questions on investigating the work environment of nursing staff in the original version. The Greek

version has removed one question about the nursing process because there is no nursing process in Greece, so the final version contains 30 questions. The questions are answered on a four-point Likert-type scale (strongly disagree, disagree, agree, strongly agree). The lower the score, the greater the presence of characteristics that favor the nursing practice. There are five dimensions: nurse participation in hospital affairs, nursing findings for quality of care, nurse manager ability, leadership and support of nurses, staffing and resource adequacy and collegial nurse–physician relationships [7]. PES-NWI has been translated and validated in Greek population and applied to nursing staff [8].

2.4.2 Multifactor Leadership Questionnaire (MLQ)

The MLQ contains 45 questions—statements. The answers are given on a 5-point Likert-type scale with a minimum score of 0 and a maximum of 4. The 0 corresponds to "not at all," 1 to "rare," 2 to "sometimes," 3 to "frequent," and 4 to "very often, if not always." The questionnaire assesses 12 dimensions of leadership, which are idealized influence (attributed), idealized Influence (behavior), exceptional management (active), exceptional management (passive), inspirational motivation, Laissez-Faire, intellect effort, individualized consideration, effectiveness, dependable reward, and satisfaction. The questionnaire is available free of charge from MindGarden. It has been translated into many different languages and has Cronbach's alpha of greater than 0.70 [9].

2.5 Statistical Analysis

Firstly, descriptive statistics were made. Qualitative variables were calculated in frequencies and percentages, while quantitative as means ± standard deviation. T-test and one-way Anova analysis were performed to compare variables. Finally, multiple logistic regression was performed to find out which factors influence the dimensions of the work environment. Statistical analysis of data was done with IBM

SPSS v. 22.0. A p value of less than 0.05 indicates a significant statistical difference.

3 Results

The demographics and occupational data of participants present in Table 1. The age of participants was 43.6 ± 6.4 years. The total work experience of participants was 16.7 ± 6.3 years, while the work experience of participants in ICUs was 10.4 ± 5.9 years.

3.1 Work Environment

The Cronbach's α of the questionnaire was found to be 0.950 indicating very high reliability. Table 2 presents the dimensions of the working environment questionnaire. Nursing foundations for quality of care (2.4 ± 0.6) and collegial nurse–physician relations (2.4 ± 0.6) had the highest score and nursing foundations for quality of care (2.2 ± 0) and nurse manager ability, leadership, and support of nurses (2.2 ± 0.6) had the lowest score.

3.2 Leadership

The Cronbach's α of the questionnaire was found to be 0.930 indicating very high reliability. Table 3 shows the dimensions of the leadership questionnaire. Individualized consideration (2.6 ± 0.8) and active management-by-exception passive (2.6 ± 0.9) had the highest score, while contingent reward (1.8 ± 0.5) and idealized influence behavior (1.6 ± 0.6) had the lowest score.

Participants attending continuing professional training seminars scored significantly higher on the effectiveness dimension than those who did not (2.6 ± 0.6 vs. 2.2 ± 0.6, $p = 0.043$).

The factors of nursing leadership that affect the dimensions of the working environment are presented in Table 4. Nurse participation in hospital affairs was found to be mainly dependent on collegial nurse–physician relationships

Table 1 Demographics and occupational data of participants

	Variable	N	%
Gender	Males	14	21.9
	Females	50	78.1
Education level	Master	3	4.7
	RN	51	79.7
	Nursing assistants	10	15.6
Attending continuing professional training seminars		46	71,9
N seminars	1	24	52.2
	2–3	21	45.7
	>3	1	2.2

Table 2 Dimensions of work environment

Dimensions	Mean	SD	Minimum	Maximum
Nurse participation in hospital affairs	2.3	0.6	1.1	4
Nursing foundations for quality of care	2.2	0.6	0.4	3.1
Nurse manager ability, leadership, and support of nurses	2.2	0.6	0.8	4
Staffing and resource adequacy	2.4	0.6	0.8	4
Collegial nurse–physician relations	2.4	0.9	0.3	4
Total score	2.3	0.6	0.8	3.6

Table 3 Leadership's dimensions

Dimensions	Mean	SD	Minimum	Maximum
Idealized influence attributed	2.3	0.8	0.5	4
Idealized influence behavior	1.6	0.6	0.25	3
Inspirational motivation	2.4	0.9	0.25	4
Intellectual stimulation	2.5	0.9	0.25	4
Individualized consideration	2.6	0.8	1	4
Contingent reward	1.8	0.5	0.75	3
Active management-by-exception	1.9	0.5	0.25	3.3
Active management-by-exception passive	2.6	0.9	0.5	4
Laissez-Faire	2.5	0.9	0.5	4
Extra effort	2.4	0.8	0.69	4
Effectiveness	2.5	0.6	1.24	3.7
Satisfaction	2.4	0.9	0.22	3.6

($B = 0.463$, 95% CI: 0.357–0.568). Nursing foundations for quality of care were found to be dependent on inspirational motivation ($B = 0.505$, 95% CI: 0.264–0.745). Nurse manager ability, leadership, and support of nurses depend mainly on staffing and resource adequacy ($B = 0.533$, 95% CI: 0.280–0.786). Staffing and resource adequacy were found to be mainly dependent on Laissez-Faire ($B = 0.389$, 95% CI: 0.089–0.689) and collegial nurse–physician relationships were found to be primarily dependent on extra effort ($B = 0.748$, 95% CI: 0.405–1.091).

Table 4 Results of multivariate logistic regression with dependent variable dimensions of the working environment

Variable	B	P	95% CI for B
Nurse participation in hospital affairs			
Collegial nurse–physician relations	0.463	0.000	0.357–0.568
Idealized influence behavior	0.311	0.000	0.215–0.407
Inspirational motivation	0.382	0.000	0.215–0.549
Intellectual stimulation	0.262	0.031	0.024–0.500
Individualized consideration	0.339	0.000	0.215–0.549
Laissez-Faire	0.295	0.013	0.065–0.525
Extra effort	0.271	0.035	0.020–0.522
Effectiveness	0.374	0.004	0.122–0.625
Nursing foundations for quality of care			
Age	0.061	0.008	0.017–0.106
Work experience, years	0.053	0.038	0.003–0.103
Collegial nurse–physician relations	0.349	0.000	0.189–0.509
Inspirational motivation	0.505	0.000	0.264–0.745
Intellectual stimulation	0.365	0.017	0.067–0.664
Active management-by-exception	0.251	0.000	0.163–0.339
Active management-by-exception passive	0.454	0.004	0.153–0.755
Extra effort	0.330	0.000	0.162–0.498
Effectiveness	0.225	0.016	0.043–0.407
Satisfaction	0.351	0.000	0.231–0.471
Nurse manager ability, leadership, and support of nurses			
Staffing and resource adequacy	0.533	0.000	0.280–0.786
Idealized influence attributed	0.495	0.000	0.340–0.650
Individualized consideration	0.215	0.005	0.068–0.363
Laissez-Faire	0.298	0.032	0.027–0.569
Contingent reward	0.327	0.000	0.194–0.460
Extra effort	0.234	0.004	0.076–0.392
Staffing and resource adequacy			
Age	0.046	0.047	0.001–0.091
Collegial nurse–physician relations	0.191	0.028	0.021–0.361
Idealized influence behavior	0.160	0.002	0.063–0.257
Inspirational motivation	0.253	0.048	0.003–0.504
Contingent reward	0.300	0.000	0.176–0.424
Active management-by-exception passive	0.288	0.000	0.157–0.420
Laissez-Faire	0.389	0.012	0.089–0.689
Effectiveness	0.279	0.032	0.024–0.534
Collegial nurse–physician relations			
Age	0.091	0.014	0.019–0.162
Work experience, years	0.085	0.039	0.004–0.165
Idealized influence attributed	0.356	0.000	0.163–0.549
Inspirational motivation	0.195	0.025	0.025–0.365
Intellectual stimulation	0.207	0.045	0.005–0.409
Contingent reward	0.354	0.000	0.187–0.522
Active management-by-exception	0.311	0.000	0.145–0.478
Laissez-Faire	0.296	0.005	0.092–0.500
Extra effort	0.748	0.000	0.405–1.091
Nurse participation in hospital affairs			
Collegial nurse–physician relations	0.463	0.000	0.357–0.568
Idealized influence behavior	0.311	0.000	0.215–0.407

(continued)

Table 4 (continued)

Variable	B	P	95% CI for B
Inspirational motivation	0.382	0.000	0.215–0.549
Intellectual stimulation	0.262	0.031	0.024–0.500
Individualized consideration	0.339	0.000	0.215–0.549
Laissez-Faire	0.295	0.013	0.065–0.525
Extra effort	0.271	0.035	0.020–0.522
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Nursing foundations for quality of care			
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Laissez-Faire	0.389	0.012	0.089–0.689
Effectiveness	0.279	0.032	0.024–0.534
Collegial nurse–physician relations			

4   Discussion

The aim of this study was to investigate the relationship between the work environment and nursing leadership in intensive care units. The highest negative rating means that participants disagreed with the dimensions of the Staffing and resource adequacy and collegial nurse–physician relations environment, and the highest positive rating means that participants agreed with the dimensions of nurse participation in hospital affairs, nursing foundations for quality of care and nurse manager ability, leadership, and support of nurses. As far as leadership, the ICUs in hospitals of Northern Greece are characterized by individualized consideration, passive management, intellectual stimulation, Laissez-Faire, effectiveness, inspirational motivation, extra effort, satisfaction, idealized attributed influence, active management-by-exception, contingent reward and idealized influence behavior.

The results of our study show that the working environment in the ICUs of Northern Greece is marginally favorable. In other studies, in ICUs in

Brazil with the same tool, the working environment has been found to be more favorable [10, 11]. The ICU work environment is quite attractive to nurses. This claim is corroborated by a study conducted in South Korea that investigated nurses' perceptions of working conditions in the hospital and ICU at the same time. The sample consisted of 817 nurses from 39 ICUs in 15 hospitals. The working environment was characterized good by 13.4% of participants, moderate by 66.6%, and poor by 20% of participants. ICUs working environment was rated as good (23.1%), moderate (61.5%), and poor (15.4%) [12].

Some behaviors of nurse managers affect the well-being of ICU nurses and their ability to provide quality care. It has been reported that the supportive behavior of nurse manager creates relationships of trust. The need for nurse managers focusing on "people" and "relationships" has been widely reported in the literature [13, 14] and has been associated with the relational leadership styles, including transformational, authentic, and supportive styles of management. These leadership styles have been associated with improved health and well-being of nurses [15].

In acute care hospitals, leadership strengthening has been shown to increase satisfaction and nurses' stay at work [16]. Researchers have also described how ICU nurses who feel empowered are more likely to stay at work [17]. Sawatzky et al. [17] argue that because increased autonomy is one of the reasons why nurses choose to work in ICUs, reduced autonomy is associated with reduced nursing well-being.

In acute care hospitals, the empowerment via leadership has been shown to increase satisfaction and decrease nurses' turnover [16]. Researchers have also described how ICU nurses who feel empowered are more likely to stay at work [17]. Sawatzky et al. [17] argue this statement because the increased autonomy is one of the reasons why nurses choose to work in ICUs.

Although there is an ongoing growing body of literature supporting empowering leadership styles, some nurse managers do not sufficiently support the well-being of ICU nurses. ICU nurses have identified unsupportive leadership behaviors that could be linked to the "Laissez-faire" leadership style. Such managers try very little to satisfy the needs of the nurses, do not provide them with feedback, and do not include nurses in decision-making [18]. Laissez-faire leadership is problematic due to its negative impacts on nurses' productivity, satisfaction [19], and the quality of care provided [20].

ICUs have been described by nurse managers as stressful workplaces with multiple responsibilities [21], with little available time to build relationships with staff [22] or for professional development [23], without any authority or involvement in decision-making [24] and do not feel the value and support of staff and senior managers [25]. There have been identified various barriers for clinical specialists, as managers and as leaders [13]. In recent decades, the role of the nurse manager has changed dramatically [26] and has been described as one of the most difficult roles [27]. Anxiety experienced by nurse managers due to the complexity of their role has been highlighted and nurse managers have reported that they do not feel prepared and do not receive sufficient support from the organization [28].

Healthy work environments play an important role in the quality of healthcare provided, as recognized by the American Association of Nurses (AACN), which has established six gold standards, each considered necessary and closely linked to excellent nursing practice and care: (1) specialized communication, (2) true collaboration, (3) effective decision-making, (4) appropriate staffing (5) effective recognition, and (6) authentic leadership [29]. Standards intended to provide an autonomous framework for implementing agencies, are evidence-based and use relationships-based principles to guide healthcare professionals. The goal of applying the standards is to improve the elements of the work environment, thereby ultimately improving patient-centered care. Since the implementation of the standards in 2005, however, the overall health of ICU nurses has declined [5].

5 Conclusion

Nurses working in ICUs in Northern Greece supported that there was a shortage of nursing staff and that collegial nurse–physician relations were not good. They agreed that they are involved in hospital affairs and that their managers are capable and supportive. The work environment was not related to nursing leadership. According to the results, nurses need to develop leadership skills. Also, the work environment has no influence on the study population. Thus, nurses need individual development plans that include the kinds of knowledge, skills, attitudes, and values required for leadership. In this context, continuing professional training centers play an important role because they are responsible for training and developing leaders who are suitable for work in intensive care units.

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Health-Related Quality of Life and Rehabilitation Costs of Patients with Amputated Limb

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Abstract

Aim: The aim of this study was the evaluation of health-related quality of life (HRQoL) and rehabilitation costs of patients with amputated limb.

Materials and Methods: This is a cross-sectional study and the study sample, which was a sample of convenience, included 100 patients with amputated limb. The tools of the survey were the Short Form Questionnaire-36 (SF-36) and the Questionnaire used for measuring rehabilitation costs in trauma patients by Stergiannis et al.

Results: The sample of the study consisted of 107 patients with amputation. HRQoL significantly increased ($p < 0.001$) between all-time points. According to the patients' answers, there were zero costs related to rehabilitation 1 year after the amputation. The type of edge amputation had significant impact on the rate of HRQoL increase. Rehabilitation costs increased over time during the first year. The mean (SD) rehabilitation cost was 1372 (2200) € at the first 6 months and 4774 (9109) € at the second half year. HRQoL was associated with age at all-time points and with costs of purchase of special pharmaceuticals, hospitalization, other expenses, number of medical visits, and cost of phone calls.

Conclusions: The economic costs due to the amputation need to be studied as they affect the extent to which an amputated patient can meet his new emerging needs. Therefore, future research should focus in the economic dimension of the amputation in relation with the HRQoL of these patients and their relatives, so that new health policies may be conducted.

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1 Introduction

Amputation is considered necessary in severe ischemia and bone damage that threatens a patient's life. However, the impact on the quality of life and well-being of the patient is very important because it usually causes mental injury [14]. These patients experience a new situation in their lives that includes changes in their mobility, work status, social status, and way of living [1]. The mobility problems that impede the conduction of daily activities also contribute to the failed integration of these patients into society [7]. Age is one of the important factors that affect the health-related quality of life (HRQoL) and especially the younger age, as it is not possible for most of these patients to achieve their goals and ambitions. Therefore, mental disorders such as anxiety and depression are highly prevalent and adversely affect their HRQoL quality of life [5].

Pain plays an important role along with the phantom limb phenomenon in which the patient feels the cut-off body part despite not seeing it and also has the sensation of burning or pain, with varying intensity and frequency [9]. In combination with low self-esteem, psychological symptoms affect the patient's physical and psychosocial rehabilitation, undermining the acquisition of skills that will enhance their HRQoL. All these facts contribute to the patients' refusal to use prosthetic members [2].

The aim of this study was the evaluation of health-related quality of life (HRQoL) of patients with amputated limb and the effect of their injury at their rehabilitation costs.

2 Materials and Methods

This is a cross-sectional study and the study sample, which was a sample of convenience, included 100 patients with amputated limbs from March 2017 to February 2020 at the Trauma hospital "KAT" in Greece. Data collection was conducted every 6 months over 2 years after the amputation, so that changes in the rehabilitation costs and HRQoL of amputee participants could be assessed.

Tools

The main tools of the survey were the Greek Version of the Short Form Questionnaire-36 (SF-36) and the Questionnaire conducted by [11].

The Short Form Questionnaire-36 (SF-36) is designed to assess HRQoL of both patients and the general population and includes questions that examine a person's physical functioning, physical function, physical pain, general health, and well-being, its vitality and social function. It also includes questions about the role of emotions as well as his mental health [6].

The second questionnaire was specifically designed to measure the rehabilitation costs of trauma patients [12]. It includes questions regarding the demographic characteristics of the sample, open questions about the costs of injury and rehabilitation, the loss of income due to work changes or other compulsory costs to deal with the consequences of the injury.

Statistical Analysis

Categorical variables are presented as numbers and percentages, while continuous variables are presented as mean (standard deviation). The Kolmogorov–Smirnov test and graphs (histograms and normal Q–Q plots) were used to test the normality of the distribution of the continuous variables. The T-test and analysis of variance (ANOVA) were applied for the analysis of group differences within continuous variables. The Pearson correlation coefficient was used to estimate correlations between continuous variables. Repeated-measures ANOVAs were used to determine whether observed changes in quality of life and rehabilitation cost were statistically significant among the participants during follow-up.

Multivariate linear regression analysis was used for the identification of the predictive factors that were associated with quality of life and rehabilitation costs. Variables with $p < 0.20$ in bivariate analysis were included in multivariate modeling. A backward stepwise elimination method was used for model development in multivariate linear regression. Criteria for entry and removal of variables were based on the likelihood ratio test, with enter and remove limits set at $p < 0.05$ and $p > 0.10$. Multivariate analysis was

used for the control of each potentially confounding statistically significant factor to the others. The predictive variables were identified in terms of coefficients beta with 95% confidence intervals. A two-sided *p*-value of less than 0.05 was considered statistically significant. Statistical analysis was performed using the Statistical Package for Social Sciences software (IBM SPSS Statistics 25.0 for Windows, SPSS Inc., Chicago, Illinois, USA).

3 Results

The sample of the study consisted of 107 patients with amputation, aged 18 years or older. Seven patients were excluded from the study because they died or did not complete all of the four follow-up evaluations. There were no significant differences between participants and patients who dropped out of the study. Patients' demographic and clinical characteristics are shown in Table 1. According to the patients' answers, there were zero costs related to rehabilitation 1 year after the amputation.

The mean and the standard deviation in all eight dimensions of the HRQoL at 6, 12, 18, and 24 months after the amputation are presented in Table 2. The total HRQoL at 6, 12, 18, and 24 months is graphically displayed in Fig. 1 and the total rehabilitation costs after 6 and 12 months are graphically displayed in Fig. 2.

Table 1 Social-demographic data of patients

Variable	N (%)
Gender	
Male	99 (92.5)
Female	8 (7.5)
Age, year	48.84 (16.69)
Residence	
Urban (Athens/Piraeus)	52 (48.6)
Rural	55 (51.4)
Family status	
Single/widowed	50 (46.7)
Married/domestic partner	57 (53.3)
Presence of children	
Yes	61 (57)
No	46 (43)
Number of children	1.25 (1.39)
Education level	
Illiterate	2 (1.9)
Elementary	25 (23.4)
High school	61 (57)
College	11 (10.3)
Higher	8 (7.5)
Other people living at home	
Yes	17 (15.9)
No	90 (84.1)
Monthly household income, €	
≤1000	20 (27.7)
≥1000	87 (72.3)
Employment status	
Part-time	7 (6.5)
Full-time	69 (64.5)
Retired	22 (20.6)
Unemployed	9 (8.4)

Table 2 Descriptive characteristics of the MOS-HIV scales

	6 months		12 months		18 months		24 months	
	Mean	Std. deviation	Mean	Std. deviation	Mean	Std. deviation	Mean	Std. deviation
General health	35.74	20.96	47.06	26.71	67.03	25.36	70.00	24.64
Vitality	22.28	21.74	36.57	28.32	54.85	29.08	62.15	26.75
Social functionality	15.44	18.79	30.11	27.66	53.06	32.78	62.62	29.86
Physical functionality	32.90	30.35	44.95	35.09	57.50	36.40	64.20	34.09
Mental health	23.66	20.85	34.36	26.01	52.58	27.16	59.08	25.46
Physical role	1.40	10.2	21.19	39.49	34.55	44.92	44.5	47.88
Physical pain	14.88	19.88	28.47	25.38	59.75	25.56	76.00	22.60
Emotional role	8.72	23.04	27.30	42.05	55.23	46.30	69.33	42.81
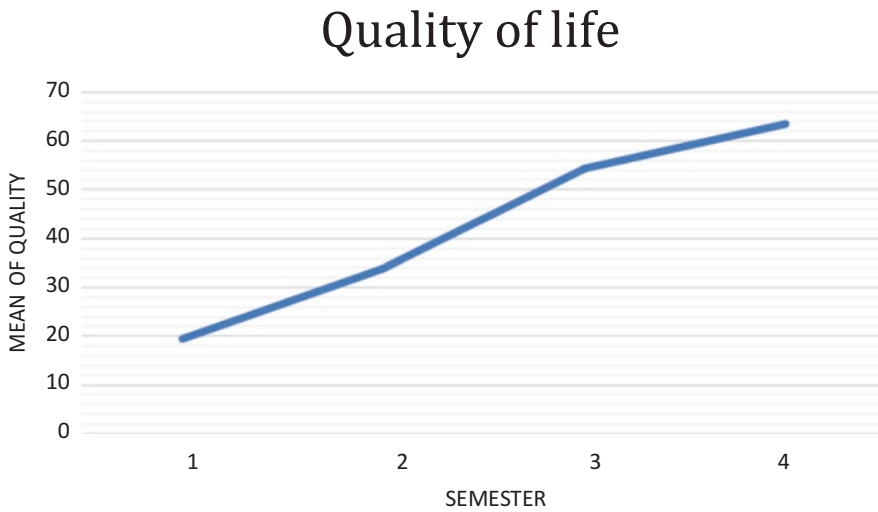
Quality of life

Fig. 1 HRQoL overtime (four measurements)
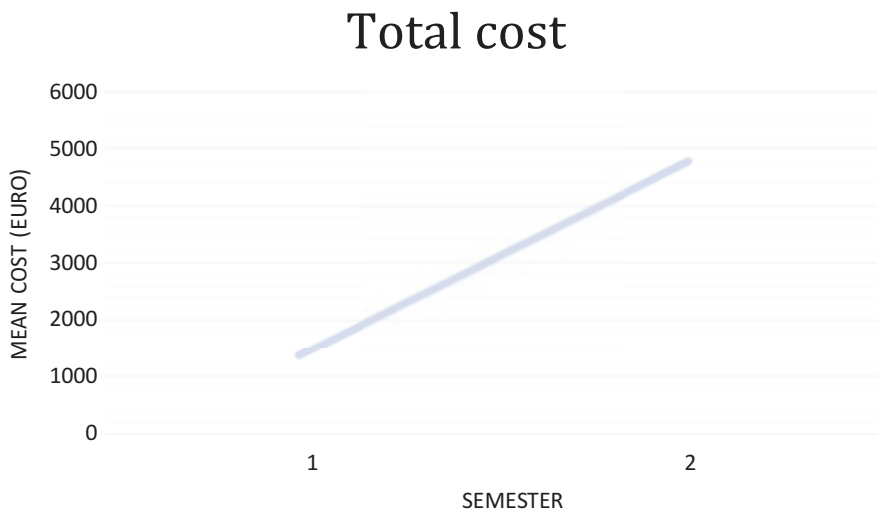
Total cost

Fig. 2 Total cost overtime (two measurements)

Quality of life significantly increased ($p < 0.001$) between all-time points. Repeated-measures ANOVA showed that the type of edge amputation had a significant impact on the rate of HRQoL increase. On the contrary, rehabilitation costs increased overtime during the first year. The mean (SD) rehabilitation cost was 1372 (2200) € at the first 6 months and 4774 (9109) € at the second half-year. The difference was statistically significant ($p < 0.001$).

Multivariate linear regression analysis was performed in the study population to identify factors related to HRQoL. Correlation analysis showed that the use of cosmetics in the first semester ($r = 0.321$, $p < 0.05$), the total cost of phone calls in first semester ($r = -0.214$, $p < 0.05$), other expenses in the first semester (due to illness) ($r = -0.219$, $p < 0.05$), number of medical visits in the first semester ($r = 0.197$, $p < 0.05$), the number ($r = 0.323$, $p < 0.05$) and the cost of purchase ($r = 0.279$, $p < 0.05$) of spe-

Table 3 Days of absence from work and lost income of patients and caregivers

Independent variables	Coefficient b	p
6 months		
Cost of purchase of special pharmaceuticals	−0.28	<0.05
Age	−0.262	<0.05
Hospitalization	5.7	<0.05
12 months		
Cost of purchase of special pharmaceuticals	−0.100	<0.05
Age	−0.459	<0.05
Other expenses (due to illness)	−0.001	<0.05
18 months		
Number of medical visits	6.644	<0.05
Age	−0.447	<0.05
Hospitalization	−0.377	<0.05
24 months		
Cost of phone calls	−0.109	<0.05
Age	−0.391	<0.05
Hospitalization	−0.431	<0.05

cial pharmaceuticals in the first semester the use of cosmetics in the first semester ($r = 0.321$, $p < 0.05$), the use ($r = 0.352$, $p < 0.05$) and the total cost ($r = 0.289$, $p < 0.05$) of cosmetics in the second semester have very low correlation with changes in the quality of life. Although, there was not found a statistically significant correlation between the total costs or rehabilitation along the time and the changes in quality of life. Among other factors, there was also found a lower correlation between age and the quality ($r = -0.221$, $p < 0.05$) or changes ($r = -0.386$, $p < 0.05$) of the quality of life.

The analysis showed that the quality of life was associated with age at all- time points and with cost of purchase of special pharmaceuticals, hospitalization, other expenses (due to illness), number of medical visits, and cost of phone calls as shown in Table 3.

4   Discussion

In this study, an attempt was made to assess the HRQoL of a group of amputated patients, who were regularly monitored by doctors at the Trauma hospital "KAT" in Greece. The main purpose of the research was to find data on the change in HRQoL of this kind of patients in Greece due to the amputation and the additional costs needs arising. Such information is scarce on Greek data and could be important for future research. We evaluated the HRQoL of the patients, according to their responses to the SF-36 questionnaire, in eight dimensions, and the rehabilitation costs according to their responses to the Questionnaire conducted by Stergiannis et al. [12].

Sinha et al. [10] investigated the influence of adjustments to amputation and artificial limb on HRQoL in patients following lower limb amputation. They found that the patients' HRQoL was affected by the amputation. They pointed out that the absence of comorbidity and residual stump pain, being employed, young age, less functional restriction, being more adjusted to limitation, increased social adjustment, and less restriction in athletic activity were related to better physical components of HRQoL scores. Mental components of HRQoL scores were related to the absence of comorbidity and phantom limb pain, nonuse of assistive device, being more adjusted to limitation, increased social adjustment, and being less functionally restricted. Moreover, a study conducted in Brazil found that the time since amputation, male gender and below-knee amputations were predictors of a better perception of quality of life and better adjustment to amputation [3].

A recent review states that a major factor that affects the HRQoL of patients with an amputation is pain. According to the findings of this review, these patients feel pain up to 3 months after the amputation. If the pain persists, it is because it has not been treated properly. Present pain after 6 months of the amputation is related to the problematic fitting prosthesis and, therefore, should be labeled as residual limb pain [13].

A study in the USA estimated the self-reported cognitive concerns in patients with lower limb loss. They found that these patients reported serious cognitive concerns regarding their HRQoL. They concluded that the presence of cognitive concerns in people with lower limp amputation suggests a need to assess perceived cognitive function in order to tailor education and training in prosthetic use and care [4]. Another study points out that the success or failure of lower limb amputation affects the patients' HRQoL. Therefore, a number of factors need to be taken into consideration to ensure holistic reintegration of the amputees back into the society [8].

A cross-sectional international multicenter study used the EQ5D questionnaire to assess HRQoL and reasons for the abandonment of upper limb prostheses of these patients. The results of this study showed that HRQoL was significantly higher in prosthesis users than in nonusers. According to the authors, more prosthesis users were employed compared with nonusers. Care should be taken not to overestimate the QoL of male patients with upper limb loss as their proxies often did [15].

In the second part of our research regarding the rehabilitation costs of patients with amputated limb, it was not possible to compare it with other data in Greece or abroad, as we did not find similar studies conducted in the past. Overall, it was observed that there were burdens on patients' lives with the greatest damage coming from other costs, visits to a psychologist, followed by the burden of loss of income due to absence from work, both for patients and for carers.

Limitations

The main limitations of this study are the relatively small sample size and the fact that the study was conducted in only one hospital. These limitations prevent the investigation of correlations between various research parameters and especially demographic and personal data referring to similar studies.

5   Conclusion

As the amputation affects the HRQoL of the patients, the economic costs due to the amputation need to be studied as they affect the extent to which an amputated patient can access medical care and meet his new emerging needs. Therefore, future research should focus on the economic dimension of the amputation in relation to the HRQoL of these patients and their relatives so that new health policies may be conducted.

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Anxiety and Depression in Hemodialysis: Sex Differences

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Abstract

Introduction: Approach to hemodialysis care from a gender perspective has received a great deal of attention globally since two sexes may have different experiences and manifestations of the same disease. *Purpose*: To explore sex differences in anxiety and depression among hemodialysis patients. *Method and material*: In the study were enrolled 200 patients (100 men and 100 women) who underwent hemodialysis. Data were collected by the completion of "The Hospital Anxiety and Depression Scale (HADS)" which included patients' self-reported characteristics. The statistical significance level was $p < 0.05$. *Results*: In men and women, anxiety was statistically significantly associated with relations with nurses ($p = 0.033$ and $p = 0.001$, respectively), concealment of hemodialysis ($p = 0.013$ and $p = 0.001$, respectively), and insomnia ($p = 0.001$ and $p = 0.001$, respectively). Only in women, anxiety was statistically significantly associated with years under hemodialysis ($p = 0.002$), relation with doctors ($p = 0.001$), and their belief that life had changed ($p = 0.002$), whereas only in men,

anxiety was associated with help in daily activities ($p = 0.001$). In men and women, depression was statistically significantly associated with relations with nurses ($p = 0.002$ and $p = 0.001$, respectively) and dependency on health professionals ($p = 0.001$ and $p = 0.002$, respectively). Only in women, depression was statistically significantly associated with years under hemodialysis ($p = 0.002$), level of information ($p = 0.022$), relations with doctors ($p = 0.001$), concealment of hemodialysis ($p = 0.001$), their belief that life had changed ($p = 0.001$), and insomnia ($p = 0.001$). *Conclusions*: The development of an effective treatment that may alleviate anxiety and depression needs to capture how patients perceive and respond to hemodialysis.

1 Introduction

During recent decades, the approach to care from a gender perspective has received a great deal of attention globally since two sexes may have different experiences of the same disease. Interestingly, care in the hemodialysis from the

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scope of sex is of precious value due to differences in symptoms, and in response to therapy [1].

Sex has been viewed as an important factor influencing the outcome of kidney disease [1, 2] with women to tend to progress to end-stage renal disease (ESRD) at a slower rate than men, regardless of the etiology [1, 3]. Although sex-specific differences in hemodialysis are not deeply understood, some of the potential mechanisms include the differential impact of sex on risk factors of lifestyle and lower disease awareness, which leads to late or no start of dialysis among women [1, 4].

Additionally, sex-specific distinctions have been recognized in those medical conditions, which coexist or contribute to the development of chronic kidney diseases such as obesity, diabetes mellitus type 2, cardiovascular disease, and depression [4]. Other factors involved in sex disparities in hemodialysis may include diet, kidney and glomerular size, differences in glomerular hemodynamics, and the direct effects of sex hormones [2]. More strikingly, men have a higher estimated glomerular filtration rate (eGFR) at the start of dialysis than women [5]. Moreover, women are shown to have a lower probability of receiving arteriovenous anastomosis (AV fistula) than men [6] and are more likely to be kidney donors rather than recipients in national programs [7]. Last but not least, the survival advantage of women over men in the general population is markedly diminished in patients with ESRD [5].

Sex differences are not only observed in ESRD [8, 9]. Also, anxiety and depression share many dissimilarities in regard to sex among hemodialysis patients with female gender to be significantly associated with this psychiatric comorbidity [9]. Women experience pathologic anxiety at a rate approximately twice that of men, which has a significant adverse impact on patients' quality of life since it is perceived as a cause of disability [8].

Anxiety symptoms are more prevalent among females than males [10, 11], whereas males are more likely to show symptoms of depression [11]. A low quality of life among hemodialysis women is partially explained by depression

symptoms [12]. It is not rare that this emotional burden (anxiety/depression) is frequently under-recognized in both sexes. Healthcare providers put less emphasis on these mental disorders and devote little time to effectively assess patients' emotional states, though they are usually aware of this reality [10]. It is reported that only one-third of patients with a diagnosis of depression are receiving treatment [4]. Therefore, research needs to focus on sex differences when exploring vulnerability to anxiety and depression. Integration of gender aspects in hemodialysis management is essential not only to plan therapeutic targets but also to improve current treatment options [9]. To the best of our knowledge, data exploring sex differences regarding anxiety/depression among hemodialysis patients are limited in Greece. Thus, the aim of this cross-sectional study was to explore levels of anxiety/depression in two sexes among hemodialysis patients and the associated self-reported characteristics.

2 Methods and Material

Design, Setting, and Period of the Study

In this study were enrolled 200 patients (100 men and 100 women) undergoing hemodialysis at two hemodialysis units in Athens. This was a cross-sectional descriptive study. The method patients were selected was a convenience sampling.

Sample: Inclusion and Exclusion Criteria

During the period when the research was conducted, from a total of 220 patients who were initially identified as eligible to participate in the study, only 200 were finally enrolled because 20 refused to participate.

Criteria for patients' inclusion in the study were as follows:

1. Age over 18 years
2. Being under hemodialysis
3. Ability to write, read, and understand the Greek language
4. Ability to read and sign the informed consent form

The exclusion criteria were as follows:

1. Patients with a history of mental illness
2. Patients with cognitive disorders and sight or hearing problems

Data Collection and Procedure

The collection of data was performed by the method of interview using a questionnaire, which was developed by the researchers to fully serve the purposes of the study.

Completion of each questionnaire lasted approximately 15 min and took place for each participant after the end of the hemodialysis session. Specifically, the interview was conducted in a private room located in the dialysis department.

The demographic characteristics were sex and age. The self-reported characteristics for each patient included clinical characteristics such as years undergoing hemodialysis, co-existence of other diseases, level of information about health, strict adherence to treatment recommendations, and insomnia. Other self-reported characteristics were: relationship with nurses and medical staff, change in body image, concealment of health problem, help in daily activities, dependence on hemodialysis machines and health professionals, and change in lifestyle.

To explore patients' self-reported characteristics, a 3-point Likert scale was designed as following: 1 = very, 2 = enough, 3 = little/not at all. Only in two questions regarding relations with nurses and medical staff, a 3-point Likert scale was used as follows: 1 = very good, 2 = good, 3 = moderate. Also, patients had to answer some closed-ended type of questions (with only a "yes" or "no" response).

Assessment of Anxiety and Depression

For the evaluation of depression and anxiety of patients, The Hospital Anxiety and Depression Scale (HADS) was used. This scale was proposed in 1983 by Zigmond and Snaith [13]. The scale consists of 14 questions that assess how patients felt during the previous week. Patients could answer every question on a 4-point Likert scale

ranging from 0 to 3. Seven of fourteen questions assess the level of depression and the other seven the level of anxiety. Scores attributed to questions are summed separately for anxiety and depression, leading to two scores with range 0–21. A higher score indicates higher levels of anxiety and depression, respectively. In addition, the following categorization has been proposed, which is also widely used in the literature: score 0–7 indicating no stress or depression, score 8–10 indicating moderate levels of anxiety or depression, and score >11 indicating high levels of anxiety or depression. This categorization was used in this study. The scale HADS had been translated and tested for its validity and reliability in Greek population by Mistakidou et al. [14].

Ethical Considerations

The study was approved by the Ethical Committee of the unit where it was conducted. Patients who met the entry criteria were informed by the researcher for the purposes of this research. All patients participated only after they had given their written consent. Data collection guaranteed anonymity and confidentiality. All subjects had been informed of their rights to refuse or discontinue participation in the study, according to the ethical standards of the Declaration of Helsinki (1989) of the World Medical Association.

Statistical Analysis

The data are presented with absolute and relative (%) frequencies. X2 independence testing was used to test the association between anxiety and depression levels and patients' characteristics. The observed level of significance of 5% was statistically significant. All statistical analyses were performed with version 22 of the SPSS program (SPSS Inc., Chicago, IL, USA).

3   Results

Sample Description

Table 1 shows that 53% of participants were over the age of 60, regardless of sex.

Table 2 presents patients' self-reported clinical characteristics. In more detail, 14% of men

and 44% of women underwent hemodialysis for more than 10 years, while 43% of men and 47% of women have had other co-existed diseases. Moreover, 36% of men and 32% of women reported being well-informed about their problem. Furthermore, 41% of men and 31% of women stated adhering strictly to treatment recommendations while 48% of men and 63% of women reported to have insomnia.

Table 3 presents patients' self-reported characteristics in total and according to sex.

Table 1 Distribution of the sample in total ($n = 200$) and according to sex ($n = 100$)

	Total	Men	Women	
	N (%)	N (%)	N (%)	p-value
Age (years)				0.375
<50	57 (28.5%)	33 (33.0%)	24 (24.0%)	
51–60	37 (18.5%)	20 (20.0%)	17 (17.0%)	
61–70	66 (33.0%)	30 (30.0%)	36 (36.0%)	
71–80	40 (20.0%)	17 (17.0%)	23 (23.0%)	

From the total number of participants, 65% and 70% reported to have very good relationships with nurses and medical staff, respectively. In more detail, 66% of men and 64% of women reported to have very good relationships with nurses, while 73% of men and 67% of women reported to have very good relationships with medical staff.

In addition, in total number, 35% of participants reported to experience a change in body image. Specifically, 34% of men and 36% of women reported to experience a change in body image.

Moreover, in total of participants, 18% reported to conceal their health problems. Specifically, 15% of men and 36% of women reported to conceal their health problems. Furthermore, in total of participants, 59% reported to have a person to help them in daily activities. Specifically, 66% of men and 52% of women reported to have a person to help them in daily activities.

In terms of dependence, in total of participants, 46.5% reported to depend on hemodialysis machines and the 48.5% to depend on health professionals. Specifically, 51% of men and 42% of

Table 2 Patients' clinical characteristics in total ($n = 200$) and according to sex ($n = 100$)

	Total	Men	Women	
	N (%)	N (%)	N (%)	p-value
Years undergoing hemodialysis?				*0.001*
<6 years	90 (45.0%)	54 (54.0%)	36 (36.0%)	
6–10	52 (26.0%)	32 (32.0%)	20 (20.0%)	
>10	58 (29.0%)	14 (14.0%)	44 (44.0%)	
Other diseases				0.570
Yes	90 (45.0%)	43 (43.0%)	47 (47.0%)	
No	110 (55.0%)	57 (57.0%)	53 (53.0%)	
Level of information about health				0.681
Very	68 (34.0%)	36 (36.0%)	32 (32.0%)	
Enough	124 (62.0%)	61 (61.0%)	63 (63.0%)	
A little/not at all	8 (4.0%)	3 (3.0%)	5 (5.0%)	
How strictly do you adhere to treatment recommendations?				0.336
Very	72 (36.0%)	41 (41.0%)	31 (31.0%)	
Enough	108 (54.0%)	50 (50.0%)	58 (58.0%)	
A little/not at all	20 (10.0%)	9 (9.0%)	11 (11.0%)	
Do you have insomnia?				*0.033*
Yes	111 (55.5%)	48 (48.0%)	63 (63.0%)	
No	89 (44.5%)	52 (52.0%)	37 (37.0%)	

Table 3 Patients' self-reported characteristics in total (*n* = 200) and according to sex (*n* = 100)

	Total *N* (%)	Men *N* (%)	Women *N* (%)	*p*-value
Relationship with nurses				0.351
Very good	130 (65.0%)	66 (66.0%)	64 (64.0%)	
Good	62 (31.0%)	32 (32.0%)	30 (30.0%)	
Moderate	8 (4.0%)	2 (2.0%)	6 (6.0%)	
Relationship with medical staff				0.053
Very good	140 (70.0%)	73 (73.0%)	67 (67.0%)	
Good	45 (22.5%)	24 (24.0%)	21 (21.0%)	
Moderate	15 (7.5%)	3 (3.0%)	12 (12.0%)	
Has your body image changed?				0.767
Yes	70 (35.0%)	34 (34.0%)	36 (36.0%)	
No	130 (65.0%)	66 (66.0%)	64 (64.0%)	
Do you conceal your health problem?				0.269
Yes	36 (18.0%)	15 (15.0%)	21 (21.0%)	
No	164 (82.0%)	85 (85.0%)	79 (79.0%)	
Do you have a person to help you with your daily activities?				*0.044*
Yes	118 (59.0%)	66 (66.0%)	52 (52.0%)	
No	82 (41.0%)	34 (34.0%)	48 (48.0%)	
How dependent do you feel on hemodialysis machine?				0.061
Very	93 (46.5%)	51 (51.0%)	42 (42.0%)	
Enough	91 (45.5%)	38 (38.0%)	53 (53.0%)	
A little/not at all	16 (8.0%)	11 (11.0%)	5 (5.0%)	
How dependent do you feel on health professionals?				0.569
Very	97 (48.5%)	52 (52.0%)	45 (45.0%)	
Enough	82 (41.0%)	39 (39.0%)	43 (43.0%)	
A little/not at all	21 (10.5%)	9 (9.0%)	12 (12.0%)	
How much has your lifestyle changed?				*0.024*
Very	82 (41.0%)	49 (49.0%)	33 (33.0%)	
Enough	89 (44.5%)	35 (35.0%)	54 (54.0%)	
A little/not at all	29 (14.5%)	16 (16.0%)	13 (13.0%)	

women reported to depend on hemodialysis machines, while 52% of men and 45% of women reported to depend on health professionals.

Finally, 41% of the participants reported that their life had changed. Specifically, 49% of men and 33% of women reported that life had changed.

Anxiety and Depression Levels

In Table 4, it is observed that in total number of participants 31.5% experienced high levels of anxiety. More specifically, 26% of men and 37% of women experienced high levels of anxiety (statistically significant difference, *p* = 0.040).

In terms of depression, it is observed that in total number of participants 26% experienced high levels. More specifically, 12% of men and 40% of women experienced high levels of depres-

sion (statistically significant difference, *p* = 0.001).

Association Between Patients' Self-Reported Characteristics and Anxiety According To Sex

Table 5 represents patients' self-reported characteristics that were statistically associated with high anxiety levels, separately for men and women.

In men, a statistically significant association was observed between high levels of anxiety and relationships with nurses (*p* = 0.033), as to whether they concealed their health problem (*p* = 0.013), whether they had help in daily activities (*p* = 0.020), and whether they had insomnia (*p* = 0.001). More specifically, male participants who reported to have very good relationships with nurses had high levels of anxiety at a lower

Table 4 Anxiety/depression levels in total ($n = 200$) and according to sex ($n = 100$)

	Total	Men	Women	
	N (%)	N (%)	N (%)	p-value
Anxiety levels				*0.040*
Low	72 (36.0%)	42 (42.0%)	30 (30.0%)	
Moderate	65 (32.5%)	32 (32.0%)	33 (33.0%)	
High	63 (31.5%)	26 (26.0%)	37 (37.0%)	
Depression levels				*0.001*
Low	91 (45.5%)	53 (53.0%)	38 (38.0%)	
Moderate	57 (28.5%)	35 (35.0%)	22 (22.0%)	
High	52 (26.0%)	12 (12.0%)	40 (40.0%)	

percentage (18.2%). Men who concealed their problems and those who had no other person to help them in their daily activities had high levels of anxiety at a higher percentage (53.3% and 38.2%, respectively) than those who did not conceal it and those who had someone to help them (21.2% and 19.7%, respectively). In addition, men who suffered from insomnia (39.6%) experienced a higher level of anxiety than those who do not (13.5%).

In women, a statistically significant association was observed between high levels of anxiety and years under hemodialysis ($p = 0.002$), relationships with nurses and medical staff ($p < 0.001$), whether they concealed their problem ($p < 0.001$), the change in lifestyle ($p = 0.002$) as well as whether they had insomnia ($p = 0.001$). More specifically, female participants undergoing dialysis from 6 to 10 years had high levels of anxiety at a higher percentage (50%). Similarly, women who reported to have moderate relationships with nurses and medical staff had high levels of anxiety at a higher percentage (83.3% and 66.7%, respectively). In addition, women who concealed their problem reported that their lifestyle had changed a lot, and those who suffered from insomnia had high levels of anxiety at a

higher percentage (71.4%, 51.5%, and 47.6%, respectively).

Association Between Patients' Self-Reported Characteristics and Depression In Terms of Sex

Table 6 represents patients' whose self-reported characteristics were statistically associated with high depression levels, separately for men and women.

In men, a statistically significant association was observed between high levels of depression and relationships with nurses ($p = 0.001$) and dependence on health professionals ($p = 0.001$). More specifically, male participants who reported to have very good relationships with nurses had high levels of depression at a lower percentage (7.6%), while those who declared to depend a little or not at all on health professionals had high levels of depression, at a higher percentage (44.4%).

In women, a statistically significant association was observed between high levels of depression and age ($p = 0.006$), years under hemodialysis ($p = 0.002$), level of information ($p = 0.022$), relationships with nurses and medical staff ($p = 0.001$), whether they concealed their health problems ($p = 0.011$), dependence on health professionals ($p = 0.002$), lifestyle change ($p = 0.001$), and whether they had insomnia ($p = 0.001$). More specifically, female participants under the age of 50 and those over the age of 70 had high levels of depression at a higher percentage (45.8% and 47.8%, respectively). Women undergoing dialysis for 6–10 years had high levels of depression at a higher percentage (50%). Similarly, high levels of depression at a higher percentage had women who were a little or not at all informed about their health problem (60%) and those who reported to have moderate relationships with nurses and medical staff (83.3% and 66.7%, respectively). In addition, women who concealed their problem, those who reported to depend a little or not at all on health professionals, those reported their life had changed a lot, and those who had insomnia, had high levels of depression at a higher percentage (66.7%, 83.3%, 63.6%, and 52.4%, respectively).

Table 5 Association between patients' self-reported characteristics and anxiety levels according to sex ($n = 100$)

	Men's anxiety levels			p-value	Women's anxiety levels			
	Low	Mean	High		Low	Mean	High	
	N (%)	N (%)	N (%)		N (%)	N (%)	N (%)	p-value
Age				0.193				0.503
<50	11 (33.3%)	13 (39.4%)	9 (27.3%)		7 (29.2%)	6 (25.0%)	11 (45.8%)	
51–60	5 (25.0%)	7 (35.0%)	8 (40.0%)		7 (41.2%)	5 (29.4%)	5 (29.4%)	
61–70	15 (50.0%)	9 (30.0%)	6 (20.0%)		12 (33.3%)	14 (38.9%)	10 (27.8%)	
71–80	11 (64.7%)	3 (17.6%)	3 (17.6%)		4 (17.4%)	8 (34.8%)	11 (47.8%)	
Years under hemodialysis				0.319				*0.002*
<6 years	26 (48.1%)	13 (24.1%)	15 (27.8%)		19 (52.8%)	8 (22.2%)	9 (25.0%)	
6–10	11 (34.4%)	12 (37.5%)	9 (28.1%)		5 (25.0%)	5 (25.0%)	10 (50.0%)	
>10	5 (35.7%)	7 (50.0%)	2 (14.3%)		6 (13.6%)	20 (45.5%)	18 (40.9%)	
Other diseases				0.994				0.789
Yes	18 (41.9%)	14 (32.6%)	11 (25.6%)		13 (27.7%)	15 (31.9%)	19 (40.4%)	
No	24 (42.1%)	18 (31.6%)	15 (26.3%)		17 (32.1%)	18 (34.0%)	18 (34.0%)	
Information about health problem				0.696				0.485
Very	16 (44.4%)	10 (27.8%)	10 (27.8%)		8 (25.0%)	11 (34.4%)	13 (40.6%)	
Enough	24 (39.3%)	22 (36.1%)	15 (24.6%)		22 (34.9%)	20 (31.7%)	21 (33.3%)	
A little/not at all	2 (66.7%)	0 (0.0%)	1 (33.3%)		0 (0.0%)	2 (40.0%)	3 (60.0%)	
How strictly do you adhere to treatment recommendations?				0.251				0.294
Very	21 (51.2%)	9 (22.0%)	11 (26.8%)		10 (32.3%)	9 (29.0%)	12 (38.7%)	
Enough	18 (36.0%)	18 (36.0%)	14 (28.0%)		19 (32.8%)	21 (36.2%)	18 (31.0%)	
A little/not at all	3 (33.3%)	5 (55.6%)	1 (11.1%)		1 (9.1%)	3 (27.3%)	7 (63.6%)	
Relationship with nurses				*0.033*				*0.001*
Very good	32 (48.5%)	22 (33.3%)	12 (18.2%)		26 (40.6%)	25 (39.1%)	13 (20.3%)	
Good	10 (31.3%)	10 (31.3%)	12 (37.5%)		4 (13.3%)	7 (23.3%)	19 (63.3%)	
Moderate	0 (0.0%)	0 (0.0%)	2 (100.0%)		0 (0.0%)	1 (16.7%)	5 (83.3%)	

(continued)

Table 5 (continued)

	Men's anxiety levels			p-value	Women's anxiety levels			
	Low	Mean	High		Low	Mean	High	
	N (%)	N (%)	N (%)		N (%)	N (%)	N (%)	p-value
Relationship with medical staff				0.401				*0.001*
Very good	34 (46.6%)	22 (30.1%)	17 (23.3%)		27 (40.3%)	25 (37.3%)	15 (22.4%)	
Good	8 (33.3%)	8 (33.3%)	8 (33.3%)		0 (0.0%)	7 (33.3%)	14 (66.7%)	
Moderate	0 (0.0%)	2 (66.7%)	1 (33.3%)		3 (25.0%)	1 (8.3%)	8 (66.7%)	
Change in body image				0.363				0.167
Yes	12 (35.3%)	14 (41.2%)	8 (23.5%)		11 (30.6%)	8 (22.2%)	17 (47.2%)	
No	30 (45.5%)	18 (27.3%)	18 (27.3%)		19 (29.7%)	25 (39.1%)	20 (31.3%)	
Concealment of health problem				*0.013*				*0.001*
Yes	6 (40.0%)	1 (6.7%)	8 (53.3%)		4 (19.0%)	2 (9.5%)	15 (71.4%)	
No	36 (42.4%)	31 (36.5%)	18 (21.2%)		26 (32.9%)	31 (39.2%)	22 (27.8%)	
Help in daily activities				*0.020*				0.085
Yes	34 (51.5%)	19 (28.8%)	13 (19.7%)		19 (36.5%)	19 (36.5%)	14 (26.9%)	
No	8 (23.5%)	13 (38.2%)	13 (38.2%)		11 (22.9%)	14 (29.2%)	23 (47.9%)	
Dependence on hemodialysis machine				0.934				0.878
Very	20 (39.2%)	16 (31.4%)	15 (29.4%)		11 (26.2%)	16 (38.1%)	15 (35.7%)	
Enough	17 (44.7%)	12 (31.6%)	9 (23.7%)		17 (32.1%)	16 (30.2%)	20 (37.7%)	
A little/not at all	5 (45.5%)	4 (36.4%)	2 (18.2%)		2 (40.0%)	1 (20.0%)	2 (40.0%)	
Dependence on health professionals				0.292				0.057
Very	19 (36.5%)	17 (32.7%)	16 (30.8%)		16 (35.6%)	15 (33.3%)	14 (31.1%)	
Enough	20 (51.3%)	13 (33.3%)	6 (15.4%)		12 (27.9%)	18 (41.9%)	13 (30.2%)	
A little/not at all	3 (33.3%)	2 (22.2%)	4 (44.4%)		2 (16.7%)	0 (0.0%)	10 (83.3%)	
Change in lifestyle				0.178				*0.002*
Very	15 (30.6%)	20 (40.8%)	14 (28.6%)		4 (12.1%)	12 (36.4%)	17 (51.5%)	
Enough	19 (54.3%)	9 (25.7%)	7 (20.0%)		17 (31.5%)	17 (31.5%)	20 (37.0%)	
A little/not at all	8 (50.0%)	3 (18.8%)	5 (31.3%)		9 (69.2%)	4 (30.8%)	0 (0.0%)	
Insomnia				*0.001*				*0.001*
Yes	9 (18.8%)	20 (41.7%)	19 (39.6%)		7 (11.1%)	26 (41.3%)	30 (47.6%)	
No	33 (63.5%)	12 (23.1%)	7 (13.5%)		23 (62.2%)	7 (18.9%)	7 (18.9%)	

Table 6 Association between patients' self-reported characteristics and depression levels according to sex (*n* = 100)

	Men's depression levels			*p*-value	Women's depression levels			
	Low	Moderate	High		Low	Moderate	High	
	N (%)	*N* (%)	*N* (%)		*N* (%)	*N* (%)	*N* (%)	*p*-value
Age				0.057				*0.006*
<50	20 (60.6%)	11 (33.3%)	2 (6.1%)		7 (29.2%)	6 (25.0%)	11 (45.8%)	
51–60	8 (40.0%)	11 (55.0%)	1 (5.0%)		7 (41.2%)	5 (29.4%)	5 (29.4%)	
61–70	15 (50.0%)	11 (36.7%)	4 (13.3%)		12 (33.3%)	14 (38.9%)	10 (27.8%)	
71–80	10 (58.8%)	2 (11.8%)	5 (29.4%)		4 (17.4%)	8 (34.8%)	11 (47.8%)	
Years of dialysis				0.237				*0.002*
<6 years	31 (57.4%)	14 (25.9%)	9 (16.7%)		19 (52.8%)	8 (22.2%)	9 (25.0%)	
6–10	16 (50.0%)	14 (43.8%)	2 (6.3%)		5 (25.0%)	5 (25.0%)	10 (50.0%)	
>10	6 (42.9%)	7 (50.0%)	1 (7.1%)		6 (13.6%)	2 (45.5%)	1 (40.9%)	
Other diseases				0.231				0.054
Yes	1 (44.2%)	1 (44.2%)	(11.6%)		1 (27.7%)	1 (31.9%)	1 (40.4%)	
No	3 (59.6%)	1 (28.1%)	(12.3%)		1 (32.1%)	1 (34.0%)	1 (34.0%)	
Level of information about health				0.353				*0.022*
A lot	2 (63.9%)	1 (30.6%)	2 (5.6%)		8 (25.0%)	11 (34.4%)	13 (40.6%)	
Enough	28 (45.9%)	23 (37.7%)	10 (16.4%)		22 (34.9%)	20 (31.7%)	21 (33.3%)	
A little/not at all	2 (66.7%)	1 (33.3%)	0 (0.0%)		0 (0.0%)	2 (40.0%)	3 (60.0%)	
How strictly do you adhere to treatment recommendations?				0.422				0.133
A lot	25 (61.0%)	13 (31.7%)	3 (7.3%)		10 (32.3%)	9 (29.0%)	12 (38.7%)	
Enough	25 (50.0%)	17 (34.0%)	8 (16.0%)		19 (32.8%)	21 (36.2%)	18 (31.0%)	
A little/not at all	3 (33.3%)	5 (55.6%)	1 (11.1%)		1 (9.1%)	3 (27.3%)	7 (63.6%)	
Relationship with nurses				*0.001*				*0.001*
Very good	38 (57.6%)	23 (34.8%)	5 (7.6%)		26 (40.6%)	25 (39.1%)	13 (20.3%)	
Good	15 (46.9%)	12 (37.5%)	5 (15.6%)		4 (13.3%)	7 (23.3%)	19 (63.3%)	
Moderate	0 (0.0%)	0 (0.0%)	2 (100.0%)		0 (0.0%)	1 (16.7%)	5 (83.3%)	

(continued)

Table 6 (continued)

	Men's depression levels			p-value	Women's depression levels			
	Low	Moderate	High		Low	Moderate	High	
	N (%)	N (%)	N (%)		N (%)	N (%)	N (%)	p-value
Relationship with medical staff				0.570				*0.001*
Very good	39 (53.4%)	25 (34.2%)	9 (12.3%)		27 (40.3%)	25 (37.3%)	15 (22.4%)	
Good	12 (50.0%)	10 (41.7%)	2 (8.3%)		0 (0.0%)	7 (33.3%)	14 (66.7%)	
Moderate	2 (66.7%)	0 (0.0%)	1 (33.3%)		3 (25.0%)	1 (8.3%)	8 (66.7%)	
Change in body image				0.635				0.744
Yes	16 (47.1%)	14 (41.2%)	4 (11.8%)		11 (30.6%)	8 (22.2%)	17 (47.2%)	
No	37 (56.1%)	21 (31.8%)	8 (12.1%)		19 (29.7%)	25 (39.1%)	20 (31.3%)	
Concealment of health problem				0.161				*0.011*
Yes	7 (46.7%)	4 (26.7%)	4 (26.7%)		6 (28.6%)	1 (4.8%)	14 (66.7%)	
No	46 (54.1%)	31 (36.5%)	8 (9.4%)		32 (40.5%)	21 (26.6%)	26 (32.9%)	
Help in daily activities				0.174				0.243
Yes	39 (59.1%)	19 (28.8%)	8 (12.1%)		22 (42.3%)	8 (15.4%)	22 (42.3%)	
No	14 (41.2%)	16 (47.1%)	4 (11.8%)		16 (33.3%)	14 (29.2%)	18 (37.5%)	
Dependence on dialysis machine				0.118				0.121
A lot	21 (41.2%)	22 (43.1%)	8 (15.7%)		15 (35.7%)	7 (16.7%)	20 (47.6%)	
Enough	25 (65.8%)	11 (28.9%)	2 (5.3%)		23 (43.4%)	12 (22.6%)	18 (34.0%)	
A little/not at all	7 (63.6%)	2 (18.2%)	2 (18.2%)		0 (0.0%)	3 (60.0%)	2 (40.0%)	
Dependence on health professionals				*0.001*				*0.002*
A lot	22 (42.3%)	23 (44.2%)	7 (13.5%)		20 (44.4%)	6 (13.3%)	19 (42.2%)	
Enough	29 (74.4%)	9 (23.1%)	1 (2.6%)		18 (41.9%)	14 (32.6%)	11 (25.6%)	
A little/not at all	2 (22.2%)	3 (33.3%)	4 (44.4%)		0 (0.0%)	2 (16.7%)	10 (83.3%)	
Change in lifestyle				0.166				*0.001*
A lot	20 (40.8%)	22 (44.9%)	7 (14.3%)		6 (18.2%)	6 (18.2%)	21 (63.6%)	
Enough	24 (68.6%)	8 (22.9%)	3 (8.6%)		21 (38.9%)	14 (25.9%)	19 (35.2%)	
A little/not at all	9 (56.3%)	5 (31.3%)	2 (12.5%)		11 (84.6%)	2 (15.4%)	0 (0.0%)	
Insomnia				0.079				*0.001*
Yes	20 (41.7%)	20 (41.7%)	8 (16.7%)		14 (22.2%)	16 (25.4%)	33 (52.4%)	
No	33 (63.5%)	15 (28.8%)	4 (7.7%)		24 (64.9%)	6 (16.2%)	7 (18.9%)	

4   Discussion

Results showed that 26% of men and 37% of women experienced high levels of anxiety, and 12% of men and 40% of women experienced high levels of depression. Females usually tend to be more anxious with more suicidal thoughts than males [10]. Greek females had significantly higher scores than males in trait anxiety as measured by the State-Trait Anxiety Inventory [15]. Gerogianni et al. [9], who explored 414 patients on hemodialysis (262 males) from 24 dialysis centers in Greece with the mean time of dialysis being 36 months, showed that depression and anxiety were significantly associated with female gender. Similarly, a study conducted in Korea illustrated higher depression in women aged ≥65 years than in men regardless of the disease stage [10, 16].

Women are at higher risk for depression and the female-to-male ratio for depression is approximately 2:1 [10]. Indeed, from early adolescence until adulthood, women are twice as likely as men to experience depression through many different pathways, but this area still remains obscure. Sex is a valuable source to examine basic human processes in psychopathology [17, 18].

Also, coping styles may be different in women since they have the tendency to respond to stress with rumination by focusing inward on personal concerns rather than taking action to relieve their distress. Individuals who ruminate in response to stress are at increased risk to develop depressive disorders over time. Rumination may impair problem solving, and thus preventing women from taking action to overcome the stressors they face [18]. Understanding sex differences in depression is important because high rates of depression adversely affect the quality of life for women and their families. Also, it is essential to explore sex differences in anxiety and depression across cultures and ethnicities [17, 18].

Women who underwent hemodialysis from 6 to 10 years experienced high levels of depression and anxiety. A possible explanation is that women are more likely to fall behind on social activities and become socially isolated due to hemodialysis [10]. An alternative suggestion is that women may suffer significant medical conditions prior to hemodialysis, which deteriorate their health as the years on hemodialysis increase.

Shah et al. [4], who explored 885.699 patients (mean age 65 ± 14) and initiated hemodialysis, showed women to have higher rates of obesity (43.5% vs. 33.6%), diabetes mellitus (59.3% vs. 55.1%), and heart failure (35.7% vs. 34.2%) compared to men as well as to have higher rates of poor functional status (18.6% vs. 14.5%). Additionally, more frequent in females were low albumin <3.5 (51.8% vs. 50.1%) and low hemoglobin <11 (72.4% vs. 69.3%). Another possible contributor to the depression is that the severity of chronic kidney disease may be recognized later in women, resulting in a delayed referral to a nephrologist and in turn in a delay of initiating hemodialysis. Consequently, women enter hemodialysis at a more severe stage [6]. Furthermore, after the start of hemodialysis, the hospitalization rates are consistently higher for women with greatest differences in younger age groups. In more detail, women aged 18–34 years and those ≥75 years have 54% and 14% higher hospitalization rates, respectively, than men of the same ages. Also, women are at a higher risk for 30-day readmission than men. Increased hospitalization among women may serve as an indicator of a higher burden of coexisting illnesses [19, 20]. Interventions targeting to reduce differences in hospitalizations by sex for patients undergoing dialysis could have a substantial effect on healthcare costs. For example, if women experienced the same hospitalization rate as men of the same age, then more than 30,000 hospitalizations would have been averted over 5 years [20].

Last but not least, treatment-related areas may explain sex differences. In more detail, women have different responses to drugs as a result of physiological differences in body weight, height, body surface area, and total body water. Women require lower drug dosages, but treatments are universal and drug dosage is often not individualized according to the sex. Therefore, overdosing is a principal cause of drug-related adverse outcomes among women in both hospital and ambulatory care [1, 20, 21].

Results also revealed that women reporting a change in their life experienced higher levels of anxiety and depression. Societies strictly define social roles. For example, men are responsible for financial responsibilities and women are responsible for domestic duties [22, 23]. Needless to say, the role of women in the family across all societies of the world is well known. It is not rare that women place more importance on the family's health than their own. Impressively, the type of household (families of more than three members) may result up to some extent in elevated levels of stress due to care-giving responsibilities [1]. Women's social roles also carry a number of chronic strains that might contribute directly or indirectly to depression. Women's tendency to be concerned with the status of their relationships and the opinions others hold of them is one consistent difference in males' and females' concerns [18].

Additionally, the more stress women suffer, the more hyperresponsive to stress they become, thus impairing their ability to control their environments and overcome their stress. At the same time, depression may exacerbate stressful experiences such as hemodialysis by interfering with occupational and social functioning, and undermining a sense of mastery the women had [18].

The way women interpret hemodialysis within the context of their current state may explain the association between depression and the report of women that life changed. In more detail, when women comprehend that they are not able to fulfill their prior family or social roles, they experience a heavy emotional burden. Hemodialysis women with poor social support and lower income are at risk of depression [22]. At one point, increase of support from significant others, family, and friends was found to reduce by 77%, 71%, and 56%, respectively, the probability of experiencing high levels of depression [24]. Moreover, the more support hemodialysis patients have from their significant others, family, and friends, the better quality of life they also have [25]. Treatment methods, including pharmacological therapy, cognitive-behavioral therapy, regular exercise, and relaxation techniques

as well as social support, spirituality and religiosity, and participation in network support groups frequently lead to a reduction of anxiety and depression symptoms [9].

Results also revealed that in both sexes, anxiety was statistically significantly associated with dependency on healthcare professionals. Hemodialysis is an unpleasant and time-consuming experience, since patients are obliged to stay in dialysis units approximately 3 or 4 h for each session and three times each week. Health professionals are those who maintain patients' life by using hemodialysis machines, thus helping patients to lead a technologically sustained life. No matter how innovative the hemodialysis device may be, if it is not handled by a competent health professional then its usage may not maximize patients' benefit. Dependency on health professionals means a loss of freedom that disrupts normal life but at the same time is necessary to maintain life. Dependency on machines and health professionals along with time spent in dialysis centers entails major burden for patients [26]. It is not rare that patients experience a state of conflict between dependency on others including machines and a desire to be independent [27]. Given that dependency or inability to perform daily activities may lead to patients' social isolation, it is then easily understandable that nurses should allow patients to perform their daily activities alone, as far as this activity does not jeopardize their safety [27].

In both sexes, anxiety was statistically significantly associated with concealment of their health problems. This finding supports the interesting possibility that patients do not want to be pitied or they may be upset about losing their social relationships [27]. It is noteworthy that patients perceive hemodialysis as a disaster and live under a shock or crisis [28]. Chronicity associated with the disease leads to possible changes of life, values, beliefs, habits, and knowledge. Furthermore, it provides a culture associated with being closer to death, or a culture of a social stigma and is, therefore, marginalized [29].

In men and women, anxiety was associated with insomnia whereas depression was associated with insomnia only in women. Similarly,

Firoz et al. [30], who explored 310 patients undergoing hemodialysis, demonstrated poor sleep quality in 73.5% of hemodialysis patients, which was found to be associated with female sex, with aging and reduced frequency of weekly hemodialysis. Apart from psychological factors (e.g., anxiety, depression), sleep quality is affected by physical factors (e.g., uremia, itching, anemia), and lifestyle factors (e.g., timing of hemodialysis) [30]. Hamzi et al. [31] showed that insomnia was associated with female gender and time under dialysis with the most frequent disorders to be waking up at night (90%), difficulty falling asleep (60%), and daytime sleepiness (60%). A prior study by Paparrigopoulos et al. [32] showed that independent predictors associated with insomnia in ESRD patients were female sex and depression as measured by HADS. While sleep is essential to physical and psychological health in all individuals including hemodialysis patients, whereas sleep disorders adversely affect the quality of life [33].

Strength and Limitations

The method of the present study was convenience sampling and therefore was not representative of hemodialysis patients in Greece. Moreover, it was a cross-sectional study, thus not allowing the emergence of a causal relation between anxiety/depression and patients' self-reported characteristics.

The strength of the study is that HADS is easy to interpret, is widely accepted, is used in a number of populations, and patients may complete this questionnaire within few minutes. This instrument may permit comparisons between populations all over the world.

5   Conclusion

A multidisciplinary team of healthcare professionals, including nephrologists, primary-care physicians, mental health professionals, as well as the dialysis unit staff, is essential in helping patients with anxiety and depression to resolve problems according to their sex. An in-depth

understanding of sex dissimilarities among hemodialysis has important clinical implications when developing effective interventions.

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Patient Knowledge, Adherence to the Therapeutic Regimen, and Quality of Life in Hemodialysis

Knowledge, Adherence, and Quality of Life in Hemodialysis

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Abstract

The aim of this study was to investigate the effect of patients' knowledge on adherence to the hemodialysis regimen and Quality of Life (QoL) of patients undergoing hemodialysis as well as the effect of adherence on QoL. Also, the effect of demographic and clinical charac-

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teristics on the above three variables was studied**.** In this cross-sectional study conducted between March and May 2017, 321 patients on hemodialysis from six hemodialysis units completed the Kidney Disease Questionnaire, the GR-Simplified Medication Adherence Questionnaire and the Missoula Vitas Quality of Life Index-15 to measure the patient knowledge, the adherence to hemodialysis regimen, and the QoL, respectively. The statistical analysis was performed via the Statistical Program SPSS 19.0. The statistical significance level was set up at 0.05. The knowledge was independently associated with the overall QoL and its dimension—transcendence—with total adherence and its dimension—diet/fluid adherence. The total adherence was independently associated with overall QoL and its dimensions—symptoms and interpersonal. The educational level, the type of vascular access, and the daily number of pills were independently associated with the total adherence and the overall QoL. Patient knowledge may have an important effect on adherence and QoL. Adherence may have an important effect on QoL. Demographic and clinical characteristics play, also, a crucial role in the above variables. The findings can help nephrology nurses

to quantify the extent of non-adherence in hemodialysis and poor quality of life.

1   Introduction

End-stage renal disease (ESRD) is a long-term exhausting disease which results in significant limitations on physical and psychosocial well-being and interferes with patients' ability to live normal life [1]. Patients with ESRD should undergo a hemodialysis (HD) program three times a week. Although advances in dialysis technology have changed the characteristics of dialysis, there are still serious dietary and fluid restrictions, fatigue [2], weakness, pain [3], discomfort, itching [4], loss of time, clinical complications, and high mortality [5]. Renal replacement therapy can cause changes in sexual desire, in social status, by limiting opportunities and memory impairment [6]. The patient undergoing HD experiences loss of previous social and family roles, dependency on others, family stress, low self-esteem, insecurity, disturbed body image, and depression [7].

The success of an HD program requires adherence to the therapeutic regimen. It is estimated that about 50% of patients undergoing HD have poor adherence to the treatment regimen [8]. According to the National Kidney Foundation-Kidney Disease Outcomes Quality Initiative [9], non-adherence to HD regimen includes: (a) excessive intake of fluids and foods containing phosphorus and potassium, (b) omitting or shortening of the duration of the HD session, and (c) non-adherence to medication treatment. Especially, regarding the non-adherence to phosphate binders is defined as skipping >3 times in the past month [10]. The average prescription medication for a patient undergoing HD is 11–12, while the average number of tablets per day is 17–25 [11, 12]. In particular, with regard to phosphate binders, the rate of non-adherence ranges

from 22% to 74% and can lead to hyperphosphatemia, renal osteodystrophy, and secondary hyperparathyroidism. It is higher (24%) in the USA and lower (12%) in Europe and Japan [10]. The burden on the patient is due to factors such as the size of the pill, its form (capsule or tablet), the method of ingestion (swallowing or chewing), and ingestion during meals [13]. Non-adherence to fluid restrictions is estimated at 9% (Interdialytic Weight Gain ≥5.7% of dry weight) and can cause hypertension, dyspnoea, pulmonary edema, and heart failure. On the other hand, missed HD sessions (≥1 HD sessions in the past 4 months) are estimated from 1% in Italy and Japan to 24% in the USA [14] and shortening of HD sessions at 49% (≥1 HD sessions for ≥10 min). In general, non-adherence to HD regimen varies in countries and depends on the dimension of non-adherence in each sector. Non-adherence to the above areas leads to increased levels of serum urea, loss of muscle mass, and low cognitive function. In addition, it is associated with poor adjustment to HD, anxiety, and low quality of life [15]. Considering that these data are derived from patient self-reports, the real extent of the problem may be greater [16].

Studies have shown that many patients undergoing HD do not have sufficient knowledge to adhere to treatment recommendations [17]. It makes sense to think that the better informed a patient is about the disease, the more adherent he or she will be. In addition, the patient is not expected to adhere to a treatment plan that he does not understand. In a study conducted in Egypt, patients undergoing HD with low knowledge had higher levels of serum phosphorus than those with higher levels of knowledge [13]. However, studies have shown that knowledge is not always associated with adherence. Although the knowledge about the requirements of the treatment (i.e., "when" and "how"), is closely related to adherence, the acquisition of knowledge does not necessarily mean increasing adherence [19].

In addition to adherence, studies demonstrate that patient knowledge is associated with increased QoL among patients undergoing HD. A study investigating the role of nutritional knowledge in QoL showed that patients undergoing HD who had been educated in nutritional issues had

significantly higher scores in several dimensions of QoL than those who had not been [20]. Patients undergoing HD with a high level of knowledge seem to effectively manage their disease, accept the therapeutic regimen, and have improved perceived QoL [21].

Apart from the above, many demographic and clinical factors have been found to be related to non-adherence in HD and quality of life such as the age [22, 23], the gender [22], the educational level [24], occupational status [23], and marital status [25].

Based on the above, the purpose of this study was to investigate (i) the effect of patient knowledge on adherence to the HD regimen and QoL (*independent variable*: knowledge, *dependent variables*: adherence and QoL, (ii) the effect of adherence to the HD regimen on QoL (*independent variable*: adherence, *dependent variable*: QoL), and the effect of demographic and clinical characteristics in patient knowledge, adherence, and QoL (*independent variables*: demographic and clinical characteristics*, dependent variables*: knowledge, adherence, and QoL) (Fig. 1). This is the first study exploring the levels and the interaction of the above variables not only in Greece but internationally. Also, it is a unique study exploring these three variables among patients undergoing HD.

2   Methods

2.1   Study Participants

This cross-sectional study was carried out from March 2017 to May 2017. The participants became from six HD units in the broad area of Attica, Peloponnese, and Thessaly which are the most populated counties in Greece. The inclusion criteria were:

(a) having been on HD three times a week for at least 6 months,
(b) age >18–65 years,
(c) ability to write and speak the Greek language fluently, and
(d) ability to read and sign the consent.

Patients with psychiatric or cognitive disorders, eye or mobility issues, and those who were not time and space oriented, were excluded. All 403 patients on maintenance HD were recruited in this survey of which 361 met the criteria. Of
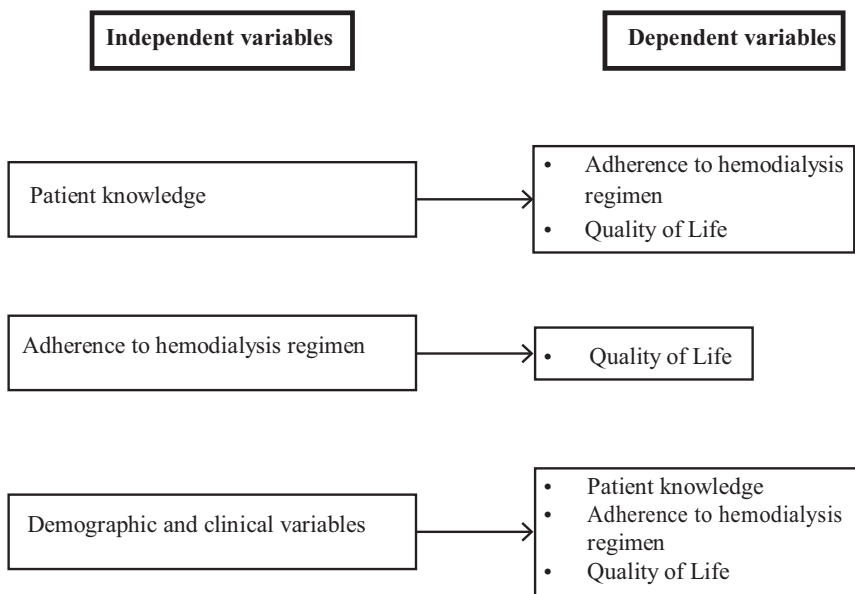
Fig. 1 Diagram presenting the dependent and independent variables

these, 30 patients did not accept to participate in the study while 10 were excluded as they did not answer some items. Finally, we studied 321 patients undergoing HD and analyzed their answers. The questionnaires were given to the patients by the researchers who are clinical nurses.

2.2 Measures

After the patients' selection process, the following questionnaires were provided to the patients:

Knowledge Assessment: The Greek version of the Kidney Disease Questionnaire (KDQ) [26] is a self-administered questionnaire measuring the level of knowledge among patients undergoing HD on the following areas of kidney disease: kidney function, kidney anatomy, hemodialysis, peritoneal dialysis, medication, nutrition, fluid intake, and transplantation. It consists of 26 multiple choice questions of which 13 are included in Form A and 13 in Form B. The total score ranges from 0 to 26 and is extracted by adding the correct answers (score 1 for each correct answer and 0 for each wrong answer). The higher the score, the higher the level of knowledge. It takes 10 min to complete. The original version [27] of the KDQ was constructed for exploring the knowledge levels of Canadian patients undergoing HD. It has been used in previous studies [26, 28] among Greek patients undergoing HD with excellent internal consistency (Cronbach's α Index 0.85).

Adherence Assessment: The GR-Simplified Medication Adherence Questionnaire-Hemodialysis (GR-SMAQ-HD) [29] consists of eight items exploring all dimensions of adherence in HD: Medication adherence (items 1–4), Attendance at the HD session (items 5, 6), and diet/fluid restrictions (items 7, 8). Three of the items are dichotomous (yes/no) and five are scored on a 5-point Likert-type scale. The score ranges between 0 and 8. The higher the score, the higher the level of adherence. It has been used to measure adherence among Greek patients undergoing HD [29] with total internal consistency 0.751 [28, 29]. GR-SMAQ-HD is the first scale measuring all dimensions of self-reported adherence adopted for Greek patients undergoing HD.

Quality of Life Assessment: The Greek version of the Missoula Vitas Quality of Life Index-15 (MVQoLI-15) [30] is a self-administered questionnaire which evaluates each patient's subjective experiences regarding QoL during the end stage of chronic disease. MVQoLI-15 is a 15-item questionnaire which consists of five dimensions of QoL: symptoms, function, interpersonal, well-being, and transcendent. Each dimension consists of three items and each item provides information about assessment (scoring -2 to $+2$), satisfaction (scoring -4 to $+4$), and importance (scoring 1–5). A 5-point Likert-type scale (from strongly agree to strongly disagree) is employed to assess the range to which respondents believe that are related to the items or not. The QoL score of each dimension is extracted as follows: (Assessment + Satisfaction) × Importance = Quality of Life. The original version of the MVQoLI-15 was constructed by Byock and Merriman [31]. The Greek version of the MVQoLI-15 has been used in several studies [3, 32] with satisfactory internal consistency (Cronbach's a 0.74).

Finally, a questionnaire of demographic and clinical characteristics was given to the participants.

2.3 Ethics

To carry out the study, licenses were secured from the Authority for Personal Data Protection (Code: ΓΝ/ΕΞ/240-3/11-02-2016) and Scientific Councils of the Hospitals:

(a) Iatriko Therapeutirio Iliou Medifil A.E., Athens
(b) General Hospital of Tripolis—Evangelistria, Arcadia (5.12.2016)

(c) General Hospital of Korinthos, Korinthos (21.12.16)
(d) General Hospital of Sparta, Laconia (10.12.16)
(e) General Hospital of Molaoi, Laconia (24.10.16)
(f) General Hospital of Lamia, Thessaly (23.12.2016)

Patients were informed by the researchers about the aim of the study, the anonymity of the data, the voluntary participation, and that the data will be used for research purposes only. All participants signed an information and consent form.

2.4   Data Analysis

To describe the quantitative variables, mean values and standard deviations were used while the absolute (N) and relative (%) frequencies were used to describe the qualitative variables. Linear regression analysis with the stepwise method was used to find independent factors related to the study scales from which dependence coefficients (β) and their standard errors (SE) were derived. The linear regression analysis for the dimensions of adherence scale was performed using logarithmic transforms. Statistical significance was set up at 0.05. The statistical program IBM 19.0 was used for the statistical analysis.

3   Results

The demographic and clinical characteristics of 321 individuals were recorded and are presented in Table 1.

Table 2 presents the participants' knowledge, adherence, and quality of life scores. In terms of knowledge score, none of the participants had the minimum or maximum knowledge score.

Subsequently, multivariate linear regression was performed using the knowledge score as the dependent variable and the demographic and clinical data of the participants as the independent variables. Applying the stepwise method, the results of Table 3 were found. The age, educa-

tion level, years of diagnosis, vascular access, and whether they lived alone were associated independently with the knowledge score.

The knowledge score, the educational level, the type of vascular access, the daily number of pills, the existence of children, and the years passed from diagnosis of ESRD disease were found to be independently associated with the total adherence score and its dimensions (Table 4).

Table 5 gives the results of a multivariate linear regression using QoL and its dimensions as the dependent variable while knowledge, adherence, demographic and clinical data were used as independent variables. The stepwise method revealed that the Total Adherence Score, the age, the type of vascular access, the place of residence, the educational level, the years passed from diagnosis of ESRD, the daily number of pills, the marital status, whether they lived alone and whether they had ever undergone peritoneal dialysis were independently related to the QoL Total Score and its dimensions (Table 5).

4   Discussion

The present study was carried out in six HD units in the broad area of Attica, Peloponnese, and Thessaly which are three of the largest geographical counties of Greece. This study investigated the levels of knowledge, adherence, and QoL among patients undergoing HD, the effect of knowledge on adherence and QoL, as well as the effect of adherence on QoL. Additionally, the effect of clinical and demographic characteristics on the aforementioned variables was investigated.

Knowledge was found to be independently associated with total adherence and diet/fluid restrictions. Specifically, the higher the levels of knowledge, the higher the total adherence and the adherence to diet/fluid restrictions. In fact, the findings of scientific studies on the effect of knowledge of patients undergoing HD on adherence to therapeutic regimen are contradictory. Results of studies related to adherence to phosphate binders showed that patients undergoing

Table 1 Demographic and clinical characteristics of patients undergoing hemodialysis (*N* = 321)

		N	*%*
Age, mean (SD)		56.5 (10.0)	
Gender	Males	206	65.0
	Females	111	35.0
Place of residence	Rural	87	27.8
	Semi-urban	27	8.6
	Urban	199	63.6
Marital status	Unmarried	71	22.3
	Married	177	55.7
	Divorced	27	8.5
	Widowed	43	13.5
Children	No	90	28.3
	Yes	228	71.7
Living alone	Yes	50	16.0
	No	263	84.0
Educational level	Illiterate	21	6.6
	Primary school	104	32.6
	Secondary	71	22.3
	High school	72	22.6
	Student/Graduate of University	51	15.9
Occupational status	Unemployed	50	15.7
	Household	35	11.0
	Self-employed	23	7.2
	Private-employed	17	5.3
	State-employee	11	3.5
	Retired	182	57.2
Co-existing diseases	Diabetes mellitus	70	23.0
	Hypertension	81	26.6
	Glomerulonephritis	58	19.0
	Polycystic disease	35	11.5
	Other	61	20.0
Ever been on peritoneal dialysis	Yes	9	2.8
	No	308	97.2
Transplantation	Yes	19	6.0
	No	298	94.0
Vascular access	Fistula	206	64.6
	Graft	45	14.1
	Central venous catheter	68	21.3
Years from diagnosis of ESRD, mean (SD)		10.7 (8.3)	
Daily number of pills, mean (SD)		12.1 (2.4)	
Years under HD, mean (SD)		6.5 (5.3)	
HD session duration (hours), mean (SD)		3.9 (0.3)	

SD Standard deviation

HD with a reduced level of knowledge had higher levels of phosphorus than those with higher levels of knowledge [18] while another study revealed that, although patients undergoing HD had a good level of knowledge about the phosphate binders and the consequences of hyper-phosphatemia, the majority of them could not adhere to medication treatment [33]. Similar results were found in a pilot study [34] among Indian patients undergoing HD who found no correlation between knowledge level and adherence behavior in diet and fluids. Wells [35]

Table 2 Mean scores and standard deviations of the dimensions of knowledge, adherence, and quality of life in patients undergoing hemodialysis (N = 321)

	Min	Max	Mean (SD)
Knowledge score *Theoretical range*: 0–26	2.00	24.00	13.1 (5)
GR-SMAQ-HD total score *Theoretical* range: 1–8	1.00	8.00	6.35 (1.64)
Medication adherence *Theoretical range*: 0–4	0.00	4.00	3.06 (1.11)
Attendance at HD session *Theoretical range*: 0–2	0.00	2.00	1.79 (0.52)
Diet/fluid restrictions *Theoretical range*: (0–2)	0.00	2.00	1.5 (0.73)
MVQoLI-15 total score *Theoretical range*: 0–30	6.30	26.00	17.06 (3.49)
Symptoms *Theoretical range*: (−30)–(+30)	−30.00	30.00	5 (9.62)
Functionality *Theoretical range*: (−30)–(+30)	−16.00	30.00	4.64 (8.66)
Interpersonal *Theoretical range*: (−30)–(+30)	−30.00	30.00	11.97 (11.14)
Well-being *Theoretical range*: (−30)–(+30)	−30.00	30.00	−6.82 (12.41)
Transcendent *Theoretical range*: (−30)–(+30)	−30.00	30.00	6.22 (12.46)

SD Standard deviation

reported a significant increase in the level of knowledge of patients undergoing HD after an educational intervention; however, this increase was not accompanied by an increased level of adherence to the therapeutic regimen.

Knowledge was found to be independently associated with the overall QoL and its dimension—transcendent. More specifically, the greater the improvement in knowledge, the greater the improvement in the overall QoL and its dimension—Transcendent. The search of the international literature revealed the positive impact of patient information on self-efficacy, self-care, and consequently, on improving various aspects of QoL [36, 19]. These studies focus on the improvement of QoL through educational interventions. An explanation is that patients undergoing HD who are informed about their disease may also have the skills to self-manage their own health care and to cope with the negative effects of the disease more effectively leading to low hospitalization and mortality.

In this study, adherence was found to be independently associated with the overall QoL and its dimensions—symptoms and interpersonal. That is, the greater the improvement in the total adherence, the greater the improvement in the overall QoL and its dimensions—interpersonal and symptoms, indicating an improvement in symptoms. It seems that higher levels of adherence are probably associated with higher QoL levels. A study [37] exploring the role of adherence in QoL revealed that patients with adherence to antihypertensive agents had a better QoL in terms of the physical dimension. Reviewing the international literature, there are few studies [38] that investigate the interaction of these two (adherence and QoL) variables. In addition, results are contradictory [39]. This may be due to the variety of methods of measuring adherence and QoL. If we consider that chronic kidney disease is a chronic disease characterized by the phenomenon of polypharmacy, we should assume that adherence to a strict treatment regimen would be associated with poor quality of life. In addition, literature [40] supports this view. However, adherence to the therapeutic regimen is an element of disease management that encompasses

Table 3 Multivariate analysis using the stepwise method with a dependent variable (knowledge) and independent variables (demographic and clinical characteristics)

Dependent variable: knowledge		β^a	SE^b	P
Age		−0.05	0.02	0.030
Living alone	Yes (reference)			
	No	−1.81	0.72	0.013
Educational level	Illiterate/Primary school (reference)			
	Secondary/High school	2.34	0.61	<0.001
	Students/Graduates of University	3.65	0.81	<0.001
Years after diagnosis of ESRD		0.13	0.03	<0.001
Vascular access	Fistula (reference)			
	Graft	−0.66	0.83	0.424
	Central venous catheter	−2.13	0.64	0.001

^{a}Beta coefficient
^{b}Standard error

Table 4 Multivariate analysis using the stepwise method with the dependent variable (adherence and its dimensions) and independent variables (knowledge, demographic, and clinical characteristics)

			β^a	SE^b	P
Dependent variable:		Illiterate/Primary school (reference)			
GR-SMAQ-HD total score	**Educational level**	Secondary/High school	0.08	0.02	<0.001
		Students/Graduates of University	0.10	0.02	<0.001
	Knowledge score		0.01	0.002	<0.001
	Type of vascular access	Fistula (reference)			
		Graft	0.02	0.02	0.433
		Central venous catheter	−0.07	0.02	<0.001
Dependent variable:		Illiterate/Primary school (reference)			
Medication adherence score	**Educational level**	Secondary/High school	0.07	0.02	<0.001
		Students/Graduates of University	0.11	0.02	<0.001
	Vascular access	Fistula (reference)			
		Graft	0.01	0.02	0.603
		Central venous catheter	−0.08	0.02	<0.001
	Daily number of pills		−0.004	0.002	0.026
Dependent variable:	**Daily number of pills**		0.004	0.002	0.020
Attendance at HD session	**Educational level**	Illiterate/Primary school (reference)			
		Secondary/High school	0.05	0.01	0.001
		Students/Graduates of University	0.06	0.02	0.003
	Children	No (reference)			
		Yes	0.04	0.01	0.007
Dependent variable:	**Knowledge score**		0.006	0.02	0.005
Diet/fluid restrictions	**Educational level**	Illiterate/Primary school (reference)			
		Secondary/High school	0.07	0.02	0.001
		Students/Graduates of University	0.03	0.03	0.202
	Years from diagnosis of ESRD		0.004	0.001	0.001

[a]Beta coefficient
[b]Standard error

the concepts of self-care and self-efficacy [41]. Thus, patients who take an active role in their treatment cease to be passive protagonists and adopt behaviors that improve their health outcomes. Patients' health behavior is expected to change only if results are not desired [42].

In this study, demographic and clinical characteristics were found to be independently associated with the dimensions of the scales. In particular, as the age increases, the lower the knowledge level they had. Our finding is supported by another study [43] in which the older age is associated with poor knowledge. Older patients need more information about their illness than younger ones [44]. This may be because healthcare professionals place more emphasis on

counseling the younger people as they consider that communicating with younger patients can yield more benefits to life expectancy [45]. Also, as the participant's age increases, both the overall QoL and its dimensions (well-being, transcendent, and interpersonal) are deteriorating. The effect of age on QoL is controversial in the literature. According to a study [46], age is inversely related to physical functioning, vitality, and social functioning. Other researchers [47] highlight that older people do not perceive the deterioration of their QoL to the same extent as younger patients. Older patients experience difficulty in maintaining their role and full participation in family activities as they invest all their energy to adapt their daily life to HD.

Table 5 Multivariate analysis using the stepwise method with the dependent variable (QoL and its dimensions) and independent variables (adherence, knowledge, demographic, and clinical characteristics)

			β[a]	SE[b]	P
Dependent variable: Symptoms	**GR-SMAQ-HD total score**		0.94	0.32	0.004
	Age		−0.18	0.05	<0.001
	Vascular access	Fistula (reference)			
		Graft	3.67	1.61	0.023
		Central venous catheter	−1.71	1.33	0.197
Dependent variable: Functionality	**Vascular access**	Fistula (reference)			
		Graft	−0.88	1.38	0.527
		Central venous catheter	−2.90	1.20	0.017
	Place of residence	Rural/Semi-urban (reference)			
		Urban	3.34	1.02	0.001
	Living alone	Yes (reference)			
		No	3.12	1.31	0.018
	Have you ever been on peritoneal dialysis?	Yes (reference)			
		No	6.41	2.84	0.025
Dependent variable: Interpersonal	**Living alone**	Yes (reference)			
		No	10.55	1.65	<0.001
	Age		−0.18	0.05	0.001
	GR-SMAQ-HD total score		1.01	0.38	0.010
	Educational level	Illiterate/Primary school (reference)			
		Secondary/High school	−0.10	1.34	0.943
		Students/Graduates of University	4.80	1.79	0.008
Dependent variable: Well-being	**Age**		−0.25	0.06	<0.001
	Years from diagnosis of ESRD		−0.20	0.09	0.025
	Daily number of pills		0.37	0.17	0.029
	Married	No (reference)			
		Yes	−3.06	1.46	0.037
Dependent variable: Transcendent	**Age**		−0.32	0.06	<0.001
	Knowledge score		0.33	0.15	0.022
	Place of residence	Rural/Semi-urban (reference)			
		Urban	4.89	1.43	0.001
	Years from diagnosis of ESRD		−0.19	0.09	0.027
Dependent variable: Total QoL score	**Age**		−0.10	0.02	<0.001
	Knowledge score		0.10	0.04	0.027
	GR-SMAQ-HD total score		0.29	0.12	0.025
	Place of residence	Rural/Semi-urban (reference)			
		Urban	1.37	0.41	0.001
	Living alone	Yes (reference)			
		No	1.18	0.52	0.022

[a]Beta coefficient
[b]Standard error

In this study, the low education level was associated with a low knowledge score. In particular, secondary/lyceum graduates and students/graduates of universities had a higher score of 2.34 and 3.65 points, respectively, compared to illiterate and primary school graduates. In this study, the effect of the educational level is catalytic since it affects not only the level of knowledge but also the dimension—interpersonal—of QoL as well as the total adherence and its dimensions. It seems that high levels of education have a positive influence on adherence and QoL [48] while Kauric–Klein [24] did not find any association. Bland, Cottrell, and Guyler [23] showed that patients undergoing HD with high educational level were more informed about their condition and therefore, more compliant. According to the literature [49] patients undergoing HD with a high educational level could assume roles to maintain their health and thus use strategies to cope with their illness and symptoms, leading to improved QoL.

Participants who did not stay alone had a knowledge score of 1.81 points lower than those who stayed alone. In Greece, family ties are very strong, but this leads to a patient's overprotection status and a lack of self-management of the disease. Thus, patients without family support develop high levels of self-management of the disease and, therefore, are more likely to report high levels of knowledge about the disease [50]. The role of family support in Greece also confirms the finding of this study that adherence to Attendance at the HD session for those who had children and the dimension of interpersonal for those who did not stay single were higher than the opposites.

Participants who performed HD using central venous catheter had a 2.13 point lower knowledge score than those with fistula. In a similar study [44], researchers after exploring the levels of knowledge found that patients with fistula had higher knowledge score than the rests (with graft or vascular catheter) while other researchers [51] note that patients with fistula are more likely to demonstrate low health literacy. Also, in our study, the vascular access was associated independently with adherence and QoL of partici-

pants. Participants with central venous catheter had a significantly lower score of total adherence—medication adherence and functionality—compared to those with fistula.

The more pills the participants received per day, the worse their adherence to medication treatment and attendance at the HD session. This finding is in line with previous findings [11, 52] according to which the complex therapeutic regimen is associated with low levels of adherence to treatment. In this study, the daily number of pills taken by patients was 12.1. The large number of pills is justified if we consider that patients undergoing HD receive medication not only for chronic kidney disease itself but, also for other diseases such as diabetes mellitus and hypertension. If we compare the number of pills taken by patients undergoing HD with the number of pills taken by patients with other chronic diseases such as heart failure (eight pills/day), [53] we could understand that it is quite high. In addition to the above finding, surprisingly we saw a positive correlation between the number of pills with well-being and interpersonal—in contrast with other studies [54].

The more the years they had been diagnosed with ESRD, the higher the knowledge and adherence to diet/fluid restrictions but the lower the well-being and transcendent levels. It appears that the negative experiences from the complications (hyperkalemia, acute pulmonary edema) accumulated by patients during the years on HD trigger greater adherence to diet and fluid restriction and lower perceived well-being.

In the present study, the place of residence appears to have an impact on QoL since the residents of the province had worse QoL compared to the city dwellers. These results are in contrast to those of other studies [55] according to which residents of provincial cities/villages experience better QoL. However, it is difficult to compare the results with those of other studies as there are great differences among the health systems of countries.

The major strength of this study is that it is the first internationally exploring knowledge, adherence, and QoL not only in this particular patient group but also in any other patient group. Also, the

GR-SMAQ-HD is the unique self-report tool which measures all dimensions of self-reported adherence of HD patients. The limitation is that the study was carried out during the HD session so some factors such as the presence of other healthcare professionals and workers in HD unit, various incidents, and the fatigue of patients undergoing HD may affect the objectivity of the answers.

5 Conclusions

In sum, the findings highlight the importance of patient knowledge as a crucial part of patient participation in clinical decision-making and self-care. The increase in patient knowledge and adherence to therapeutic regimen may improve the QoL especially in the domains of symptoms, interpersonal relationships, and transcendent.

The findings of this study will help nephrology nurses to quantify the extent of non-adherence and poor quality of life. The identification of non-adherence and its factors are key elements for healthcare professionals. Nephrology nurses have ongoing interactions with patients undergoing HD while the educational and counseling programs organized by nurses may improve adherence. At this point, the importance of the multidisciplinary team's role consisting of psychologists, dieticians, nephrologists, and social workers, in addition to nurses, should be emphasized.

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The Burden of Caregivers of Patients After Hip Replacement and Its Impact on the Cost of Living of the Family

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Abstract

Aim: The aim of this study was the evaluation of the degree of burden of caregivers of patients with hip fracture surgery and the assessment of its impact on their cost of living.

Material and Method: This is a cross-sectional study and the study sample, which was a sample of convenience, included 100 caregivers of patients after hip replacement from February to May 2019 at the General Hospital of Thessaloniki "G. Gennimatas" in Greece. The main tools of the survey were the Bakas Caregiving Outcomes Scale (BCOS) Care Outcome Scale and a Questionnaire used for measuring rehabilitation costs in trauma patients adjusted for the needs of the present study.

Results: Of the 100 caregivers in the sample, 35% were male, 65% women and children of patients. Most caregivers worked full-time (47%), or had retired (39%). The costs incurred by the carers, which were not covered by the insurer, were, with the highest concerns, the rehabilitation center, the services of another caregiver, the services of an exclusive nurse, and physiotherapy.

Conclusions: Informal caregivers often fill the gaps and shortcomings of the health systems of many countries, saving large sums of money. The state should take care of consolation leave to caregivers so that they can provide the necessary assistance to their people, thereby reducing their burden. The development of ambulatory care would offer such important and necessary respite for caregivers, having a positive impact on the care and course of the patient.

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Keywords

Caregivers · hip replacement · income · living costs · patients

1   Introduction

The increase in life expectancy in recent years worldwide has also led to an increased incidence of hip fractures [3]. These increasingly frequent fractures and the serious complications that accompany them are now a major challenge for most countries' society, health, and social security systems. Their impacts are significant on the quality of life of patients and their families, with economic and social implications [11]. In Greek and foreign literature, we could not find work related to the quality and cost of life of these patients' caregivers, which is usually offered by the family environment.

The present study investigates the burden rate of people who provide care without compensation to hip fracture patients during hospitalization, postoperatively in the rehabilitation center and later as needed. The burden rate relates to the financial, physical, and psychological part of caregivers' lives, as this caring affects all aspects of their lives and their daily lives.

2   Materials and Methods

This is a cross-sectional study and the study sample, which was a sample of convenience, included 100 caregivers of patients after hip replacement from February to May 2019 at the General Hospital of Thessaloniki "G. Gennimatas" in Greece.

Tools
We used the BCOS Care Outcome Scale to measure the burden of caregivers. It involves questions that explore the potential changes that occur in the caregiver's life by providing care to the patient, measuring perceptions of atypical caregivers and the extent to which it has changed their lives, because of the care of a family member or their wider environment. The number of BCOS questions is 16 and relates to the physical health, social functionality, and subjective well-being of caregivers. Scoring is done with a Likert scale, 7 points and is a reliable and weighted tool

for measuring both the negative and positive aspects of care. Caregivers are asked to choose prices from (−3) for high charge, (−2) for moderate charge, and (−1) for low charge, and choose (0) when nothing has changed in their life, due to the care provided to the patient, (1) when something positive changes in their lives, (2) even better, and (3) the care of the patient has very positively affected some aspects of their lives. The grading of the scale ranges from 15(−1) the lowest, which means high overhead rates, to a maximum of 105(+3), which means low levels of overhead.

The second questionnaire was specifically designed to investigate changes in the cost of living of the family of patients after hip replacement due to the illness. As this parameter has not been investigated in Greece, the formulation of the questionnaire was based on previous research measuring the rehabilitation costs of trauma patients [10].

Statistical Analysis
SPSS for Windows (version 25) statistical software was used for statistical analysis. The statistical analysis included descriptive statistics. The frequencies and percentages of the qualitative variables were calculated and mean values and standard deviations were calculated on the quantitative variables (mean ± standard deviation). The check of the regularity of the variables was done with the Kolmogorov–Smirnov test for variables with more than 50 cases and with the Shapiro–Wilk test for variables with less than 50 cases.

The nonparametric Mann–Whitney U test and Kruskal–Wallis tests were used in the inductive statistics on continuous variables that did not follow normal distribution. The Spearman's rho correlation coefficient was used to control the degree of correlation between two continuous variables and the Linear Logistic Regression model was used. The test of the dichotomy and categorical variables between two independent samples was carried out with the chi-square test and Fisher's exact test. All cases were checked with a statistical significance $p < 0.05$.

3 Results

Of the 100 caregivers in the sample, 35% were male, 65% women and children of patients. The demographic characteristics of carers are shown in Table 1. Most carers were full-time (47%), or retired (39%). The socio-economic characteristics of carers are presented in Table 2. The costs incurred by the carers, which were not covered by the insurer, were, with the highest concerns, the rehabilitation center, the services of another caregiver, the services of an exclusive nurse, and physiotherapy. Table 3 shows the median prices, the cost of expenditure.

The general question stating how much their lives have changed as a result of patient care found that for 93.4% of carers their lives changed for the worse, 2.2% replied that they did not change at all, and 4.4% changed for the better. Carers pointed out that their physical health (93.5%), time for family activities (75%), their ability to cope with stress (82.5%), their relationships with friends (64.1%), their future prospects (87%), their level of energy (93.5%), their emotional well-being (90.3%), their roles in life (87%), their time for social activities with friends (80.4%), their economic well-being (81.5%), their physical functionality (92.4%), and their general health (90.2%). In terms of their self-esteem, it appeared that 38.5% of carers did not indicate that there was a change, 28.6% that it changed for the better, and 32.9% that it changed for the worse. However, 25% of carers replied that there had been no change in their relationship with their family, 5.5% replied that their relationship with their family had changed for the better, and 69.5% that it had changed for the worse. Finally, regarding the caregiver's relationship with the patient, 26.4% of car-

Table 1 Social-demographic data of caregivers

	n/N	%
Sex		
Male	35/100	35
Female	65/100	65
Relation between patient and the person who takes care of him		
Husband–wife	28/100	28
Child	55/100	55
Other	17/100	17
Age group		
18–30 years	3/100	3
31–44 years	12/100	12
45–60 years	47/100	47
61–74 years	30/100	30
Over 75 years old	8	8
Family condition		
Married	70/99	70.7
Single	18/99	18.2
Divorced	5/99	5.1
Widowed	6/99	6.1
Number of children		
Childless	29/100	29
One child	18/100	18
Two children	27/100	27
Three children	21/100	21
Four children	5/100	5
Residence		
Thessaloniki	65/100	65
Country side	32/100	32
Other city/country	3/100	3

Table 2 Socio-economic characteristics of caregivers

	n/N	%
Education		
Basic	25/100	25
Secondary education	45/100	45
Higher education	30/100	30
Master		
Yes	10/100	10
No	90/100	90
Occupation		
Full time	47/100	47
Part time	5/100	5
Unemployment	9/100	9
Pensioner	39/100	39
Sector of occupation		
Public	15/52	28.8
Private	23/52	44.2
Freelance	14/52	26.9
Monthly income		
0–500€	18/91	19.8
501–1000€	28/91	30.8
1001–1500€	22/91	24.2
1501–2000€	17/91	18.7
2001–2500€	6/91	6.6
Annual leave		
Yes	18/41	43.9
No	23/41	56.1
	Median value	Value range (IQR)
Days out off work due to patient care	10	2–15 (IQR:5)
Income loss	400	60–700 (IQR: 400)

Table 3 Caregivers' costs due to the state of health of patients

Costs	Median value	Value range (IQR)
Medical services	60€	30–150 (80)
Nursing services	60€	20–90 (50)
Use of exclusive nurse	200€	50–600 (180)
Other caregiving services	350€	80–1200 (387.5)
Physiotherapy services	115€	150–600 (220)
Drugs	30€	10–50 (20)
Admission riot police	735€	250–1250 (450)
Home conversion	35€	20–120 (8.75)
Special diet	100€	80–150 (20)
Special means of movement (private stretcher, chair, etc.)	85€	35–240 (55)
Purchase of pharmaceutical material—accessories crutches, walks, etc.	35€	20–68 (10)
Travel-fuel	80€	10–700 (65)
Other	100€	40–1000 (132.5)

ers replied that there was no change, 31.9% that their relationship changed for the better, and 41.8% that it changed for the worse (Table 4).

The calculation of the average price per question in the BCOS questionnaire showed that in most questions the average value was less than 3. The only questions in which the average values were above 3 (meaning changing the life of the caregiver for the better) was the question concerning the self-esteem of the caregivers and the relationship of the caregiver with the patient. From the results of Table 5, it appears that the life of carers in almost all the fields examined in the questionnaire changed for the worse with the overall average of the BCOS questionnaire at 36.8 ± 11.4. Cronbach's relevance factor α of the questionnaire changed for the worse with the overall average of the BCOS questionnaire at 36.8 ± 11.4. Cronbach's alpha relevance factor of the questionnaire was found at 0.913, which shows an excellent correlation between the questions in the questionnaire.

Finally, comparisons and correlations with the social-demographics of carers conclude in differences in the quality and type of care benefits for the patient, such as highly educated caregivers, with a higher income provide better quality health services to their patient, using an exclusive nurse or more days of stay in the rehabilitation center.

4 Discussion

The findings of this study showed that most of the caregivers of patients after hip replacement are their children. These findings are consistent with

Table 4 Frequencies of questions in the BCOS questionnaire

BCOS	% (n/N)						
	It changed for the worse			It didn't change	It changed for the better		
	−3	−2	−1	0	+1	+2	+3
My self-esteem	5.5 (5/91)	6.6 (6/91)	20.9 (19/91)	38.5 (35/91)	16.5 (15/91)	9.9 (9/91)	2.2 (2/91)
My body health	26.1 (24/92)	41.3 (38/92)	26.1 (24/92)	6.5 (6/92)	–	–	–
My time for family activities	34.8 (32/92)	14.1 (13/92)	19.6 (18/92)	28.3 (26/92)	3.3 (3/92)	–	–
My ability to cope with stress	29.7 (27/91)	33 (30/91)	19.8 (18/91)	17.6 (16/91)	–	–	–
My relationship with my friends	14.1 (13/92)	27.2 (25/92)	22.8 (21/92)	31.5 (29/92)	–	2.2 (2/92)	2.2 (2/92)
My future prospects	52.2 (48/92)	18.5 (17/92)	16.3 (15/92)	13 (12/92)	–	–	–
My level of energy	28.6 (26/91)	46.2 (42/91)	18.7 (17/91)	6.6 (6/91)	–	–	–
My emotional well-being	44.6 (41/92)	25 (23/92)	20.7 (19/92)	6.5 (6/92)	3.3 (3/92)	–	–
My roles in life	42.4 (39/92)	35.9 (33/92)	8.7 (8/92)	9.8 (9/92)	3.2 (3/92)	–	–
My time for social activities with friends	30.4 (28/92)	26.1 (24/92)	23.9 (22/92)	14.1 (13/92)	3.3 (3/92)	2.2 (2/92)	–
Relationships with my family	19.6 (18/92)	32.6 (30/92)	17.4 (16/92)	25 (23/92)	3.3 (3/92)	1.1 (1/92)	1.1 (1/92)
My financial well-being	35.9 (33/92)	29.3 (27/92)	16.3 (15/92)	17.4 (16/92)	1.1 (1/92)	–	–
My relationship with the patient	12.1 (11/91)	12.1 (11/91)	17.6 (16/91)	26.4 (24/91)	14.3 (13/91)	9.9 (9/91)	7.7 (7/91)
My physical functionality	31.5 (29/92)	44.6 (41/92)	16.3 (15/92)	7.6 (7/92)	–	–	–
The general state of my health	26.1 (24/92)	39.1 (36/92)	25 (23/92)	9.8 (9/92)	–	–	–
Generally how much your life has changed as a result of patient care?	40 (36/90)	35.6 (32/90)	17.8 (16/90)	2.2 (2/90)	3.3 (3/90)	1.1 (1/90)	–

the results of other gender-specific surveys of caregivers, as in others diseases [1, 7], but disagree with other studies that state that female wives are the primary caregivers and not the children of patients [2, 9, 12]. Finally, the rate of care provided by the male sex remains quite high and is probably justified by the increased appearance of this fracture, more in women, but also because of the high demands of these diseases, in muscle strength, in order to move the patient. So, while the female sex has been recognized as a protagonist in informal care over the years and as social roles change, male carers are significantly increasing.

In terms of the rate of burden on carers, this was found, very high affecting all aspects of their lives, affecting all aspects of their lives and all levels regardless of gender, age, income, and educational level. Comparing the rate of burden of caregivers with a hip fracture with corresponding oncology caregiver studies, it was found considerably higher, indicating the severity of their condition [6]. Another study carried out in Africa showed that the burden rates of caregivers of patients with a hip fracture were high at all levels—economic, emotional, and physical [4]. A study in Singapore, respectively, found that

Table 5 Average values of the questions of the BCOS questionnaire

	Median value	±SD
My self-esteem	3.9	±1.3
My physical health	2.1	±0.9
My time for family activities	2.5	±1.3
My ability to cope with stress	2.3	±1.1
My relationship with my friends	2.9	±1.3
My future prospects	1.9	±1.1
My level of energy	2	±0.9
My emotional well-being	1.9	±1.1
My roles in life	1.9	±1.1
My time for social activities with friends	2.4	±1.3
Relationships with my family	2.7	±1.3
My financial well-being	2.2	±1.1
My relationship with the patient	3.8	±1.7
My physical functionality	2	±0.9
The general state of my health	2.2	±0.9
Generally how much has your life changed as a result of patient care?	1.9	±1.1

1 month after leaving the hospital, caregivers of patients with hip fracture reported a higher burden at home than in the hospital or rehabilitation center, precisely because the transition of sick at home is a new and difficult situation that caregivers have to deal with alone [8]. A Spanish study showed that the rate of psychological burden and stress of caregivers increased from the low functional level of patients before the accident and the existence of postoperative complications [1].

A comparison of the average BCOS value in relation to the social-demographic characteristics of carers showed no statistically significant differences. The only statistically significant difference was found in the relationship between the caregiver and the patient, stating that the burden on family caregivers and especially the children of patients is statistically significant ($p = 0.011$) versus the more distant relatives or friends. Comparisons with the social, economic characteristics of carers did not show statistically significant differences in terms of educational, professional, and economic situation. The results of surveys on these issues are contradicted. In some studies it has been found that the high educational level reduces the burden on caregivers [1] while in others that low educational background does not affect the burden of caregivers [5]. It is likely that low-educated people, who do not necessarily have high professional aspirations, will draw particular satisfaction from the offer of care to their loved ones.

Generally, higher education caregivers spend more money than other levels of education, rehabilitation centers, dedicated nurse, and special diet, thus offering better and more quality services health to their patients. According to the work situation of caregivers, those who work full-time or are self-employed or work in the public and private sectors, spent more money on an exclusive nurse or other caregiver than unemployed carers. The above may indicate the lack of time of the working caregivers and the financial ability to offer this kind of service to their patients. Also, carers working in the public sector all took regular paid leave of some days, using it, in the care of their relatives, while only half of the private staff-carers took paid leave. The costs incurred as a result of the care of patients with a hip fracture and had an impact on the cost of living of caregivers, is a result of the admission to a rehabilitation center, the use of an exclusive nurse or another caregiver with compensation, costs for physiotherapy and the diet of patients.

Limitations
The main limitations of the present study are the relatively small sample size and the fact that the

study was conducted in only one hospital. These limitations prevent the investigation of correlations between various research parameters and especially demographic and personal data referring to similar studies.

5   Conclusions

Nontypical caregivers usually do not have the necessary knowledge and skills to deal with a patient who has mobility and other problems. At this point, health professionals, with their knowledge and experience, will train and reassure these people, who are suddenly called upon to undertake this new and difficult task. It is the informal caregivers who often fill the gaps and shortcomings of the health systems of many countries, saving large sums of money. The state should take care of consolation leave to caregivers so that they can provide the necessary assistance to their people, thereby reducing their burden. The development of ambulatory care would offer such important and necessary respite for caregivers, having a positive impact on the care and course of the patient.

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The Effects of Exercise in Patients with Sarcopenia

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Abstract

The aim of this study was to assess the effects of different types of exercise interventions for treating sarcopenia compared to no specific treatment, a minimal intervention (e.g., education), or another active treatment (nutritional supplements). A review was conducted of the recent English literature searching PubMed and ScienceDirect databases. Ten randomized controlled trials (RCTs) were included in this review, presenting the results of 671 sarcopenic patients. The exercise interventions were resistance training (four studies), a multimodal program (five studies, encompassing resistance training and additional exercises such as aerobic exercises, flexibility, balance and strength training), and a whole body vibration program (one study). Results show that exercise interventions could have beneficial effects in improving muscle mass, muscle strength, and physical performance in 3 months of intervention. Resistance training, added to an adequate nutrition and aerobic exercise, appeared to deliver the most positive outcome after 3 months of intervention. Types of exercise and dose–response parameters of exercise eliciting improvement warrant further investigation. Due to the significant heterogeneity in clinical trials, the current evidence provides limited guidance. Well-designed studies evaluating exercise interventions are needed before treatment guidelines can be developed.

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1   Introduction

Sarcopenia is a progressive and generalized skeletal muscle disorder associated with adverse effects such as physical disability, fatigue, fractures, falls, comorbidities, poor quality of life, and mortality [1, 2]. Its prevalence varies widely, ranging from 0.9% to 52.9%, depending on the population studied and the different definitions and cutoff points used [3–5]. In its 2018 definition, the European Working Group of Sarcopenia in Older

People (EWGSOP2) used low muscle strength as the primary parameter of sarcopenia; and muscle strength is presently the most reliable measure of muscle function. Specifically, sarcopenia is probable when low muscle strength is detected. When low muscle strength, low muscle quantity/quality, and low physical performance are all detected, sarcopenia is considered severe [1].

The main interventions are pharmacological treatments, nutritional approaches, and physical activity/exercise [6, 7]. Physical exercise is effective for sarcopenic elderly but evidence for the most effective mode of exercise is conflicting [8]. It is a common belief that physical activity and exercise can delay the loss of skeletal muscle mass and function [6]. Although exercise seems to have the most beneficial effects [3, 4, 9, 10], exercise programs are highly variable in terms of type (resistance, aerobic, multicomponent, etc.) and training mode (type, frequency duration, setting, etc.) preventing a standardized exercise prescription for sarcopenia [11]. Even if exercise is an effective therapeutic agent, the dosage (intensity of the exercise), frequency (sessions/week), type (aerobic vs. resistance exercise), and effects of the exercise must be taken into account in order to achieve the best clinical outcome [12]. Given the above, this systematic review will explore the current evidence on the effects of different types of exercise for sarcopenic patients.

2   Methods

Search Strategy

Medline database was searched from June 2019 to August 2019 using the predefined search terms "sarcopenia" and "exercise." The reference lists of systematic review articles and meta-analyses were also scanned for any additional references missed from the PubMed searches. Studies were only included if published in English. The reference lists of all eligible papers were also screened to identify any missing studies.

Eligibility Criteria

Two independent reviewers used predefined inclusion and exclusion criteria to identify all eligible articles. Studies were included if they fulfilled the following five criteria: (1) study design was a randomized controlled trial (RCT); (2) the full paper was published in English; (3) population study had to be defined as sarcopenic; (4) participants were aged 60 years and older; (5) an exercise-based intervention was included; and (6) date of published studies was after 2000. The following cases were excluded: patients with decreased muscle mass and functional status due to other specific health conditions (such as cancer, diabetes, chronic heart failure, AIDS, kidney failure, chronic obstructive pulmonary disease, liver cirrhosis, rheumatoid arthritis, anorexia, recent surgery or transplant, or severe neurologic or cognitive disorders).

3   Results

The current search identified a total of 75 studies related to sarcopenia and exercise. Out of the 75, 69 were undertaken in frail (and not sarcopenic) patients. Thus, 10 RCTs were finally included in the review: two studies were performed in USA [13, 14], three in Japan [15–17], one in Taiwan [18], one in Germany [19], one in China [20], one in Greece [8], and one in Brazil [21]. Study details are shown in Table 1.

Exercise intervention as monotherapy was explored in five studies [13, 14, 18, 20, 21]. In three studies, researchers performed resistance exercise training (RET) program in 128 patients (in total) with sarcopenia. In the study conducted by Liu et al. [14], the intervention group ($n = 16$ sarcopenic and 73 no sarcopenic patients) performed a multicomponent training exercise program (including aerobic, strength, balance, and flexibility training). In the study conducted by Wei et al. [20], the intervention group used whole-body vibration training for 12 weeks. The other four studies investigated the effects of exercise programs plus nutrition supplementation [15–17, 19]. One study evaluated group versus home-based exercise programs for elderly with sarcopenia. The principal finding was that supervised group-exercise therapy was more effective than home-based exercise therapy in improving

Table 1 Description of studies including exercise training in patients with sarcopenia

Study	Type of study	Sample	Age (years)	Intervention	Dose of exercise	Outcome measure	Results
Zdzieblik et al., 2015 (Germany)	Double-blind RCT	53 male sarcopenic	Mean age 72.2	*Control group*: RET + placebo SUPP (*n* = 27) *Intervention group*: RET plus SUPP (collage n peptides) (*n* = 26)	12 weeks 3 times/week	*Muscle mass/body composition*: DEXA *Muscle strength*: IQS *Physical function*: standardized one-leg stabilization test Other: bone mass (DEXA)	*Muscle mass/body composition*: decrease in fat mass, increase in fat free mass in both groups, slight improvement in IG compared to CG *Muscle strength*: increase in muscle strength in both groups *Physical function/ performance*: no differences between groups Other: increase in bone mass in both groups
Gadelha et al., 2016 (Brazil)	Single blind RCT	113 sarcopenic obese adults	67.0 ± 5.2	*Control group*: was instructed to maintain their lifestyle routine (*n* = 64) *Intervention group*: RET (*n* = 69)	24 weeks 3 times/week	*Muscle mass/body composition*: DEXA *Muscle strength*: BIODEX dynamoter (IQS)	*Muscle mass/body composition*: increase in fat-free mass, RT program improved appendicular FFM in the IG *Muscle strength*: increase *Physical function/ performance*: increase

(continued)

Table 1 (continued)

Study	Type of study	Sample	Age (years)	Intervention	Dose of exercise	Outcome measure	Results
Balachandran et al., 2014 (USA)	RCT	21 sarcopenic obese adults	60+	*Control group*: RET intrevention (SH, *n* = 9) *Intervention group*: RET with high-speed circuit (HSC, *n* = 8)	15 weeks 3 times/week	*Muscle mass/body composition*: BIA *Muscle strength*: grip strength *Physical function*: SPPB *Other*: instrumental activities of daily living (IADL), ratings of perceived exertion (RPE), 6 min walking test	*Muscle mass/body composition*: body fat percentage showed no significant differences between the groups *Muscle strength*: HGS showed no statistically significant differences between groups *Physical function/ performance*: SPPB results favored HSC over SH other: lower body power and RPE also favored HSC
Kim et al., 2013 (Japan)	RCT	128 sarcopenic women	75+	*Control group*: or health education (*n* = 32). *Intervention groups*: (1) exercise and tea catechin supplementation (*n* = 32), (2) exercise (*n* = 32), (3) tea catechin supplementation (*n* = 32)	12 weeks 2 times/week	*Muscle mass/body composition*: BIA *Muscle strength*: grip strength, knee extension strength *Physical function/ performance*: walking ability (usual and maximum walking speed, and TUG) and balance (one leg standing time with eyes open)	*Muscle mass/body composition*: first group showed significant effect for changes in the combined variables of leg muscle mass *Muscle strength*: leg muscle mass increased in the first group, small changes in the other groups *Physical function/ performance*: usual walking increased in the exercise + TC group, a modest increase was seen in the exercise group

| Kim et al., 2012 (Japan) | RCT | 155 sarcopenic women | 75+ | *Control group:* health education (HE; $n = 39$) *Intervention groups:* (1) exercise and amino acid supplementation (exercise + AAS: $n = 38$), (2) exercise ($n = 39$), (3) amino acid supplementation (AAS; $n = 39$) | 12 weeks 2 times/week | *Muscle mass/body composition:* BIA *Muscle strength:* knee extension strength *Physical function/ performance:* walking speed (5 min) | *Muscle mass/body composition:* significant changes in leg muscle mass in the exercise + AAS and exercise groups *Muscle strength:* improved significantly only in the exercise + AAS group *Physical function/ performance:* walking speed in the first and second group improved |
| Kim et al., 2016 (Japan) | RCT | 136 sarcopenic obese women | 70+ | *Control group:* or health education ($n = 66$) *Intervention groups:* (1) essentials amino acid supplementation (3 g) and tea catechin (540 mg) supplementation (daily), (2) exercise, (3) exercise and nutrition | 12 weeks 2 times/week | *Muscle mass/body composition:* BIA *Muscle strength:* grip strength, knee extension strength *Physical function/ performance:* walking speed and walking parameters (stride step, length width, walking angles) *Other:* blood samples (vitamin D, Leptin etc.) | *Muscle mass/body composition:* significant decrease total fat mass in exercise + nutrition group *Muscle strength:* knee extension strength improved significantly only in the exercise + SUPP *Physical function/ performance:* improvement in usual walking speed in the exercise + group, stride increase *Other:* improvement in vitamin D and Leptin |

Table 1 (continued)

Study	Type of study	Sample	Age (years)	Intervention	Dose of exercise	Outcome measure	Results
Liu et al., 2014 (USA)	Single-blind multi-center RCT	Sarcopenic 33 (non sarcopenic 144, total = 177)	70–89	*Control group:* a successful aging educational program about healthy aging (*n* = 17 sarcopenic, 71 no sarcopenic) *Intervention group:* exercise program featuring aerobic, strength, balance, and flexibility training (*n* = 16 sarcopenic, 73 no sarcopenic)	12 months 8 weeks, 3 sessions/week, week 9–12, supervized sessions were twice weekly, 24–52 weeks home exercise	*Muscle mass/body composition:* DEXA *Muscle strength:* Hand grip *Physical function/ performance:* SPPB, gait speed 400 meters	*Muscle mass/body composition:* increase leg muscle mass *Muscle strength:* improved *Physical function/ performance:* higher mean SPPB scores, faster mean gait speeds were observed in intervention group
Liao et al., 2017 (Taiwan)	Prospective RCT	46 women with sarcopenic obesity	67.3 (5.2)	*Control group:* no exercise intervention (*n* = 21) *Intervention group:* RET (*n* = 25)	12 weeks 3 sessions/week	*Muscle mass/body composition:* DEXA, BIA *Muscle strength:* HGS, hand-held dynamometer *Physical function/ performance:* TUG, single leg stance, timed chair rise *Other:* Muscle Quality: HGS/arm lean mass	*Muscle mass/body composition:* the IG exhibited greater changes in fat-free mass, leg lean mass absolute total fat mass and percent body fat *Muscle strength:* increase in IG *Physical function/ performance:* the IG exhibited greater improvements in gait speed-TUG
Wei et al., 2016	RCT	80	65+	*Control group:* no exercise intervention (*n* = 60) *Intervention group:* WBV (*n* = 20)	12 weeks 3 sessions/week	*Muscle mass/body composition:* DEXA ultrasound cross-sectional area, measurement of vastus medialis (VM) *Muscle strength:* knee extension strength *Physical function/ performance:* TUG, sit-to-stand test, 10 m walking	*Muscle mass/body composition:* not improvement in CSA and VM *Muscle strength:* improvement in isometric and IQS *Physical function/ performance:* improvement in TUG, 5STS and 10MWT

| Tsekoura et al., 2018 (Greece) | RCT | 54 sarcopenic older adults | 72.87 ± 7 | *Control group*: educational program about healthy aging (*n* = 18 sarcopenic) *Intervention groups*: (1) group exercise program-aerobic, strength, balance, flexibility (*n* = 18), (2) home program—same training (*n* = 18) | 12 weeks 2 sessions/week | *Muscle mass/body composition*: BIA *Muscle strength*: knee extension strength, hand-grip strength *Physical function/ performance*: TUG, sit-to-stand test, 4 m walking | *Muscle mass/body composition*: group-based compared to home-based exercise yielded improvements in muscle mass index *Muscle strength*: increase in intervention groups *Physical function/ performance*: intervention groups exhibited significantly greater improvements in gait speed, TUG s & 4 m test |

EG experimental group, *IG* intervention group, *CG* control group, *ExG* exercise group, *PrG* protein supplementation group, *BW* body weight, *BIA BIA B*ioelectrical impedance analysis, *DEXA* dual-energy X-ray absorptiometry, *FFM* free-fat mass, *FM* fat mass, *KE* knee extension, *MM* muscle mass, *MP* muscle power, *MS* muscle strength, *RET* resistance exercise training, *PA* physical activity, *SUPP* nutritional supplement, *IQS* isokinetic quadriceps strength, *SMC* sensory motor control, *SFT* senior fitness test

muscle strength, muscle mass, and physical performance after 12 weeks [8]. Results show that exercise interventions could have beneficial effects in improving muscle mass, muscle strength, and physical performance in 3 months of intervention. The studies ranged in sizes from 21 [13] to 155 participants [15]. The duration of the interventions varied from 12 weeks in seven studies [8, 15–20] to 15 weeks [13] and to 24 weeks [14]. In terms of exercise frequency, in five studies, sessions were performed three times per week [13, 18–21]; in four studies, sessions were performed two times per week [8, 15–17]; and in one study, sessions during weeks 1–8 were three times per week and from weeks 9 to 24, supervised sessions were twice weekly [14].

4   Discussion

This review aimed to provide an overview of the possible exercise interventions for sarcopenia. According to the results of 10 RCTs, it seems that exercise interventions (resistance training and multimodal exercises) appear to have a role in increasing muscle strength, muscle mass, and improving physical performance in sarcopenic patients. Literature findings support these results [10, 22]. However, the included studies used different methods and cutoff points used to diagnose sarcopenia. One possible explanation is the fact that there are no universally accepted criteria for the diagnosis of sarcopenia. Indeed, several working groups have recommended definitions for sarcopenia [1, 22–24] but these definitions differ slightly. The intervention strategies vary also. There were differences in type of exercise, in doses and frequency, as well as design.

Five studies employed a multimodal exercise program that involved both resistance training and additional exercises such as aerobic exercises, flexibility, and balance [8, 14–17]. The effects of aerobic exercise are modest and its definitive effect on sarcopenia is not completely clarified [6]. It is well known that aerobic exercise induces an increase in skeletal muscle mitochondria and this is particularly true in aging muscle [6]. RET programs (that requires participants to exercise

against an increasing external load) has been used in many studies [2, 8, 13, 18, 19]. It seems that the combination of both resistance and aerobic exercises is more healthy for elderly people because it produces multiple benefits preventing and treating prevalent diseases at old ages [8, 25]. Evidence suggests that both resistance exercise and aerobic training lead to beneficial adaptations on muscle strength and improve physiological responses in the aging population [8, 26, 27]. The combined effects of exercise programs together with supplementation with a range of nutrients were evaluated in four studies. The finding of enhanced benefits of exercise training when combined with dietary supplementation in some trials [15–17, 19] highlights its potential as a strategy for the prevention and management of sarcopenia. Beaudart et al. observed huge variations in the dietary supplementation protocols and remarked that the studies included mainly well-nourished subjects [4]. Researchers concluded that "the interactive effect of dietary supplementation on muscle function appears limited" [4, 22]. Further studies are needed to address the effects of supplementation and exercise on muscle strength and physical performance of older adults.

Dosing in exercise is extremely important to get the beneficial effects [12]. Regarding duration of the exercise intervention protocols, many of the studies reviewed had implemented 12-week programs (two or three sessions/week; 45–60 min) of supervised exercise [8, 15, 16, 19]. In order to obtain an impact of muscle function, the duration of the intervention should be at least 3 months practice. Available intervention programs vary in terms of frequency, duration, and intensity of exercises. It is difficult to give a sarcopenic patient specific exercise prescription based on the results of these 10 studies. Furthermore, it is important to note that specific modifications to dosing of exercise are sometimes necessary in frail older patients with pre-existing medical conditions and special needs [28, 29, 30].

Additionally, effects of exercise may also depend on population characteristics (including age, gender, and lifestyle factors) [8, 28]. The profile of the patients in this study presents heterogeneity. The assessment of sarcopenia was performed

with different criteria in all studies. It is not unreasonable to assume that differences in sarcopenic status may have an effect in both exercise and assessment parameters [8]. In 4 of the 10 studies [13, 17, 18, 21], participants were sarcopenic obese. RET could improve the sarcopenic obesity index in older women and may also promote indirect benefits, wherefore sarcopenic obesity has been considered as a public health problem [21]. Future studies are recommended to assess impacts on muscle strength, muscle mass, and functional performance in elderly with sarcopenia.

Clinical Significance of This Study

Exercise is so beneficial for health that it should be considered as a drug. Type of "exercise pill" and dosing is very important to get the beneficial effects of exercise training programs [12]. Sarcopenic patients need exercise in their attempt to improve body compositions/muscle mass and to increase muscle strength and physical performance/function. Clinicians should consider these critical parameters in order to be more effective in management of patients with sarcopenia. Furthermore, this review could help designing in future best practice guidelines.

Strengths and Weaknesses of This Study

This review is beneficial because in involved studies, all patients were identified as sarcopenic. This study included only RCTs. Furthermore, studies with patients with sarcopenic obesity were also included so long as the study considered the anti-sarcopenic effects of exercise. Therefore, we feel that this study's findings provide more "robust" and reliable results compared to previous systematic reviews of similar kind, contributing to its external validity. A limitation, inherent to this review, is that the quality of the individual randomized clinical trials was not analyzed.

5   Conclusions

The findings of this review provide encouraging qualitative data on effects of exercise interventions in sarcopenic population. Exercise interventions may play a role in improving muscle mass,

muscle strength, and walking speed. Exercise interventions should focus on well-defined sarcopenia and should include resistance training. Multimodal training may be one of the main tools to prevent and treat sarcopenia in the elderly. Intensity and frequency of exercise and criteria of progression warrant further investigation.

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Fluid Dynamics–Derived Parameters in Coronary Vessels

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Abstract

Continued development in the field of cardiovascular modeling over the past few years has contributed to the production of precise three-dimensional models of main coronary arteries. Computational fluid dynamic–derived parameters such as smartFFR, a CT-FFR surrogate, and endothelial shear stress (ESS) can be assessed from non-invasive imaging techniques like computed tomography coronary angiography using novel 3D reconstruction methods and can be used to investigate the functional significance of an artery. The investigation of the different flow conditions for the calculation (steady state vs. transient) of the ESS presents that while there is a difference in the final values, it is not statistically significant. ESS in the whole vessel is higher compared to the lesion-specific segments and smartFFR calculated in lesion segment does not reflect accurately the flow capability of the vessel. Higher ESS is present in vessels with <0.85 smartFFR and both parameters are present higher values in vessels with abnormal PET myocardial perfusion imaging.

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1 Introduction

The death rate caused by cardiovascular disease continues to expand each year primarily due to the Westernized Living Method, which mostly incorporates a complete non-appearance of activity and high-fat weight control plans incorporating incredible amounts of red meat and increased regular pressure [1]. The field of interventional cardiology is continually evolving and growing to ensure that this rise in mortality is addressed. Numerous coronary imaging methods are used daily in clinical practice, including either invasive (i.e., invasive coronary angiography – ICA) or non-invasive techniques (i.e., computed tomography coronary angiography – CTCA). Over the last few years, CTCA has managed to win ground as it has the potential to provide information both on the lumen and the exterior surface, on the structure of the atheromatic plaques. The main technique to assess the functional status of a major coronary vessel is the well-established fractional flow reserve (FFR) and is used when the clinician does not have a clear view of the vessel of interest using the aforementioned imaging modalities or when the

decision on the treatment that must be followed is marginal [2–4]. The procedure is as follows:

A dedicated pressure wire is used in order to measure the intravascular pressure after the desired stenosis and is defined as the ratio of the pressure after the stenosis of interest divided by the mean aortic pressure. The measurement is done after the pharmaceutical induction of hyperemia on the patient.

Advances in the field of computer sciences have made it possible to develop 3D reconstruction techniques, which can be employed throughout the whole coronary vasculature. Various literature techniques for 3D reconstruction that could only use a single imaging model or a fusion of two imaging modalities were reported. In recent times, single imaging methods like CTCA or ICA [5–6] were more than sufficient to generate either the lumen or any coronary vasculature feature, including the entire coronary arterial tree. Applying computational fluid dynamics (CFD) to 3D coronary models has provided accurate and detailed measurement of very critical hemodynamic variables such as the endothelial shear strain (ESS). The ESS is a hemodynamic parameter that is heavily determined by geometrical changes in the vessel (i.e., plaque progression stenosis). This sensitivity is important for an evaluation of the coronary lesion.

The following are our aims for this study:

To investigate and compare two different flow dynamics techniques (steady-state pulsatile flow) for endothelial shear stress calculation, to compare lesion-specific smartFFR and endothelial shear stress values as well as the abovementioned for the whole vessel and to examine the relationship between smartFFR and ESS in addition to MBF stress (myocardial blood flow) and MFR (myocardial flow reserve).

2   Methods

2.1   Study Population

Five patients with intermediate pre-test likelihood for coronary artery disease (CAD), who were enrolled in the EVINCI [7] and SMARTooL

[6] projects and had undergone CTCA and PET-MPI using ^{15}O-water or ^{13}N-ammonia were included in the study. The characteristics of the study population and imaging procedures and protocols have already been described in detail elsewhere [7]. In the context of the main EVINCI study, ethical approval was provided by each participating center and informed consent was obtained by all study participants [7].

2.2   3D Coronary Artery Reconstruction

The algorithm is based on the following approach: (a) the CCTA images are pre-processed, and the image distortion caused by intense calcified objects is removed. (b) A minimum cost path approach is used to extract the 3D centerline of the artery of interest. (c) Using a function of the distance from the centerline and the Hounsfield Units (HU) values, an estimation of the weight function for the lumen is made. A final refinement of an active contour model for the lumen is implemented. (d) Finally, the 3D surfaces for the lumen are created.

2.3   Computational Fluid Dynamics and Boundary Conditions

A tetrahedral mesh was created for each vessel, and steady-state flow simulations were performed using the incompressible Navier–Stokes equations. Blood was considered Newtonian, with a density of 1050 kg/m^3 and a dynamic viscosity of 0.0035 Pa•s. Flow was considered laminar and incompressible. The wall was considered to be rigid and a no-slip and no-penetration boundary condition was applied [8]. We used a pressure of 100 mmHg as a boundary condition at the inlet (i.e., mean human aortic pressure). Steady-state and pulsatile flows were performed for all cases. For the steady-state simulation, a uniform velocity profile of 1.5 mL/s was applied. For the for the pulsatile flow, a pulsatile flow waveform was selected based on the literature data [9] and was adjusted in order to be equal with the steady-state case of 1.5 mL/s.

2.4 Assessment of Endothelial Shear Stress

The ESS at the luminal surface of the artery was calculated as the product of viscosity and the gradient of blood velocity near the vessel wall. ESS was calculated at the most stenotic segment as well as in the whole vessel. For the case of pulsatile flow, the time-average ESS was calculated.

2.5 Calculation of smartFFR

To calculate the smartFFR index, we performed a transient simulation for each case. We used a pressure of 100 mmHg as a boundary condition at the inlet (i.e., mean human aortic pressure). At the outlet, a flow profile of five timesteps with a timestep duration of 0.25 s was used. In each timestep, a volumetric flow rate of 0, 1, 2, 3, and 4 mL/s are applied as outlet boundary conditions. The wall was assumed to be impermeable (i.e., no-penetration) and a no-slip condition was also applied. In order to build the patient-specific Pd/Pa curve, we calculated the Pd/Pa value for every timestep of the simulation, and the final values are then plotted and fitted by a smoothing spline consisting of 100 points. The final curve is then used to calculate the area under it, which is then normalized by dividing with the AUC of the same artery if no pressure drop existed (i.e., healthy segment). The calculated ratio represents the smartFFR value. From previous studies [10], the cut-off value for a pathological smartFFR is considered to be 0.85.

2.6 PET Imaging and Data Analysis

PET/CT imaging was performed in agreement with international guidelines and the EVINCI study protocol [11] using 15O-water or 13N-ammonia. PET was considered abnormal when >1 contiguous segments showed both stress MBF $\leq$2.3 mL/g/min and myocardial flow reserve (MFR) $\leq$2.5 for 15O-water or <1.79 mL/g/min and $\leq$2.0 for 13N-ammonia, respectively [12].

3 Statistical Analysis

Continuous variables are presented as mean values ± SD or median and interquartile range (IQ), while qualitative variables as absolute and relative frequencies. Probability values are two sided from the t-test and the Mann–Whitney U test for continuous variables. ANOVA or Kruskal–Wallis test was selected for multiple groups comparisons. To compare the two ESS calculation methods, Bland and Altman plots were implemented. A p-value <0.05 was considered statistically significant.

4 Results

4.1 Patient and Vessel Characteristics

Demographics and clinical and coronary lesion characteristics of the total study population are presented in Table 1. Five vessels in total were selected. Three vessels consist of abnormal PET-MPI and two with normal PET-MPI values.

4.2 Comparison of Steady-State and Pulsatile Flow Methods for Endothelial Shear Stress Calculation

Pulsatile flow consists of 11 steps, simulated one full cardiac cycle from 0 to 1 s (Fig. 1). Time average ESS present lower values in the selected lesion compared to the ESS from the steady-state calculation (Fig. 2), although Bland–Altman (Fig. 3a) and correlation plots (Fig. 3b) depict a negligible difference for the two methods, so for the rest of the analysis we used the steady-state ESS values as a surrogate marker for ESS.

4.3 Comparison of Lesion-Specific and Vessel smartFFR and Endothelial Shear Stress Values

Mean ESS value in 3 out of 5 vessels is higher in the total vessel length compared to the lesion-specific segments (Fig. 4a). Regarding the lesion smartFFR, it presents higher values (i.e., above 0.85 is considered normal) compared to the whole vessel analysis (Fig. 4b).

Table 1 Baseline patients' characteristics

Patients characteristics	
Patients ($n = 5$)	N (%)
Age (years)	62.3 ± 5.2
Gender (male)	4 (80)
Vessel	
LAD	3 (60)
RCA	2 (40)
Position of the lesion	
Proximal	2 (67)
Middle	1 (33)

4.4 Relationship Between smartFFR and ESS

ESS in lesion presents higher values in vessels with <0.85 smartFFR compared to vessels with >0.85 smartFFR (Fig. 5a). There is an expected negative correlation between the two metrics (rho = 0.6, $p = 0.3$) without, however, being statistically significant due to the small number of vessels (Fig. 5b).

4.5 MBF Stress and MFR Relationship with smartFFR and ESS

When considering the PET-MPI results in every vessel, the total length of the vessel smartFFR and ESS in lesion appears to represent in more detail the functional significance of the vessel (Fig. 6a, b).
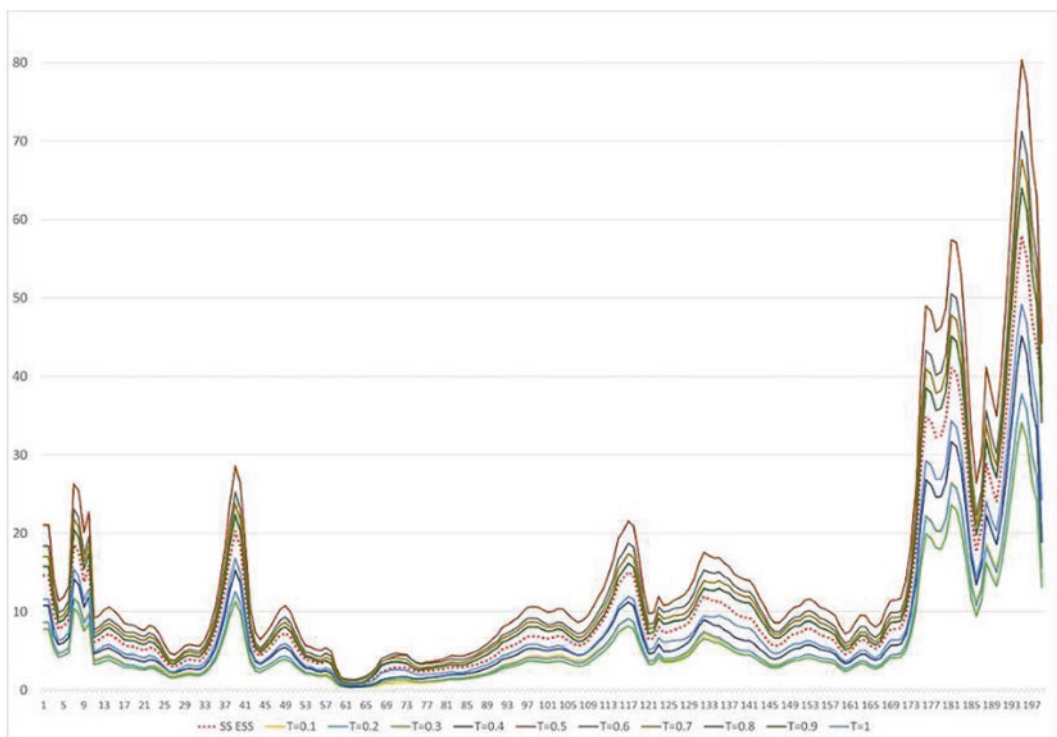
Fig. 1 ESS distribution along the vessel length for steady state (red dot line) and transient time steps ($T = 1$ s, $T = 2$ s, etc.)
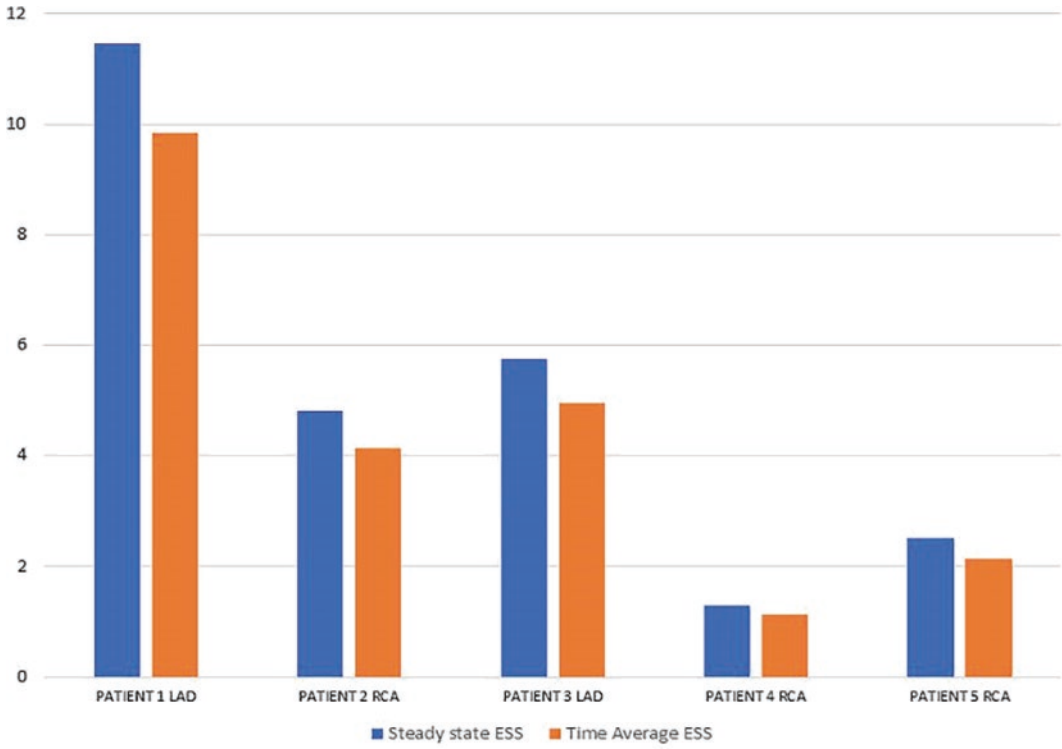
Fig. 2 Steady state versus time average ESS comparison
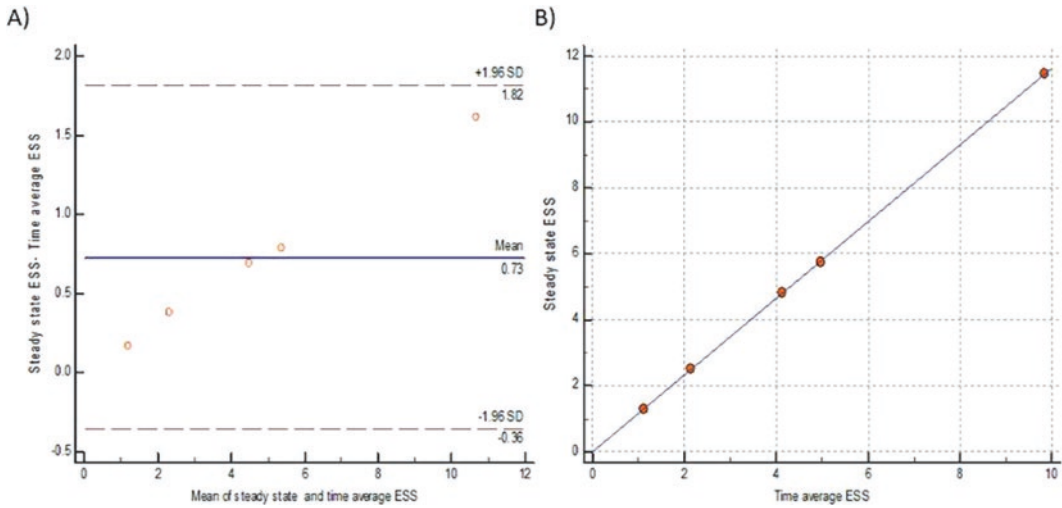
Fig. 3 (**a**) Bland–Altman and (**b**) correlation plot for steady state versus time average ESS
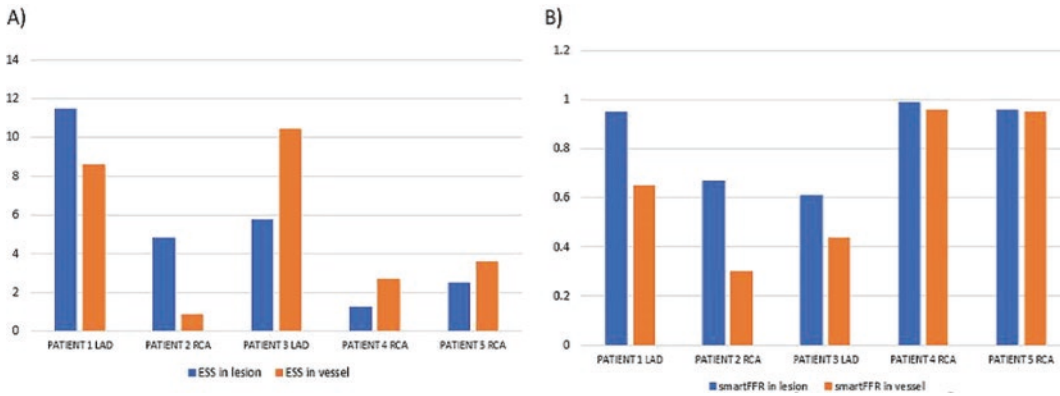
Fig. 4 (**a**) ESS and (**b**) smartFFR values comparison between lesion-specific areas and whole vessel
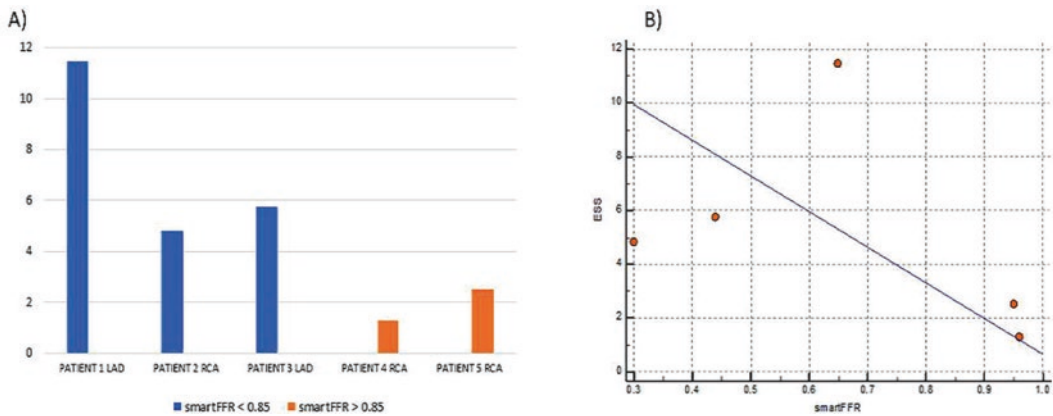
Fig. 5 (**a**) ESS values in vessels with smartFFR above and below 0.85. (**b**) Correlation plot between ESS and smartFFR

5 Discussion

In this work, we presented a parametric study regarding how the type of simulation affects the calculation of important hemodynamic parameters and used five coronary arterial segments with mild or severe stenoses in order to reveal the correlation between hemodynamic parameters such as ESS and smartFFR and PET-MPI derived parameters such as stress MBF and MFR.

The main scope of our work was to create a non-invasive method of the functional assessment of major coronary vessels by combining an already validated 3D reconstruction method and a validated FFR surrogate marker. Having this in mind, we combined the smartFFR values that are calculated with the ESS values that were generated during the respective blood flow simulations and

ended up having a surrogate marker with a better discriminative power than each of the two markers alone. Our results indicate a good agreement between the calculated abnormal ESS or smartFFR cases and the calculated abnormal PET-MPI markers. However, due to the small dataset size, we cannot draw safe conclusions regarding the overall efficacy of the proposed combined surrogate marker, thus indicating the need for a more extended validation strategy.
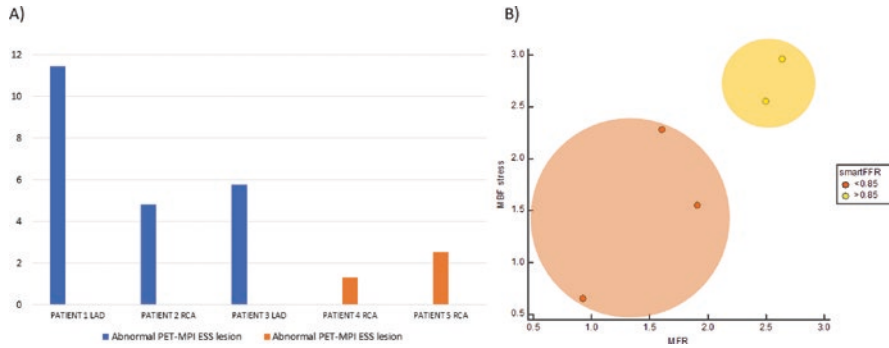
Fig. 6 (**a**) Lesion-specific ESS in vessels with normal-abnormal PET-MPI. (**b**) Clustering representation of vessels with normal-abnormal smartFFR with normal-abnormal PET-MPI

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Level of Knowledge About COPD Among Patients and Caregivers

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Abstract

Chronic obstructive pulmonary disease (COPD) represents a major health burden worldwide. COPD-specific education may positively affect the emotional distress associated with the disease and may contribute to the patients' poor health-related quality of life. Studies have shown that education regarding COPD is lacking among disease sufferers. The aim of our study was to evaluate the knowledge of COPD among patients and caregivers. We used the Bristol COPD Knowledge Questionnaire in hospitalized and nonhospitalized patients with COPD and other pulmonary diseases, their caregivers, and healthy volunteers. Mean total knowledge score of patients with COPD was 24.27 ± 8.44, of patients with other respiratory diseases 25.53 ± 7.93, of caregivers of patients with COPD 21.80 ± 5.32, of caregivers of patients with other pulmonary diseases 23.50 ± 8.79, and of healthy subjects 25.85 ± 9.27 ($p = 0.071$). Our data further indicate the lack of knowledge of COPD among patients and their carers and emphasize the need of education programs.

1 Introduction

Chronic obstructive pulmonary disease (COPD) is associated with high morbidity and a prevalence between 210 and 600 million cases [1, 2]. COPD is responsible for 2.9 million deaths worldwide; namely, it ranks third behind cardiovascular disease and cancer regarding its mortality [3]. COPD prevalence rate in Greece is approximately 8.4% concerning people aged >35 years whose smoking history is over 100 cigarettes per lifetime [4].

COPD burden is expected to rise in the following years along with the morbidity associated with the disease [5]. The disease is associated with psy-

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chological consequences that contribute to the patients' poor health-related quality of life. Disease-specific education has been recognized as an important element of the disease overall treatment and a cornerstone of self-management, especially in rehabilitation programs, and has been recommended by international guidelines [6]. In the review by Wang et al. [7] addressing the effectiveness of self-management education to improve quality of life and knowledge in COPD patients, the authors concluded that self-management education may positively affect the emotional distress associated with the disease, while other parameters such as pulmonary function testing, dyspnea, and nutritional status are not influenced.

Recently, education of both patients and their close relatives regarding medical conditions has become increasingly important. The reasons behind this lie on the patients' desire for optimal information about their medical condition and, also, on the increasing amount of attention that health professionals currently direct to self-management, thus affecting positively the patients' treatment. Studies [8, 9] have shown that education regarding COPD is lacking among disease sufferers. The aim of our study is to evaluate the knowledge of COPD among patients with COPD and other pulmonary diseases, their caregivers, and healthy subjects.

2   Methods

The Bristol COPD Knowledge Questionnaire (BCKQ) [10] was distributed in hospitalized patients and outpatients of the Respiratory Medicine Department of the University Hospital of Larissa, as well as their caregivers. The disease diagnosis was based on clinical history and/or objective lung function testing and/or radiology and laboratory markers, according to international guidelines [11–15]. During the same period, the questionnaire was completed by healthy volunteers. BCKQ is a previously published multiple choice questionnaire that addresses several aspects of knowledge about COPD. Briefly, the questionnaire consists of 13 question groups that address knowledge about the epidemiology, etiology, symptoms of COPD, as well as knowledge on the impact of smoking

and exercising on COPD and the role of immunization, inhaled bronchodilators, antibiotics, oral, and inhaled steroids. Each topic has 5 statements providing a sum of 65 questions. Each of the 13 question groups is scored based on the number of correct answers. Each question groups contains five questions, and each correct question is graded with 1 point and 0 points otherwise [10].

2.1   Statistical Analysis

Socio-demographic data were analyzed using descriptive statistics. Quantitative variables used in the study are presented as mean ± standard deviation. Qualitative variables are expressed as absolute or relative frequency (%) in each category of the variable. The normality assessment of continuous variables was evaluated with the use of a Kolmogorov–Smirnov test (when the sample size was $n > 30$) and a Shapiro–Wilk test (when the sample size was $n < 30$) in order to determine whether or not to use parametric methods for the analysis of the sample data. The nonparametric test Kruskal–Wallis was used to investigate statistically significant differences between the five groups of the diagnosis for each factor since not all five parameters met the assumption of normality. When the Kruskal–Wallis test was statistically significant, a Dunn–Bonferroni approach followed so as to determine the subgroups in which the differences were found.

The reliability was tested with Cronbach's alpha estimator, with a range of 0–1. Values higher than 0.7 indicate good internal consistency of the items.

All the aforementioned statistical tests were two-sided and were performed at the statistical significance level of 5%. Data were analyzed using SPSS software, version 22 (Statistical Package for Social Sciences Inc., 2003, Chicago, USA).

3   Results

The basic demographic characteristics for the collected sample are presented in Table 1. Most of the participants were males ($n = 201$, 59.3%) while 138 (40.7%) were females. The mean age was 55.97 (±13.64) years. The majority of the sample

Table 1 Demographic characteristics of participants

	N (%) or Mean ± SD
Gender	
Female	138 (40.7)
Male	201 (59.3)
Age	55.97 (13.64)
Diagnosis (%)	
COPD	60 (17.3)
Asthma	26 (7.5)
Other lung diseases	31 (9.0)
Healthy	158 (45.7)
Caregivers of patients with other pulmonary	56 (16.2)
Diseases	
Caregivers of patients with COPD	15 (4.3)
Smoking history	
Current	192 (57.5)
No	52 (15.6)
Ex-smokers	90 (26.9)
Packyears	43.02 ± 37.65

Data are presented as absolute number, mean ± SD, or percentage

Table 2 Results for each subscale of the questionnaire for the whole group of participants

	Mean	Standard deviation
Epidemiology	1.93	1.01
Etiology	2.99	1.39
Symptoms	2.28	1.20
Breathlessness	2.06	1.10
Phlegm	2.64	1.33
Chest infections	1.65	1.13
Exercise	2.37	1.14
Smoking	2.66	0.97
Vaccination	1.81	1.05
Inhaled bronchodilators	1.15	1.16
Antibiotics	1.99	1.33
Oral steroids	0.94	1.18
Inhaled steroids	0.41	0.70

($n = 158$, 45.7%) were healthy subjects unrelated to patients with lung diseases, while 17.3% ($n = 60$) suffered from COPD, 7.5% were asthmatics, and 9.0% suffered from various other lung diseases. Additionally, 4.3% were caregivers of patients with COPD whereas 16.2% ($n = 56$) were caregivers of patients with other pulmonary diseases. Regarding smoking, the majority were current or ex-smokers ($n = 282$, 84.4%) with an average number of packyears reaching 43.02 (±37.65).

Table 2 describes the mean scores (±SD) for all the subscales of the questionnaire in relation to their awareness of COPD and its consequences. Overall, participants appeared to have knowledge and awareness ranging from poor to moderate. Moreover, reliability of the subscales of the questionnaire was also estimated. The reliability estimation comes from the Cronbach's alpha which was above 0.7 in all subscales.

Mean total score of patients with COPD was 24.27 ± 8.44, of patients with other respiratory diseases 25.53 ± 7.93, of caregivers of patients with COPD 21.80 ± 5.32, of caregivers of patients with other pulmonary diseases 23.50 ± 8.79, and of healthy subjects 25.85 ± 9.27 ($p = 0.071$).

We observed statistically significant differences among the study groups concerning knowledge about COPD epidemiology ($p = 0.011$). A Dunn–Bonferroni approach followed so as to determine which subgroups differed. The results showed that knowledge about epidemiology differed significantly among caregivers of patients with pulmonary diseases (other than COPD) versus patients with COPD ($p = 0.012$) and healthy subjects ($p = 0.032$). Additionally, there were statistically significant differences between the study groups concerning knowledge about COPD etiology ($p = 0.017$). In subgroup analysis, we observed that the difference was mainly attributed to the comparison of healthy subjects with caregivers of patients with COPD ($p = 0.049$) (Table 3).

In the same context, the groups differed in terms of knowledge concerning symptoms of COPD ($p = 0.032$). Subgroup analysis revealed that knowledge about COPD symptoms differed significantly among healthy subjects and caregivers of patients with other diseases than COPD ($p = 0.029$). In addition, the groups differed in how knowledgeable participants were about the breathlessness caused from COPD but this did not reach statistical significance ($p = 0.056$). Similarly, there was no statistically significant difference between the groups concerning knowledge about phlegm associated with COPD ($p = 0.262$), infections

Table 3 Results for each subscale of the questionnaire per study group

	Diagnosis	_n_	Median	IQR	_p_-value
Epidemiology	COPD	59	2	2–3	0.011
	Other pulmonary diseases	47	2	2–3	
	Caregivers of patients with other pulmonary diseases	56	1.5	1–2	
	Caregivers of patients with	15	1	1–3	
	COPD				
	Healthy	133	2	1–3	
Etiology	COPD	59	3	2–4	0.017
	Other pulmonary diseases	47	3	2–4	
	Caregivers of patients with other pulmonary diseases	56	3	2–4	
	Caregivers of patients with	15	2	1–3	
	COPD				
	Healthy	133	3	2–4	
Symptoms	COPD	59	2	2–3	0.032
	Other pulmonary diseases	47	2	2–3	
	Caregivers of patients with other pulmonary diseases	56	2	1–2.75	
	Caregivers of patients with	15	2	2–2	
	COPD				
	Healthy	133	2	2–3	
Breathlessness	COPD	59	2	2–3	0.056
	Other pulmonary diseases	47	2	1–3	
	Caregivers of patients with other pulmonary diseases	56	2	1–2	
	Caregivers of patients with	15	2	1–2	
	COPD				
	Healthy	133	2	1.5–3	
Phlegm	COPD	59	3	2–3	0.262
	Other lung diseases	47	3	2–4	
	Caregivers of patients with other pulmonary diseases	56	2	1–3	
	Caregivers of patients with	15	3	2–4	
	COPD				
	Healthy	133	3	2–4	
Chest infections	COPD	59	2	1–3	0.489
	Other pulmonary diseases	47	2	1–3	
	Caregivers of patients with other pulmonary diseases	56	2	1–2	
	Caregivers of patients with	15	1	1–2	
	COPD				
	Healthy	133	2	1–3	
Exercise	COPD	59	3	1–3	0.265
	Other pulmonary diseases	47	2	2–3	
	Caregivers of patients with other pulmonary diseases	56	2	1–3	
	Caregivers of patients with	15	2	1–3	
	COPD				
	Healthy	133	3	2–3	

Table 3 (continued)

	Diagnosis	n	Median	IQR	p-value
Smoking	COPD	59	3	2–3	0.558
	Other pulmonary diseases	47	3	2–3	
	Caregivers of patients with other pulmonary diseases	56	3	2–3	
	Caregivers of patients with	15	3	2–3	
	COPD				
	Healthy	133	3	2–3	
Vaccination	COPD	59	2	1–2	0.075
	Other pulmonary diseases	47	2	1–3	
	Caregivers of patients with other pulmonary diseases	56	2	1.25–3	
	Caregivers of patients with	15	1	1–2	
	COPD				
	Healthy	133	2	1–3	
Inhaled bronchodilators	COPD	59	1	0–2	0.563
	Other pulmonary diseases	47	1	0–2	
	Caregivers of patients with other pulmonary diseases	56	1	0–2	
	Caregivers of patients with	15	1	0–2	
	COPD				
	Healthy	133	1	0–2	
Antibiotics	COPD	59	2	1–3	0.526
	Other pulmonary diseases	47	2	1–3	
	Caregivers of patients with other pulmonary diseases	56	2	1–3	
	Caregivers of patients with	15	1	1–3	
	COPD				
	Healthy	133	2	1–3	
Oral steroids	COPD	59	0	0–1	0.493
	Other pulmonary diseases	47	1	0–2	
	Caregivers of patients with other pulmonary diseases	56	1	0–2	
	Caregivers of patients with	15	0	0–1	
	COPD				
	Healthy	133	1	0–2	
Inhaled steroids	COPD	59	0	0–0	0.382
	Other pulmonary diseases	47	0	0–1	
	Caregivers of patients with other pulmonary diseases	56	0	0–1	
	Caregivers of patients with	15	0	0–1	
	COPD				
	Healthy	133	0	0–1	

IQR Interquartile range

($p = 0.489$), exercise ($p = 0.265$), smoking ($p = 0.558$), vaccination ($p = 0.075$), inhaled bronchodilators ($p = 0.563$), treatment with antibiotics ($p = 0.526$), oral steroids ($p = 0.493$), and inhaled steroids ($p = 0.382$) (Table 3).

4 Discussion

Our results indicate that the overall knowledge for COPD among patients suffering from the disease as well as their caregivers and patients with other pulmonary diseases is poor. There are gaps

in knowledge about COPD etiology and epidemiology, as well as the disease symptoms and treatment, and therefore, educational programs aiming at COPD training are considered mandatory.

Disease-specific education has been recognized as an integral component of self-management programs that have been associated with improved health-related outcomes in patients with chronic conditions such as asthma [16]. Studies have shown that patient education can improve medication adherence in COPD patients as indicated by the associated reduction of the amount of short-acting inhaled b2-agonists intake [17]. Additionally, self-management programs including a comprehensive patient education program can significantly reduce the utilization of healthcare services and improve health status in COPD patients [18] and generally improve health-related quality of life [19]. The aforementioned data underlie some of the beneficial effects of education programs in COPD.

Previously reported data are in accordance with our results suggesting that COPD patients' knowledge about their disease is poor [20, 21]. Knowledge about COPD among patients with the disease has been reported to be impaired in several domains such as the disease etiology, the consequences of inadequate therapy, and the management of exacerbations [20]. The need for more education on self-management [21], the scope of rehabilitation, and its role in disease management [22] have been underlined by several studies. Better understanding of their illness may increase the ability of patients to effectively self-manage their disease as well as improve the adherence to treatment action plans [21].

Patients with COPD often experience depression and anxiety symptoms [23]. Interestingly, under-recognized and untreated depression and anxiety may have a significant negative impact on functional status and social interaction of COPD patients and are associated with increased healthcare utilization [24]. Recent research has shown that the level of disease knowledge is an important risk factor of anxiety and/or depression in COPD [25]. COPD patients with greater disease knowledge (as assessed by BCKQ) have

fewer anxiety- and depression-associated symptoms and one explanation could be that anxiety and depression are driven by the patients' perception of his/her disease and its' consequences in real life [25].

The level of our knowledge concerning the etiology of COPD was poor not only in patients but also in healthy subjects and caregivers. COPD is strongly associated with smoking history which was significant in our cohort; more than ¾ of the study population were current or ex-smokers. Our results underline the need for education aimed at increasing the awareness concerning smoking consequences in the respiratory system and its devastating results in increase of COPD incidence. Training programs designed to raise awareness of COPD etiology and thus prevention are warranted so as to encourage subjects to seek help for smoking cessation programs.

5 Conclusion

Our observations provide further confirmation that overall knowledge of the disease in COPD patients is poor, emphasizing the need for patient education programs. Since disease knowledge level has been associated with anxiety and depression in patients with COPD [7], we believe that, in accordance with Wang et al. [7], our findings underlie the need for COPD-specific knowledge programs that would be of great importance in improving quality of life in this patient population.

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Increased Body Mass Index (BMI) and Sunscreen Use Are Associated with Inadequate Vitamin D Status in Greek Adults in Winter

BMI, Sunscreen Use and Vitamin D Status in Greek Adults

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Abstract

Vitamin D deficiency is common even in sunny countries like Greece, especially during winter and is associated with skeletal disorders and additionally with increased risk for chronic diseases and adipose metabolic diseases such as obesity and diabetes. The purpose of this pilot study was the determination of vitamin D status in Greek adults and the investigation of possi-

ble correlation with lifestyles and somatometric characteristics. The study was conducted during winter and included 36 members (20 women and 16 men) of a university community in central Greece (latitude 39.6° North). Their age was 36.2 ± 16.3 years, body mass index (BMI) 26.4 ± 4.8 (women 26.6 ± 5.6, men 26.3 ± 3.8), and waist circumference 85.7 ± 13.3 cm (women 81.5 ± 13.0, men 90.7 ± 12.4) (mean ± SD). Mean serum 25(OH) D concentration was 20.1 ± 7.3 ng/mL (women 19.7 ± 7.6, men 20.7 ± 7.1). More than half of the participants had 25(OH)D levels below the 20 ng/mL (50 nmol/L) threshold of deficiency. There was a significant negative association between the use of sunscreen during summer

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and serum 25(OH)D concentrations during winter and a significant positive association between physical exercise and serum 25(OH) D. Levels of 25(OH)D tended to decrease with increasing BMI in persons with a BMI over 25.0. There is a high prevalence of vitamin D insufficiency in Greek adults during winter. Serum 25(OH)D levels in winter are positively associated with exercise and negatively associated with high BMI and the use of sunscreen during summer.

Keywords

Vitamin D · 25 Hydroxyvitamin D · Deficiency · Body mass index · Sunscreen · Physical activity

1 Introduction

Vitamin D is a fat-soluble vitamin that exists in two chemical forms, vitamin D_2 or ergocalciferol and vitamin D_3 or cholecalciferol [1, 2]. The latter is synthesized in the skin from 7-dehydrocholesterol via sunlight exposure [1–4]. Vitamin D is mainly stored in adipose tissue and can be obtained from the diet (e.g., fatty fish, fortified foods, and food supplements) but sunlight exposure is responsible for approximately 90% of the circulating levels of the vitamin when no supplements are consumed [2]. Both forms of vitamin D (D_2 and D_3) are metabolized in the liver to form the major circulating metabolite, 25-hydroxyvitamin D (25(OH)D). This metabo-lite is further hydroxylated in the kidney to form the biologically active form, 1α, 25-dihydroxyvitamin D ($1\alpha,25(OH)2D$) also known as calcitriol [1]. $1\alpha,25(OH)_2D$ acts as a steroid hormone and plays an important role in calcium and phosphorus homeostasis and metabolism, and hence, in bone health. Vitamin D deficiency is associated with rickets, osteomalacia, and osteoporosis but also with a number of other health problems [5]. Vitamin D is typically involved in the modulation of cell growth, immune, and neuromuscular functions as well as reduction of inflammation. Vitamin D deficiency/insufficiency can affect insulin secretion and resistance as well as inflammation leading to adipose metabolic diseases, such as obesity and diabetes [4]. In addition, low vitamin D status has been associated with sarcopenia and dementia, even though the mechanisms of this association are not yet fully elucidated [6].

Serum concentration of 25(OH)D is considered to be the best indicator of vitamin D status. There is a number of factors that determine serum 25(OH)D including age, intestinal absorption capacity, exposure to sunlight in summer months, use of sunscreen, physical activity, and diet [7–9]. Different values have been used as references, and guidelines from different scientific bodies and countries have set different threshold for hypovitaminosis D [2, 6]. Despite this, it is generally accepted that vitamin D deficiency is prevalent worldwide [4, 10] with certain population groups being at higher risk [11]. In Greece, according to the latest national dietary survey, serum 25(OH)D deficiency is prevalent in Greek adults of both genders with median serum 25(OH)D concentra-

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tion of 16.7 ng/mL [8] and vitamin D intake below the average requirement [12].

Obesity is another major public health problem worldwide [13] affecting both high-income and low-income countries. In Greece, obesity rates are high in both children [14] and adults [15]. Obesity is regarded as a multifactorial disease and hence identifying the factors and physiopathological mechanisms leading to obesity have become a pivotal issue in scientific literature. Recently, there have been studies showing that reduced 25(OH)D concentrations coexist with obesity [7, 10], although there is uncertainty as to the clinical significance of this association [10]. This pilot study aimed to investigate primarily the association of 25(OH)D levels with somatometric indices such as body mass index (BMI) and waist circumference (WC) in healthy adults in a university community in Greece. Secondary outcomes of this pilot study include the potential association of 25(OH)D levels with other factors such as physical activity, smoking, and use of sunscreen.

2   Materials and Methods

Adults aged between 20 and 60 years, members of the University of Thessaly community were invited to voluntarily participate in this study. Those with malignancies, diabetes, cardiovascular, renal, or hepatic disease were excluded. The sample in this pilot study consisted of 36 apparently healthy adults (16 males and 20 females). The study took place between December 2018 and February 2019. The anthropometric data collected were: (i) weight with the use of Seca 700 column mechanical balance, (ii) height with the use of Seca 214 stadiometer, (iii) percentage of body fat with the use of body fat analyzer BF-900 (bioelectrical impedance analysis [BIA]), and (iv) waist circumference measured with a tape measure following standard procedures. Body mass index (BMI) was calculated and classified according to the World Health Organization (WHO) into four categories: underweight (<18.5 kg/m^2), normal weight ($18.5–24.9$ kg/m^2), overweight ($25–29.9$ kg/m^2), and obesity (≥ 30 kg/m^2) [16]. Information on physical activity, smoking, the hours of sun exposure of the subjects, and the use

of sunscreen was also collected with the use of a validated questionnaire. Following a 12-h overnight fast, all subjects had a sample of venous blood withdrawn for serum isolation between 08:00 and 09:00 am. Serum 25(OH)D levels were determined by a commercially available ELISA kit (DRG International Inc., Springfield, NJ, USA) measuring the total 25 hydroxyvitamins D_2 and D_3. The detection limit of the assay was 2.5 ng/mL (6.3 nM). Intra- and inter-assay coefficients of variation of the kit at the level of 30 ng/mL (75 nM) were 1.6% and 3.6%, respectively. Serum 25(OH)D levels <20 ng/mL (50 nM) were regarded as deficient vitamin D status [2]. All participants provided written informed consent and ethics approval was obtained from Ethics Committee of the former TEI of Thessaly at the University of Thessaly (Approval number: 2/2019).

Statistical analysis was performed using SPSS (SPSS Statistics Version 26) and descriptive statistics and inductive data processing was performed. The statistical significance level was set at $p \leq 0.05$.

3   Results

This pilot study was based on a convenience sample of 36 adults from a university community in central Greece (Larisa. Coordinates: latitude 39.6 North and longitude 22.4 East) with a mean age of 36.2 ± 16.3 years, as depicted in Table 1. None was taking vitamin D supplements. Mean BMI values in both genders were in the range of "overweight." However, the mean waist circumference in men was below the WHO recommended cutoff point for men which is 94 cm, but in women the mean waist circumference was slightly above the WHO recommended cut-off sex-specific value for women which is 80 cm. As presented in Table 1, the mean serum 25(OH)D concentration was low with more than half of the participants having vitamin D deficiency (i.e., <20 ng/mL).

The association between serum 25(OH)D concentrations and various parameters is shown in Table 2. From the parameters that were investigated, there was a significant negative association between the use of sunscreen during the summer and serum 25(OH)D concentrations dur-

Table 1 General characteristics of the sample (mean ± SD)

	Total (N = 36)	Female (N = 20)	Male (N = 16)
Age (years)	36.2 ± 16.3	37.3 ± 16.8	34.9 ± 16.2
Weight (kg)	75.8 ± 14.1	71.2 ± 14.4	81.5 ± 11.8
Height (m)	1.69 ± 0.09	1.64 ± 0.05	1.76 ± 0.07
BMI (kg/m^2)	26.4 ± 4.8	26.6 ± 5.6	26.3 ± 3.8
Waist circumference (cm)	85.7 ± 13.3	81.5 ± 13.0	90.7 ± 12.4
Fat percentage (BIA)	29.8 ± 9.9	34.1 ± 8.9	24.4 ± 8.6
Serum 25(OH)D (ng/mL)	20.1 ± 7.3	19.7 ± 7.6	20.7 ± 7.1
% with serum 25(OH)D <20 ng/mL (50 nM)	52.8%	55.0%	43.8%

Table 2 Correlation between serum 25(OH)D concentrations and various parameters (p value for the t-test for Equality of Means)

Parameter	N	Serum 25(OH)D concentrations (ng/mL)	p value
Duration of exposure in the sun per day in the winter			
<5 min (a)	5	19.1 ± 5.1	p = 0.40 correlation between (a) and (d)
5–15 min	10	19.3 ± 6.2	
15–30 min	13	19.8 ± 9.0	
>30 min (d)	8	19.8 ± 9.0	
Use of sunscreen during summer			
Yes	27	18.5 ± 6.0	p = 0.02
No	9	25.06 ± 9.1	
Engagement in organized physical exercise			
Yes	23	22.0 ± 7.8	p = 0.04
No	13	16.8 ± 4.9	
Smoking			
Yes	10	21.0 ± 10.3	p = 0.65
No	26	19.8 ± 6.0	

ing winter time and a significant positive association between engagement in organized physical exercise and serum vitamin D levels.

The relationship of serum 25(OH)D concentrations with somatometric indices is shown in Figs. 1, 2, and 3. When all the subjects were examined, there was no correlation between the serum levels of 25(OH)D and BMI. As depicted in Fig. 1, serum concentrations of 25(OH)D tend to decrease with increasing BMI but only in persons with a BMI over 25.0, in the range of "overweight." With regard to waist circumference and percentage of body fat, this tendency exists, but appears to be less obvious.

4 Discussion

This pilot study aimed at evaluating the association of various parameters with regard to serum 25(OH)D concentrations during winter, in 36 healthy Greek adults. Despite the small sample size, this study adds to the increasing body of evidence [8, 17] that vitamin D status is low particularly during the winter period in all the age groups of the Greek population including adults [8], children, and adolescents [17]. In view of the link that has been postulated between vitamin D deficiency and obesity [18, 19], we sought to investigate this association in our sample, since obesity
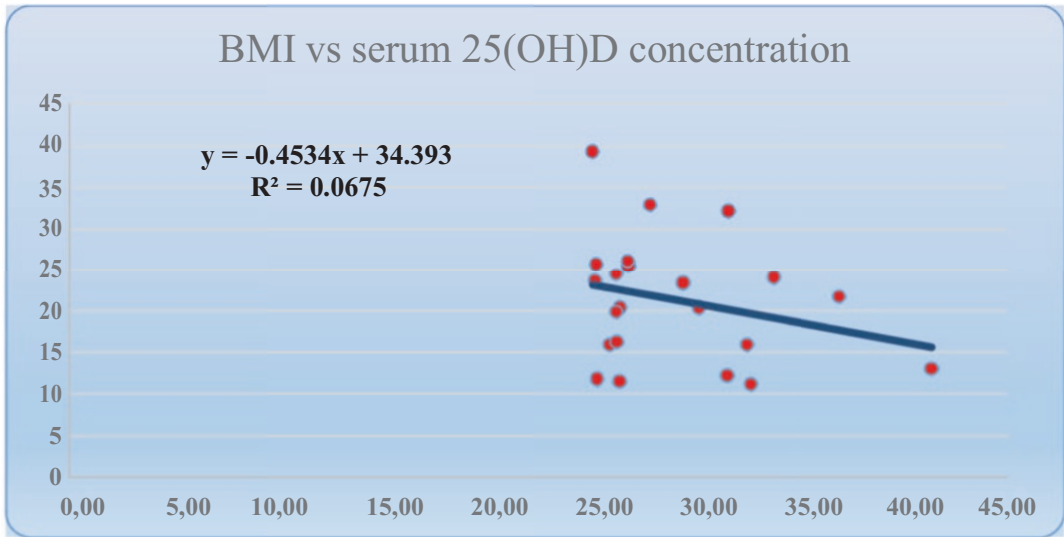
Fig. 1 Linear regression results with 25(OH)D as dependent variable and BMI as independent
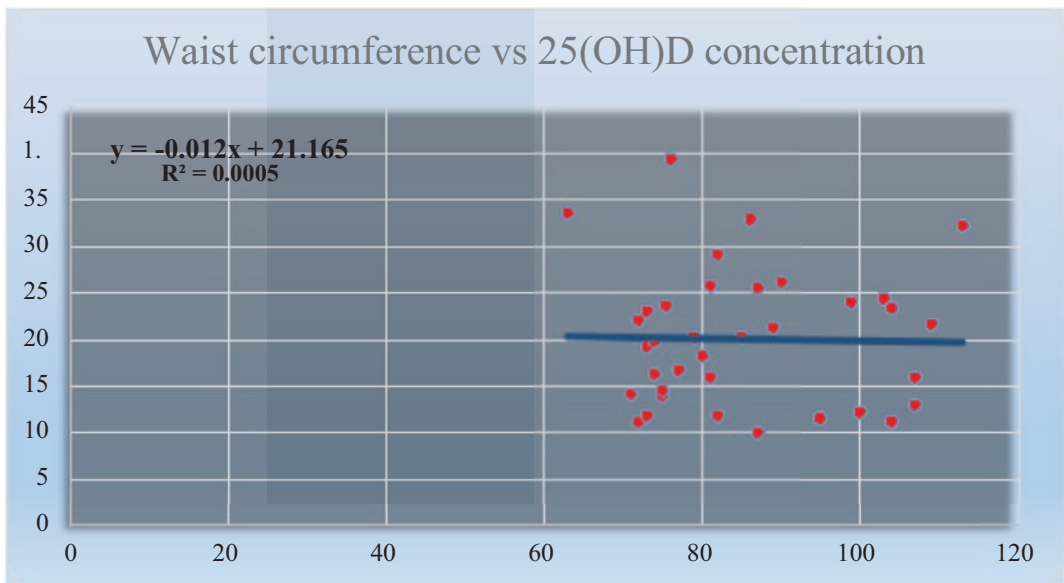
Fig. 2 Linear regression results with 25(OH)D as dependent variable and waist circumference as independent

is also a public health problem in Greece. It was found that as BMI increases, serum 25(OH)D levels decrease. However, this trend seemed to be less obvious with waist circumference. It is known that vitamin D is stored in adipose tissue. Taking into account that males and females may store fat in different sites, this could possibly explain why waist circumference was not signifi-

cantly associated with 25(OH)D levels in our sample that included both genders. Therefore, waist circumference may not be a suitable index to be used in future population studies investigating the relationship between vitamin D status and obesity. Interestingly, the correlation between serum 25(OH)D and percentage body fat was also less obvious compared to the correlation
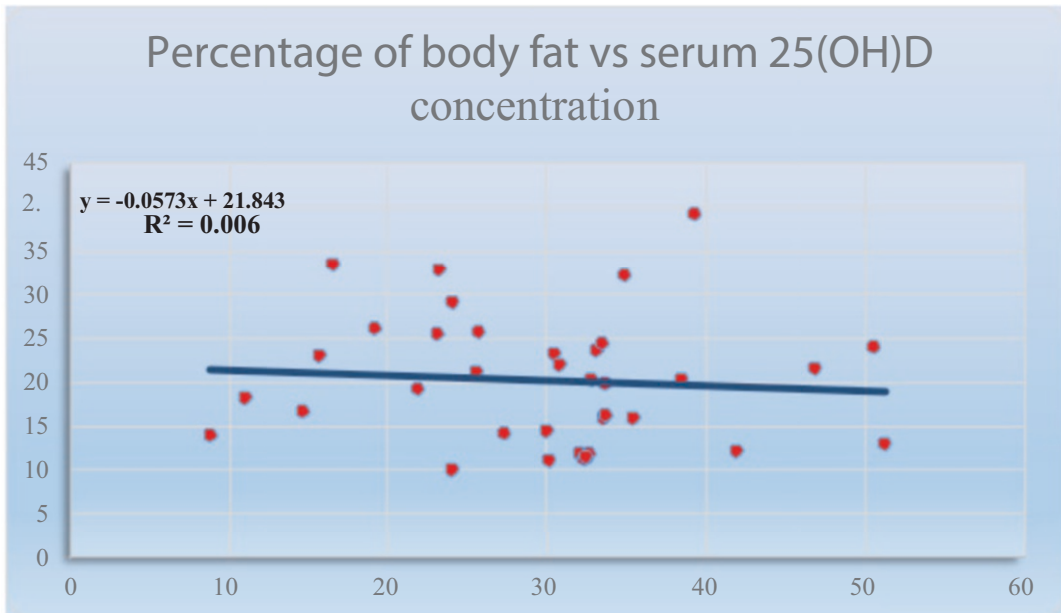
Fig. 3 Linear regression results with 25(OH)D as dependent variable and percentage of body fat as independent

observed between serum 25(OH)D and BMI. Vitamin D is known to maintain bone mineral density but is also involved in muscle functioning [20, 21]. Therefore, in addition to excess body fat, bone and muscle mass could partly explain the correlation seen between body mass index and serum concentrations of 25(OH)D. However, a larger sample size is needed to assess the individual impact of fat, muscle, and bone mass with regard to serum 25(OH)D levels.

Engagement in organized physical exercise appeared to be a statistically significant determinant of serum 25(OH)D concentrations. While it could be argued that outdoor physical activity could influence vitamin D status via the vitamin D synthesis due to sun exposure, according to a recent systematic review [22] increased serum 25(OH)D concentration occurs with physical activity either indoors or outdoors.

The lack of correlation between serum 25(OH)D concentration and duration of exposure in the sun during winter time was not surprising, since Larisa, Greece is at latitude 39.6° north of the equator and it is known that UVB (280–320 nm) intensity decreases at latitudes above 33° during the winter months, affecting vitamin D synthesis

via exposure to sunlight. Seasonal variation in serum levels of 25(OH)D has also been previously reported in Athens (Greece) [23]. However, the findings from this pilot study indicated that the non-use of sunscreen during summer time was positively correlated to serum 25(OH)D concentration during winter time. A recent cross-sectional study in Colombia [24] reported that the frequent use of sunscreen is related to lower serum 25(OH)D levels since the use of sunscreens reduces the absorption of UVB rays and hence the synthesis of vitamin D. An SPF 15 could reduce the synthesis of vitamin D by approximately 98%.

Finally, according to a recent review [25], smoking (whether active or passive) can reduce through various pathways the serum levels of 25(OH). For example, vitamin D reduction due to smoking could be attributed to enzymatic and hormonal production of subsequent metabolites or via depression in parathyroid hormone (PTH) levels [25]. The results of our pilot study did not show a significant correlation between smoking and vitamin D levels; this may be attributed to the small number of smokers in the sample, or because some of the non-smokers could have

actually been passive smokers. This aspect of passive smoking should also be taken into account in future studies on vitamin D in Greece.

The limitations of our study include the small sample size and the lack of seasonality which could otherwise provide greater insights into the association of serum 25(OH)D levels with various somatometric and other variables.

5 Conclusion

This study confirms the high percentage of Greek adults with low vitamin D status. There seems to be a tendency of lower serum 25(OH)D levels with increasing body fat and, more so, with increasing BMI. In addition, the use of sunscreens and the lack of organized physical exercise were significant determinants of vitamin D status. Exposure in the sun during winter period and active smoking did not seem to correlate with serum 25(OH)D in our sample.

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The Effect of Whole-Body Cryostimulation in Healthy Adults

Whole-Body Cryostimulation According to Gender and Smoking Status

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Abstract

Introduction: Whole-body cryostimulation (WBC) refers to the therapeutic application of extremely cold dry air for a short period of time. The method has beneficial results in various diseases as well as the recovery of athletes. The effects of WBC in healthy individuals have not been extensively investigated.

Purpose: We aim to explore differences in the effects of WBC on blood pressure (BP), oxygen saturation (SpO_2), and heart rate (HR) in healthy adults (not athletes) as well as differences according to gender and smoking status.

Materials and Methods: Fifty adults (male/female: 32/18) smokers/nonsmokers: 26/24) were included in the study. WBC was performed in a cryochamber at −85 °C for 3 min.

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Systolic BP (SBP) and diastolic BP (DBP), HR, and SpO_2 were measured before and immediately after WBC.

Results: Males and females differed significantly in SBP after WBC (138.1 ± 13.0 vs 128.5 ± 17.0 mmHg, respectively, $p = 0.029$), SpO_2 after WBC (96.6 ± 1.8 vs 98.3 ± 1.5%, respectively, $p = 0.001$) and HR after WBC (60.1 ± 9.6 vs 70.2 ± 7.7 bpm, respectively, $p < 0.001$). In males, SpO_2 remained unchanged before and after WBC, whereas in women SpO_2 increased by 1.0 ± 1.4% ($p = 0.038$) (Table 2). HR after WBC displayed a downward trend by −9.8 ± 5.9% in males compared to an upward trend by 3.6 ± 15.1 in females ($p < 0.001$). Nonsmokers displayed higher increase in SBP after WBC (4.3 ± 9.0% in smokers compared to 13.3 ± 13.2% in nonsmokers, $p = 0.007$). Smokers presented an increase by 1.0 ± 1.6% in SpO_2, while in nonsmokers, SpO_2 decreased by 0.8 ± 2.1% following WBC ($p = 0.001$).

Conclusions: Our results suggest that WBC affects the cardiovascular and the respiratory system differently in males versus females and smokers versus nonsmokers. More studies are needed in order to fully explore the effects of WBC in these population groups in order to design individualized treatment protocols.

Keywords

Whole-body cryostimulation · Gender · Smoking status

1   Introduction

Whole-body cryostimulation (WBC) refers to the therapeutic application of extremely cold dry air, usually between −110 and −140 °C for a short period of time (2–4 minutes) [1]. The method aims at minimizing inflammation. In extreme cold conditions, cutaneous thermoreceptors initiate the classical cold shock response, which is associated with an increase in heart rate (HR),

hyperventilation, vasoconstriction in the periphery, and hypertension. Despite the very low temperatures, the procedure is considered safe and has few contraindications. The method was first applied in rheumatoid arthritis patients [2] and is currently involved in the management of various disease including ankylosing spondylitis [3] and depression [4], while it is an increasingly popular tool for the recovery of athletes [5].

Only a limited number of studies have addressed the effects of WBC in respiratory and cardiovascular parameters in healthy individuals (not athletes). Additionally, the possible contribution of sex and smoking status on the effects of WBC has not been extensively investigated. The purpose of the present study is to investigate the difference in the effects of WBC in blood pressure, oxygen saturation, and heart rate among males and females as well as in smokers versus nonsmokers.

2   Materials and Methods

2.1   Participants

Fifty Caucasian adults with no known medical history were included in our study on a voluntary basis and were divided into two groups, according to gender (male $n = 32$ vs female $n = 18$) and smoking status (smokers $n = 26$ vs nonsmokers $n = 24$). Inclusion criteria included: age above 20 years, no recent injury, no menstruation, and >6 days of the last day of menstruation. Subjects with a known contraindication to WBC (i.e., cold intolerance, open wounds, ulcers, and acute disease) were excluded. The study was conducted according to the Helsinki declaration for use in Human subjects (No. 2800, Scientific Council of University Hospital of Larisa). All the participants provided a written consent.

2.2   Data Collection

For each healthy participant, anthropometric and morphological characteristics were recorded prior to WBC. Body height was assessed with a mechanical column scale (Seca 700, Seca GmbH & Co, Hamburg, Germany). Body

weight, body mass, and body composition were calculated by a commercially available body analyzer (TanitaMC-980, Tanita Europe, Amsterdam, The Netherlands). The body surface area (BSA) was calculated according to Mosteller's (1987) formula as follows: BSA (m^2) = (height (cm) × weight (kg))/3600$^{1/2}$. The lean body mass (LBM) was estimated according to Boer's (1984) formula: LBM (kg) = 0.407 × weight (kg) + 0.267 × height (cm) − 19.2, both recorded prior to WBC.

WBC was performed in a Cryochamber (MECOTEC GmbH, Bitterfeld-Wolfen, Germany) at −85 °C for 3 minutes. Systolic blood pressure (SBP), diastolic blood pressure (DBP) (measured with a sphygmomanometer, Mac, Japan), heart rate (HR), and oxygen saturation (Ri-Fox N Pulse Oximeter Riester, Germany) were measured before and immediately after WBC. During WBC, all participants were standing in the chamber motionless, wearing swimsuit, gloves, mask, ear cover, socks and rubber slippers. All sessions were performed under the same conditions in the facilities of "The Medical Project" with the environmental temperature 22 ± 2 °C and humidity 43 ± 5%. The evaluation was made between 18:00 p.m. and 20:00 p.m. All participants were evaluated in rest, without having exercised before entering the cryochamber.

2.3 Statistical Analysis

The data are presented as mean value and standard deviation (Mean ± SD) and absolute numbers of percentages. The Kolmogorov–Smirnov test was used for normality of distribution. The Mann–Whitney U test was used for comparison between groups (*t* test or Mann–Whitney U test to compare continuous or noncontinuous variables as appropriate). The level of significance was set to $p < 0.05$. We used the statistical package SPSS 21 (SPSS Inc., Chicago, IL, USA).

3 Results

The demographics and anthropometric characteristics of the study population are displayed in Table 1. Males and females were not different in terms of age (45.3 ± 9.9 vs 44.3 ± 9.2 years, respectively). Smokers were statistically significant younger than nonsmokers (42.1 ± 5.9 vs 48.1 ± 11.6, respectively, $p = 0.044$). Females when compared to males had statistically significant lower body mass index (BMI) (30.6 ± 5.5 vs 34.5 ± 6.8 kg/m^2, respectively, $p = 0.044$) and BSA (1.9 ± 0.4 vs 2.7 ± 0.5 m^2, respectively, $p < 0.001$) and higher lean body mass (58.5 ± 7.3 vs 73.0 ± 8.7, respectively, $p < 0.001$) (Table 1). Smokers and nonsmokers did not differ in terms of BMI, BSA, and lean body mass (Table 1).

3.1 Gender

Table 2 presents descriptive data and percent difference before and after WBC on ventilatory and cardiovascular parameters in males versus females. The two groups were similar in terms of SBP, SpO$_2$, and HR before WBC as well as DBP before and after WBC. Males and females differed significantly in SBP after WBC

Table 1 Anthropometric characteristics between groups

		Male $n = 32$	Female $n = 18$	*p* value	Smoker $n = 26$	Nonsmoker $n = 24$	*p* value
					(M:58%)	(M:29%)	
Age	years	45.3 ± 9.9	44.3 ± 9.2	0.731	42.1 ± 5.9	48.1 ± 11.6	0.024
Body mass index	kg/m^2	34.5 ± 6.8	30.6 ± 5.5	0.044	32.5 ± 2.9	33.8 ± 9.1	0.459
Body surface area	m^2	2.7 ± 0.5	1.9 ± 0.4	<0.001	2.3 ± 0.3	2.5 ± 0.8	0.126
Lean body mass	kg	73.0 ± 8.7	58.5 ± 7.3	<0.001	65.8 ± 5.8	69.9 ± 14.1	0.183
Total body water	%	51.5 ± 8.4	44.5 ± 3.0	0.001	48.1 ± 5.0	49.8 ± 9.9	0.434

Continuous variables are presented as mean ± standard deviation

Table 2 Results between groups before and immediately after whole-body cryostimulation (WBC)

		Male $n = 32$	Female $n = 18$	p value	Smoker $n = 26$ (M:58%)	Nonsmoker $n = 24$ (M:29%)	p value
$SBP_{pre\text{-}WBC}$	mmHg	127.9 ± 15.1	119.2 ± 14.0	0.052	129.8 ± 14.5	118.9 ± 14.4	0.010
$DBP_{pre\text{-}WBC}$	mmHg	77.4 ± 9.3	79.8 ± 9.8	0.394	83.2 ± 7.8	72.8 ± 8.1	<0.001
$SpO_{2pre\text{-}WBC}$	%	96.8 ± 1.3	97.4 ± 1.5	0.142	96.6 ± 1.4	97.4 ± 1.2	0.042
$HR_{pre\text{-}WBC}$	bpm	66.8 ± 10.7	68.7 ± 10.6	0.534	73.4 ± 9.4	60.5 ± 8.1	<0.001
$SBP_{post\text{-}WBC}$	mmHg	138.1 ± 13.0	128.5 ± 17.0	0.029	135.3 ± 17.6	133.5 ± 12.5	0.679
$DBP_{post\text{-}WBC}$	mmHg	79.5 ± 9.6	76.5 ± 11.1	0.326	84.2 ± 7.7	72.0 ± 8.7	<0.001
$SpO_{2post\text{-}WBC}$	%	96.6 ± 1.8	98.3 ± 1.5	0.001	97.7 ± 1.0	96.7 ± 2.5	0.047
$HR_{post\text{-}WBC}$	bpm	60.1 ± 9.6	70.2 ± 7.7	<0.001	67.7 ± 7.5	59.1 ± 11.3	0.003
SBP	% diff	8.8 ± 10.6	8.4 ± 14.6	0.916	4.3 ± 9.0	13.3 ± 13.2	0.007
DBP	% diff	3.6 ± 13.8	−3.8 ± 11.7	0.061	1.5 ± 9.7	0.1 ± 16.7	0.686
SpO_2	% diff	−0.1 ± 2.3	1.0 ± 1.4	0.038	1.0 ± 1.6	−0.8 ± 2.1	0.001
HR	% diff	−9.8 ± 5.9	3.6 ± 15.1	<0.001	−7.6 ± 9.0	−2.2 ± 14.1	0.136

Continuous variables are presented as mean ± standard deviation

Note: *DBP* diastolic blood pressure, *HR* heart rate, *M* male, *SBP* systolic blood pressure, *SpO2* oxygen saturation

(138.1 ± 13.0 vs 128.5 ± 17.0 mmHg, respectively, $p = 0.029$), SpO_2 after WBC (96.6 ± 1.8 vs 98.3 ± 1.5%, respectively, $p = 0.001$) and HR after WBC (60.1 ± 9.6 vs 70.2 ± 7.7 bpm, respectively, $p < 0.001$).

In both genders, SBP increased after WBC (8.8 ± 10.6% in males compared to 8.4 ± 14.6% in females). Males presented an increase by 3.6 ± 13.8% in DBP, while in females, DBP decreased by 3.8 ± 11.7% following WBC, but the percent difference among groups was not statistically significant (Table 2). In males, SpO_2 remained unchanged before and after WBC, whereas in females, SpO_2 increased by 1.0 ± 1.4% ($p = 0.038$) (Table 2). HR after WBC displayed a downward trend by –9.8 ± 5.9% in males compared to an upward trend by 3.6 ± 15.1% in females ($p < 0.001$) (Table 2).

3.2 Smoking

Smokers and nonsmokers differed significantly before WBC in SBP (129.8 ± 14.5 vs 118.9 ± 14.4 mmHg, respectively, $p = 0.01$), DBP (83.2 ± 7.8 vs 72.8 ± 8.1 mmHg, respectively, $p < 0.001$), SpO_2 (96.6 ± 1.4 vs 97.4 ± 1.2%, respectively, $p = 0.042$), and HR (73.4 ± 9.4 vs 60.5 ± 8.1 bpm, respectively, $p < 0.001$) (Table 2).

After WBC, smokers and nonsmokers differed significantly in DBP (84.2 ± 7.7 vs 72.0 ± 8.7 mmHg, respectively, $p < 0.001$), SpO_2 (97.7 ± 1.0 vs 96.7 ± 2.5%, respectively, $p = 0.047$), and HR (67.7 ± 7.5 vs 59.1 ± 11.3, respectively, $p = 0.003$). SBP after WBC did not differ before and after WBC in smokers when compared to nonsmokers (Table 2).

Nonsmokers displayed higher percent increase in SBP after WBC (4.3 ± 9.0% in smokers compared to 13.3 ± 13.2% in nonsmokers, $p = 0.007$). Smokers presented an increase by 1.0 ± 1.6% in SpO_2, while in nonsmokers, SpO_2 decreased by 0.8 ± 2.1% following WBC ($p = 0.001$). The percent difference before and after WBC in DBP and HR was not statistically significant in smokers versus nonsmokers (Table 2).

4 Discussion

Whole-body cryostimulation is a method that has been recently introduced for the treatment of rheumatoid arthritis [2], and since then, it has been massively used for treatment of different diseases and even more for sports injuries and rehabilitation of athletes. However, precise effects of WBC among healthy individuals have not been well recognized, and possible uses and contraindications of WBC have not been totally

detected. In our study, we measured the values of three basic vital signs, such as blood pressure, heart rate, and oxygen saturation and how these three are influenced by WBC in healthy individuals dividing them first by gender and second by smoking habit.

All groups showed a significant elevation of SBP immediately after the WBC process, results that agree with previous studies [6–9]. It is well defined that the main contributors of SBP are stroke volume (SV), heart rate (HR), and afterload, and the main factors affecting SV are preload and heart contractility. As a result, a mechanism affecting these factors should take place during WBC leading to an elevation of SBP. Sympathetic system activation seems to be the main regulator of this process, causing thermoregulatory responses and leading to cutaneous vasoconstriction (afterload), which drives more blood to the heart and increases preload, which produces the increase of SBP (preload) [8, 10]. This scenario seems to be confirmed also from the elevated values of norepinephrine after cold stress [9, 11–13]. However, WBC affects only skin temperature and not body temperature and makes us also hypothesize that local regulators on the skin contribute to the cutaneous vasoconstriction, like nitric oxide and its regulators [8, 14].

Moreover, in our study, smokers showed lower increase in SBP values after WBC than nonsmokers, a result of significant importance. Zalewski et al. [7] comparing the response of SBP before and after the WBC process between normotensive and hypertensive individuals showed that hypertensive individuals denoted a decrease in SBP after WBC probably because of weakened compensatory mechanisms. We hypothesize that this is a probable explanation in our results as smoking habit and hypertension have a close relation [15].

On the other hand, DBP showed only a moderate increase. Probably, this result is justified by the fact that the basic contributors of DBP in healthy individuals are total peripheral resistance (TPR) and HR. As we already mentioned, WBC mainly causes cutaneous vascular constriction, having only a gradual effect on the TPR [8]. In addition, in our study, patients showed a decline in HR after the process, which combined with the small effect on TPR is possibly the reason of the moderate rise in DBP.

Heart rate values in all groups after WBC were plummeted, compared with HR values before the process, results consistent with reports of other authors [6, 8], although some reports support an opposite effect [16]. A logical explanation of this would be the triggering of baroreceptors because of the increased blood pressure, leading to the activation of the parasympathetic system and producing bradycardia. However, some authors reported that bradycardia appeared before BP changes [17], supporting that this was due to the faster conduction of parasympathetic fibers.

Individuals showed a small change between pre- and post-cryostimulation SpO_2 values, which were fluctuating between −0.8 in smokers and +1 in females and nonsmokers. Overall, cold temperature shifts the oxygen–hemoglobin dissociation curve to the left, which could be the reason of the increase in SpO_2 seen in smokers. However, WBC has a small effect on body temperature and mainly affects skin temperature, a fact that doubts the previous hypothesis. In addition, oxygen consumption is increased because of the thermogenic procedures that take place, as does the minute ventilation [18]. Unfortunately, our study cannot answer this question, as more parameters should be added, such as oxygen and carbon dioxide partial pressure, pH, etc., for a better evaluation. Despite these limitations, the rise of SpO_2 shown in this study is really interesting because of the practical implications of cryostimulation, such as the possibility of using of WBC in patients with low oxygen saturation, such as patients with chronic obstructive pulmonary disease (COPD), and more research should be done in this field.

Previous studies have suggested that there may be a sex difference in the responses after exposure to extreme cold [1, 19]. Cutell et al. have reported lower mean skin and body temperature following WBC in females possibly

related to the relative BSA and BSA to mass ratio [1]. Others have observed differences among genders in maximal anaerobic power following WBC [20]. We observed significant differences in change following WBC in SpO_2 and HR between males and females. Our results provide important insights in the sex-related differences on the effects of WBC and suggest that gender may be considered when one designs WBC research or treatment protocols.

5 Limitations

Several potential limitations of this study should be highlighted. First, the small sample size should be mentioned. Furthermore, the limited parameters that were measured and the lack of biomarkers restricted a complete evaluation of our results and the integrated explanation of mechanisms producing these changes.

6 Conclusion

Our study supports the notion that WBC affects the cardiovascular and the respiratory system differently in males versus females and smokers versus nonsmokers. More research is warranted in order to fully discover WBC effects in these population groups in order to design individualized treatment protocols.

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Exhaled Nitric Oxide (FeNO) in Patients Hospitalized for an Exacerbation of Bronchiectasis and/or COPD

FeNO Levels in COPD and Bronchiectasis

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Abstract

Exhaled nitric oxide (FeNO) represents an important marker of airway inflammation, yet its role in chronic obstructive pulmonary disease (COPD) and/or bronchiectasis is not well studied. We aimed to measure FeNO in patients with COPD, bronchiectasis, and combination of COPD/bronchiectasis during an acute exacerbation (AE) of the underlying disease as well as to describe the characteristics of patients with COPD/bronchiectasis overlap in patients hospitalized for an acute exacerbation (AE). Seventy-nine patients were enrolled in the study as follows: COPD $n = 45$, bronchiectasis $n = 18$, and COPD and bronchiectasis $n = 16$. FeNO was measured with a commercially available analyzer within 24 hours of admission and at discharge. FeNO differed significantly on admission when compared at discharge in the whole group (16.91 ± 16.14 vs 12.48 ± 10.67, $p = 0.008$, respectively). On admission, FeNO was 17.80 ± 18.77 ppb in COPD patients, 17.12 ± 6.59 in bronchiectasis patients, and 11.55 ± 2.42 in patients with COPD/bronchiectasis overlap. At discharge, FeNO was 12.40 ± 12.11 ppb in COPD patients, 15.50 ± 6.39 in bronchiectasis patients, and 9.00 ± 3.22 in patients with combination. FeNO differed significantly in bronchiectasis patients versus patients with COPD/bronchiectasis overlap at admission ($p = 0.043$) and at discharge ($p = 0.020$) and versus COPD patients at discharge ($p = 0.043$). FeNO decreased significantly during the AE in all groups ($p = 0.001$ for COPD, $p = 0.021$ for bronchiectasis, and $p = 0.026$ for combination). FeNO levels in patients with COPD and/or bronchiectasis exacerbation are possibly increased at admission and decrease at discharge. The differences in FeNO levels

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between groups may reflect different underlying inflammatory mechanisms.

1   Introduction

Bronchiectasis is a disease characterized by chronic cough, sputum production, hemoptysis, and infectious exacerbations. High-resolution computed tomography (HRCT) imaging provides the diagnosis of bronchiectasis when signs such as abnormal dilation of bronchi and/or bronchial segment (or subsegment) larger than the accompanying artery are present [1]. In recent years, there have been many studies suggesting that radiological bronchiectasis is a common finding in patients with chronic obstructive pulmonary disease (COPD), raising the possibility of a COPD/bronchiectasis phenotype [2]. The coexistence of bronchiectasis with COPD has been associated with greater disease severity, more frequent exacerbations, and possibly increased mortality [3]. Researchers have proposed that a causal association exists between the two entities due to the frequent infectious exacerbations in COPD patients, although no definite conclusions can be drawn based on the existing literature. The relationship of COPD with bronchiectasis may have important clinical implications in terms of therapeutic management, and researchers have underlined the need for better understanding of COPD/bronchiectasis overlap [4].

Exhaled nitric oxide (FeNO) presents a reliable, quantitative, easily applicable, and safe marker of airway inflammation [5]. Current guidelines suggest that FeNO may be used as an adjunctive measure for asthma diagnosis in patients with clinical uncertainty and recommend the use of FeNO as a surrogate for the diagnosis of eosinophilic airway inflammation and estimation of responsiveness to inhaled steroid therapy.

FeNO has practical and clinical implications in the assessment of airway inflammation especially in patients with asthma where it may be helpful in the management and monitoring of the disease [6]. The exact role of FeNO in patients with COPD is not yet established, while the available data on the possible role of FeNO in bronchiectasis and COPD/bronchiectasis overlap are scarce.

In the present study, we aimed to compare clinical findings and FeNO levels at admission for an acute exacerbation (AE) and at recovery of patients with bronchiectasis, COPD, and COPD/bronchiectasis overlap.

2   Materials and Methods

2.1   Subjects

The present prospective case control study was conducted in the University Hospital of Larissa, Larissa, Greece. Patients were recruited by consecutive sampling of the patients admitted to the Respiratory Medicine Department. The study included three patient groups: patients with a diagnosis of an AE of COPD, patients with an exacerbation of bronchiectasis, and patients with concomitant COPD and bronchiectasis (COPD/bronchiectasis overlap) suffering from an AE. COPD was diagnosed according to international diagnostic criteria [7]. Bronchiectasis diagnosis was based on HRCT of the chest presenting consistent findings[8]. COPD/bronchiectasis overlap was diagnosed in patients with COPD that presented radiological findings consistent with bronchiectasis in HRCT [3]. Patients with a previous exacerbation of the underlying disease within 8 weeks and patients with cystic fibrosis or other concomitant respiratory disease (i.e., asthma, pneumonia, lung cancer, and pulmonary fibrosis) or other comorbidity that could interfere with FeNO levels (e.g., primary ciliary dyskinesia) were excluded from the study. During hospitalization, patients received standard therapy, including oxygen, nebulized bronchodilators, and/or steroids, antibiotics, and intravenous steroids according to the patient clinical presen-

tation and the physician in charge. The choice of treatment was unrelated to the inclusion of the patient in the study, and therefore, therapy was not standardized. The time of discharge was based on the patient's response to treatment. The study was approved by the University Hospital of Larissa ethics committee. Written and verbal informed consent from all subjects was obtained.

2.2 Study Design

All participants underwent a thorough medical and nursing history (including smoking history, previous medical history, concomitant diseases, and history of previous hospitalizations), clinical examination (including somatometric measurements), and arterial blood gas (ABGs) analysis (model 1630; Instrumentation Laboratories, Milan, Italy). Spirometry data at baseline were recorded (Bodyplethysmograph, Master-Screen Body, Viasys Healthcare, Höchberg, Germany) [9]. Percentage predicted values were calculated based on the age, gender, race, and the anthropometric measurements of the patient. Routine blood testing, including a complete blood count, was performed at the day of admission.

Measurement of FeNO was performed with a commercially available analyzer (NIOX MINO, Aerocrine Sweden) within 24 hours of admission and 15 days later (or at discharge if patients were still hospitalized 15 days following admission). The measurement was performed according to current guidelines and the instructions of the manufacturer [5]. Patients abstained from eating, drinking, or smoking for at least 1 hour before the measurement was performed. FeNO was measured with the patient exhaling at a constant flow at 50 mL/s for 6–10 seconds after inhaling air to total lung capacity.

2.3 Statistical Analysis

The sample size was calculated to provide 5% absolute precision with a 95% level of significance ($a = 0.05$ by a two-sided test) for an effect size of 4. According to these data, a total of 16 patients were to be enrolled in each study group. Data are presented as mean ± SD. Normal distribution was assessed by the Kolmogorov–Smirnov test. Comparison between two patients' groups was performed with the use of Student's t test or Mann–Whitney U test according to variable distribution. Correlation between the three study groups was performed with analysis of variance or Kruskal–Wallis statistic according to variable distribution. Comparison of each group at admission and at discharge was performed with paired t test or Wilcoxon signed rank test according to variable distribution. Univariate correlations were performed by Pearson's correlation coefficient or by Spearman's correlation coefficient according to variable distribution. A p-value of <0.05 was considered to be statistically significant. Analysis was performed using the SPSS 16 statistical package (SPSS Chicago, IL, USA).

3 Results

The study population consisted of 79 patients. Forty-five patients suffered from an AE of COPD, 18 were hospitalized for an AE of bronchiectasis and 16 had COPD/bronchiectasis overlap. Demographic characteristics of participants are shown in Table 1. Mean (±SD) age was 71.80 ± 9.39 years. Seventy-two patients were males and seven were females. The majority of patients were ex or current smokers and only 14 were nonsmokers. COPD patients and patients with COPD/bronchiectasis overlap were current

Table 1 Demographic characteristics and FeNO levels of the study population

Parameter	N or mean ± SD
Age (years)	71.80 ± 9.39
Gender (male/female)	72/7
Smoking habit (no/current/ex-smoker)	14/40/25
Pack-years	70.51 ± 36.00
History of an acute exacerbation in the previous year (yes/no)	25/54
FeNO at admission (ppb)	14.50 ± 6.79*
FeNO at discharge (ppb)	11.13 ± 5.60

*$p = 0.008$ as compared with FeNO levels at discharge

or ex-smokers. Mean pack-years was 70.51 ± 36.00. Mean days of hospitalization were 7.25 ± 5.70 days. We observed that 31.64% of the patients had a history of an AE the year before the inclusion in the study. All patients received systemic antibiotics. All COPD patients and 50% of COPD/bronchiectasis patients received systemic steroids. None of the bronchiectasis patients received systemic steroids regularly during their hospitalization.

Table 2 presents the demographic and clinical characteristics of the three study groups. Patients with an exacerbation of COPD, bronchiectasis, and COPD/bronchiectasis overlap did not differ in terms of age, pack years (pys), PCO_2, and pH levels. The three groups were significantly different in sex distribution, with 100% of patients with COPD/bronchiectasis overlap and 97.77% of patients with COPD belonging to the male gender as opposed to 66.66% of patients with bronchiectasis ($p < 0.001$, Table 2). Similarly, the three groups differed in terms of smoking history with the majority of patients with bronchiectasis belonging to the nonsmoker group, whereas COPD and COPD/overlap patients were current or ex-smokers ($p < 0.001$, Table 2). Exacerbation history in the previous year was more frequent in patients with COPD/bronchiectasis overlap (75%) versus patients with COPD (24.4%) and patients with bronchiectasis (11.11%) ($p < 0.001$). COPD patients and patients with COPD/bronchiectasis overlap presented worse oxygenation at admission in terms of PO_2 when compared to patients with bronchiectasis (59.02 ± 13.64 vs 59.06 ± 8.57 vs 71.66 ± 10.43,

respectively, $p = 0.001$). In the same context, patients with COPD/bronchiectasis overlap and patients with COPD presented lower FEV1%pred when compared to patients with bronchiectasis alone (38.20 ± 6.87 vs 43.58 ± 14.93 vs 77.00 ± 10.77, respectively, $p < 0.001$, Table 2).

FeNO levels at admission were statistically significantly higher than FeNO levels during discharge (14.50 ± 6.79 vs 11.12 ± 5.60 ppb, respectively, $p < 0.001$). When examining the different study groups, we observed that FeNO levels differed significantly in patients with COPD at admission versus FeNO levels at discharge (14.88 ± 8.09 vs 10.88 ± 6.18 ppb, respectively, $p < 0.001$). Similarly, FeNO levels were significantly reduced at discharge when compared to admission in patients with bronchiectasis (14.00 ± 4.98 vs 16.55 ± 4.81 ppb, respectively, $p < 0.001$) and in patients with COPD/bronchiectasis overlap (8.56 ± 2.39 vs 11.12 ± 2.06, respectively, $p < 0.001$) (Table 2).

When comparing FeNO levels at admission between study groups, we observed that patients with COPD/bronchiectasis overlap presented lower levels of FeNO (11.12 ± 2.06 ppb) versus patients with COPD (14.88 ± 8.09 ppb) and patients with bronchiectasis (16.55 ± 4.81 ppb) ($p = 0.006$, Table 2). Similarly, FeNO levels at discharge were lower in patients with COPD/bronchiectasis overlap (8.56 ± 2.39 ppb) versus patients with COPD (10.88 ± 6.18 ppb) and patients with bronchiectasis (14.00 ± 4.98 ppb) ($p = 0.002$, Table 2).

In more detail, at admission, FeNO levels in patients with COPD/bronchiectasis overlap dif-

Table 2 Demographic and clinical characteristics of the three study groups

	COPD	Bronchiectasis	COPD and Bronchiectasis	p-value
Age (years)	70.97 ± 9.61	73.00 ± 10.40	74.25 ± 5.70	0.574
Sex (male/female)	44/1	12/6	16/0	<0.001
Smoking habit (non/current/ex smoker)	0/27/18	14/2/2	0/11/5	**<0.001**
Pys	75.47 ± 36.10	33.33 ± 15.27	63.07 ± 34.25	0.101
Exacerbation history (yes/no)	11/34	2/16	12/4	**<0.001**
PaO$_2$ (mmHg)	59.02 ± 13.64	71.66 ± 10.43	59.06 ± 8.57	0.001
FEV1 (%)	43.58 ± 14.93	77.00 ± 10.77	38.20 ± 6.87	**<0.001**
FeNO—admission (ppb)	$14.88 \pm 8.09*$	$16.55 \pm 4.81*$	$11.12 \pm 2.06*$	0.006
FeNO—discharge (ppb)	10.88 ± 6.18	14.00 ± 4.98	8.56 ± 2.39	0.002

*$p < 0.001$ when compared FeNO levels at discharge. Data are expressed as mean ± SD or as absolute numbers

Fig. 1 FeNO levels at admission. $p < 0.001$ for COPD/bronchiectasis overlap versus bronchiectasis $p = 0.006$ for COPD/bronchiectasis overlap versus COPD
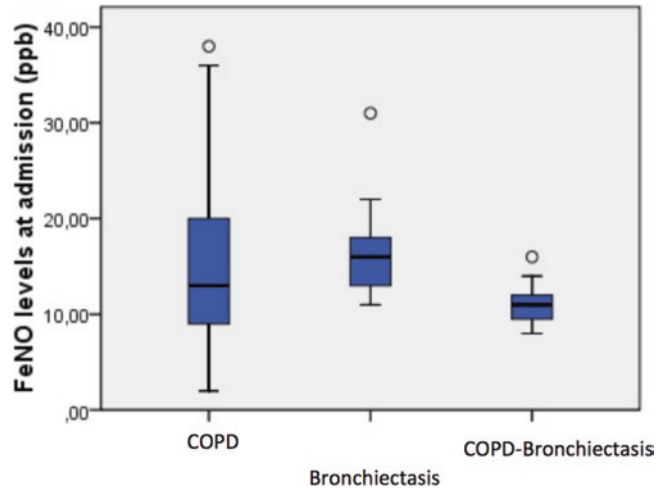
fered significantly from FeNO levels in patients with bronchiectasis ($p < 0.001$, Fig. 1) and FeNO levels in patients with COPD ($p = 0.006$, Fig. 1). FeNO levels at admission did not differ significantly in patients with COPD versus patients with bronchiectasis. In the same context, FeNO levels at discharge differed significantly in patients with COPD/bronchiectasis overlap when compared to FeNO levels in patients with bronchiectasis ($p < 0.001$, Fig. 2) and FeNO levels in patients with COPD ($p = 0.039$, Fig. 2). At discharge, FeNO levels in patients with COPD were significantly lower than FeNO levels in patients with bronchiectasis ($p = 0.013$).

4   Discussion

In the present study, we have assessed FeNO in patients with COPD, patients with bronchiectasis, and more importantly patients with COPD/bronchiectasis overlap during their exacerbations. We observed that FeNO levels in patients with COPD and/or bronchiectasis exacerbation are increased at admission when compared to follow-up. Patients with COPD/bronchiectasis overlap present decreased levels of FeNO when compared to patients with COPD and patients with bronchiectasis at both time frames suggesting a different inflammatory mechanism.

FeNO represents a reliable marker of airway inflammation especially in asthmatics and has been widely used as an adjunct to asthma diagnosis [5, 6]. The clinical implications of FeNO in the management of patients with COPD have not yet been established. In agreement with our findings, Antus et al. [10] reported decreased levels of FeNO at discharge when compared to admission in COPD patients experiencing exacerbation, while Maziak et al. have reported increase FeNO in COPD exacerbation versus stable disease [11]. However, the aforementioned findings have not been replicated by others [12]. The discrepancies among the studies may be attributed to the different instruments and expiratory flows used for the measurement of FeNO, variations of smoking habits among the populations studied, as well as differences in disease severity. Our findings suggest that FeNO levels may be used in adjunction with clinical markers for the monitoring of airway inflammation during COPD exacerbations, but clearly, further studies are warranted before any definite conclusions can be drawn.

Previous studies have suggested that FeNO levels are increased in patients with stable bronchiectasis when compared to healthy volunteers [13, 14], while exhaled NO correlates with disease extent as assessed in lung computed tomography [13]. However, others have failed to report a significant difference in FeNO levels in bronchiectasis versus controls in stable disease [2]. We have reported elevated FeNO levels in patients with bronchiectasis

Fig. 2 FeNO levels at discharge or 15 days following hospitalization. *p* < 0.001 for COPD/bronchiectasis overlap versus bronchiectasis
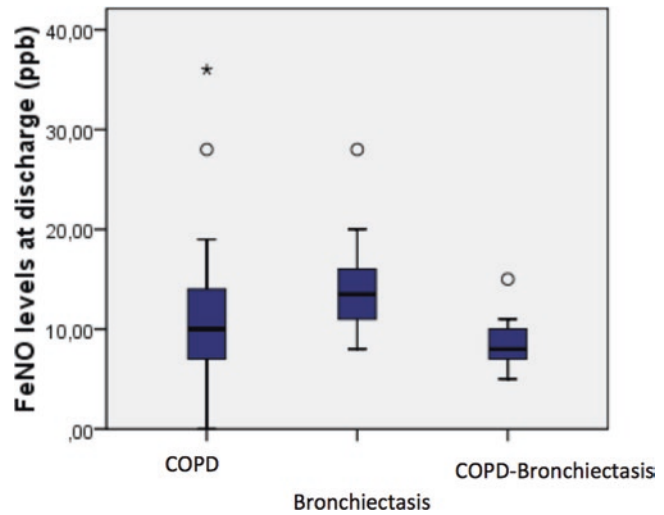
during an exacerbation when compared to COPD and especially COPD/bronchiectasis overlap. Despite that FeNO levels fall significantly during the course of the exacerbation, bronchiectasis patients still present higher FeNO values 15 days following the hospitalization as compared to COPD and COPD/bronchiectasis overlap patients. Previously, researchers have reported a trend toward a reduction of FeNO levels in a small cohort of patients with an AE of bronchiectasis following recovery, although this did not reach statistical significance [14]. In bronchiectasis, the elevated FeNO levels may be mainly attributed to an increase in peripheral airway NO [14] and may be affected by the colonization status of the airways [2].

COPD/bronchiectasis overlap prevalence is unknown. Studies have reported that 4–72% of COPD patients may have radiological signs of bronchiectasis, a condition that may be associated with greater lung inflammation [4]. COPD/bronchiectasis overlap may present a distinct clinical phenotype exhibiting differences from COPD patients in terms of mortality, sex distribution, bacteria colonization status, and systemic inflammation [15, 16]. We have reported lower levels of FeNO during an exacerbation in patients with COPD/bronchiectasis overlap when compared to COPD and bronchiectasis patients. Despite FeNO levels

fall significantly during the course of the exacerbation in all the study groups, COPD/bronchiectasis overlap patients still present lower FeNO 15 days following the hospitalization when compared to COPD and bronchiectasis. The differences in FeNO levels may underline discrepancies in the inflammatory mechanisms in the airways between the three disease groups and provide further support to the concept that the presence of bronchiectasis in patients with predominant COPD may be considered a distinct syndrome. Some researchers have suggested that smoking exposure in COPD patients may facilitate bronchial infection; the resulting inflammation may lead to bronchiectasis [4]. One hypothesis may be that the different levels of FeNO may be associated with discrepancies in vasodilation of the airways that may lead to altered penetration of inflammatory cells in the lung. However, our study lacks experimental data that may support the aforementioned speculation.

COPD/bronchiectasis overlap presents a poorly characterized entity [17]. In the present study, we report clinical data from a small cohort of patients with COPD/bronchiectasis overlap, hospitalized for an acute exacerbation of the underlying disease. We observed a male predominance in patients with COPD/bronchiectasis overlap as opposed to patients suffering from bronchiectasis, while patients with COPD/

bronchiectasis overlap were more frequently smokers and reported more frequently exacerbations in the preceding year. Our results are in agreement with Martinez-Garcia et al. [16] that reported an increased risk of exacerbations in patients with COPD and coexistent bronchiectasis. COPD/bronchiectasis overlap patients presented worse oxygenation than patients with bronchiectasis, while baseline FEV1%pred levels were lower. A more severe airflow obstruction and a male predominance have been previously reported by others [15, 18]. Although our findings need to be confirmed in larger cohorts, we believe that they may provide important information concerning the clinical characteristics that may help clinicians to identify COPD patients at risk for concomitant bronchiectasis.

Our study has several limitations. We acknowledge that the study sample is small and our results need to be replicated in a larger cohort. Additionally, treatment was not standardized throughout the study groups and was chosen by the physician in charge according to the individual patient's needs. Therefore, the possible contribution of the different treatment regimens in FeNO levels cannot be excluded. Our study included only patients hospitalized for an acute event of the underlying disease; therefore, our results cannot be safely extrapolated in patients with milder exacerbations not requiring hospitalization. Additionally, our data may be biased by the fact that most of the bronchiectasis patients were nonsmokers, which may partially explain the differences in FeNO values among groups since COPD and COPD/bronchiectasis overlap patients were mainly smokers. Finally, some of the patients did not reach the cutoff level of 4 ppb (or 10%) decrease in baseline FeNO values, which is considered clinically significant [19]. However, since there was a tendency of FeNO levels to decrease in all study groups, one may speculate that the follow-up measurement at discharge or at 15 days was scheduled too soon for the airway inflammation to fully resolve; thus, FeNO levels could still be higher than baseline when they were serially assessed.

5 Conclusions

In conclusion, we reported a reduction of FeNO levels during the course of an acute exacerbation of COPD, bronchiectasis, or COPD/bronchiectasis overlap. Additionally, we observed that patients with COPD/bronchiectasis overlap presented significantly lower FeNO levels, while they were more frequently male, had more severe obstruction, and experienced more exacerbations. Our results need to be replicated in larger cohorts before any definite conclusions can be drawn.

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Formulation and Evaluation of Dermatological Product Containing Niacinamide

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Abstract

In this study, niacinamide-based skin creams were formulated and evaluated. Niacinamide (also known as nicotinamide, 3-pyridinecarboxamide) is a physiologically active form of niacin or vitamin B3. Niacinamide, a derivative of niacin, has the ability to treat some skin conditions including aging skin. Quality of the product was assessed by using high-performance thin-layer chromatography (HPTLC) method to determine the content of niacinamide. No change in the physical properties was observed; the pH was in a proper range. The formulations showed good spreadability, no evidence of phase separation, and good consistency during this study period. From this study, it can be concluded that it is possible to develop creams that contain niacinamide having antiaging property and used as a barrier to protect skin.

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1 Introduction

Niacinamide (also known as nicotinamide, 3-pyridinecarboxamide) is a physiologically active form of niacin or vitamin B3. Niacinamide, a derivative of niacin, has the ability to treat some skin conditions including aging skin. It has anti-inflammatory properties, which makes it effective for treating acne. It may also be beneficial for treating other inflammatory skin conditions such as psoriasis and rosacea. Acne is a skin condition characterized by excess sebum production and irregular shedding of dead skin cells. Niacinamide helps to reduce the inflammation caused by dead skin cells and sebum clog hair follicles. In the body, it is converted into cofactors NADH and NADPH that are involved in many biochemical reactions. NAD and NADPH levels in skin cells decline with age. Hence, supplementing the skin with the precursor of these vital cofactors has the potential to provide appearance benefits to the aging skin. Since niacinamide penetrates the skin's surface readily, it is bioavailable for topical application for targeted delivery to specific skin sites.

Preparation of Oil Phase
Take formula quantity of oil phase material in an oil melting kettle and heat it at about 80–85 °C.

Mixing of Oil Phase into Water Phase for Emulsification

Transfer the material gradually into the mixing kettle through a 100-mesh filter and continue homogenizing. Start high-speed mixing and scraping arrangement. Mix well and transfer to the batch mixing vessel (to flash the oil transfer line). Dissolve the formula quantity of KOH in DM water (previously heated and then cooled). Add this solution in a slow stream into the batch mixture immediately and mix water phase, potassium hydroxide (KOH), and oil phase material for 30 min. Add the material, Flocare ET-58, in the same order and mix well. Add the premix solution of Tapioca starch (autoclaved for 1.5 h at 15 lb pressure), previously heated and cooled DM water, and continue high-speed mixing and homogenizing. Stop the homogenizer after 15–20 min and start water circulation for cooling. Add the mixture of DC 9050 and DC 3031 at 63–60 °C and continue mixing with side scrapping and start cooling. Dissolve the formula quantity of niacinamide in DM water (at 65–70 °C). At 52–50 °C, add the mixture into the mixing vessel, continue mixing, and cooling. Dissolve Neolone 950 in DM water (previously heated), add the mixture into the mixing vessel at 50–48 °C, and continue mixing and cooling. Add the mixture of rose water, herbal distillate, and continue mixing.

2   Determination of Marker Ingredient Niacinamide by HPTLC [1]

Preparation of HPTLC Standard Curve

About 20 milli grams of niacinamide was weighed accurately in a 10-mL volumetric flask, dissolved in methanol:water (1:3), and made up to the mark with same solvent mixture. Filter the solution by 0.45, 2, 4, and 6 μL. The above solution was injected (containing 6, 12, 24, and 36 μg) into a TLC aluminum sheet silica gel 60 F 254 plate (10/10 cm) by using a Camag Linomet 5 applicator (syringe size 100) (Table 1).

After drying, the TLC plate is put into a mobile phase with run time of 10 min. Retention

Table 1 Serial dilution to produce different concentrations of niacinamide

Volume of stock taken in μL	1	2	4	6
Amount of niacinamide in μg	6	12	24	36

factor, peak height, and peak area were measured by scanning the plate using a Camag TLC scanner 4 at 254 nm.

Estimation of Niacinamide in Sample [2] Separation of Oil Phase

About 5 g o/w (oil-in-water) emulsion containing niacinamide (1.5% w/w) was taken in a separating funnel, 100 mL of water and 20 mL of petroleum benzene were mixed to it, and then the mixture was shaken vigorously and pressure was released frequently. The mixture stood for 5 min and after the complete separation of organic phase, the water phase was taken and the same procedure was repeated three times. After removing the oil phase through organic solvent, the water phase was filtered and stored.

Niacinamide Estimation from Water Phase of the Cream [3]

The above solution (concentration 50 mg/mL) was taken in a volumetric flask. 31 Sul, 6 ul sample was applied by a Camag Linomet 5 applicator (syringe size 100,11) (Table 2).

After drying the TLC plate, it was put into the mobile phase with run time of 10 min. Qualitative and quantitative estimation was done by observing the retention factor, peak height, and peak area, which was measured by scanning the plate using a Camag TLC scanner 4 at 254 nm.

3   Other Analytical Test Procedure

There are several analytical tests which were done to evaluate the product in different stages of manufacturing. These tests were mainly used for testing the physical and chemical character of the cream.

Table 2 Serial dilution to produce different concentrations of sample

Volume of stock taken in μL	3	5	6
Amount of niacinamide in μg	150	250	300

Estimation Procedure of Total Fatty Matter in o/w Cream

The estimation procedure is done to analyze the sample of the given cream and determine the total fatty matter content.

Procedure

Weigh 5 g of cream accurately and transfer into a 250-mL beaker. Add 100 mL hot water to completely dissolve the cream. Add 4 mL of 0.5 N H2S04 until the contents turn slightly acidic. Heat the mixture over water bath until the cream is dissolved. Add 25 mL of petroleum ether/petroleum benzene to the remaining solution and transfer it to a separating funnel. Shake the solution and allow the solution to separate into two layers. Drain the bottom layer. Add 50 mL of petroleum ether/petroleum benzene to the remaining solution in the separating funnel.

Separate the fatty acid dissolved petroleum ether/petroleum benzene again as was done in the previous case and transfer it to the collected fatty matter. Weigh the fatty matter in a preweighed flat bottom flask. Allow the contents to evaporate and weigh the residue. From the difference in the weight, calculate the % of fatty matter in the given cream sample.

Calculation

Weight of the flat bottom flask (x) = _____

Weight of flat bottom flask + Cream after drying (y) = _____

% of fatty mater = (y − x) * 100* Weight of cream sample

% of fatty matter = _____

Analytical Testing Procedure for Estimation of Free Fatty Acid
Free Fatty Acid

The acid value is the number (in milligrams) of potassium hydroxides necessary to neutralize the free acids present in 1 g of the substance; more acid value means free fatty acid. This free fatty acid interferes in the transetherification with alcohol.

Potassium Hydroxide (KOH) Solution Preparation and Standardization

Preparation: Dissolve about 6 g of KOH (GR) in sufficient boil and cool (carbon dioxide-free) distilled water to produce 1000 mL.

Standardization: Titrate 20 mL of the KOH solution with 0.1 N HCl acid in a burette using phenolphthalein indicator.

Calculation

$$1\,mL \text{ of } 0.1\,N\,HCl = 0.005611\,g \text{ of } KOH.$$

$$\text{Strength } of \text{ KOH} = \frac{\left(\begin{array}{c}\text{Strength of HCL} \\ \times \text{Vol.of HCL}\end{array}\right)}{\text{Vol.of KOH solution}}.$$

Procedure

Weigh sample and transfer it into a 250-mL conical flask. Add 50 mL neutralized alcohol solution to the oil solution. Heat this mixture for 10 min by using the heater. Add 1 or 2 drops of phenolphthalein indicator to the solution after 10 min. Titrate this against the KOH solution from the burette until the solution becomes faintly pink after shaking for 30 s. The appearance of pink color indicates the end point.

The calculation in terms of different fatty acids is as follows:

(a) Free fatty acids, in terms of oleic acid, present by weight = 2.82 n/W
(b) Free fatty acids, in terms of lauric acid, present by weight = 2.0 n/W
(c) Free fatty acids, in terms of ricinoleic acid, present by weight = 2.98 n/W
(d) Free fatty acids, in terms of palmitic acid, present by weight = 2.56 n/W

Where,

N = the number of mL of 0.1 M potassium hydroxide required;

W = the weight in grams of the substance taken for test

Calculation for free fatty acid
$$\begin{pmatrix} \text{according to oleic acid} \end{pmatrix}$$
$$= \left(28.2 * \text{factor of KOH} * n \right) / \text{W}.$$

Determination of Thermal Stability of o/w Cream

Place about 30–35 g of the material to be tested in a transparent, well-closed container (50 mL PET/glass). Keep the container for 24 h in the humidity chamber at 60–70% relative humidity and temperature of 4340.2 °C.

The material passes the test if, on the removal from the thermostat, no oil separation and any markable change in the color of the product are observed.

pH of Cream

Prepare the solution (10% w/v) using freshly boiled and cooled DM water in a beaker. Mix the solution using an accurately calibrated pH meter and ensure to carry out the test at a temperature within the prescribed range. After that, check the pH.

4   Results and Discussion (Table 3)

Quantitative Estimation of Niacinamide (by HPTLC)

Niacinamide in cream is estimated by the high-performance thin-layer chromatography (HPTLC) method.

Identification of Niacinamide in the Sample

The TLC plate in Fig. 1 shows the standard and sample point for niacinamide, with the same Rf value. It helps to identify the presence of niacinamide in the sample.

Quantitative Estimation of Niacinamide in Sample
Standard Curve of Niacinamide

λkmax of niacinamide was determined by a UV–Visible spectrophotometer that scans through the entire range (190–1100). The Amax was found to be 254 nm against the reagent blank.

Table 3 Formulation design for o/w cream (500)

Sl. no.	Ingredients	Amount (gm)
1	Glycyrrhizaglabra	0.95
2	Alovera powder ext	0.005
3	Nicinamide	7.5
4	Methyl paraben	1.03
5	Propyl paraben	0.01
6	Propylene glycol	2.5
7	PEG-32	2.5
8	DC-200/350	2.5
9	Potassium hydroxide	3.5
10	Propylene glycol	5
11	Tapioca starch	15
12	DC 9040	2
13	Silicon DC-3031	5
14	Nicinamide	7.5
15	DM water	300
16	Neolone 950	0.5
17	Stearic acid	50

To determine the amount of active ingredients present in the formulation at different concentrations, a standard curve was calibrated. Here, the standard curve of niacinamide was estimated in HPTLC. In this method, the area and the height of the HPTLC spectrum curve were measured in different concentrations (Fig. 2; Table 4).

The quantitative estimation of niacinamide is done by measuring the area and height of the sample curve against standard niacinamide (Tables 5 and 6).

According to the area, % of niacinamide in batches 1, 2, and 3 are 1.46, 1.40, and 1.38, respectively.

According to the height, % of niacinamide in the three different samples from batches 1, 2, and 3 are 1.53, 1.30, and 1.41, respectively.

With the help of a spectrum scan and by identifying the Rf value through HPTLC, we can qualitatively estimate or identify niacinamide in the sample (Fig. 3).

Table 7 displays the fatty acid content of the finished product.

The free fatty acid content of the sample collected from the finished bulk of three different batches are 7.408, 7.500, and 7.4736, respectively. Standard deviation within the three layers of each batch is 0.00159, 0.008596, and 0.21088.

Fig. 1 TLC plate of niacinamide
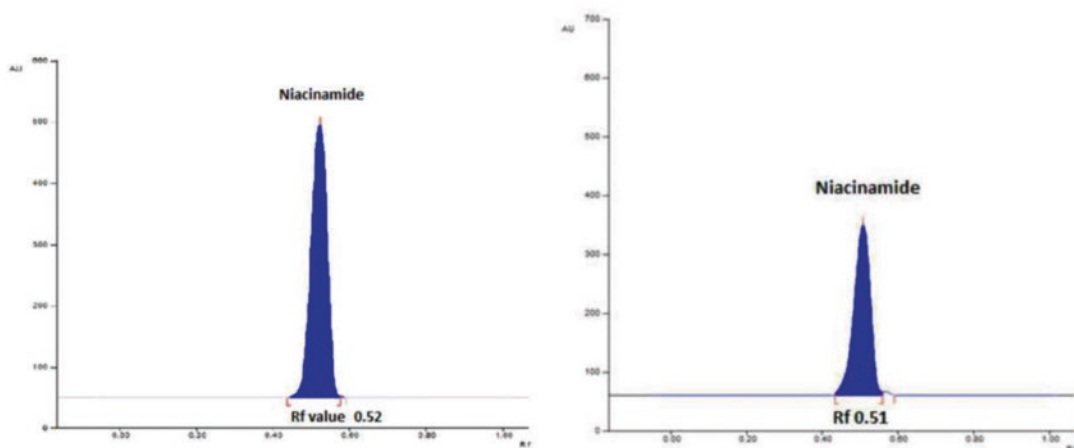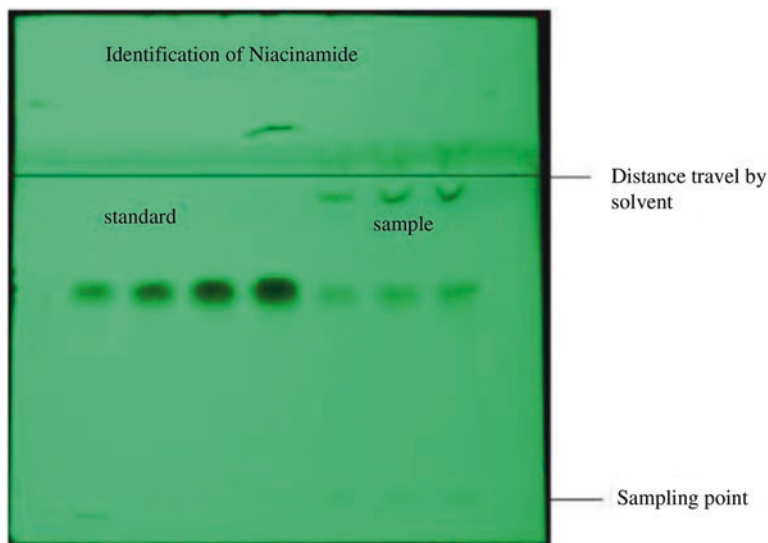
Fig. 2 The chromatogram of niacinamide in sample

Table 4 Standard curve for niacinamide

(According to area)				(According to height)			
Track	Rf	Amount (µg)	Area	Track	Rf	Amount (µg)	Height
1	0.52	4.00	15785.92	1	0.52	4.00	446.45
2	0.52	6.00	19680.35	2	0.52	6.00	530.43
3	0.52	8.00	22882.25	3	0.52	8.00	587.41

Table 5 Estimation of % of niacinamide in sample (according to area)

Track	Batch	Volume applied (µL)	Amount applied (µg)	Area	Rf	Amount of niacinamide (µg)	% of niacinamide	Std. dv.	Avg %
1	1	3	150	10,185.98	0.51	2.581	1.71		
2	1	5	250	11,987.69	0.51	3.037	1.21	0.3536	1.46
3	2	3	150	9073.22	0.51	2.299	1.53		
4	2	5	250	10,385.28	0.51	2.631	1.25	0.1980	1.40
5	3	3	150	8571.20	0.51	2.171	1.44		
6	3	5	250	9831.62	0.52	2.591	1.33	0.0778	1.38

Table 6 Estimation of % of niacinamide in sample (according to height)

Track	Batch	Volume applied (µl)	Amount applied (µg)	Height	Rf	Amount of niacinamide (µg)	% of niacinamide	Std. dv.	Avg
1	1	3	150	304.94	0.51	2.730	1.82		
2	1	5	250	351.22	0.51	3.146	1.25	0.4031	1.53
3	2	3	150	261.26	0.51	2.340	1.56		
4	2	5	250	289.18	0.51	2.590	1.03	0.3748	1.30
5	3	3	150	216.77	0.51	1.942	1.10		
6	3	5	250	238.62	0.52	2.137	1.00	0.0707	1.14
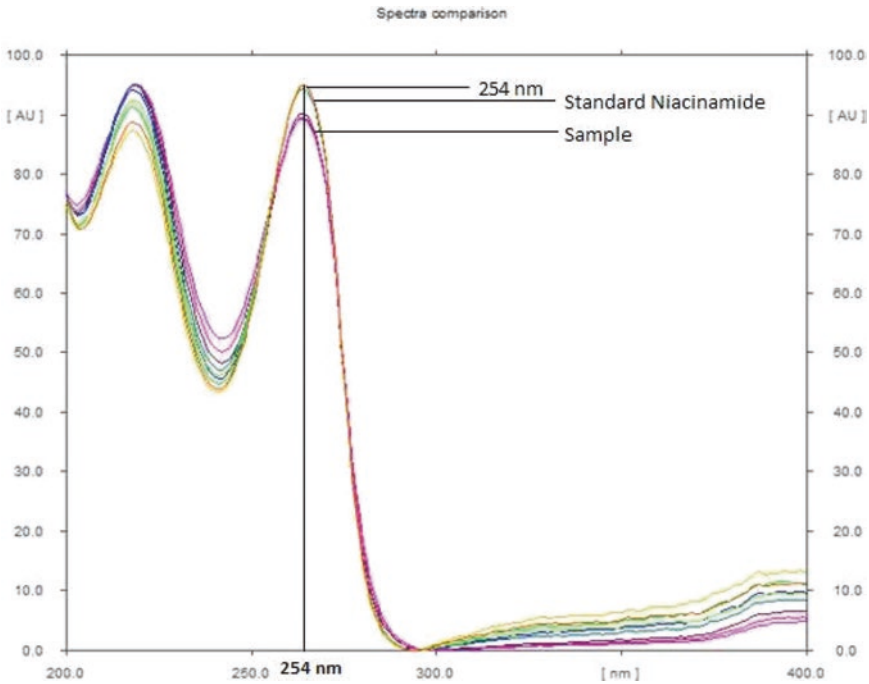
Fig. 3 Spectrum scan of niacinamide

Table 7 The free fatty acid content in three different batches

Batch no	FFA of upper layer	FFA of middle layer	FFA of lower layer	Std. dv.	Average
29	7.410217	7.408786	7.407041	0.001591	7.408681
30	7.501337	7.491278	7.508382	0.008596	7.500332
31	7.235923	7.638116	7.546996	0.210882	7.473678

Sampling from finish bull

5   Conclusion

Niacinamide-based topical dermatological product has been prepared and evaluated successfully. Active marker % of niacinamide in three batches is in between 1.2 to 1.5. All the data are in between the specific limit, that is, 1.2–1.63. Free fatty acid and total fatty matter of cream from all layer are also in the acceptable limit. So, the product quality and uniformity is satisfactory, and the process is well established.

Exhaled Breath Condensate and Dyspnea in COPD

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Abstract

Chronic obstructive pulmonary disease (COPD) possesses a crucial position in the field of respiratory medicine as there are still unsolved issues in its whole spectrum. One promising tool that is believed to provide answers to various problems in COPD is the exhaled breath condensate (EBC). Its wealth due to its content mirrors the ongoing actions taking place in the lungs and especially the two processes blamed for the pathophysiology of COPD, the inflammation and the oxidative stress. Attempts to connect the products of the analysis of the EBC with the clinical manifestations of COPD such as dyspnea are scarce. Up to date research has shown a positive correlation between the elevated levels of some markers of EBC such as H_2O_2 and 8-isoprostane and dyspnea, while others present ambiguous results. The severity of COPD also seems to be connected with their increase. The purpose of this chapter is to highlight these findings and present potential correlations. Further research in EBC and its association with the clinical phenotypes of COPD and especially dyspnea is necessary.

1 Introduction

Chronic obstructive pulmonary disease (COPD) is a disease affecting the whole spectrum of a patient's life as well as influencing the socioeconomic and health care systems [1]. Its complexity has set medical science into a constant struggle aiming to fully understand its onset and course in order to intervene properly in a therapeutic way [2]. This approach is multidimensional based on the Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines engaging various sources for COPD diagnosis, monitoring, and management. There are still questions without definite answers regarding COPD pathobiology and course [3]. The exhaled breath condensate

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(EBC) belongs to the family of breath tests and has been in an experimental vortex hoping to provide answers on the missing data regarding the nature, clinical presentation and treatment of COPD, and other respiratory diseases. It started attracting attention in the last four decades and it has been characterized as a promising resource for various disorders. This is mainly due to its noninvasive nature, safety profile, and potential unlimited repetitive applications regardless of disease stage and age [4].

2   Exhaled Breath Condensate and Dyspnea

The EBC is literally a product which is made by freezing the exhaled breath. It is now known that apart from water as its main substance, it contains a great number of other compounds but in smaller quantities [5]. The origin of these compounds and their nature has led the scientific community to consider the exhaled breath condensate as a wealth source of information and a matrix of possible biomarkers considering its connection to pathophysiological functions in the respiratory tract [6]. EBC has been characterized as a cocktail made of a wide range of elements. It is found to consist of small inorganic ions, large compound molecules, macromolecules, peptides, and proteins. This content reflects the composition of the airway lining fluid. The latest and most acceptable theory explaining this is known as the bronchiole fluid film burst (BFFB) and refers to constituents from the aqueous mucus layer of the respiratory tract that can be aerosolized by closure and reopening of the airways and can travel through them [7]. The measurement of the content of EBC attempts to describe and quantify the results of inflammation and oxidative stress in the airways. Its usage in the field of respiratory medicine is currently limited for research purposes, covering various aspects of airways diseases which are mentioned in Table 1. This ambition is due to the obtainment of results, mirroring the ongoing biochemical changes of the lungs associated with metabolic pathophysiological processes such as inflammation and oxidative stress [8].

Table 1 The potential usage of the exhaled breath condensate in respiratory medicine

Exhaled breath condensate potential usage
1. Diagnosis
2. Early detection
3. Monitoring
4. Follow-up
5. Phenotype discrimination
6. Treatment response—drug monitoring

From a clinical point of view, dyspnea is one of the cardinal COPD symptoms. Dyspnea is an unpleasant symptom of the subjective experience of breathing discomfort resulting from qualitatively distinct sensations varying in intensity [9]. Its mechanism is complex and multiple factors such as physiologic, psychological, and environmental seem to play a role in its occurrence and perception. Dyspnea is predominant in respiratory diseases and it can be either acute or chronic [10]. Experimental models of dyspnea have been developed trying to elucidate its various mechanisms. According to the current understanding, dyspnea is the result of the collection and interpretation of mechanical and chemical information that derive from a network between the cardiorespiratory system and the nervous system. The awareness of this respiratory distress symptom encompasses pathways and distinct mechanisms of sensory qualities in the form of work/effort, tightness, and air hunger [11, 12]. The severity of clinical symptoms and the pulmonary function variables are not found to correlate with the degree of inflammation in the airways of COPD patients. The lung function impairment in COPD measured commonly by the forced expiratory volume in 1st second (FEV1) seems to have no significant association with the state of inflammation in the airways [13]. Accordingly, EBC content indicating inflammation and oxidative stress has shown a poor association with lung function. A possible explanation of that is the different nature of the information provided by these two tests. The EBC content indicates inflammatory activity in the whole surface of the lungs, while the FEV1 reflects large airways and airflow limitation [14]. Dyspnea, on the other

hand, is not fully explained solely by the measurement of FEV [1]. COPD patients and their degree of discomfort vary even when they have similar impairment in pulmonary function [15]. Inflammation and oxidative stress EBC compounds may hypothetically be involved in the mechanism of dyspnea by triggering the process of the sensation of breathlessness [16]. The markers and mediators of EBC, which show abnormal activity in the lungs, belong to various groups of compounds such as nitrogen reactive species, cytokines, prostaglandins, leukotrienes, and reactive oxygen species. The measurement of pH of EBC is also a variable that is connected to inflammation and oxidative stress. The ones that have been extensively studied and seem to have a predominant role in the pathophysiology of the lungs are hydrogen peroxide (H_2O_2), 8-isoprostane, leukotrienes (LTB4), cytokines, prostaglandins (PGE2), and nitrogen oxides (NOx). Different elements of EBC probably reflect different aspects of the inflammatory process [17]. 8-Isoprostane is a marker of oxidative stress and is one of the products of free radical catalyzed lipid peroxidation of arachidonic acid. It is characterized as a compound stable chemically, with a specific picture in lipid peroxidation, important in the oxidative stress process. Its levels are high in chronic obstructive pulmonary disease, a fact observed in both stable disease and during exacerbation [18]. It is still a potential biomarker; however, not specific for COPD. Hydrogen peroxide (H_2O_2) is also a dedicated and direct marker found in oxidative stress which has endogenous or exogenous pathways of production. It is formed by the interaction between the superoxide anion (O_2) and the superoxide dismutase. A rise in its levels has been reported for various inflammatory respiratory diseases including COPD. H_2O_2 cannot be used as a disease-specific biomarker either [19]. A mediator that presents elevation in EBC is leukotriene B4 (LTB4). It derives from the metabolism of arachidonic acid and it is involved in the inflammation process by engaging neutrophils in the impaired areas due to its chemoattractant nature. Its increase has been noticed in COPD patients (stable disease and exacerbation) and it

may be used in monitoring treatment response and suppression of inflammation [20].

Cytokines (small proteins) and prostaglandins (subgroup of eicosanoids) also belong to the group of markers involved in inflammation and are increasingly studied in the EBC. Although studied in COPD, questions still exist because of their low concentrations and heterogeneity as certain rise while others decrease [21]. Nitrogen oxides (NOx) have their own role in airway inflammatory process as an indirect indicator of oxidative stress. The NO content of EBC presents a rise in some of its products of metabolism in COPD such as nitrites and nitrates. However, there is no consistency in all the literature data as there are results of no significant changes, leading to controversial interpretations. The NO metabolites are influenced by many factors such as their formation sources [22].

Although pH is not a product or substitute of inflammation or oxidative stress, its value is considered important because it characterizes the state of these two procedures and the physiological function of the airways. The level of acidification of the whole respiratory tract reflects the inflammation of the environment affected by the observed damage of its epithelium, the high production of mucus, and its impaired function. It seems to be a general marker of inflammation for many respiratory diseases and its reduction has been documented. It is mainly influenced by the volatile compounds of EBC and less by the nonvolatile ones. This might explain its considerable variability in COPD patients. However, its utility as a biomarker in COPD is questioned [23].

3 Exhaled Breath Condensate and Dyspnea Correlation

Up to date, to our knowledge, a possible association of dyspnea with EBC characteristics in COPD has not been adequately studied (Fig. 1).

In general, such an association between breathlessness and inflammation has been neglected [24]. The main focus of the conducted research has been the EBC and its relation with other clinical parameters. The interest has mainly
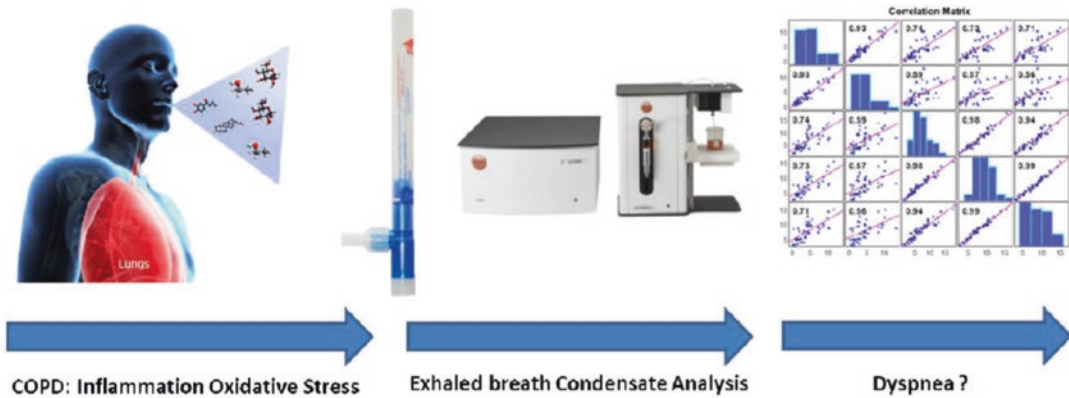
Fig. 1 Exhaled breath condensate analysis

been around two stable mediators of oxidative stress (8-isoprostane and H_2O_2) and pH, pH their quantitative changes in EBC and their relation with various respiratory diseases including COPD [25]. H_2O_2 and 8-isoprostane are different compounds regarding their origin and despite their significant activity responsible for the inflammatory pattern; there is a debate of their interaction with the pathological characteristics of respiratory diseases.

Both markers are believed to play an important role in providing information about the severity of COPD and its clinical phenotype. There are reports that correlate their raised levels in EBC with the impaired health status of COPD patients evaluated by the COPD Assessment Test (CAT) and the Medical Research Council (MRC) Dyspnea grading scale [26, 27].

Additionally, the intensity of airway inflammation in COPD appears to be described well by their serial changes in EBC. Disease activity in COPD patients is considered to be mirrored by their increase in EBC as a result of their involvement in the abnormal inflammatory response in the lungs [28, 29]. Concerning dyspnea sensation in COPD, the majority of research has demonstrated a correlation with elevated levels of H_2O_2 and 8-isoprostanein EBC [30, 31]. This is supported by the fact that H_2O_2 and especially 8-isoprostane are reliable biomarkers of oxidative stress known to be involved in the pathophysiology of COPD [32]. A different path has led to the possible connec-

tion between inflammation and breathlessness. The approach was via gauge of inflammatory markers in blood and serum and their correlation with dyspnea measured by MRC scale [33]. There is also one study which has shown a correlation between these markers and the functional disability of COPD patients [34]. On the other hand, the measurement of acidification of the environment of the airways given by pH provides ambiguous information regarding disease severity and no reference of connection with dyspnea. However, its decrease in EBC in COPD is an indication of inflammation in the airways [35]. It is worth noticing that the degree of obstruction estimated by FEV1 presents a lack of relationship between these two markers of inflammation and oxidative stress and generally with the lipid peroxidation products in EBC of COPD. This is because the onset and development of inflammation can exist without being detectable by that spirometric variable [18, 36].

4 Conclusion

To sum up, EBC is a matrix able to provide material which can act as a window with a view to the abnormal activities in the respiratory epithelium. The information obtained may shed light on the rich pathophysiology of COPD and its clinical manifestations. A small number of studies have presented an association between some EBC

compounds and COPD clinical manifestations including dyspnea. Such an association is important since it would allow recognition of patients most likely to deteriorate or that would need treatment intensification clues that solely FEV1 may not predict. Such clinical variables or treatment traits are recognized in recent GOLD guidelines. Additional research is necessary in order to establish EBC methodology, methodology standardization, and repetition and to investigate whether certain EBC inflammatory markers are associated with dyspnea in steady state and particularly its aggravation occurring in COPD exacerbation.

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The Effects of Pythagorean Self-Awareness Intervention on Irritable Bowel Syndrome Patients: A Non-randomized Controlled Trial

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Abstract

Irritable bowel syndrome (IBS) is a functional gastrointestinal disorder that affects a considerable percentage of the global population, mainly middle-aged women. IBS causes a constellation of symptoms with repercussions on patients' physical, psychological, and social well-being. Stress seems to play an important role in the pathogenesis of the disease as well as in its management. This study evaluated the effects of a novel non-pharmacological 8-week stress management intervention, the Pythagorean Self-Awareness Intervention (PSAI), in patients with IBS. In this non-randomized controlled trial, 60 IBS patients were

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assigned to an intervention and a control group. Self-reported questionnaires were used for the evaluation of IBS symptoms and a variety of biopsychological characteristics, pre- and post-intervention. All IBS-related symptoms were significantly reduced in the intervention group compared to the control group with 50% of the patients in the intervention group reporting less abdominal pain. The most potent effects of the intervention were observed in anger externalization, anger control, visuospatial memory, information processing speed, verbal memory, sense of coherence, stress, anxiety, and anger internalization. No side effects in the PSAI group were noted. In conclusion, PSAI was beneficial for patients suffering from IBS. Future research should expand and validate the results of this study.

Keywords

Irritable bowel syndrome · Stress management · Pythagorean self-awareness · Gastrointestinal · Cognitive

1 Introduction

Irritable bowel syndrome (IBS) is a functional gastrointestinal disorder characterized by abdominal pain and altered bowel habits without evidence of a structural or biochemical disorder [1]. Incidence of IBS is varying between 0.2% and 9% in different studies, whereas the estimated prevalence is 12%. The financial cost of IBS in the USA is around 20 billion dollars. IBS is further divided in IBS-constipation (IBS-C) when the predominant change in bowel habits is constipation, IBS-Diarrhea (IBS-D) when the predominant change in bowel habits is diarrhea and IBS-Mixed (IBS-M) when both constipation and diarrhea are present. This otherwise benign syndrome affects the health, daily activities and quality of life of patients, influencing their ability to work and socialize. There are also indications that it negatively affects leisure activities, travel, sexual function, eating, and quality of sleep, while it is the second leading cause of absence from work after the common cold [2, 3].

Although the exact etiology of IBS remains largely unknown, several mechanisms are implicated in the pathogenesis of the disease. There is a strong correlation between stress and IBS. Moreover, patients and especially women relate stress to the severity of symptoms. Stress usually precedes the onset and exacerbation of IBS symptoms [4]. Thus, stress coping plays an important role in IBS management. Several medical therapies for IBS are available, but none of them are consistently effective. Moreover, the fact that IBS is a chronic, benign disorder makes the patients reluctant to receive chronic medication. Therefore, although IBS patients suffer from severe abdominal pain, they prefer non-pharmacological remedies for relief of their symptoms [5]. Another study has shown better stress management of patients with IBS who meditated than controls [6]. Hypnotherapy is also considered to be an effective alternative treatment for IBS, especially if it is performed in specialized in the method facilities [7]. Other studies suggest that acupuncture can alter visceral sensation and motility in IBS, albeit the actual effectiveness of the specific treatment for IBS remains unclear [8, 9]. Lastly, cognitive behavioral therapy has been attested as a useful alternative to pharmacology therapy for IBS [10, 11].

However, most of the non-pharmacological interventions require the presence of a health professional, time, and financial resources that hamper their availability to patients. As such, this study suggested a newly designed intervention, which is completely self-administered after a short period of appropriate education. This intervention was inspired by the Pythagorean philosophy that fosters the improvement of self-awareness through introspection and engages the individual in a process of fruitful decision making about his/her life. This interventional program, the Pythagorean Self-Awareness Intervention (PSAI), has already been tested in patients with multiple sclerosis [12] and mild cognitive impairment [13]. PSAI had significant beneficial results in the physical, cognitive, and mental health of patients in both studies. As such, the aim of the present study was to evaluate the effect of PSAI on IBS patients' symptoms, as well as their cognitive and psychological health.

1.1 Pythagorean Self-Awareness Intervention

The intervention was designed on the basis of the 71 Golden Verses of Pythagoras regarding 71 rules of moral urges, attributed to the ancient Greek philosopher Pythagoras [14]. The PSAI is a technique that incorporates these rules to build the self-awareness of individuals by altering the way they view themselves and the others. The technique consists of three stages that are practiced twice per day (after wake-time and before bedtime) in a quiet place while sitting comfortably in a chair; 1st stage requires recall of daily events; 2nd stage requires contemplation on thoughts and emotions caused by each event recalled in the 1st stage; 3rd stage requires from the individual to critically appraise his/her attitude as an observer. In the Pythagorean Self-Awareness technique thought process and feelings are related and interact with each other. The PSAI is based on a key element; the neurophysiologic basis of the Default Mode Network (DMN) that is a neural brain connection system involving self-relevant processes of cognition [15]. DMN is involved in discrete aspects of retrieving [16]. The DMN is important for impulse's inhibition and thereby, individual's behavior alteration [17]. With the three stages of the intervention, individuals detect incorrect choices and unhealthy behaviors. This internal dialogue promotes awareness, resulting in correct choices and the establishment of a healthy lifestyle.

2 Material and Methods

2.1 Study Design

This was a two-armed, parallel group, 8-week non-randomized controlled study with a 1:1 allocation ratio of IBS patients to treatment or non-treatment groups. The study was conducted at the outpatient gastroenterology clinic of the Naval Hospital of Athens in Greece, from June 2016 to March 2017. The study protocol was approved by the hospital's Scientific and Ethics Committee and was consistent with the Declaration of Helsinki. All eligible participants gave their written informed consent before study entry. Participants were included regardless of their sex, as long as they were between 18 and 65 years of age and had been diagnosed of IBS according to the Rome III criteria [1]. Exclusion criteria were comorbidity with a major psychiatric disease (i.e., psychosis, major depression, or substance abuse), use of psychotropic drugs (e.g., neuroleptics, benzodiazepines, tricyclic antidepressants, etc.), pregnancy, participation in psychotherapeutic or other stress management therapies, and inability to read or write in Greek. The follow-up period was 8 weeks, and both the patients and the researchers remained non-blinded to assignment and measurements.

2.2 PSAI Implementation

The eight sessions of the PSAI were delivered by KG (MSc in Stress Management) and CD (Professor of Stress Management and Health Promotion). In the first session of the program, the participants of the intervention group were introduced to the PSAI method and underwent baseline assessment with questionnaires. A session was held on the same day at a different time for the control group to be evaluated too with the study's questionnaires. For the intervention group, the following 6 weeks sessions were based on the Pythagorean verses about health awareness and lifestyle modification and the progress of patients was discussed. For the control group only telephone contact on a weekly basis was held and the patients were asked about their physical and psychological status, with no intention of in-depth counseling or intervention. On the eighth and final session questionnaires were re-administered to every patient in order to evaluate the post-intervention results for both groups.

2.3 Measures

Sociodemographic and disease-related characteristics Sex, age, marital status, educational level, and disease duration were recorded for all patients participating in the study. The diagnosis

of IBS was based on the standard Rome III Criteria, that is, abdominal discomfort or pain associated with two or more of the following (present at least 3 days/month in the last 3 months): improvement after defecation; onset of symptoms associated with a change in stool frequency; onset associated with a change in stool form alternating between diarrhea and constipation; the aforementioned criteria should be fulfilled for the last 3 months with symptom onset at least 6 months before a diagnosis of irritable bowel syndrome is made [1].

Symbol Digit Modalities Test (SDMT) This test is widely used for the evaluation of information processing speed [18, 19]. It consists of nine symbols that correspond to nine numbers (from 1 to 9). The respondent is presented with a set of pseudo randomized sequences of symbols and asked to verbally indicate the corresponding numbers in 90 s. The score indicates the number of correct responses during this time period.

California Verbal Learning Test-II (CVLT-II) This test evaluates immediate verbal learning and memory by asking the individuals to recall as many words as possible of a total of 16 words (conceptually belonging in 4 categories; 4 words in each category) which are read by the examiner [18, 20]. The process is repeated five times, and the total score is determined by the total number of correct recalls (maximum 80).

Brief Visuospatial Memory Test-Revised (BVMT-R) This test evaluates visuospatial memory [18, 21]. The individual is presented with a matrix of six items in two columns and three rows for 10 s, and is asked to replicate the matrix unaided using pencil and paper while taking as much time as needed. The process is repeated three times. Each drawing is evaluated for both its placement (1 point) and its accuracy (1 point). Thus, the maximum score yielded by the three trials is 36, indicating unimpaired visuospatial direct memory recall.

Sense of Coherence (SOC) The Sense of Coherence Scale is a 13-item instrument measuring comprehensibility, manageability, and meaningfulness [22]. It has been validated in Greek [23]. Its score is based on a 7-point Likert scale (1 = Very often, 7 = very rare or never).

Depression Anxiety Stress Scale (DASS-21) Depression, anxiety, and stress are measured using the corresponding 7 items of the DASS-21 [24]. The respondents indicate the frequency of symptoms in a 4-point Likert scale (from 0 = did not apply to me at all to 3 = applied to me very much or most of the time) during the past week. Scores are produced by summing all items. Higher scores indicate higher levels of depression, anxiety, or stress. The scale has been adapted to the Greek population [25].

State-Trait-Anger Expression Inventory (STAXI) Scale It is comprised of 24 items and 3 subscales evaluating anger; accessing anger-in, anger-out, and anger control [26]. It has been validated in the Greek language [27]. Grading is based on a 4-point Likert scale (1 = almost never, 2 = sometimes, 3 = often, 4 = almost always). Higher scores indicate higher level of anger in each subscale.

2.4 Statistical Analyses

Baseline demographic and outcome data are presented as means, standard deviations (SD), or frequencies within groups. Within group comparisons for baseline data were performed by using Pearson's chi-square and Student's t-tests for categorical and interval characteristics, respectively. Longitudinal changes in outcome measures from baseline to 8 weeks (or rate of outcome change) were analyzed using linear mixed-effects models with interaction terms for study group and time. Random intercepts were used for the random effect of each participant in the model. The models' formula was the following:

Table 1 Baseline demographic characteristics of the study sample ($N = 60$)

Characteristic	Intervention group ($N = 30$)	Control group ($N = 30$)	p value[a]
Age (years)	42.2 ± 10.0	37.4 ± 8.7	0.07
Women	16 (53.3)	15 (50)	1.0
Tertiary education	25 (83.3)	28 (93.3)	0.42
Currently working	28 (93.3)	30 (100)	0.49
Married	13 (43.3)	13 (43.3)	1.0
Smokers	13 (43.3)	14 (46.7)	1.0

Values represent means ± standard deviation, number of patients (within group frequency %)

[a]Student's t-test and chi-square test

weighed married and smokers, respectively. No statistically significant group differences at baseline were noted, signifying well-matched groups.

All patients reported abdominal pain at least three times per month at baseline. After the 8-week follow-up, 50% of patients ($N = 15$) in the intervention group reported abdominal pain less than three times per month compared to none of the patients in the control group. All IBS-related symptoms were significantly reduced in the intervention group compared to the control group (Table 2). Clinically meaningful improvement, that is, relief after defecation and flatulence

$$Y_{ti} = b_0 + b_1 \left(TIME_{ti} \right) + b_2 \left(GROUP_i \right) + b_3 \left(GROUP_i \right) \times \left(TIME_{ti} \right) + b'_0 + b'_1 \left(TIME_{ti} \right) + e_{ti},$$

where Y_{ti} is the outcome, b_0 is the intercept, b_1, b_2, b_3 are the fixed coefficients, b'_0 and b'_1 are the random coefficients for intercept, $TIME_{ti}$ is the time point (t) for each individual (i), $GROUP_i$ is the intervention condition, and e_{ti} is the time specific residual of the model. The H_0 null hypothesis of interest was $b_3 = 0$. By coding control group and baseline time as zeros (intervention and follow-up time as one), b_3 represents the adjusted difference of the average rate of outcome of the intervention group relative to the control group. The Reliable Change Index (RCI) was calculated for each outcome questionnaire based on z scores of the score changes. An absolute RCI above 1.65 or below -1.65 (depending on the direction signifying beneficial change) denotes significant difference. The level of significance was set at 0.05. Analyses were performed using SPSS version 22.0 (Chicago, IL).

3 Results

Table 1 presents the demographics of the study sample. Most participants were middle aged, were almost equally distributed in terms of sex and the majority was of tertiary education and employed at the time the study was conducted. Also unmarried and nonsmokers marginally out-

were significantly improved in the intervention group. In total, 4 out of 30 patients (13.3%) in the intervention group reported significant clinically meaningful IBS symptom relief but none in the control group.

Table 3 presents the results of the mixed-effects models for the rates of outcomes' changes across time. Based on the b-coefficients representing the difference of the rate of outcome between patients in the intervention group and controls, significant differences were recorded for cognitive scores (processing speed, verbal and visuospatial learning, and memory), sense of coherence, stress, anxiety, depression and anger subscales. Based on the number of patients with clinically meaningful changes, the most potent effects of the intervention were observed in anger externalization ($N = 10$), anger control ($N = 6$), visuospatial memory ($N = 5$), information processing speed ($N = 4$), verbal memory ($N = 3$), sense of coherence ($N = 2$), stress ($N = 2$), anxiety ($N = 2$), and anger internalization ($N = 1$). Although significant, there was no meaningful decrease of depressive symptoms in any participant in the intervention group. In total, 76.7%, 23.3%, and 13.3% of patients in the intervention group had significant clinically meaningful improvements in at least one, two or three endpoints of the study, respectively.

Table 2 Observed rates of IBS symptom changes and results of the linear mixed-effects models ($N = 60$)

Outcomes	Intervention group ($N = 30$)	Control group ($N = 30$)	Group*time b ± SE[a]	p-value	Improved based on RCI (N)
Total IBS symptoms change	−4.07 ± 1.87	0.2 ± 0.41	−4.23 ± 0.34	<0.0001*	4
Defecation relief symptoms change	−0.5 ± 0.86	0.03 ± 0.18	−0.53 ± 0.16	0.001*	5
Feces composition change	−0.7 ± 0.65	0.07 ± 0.25	−0.77 ± 0.13	<0.0001*	3
Defecation frequency change	−0.67 ± 0.61	−0.03 ± 0.18	−0.63 ± 0.11	<0.0001*	2
Feces mucus change	−0.57 ± 0.68	0.13 ± 0.35	−0.7 ± 0.14	<0.0001*	3
Flatulence change	−1.63 ± 0.93	0 ± 0	−1.63 ± 0.17	<0.0001*	5

Values represent means ± standard deviation

RCI Reliable Change Index, *SE* Standard Error

[a]Reference categories: b represents the coefficient of the interaction test group*time. Since both control group and baseline were coded as zeros, b is the average score change in the intervention group compared to the change in the control group *$p < 0.05$

4   Discussion

IBS is a multifactorial disorder with worldwide distribution. Many different pathogenetic mechanisms are implicated in the development of IBS, such as infections and immune activation, genetic predisposition, serotonin dysregulation, bacterial overgrowth, central dysregulation with brain-gut interaction. There is a well-established bidirectional connection between the central nervous system and the enteric nervous system [28]. It is proven that gastrointestinal functions like secretion, motility, and blood flow are regulated by the central nervous system. But also gut-driven signals are important for the regulation of these functions. With the use of functional magnetic resonance imaging, the interaction between gut and brain has been elucidated. Mounting evidence indicates that, in response to visceral pain stimulation, patients with IBS exhibit abnormal brain activity in regions involved in pain processing and endogenous pain modulation [29]. Also, Aizawa et al., showed that individuals with IBS have latent impairments in cognitive flexibility as a result of altered activity of prefrontal cortex, insula, and hippocampus [30].

Stress often burdens the symptoms of patients with IBS. The hypothalamic-pituitary-adrenal (HPA) axis is an important component of regulatory mechanisms governing behavioral, neuroendocrine, and autonomic responses to stress and it has been identified that in IBS patients there are alterations in corticotropin-releasing hormone (CRH), adrenocorticotropin hormone (ACTH), and cortisol levels [31]. The results of our study reveal a statistically significant reduction in IBS symptoms, suggesting that PSAI could reduce the symptoms of IBS patients through stress management.

PSAI results in cognitive rehabilitation representing a metacognitive process in which memory has an integral role by providing all the necessary data from recollections of events and previous experiences to enhance a healthy lifestyle and to improve decision making, psychological status and cognitive functions. This study showed that PSAI had beneficial effects on IBS patients' symptoms, cognitive function, sense of coherence, psychological wellbeing (depression-anxiety-stress) and anger. Qualitative data that were collected after every lecture underlined the favorable attitude of the patients for the intervention, reporting being more relaxed, having fewer headaches, setting limits to others, experiencing better quality of sleep, increasing self-efficacy and having a better perspective of their lives.

Table 3 Observed rates of outcome change and results of the linear mixed-effects models ($N = 60$)

Outcomes	Intervention group ($N = 30$) Mean ± SD	Control group ($N = 30$) Mean ± SD	Group*Time b ± SE[a]	p value	Improved based on RCI (N)
SDMT change	3.83 ± 2.68	0.0 ± 2.1	3.83 ± 0.61	<0.0001*	4
CVLT-II change	5.0 ± 4.01	−0.33 ± 1.65	5.33 ± 0.78	<0.0001*	3
BVMT-R change	2.4 ± 1.96	0.23 ± 1.87	2.17 ± 0.49	<0.0001*	5
Sense of coherence change	9.3 ± 6.20	−1.80 ± 7.58	11.13 ± 1.76	<0.0001*	2
Stress change	−5.67 ± 1.79	−0.20 ± 2.30	−5.47 ± 0.52	<0.0001*	2
Anxiety change	−3.50 ± 2.15	0.93 ± 3.11	−4.43 ± 0.68	<0.0001*	2
Depression change	−2.67 ± 1.18	0.37 ± 2.81	−3.03 ± 0.55	<0.0001*	0
Anger in change	−0.87 ± 2.57	0.20 ± 1.06	−1.07 ± 0.5	0.037*	1
Anger out change	−2.73 ± 2.20	0.33 ± 0.76	−3.06 ± 0.42	<0.0001*	10
Anger control change	4.20 ± 2.93	0.03 ± 0.56	4.17 ± 0.54	<0.0001*	6

Values represent means ± standard deviation

RCI Reliable Change Index, *SE* Standard Error

[a]Reference categories: b represents the coefficient of the interaction test group*time. Since both control group and baseline were coded as zeros, b is the average score change in the intervention group compared to the change in the control group.*$p < 0.05$

All patients who received the intervention liked the technique and reported no side effects or negative thoughts related to practicing it.

Several studies have identified cognitive deficits associated with stress and problems in executive functions and, in particular, labor and attention memory processes [32], while other studies confirm that in conditions involving chronic pain there are deficits in decision-making and associative learning [33]. An altered cognitive function on a hippocampal-mediated test of visuospatial memory, which was related to cortisol levels and independent of psychiatric comorbidity, has been recently identified in IBS as well [34]. Visuospatial memory impairment may be a common but currently neglected component of IBS. The present study found significant differences for information processing speed, verbal learning and visuospatial memory, which indicate that certain domains of cognition may be more amenable to change through stress management.

In accordance with previous reports, levels of both depression and anxiety are high in IBS [35]. Both clinical and healthy population-based studies applying screening instruments for anxiety and depression have found similar increased rates of psychological distress in patients with IBS [36, 37]. Furthermore, there is a shared underlying pathophysiological mechanism, such as heightened levels of pro-inflammatory cytokines, which have been identified in both IBS [38, 39] and depression [40]. It is important to note that the results of the PSAI implementation seem encouraging in the amelioration of depressive symptomatology.

Another important fact that supports the benefits of PSAI is that in the present study, the technique of PSAI seems to have led to a statistically significant reduction in the externalization and internalization of anger, and statistically significantly increased anger control. IBS subtypes have shown different symptomatic profiles in depression, anxiety and anger, with constipation predominant IBS patients more psychologically distressed than diarrhea predominant IBS subjects [41]. Another study has shown that trait and suppressed anger were greater in IBS patients, when compared to an organic bowel disease group [42]. Moreover, there is a bidirectional relation of anger and stress, were stress promotes anger and vice versa [43]. PSAI fosters a more "realistic" view of the individual's actions and thoughts (3rd person narrative perspective) via cognitive appraisal and this leads to resolution of tension, anger management and prevents accumulation.

Studies to date have shown that women with IBS have low sense of coherence (SOC) [44], and individuals with low SOC may be more likely to express symptoms of psychological distress. Consequently, the presence of IBS may adversely affect SOC [45]. According to Antonovsky [46] an individual with high SOC faces a stressful factor, mobilizes in order to collaborate and understand the challenge, believing that alternative management resources do exist. The PSAI's primary aim is to empower responsibility over one's life, especially through higher sense of coherence.

This study has some limitations. The sample was small, thus the results cannot be generalized. Moreover, apart from the tests on cognitive function, measurements derived from self-reports and as such, there is always a chance of intervention bias. Also, if benefits were maintained after the 8 weeks of intervention, they were not asserted. Finally, this was a non-randomized study thus the results could suffer from bias. Nevertheless, intervention and control groups were well-matched for basic demographic variables.

In summary, this study provides evidence that stress management in IBS patients may merit benefits for both physical and psychological well-being. PSAI could be considered an inclusive, metacognitive process of stress management and self-empowerment that is easily taught, and most importantly, it can be practiced by the participant for a lifetime. Future studies should extend these findings using larger samples and randomization procedures. It would also be useful to study the outcomes after a longer period of follow-up. We also suggest that future studies should expand our findings using not only participants' self-reports, but a variety of measurements.

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Adults' Stress Response to Unexpected Oral and Arithmetic Tasks in Supine Position

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Abstract

To study the autonomic nervous system (ANS) and hypothalamus pituitary adrenal axis (HPA) response before and after mental stress test in healthy adolescents and adults, is the aim of this study. Twenty healthy adults (aged 23–46 years) entered the Trier Social Stress Test (TSST), after informed consent signing. The procedure was modified: (a) the participants' position was supine as ANS system changes were to be assessed, (b) the interviewers were entering and departing from the session room. Salivary cortisol (marker of HPA axis response) samples were collected at the end of the baseline and 20 min after TSST. ANS of the heart was measured with CNS Task Force Monitor in supine position and was recorded during relaxation (15 min) and after TSST. The sympathovagal balance (LF/HF ratio) for each phase was computed. Evaluations were conducted with R. The HPA axis disturbance between baseline and 20 min after TSST was significant ($g = 0.545$ [0.092, 0.999]) and in adolescents (whereas, the mean intervals of the sinus rhythm RR parameter were found largely changed ($g = 0.834$ [0.340, 1.327]). The sympathovagal balance component of heart rate variability LF/HF ratio was founded unchanged ($g = 0.215$ [−0.211, 0.641]). RR changes were not correlated to salivary cortisol concentrations at any phase. Mean RRIs and salivary cortisol levels were significantly increased, although HPA axis showed medium

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size effect. However, the systems effectively counterbalance the perturbation, since the LF/HF ratio does not change. Our findings suggest further research in stress effect on HPA and ANS cross-talk and dynamics.

Keywords

Salivary cortisol · Trier Social Stress Test · HPA axis · Hypothalamic-Pituitary-Adrenal axis · R–R interval · supine position · LF/HF · Hedge's g

1 Introduction

Stress either chronic or acute may influence learning and interfere to mental as well as somatic physiology functions [1–4]. Hypothalamus pituitary adrenal axis (HPA) is the janitor of the body that, when moved, may trigger a systemic response in cardiovascular, immune, and other systems [5].

The autonomic nervous system (ANS) and the parasympathetic tone, in particular, are proposed to contribute to the regulation of allostatic systems associated with inflammation, hypothalamus-pituitary-adrenal axis (HPA) function, [6, 7]. On the other hand, it is well established that the vagus nerve plays a significant role in health and disease [8, 9], while the ratio of low frequencies to high frequencies (LF/HF) is proposed as a measure of sympathovagal balance in health and disease [10, 11]. Heart rate variability (HRV) has been a useful tool for evaluating vagus nerve outflow. It represents the beat-to-beat variation in the duration of the R–R interval (heart period), reflecting complex interactions between parasympathetic, sympathetic, mechanical, and other factors on the pacemaker located at the sinoatrial node of the heart [12, 13].

Trier Social Stress Test, abbreviated henceforth as TSST, is a procedure evaluated by Clemens Kirschbaum and his colleagues in Trier University in 1993. This tool is competent to induce a reliable stress response by public speaking [14]. Many prior existing protocols of inducing stress had not accomplished to mimic reality or express psychological dimensions [15–17]. It is a reliable combination of known laboratory stress generating procedures independent of personality, education, income confounders. More interestingly, a meta-analysis by Dickerson and Kennenty, already in 2004, established that TSST is a valid method of inducing short-term stress in controlled conditions [18]. It is, also, considered a valid tool for assessing acute and chronic stress response and is widely used in brain studies, in human resources selection procedures, in experimental settings. The method incorporates social dimensions, unpredictability, imposes public speaking, followed by surprising arithmetic tasks, all in front of an undecipherable audience.

It has been repeatedly modified for different age groups, ethnicities, cultural diversities [19–22]. While it was, initially, designed for healthy subjects, it has been applied in physiology studies of pathological entities, like mentally ill persons [23], major depressive disorder (MDD) [24], Atopic dermatitis [22, 25], etc. Various markers have been assessed, i.e., salivary and/or blood cortisol, adrenocorticotropic hormone (ACTH), corticotrophin releasing hormone (CRH), norepinephrine, epinephrine, prolactin, human growth hormone, dehydroepiandrosterone, heart rate, gene expressions, etc. [14, 26]. Finally, all protocols were applied with subjects in standing position, except the Geronikolou 2015 [19], where participants were in supine position. Supine position assessment was suggested as preferred by the European Society of Cardiology in 1996 [13]. To evaluate the HPA and ANS response to oral and arithmetic tasks of TSST in Greek adults in supine position is the aim of this study. The study would contribute to ethnic and age information, as Greek adults' responsiveness is an absolute gap in literature. The protocol modification to supine position is another necessity for ANS valid and credible evaluations, also limited in literature.

2 Subjects and Methods

2.1 Population

Twenty healthy adults (>21 years), working in the Academy of Athens (graduates, post-graduates, post-docs, administrative, and research staff) participated in this prospective study.

The inclusion criteria of the study were: (a) the absence of an infection during the previous month, cardiac, or other chronic disease, obesity or chronic medication, and (b) age greater than 21 years. The study has been conducted in the Clinical, Experimental Surgery, and Translational Research Center in the Biomedical Research Foundation of the Academy of Athens (BRFAA).

The study protocol has been conducted in accordance with the ethical principles originated in Declaration of Helsinki, and was consistent with the Guidelines of Good Clinical Practice and the applicable regulatory requirements. The protocol had been approved by the Ethics Committee of the Aghia Sophia Children's Hospital. All subjects gave informed consent before their enrollment.

2.2   Trier Social Stress Test

Upon arrival in the laboratory, the participants were instructed to lay in calm for 20 min. The mental stress procedure targeted to adults, involving oral and arithmetic tasks in front of interviewers had been described in detail by Buske Kirschbaum in 1997 [22]. The process has been followed in our case with a modification: participants were lying in a comfortable bed and investigators-interviewers were leaving the room instead of the participants as modified by Dedovic in 2005 and Geronikolou 2015 (Fig. 1) [19, 27]. At time + 20 min, the researcher entered the room asking the participant to introduce himself so as to get a better job/post, because the foundation evaluates all staff. The investigator quits the room again and returns 2 min later to hear the self-presentation of the participant. This constituted the narrative part of the test. Afterwards, the investigator asked the participant to count down from a large prime number (1492) in decrements of 13 as quickly and accurately as possible. On every failure, the participant had to restart at the beginning number with the prime investigator prompting: "error-restart." Five minutes later, the task was completed and the investigator quitted the room. A calming period lasting 20 min followed the arithmetic task, with the subjects in the same position.
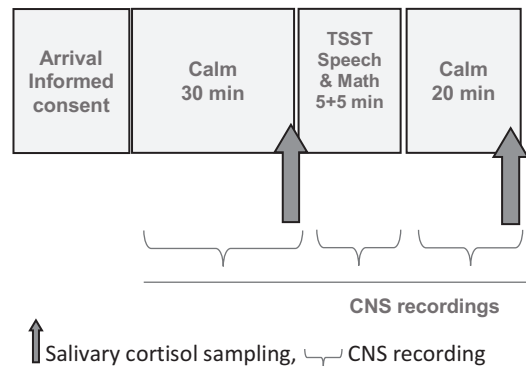
Fig. 1   Protocol applied

2.3   Measurements

Salivary cortisol (marker of HPA axis response) was collected at the end of the baseline and 20 min after the mental stress caused by Trier Social Stress Test (Fig. 1). Salivette saliva collection devices (Stardsted, Norbrecht, Germany) were used for salivary cortisol samples collection. Consequently, the Salivettes were centrifuged at 2400 g for 20 min in 4 °C and aliquots were stored in −80 °C in the Biomedical Research Foundation of the Academy of Athens, until transportation, to the Choremeion Endocrinology Laboratory of "Aghia Sophia" Children's Hospital (Athens, Greece) in dry ice so as to be analyzed. The samples were analyzed by a Chemiluminescence assay in a Roche COBAS E411 analyzer.

Heart rate variability (HRV) is a valid marker of the ANS and was also assessed. HRV recordings were conducted by Task Force Monitor (Austria) in supine position, in a quiet laboratory room, in the Cardiology Lab in BRFAA. The baseline calming recordings lasted 30 min, the oral and arithmetic tasks lasted 10 min and the following recording resting period lasted 20 min (Fig. 1). Frequency domain parameters were calculated as well as low to high frequencies ratio (LF/HF) as marker of sympathovagal balance.

3   Statistical Analysis

We used Mann–Whitney non-parametrical test to evaluate the markers levels differences between pre- and post-exposure to the mental stress test.

All p-values are two-sided with a value of $p = 0.05$ considered as statistically significant. The effect sizes of the observed differences have been evaluated with the modification proposed by Lipsey and Wilson (2001) and Durlak (2009) on Hedge's g statistics formula (Hedges' g is a variation of Cohen's d that corrects the bias due to small sample sizes) [28–31]. It can be interpreted in the same way as Cohen's d, whereby 0.2 represents a small effect, 0.5, a medium effect and 0.8, a large effect [32]. Confidence intervals were also calculated. The evaluations were performed in R software.

4   Results

Twenty healthy participants aged 23–46 years were recruited and signed the informed consent. Almost half of them (55%) were females and the rest males, 15% were smokers, while their body mass index ranged from 22.9 to 29.1. Their characteristics are presented in Table 1. Differences evaluation results are presented in effect sizes and confidence intervals in (Table 2). The salivary cortisol levels increased after mental stress caused by the TSST ($g = 0.545$ [0.092, 0.999]).

Table 1 Partcipants' characteristics

Characteristics	Participants ($n = 20$)
Age (years)	23–46
Gender	45% males
BMI	26 ± 3.1
Smokers	15%

Table 2 Salivary cortisol and sympathovagal balance (LF/HF) differences in Hedge's g (95% confidence intervals)

System	Measurements	Comparison	Hedge's g (95% confidence intervals)
HPA axis	Salivary cortisol	Within phases	0.545 (0.092, 0.999)
ANS	LF/HF	Within phases	0.215 (−0.211, 0.641)
	RRI	Within phases	0.834 (0.340, 1.327)
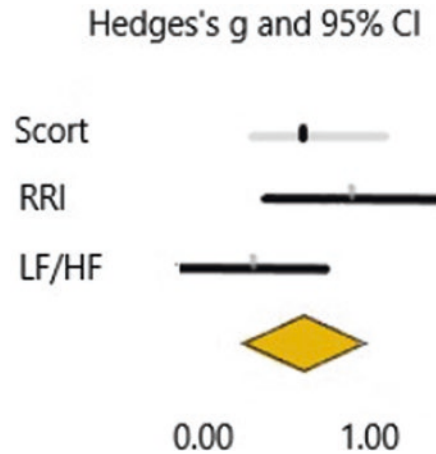
Fig. 2 Mental stress effect sizes comparison of HPA and ANS components (Forest plot) in Hedge's g. Scort salivary cortisol, RRI R–R intervals, LF/HF low to high frequencies ratio (sympathovagal balance)

LF/HF ratio was not significantly increased (0.215 [−0.211, 0.641]). Yet, RR intervals were altered after stress ($g = 0.834$ [0.340, 1.327]). In addition, the effect sizes were illustrated comparatively in a Forest plot (Fig. 2).

5   Discussion

This study presents for the first time, HPA and ANS responsiveness to Trier Social Stress Test in a Greek healthy adult population. It confirms that the TSST method is independent of ethnicity diversities and more importantly, is equally valid in supine position. The latter position adhered the Task Force monitoring requirements of the European Society of Cardiology in 1996 [13]. It directed the modification adopted in our protocol.

We have previously suggested that small samples like ours should be presented with effect sizes like Hedge's g and confidence intervals rather than just statistics [31]. This choice allows us to (a) overcome the bias due to small sampling and (b) compare the effect of the test to the different systems and their components.

Salivary cortisol is a non-invasive credible marker of HPA activation [33]. In this study, salivary cortisol levels were increased with a

medium size effect. In the same supine position (in the same laboratory conditions, with the same investigators, and the exact recording device), Greek adults increased salivary cortisol after TSST contradictory to Greek children and adolescents that had decreased it [19]. The same observation, but in standing position, has been previously reported [34–36].

The sympathovagal balance—expressed in LF/HF ratio—was found unchanged. The observation is consistent to human physiology, as any perturbation to this marker is consistent to morbid conditions [13] not included in this investigation. In addition, such a result could not be caused by a transient situation as TSST. Yet, RR intervals were found definitely altered. RR intervals represent the time elapsed between two successive R waves of the QRS signal on the electrocardiogram (and its reciprocal, the HR) and consist a function of intrinsic properties of the sinus node as well as autonomic influences. The alteration is expected as acute mental stress influences ANS. The markers assessed when compared by their effect sizes we see that the effect in RRIs is strong and greater than the effect in salivary cortisol levels where the effect is medium ($g_{RRI} > g_{sc}$) (Table 2, Fig. 2). The RRIs change, though robust, does not affect body's health as the effect in the sympathovagal balance is null as nonsignificant (Table 2, Fig. 2). It reflects the body's effort to counterbalance the allostatic load caused the oral and arithmetic tasks of the TSST. Yet, it may guide to further research in terms of dynamics and/or time domain parameters as well as deeper investigation in HPA and ANS cross-talk during and after stress.

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Triangles and Family Engagement in Drug and Alcohol Addiction Treatment

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Abstract

Despite the large number of studies that demonstrate the need for family involvement in addiction treatment, mental health professionals (MHPs) are often reluctant to collaborate with the affected family members (AFMs), while several times they enter—consciously or unconsciously—into a competitive relationship with the family of the person with addiction problems (PAPs). The present study presents the results of a thematic analysis of 42 vignettes provided by MHPs working in drug and alcohol addiction treatment. Participants' experiences were depicted by two overarching themes: the caring and the traumatizing triangle. Present findings suggest that MHPs' awareness of triadic influences and attempts to build alliances with AFMs supports PAPs' needs for reconciliation with AFMs and is supported by multidisciplinary need containment. In the attempt to collaborate with AFMs, MHPs need to avoid accepting the idealization of the PAPs and not to ally into the underestimation of the family, in order to resolve possible separation phenomena and to avoid therapeutic failure. Additionally, MHPs are called upon working out their own difficulties and possibly their prejudices about triangular interactions, so that the triangle MHPs–PAPs–AFMs can function therapeutically in a multidisciplinary context. Clinical supervision and Balint groups may support addiction professionals in these challenging tasks.

1   Introduction

The family is the silent witness in the encounter of mental health professionals (MHPs) and person with addiction problems (PAPs). Even in its absence, it reasonably affects the course of treatment constituting the third pole of the triangle. However, MHPs—most often trained in individual-centered contexts and engaged in services based on policies and practices focused on the individual—often ignore the presence of the family, despite the multitude of research that demonstrates the need for family engagement in the treatment process [26]. Barnard [2] observes

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that the attitude of addiction professionals toward the family is characterized by denial, similar to that manifested in the family system for the problem itself. But even in the case of family engagement, often competition develops between MHPs and the family ("new parents"—natural parents) [24], while it is possible that the therapist may be drawn into the relationship with the affected family members (AFMs) in a claim of control and power [25].

A binary system remains stable for as long as peace prevails, but as soon as the stress increases, a person, usually the most vulnerable, will be involved to form a triangle [4]. The binary relation is generally an unstable relation which is stabilized by the presence of a third pole. An example of normal triangulation is the birth of a child. However, examining the literature on triangular interactions, despite the common finding about the universality of triangular relationships, there seems to be a fear of their development, while they are often seen negatively. Whitaker tries to stigmatize triangulation in both treatment and family [33, 34]. Triads tend to form alliances of the two against the third ("two against one," "two except one," i.e., the third pole is excluded and not included "two for one") which can be occasional, fixed, or even refer to established intergenerational triangles. Of particular importance is the change in the ways in which the members of the triangle ally by including or excluding the third pole in the evolving triangular process (frequency, periodicity, duration, etc.). Thus, the triangle can be flexible and a space for reflection rather than static and painful [12].

In addiction recovery, the family is an integral witness and participates both physically and emotionally in the course of treatment. Whether it is present or not in some way, silently or openly it affects the therapeutic process and completes the triangle forming the third pole. Thus, ignoring AFMs or the challenges in integrating them into the therapeutic process due to the difficulty of managing alliances in the context of triangular interactions is more a denial of the possibility often offered for interventions crucial to the outcome of addiction treatment. It is worth noting that we observe similar functions in other con-

texts as well, in the teacher-student-parent triangle. Teachers, very often, treat with suspicion and negativity the relationship with the students' parents, a relationship that is particularly valuable for a quality pedagogical process.

Lee et al. [20] conducted semi-structured interviews with service providers regarding family involvement in alcohol treatment. Apart from barriers related to organizational issues (e.g., lack of funding, time, space, limited support from management) and to family issues (e.g., diminished or no motivation for change, lack of or limited networks, substance misuse in the network), participants reported personal barriers related to their self-efficacy and distressing feelings during the encounter with families. Copello et al. [7] described the dilemmas and complexities that determine whether family work is implemented in drug services, concluding that there are still several misconceptions regarding family involvement. Their results were supported by Orr et al. [27] who suggested that by reinforcing stereotypes, perpetuating stigma, and fuelling self-fulfilling prophecies, professionals maintain a dominant narrative of "family as part of the problem," which inhibits family involvement.

In order to move this area forward, and understand more fully the MHPs' reluctance for working with families, we conducted the present study with the aim to explore MHPs subjective experience of their interactions with PAPs and AFMs. This was seen as an important step toward an in-depth understanding of the challenges that professionals meet in their attempt to involve families in addiction treatment.

Cultural and Theoretical Considerations

Around 14,500 people in Greece are high-risk heroin users [10]. Heroin use is the most common reason for seeking specialized treatment. As regards alcohol misuse, 38% of male Greeks report heavy episodic drinking in the last 30 days [35]. Addiction became a major public issue in Greece in the 1980s and led to the development of treatment services. Interventions were inextricably linked both to socio-political changes and an urbanization process, which affected Greeks who moved from a traditional way of life to a

post-industrial era [31]. In spite of these changes, the centrality of family in Greek life remained intact. Kaldi-Koulikidou [16] suggests that the emerging model of the Greek family has "elements of a progressive society with a traditional foundation" (p. 399). The Greek culture remains quite collectivist with values that are largely affected by the Greek Orthodox Church [17]. Greece and Spain have the highest percentage of adult children cohabiting with parents while 96% of adults up to the age of 50 value the family above all other things in their lives [32]. Available data on addictions suggest that 58% of those who face drug misuse problems (mean age 33 years, and 85% of male gender) live with their family [9].

The present study was conducted in a setting that was theoretically affected by group analysis [3, 13, 37] and systemic principles [11]. The individual with a substance misuse problem and his or her family are seen as *suffering individuals* trapped in the traumatic experience of addiction. Feelings of being cut off from others and life cause increased suffering and bring forward needs for "community," "attachment," and a desperate longing for forgiveness, acceptance, and reconciliation [36]. Family members who witness the tragic consequences of their loved one's addiction, experience an overwhelming sense of distress, anger, guilt, despair, and oftentimes struggle with financial drainage, social isolation, or serious stress-related health problems [2, 38]. In the midst of all these problems, addiction often generates projection and splitting processes which are manifested in the therapist-client-family triangle [14]. The therapeutic context functions as a container, enabling all parties to handle anxiety and, therefore, avoid projections, splitting, acting out, and scapegoating. By reflecting upon the suffering, individuals and families in treatment are helped to find new meanings and (re)connect both with self and each other. The therapeutic approach endorses values of caring and incrementalism on the basis of conflict de-escalation and parents' limit-setting on their own behavior, which are more compatible with harm reduction principles that enhance motivation to change [8].

2   Methods

Study Design
A qualitative design was adopted which involved an inductive content analysis of data obtained from vignettes that explored the experiences of professionals' collaboration with parents. Qualitative content analysis constitutes a research method that focuses on the subjective interpretation of text data through the systematic classification process of coding and identification of themes or patterns.

Participants and Procedure
The study was conducted at the Drug and Alcohol Treatment Units of the Psychiatric Hospital of Attica, Greece which has six in-patients units, providing 3, 6, 9-month treatment, and four specialized Units (i.e., family, adolescent, mother, out-patient). Most individuals seeking treatment for drug and alcohol problems were male (83%) in the age range of 20–39 and had voluntarily accessed treatment. Overall, MHPs provided 42 written case reports (i.e., approximately one and a half pages long) of a successful and an unsuccessful cooperation with a family of an addicted client. Twenty-one professionals consented to participate (i.e., 19 psychologists, 1 psychiatrist, 2 social workers). Participants' age ranged from 29 to 55 years ($M = 35$ years) while their clinical experience ranged from 4 to 26 years ($M = 9$ years). The large majority (93.3%) had completed a lengthy psychotherapeutic training program (of a psychodynamic or systemic orientation) and personal psychotherapy. Ethical approval to conduct the study was obtained from the Scientific Counsel of the hospital.

Family Services
Families were offered multifamily group sessions every 2 weeks or monthly throughout the in-patient and rehabilitation phases of treatment. Service provision depended on the unit's capacity and length of treatment. The alcohol treatment unit offered in addition psychiatric assessment, as well as brief couple-therapy treatment, long-term family support groups that focused on motivational issues and self-development. Finally, the

family unit offered comprehensive assessment sessions, pychoeducational seminars, two levels of family groups focusing on motivation/rehabilitation, drama therapy groups, as well as family and couple therapy.

Analysis

In our attempt to understand the richness of the data and to interpret the "social reality" of participants, a thematic analysis [5] was employed to explore the nurses' experiences of working in open wards. The process of analysis included open coding, creating categories and abstraction. To ensure the credibility of findings, three researchers read independently the transcripts, and consensus was reached on the identified themes, subthemes, and analysis of group dynamics. Confirmability of results was enhanced by data (space and person) triangulation and researcher triangulation. A reflective approach entailed thinking through any preconceptions about the data and any preliminary understandings borne out by the data.

3   Results

Overall, two themes and eight subthemes emerged regarding MHPs' interactions with PAPs and AFMs (Table 1).

Theme 1: The Caring Triangle

This theme comprised four subthemes: (a) Awareness of triadic influences, (b) Building an alliance, (c) Open communication and reconciliation, and (d) Support and containment by multidisciplinary team. Participants' vignettes descriptions illuminated therapeutic interactions in which the family was rarely present physically. Nonetheless significant others' virtual presence was evident in recovery and relapse narratives. Family members influenced the course of treatment and colored the quality of therapeutic contact. In the following vignette section, the PAPs' alliance to the therapist is experienced as betrayal to his attachment to his mother. Awareness of coalitions examines the relations of power and control. "It is very important that, at the begin-

Table 1 Themes and subthemes

Themes	Subthemes
The caring triangle	Awareness of triadic influences Building an alliance Open communication and reconciliation Support and containment by multidisciplinary team
The traumatizing triangle	Powerlessness and guilt Rejection and acting outs Taking on the roles of victim, rescuer, or persecutor Relapse

ning of the re-entry phase, the mother got angry with the coordinators of the parent group, and in particular with me... Subsequently, the patient somehow distanced himself from treatment—he did not come to individual therapy sessions, he was aggressive and seemed confused. As he later said, 'I did not know how to defend my treatment without feeling that I was betraying my mother.' After a personal intervention (by me) towards the mother, she changed her attitude towards us and he was also unblocked. All this had a positive impact on T." (V34)

> M was always very negative and looked down on this collaboration, which she felt was a conspiracy against her and made her feel 'small'. (V21)

Building an alliance with parents and spouses appears to be very important for many PAPs' recovery. Significant others' acceptance of the therapeutic program motivates and empowers PAPs. Strengthening the connections between triangle sides constitutes an ongoing process throughout the course of treatment.

> At the same time, it seems that her therapists have gained the trust and appreciation of her parents who, despite the difficult beginning in their relationship to therapists and their distrust, they now seem to recognize the help they received from the therapists and turn to them for advice when something concerns them in their relationship with M. (V13)

The mother participated in the parent groups from the first moment. During the re-entry phase, she seemed to have understood many things and showed to E. that she is completely committed to her treatment and trusts entirely her therapists. This "alliance" seemed to be very decisive for E. as well. On the other hand, her father had difficulty in listening to other in the group and for a long time while Eleni was in inpatient treatment he did not participate in parent groups. Finally, at some point, he decided to give a second chance and did not give E. the right to believe that he was against her treatment program. Today, E. has been abstinent for 3 years. She is working and studying. (V8)

Open communication, forgiveness and reconciliation constitute deeper wishes of PAPs despite a past of competitive, aggressive, and even emotionally abusing behaviors.

As regards the collaboration with her father, M insistently refused the idea of inviting him in a session for a long time, telling me that he would deny it and that he was a father who did not want to collaborate... When, after many months during which M could not keep her abstinence, she finally agreed to call him, her father responded immediately to our request and came to the appointment. Indeed, he was a man with a very strict value system (military by profession) and seemed very angry and frustrated with his daughter. He told her that he would not be with her until she finished the Program and that he did not give her much hope. He was very dogmatic in what he said, so that he provoked the anger of the therapist. This was the only appointment that was made with the father in the first phase, which nevertheless seemed to mobilize M. She finally managed to stay abstinent have progress in her recovery. (V11)

The primary alliance develops between the patient and her therapist despite the difficulties and the obstacles (snobbish attitude of the patient within the group). The therapeutic relationship is strong enough and the patient is not shaken learning that her therapist meets her mothers. She trusts her therapists, opens up and interacts. The mothers sits at the corner of the healing triangle, the most uncomfortable place. She seems skeptical, suspicious, defensive, controlling, slow to trust, afraid to be exposed. She is the guilty, the bad mother. When the mother in her own therapy team man-

ages to give her home to this difficult child who tormented her so much from a young age, the hostile, competitive, difficult relationship between the mother and her daughter begins to change. Recovery starts and tensions begin to subside. The relationship seems to be gradually 'normalized'. The mother experiences and allied relationship with the therapist who sympathizes with her and does not judge her. Her daughter reveals that she was the outcome of an unwanted pregnancy of her mother and expresses emotions that she experienced for years. Gradually she "forgives" her mother and then the mother begins to "forgive" her. This house becomes her dowry which although it came so late into her hands, she managed it to get it from her mother' hands. (V24)

In participants' vignettes, the therapeutic context is depicted as a container for intense feelings of stress, emotional pain, and aggression. Multidisciplinary team containment is presented as necessary in the landscape of trauma, loss, and abuse.

During the second month of re-entry phase N has a relapse. The parents ask for help and try to follow therapists' advice. Personally, I believe that their attitude helped N. to overcome the relapse quickly. They understood that they were called to support him discreetly, without burdening him with their own tension and worries, without pressurizing him and checking over him and without excessive benefits. It seems that through their attitude the shape of the family that includes N. works, supports him and strengthens him in his course without blocking him, helping him to gradually pass to full independence. (V5)

After the first meeting with his parents, I understand that I am dealing with two people burdened both by the condition of X. and by the loss of their daughter. The mother has anorexia and the father feels lost and seeks answers and solutions. I understand that parallel intervention is necessary on many levels. We agree that they will start weekly sessions in the family department despite the father's objections. At the same time the mother starts individual psychotherapy in the eating disorders department. In addition, we agree to meet once a month in order to discuss about issues they need advice regarding their son. After a few months X. got stabilized and began to work on many

issues. Collaborating with colleagues in the eating disorder department and the family department helped me in a comprehensive treatment plan for X. He is still abstinent, his mother is continuing her own therapy and the father is about to start counselling sessions. (V41)

Theme 2: The Traumatizing Triangle

This theme comprised four sub-themes: (a) Powerlessness and guilt, (b) Rejection and acting outs, (c) Taking on the roles of victim, rescuer, or persecutor, and (d) Relapse.

Powerlessness is a central element in several participants' vignettes. AFMs strenuous long-term effort to fight addiction drains them emotional while omnipotence gradually gives place to feelings of impotence are described in participants' case vignettes. Earlier trauma colored the landscape of loss which perpetuates transgenerational transmission of pain and trauma.

At the start of her effort to enter treatment, E. was mainly accompanied by her mother. The attitude the latter held was one of distrust mainly towards her daughter's effort but also towards the ability of the therapists to help E. She considered herself completely helpless to help her daughter. The father came twice before E's admission to inpatient treatment and did not seem to understand the extent of his daughter's problem. (V9)

In many vignettes families are divided to sub-systems, rejection, dividing and controlling behaviors, aggressiveness and acting outs split the family and block communication.

When P. came out of inpatient treatment, his mother told him that she did not want any relationship with him and the father could not devote time to him due to work. They had no contact with the program. P. at that time broke many boundaries and relapsed with alcohol. He is a patient who feels alone despite the relationships he has developed and constantly talks about everything he wanted to have but does not succeed in having. He seems to experience repeatedly a feeling of emptiness, loneliness and lack of communication. (V47)

Family members, PAPS and MHPs take on the roles of rescuer, victim, and persecutor. For example, a therapist may assume the role of a rescuer which may result in persecuting a/some family members at later stages. Or a PAP may be

the victim who rescues the family member by the persecuting therapist or the victim therapist by the persecuting AFM.

"She feels intense anger towards her parents whom she considers responsible for her addiction and especially her father (alcohol-domestic violence). She feels despair, hopelessness and anger when considering her own lost childhood and adolescence. Working with her family has been extremely difficult. Patterns of communication that dominated the family seemed to be repeated with the therapists. The father acted authoritarianly and rudely towards us. He constantly raised the tone of his voice and the attribution of causes was external ("it's her fault, the society's fault, the program's fault). When he disagreed and got angry with us, he moved threateningly towards us, wanting to show us the intention to use physical violence, as he used to do to his wife and daughter. He seemed to place us in the position of the unruly child who is disobedient, who contradicts and blames him for his actions. In general, his attitude was ambivalent towards the therapists, since sometimes he was angry and sometimes he treated us as role models and wished that his daughter was like us. The mother, on the other hand, maintained a passive attitude and appeared to have the role of the victim towards the perpetrator, a tyrant husband, and father. Due to the frequent repetition of patterns of pathological communication, I was discouraged regarding our steps of progress and change and disappointed to see the same triangles and dysfunctional forms of communication being repeated." (V40)

Lack of AFMs' alliance with the therapeutic context and perpetuation of aggressive/guilt provoking attitudes toward PAPs appeared to result in relapse in participants' vignettes.

H. is married with two sons of which the second-16-year old- is currently using psychoactive substances. H. completed the two-month program and had a relapse. During our cooperation, he maintains abstinence without substantial steps of motivation toward life changes. He strongly highlights the problems in the relationship with his wife who does not cooperate with the therapeutic program resulting in constant relapses. I suggest a joint session with my wife. They come together and for the first time S. speaks and H. listens to her complaints. I suggest helping her and continuing couple therapy sessions. S. does not want another therapist and we arrange appointments together but she did not continue ignoring or canceling all appointments. H. very soon had a full blown relapse. (V36)

4 Discussion

The aim of the present study was to illuminate the subjective experience of MHPs' relation to PAPs and AFMs during addiction recovery. Participants' experiences were depicted by two overarching themes: the caring and the traumatizing triangle. Present findings suggest that MHPs' awareness of triadic influences and attempts to build alliances with AFMs supports PAPs' needs for reconciliation with AFMs and is supported by multidisciplinary need containment. If coalitions among all poles of the triangle are not re-enforced, MHPs, AFMs, and PAPs may assume the roles of rescuer, persecutor, and victim while difficulties associated with professional intra- and inter-team collaboration may arise.

The triangle Savior–Perpetrator–Victim ("drama triangle") is often recognized in the interactions of family members who face addiction problems [18] and is considered particularly important for the management of countertransference in the treatment of borderline patients [15]. However, these interactional patterns are often unconscious and certainly do not justify a defensive or aggressive (silent or open) attitude of the MHP toward AFMs. In fact, in some cases—especially in the treatment of borderline patients—the therapist is idealized and becomes the "good person," while the parents and other family members represent the "bad people." In other words, there is a splitting which, if not resolved in the treatment, the therapeutic failure is certain [14]. In addition, a rigid attitude toward AFMs, which places them in the role of perpetrator, may indicate that the MHP has been drawn into the role of savior, which helps neither PAPs nor AFMs to seek new ways of interaction. For example, the Healer-Savior, who attempts to "save" the dependent (on the relationship with substances) daughter from her intervening mother, contributes to the perpetuation of the victim–perpetrator roles in the mother–daughter relationship, intensifying in this way the conflict element of their relationship, which is likely in turn to lead to relapse. On the contrary, if MHPs differentiate themselves and do not assume such roles then they may contribute to PAPs' and AFMs' ability to see themselves in all three roles of the triangle Savior–Perpetrator–Victim, thus gaining awareness of assumed roles and de-escalating the intensity of the "drama triangle" [19].

It is also worth noting in families with a history of trauma and abuse problems, the tendency to entice the therapist into the role of savior in the triangular interactions with AFMs may result in members of the treatment team being involved in intense disagreements over family involvement issues [25]. One or more therapists support diametrically opposed positions by protecting one or more family members from someone else, for example, the child by the parents, the child and the mother by the father, etc. [14]. In these cases, the MHP experiences strong feelings for family members (e.g., strong sympathy for the child and strong anger for the parents), which affect his/her clinical judgment (e.g., feels indifferent, reduces, or rejects any information about the parents' ability to help the child, while treating the child as someone who will undoubtedly gladly leave his/her parents). MHPs who take on the role of savior of the child are usually young professionals who work on issues of differentiation from their own family or professionals who, due to their involvement in personal therapy or a personal crisis, work on similar issues [14]. When the MHP identifies with the PAP, then family members may represent the protagonists of his own past. In fact, Whitaker has underlined the function that family work performs for an MHP: in his opinion, the MHP will relive in his/her clinical practice with the families, the tensions he has experienced within the social structure in which he grew up [33].

In a group characterized by mutual respect and open communication, MHPs' unconscious reactions are recognized and understood without having a negative impact on treatment [14]. However, when team members are dominated by unconscious feelings of aggression then they are expressed under the guise of rigid use of professional regulations or inappropriate use of exclusion [14]. Also, when the MHP is unable to contain emotions of anger and rage—usually in young professionals—then it often leads to the

acting out of aggressive emotions with disastrous results for the outcome of the PAP's treatment and the burden of guilt carried by AFMs. An atmosphere of open dialogue and trust in the treatment team is required, which will allow team members to discuss their experiences and express their negative feelings. It is important for the clinical team to accept feelings of powerlessness and anger as inevitable in the landscape of addiction trauma and suffering and to use them as a valuable source of information for the family.

In clinical practice, multidisciplinary team collaboration and containment of the intense emotions experienced in addiction treatment are necessary. Part of the family system may be invited for one or more sessions as part of individual addiction therapy. Of course, this invitation must include a discussion of issues concerning the PAP. At the Drug and Alcohol Addiction Unit of the Psychiatric Hospital of Attica, individual treatment can be combined with family or couple therapy after agreement with the patient and family members. The MHP can shift the focus between individual, family, and couple therapy. If this change is discussed in advance with the PAPs, they usually react well and do not get confused. Finally in several cases, the PAP and his/her spouse or other family members can have two simultaneous treatments (individual or group). However, this parallel treatment does not exclude the need to deal with the relationship between them. In cases where the patient seeks the MHP alliance against family members and vice versa, the therapeutic triangle can work satisfactorily when the MHP does not accept idealization and does not ally with the devaluation of the member.

A triangle can work therapeutically when the alliance patterns of the MHP and the other two poles of the triangle are constantly reformulated and changed. Since it is not possible for an MHP to be objective, to the extent that he is quickly drawn into the interaction, he can be part of one and the other and thus remain impartial. Of course, creating "multiple alliances" with family members is a challenge for any mental health team and requires support from a supervisory framework. Nonetheless, AFMs come into contact with addiction treatment agencies in a state of crisis bearing the burden of intense stress, stigma, guilt, and chronic social isolation. Therefore, their first contact with an addiction program would be preferable to be done in an individual and not in a group context. Acquaintance with the MHP and confidence in his/her face could significantly alleviate these feelings. According to McWilliams [22], establishing a therapeutic alliance might be possible within minutes or could take years.

5   Limitations

As far as the limitations of the present study are concerned, some of the challenges experienced by participants could perhaps be explained by the cultural context in which addiction occurred and services were provided. More specifically, in child-centered South European cultures, such as the Italian, Greek, Portuguese, and Spanish, the transition to adulthood is delayed [1, 6], with parents exerting control over their adult child's life [1, 21], and, by extension, over the professionals who are responsible for his or her treatment. Moreover, in these cultures, the individual's addiction is stigmatized, with parents often feeling guilty and responsible for his or her behavior. Thus, the interpretation of findings must take into account the different structures, power division, religions, attitudes toward drugs, and the role of self-help of relevant cultural contexts. A further limitation of the present study is that it focused on the experiences of professionals in different units of a single organization. Nonetheless, professionals' experiences extend beyond the family–therapist relationship to include work factors (e.g., workload, availability of supervision) and health policies to endorse a family care approach. Therefore, work factors related to service provision in this organization may have influenced participants' experiences of engaging parents in treatment.

6   Implications

Implications of results with regard to the clinical practice, research, and education are founded on the acknowledgment that engaging parents in addiction treatment is a challenging process for professionals. Lacking training and confidence in this area could also culminate in feelings of helplessness and inadequacy which are often exacerbated by the unrelenting demands for individual and family support and may increase the risk for burnout and secondary traumatization [23]. Alternatively, it could result to disengagement, detachment, or acting out the heightened hostile emotions toward parents. Therefore, findings underscore the value of clinical supervision and Balint groups [28] in addition to specialized training and peer consultation, to help professionals work on their prejudices, anxiety, anger, guilt, and deception, when engaging parents in the treatment of their addicted child. After all, clinical supervision has been suggested as a promising workforce development strategy within the addiction field [29, 30]. Through supervision, professionals can be helped to step back from and reflect on their strong reactions to parents. This may help them to gain a deeper understanding of the therapist–family communication and interaction, and avoid becoming rigid in their thinking by building a "wall" between themselves and parents and by applying rules and theories. It may also allow the opportunity to gain insight into their contribution to the relationship they form with the family.

7   Conclusion

In conclusion, the results of the present study point to the need for providing training and supervision to support the development of therapeutic skills in addiction professionals in their attempt to engage parents in treatment. If the challenging and demanding nature of family involvement is not recognized, and no policies exist for adequate staff training and supervision, then the invaluable contribution of family engage-ment in addiction treatment will remain limited. Family work is not, and should not be, an individual affair or a field of specialist work [25], but rather a collective pursuit, which promotes mutual support in times of distress, and the sharing of rewarding experiences that derive from our encounters with families.

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Use of Fortified Bread for Addressing Vitamin D Deficiency

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Abstract

Vitamin D deficiency due to inadequate sun exposure and/or inadequate intake from food is very common worldwide, consisting a major public health problem. As prolonged exposure to ultraviolet radiation involves risks, food fortification of staple foods emerges as a favorable solution for addressing vitamin D deficiency. Bread is a suitable candidate for fortification as it is consumed often and is the main carbohydrate source in European countries.

The purpose of this study was the evaluation of the bioavailability of vitamin D from a fortified Greek-type bread that was developed as a means for addressing vitamin D deficiency, by comparing the absorption curve of vitamin D in fortified bread in relation to that of plain vitamin supplementation. Two groups of clinically healthy volunteers consumed 25,000 international units (IU) of vitamin D_3 (cholecalciferol) either in fortified bread (Group A) or in a plain supplement form (Group B). The baseline plasma concentrations of cholecalciferol were 8.1 ± 6.0 ng/mL and 6.8 ± 3.4 ng/mL in Groups A and B, respectively. After 12, 24, and 48 h, the concentrations of cholecalciferol in Group A were 16.7 ± 4.8, 15.3 ± 8.3 and 11.9 ± 6.0 ng/mL, respectively, and in Group B, 15.2 ± 3.3, 11.6 ± 2.4, and 9.6 ± 3.6 ng/mL, respectively. In both groups, the concentrations of cholecalciferol at 12 and 24 h were significantly higher than the baseline concentrations ($p < 0.01$). There were no statistically significant differences between the concentrations of cholecal-

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ciferol between Groups A and B, at each time point.

Cholecalciferol is bioavailable from Greek-type fortified bread and bread could be used for addressing vitamin D deficiency.

Keywords

Vitamin D · Cholecalciferol · Ergocalciferol · Vitamin D deficiency · Food fortification · Fortified bread

1   Introduction

1.1   Vitamin D

Vitamin D is a generic term referring to fat-soluble secosteroids with anti-rachitic activity and other important biological functions. Vitamin D_3 or cholecalciferol is produced in the skin by isomerization of the precursor molecule 7-dehydrocholesterol, while vitamin D_2 or ergocalciferol is of plant origin [1, 2]. Both forms can be obtained from food and have similar metabolism although the D_3 metabolites are believed to have higher biological activity [3]. Vitamin D (D_2 or D_3) is activated in two metabolic steps. The first takes place in the liver by hydroxylation to the main circulating metabolite 25-hydroxyvitamin D (25(OH)D) which is also a marker of vitamin D status. The second hydroxylation takes place in the kidney, where the active hormonal form $1\alpha,25(OH)_2D$ is produced [1–3]. Vitamin D is found in a few foods, either in the form of cholecalciferol that is highly bioavailable and can be acquired from animal sources, such as fatty fish and cod liver oil or as ergocalciferol available in fungal sources such as mushrooms and yeast exposed to sunlight or UV radiation [1, 4, 5]. The amounts of the vitamin in a normal diet not containing fortified foods or supplements are usually not enough to sustain sufficiency. The main source of vitamin D in humans is exposure to sunlight. About 80% or more of vitamin D is attained from UV-B induced production in the skin, while dietary intake plays a relatively minor role, although this varies considerably depending on factors such as geographical location, use of sunscreen and type of clothing, time spent outdoors and time of the day, age, skin pigmentation as well as environmental pollution, nutrition/supplement intake, or ethnicity [1, 6, 7]. Lack of regular sun exposure contributes to vitamin D deficiency and thus food fortification emerges as a solution for addressing vitamin D deficiency [8].

1.2   Vitamin D Status and Vitamin D Deficiency

Vitamin D is an important regulator of calcium and bone metabolism. Apart from this well-studied role, vitamin D has also non-skeletal effects including impact in cell growth modulation, neuromuscular and immune function, and inflammation reduction. Several animal and epidemiological studies have shown that low serum 25(OH)D concentrations are a risk marker for various non-skeletal diseases as well as for increased mortality [9–13]. The possible role in chronic diseases such as multiple sclerosis, autoimmune disorders, infections, respiratory disease, cardiovascular disease, cancer, and fracture risk is still being investigated [14].

In recent years, vitamin D deficiency has become a worldwide public health problem, in all age groups, with more than 1 billion people having inadequate levels of serum vitamin D concentration [15, 16]. Most populations fail to meet the recommended circulating levels of 25(OH)D ranging from 25 to 50 nmol/L (10–20 ng/mL), corresponding to a minimum daily vitamin D intake of 10–20μg (400–800 international units (IU, 1 IU = 0.025μg of cholecalciferol) [17]. The prevalence of low serum 25(OH)D concentrations and of inadequate vitamin D intakes worldwide, is indicated by recent surveys, where serum 25(OH)D concentrations <30 nmol/L (12 ng/mL) and <50 nmol/L (20 ng/mL) are present in 13.0 and 40.4% of the general population in Europe, and in 6.7 and 26.0% of the general population in the USA, respectively [18–20]. Vitamin D deficiency and insufficiency have been of concern

even in sunny countries, like Greece. Data from measurements in Greek adults have documented that 36% of adults had insufficient serum 25(OH)D concentration (<50 nmol/L or <19.9 ng/ml) and 28.8% had deficient concentration (<30 nmol/L or 12 ng/ml) [21]. Low 25(OH)D levels have also been reported in children and adolescents in Greece, especially during winter [22, 23].

Given the significant prevalence of vitamin D deficiency in Greece, despite the frequent sunshine, relevant public health policies that include vitamin D fortification are recommended [8]. The development of fortified foods of the Mediterranean Diet that are at the base of the nutrition pyramid and can be consumed daily, such as bread and other starch-containing foods, could help in the management of vitamin D deficiency. These foods have the additional advantage of being suitable for vegetarian and vegan diets. Bread is the main source of carbohydrates in European countries [24] and since 25(OH)D synthesis is directly dependent on vitamin D availability, fortified bread could be a good way of facing the problem on a public scale.

Herein we describe the evaluation of the bioavailability of vitamin D_3 from a fortified Greek-type bread that was developed as a means for addressing vitamin D deficiency. The aim of the study was to compare the absorption curve of vitamin D in fortified bread in relation to plain vitamin D intake.

2   Materials and Methods

2.1   Preparation of Fortified Bread

Bread was prepared using a standard preparation method following a traditional recipe with durum and bread wheat flour (in a ratio 1:0.43), water (58% on flour basis), yeast (1.5%), and salt (1.5%). Yeast and salt were dissolved in separate aliquots of water and added to flour. Dough was prepared by mixing for 2 min at medium speed all the ingredients in a mixer. Dough samples (~100 g) were proofed for 45 min at room temperature, kneaded, molded, and left to reach mat-

uration for another 45 min at 30–32 °C, 80–90% relative humidity in greased with olive oil aluminum pans; the baking was performed in an electric oven for 20–25 min (210 °C). For the fortified bread, a water-dispersible vitamin D_3 formulation (BASF, Germany) was accurately weighed and dispersed in the remaining water of the recipe; the bread was prepared in the same way with the non-fortified bread.

2.2   Subjects

The study was carried out in June 2015. Twenty-six adult volunteers, members of the academic community of the University were recruited for this study and participated after being informed about the purpose of the study and giving a written signed consent. Exclusion criteria were consumption of vitamin D supplements, diabetes, neoplastic, cardiovascular, renal, and hepatic diseases.

After an overnight fast, Group A ($n = 13$; 5 m/7 f) was assigned to the consumption of one slice (40 g) of Greek-type bread containing 25,000 IU cholecalciferol while Group B ($n = 11$; 7 m/4 f) was assigned to consumption of 25,000 IU of cholecalciferol in the form of a dietary supplement together with a slice (40 g) of similar but non-fortified Greek-type bread.

Blood samples were drawn before and at 12, 24, and 48 h after intake and the plasma content of cholecalciferol was determined. Participants were instructed to consume the provided breads and supplement at the beginning of the study and also to follow their usual lifestyle, including physical activity and dietary habits.

2.3   Determination of Cholecalciferol in Plasma

Blood samples (5 ml) were drawn from each volunteer at the specified times and placed in plastic tubes in the presence of heparin. Plasma separation was performed immediately by centrifugation and the samples were stored at −20 °C until analysis.

Determination of cholecalciferol in plasma was performed with a high-pressure liquid chromatography (HPLC) method, after extraction from the samples (solvent demixing method). Ergocalciferol was used as an internal standard for the calculation of the recoveries during extraction. Cholecalciferol and ergocalciferol standards, acetonitrile and methanol were purchased from Sigma Aldrich.

A volume of 250μL plasma was transferred into centrifuge tubes, followed by the addition of 20μL of internal standard (750 ng/mL ergocalciferol in acetonitrile) and 480μL acetonitrile. The samples after 3 min gentle shaking and vortex mixing for 3 min were centrifuged at 13,000 rpm for 10 min. The supernatant was filtered with a 0.2μm syringe filter (Millipore) and a volume of 100μL of the supernatant was injected into the chromatography system.

Chromatography was performed on an Agilent 1100 liquid chromatography system (Agilent Technologies, Santa Clara, CA, USA) consisting of a degasser (G1379B), a pump (G1312A), an automatic sampler (G1329A), a temperature adjustable column section (G1316A), and a UV detector. The ChemStation software was used for data acquisition and processing. For the determination of the elution times, each form of vitamin D was injected into the system and the corresponding recovery time was recorded.

A C_{18} 250 × 4.6 mm chromatography column, with 5μm particles (Thermo Hypersil, Betasil) was used as the static phase. The elution was isocratic with a mixture of acetonitrile: methanol 30:70 by volume. The mobile phase flow rate was 1 mL/min. The spectrophotometer of the UV detector was adjusted to a wavelength of 265 nm and the volume of the injected sample in the chromatography column was 100μL. The amount of vitamin D was calculated from the comparison of the height of its peak to the height of standards, using a reference curve.

## 2.4	Statistics

All results are expressed as mean ± standard deviation (SD). Statistical calculations were performed with the use of the Statistical Package for Social Sciences (SPSS) version 26 (IBM, Armonk, NY, USA). Plasma concentrations of cholecalciferol before and after consumption of fortified bread or supplement at different time points were compared by repeated measures analysis of variance (ANOVA) and the significance level used was $p < 0.05$.

## 3	Results

The study population consisted initially of 26 volunteers that were randomly assigned to two equally numbered groups of 13, Group A receiving 25,000 IU of cholecalciferol in fortified bread and Group B receiving 25,000 IU in a cholecalciferol supplement. Two subjects from Group B did not abide by the study from day one and were excluded. Finally, Group A consisted of 13 participants, 5 males and 8 females, and Group B consisted of 11 participants, 4 males and 7 females. As shown in Table 1, the study subjects in the two groups did not differ with respect to age, sex, and BMI.

None of the subjects who completed the study reported any adverse effects. The baseline plasma concentrations of cholecalciferol were comparable (8.1 ± 6.0 and 6.8 ± 3.4 ng/mL in Groups A and B, respectively). After the consumption of the fortified bread in Group A or the supplement in Group B, a sharp increase in the cholecalciferol concentrations was observed in the first 24 h. Maximum concentration in plasma was achieved at 12 h for both groups (A 16.7 ± 4.8, $p < 0.01$ and B 15.2 ± 3.3 ng/mL, $p < 0.001$, comparison between baseline and 12-h levels). At 24 h, the concentration of cholecalciferol was 15.3 ± 8.3 ng/mL in Group A, $p < 0.01$ and 11.6 ± 2.4 ng/mL in Group B, $p < 0.001$ (comparison between baseline and 12-h levels). At 48 h, the respective concentrations were 11.9 ± 6.0 ng/mL in Group A and 9.6 ± 3.6 ng/mL in Group B and there was no significant difference than baseline in either group (Fig. 1).

No statistically significant differences were found in the concentrations of cholecalciferol between Group A and Group B, at each time point.

Table 1 Demographic characteristics of the study participants

	Group A			Group B		
	Average	SD	n	Average	SD	n
Age (years)						
All subjects	22.9	3.8	13	22.5	3.3	11
Male	24.2	5.0	5	24.0	4.7	4
Female	22.1	2.4	8	21.7	1.6	7
BMI (kg/m²)						
All subjects	22.3	1.8	13	24.3	3.0	11
Male	23.8	1.6	5	24.6	2.2	4
Female	21.4	1.3	8	24.1	3.3	7

BMI body mass index in kg/m²

Fig. 1 Plasma cholecalciferol levels (ng/mL) in subjects before and at 12, 24, and 48 h after consumption of either 25,000 IU of cholecalciferol in fortified bread (Group A) or in a supplement formulation (Group B). *$p < 0.01$, **$p < 0.001$, repeated measures ANOVA, comparison of each time point (12, 24, 48 h) with baseline (0 h) within each of the groups A and B
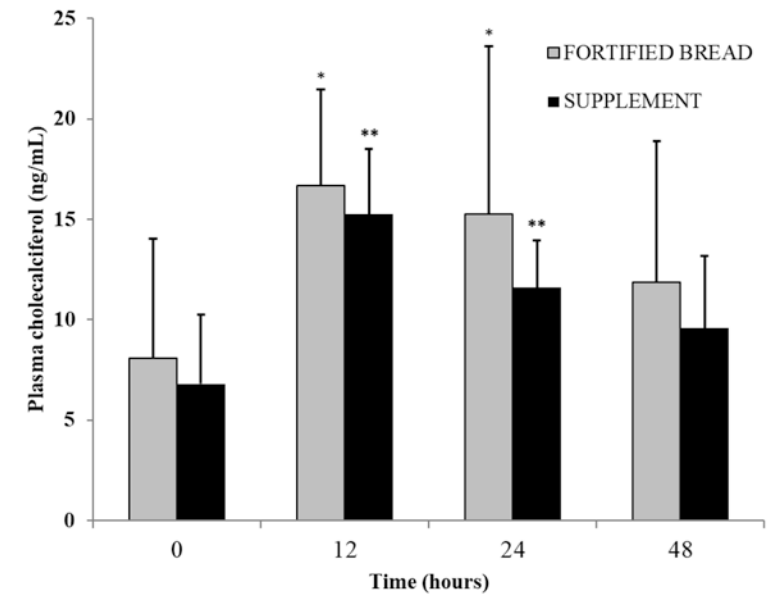
4 Discussion

4.1 Bioavailability of Cholecalciferol from Bread

In this study, we evaluated whether vitamin D_3 was bioavailable from the Greek-type fortified bread by comparing the circulating cholecalciferol levels after consumption of the bread with the respective levels after receiving equal quantity of the vitamin in a supplement. The concentration of cholecalciferol in the plasma of all volunteers rose significantly 12 h and remained significantly higher than the basal concentrations up to 48 h. The rise observed from bread consumption was comparable with that caused by the supplement.

Although there are some studies reporting that long-term consumption of other types of fortified bread can increase the serum concentrations of 25(OH)D [25–27], there are no studies measuring vitamin D_3 itself in plasma as index for its bioavailability. The prevailing belief so far is the use of 25(OH)D concentrations as an index for vitamin D status [1, 8, 18, 28]. 25(OH)D has a half-life of a few weeks while cholecalciferol has a relatively short half-life of approximately 1 day. It was thus proposed that cholecalciferol concentrations may be a better index of vitamin D status in the short-term as it can reflect recent consumption of the vitamin or exposure to sunlight [29]. Whatever the case, it is useful to measure the concentration of cholecalciferol in the circulation

in order to assess the bioavailability of the vitamin from a specific food. For this reason, the experiment was designed to involve consumption of a relatively large amount of cholecalciferol, so that it would be easily detectable in the circulation until the end of the 48-h period of our experiment. In a similar way, Tangpricha et al. (2003) have assessed the bioavailability of vitamin D_2 in whole milk, skim milk, and corn oil on toast bread by determining the serum vitamin D_2 levels from 19 subjects that ingested the fortified food [30]. Their findings displayed a similar time profile, showing an increase of the serum vitamin D_2 concentrations within 4 h, a peak at 12 h, and a return to near baseline values by 72 h.

The existing evidence in the literature that cholecalciferol is superior than ergocalciferol in raising 25(OH)D levels led us to choose cholecalciferol over ergocalciferol for the fortification of the bread [28, 31].

Our results showed that cholecalciferol can be as efficiently bioavailable when ingested with fortified bread as when taken as a plain supplement.

4.2 Bread for Addressing Vitamin D Deficiency

Vitamin D deficiency is an important public health concern [28]. Considering the beneficial effects of vitamin D in the prevention of many human diseases [6, 32], the optimization of vitamin D status is among the top priorities of public health interventions in several countries [33]. Several studies have suggested that vitamin D supplementation can increase circulating serum 25(OH)D levels [34, 35]. Since environmental, cultural, and social as well as other factors can influence the amount of cutaneous vitamin D synthesis upon exposure to solar UVB radiation, possible solutions could be either oral supplementation or food fortification. As many people either do not like taking pills as supplements or forget, fortification of foods included in the everyday menu would be an answer and represents one of the most important and cost-effective strategies to improve and combat vitamin D deficiency. Several food items have been suggested as good vehicles for vitamin D fortification, such as milk, mushrooms, bread, and orange juice [8]. Although fortification of dairy products has already been applied in many countries, such as the USA, it has not been as effective for preventing vitamin D inadequacy in the general population as expected. This partly has been attributed to lactose intolerance and vegetation cause [36, 37]. Therefore, it was reasonable to consider fortifying foods of the Mediterranean Diet that belong to the base of the nutrition pyramid and can be consumed nearly daily. Bread, as a staple food, which is consumed with most meals, consist a good vehicle for fortification.

5 Conclusion

Bread is a primary food in a large number of countries, making it a good candidate for fortification. In our experimental setting, we have shown that fortification of Greek-type bread with 25,000 IU vitamin D_3 has similar efficacy with the plain vitamin D supplements. The results demonstrated that the cholecalciferol incorporated in the bread was stable and bioavailable, suggesting that fortification of foods of the Mediterranean nutrition may be a feasible way for addressing vitamin D deficiency. Further studies with fortifying food items that belong to the Mediterranean nutrition for a longer duration of 6–12 months may be required to assess the long-term effects. Other populations that should be investigated with respect to the best food vehicle, as well as the dosage, are the children and other special diet groups.

Conflict of Interest The authors have no conflict of interest to disclose.

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Correction to: Adults' Stress Response to Unexpected Oral and Arithmetic Tasks in Supine Position

Styliani Geronikolou, Ioannis Koutelekos, George Lambrou, Anna Tagka, Dennis Cokkinos, and George P. Chrousos

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In the original version of this chapter, the name of the Author "Dennis Kokkinos" was printed incorrectly. The author's name has now been updated to "Dennis Cokkinos" in this revised version of the chapter.

The updated version of this chapter can be found at
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