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ORIGINAL ARTICLE

The relationship between disease activity, quality of life, and personality types in rheumatoid arthritis and ankylosing spondylitis patients

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Abstract We hypothesized that clinical outcomes might be influenced by personality type (A, B, C, D) in rheumatoid arthritis (RA) and ankylosing spondylitis (AS). One hundred ninety-four patients (104 with RA, 90 with AS) participated in a questionnaire study. We evaluated health-related quality of life (HRQoL) using the Medical Outcome Study Short-Form 36 (SF-36), personality type A/B with the Jenkins Activity Survey, type C with the State-Trait Anger Expression Inventory Anger-in Scale, type D with the Type D Personality Scale, and disease activity with Disease Activity Score with 28 joints for RA and Bath Ankylosing Spondylitis Disease Activity Index for AS. We used Pearson's correlation coefficient, independent samples *t* tests, and multivariate analyses of variance. In the RA group, type D personality was significantly correlated with 7/12 SF-36 components. AS patients with type D personality had deficits in all SF-36 subscales. Type D was related with higher disease activity in RA and AS. Both RA and AS type C patients had more active disease forms and negatively affected HRQoL subscales. In the RA group, type A personality did not correlate with HRQoL, but it positively influenced pain visual analog scale scores. In AS patients, type A personality was linked with higher HRQoL and with less active disease. Type C and type D personality types were correlated with decreased HRQoL and higher disease activity in RA and AS patients. Type A personality was associated with less active disease and higher HRQoL in AS patients and with less pain in RA patients.

Keywords Ankylosing spondylitis · Disease activity · Health-related quality of life · Personality type · Rheumatoid arthritis

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Introduction

Particularities of disease activity assessment in rheumatic conditions

In most rheumatic conditions, disease activity or therapeutic outcome cannot be measured using a single standardized variable, thus the need to rely on multiple information sources, such as physical examination, blood tests or imaging. Patients' subjective assessments are increasingly included in the characterization of disease activity. Patients and doctors perceive disease activity differently, the former emphasizing complaints, and the latter objective evidence [1]. The approach becomes more complicated with diseases that exhibit a high degree of polymorphism, such as rheumatoid arthritis (RA) and ankylosing spondylitis (AS).

In line with modern ideas on how to approach rheumatic diseases (e.g. the Patient-Reported Outcomes Measurement Information System, PROMIS, initiative) [2], it is acknowledged that the evaluation of disease activity has an important subjective component (the patient's complaints). As such, studies have emerged regarding the potential influence of personality types in the evolution of these diseases [3].

Personality types and somatic diseases

The concept of personality types (classified as personality types A, B, C, and D, as detailed in "*Personality types and rheumatic diseases*" section) is used in Medical psychology as a predictor for somatic diseases [4]. Two of the most important causes of death in modern society, coronary artery disease [5] and cancer [6], are the conditions most commonly studied regarding the significance of personality in their pathogenesis. An important reasoning behind this type of research is that traditional risk factors do not always explain the appearance of the disease.

Personality types and rheumatic diseases

A few clear links have already been established between personality components, health-related quality of life (HRQoL), and disease activity in patients with rheumatic diseases. Optimism has globally beneficial effects, and negative affectivity leads to discontent regarding health status [7], and is correlated with symptoms of anxiety and depression, proven to negatively affect HRQoL [8].

Personality type D ("distressed") characterizes individuals with predominantly negative emotions (e.g., anxiety, depression, hostility, anger) that they tend to repress for fear of rejection, making them socially inhibited [9]. Because this personality type was shown to be related to decreases in HRQoL [10], it was also studied in correlation with RA [3]. The influence of psychological parameters on immunity has been proven for components of other personality types as well. Stress is very well studied in this regard, as it is shown to have a multitude of immunologically mediated effects in rheumatic diseases [11]. Personality type A, unlike personality type B (also known as non-A personality type), amplifies stress responses. These individuals are the overachievers, described as competitive, stressed, hostile, and aggressive; they have higher cortisol, adrenaline, CRP, and fibrinogen levels [12]. Neuroticism and introversion, seen in personality type C, inhibit the hypothalamic-pituitary-adrenal response and the NK cells activity [13]. Worrying about avoiding dangerous situations, together with a lack of initiative (also seen in personality type C) relate with higher cortisol secretion [14].

Aim

There are very few studies evaluating the relationship between personality types, HRQoL, and disease activity for RA and AS, this being the aim of our study.

Materials and methods

Study description

Our study was a cross-sectional, multicentric study that included a total of 194 consecutive patients from tertiary units, of which 104 were RA patients and 90 were AS patients (Table 1). We investigated sociodemographic factors, personality types, disease activity, and HRQoL. Every patient included in the study completed an individual questionnaire, containing a sociodemographic component, a HRQoL questionnaire (Medical Outcome Study Short-Form 36 [SF-36v2]), three personality type tests (Jenkins Activity Survey [JAS-13] for personality type A/B; Anger-in Scale [AIS] of the State-Trait Anger Expression Inventory [STAXI] for personality type C; Type D Personality Scale [DS-14] for personality type D), and one disease activity evaluation (Disease Activity Score with 28 Joints [DAS28] for RA, or Bath Ankylosing Spondylitis Disease Activity Index [BASDAI] for AS).

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all patients for being included in the study.

Measuring HRQoL

Short Form 36 (SF-36) health survey questionnaire is a widely used generic instrument used to evaluate HRQoL [15]. It has 8 individual dimensions, divided in physical and psychological areas: functional status (physical functioning—PF, social functioning—SF, role limitations physical problems—RP, role limitations emotional problems—RE), wellbeing (mental health—MH, vitality—VT, bodily pain—BP), and overall evaluation of health, general health perception—GH. The scores of these subscales can be combined to form two generic concepts: physical component summary—PCS (PF, RP, BP, and GH) and mental component summary—MCS (MH, VT, SF, and RE), which have been shown to positively correlate with HRQoL. Values are obtained using a complex calculation, representing percentages between 0 (worst health) to 100 (best health). The items used in SF-36 include not only subjective and objective answers, but also patients' self-evaluations of general global health. SF-36 was proven to be a valid and trustworthy scale in RA [16] and AS [17], being well correlated with Health Assessment Questionnaire (HAQ) [18] or specific tests like Arthritis Impact Measurement Scale (AIMS) [19] for RA and Ankylosing Spondylitis Quality of Life Scale (ASQoL) [20] for AS. It accurately reflects the therapeutic impact, thus distinguishing treatments with significant functional benefits [21]. The questionnaire is internally consistent, reliable, and valid [22].

Table 1 Demographic characteristics

		RA (N = 104)	AS (N = 90)
Gender	Female	N = 96	N = 22
	Male	N = 8	N = 68
Age		M = 59 ± 12.5 (26–80)	M = 43.6 ± 12.1 (24–70)
Alcohol consumption		N = 30 (28.8%)	N = 55 (61.1%)
Years of formal education	<1	N = 2 (1.9%)	N = 0
	1–4	N = 6 (5.8%)	N = 0
	4–8	N = 19 (18.3%)	N = 8 (8.9%)
	8–12	N = 42 (40.4%)	N = 43 (47.8%)
	>12	N = 34 (32.7%)	N = 39 (43.4%)
Employment	Retired because of old age	N = 49 (47.1%)	N = 9 (10%)
	Retired because of disability	N = 37 (35.6%)	N = 33 (36.7%)
	Full-time	N = 10 (9.6%)	N = 37 (41.1%)
	Part-time	N = 2 (1.9%)	N = 2 (2.2%)
	Unemployed	N = 1 (1%)	N = 6 (6.7%)
	Other	N = 3 (3.9%)	N = 1 (1.1%)
Disease duration		M = 12.8 ± 8.5 (0–38)	M = 12.7 ± 10.1 (0–41)

AS ankylosing spondylitis, *M* mean ± standard deviation (min-max), *N* number of patients, *RA* rheumatoid arthritis

Determining personality types

Personality type A

Jenkins questionnaire is a self-evaluating method of the personality type, discriminating between personality type A and non-A (personality type B). The 52-item version has multiple-choice questions, comprising four scales: global type A scale—21 items, speed and impatience scale—21 items, job involvement scale—24 items, and hard-driving and competitiveness scale—20 items. Because of practical reasons concerning the cost-efficiency balance, shorter versions have been created, offering an easily comparable structure of personality type A and B, sometimes preferred even in instances where completion time is not relevant [23]. In the current study, the 13-item form was used (JAS-13). Patients were considered to be type A or B considering the maximal possible score obtainable in JAS-13. The limit for regarding an individual as type A or B (non-A) was chosen considering either 50% of the maximal possible score (personality-type-A-50 being over 50% and personality-type-B-50 under 50%), or with a more restrictive scoring, personality-type-A-68 being over 68% of the maximal possible score (+1 standard deviation – SD), and personality-type-B-16 under the 16% limit (−1 SD).

Personality type C

State-Trait Anger Expression Inventory (STAXI) is an instrument with 4 items, conceived to quantify anger as an emotional response (state) and a predisposing quality (trait). STAXI contains three scales meant to measure three different dimensions of anger: repressed anger (anger-in), expressed anger (anger out) and controlled anger (anger control) [24]. Relevant for personality type C is the anger-in scale, containing 8 items, each with 4 choices on a Likert scale (1–4). Patients were classified as type C by two methods, as described before for personality type A: personality-type-C-50 and personality-type-C-68 (+1 SD).

Personality type D

Type D Personality Scale (DS14) was especially created to identify negative affectivity (NA, 7 items), social inhibition (SI, 7 items), and personality type D in a standardized, trustworthy fashion [25]. NA evaluates the tendency to experiment dysphoria, anxiety, and irritability. SI is concerned with discomfort in social interactions, lack of social stability, and the tendency to avoid confrontations within social interactions. Subjects describe their personality by answering the 14 questions using a Likert scale with 5 points (0–4). DS-14 is a valid, sensitive, and specific questionnaire [25]. An individual is considered to be type D if NA ≥ 10 and SI ≥ 10.

Measuring disease activity

Rheumatoid arthritis

Disease activity score with 28 joints (DAS28) used in RA is a reliable and valid instrument [26], being very useful not only

in the clinical practice, but also in research. It includes 4 variables: number of painful joints, number of swollen joints, patient global evaluation of the disease activity, and biological inflammatory markers (erythrocyte sedimentation rate used in the current study) [27]. The calculation formula is complex, the results being presented as values between 0 and 10 (<2.6 = remission, 2.6–3.2 = mild disease, 3.3–5.1 = moderate disease, >5.1 = severe disease).

Ankylosing spondylitis

Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) is a questionnaire developed by a multidisciplinary team, including patients, as a new approach in defining disease activity for AS patients. It has 6 questions representing visual analog scales of 10 cm (0—absent, 10—very severe) measuring fatigue, spinal and joint pain, areas of localized tenderness, and morning stiffness (qualitatively and quantitatively), noticed within the previous week. The BASDAI final score varies between 0 and 10, with smaller values indicating decreased disease activity. It is a rapid and simple instrument, reliable and sensitive in detecting treatment-related changes [28].

Statistical analyses

The descriptive statistics comprised parameters with continuous Gaussian distribution, expressed as averages ± SD, while discontinuous parameters as numbers or percent. The Pearson correlation coefficient was used to analyze correlations for normally distributed variables. Differences between the two groups were evaluated for statistical significance using the independent samples *t* test, a test that compares the mean values for each of the studied groups. We also reported Cohen's *d* to measure the effect size (.8 = large, .5 = moderate, .2 = small). Multivariate analyses of variance (MANOVA) were performed, with each analysis of variance (ANOVA) evaluated at an alpha level of .025. The statistical significance threshold was 95%, $p < .05$. The statistical software used was *SPSS 20 (IBM Corporation, USA).*

Results

Patients

Of the 194 patients included in the study (Table 1), 104 were diagnosed with RA (96 women, 8 men, consistent with epidemiological data, RA being more frequent in women) [29], and 90 with AS (22 women, 68 men, in accordance with the prevalence reported in recent studies) [30]. The mean age was 51.9 ± 14.5 years, with differences between the two groups: in RA patients it was 59 ± 12.5 years old, and in AS patients it was 43.6 ± 12.1 years old. The age distributions are according to specialty literature data: RA is a condition whose incidence increases with age [31] (in our groups, the maximal prevalence was in the 5th and 6th decades), and AS is found more often in young adults [32] (in our groups, maximal prevalence was in the 3rd and 4th decades). Regarding alcohol consumption, the RA group reported lower drinking levels (30 patients, 28.8%) than AS patients (55 patients, 61.1%). Most patients had between 8 and 12 years of formal education (85 patients, 43.8%), but there were also some with higher education (73 patients, 37.6%), with 4–8 years of formal education (27 patients, 13.9%), with 1–4 years of formal education (6 patients, 3.1%), and some without any formal education (2 patients, 1%). The majority of patients were retired (67%), either because of old age (58 patients, 29.9%), or because of their disabilities (70 patients, 36.1%). Others were full-time employees (47 patients, 24.2%), part-time employees (4 patients, 2.1%), students (2 patients, 1%), unemployed (9 patients, 4.6%), or in other situations (1 patient, .5%). The mean disease duration was 12.7 years, a value similar within the two disease groups. Most of the patients were diagnosed less than 10 years prior (91 patients), very little baring the diseases for more than 30 years (10 patients).

Personality types

Personality types A and B were evaluated using the JAS-13 score, with 2 types of thresholds, as explained in "Personality type A" section (personality-type-A-50, personality-type-B-50 and personality-type-A-68, personality-type-B-16, respectively). In the analyzed patient groups, 71 were identified with personality-type-A-68 (36.6%), 29 with personality-type-B-16 (14.9%), and 131 personality-type-A-50 (67.5%), 62 with personality-type-B-50 (32%), respectively. Similar to personality types A and B, personality type C was evaluated using two thresholds, personality-type-C-50—14 patients, 7.2%; personality-type-C-68—7 patients, 3.6%. Personality type D was identified in 65 patients (33.5%), with NA median = 12 ± 7.53 (min = 0, max = 36), and SI median = 7 ± 6.02 (min 0, max 24).

Disease activity

The RA patients from the studied group had a mean DAS28 value of 3.52 ($M = 3.38 \pm 1.31$, min = 1.4, max = 7.24), with 27 patients in remission (26%), 20 with mild disease types (19%), 39 with moderate disease activity (38%), and 18 with severe disease activity (17%). AS patients had mean BASDAI values of 4.51 ($M = 4.6 \pm 2.68$, min = 0, max = 9.3), with 43 having decreased disease activity (47.8%) and 47 high disease activity (52.2%).

RA patients

Personality type C

The statistical analyses performed within the RA group showed that personality type C patients had most of the HRQoL components negatively affected, with lower HRQoL than those without this personality type (negative independent samples *t* test values, Table 2). This was supported by Pearson's correlation, revealing that the AIS scores were inversely proportional with the scores for some of the HRQoL components. When MANOVA was performed, a significant difference between the type C personality group and the non-C group was found when considered jointly on PCS and MCS, Wilk's $\Lambda = .839$, $F(2,99) = 9.5$, $p = .000$, partial $\eta^2 = .16$. On a separate ANOVA conducted for each dependent variable, MCS scores were significantly different, $F(1100) = 19.1$, $p = .000$, partial $\eta^2 = .16$, type C individuals ($M = 27.3$) scored lower than non-C ($M = 45.2$). Running *t* test for DAS28 identified that personality type C patients had higher disease activity than non-C.

Personality type D

The same patterns of correlation were identified within personality type D RA patients, which had most of their HRQoL components negatively affected when compared to those without this personality type. Pearson's correlations supported the *t* test results by identifying an inversely proportional relationship between NA, SI, and HRQoL (Table 3). There was a significant difference between individuals exhibiting personality type D and those non-D when considered jointly on PCS and MCS, Wilk's $\Lambda = .875$, $F(2100) = 7.13$, $p = .001$, partial $\eta^2 = .13$. The difference on MCS scores was statistically relevant, $F(1101) = 13$, $p = .000$, partial $\eta^2 = .11$. Type D individuals ($M = 37$) scored lower than non-D ($M = 46.5$), as found on a separate ANOVA conducted for each dependent variable. Furthermore, personality type D patients had higher disease activity levels than non-D patients, as interpreted from the positive Pearson's correlations (direct relationship between NA and HRQoL, and SI and HRQoL respectively), as well as from positive *t* tests (personality type D patients have higher DAS28 values).

Personality type A

RA patients with personality type A had significant correlations only with pain. The BP HRQoL component was smaller in these patients than in personality type B ones. This correlation was statistically significant only with *t* test (negative value), not with Pearson's test.

AS patients

Personality type C

Within the AS group, personality type C patients had smaller HRQoL values, as could be noticed with *t* testing. Furthermore, Pearson's correlations were found with all HRQoL components, indicating an inversely proportional relationship with AIS scores. There was a significant difference between individuals exhibiting personality type C and those non-C when considered jointly on PCS and MCS, Wilk's $\Lambda = .908$, $F(2,83) = 4.18$, $p = .019$, partial $\eta^2 = .09$. There

Table 2 Health-related quality of life and disease activity in personality type C patients

	Independent *t* test		Cohen's *d*		Pearson's correlation	
	RA	AS	RA	AS	RA	AS
PF	–	–		–	–	$r = -.25$
RP	$t(88.43) = -5.11$	–	$d = -.88$	–	–	$r = -.30$
BP	–	$t(85) = -2.09$	–	$d = -.78$	–	$r = -.25$
GH	$t(35.3) = -2.31$	$t(85) = -2.33$	$d = -.50$	$d = -.98$	–	$r = -.45$
VT	$t(100) = -3.23$	$t(84) = -2.50$	$d = -.94$	$d = -1.05$	$r = -.32$	$r = -.46$
SF	$t(100) = -2.07$	–	$d = -.54$	–	–	$r = -.28$
RE	$t(49.86) = -6.05$	$t(84) = -2.46$	$d = -1.20$	$d = -.97$	$r = -.40$	$r = -.31$
MH	$t(100) = -5.45$	$t(84) = -2.73$	$d = -.48$	$d = -1.21$	$r = -.58$	$r = -.49$
PCS		–		–		$r = -.26$
MCS	$t(100) = -4.89$	$t(84) = -2.61$	$d = -1.37$	$d = -1.10$	$r = -.52$	$r = -.42$
BASDAI	–	–	–	–	–	$r = .33$
DAS28	$t(98) = 2.01$	–	$d = .44$	–	–	–

AS ankylosing spondylitis, *BASDAI* Bath Ankylosing Spondylitis Disease Activity Index, *BP* bodily pain, *DAS28* disease activity score with 28 joints, *GH* general health perception, *MCS* mental component summary, *MH* mental health, *PCS* physical component summary, *PF* physical functioning, *RA* rheumatoid arthritis, *RE* role limitations due to emotional problems, *RP* role limitations due to physical problems, *SF* social functioning, *VT* vitality

Table 3 Health-related quality of life and disease activity in personality type D patients

	Independent *t* test		Cohen's *d*		Pearson's correlation			
					NA		SI	
	RA	AS	RA	AS	RA	AS	RA	AS
PF	–	$t(85) = -1.98$	–	$d = -.45$	–	$r = -.41$	–	–
RP	$t(87.42) = -2.26$	$t(68.45) = -2.83$	$d = -.45$	$d = -.62$	$r = -.25$	$r = -.38$	$r = -.25$	–
BP	–	$t(85) = -2.22$	–	$d = -.51$	$r = -.28$	$r = -.39$	$r = -.21$	–
GH	–	$t(85) = -3.57$	–	$d = -.82$	$r = -.29$	$r = -.57$	$r = -.20$	$r = -.32$
VT	$t(101) = -2.64$	$t(84) = -3.89$	$d = -.45$	$d = -.92$	$r = -.37$	$r = -.61$	$r = -.38$	$r = -.35$
SF	–	$t(85) = -2.89$	–	$d = -.64$	$r = -.21$	$r = -.47$	–	–
RE	$t(76.24) = -2.62$	$t(49.77) = -4.20$	$d = -.53$	$d = -.97$	$r = -.42$	$r = -.49$	$r = -.29$	$r = -.31$
MH	$t(101) = -4.69$	$t(84) = -5.51$	$d = -.95$	$d = -1.23$	$r = -.63$	$r = -.67$	$r = -.46$	$r = -.47$
PCS	–	–	–	–	–	$r = -.35$	–	–
MCS	$t(101) = -3.60$	$t(84) = -5.20$	$d = -.74$	$d = -1.16$	$r = -.55$	$r = -.61$	$r = -.38$	$r = -.39$
BASDAI	–	$t(84) = 2.42$	–	$d = .56$	–	$r = .40$	–	$r = .22$
DAS28	$t(35.92) = 2.03$	–	$d = .48$	–	$r = .21$		$r = .27$	–

AS ankylosing spondylitis, *BASDAI* Bath Ankylosing Spondylitis Disease Activity Index, *BP* bodily pain, *DAS28* disease activity score with 28 joints, *GH* general health perception, *MCS* mental component summary, *MH* mental health, *NA* negative affectivity, *PCS* physical component summary, *PF* physical functioning, *RA* rheumatoid arthritis, *RE* role limitations due to emotional problems, *RP* role limitations due to physical problems, *SF* social functioning, *SI* social inhibition, *VT* vitality

was a significant difference between personality type C and non-C individuals on MCS scores on a separate ANOVA conducted for each dependent variable, $F(1,84) = 6.84$, $p = .011$, partial $\eta^2 = .07$. Type C individuals ($M = 36$) scored lower than non-C ($M = 48.73$). Regarding disease activity, the higher AIS scores are associated with more active disease forms.

Personality type D

The same negative tendency was found in personality type D AS patients, with generally low values of all HRQoL components (negative t test values). In accordance with *t* test values, Pearson's coefficients statistically significantly correlated NA with all HRQoL scales, while SI correlated with only 5 of the subscales. Both NA and SI increased while HRQoL decreased. The statistical tests were numerically positive regarding disease activity, which were higher in personality type D.

MANOVA results supported the above mentioned correlations. We found significant differences between individuals exhibiting high disease activity and low disease activity when considered jointly on personality types A and C, NA and SI (type D components), Wilk's $\Lambda = .883$, $F(4,82) = 2.72$, $p = .035$, partial $\eta^2 = .12$. A separate ANOVA was conducted for each dependent variable, and there was a significant difference between high disease activity and low disease activity on NA scores, $F(1,85) = 7.17$, $p = .009$, partial $\eta^2 = .08$, with individuals having high disease activity ($M = 12.66$) scoring higher in NA (more type D) than those with low disease activity ($M = 8.5$).

Personality type A

AS patients with personality type A, unlike type C or D, had positive correlations with HRQoL and negative ones with disease activity. Type A patients had better HRQoL scores than type B patients (positive *t* test results) and JAS-13 was directly proportional with HRQoL, but the correlation was weak (~.2 Pearson's coefficient). Type A patients also had decreased disease activity when compared to type B, as could be seen from the negative t test values for BASDAI.

Discussions

This study found statistically significant correlations between seven out of eight subcomponents of SF-36 and personality type D in RA patients, proving that they have lower HRQoL than non-D ones. These patients had reduced functional status (decreased physical and emotional roles, precarious social function), general welfare (bigger pain, lower vitality, worse mental health), and they evaluated their general health as being worse than non-D patients. The correlations were stronger for AS than for RA, as in the first group personality type D was correlated with deficits regarding all SF-36 subcomponents, even with global physical and mental scores.

These results are in accordance with previous studies on subcomponents of type D in RA patients, stating that patients with negative affectivity are more displeased with their health status [7]. Personality type D is an independent predictor for

HRQoL decreases [33], although recent research analyzing subcomponents of it (NA, SI) denied this correlation [34]. The current study could not find statistically significant correlations between NA and SI for each HRQoL component, although in AS patients, NA decreased PF, RP, BP, SF and PCS.

Personality type D was related to higher disease activity both in RA and AS groups. NA and SI correlated with higher DAS28 and BASDAI scores. There is research regarding the relationship between type D and disease activity in AS, reporting similar results [35]. In RA patients, however, we found information stating that disease activity is not significantly different between type D and non-D patients [3]. There is research indirectly supporting our results, suggesting strong correlations between negative emotions, pain, and physical function impairments [36], and also between difficulties in expressing emotions and higher pain levels [37].

The same correlation pattern was found between personality type C, HRQoL, and disease activity in RA and AS. HRQoL was completely affected on all subcomponents and composite SF-36 scores in type C patients with AS. For RA patients, seven out of 12 correlations were present, concerned components being SF, VT, MH, RP and RE, all decreased, as well as GH and MCS. There are too few studies analyzing type C in RA or AS patients, but there is research indirectly supporting our results. Aside from the psychological aspects that personality type C has in common with type D (negative emotions, difficulty in expressing emotions), alexithymia (strongly correlated concept with type C) [38] and anger repression [39] lower HRQoL.

Both RA and AS personality type C patients had higher disease activity, identified by the positive correlations with DAS28 and BASDAI, respectively. These results might be explained by the biological influence of type C on immunity [40], an essential determinant of disease activation in RA and AS.

Within the RA group, personality type A patients did not have significant correlations with HRQoL, but they positively influenced patients' perceptions of pain. In AS patients, this personality type was proven to have more beneficial effects regarding HRQoL, with higher scores in physical components (VT, PF, RP, RE, GH and PCS). Furthermore, patients with AS and personality type A had less active disease forms (lower BASDAI scores).

Although personality type A is characterized by hostility and stress, parameters known to negatively influence the studied variables [39], these patients are physically active, an element which is known to be positive in AS [41]. From the descriptive statistics data regarding the AS group, we notice that most were young patients, many of them with full-time jobs (keeping a job has a positive influence on HRQoL) [42]. Another hypothesis that might explain the beneficial correlations between type A and HRQoL derives from the observation that this personality type is associated with lower disease activity scores (correlation does not imply causality, so we cannot infer whether type A influences disease activity or if it is the other way around). Although we could not find statistically significant links between disease duration or age and personality type A, it is possible that patients who are in early stages of the diseases could be in denial, thus using this coping mechanism to increase their HRQoL [43]. Further studies could be done on the correlation between type A and positive coping mechanisms in RA and AS patients, the latter being proven to be beneficial in rheumatic diseases [42].

The results must be interpreted taking into account the study's limitations, deriving firstly from its cross-sectional nature. Another problem stems from the lack of comorbidity analysis, an example in this regard being the results of SF-36 itself, which evaluates global pain, without discerning between its origins. Furthermore, SF-36 evaluates pain in a certain time range and rheumatic diseases in particular have an undulant evolution—the patient may choose to write the maximum pain levels from the given time range or just an average. Pearson's correlation test does not offer information on the causality of the relationship between the variables. Gender distribution was not uniform among the studied groups, even though it was in accordance with the gender prevalence for both RA and AS.

Our study found associations between personality type C and D with negative effects on more HRQoL components in patients with RA and AS, but also with increased disease activity levels. Personality type A, on the other hand, seemed to be positively correlated with HRQoL and disease activity in AS patients, these correlations not being statistically significant in RA patients. The causality relationship between personality type, disease activity, and HRQoL prompts for further longitudinal studies. The hypothesis that the personality type influences the evolution of rheumatic diseases and the response to therapy, in light of the powerful correlations identified with HRQoL and disease activity in both RA and AS, also brings the need for further studies. It is possible that, relying on immune-mediated mechanisms, the personality type could be one of the risk factors for a worse disease outcome, considering the well-established negative effect that stress has on immunity in patients with rheumatic diseases [11]. On the other hand, there is research stating that personality type, while generally stable over time [44], can change in response to major stressful life events [45]; this has not yet been studied concerning illness in rheumatic diseases.

Conclusions

Our study found that type A personality was associated with less pain in RA patients and with lower disease activity and higher HRQoL in AS patients. In contrast, we found that C and D personality types were strongly correlated with higher

disease activity and with negative effects on multiple aspects of HRQoL in both RA and AS patients. Longitudinal studies are necessary in order to establish the eventual causality of these relationships.

Compliance with ethical standards

Disclosures None.

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