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VISUAL IMPAIRMENT SCREENING AT THE GERIATRIC FRAILTY CLINIC FOR ASSESSMENT OF FRAILTY AND PREVENTION OF DISABILITY AT THE GÉRONTOPÔLE

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Abstract: *Objectives:* To evaluate visual performance and factors associated with abnormal vision in patients screened for frailty at the Geriatric Frailty Clinic (GFC) for Assessment of Frailty and Prevention of Disability at Toulouse University Hospital. *Design:* Retrospective, observational cross-sectional, single-centre study. *Setting:* Institutional practice. *Participants:* Patients were screened for frailty during a single-day hospital stay between October 2011 and October 2014 (n = 1648). *Measurements:* Collected medical records included sociodemographic data (including living environment and educational level), anthropometric data, and clinical data. The general evaluation included the patient's functional status using the Activities of Daily Living (ADL) scale and the Instrumental Activity of Daily Living (IADL) scale, the Mini-Mental State Examination (MMSE) for cognition testing, and the Short Physical Performance Battery (SPPB) for physical performance. We also examined Body Mass Index (BMI), the Mini-Nutritional Assessment (MNA), and the Hearing Handicap Inventory for the Elderly Screening (HHIE-S) tool. The ophthalmologic evaluation included assessing visual acuity using the Snellen decimal chart for distant vision, and the Parinaud chart for near vision. Patients were divided into groups based on normal distant/near vision (NDV and NNV groups) and abnormal distant/near vision (ADV and ANV groups). Abnormal distant or near vision was defined as visual acuity inferior to 20/40 or superior to a Parinaud score of 2, in at least one eye. Associations with frailty-associated factors were evaluated in both groups. *Results:* The mean age of the population was 82.6 ± 6.2 years. The gender distribution was 1,061 females (64.4%) and 587 males (35.6%). According to the Fried criteria, 619 patients (41.1%) were pre-frail and 771 (51.1%) were frail. Distant and near vision data were available for 1425 and 1426 patients, respectively. Distant vision was abnormal for 437 patients (30.7%). Near vision was abnormal for 199 patients (14%). Multiple regression analysis showed that abnormal distant vision as well as abnormal near vision were independently associated with greater age ($P < 0.01$), lower educational level ($P < 0.05$), lower performance on the MMSE ($P < 0.001$), and lower autonomy ($P < 0.02$), after controlling for age, gender, educational level, Fried criteria, and MMSE score. *Conclusion:* The high prevalence of visual disorders observed in the study population and their association with lower autonomy and cognitive impairment emphasises the need for systematic screening of visual impairments in the elderly. Frailty was not found to be independently associated with abnormal vision.

Key words: Frailty, elderly, vision, visual impairment.

Introduction

Frailty is usually defined as a clinical geriatric syndrome characterised by increased "latent vulnerability" resulting from the reduction of physiological reserves and the decreased capacity to cope with exogenous as well as endogenous stressors (1-3). Fried et al. (2) defined frailty as meeting three of the following five criteria: sedentariness or low physical activity, involuntary weight loss, self-reported exhaustion, poor muscle strength, and slow gait speed. Pre-frailty is the term used when two of these criteria are met. Frailty is usually considered a non-definitive state that is amenable to preventive interventions. However, this condition is associated with an increased risk of hospitalisation (2), falls (2, 4), loss of autonomy, institutionalisation (5), cardio-vascular disease (6), and death (2, 5, 7, 8).

According to the United Nations (9), the global population will include approximately 2 billion people older than 60 by 2050. When also taking rising life expectancies into account, the primary public health challenge due to population aging will be to maintain physiological abilities as long as possible to delay the shift from frailty to dependency. Currently, it is estimated that frailty affects approximately one-quarter to one-half of people greater than 85 years old (2, 7). Thus, early and

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reliable screening to identify those in a pre-disabled or frail state is critical to delay or even prevent adverse outcomes and dependency, as well as the resulting costs of care.

In France, Lafuma et al. (10) estimated the prevalence of visual impairment to be approximately 5.9%, 14.1% and 23.1% among those ranging in age from 70–79 years, 80–89 years, and 90–99 years, respectively. In western European countries, the most frequent causes of visual impairment among the elderly are age-related macular degeneration, uncorrected refractive errors (11), cataract, and glaucoma (12).

In general, even a moderate visual impairment has been shown to be a risk factor for injurious accidents, disability, and falling, as well as depression and anxiety (13-17). Visual impairment is one of the main deficiencies leading to activity limitations (18). From a socioeconomic viewpoint, the number of visually impaired persons in France was estimated at 1.27 million in 2006, which amounted to an annual total cost of €10,749 million in non-medical expenses (approximately $12,089 million) (19). This cost may increase in the future. Thus, in the light of previous arguments, frailty detection programs should include strategies to identify visual impairment.

The aim of the present study was to evaluate visual performance and factors associated with abnormal vision in patients screened for frailty among the first 1,648 patients evaluated during the first three years of operation of the Geriatric Frailty Clinic (GFC) for Assessment of Frailty and Prevention of Disability (Centre Hospitalier Universitaire (CHU) de Toulouse, Toulouse, France).

Material and methods

Patients

In this retrospective, observational cross-sectional, single-centre study, we reviewed the medical records of all patients who underwent medical evaluation at the GFC (CHU de Toulouse, Toulouse, France) between its opening date in October 2011 and October 2014.

The GFC is a geriatric day hospital unit of the Gérontopôle of Toulouse, France (20). In a previous paper, Tavassoli et al. (21) described the structure and organisation of the GFC and also reported the main characteristics of the first 1,108 patients evaluated during the initial two years of operation. Each patient, referred by his/her family physician, benefits from a medical assessment (21). The GFC evaluation is then followed by personalised treatment and follow-up with physicians.

Medical evaluation

Collected medical records included sociodemographic data (including living environment and educational level), anthropometric data, and clinical data (medical and surgical history, current treatments, and allergies). Pre-frailty and frailty were defined as meeting two or three of the five Fried criteria (2), respectively, as described in the Introduction.

The assessment also included the administration of several questionnaires/scales to objectively evaluate specific patient capacities (21). These include the patient's degree of disability using the basic Activities of Daily Living (ADL) scale (22) and the Instrumental Activities of Daily Living (IADL) scale (23), the Mini-Mental State Examination (MMSE) for cognition testing (24), and the Short Physical Performance Battery (SPPB) for testing physical function (25). The assessment also included the Body Mass Index (BMI) (26), the Mini Nutritional Assessment (MNA) (27), and the Hearing Handicap Inventory for the Elderly Screening (HHIE-S) tool (28).

Ophthalmologic evaluation

Ophthalmologic assessments included: visual acuity (VA) measurement and Amsler grid testing. VA was assessed using the Snellen decimal chart for distant vision, and the Parinaud chart for near vision. Presenting VA with patients' daily optic correction was evaluated, whereas best-corrected VA was not evaluated. Ophthalmologic assessments were conducted by a nurse who received specialised training. Distant vision was considered normal when distant VA was ≥ 20/40 in both eyes, and abnormal when distant VA was < 20/40 in at least one eye. A patient was considered to have low vision when VA in the better eye < 20/60. Mild vision loss was defined as VA < 20/40, but ≥ 20/60. Near vision was considered normal when near VA was equal to Parinaud 2, and abnormal when near VA was worse than Parinaud 2 in at least one eye. Amsler grid testing was considered abnormal when patients described scotoma and/or metamorphopsia.

Analysis

Distant and near vision were analysed separately. For each type of vision (distant vision, DV; near vision, NV), we divided the study population into two groups: those with normal distant vision (NDV) and normal near vision (NNV), and those with abnormal distant vision (ADV) and abnormal near vision (ANV).

Statistical methods

Distributions of Gaussian variables are presented as the means ± standard deviation (SD). Categorical variables were expressed as counts (n) and percentages (%). The $\chi 2$-test and t-test were used to examine differences in covariates. A stepwise backward logistic regression was used to identify factors associated with abnormal vision. Two separate models were performed for distant or near vision as the dependent variable, while systematically controlling for age, sex, and Fried criteria. For other covariates, an entry criterion of $P < 0.20$ (based on univariate Cox analyses) and a removal criterion of $P > 0.05$ were used for adjustment in the models. All tests were two-sided and were considered statistically significant at $P < 0.05$. Analyses were performed using STATA® software package (StataCorp LP, College station, TX, USA), version 11.

Table 1
Main clinical characteristics of patients screened for frailty at the Geriatric Frailty Clinic for Assessment of Frailty and Prevention of Disability

Age (mean ± SD)	82.6 ± 6.2 years
Gender (female), n (%)	1,061 (64.4)
Educational level	
No education, n (%)	60 (4.0)
Primary school, n (%)	573 (38.3)
Middle school, n (%)	327 (21.9)
High school, n (%)	228 (15.2)
University, n (%)	307 (20.5)
Living alone, n (%)	653 (43.0)
Autonomy	
ADL	
Mean ± SD	5.5 ± 0.9
≥ 5.5 (autonomous), n (%)	1165 (75.9)
IADL	
Mean ± SD	5.6 ± 2.4
>7 (completely autonomous), n (%)	486 (32.0)
MMSE (mean ± SD)	24.9 ± 4.7
Fried score	
Robust, n (%)	118 (7.8)
Pre-frailty (1–2 criteria), n (%)	619 (41.1)
Frailty (≥ 3 criteria), n (%)	771 (51.1)
SPPB class	
Highest performance (≥ 10), n (%)	427 (28.5)
Medium performance (7–10), n (%)	516 (34.5)
Lowest performance (≤ 6), n (%)	554 (37.0)
Nutritional status	
MNA	
Undernourished (< 17), n (%)	82 (5.5)
At risk of malnutrition (17–24), n (%)	550 (37.1)
Normal (≥ 24), n (%)	852 (57.4)
Sensorial status	
Hearing impairment (mild to moderate HHIE-S score), n (%)	652 (43.5)
Abnormal near vision (Parinaud > 2), n (%)	199 (14.0)
Distant vision†	
Normal (score = 1, both eyes ≥ 20/40), n (%)	988 (69.3)
Unilateral low vision (score = 2, worse eye < 20/60), n (%)	129 (9.1)
Mild vision loss (score = 3, better eye < 20/40), n (%)	215 (15.1)
Bilateral low vision (score = 4, better eye < 20/60), n (%)	93 (6.5)
Amsler grid testing, abnormal, n (%)	246 (16.1)

SD, standard deviation; ADL, Activities of Daily Living; IADL, Instrumental Activities of Daily Living; MMSE, Mini Mental State Examination; SPPB, Short Physical Performance Battery; MNA, Mini Nutritional Assessment; HHIE-S, Hearing Handicap Inventory for the Elderly Screening. †Distant vision assessed using a Snellen decimal chart

Results

Patient characteristics

From October 2011 to October 2014, 1,648 patients were screened. The main clinical characteristics of these patients are reported in Table 1. The mean age of the population was 82.6 ± 6.2 years. The gender distribution was 1,061 females (64.4%) and 587 males (35.6%). According to the Fried criteria, 619 patients (41.1%) were pre-frail and 771 (51.1%) were frail. Distant vision was normal for 988 patients (69.3%). Amsler grid testing was abnormal for 246 patients (16.1%).

Patient characteristics according to distant vision status

Distant vision data were available for 1,425 patients, of which 988 patients (69.3%) had normal distant vision, whereas 437 (30.7%) had abnormal vision. Among the 437 patients in the ADV group, 129 patients (9.1%) had unilateral low vision, 215 (15.1%) had mild vision loss, and 93 (6.5%) had bilateral low vision (Table 1). The mean age in the ADV group (83.4 ± 5.9 years) was significantly higher than in the NDV group (80.3 ± 6.4 years; $P < 0.001$) (Table 2). Compared to patients in the NDV group, those in the ADV group presented with a lower educational level ($P < 0.001$), a lesser degree of autonomy ($P < 0.001$), greater cognitive impairment ($P < 0.001$), a greater degree of frailty ($P < 0.001$), and showed poorer physical performance ($P < 0.001$). The ADV group also showed poorer nutrition overall ($P < 0.001$) and presented more frequently with abnormal near vision ($P < 0.001$) and abnormal Amsler grid scores ($P < 0.001$).

Patient characteristics according to near vision status

Near vision data were available for 1,426 patients, of which 1,227 (86%) had normal near vision, whereas 199 (14%) patients had abnormal near vision. The mean age in the ANV group (84.4 ± 5.7 years) was significantly higher than in the NNV group (82.1 ± 6.2 years; $P <0.001$) (Table 3). Compared to patients in the NNV group, ANV patients presented with lower educational level ($P < 0.001$), a lesser degree of autonomy ($P < 0.001$), greater cognitive impairment ($P < 0.001$), a greater degree of frailty ($P < 0.001$), and showed poorer physical performance ($P < 0.001$). The ANV group patients were also more undernourished ($P < 0.001$), and more frequently presented with abnormal distant vision ($P < 0.001$) and abnormal Amsler grid test scores ($P < 0.001$) compared to patients in the NNV group (Table 3). These results were similar to the analysis for distant vision status.

Multivariate analysis focusing on distant vision

Multiple regression analysis showed that abnormal distant vision was independently associated with greater age ($P < 0.001$), lower educational level ($P = 0.044$), poorer performance on the MMSE ($P < 0.001$), and a lesser degree of autonomy ($P = 0.018$), after controlling for age, gender, educational level, Fried criteria, and MMSE score (Table 4).

Table 2
Patient characteristics according to distant vision status

	Distant vision Mean ± SD1 or n (%)		
	Normal (n = 988; 69.3%)	**Abnormal (n = 437; 30.7%)**	**P**
Age (mean ± SD)	80.3 ± 6.4	83.4 ± 5.9	<0.001
Gender (female), n (%)	639 (64.7)	292 (66.8)	0.433
Living alone, n (%)	417 (42.7)	196 (45.3)	0.367
Educational level			<0.001
No education, n (%)	29 (3.0)	22 (5.2)	
Primary school, n (%)	352 (36.5)	180 (43.0)	
Middle school, n (%)	202 (20.9)	102 (24.3)	
High school, n (%)	155 (16.1)	57 (13.6)	
University, n (%)	227 (23.5)	58 (13.8)	
ADL ≥ 5.5 (autonomous), n (%)	802 (81.2)	288 (65.9)	<0.001
IADL > 7 (autonomous), n (%)	360 (36.5)	93 (21.7)	<0.001
MMSE (mean ± SD1)	26.4 ± 0.3	24.5 ± 4.8	<0.001
Fried score			<0.001
Robust, n (%)	86 (8.8)	24 (5.6)	
Pre-frailty (1–2 criteria), n (%)	436 (44.7)	148 (34.7)	
Frailty (≥3 criteria), n (%)	454 (46.5)	254 (59.6)	
SPPB class			<0.001
Highest performance (≥ 10), n (%)	304 (31.4)	91 (21.5)	
Medium performance (7–10), n (%)	357 (36.9)	129 (30.4)	
Lowest performance (≤ 6), n (%)	307 (31.7)	204 (48.1)	
MNA			
Undernourished (< 17), n (%)	42 (4.4)	28 (6.6)	<0.001
At risk of malnutrition (17–24), n (%)	315 (33.0)	194 (45.9)	
Normal (≥ 24), n (%)	599 (62.4)	201 (47.5)	
Hearing impairment (mild to moderate HHIE-S score), n (%)	407 (42.1)	196 (46.1)	0.158
Near vision abnormal, n (%)	66 (7.0)	105 (27.9)	<0.001
Amsler grid testing abnormal, n (%)	101 (10.3)	118 (27.6)	<0.001

SD, standard deviation; ADL, Activities of Daily Living; IADL, Instrumental Activities of Daily Living; MMSE, Mini Mental State Examination; SPPB, Short Physical Performance Battery; MNA, Mini Nutritional Assessment; HHIE-S, Hearing Handicap Inventory for the Elderly Screening

Multivariate analysis focusing on near vision

Multiple regression analysis showed that abnormal near vision was independently associated with greater age (P = 0.007), lower educational level (P < 0.001), lower performance on the MMSE (P < 0.001), and a lower degree of autonomy (P = 0.016), after controlling for age, gender, educational level, Fried criteria, and MMSE score (Table 5).

Discussion

During the last decade, gerontological research has focused on more precisely defining the clinical and physiological characteristics of the vulnerable state corresponding to frailty (1-3, 29). Frailty currently affects approximately 25 to 50% of the population greater than 85 years old (2, 7), and frailty risks include a number of medical and social complications that may lead to death (2, 5, 7, 8).

Early preventive measures are needed to moderate or attenuate this functional decline, and to prevent frail patients from experiencing more serious disabilities or even dependency, and the adverse events associated with these states. These preventive measures include first identifying the population at risk (i.e. pre-frail and frail populations), and secondly establishing effective interventions in collaboration

Table 3
Patient characteristics according to near vision status

		Near vision Mean ± SD1 or n (%)		
		Normal (n = 1227; 86%)	**Abnormal (n = 199; 14%)**	**P**
Age (mean ± SD)		82.1 ± 6.2	84.4 ± 5.7	<0.001
Gender (female), n (%)		788 (64.2)	132 (66.3)	0.56
Living alone, n (%)		519 (42.3)	88 (45.1)	0.54
Educational level				
	No education, n (%)	32 (2.7)	23 (11.9)	<0.001
	Primary school, n (%)	428 (35.8)	89 (45.9)	
	Middle school, n (%)	277 (23.1)	39 (20.1)	
	High school, n (%)	188 (15.7)	25 (12.3)	
	University, n (%)	272 (22.7)	18 (9.3)	
ADL ≥ 5.5 (autonomous), n (%)		969 (79.0)	121 (61.4)	<0.001
IADL > 7 (autonomous), n (%)		428 (35.2)	35 (17.8)	<0.001
MMSE (mean ± SD1)		25.5 ± 4.2	22.4 ± 6.2	<0.001
Fried score				
Robust, n (%)		375 (31.2)	8 (4.1)	<0.001
Pre-frailty (1–2 criteria), n (%)		424 (35.3)	70 (36.3)	
Frailty (≥3 criteria), n (%)		590 (48.8)	115 (59.6)	
SPPB class				
Highest performance (≥ 10), n (%)		375 (31.2)	32 (16.8)	<0.001
Medium performance (7–10), n (%)		424 (35.3)	63 (33.2)	
Lowest performance (≤ 6), n (%)		403 (33.5)	95 (50.0)	
MNA				
Undernourished (< 17), n (%)		56 (4.6)	14 (8.0)	<0.001
At risk of malnutrition (17–24), n (%)		414 (64.2)	80 (45.4)	
Normal (≥ 24), n (%)		740 (61.2)	82 (46.6	
Hearing impairment (mild to moderate HHIE-S score), n (%)		512 (42.6)	90 (47.1)	0.24
Near vision abnormal, n (%)		271 (23.7)	105 (61.4)	<0.001
Amsler grid testing abnormal, n (%)		157 (12.8)	53 (26.8)	<0.001

SD, standard deviation; ADL, Activities of Daily Living; IADL, Instrumental Activities of Daily Living; MMSE, Mini Mental State Examination; SPPB, Short Physical Performance Battery; MNA, Mini Nutritional Assessment; HHIE-S, Hearing Handicap Inventory for the Elderly Screening

with general practitioners and specialists. These are the two primary goals of the GFC, which was established in October 2011 (20, 21). Patients undergo physical performance evaluation, as well as cognitive, nutritional and sensorial assessments. This global testing battery is used to develop a personal prevention plan adapted to each patient, and allows clinicians to take into account all frailty-related factors (21).

The ophthalmologic assessment at the GFC aims to evaluate patients under conditions as similar as possible to the patients' daily living conditions, and to orientate the patient to his ophthalmologic practitioner if necessary. For this reason, the ophthalmologic examination is not based on best-corrected VA, but rather presenting VA with daily living optical correction. Indeed, using best-corrected VA would have led us to overlook patients with visual impairment due to uncorrected refractive disorders. Moreover, we set the threshold for abnormal vision at a VA of 20/40 based on the Snellen chart, as recommended by Dandona et al (30). This threshold is widely used for assessing fitness for operating a motor vehicle (31), in combination with visual field and contrast sensitivity, and it is also used as a decision threshold for performing cataract surgery (31). Thus, the 20/40 threshold was deemed appropriate to evaluate visual impairment and its relationship with frailty factors.

Table 4
Multivariate analysis: factors associated with abnormal distant vision

	OR	P	95 % CI
Age (≥ 85 years)	2.24	<0.001	1.73–2.89
Gender (female)	0.96	0.734	0.73–1.24
Educational level			
No education	REF		
Primary school	0.70	0.255	0.37–1.30
Middle school	0.82	0.559	0.43–1.58
High school	0.69	0.282	0.34–1.36
University	0.50	0.044	0.25–0.98
Fried score			
Robust	REF		
Pre-frailty (1–2 criteria)	0.99	0.959	0.58–1.67
Frailty (≥ 3 criteria)	1.18	0.531	0.70–2.00
MMSE (score)	0.94	< 0.001	0.92–0.97
ADL (score ≥ 5.5)	0.70	0.018	0.52–0.94

OR, odds ratio; 95% CI, 95% confidence interval; MMSE, Mini Mental State Examination; ADL, Activities of Daily Living

Table 5
Multivariate analysis: factors associated with abnormal near vision

	OR*	P	95 % CI
Age (≥ 85 years)	1.60	0.007	1.14–2.26
Gender (female)	0.95	0.784	0.66–1.36
Educational level			
No education	REF		
Primary school	0.38	0.004	0.20¬–0.73
Middle school	0.30	0.001	0.15–0.61
High school	0.33	0.005	0.15–0.71
University	0.17	<0.001	0.07–0.38
Fried score			
Robust	REF		
Pre-frailty (1–2 criteria)	1.52	0.319	0.67–3.48
Frailty (≥ 3 criteria)	1.53	0.314	0.37–3.49
MMSE (score)	0.92	< 0.001	0.89–0.94
ADL (score ≥ 5.5)	0.63	0.016	0.43–0.92

OR, odds ratio; 95% CI, 95% confidence interval; MMSE, Mini Mental State Examination; ADL, Activities of Daily Living

Our results show a high prevalence of visual disorders among the study population. Indeed, more than one-third of the patients participating in this study demonstrated visual disorders: 531 (34.6%) presented with abnormal distant vision or abnormal near vision. These data are consistent with previous reports (18, 32). Our bivariate analysis showed that, in our population, abnormal vision in the ADV and ANV groups was associated with greater age, lower educational level, a lesser degree of autonomy, cognitive impairment, frailty, poorer physical performance, and poorer nutritional state. Among these characteristics, the multivariate analysis showed that four factors were independently associated with abnormal vision: greater age, lower educational level, cognitive impairment, and a lesser degree of ADL-assessed autonomy.

The first independent factor is not surprising as normal aging is characterised by worsening vision (33).

However, it is interesting to observe that cognitive disorders and lower educational level are independently associated with abnormal vision. Indeed, this may be expected as cognitive activities are known to have a positive effect on cognitive status and on patient trajectory (34, 35). Cognitive function was assessed using the MMSE, which comprises visual tasks that would decrease the final score in this study population and thus may have increased the power of the association observed between visual impairment and lower cognitive testing scores.

The observed relationship between educational level and abnormal vision is particularly strong with respect to near vision. Indeed, near vision is required for reading, and reading abilities are correlated with educational level (36). In addition, lower educational level is associated with lower income (37) and low income may have prevented patients from having regular ophthalmologic check-ups and optical correction. Previous work has also shown that autonomy is associated with visual impairment (38). Our results confirm this association for a visual impairment threshold of VA < 20/40, as shown by Daien et al (11).

Frailty was not found to be independently associated with visual disorders. However, our population was composed of only 118 (7.8%) robust patients, whereas 1390 (84.3%) patients were pre-frail or frail. This imbalance in the study population may have decreased the power of our analysis. In addition, we did not consider abnormal vision itself as a frailty criterion, as in some existing frailty scales (2, 39). Instead, we used the Fried frailty criteria, which focus on sarcopenia and physical performance as key indicators of frailty. Our results may have differed had we used the Frailty Risk Index (40, 41), for example, which also considers visual impairment, or by considering additional cognitive, social, or psychological criteria to define frailty.

Several factors previously found to be associated, or not associated, with visual impairment were not included in the present analyses. For examples, the relationship between falls and visual impairment was not studied, although an association between these two factors has been reported in previous studies (42, 43). Furthermore, the effect of socioeconomic status, which includes income and geographical origin, on visual impairment has not been reported consistently in the literature (10, 44-46), and a lack of data prevented us from including this factor in our analysis. Unfortunately, due to the exhaustive general examination of our elderly patients during a single-day stay in hospital, the ophthalmologic evaluation had to be limited and we were unable to obtain best-corrected VA or to collect additional information concerning the aetiology of visual impairment. Thus, the next step in our visual impairment detection strategy at GFC will be to include fundus photography and intraocular pressure measurements using telemedicine tools, such as a portable retinal camera and portable tonometer. Indeed, telemedicine has been proven to be efficient for the screening of retinopathies (47) and this improvement will allow us to systematically investigate the primary aetiologies of visual impairments among the elderly, which include but are not limited to age-related macular degeneration, cataract, and glaucoma. The data will be systematically transferred to the Ophthalmology Department of the CHU de Toulouse for analysis.

Conclusion

Our results show that visual impairment is independently associated with lower educational level, cognitive impairment, and lower ADL-assessed autonomy. Frailty was not found to be independently associated with visual impairment. These results and the high prevalence of visual disorders observed among the study population emphasises the need for systematic screening for visual impairment in elderly in clinical practice as well as in further research field. This idea is consistent with the multi-domain approach developed by Cesari et al. (48), which uses physical exercise, nutrition, and cognitive training as part of an optimised personal prevention plan to avoid or delay disability among the elderly.

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