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Factors associated with health-related quality of life (HRQoL): differential patterns depending on age

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Abstract

Purpose The aims of this study were: (1) to analyze age differences in health-related quality of life (HRQoL) between the young old (aged 65–84) and the oldest old (aged 85 and over), and (2) to investigate three types of predictors: (a) physical health [Basic Activities of Daily Living (BADL), Instrumental Activities of Daily Living, comorbidity, use of medication], (b) global cognitive ability and (c) psychosocial factors, specifically personality traits, social support and emotional functioning (positive and negative affect and life satisfaction), which may influence the HRQoL of both the young old and the oldest old.

Method A cross-sectional study was conducted with 257 healthy community-dwelling elderly people. HRQoL was assessed using the SF-36 Health Survey. Functional and health status, global cognitive ability and psychosocial variables were also assessed.

Results Age differences were found in HRQoL, with the oldest old scoring lower for this variable. Multiple stepwise hierarchical linear regression analyses revealed that, in relation to the *physical health component*, use of medication, BADL and positive affect had the greatest influence among the young old (65–84), whereas among the oldest old, neuroticism and the BADL were the most influential factors. As regards the *mental health component*, neuroticism, use of medication and positive affect were the main predictor variables among the young old, while neuroticism and negative affect had the greatest influence among the oldest old group.

Conclusion The oldest old had a poorer HRQoL in both dimensions measured (physical and mental). There appear to be differences between the determinants of HRQoL for young old and oldest old adults, suggesting that these associations change with age.

Keywords Age differences · Young old · Oldest old · HRQoL

Health-related quality of life (HRQoL) is defined as "the extent to which physical dysfunction, pain, and distress result in limitations of people's everyday behaviors, social activities, and psychological well-being" [1]. Maintaining a good HRQoL is especially important in older adults, who frequently experience poor functional health and are more vulnerable to negative health outcomes. Studies conducted with older adults have concluded that age is associated with a lower level of HRQoL [2, 3]. Specifically, the oldest old consider themselves to have a "poorer" HRQoL than younger elderly people due to an increase of physical health problems and limitations in their functional health [4]. Previous studies have identified certain predictor variables of HRQoL among both the young old and the oldest old, although it is true that the number of studies focusing on this latter age group is much lower. Below, we outline the key findings reported to date for each age group: young old and oldest old.

Cross-sectional and longitudinal studies have identified several factors that seem to have a detrimental effect on HRQoL in young older adults: being older and being a woman are considered to be risk factors for a lower HRQoL

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[5, 6], and higher levels of functional limitations [7], low socio-economic status [5], the presence of depressive symptoms [8–10], low social support [6, 11] and increased social isolation (living alone) [10, 12] have also been identified as determinants of a poorer HRQoL in this age group. However, most of these studies were carried out only with young older adults, and there is a need for further research into the factors associated with HRQoL at a more advanced age. Only a few studies have outlined the possible factors affecting HRQoL among the oldest old. The results of a Spanish research project indicate that gender (being a women), being pre frail, having heart failure and having a high social risk score were predictive factors of a poorer HRQoL in a 3-year follow-up study, whereas higher functional status and nutrition scores appeared to predict an enhanced HRQoL [13]. Among the oldest old, it has also been found that economic situation and social welfare predict QoL and self-reported health [14]. Other studies with this age group have associated factors such as increased use of medication and increased number of chronic illnesses with a poorer HRQoL [15] and body fat percentage was also associated with lower HRQoL and depression among nonagenarians [16]. In a study exploring the predictive factors of quality of life in different oldest old cohorts, Brett et al. [17] found that depressive symptoms and low-emotional stability levels (personality trait) were variables with a higher predictive power for QoL. Nevertheless, the results found for other personality traits (conscientiousness, extraversion, openness and agreeableness) were inconclusive. In another study by Brett et al. [18], which aimed to analyze predictors of change in QoL across 11 years, the authors compared the results of the same cohort at ages 79 and 90 years. The results revealed a significant decrease in most dimensions of QoL among nonagenarians. Furthermore, QoL at age 79 was the variable with the greatest predictor power for QoL at age 90, and lower physical QoL was related to depression and functional ability, whereas psychological QoL was associated with anxiety. Finally, correlational studies concluded that lower HRQoL was associated with increased risk of depression, increased use of medication, increased number of chronic diseases and more problems with the Instrumental Activities of Daily Living (IADL) among the oldest old in Sweden [19].

Although there are few references regarding which variables have the greatest predictive power among people over and under the age of 85, the findings outlined above seem to indicate differences in the determinants of HRQoL between young old and oldest old adults, thus suggesting that these associations change with age. Nevertheless, the studies mentioned above have certain limitations. Gouveia et al. [10] and Hong [15] are the only authors who compare different age groups (60–69 and 70–79, and 65–69, 70–74, 75–79, 80–84 and above 85, respectively), with all the other studies focusing on a single one (either the young old or the oldest old). Furthermore, unlike sociodemographic variables and those linked to medical condition, psychosocial variables have received relatively little attention in the current literature. In short, more studies are required, which focus jointly on health, cognitive functioning and psychosocial variables in both age groups (under and over the age of 85).

To contribute to a deeper understanding of these issues, our main aims were: (1) to analyze age differences in HRQoL between the young old (aged 65–84) and the oldest old (aged 85 and over), and (2) to investigate three types of predictors: (a) physical health (BADL, IADL, comorbidity, use of medication), (b) global cognitive ability and (c) psychosocial factors, specifically, personality traits, social support and emotional functioning (positive and negative affect and life satisfaction), which may influence the HRQoL of both the young old and the oldest old.

Method

Participants

This cross-sectional study was carried out with 257 community-dwelling older adults from Spain, aged between 65 and 104. The sample was divided into two age groups: 65–84 ($n = 155$), and 85–104 years old ($n = 102$). The inclusion criteria for participating in the study where: (a) being over 65 years of age; (b) not being dependent in activities of daily living (ADL); (c) not needing round-the-clock care; and (d) not having a mood disorder or an age-related neurodegenerative disease. Several screening measurement tools were applied during the selection process. The Barthel Index and the Lawton Instrumental Activities of Daily Living (IADL) Scale were used to measure ADL, the Goldberg Anxiety and Depression Scale was used to screen for mood and anxiety disorders, and finally, the Mini-Mental State Examination was used to screen for cognitive impairment. A summary of the population details of the sample group is provided in Table 1.

Measures

Outcome variable

HRQoL was evaluated using the *SF-36 Health Survey* [20, 21], a set of eight multi-item scales designed to measure eight different dimensions: social functioning (SF), physical functioning (PF), bodily pain (BP), role physical (RP), role emotional (RE), mental health (MH), vitality (VT) and general health (GH). The scores obtained for all items are coded and amalgamated into a single scale ranging from 0 (poor health) to 100 (optimal health). By summing the scores, two

Table 1 Population characteristics ($N = 257$)

Parameter	65–84 years old ($n = 155$) *N* (%)	85–104 years old ($n = 102$) *N* (%)
Gender		
Female	90 (58.1)	90 (60.8)
Men	65 (41.9)	12 (39.2)
Marital status		
Widowed	27.1	64.7
Married	57.4	12.7
Single	8.4	17.6
Divorced	7.1	5
Education		
Illiterate	0	6.9
Basic literacy skills	13	21.6
Primary education	53.3	55.9
Secondary education	11	5.8
Higher education	15.6	8.8
Vocational training	7.1	1
Other members of the household		
Lives alone	27.3	21.7
Spouse	57.3	16.3
Sons/daughters	14.2	41.3
Nieces/nephews/sister	.6	12
Carer	.6	8.7
Occupation		
Administration or services	31	30.4
Homemaker	22	20.6
Professional	16.1	20.6
Farmer	3.2	14.7
Manual laborer	8.4	5.9
Technician or middle management	10.3	3.9
Business person or executive	9	3.9

major components can be obtained: (1) the physical component summary (PCS), composed of PF, RP, BP and GH; and (2) the mental component summary (MCS) made up of VT, SF, RE and MH.

Predictor variables

Physical health: the basic activities of daily living (BADLs) were assessed with the Spanish version of the *Barthel Index* [BI; 22, 23]. This scale consists of ten items that measure a person's daily functioning, particularly the ADL and mobility. Items focus on activities such as feeding, grooming, bathing, dressing, toilet use, bladder control, bowel control, ambulation, chair transfers and stair climbing. Items are rated in terms of whether individuals can perform activities independently, with some assistance, or are dependent (scored as 10, 5 or 0). The total score ranges from 0 to 100, with lower scores representing greater dependency. Independent living skills were measured by means of the Spanish validated version of the *Lawton Instrumental Activities of Daily Living Scale* [IADL; 24, 25]. This scale measures eight domains of function, including areas such as cooking, shopping and managing finances, with scores ranging between 0 (low function) and 8 (high function). This predictor variable (physical health) was also assessed using the Age-adjusted *Charlson Comorbidity Index* [AACI; 26], which weights and scores 19 comorbid conditions (such as, for example, cerebrovascular disease, chronic pulmonary disease and myocardial infarction). Extra points are awarded for age (for each decade over the age of 40, with a maximum of 4). We also registered the level of medication intake among respondents.

Cognitive health: this variable was assessed using the *Mini Examen Cognoscitivo* [MEC; 27], which is the adapted and validated Spanish version of the Mini-Mental State Examination (MMSE), originally developed by Folstein et al. [28]. This instrument is a simple measure made up of 24 items which analyze the following cognitive areas: orientation, concentration, attention, recall, calculation and language. The maximum overall score that can be obtained is 35 points.

Psychosocial factors: the Spanish version of the *NEO Five Factor Inventory* [NEO-FFI; 29, 30] was used to evaluate personality traits. This instrument is the short form of the NEO PI-R and consists of 60 items, 12 for each of the 5 factors: conscientiousness, agreeableness, neuroticism, extraversion and openness to experience. Items are assessed using a Likert-type scale, with scores ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Social support was assessed by means of the *Functional Social Support Questionnaire* [DUKE-UNK-11; 31], a validated Spanish-language scale comprising 11 items measuring total support, affective or emotional support (e.g. demonstrations of empathy and affection) and confidential support (e.g. whether or not an individual has someone with whom to communicate). Responses are given on a Likert-type scale from 1 (*much less than I would like*) to 5 (*as much as I would like*). Emotional functioning was assessed with the Spanish version of the *Positive and Negative Affect Scale* [PANAS; 32, 33], an instrument comprising two mood scales (with ten items per scale) developed to enable brief assessments of both positive and negative affect. Participants use a five-point scale ranging from 1 (*very slightly or not at all*) to 5 (*very much*) to rate the degree to which they have felt each emotion during the specified period. Finally, life satisfaction was measured using the Spanish version of the *Life Satisfaction Scale* [34, 35], on which respondents are asked to rate the extent to which they agree or disagree with each of the five items. Answers are given on a seven-point scale ranging from 7 (*strongly agree*) to 1 (*strongly disagree*).

Procedure

To recruit participants for the young old sample (under 85s) we contacted the governing boards of social centers located in towns near the city of San Sebastián. To recruit participants aged 85 and over, particularly centenarians, we contacted geriatric social workers from several different municipalities in the province of Gipuzkoa. Following initial telephone conversations with social workers or members of the governing boards, we then contacted participants themselves and arranged an interview if they expressed an interest in participating. We first explained the aim of the study and then informed participants that their collaboration would be strictly voluntary, anonymous and confidential. After this step, participants were asked to give their informed consent and were given the choice of being interviewed in their own homes or at our offices. Those who were able to travel were asked to come to our offices at the Matia Instituto Gerontológico in San Sebastián, Spain. However, all of the oldest old (85+) participants chose to conduct the interview at home due to poor health or lack of transportation. Next, after basic background details such as age, education level, occupation, marital status and cohabitation were obtained, interviews were held with participants. These interviews were conducted by experienced psychologists who were tasked with completing a series of questionnaires measuring the variables described above: HRQoL, physical health, cognitive functioning and psychosocial factors.

Statistical analyses

The data collected were analyzed using the SPSS 21.0 statistical package program. Independent *t* samples were used to compare the mean scores of the two age groups. Moreover, the Cohen's d effect sizes were calculated from the *t* tests to determine the practical significance of the results. Bivariate analyses were conducted using the Pearson correlation coefficient to assess the strength of the associations between all study variables. Variables which, in the bivariate analyses, were associated with HRQoL in each age group were entered into a multiple stepwise hierarchical linear regression model determined by the strength of their association with the outcome variable. The critical value for significance in all analyses was set at $p < 0.05$.

Results

The means and standard deviations for HRQoL by age groups (young old vs. oldest old) are presented in Table 2. The oldest old age group was found to score significantly lower than the young old age group both in the physical component summary of HRQoL ($p < 0.001$, $d = .76$) and in some of the dimensions belonging to this component (physical functioning and general health, $p < 0.001$, $d = 1.42$ and .48, respectively). The effect size of the physical component summary and general health was medium, whereas that of physical functioning was large. Significantly, lower scores were also observed among the oldest old in the mental component summary ($p < 0.001$, $d = .57$) of HRQoL and in two of the domains belonging to this component (vitality and mental health $p < 0.05$, $d = .76$ and .29, respectively). The effect size of the mental component summary was medium, that of vitality was large and that of mental health was small.

As shown in Table 3, among the 65–84 age group, the bivariate analyses revealed that the physical component summary was significantly and positively correlated with BADL and IADL, conscientiousness and positive affect, and was negatively associated with comorbidity, use of medication and neuroticism. Regarding the mental component summary, a significant positive relationship was observed with extraversion, conscientiousness, social

Table 2 Descriptive statistics and age-related (young old vs. oldest old) differences in HRQoL

	Young old (65–84 years old) M ± SD ($n = 155$)	Oldest old (85–104 years old) M ± SD ($n = 102$)	*p*	*d*
Age (years)	74.15 ± 5.92	92.53 ± 5.91		
PF: physical functioning	79.77 ± 24.97	37.78 ± 32.43	< .001	1.42
RP: role physical	88.39 ± 21.86	87.94 ± 22.14	0.874	0.02
BP: bodily pain	78.79 ± 23.09	78.34 ± 25.32	0.885	0.01
GH: general health	66.56 ± 16.39	59.39 ± 14.00	< .001	0.48
PCS: physical component summary	78.38 ± 16.28	65.86 ± 16.62	< .001	0.76
VT: vitality	70.94 ± 21.68	52.08 ± 26.86	< .001	0.76
SF: social functioning	96.19 ± 13.88	92.42 ± 18.71	0.088	0.02
RE: role emotional	91.13 ± 19.09	92.59 ± 17.45	0.538	0.08
MH: mental health	79.03 ± 17.81	73.74 ± 18.08	0.023	0.29
MCS: mental component summary	81.20 ± 11.94	74.12 ± 12.93	< .001	0.57

Table 3 Bivariate correlations between study variables among the young elderly (from 65 to 84 years old)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. PCS															
2. MCS	0.63**														
3. Comorbidity	−0.42**	−0.24**													
4. Use of medication	−0.51**	−0.40**	0.53**												
5. BADLs	0.47**	0.15	−0.42**	0.32**											
6. IADLs	0.29**	0.11	−0.22**	−0.27**	0.58**										
7. Cognition	0.16	0.05	−0.13	−0.10	0.17**	0.17*									
8. Neuroticism	−0.22**	−0.41**	0.18	0.19	−0.18*	−0.10	0.02								
9. Extraversion	0.12	0.25**	−0.04	−0.08	−0.02	0.05	0.05	−0.19*							
10. Openness	0.06	0.04	−0.16*	−0.20*	0.03	0.06	0.14	−0.01	0.38**						
11. Agreeableness	0.04	0.13	0.01	−0.09	0.00	−0.00	0.02	−0.45**	0.31	0.12					
12. Conscientiousness	0.24**	0.27**	−0.17*	−0.17*	0.19**	0.09	0.00	−0.44**	0.19*	0.09	0.36**				
13. Social support	0.01	0.21**	0.12	0.04	−0.08	0.09	−0.06	−0.22*	0.17*	0.05	0.26**	0.32**			
14. Positive affect	0.34**	0.36**	−0.23**	−0.25**	0.18*	0.14	0.25*	−0.14	0.44**	0.41**	0.07	0.32**	0.21**		
15. Negative affect	− 0.10	−0.24**	−0.03	0.08	0.05	0.02	0.16*	0.64**	0.03	0.07	−0.24**	−0.23**	−0.36**	0.07	
16. Life satisfaction	0.15	0.28**	0.01	−0.13	−0.12	−0.19	0.15	0.35**	0.15	−0.11	0.31**	0.33**	0.35**	0.21**	−0.36**

PCS physical component summary, *MCS* mental component summary, *BADLs* basic activities of daily living, *IADLs* instrumental activities of daily living

*$p < .05$, **$p < .01$

support, positive affect and life satisfaction. Moreover the mental component summary was negatively associated with comorbidity, use of medication, neuroticism and negative affect in the same age group.

Among the oldest old, the physical component summary was significantly and positively correlated with BADL and IADL, cognitive functioning, conscientiousness and life satisfaction, and was negatively associated with comorbidity, neuroticism and negative affect (Table 4). As regards, the mental component summary, a significant positive relationship was found between this variable, extraversion and conscientiousness. Moreover, this same variable was negatively associated with neuroticism and negative affect in the oldest age group.

Having identified a number of significant associations, we then conducted a multiple stepwise hierarchical linear regression analysis. Three types of predictors were entered in the analysis: (1) physical health (BADL, IADL, comorbidity, use of medication), (2) global cognitive ability and (3) psychosocial factors, specifically, personality traits, social support and emotional functioning (positive and negative affect and life satisfaction). The outcome variables were: the PCS and the MCS of HRQoL.

Among the younger age group (from 65 to 84 years old), the variable found to best predict the PCS of HRQoL was use of medication, which explained 25.8% of the variance (Table 5). Although they also entered into the equation, BADL and positive affect were found to be less powerful predictors of the PCS of HRQoL (explaining 10.9% and 2.9% of the variance, respectively). Together, these three variables explained 39.6% of the variance.

Among the oldest old, the variables found to best predict the PCS of HRQoL were the personality trait neuroticism, which explained 26.6% of the variance (Table 5), and BADL, which explained 12.3% of the variance. The total percentage of variance explained by these two variables was 38.9%.

As regards, the MCS of HRQoL, in the younger age group the variable found to be the best predictor was neuroticism (16.1%). Although they also entered into the equation, BADL and positive affect were found to be less powerful predictors of the MCS of HRQoL (explaining 10.7% and 5.4% of the variance, respectively). Together, these three variables explained 32.2% of the variance.

Among the oldest old, neuroticism was also found to predict this outcome variable, explaining 24.4% of the variance. To a much lesser extent (only 3%), the variance was also explained by negative affect. Together, these two variables explained 27.4% of the variance. The results are presented in Table 6.

Discussion

The results indicate significant differences in HRQoL between those aged 65–84 and those aged 85 and over. As expected, the oldest old (those aged 85 and over) were found to have a lower level of HRQoL than their younger counterparts in both dimensions measured (physical and mental). This result is consistent with those reported by previous studies which identify age as a predictor of HRQoL, with levels dropping as individuals grow older [4, 5].

As regards to predictor variables, the results indicate that they are different for each group. In the younger age group, objective health (specifically the use of medication) was found to be the variable which best predicted the PCS of HRQoL (25.8%), although BADL and positive affect were also found to have some predictive power (10.9% and 2.9%, respectively).

Among the young old, results suggest that maintaining optimum levels of basic functional capacity and health is very important to ensuring satisfactory aging among this age group, since a decrease in physical health (either due to an increase in the number of medicines taken or to reduced functional capacity) was found to have a negative effect on participants' perception of the physical component of their HRQoL. As Rowe and Kahn [36] pointed out, variables such as low likelihood of disease, active engagement and high cognitive/physical functional capacity are all key factors in successful aging, at least among the young old since, as explained below, among the oldest old the situation is different. Thus, when young old people perceive a reduction in these abilities, this results in a poorer perception of the physical component of HRQoL. This does not tend to happen, however, among the oldest old. The adults in this age group have become accustomed to constraints in the activities of daily living, and have often learned to live also with chronic illness, which they see as an intrinsic part of growing old. The oldest old generally experience more complex health problems, with some authors referring to these individuals as "sick survivors" [37]. This is perhaps why the use of medication does not predict the physical dimension of HRQoL in this age group, with personality, and more specifically, neuroticism, being the variable with the greatest predictive power. It has been argued that acceptance among the oldest old of chronic conditions in the physical dimension does not in itself necessarily indicate a higher level of emotional vulnerability or a worse psychological state. Thus, although there is a close link between more advanced age and both functional deterioration and physiological change, among the oldest old at least, it may be that there is no positive correlation between the psychological and

Table 4 Bivariate correlations between study variables among the oldest old (from 85 to 104 years old)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. PCS															
2. MCS	0.67**														
3. Comorbidity	−0.21*	−0.19													
4. Use of medication	−0.13	−0.04	0.26**												
5. BADLs	0.43**	0.14	−0.32**	−0.04											
6. IADLs	0.40**	0.06	−0.46**	−0.08	−0.08										
7. Cognition	0.35**	0.18	−0.19	0.08	0.57**	0.54**									
8. Neuroticism	−0.51**	−0.50**	0.08	0.18	−0.17	−0.08	−0.10								
9. Extraversion	0.14	0.25**	0.18	−0.05	−0.05	0.03	0.04	−0.34**							
10. Openness	0.05	0.06	0.04	−0.01	0.04	0.02	0.22*	−0.08	0.43**						
11. Agreeableness	0.17	0.05	−0.18	0.12	0.30**	0.35*	0.25**	−0.31**	0.02	−0.06					
12. Conscientiousness	0.31**	0.24**	−0.13	0.03	0.26**	0.24**	0.24*	−0.38**	0.33**	0.28**	0.28**				
13. Social support	−0.04	0.02	−0.07	−0.09	−0.01	0.02	−0.05	−0.24*	0.32**	0.02	0.16	−0.04			
14. Positive affect	0.16	0.15	0.02	−0.13	0.04	0.17	0.20*	−0.19	0.53**	0.46**	0.04	0.51**	0.03		
15. Negative affect	− 0.22*	−0.36**	0.12	0.01	0.07	0.01	−0.02	0.44**	−0.16	0.03	−0.19	−0.11	−0.12	0.09	
16. Life satisfaction	0.21*	0.10	0.08	−0.15	0.01	−0.04	−0.10	−0.39*	0.34**	−0.01	0.07	0.18	0.16	0.18	−0.18

*$p < 0.05$, **$p < 0.01$

Table 5 Stepwise hierarchical linear regression to PCS of HRQoL among the young old and the oldest old

	B	Standard error	β	R^2	t	p
Young old (from 65 to 84 years old)						
Use of medication	−2.48	0.46	−0.36	0.25	−5.30	<.001
Basic activities of daily living (BADL)	0.86	0.17	0.33	0.36	4.91	<.001
Positive affect	0.45	0.16	0.18	0.39	2.83	<.001
(Constant)*	−12.44	17.92			−0.69	0.488
Oldest old (from 85 to 104 years old)						
Neuroticism	−0.98	0.19	−0.42	0.26	−5.56	<.001
Basic activities of daily living (BADL)	0.21	0.04	0.37	0.38	4.16	<.001
(Constant)**	70.44	6.14			6.70	<.001

*$F(3, 151) = 33.96$, $p < .001$, $R^2 = 0.39$

**$F(2,91) = 29.93$, $p < .001$, $R^2 = 0.38$

Table 6 Stepwise hierarchical linear regression to MCS of HRQoL among the young old and the oldest old

	B	Standard error	β	R^2	t	p
Young old (from 65 to 84 years old)						
Neuroticism	−0.47	0.10	−0.31	0.16	−4.63	<.001
Use of medication	−1.40	0.35	−0.28	0.26	−3.98	<.001
Positive affect	0.43	0.12	0.24	0.32	3.56	<.001
(Constant)*	80.90	4.45			18.15	<.001
Oldest old (from 85 to 104 years old)						
Neuroticism	−0.79	0.18	−0.42	0.24	−4.43	<.001
Negative affect	−0.65	0.29	−0.22	0.27	−2.20	0.030
(Constant)**	99.28	4.50			22.01	<.001

*$F(3,151) = 24.85$, $p < .001$, $R^2 = 0.32$

**$F(2, 94) = 18.72$, $p < .001$, $R^2 = 0.27$

social aspects of aging and the physiological changes that take place throughout the life cycle [38]. Reaching very old age in optimum condition poses a series of important challenges, in which resilience and adaptive fitness are crucial for maintaining positive well-being [39, 40]. Indeed, among the oldest old, personality may be a vital factor for developing the positive attitude required, with the lowest levels of both physical and mental HRQoL being perceived by those individuals with strong neurotic tendencies. This is not surprising given the mental health implications of neurotic tendencies (which have also been found to predict the mental component of HRQoL among young old adults). Prior research has found that neurotic people report more functional limitations and steeper declines in physical functioning [41, 42], less energy and increased risk of frailty in old age [43, 44]. The association between neurotic traits and poorer perception of the physical and mental components of HRQoL among the oldest old, but also between neuroticism and the mental health component among the young old, may reflect a lifetime of health-damaging behaviors associated with this trait, such as smoking and physical inactivity [45], as well as increased negative affect [46].

In both age groups, the BADL were found to explain the physical component of HRQoL (alongside other variables). In this, our results are consistent with those reported by previous studies, which found that functional capacity is one of the determining factors of HRQoL in both the young old and the oldest old [7, 13]. In other words, among the young old, those who take more medication, have less basic functional capacity and lower levels of positive affect have a poorer perception of their physical health. In the group of the oldest old, neurotic traits and less functional capacity were found to predict the physical component of HRQoL.

The association between positive and negative affect and HRQoL is also worth mentioning. Among the young old, positive affect was found to explain 12.9% of the variance in relation to the physical component, and 5.4% of the variance in relation to the mental component. Among the oldest old, negative affect only explained 3% of the variance in relation to the mental component. To the best of our knowledge, only a few studies have focused on the association between positive and negative affect and HRQoL [47]. According to our results, the role of positive affect is significant, particularly among the young old and in relation to the physical dimension. In

this sense, previous studies have highlighted the protective role played by positive emotions in relation to illness and death [48, 49]. Our results support the design of intervention programs targeted at fostering positive emotions and ensuring the effective management of distress and anxiety (a common problem among those with neurotic tendencies), in order to help older adults to enjoy a better HRQoL.

Finally, we would like to highlight the importance of medication intake as a predictor of the physical component of HRQoL among the young old. Most studies exploring the relationship between medication and quality of life have done so from the perspective of adherence. However, more recently, some authors have highlighted the importance of medication intake as a predictor variable of (among other aspects) HRQoL among the young old (mean age 74.72 years) [50]. The number of medicines taken was the medication-related variable that had the most robust association with HRQoL. Our results coincide with this finding, since among the young old adults in our study, this variable was the most powerful predictor of the physical component of HRQoL, and the second-most powerful predictor (after neuroticism) of the mental component. The implications of these results are similar to those outlined above, since the paradigm of active aging in this age group is directly linked to good health. Higher medication intake among older adults implies a greater number of diseases and, consequently, a poorer HRQoL.

The study has certain limitations that should be borne in mind. First, it is a cross-sectional rather than longitudinal study, and second, the sample group did not include any young old or oldest old adults with cognitive impairment or in a state of ADL dependence. In other words, it comprised only individuals who were aging satisfactorily. Despite this being necessary for both the aim of the study and to enable participants to complete the assessment instruments used, future research may wish to expand the sample to include a more representative range of people in this age group, although it would be particularly interesting to have a broader sample of oldest old people, since this is an age group that is expected to increase over coming years. Another limitation that should be mentioned refers to how the medication taken by participants on a daily basis was recorded (number of medications per day). This general information was used for the subsequent analyses and may have influenced the results, since no specific weight was given to the type of medication, only the number of pills taken daily.

Despite these limitations, however, we believe that one of the strengths of this study was the inclusion of two groups of individuals, aged under and over 85. Moreover, the inclusion of psychosocial variables, which have received very little attention to date, is another novel contribution made by the study.

In sum, the results of this study indicate the existence of age-related differences in HRQoL between those aged under and over 85, with the older age group having a poorer perception of their physical and mental health. In relation to the predictor variables for the two age groups analyzed, the results indicate age-related differences in the determinants of HRQoL, thereby suggesting that the associations change with age. We can, therefore, conclude that among the young old, objective health (use of medication) and the personality trait neuroticism, as well as (to a lesser extent) BADL and emotional functioning (positive affect), are the variables with the greatest predictive power for HRQoL. Among the oldest old, neuroticism was the variable with the greatest predictive power, followed (to a much lesser extent) by emotional functioning (negative effect) and BADL. Our findings highlight the fact that, in addition to some variables that have previously been identified as being related to HRQoL (medication intake and BADL), there are also other, less-studied, psychosocial ones (personality trait neuroticism and affect) which predict HRQoL, regardless of age. This suggests that researchers and clinicians should take into account the differences which exist in HRQoL between those aged under and those aged over 85, as well as the variables which predict them. In relation to prevention and intervention programs, special attention should be paid to those individuals with high levels of neuroticism, and specific programs should be developed to help them cope better with negative emotions, which are generally more prevalent among those with neurotic traits. By enhancing these skills we can help these individuals develop a better perception of their HRQoL during old age. Moreover, the findings suggest that home and community intervention programs should be developed to promote elderly people's basic functional capacity, and that health professionals should monitor their pharmacological treatments more closely (especially among the young old) in order to promote health and, therefore, HRQoL among this age group.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in this study involving human participants were carried out in accordance with the ethical standards of the institutional research committee (Ingema-Matia-Hurkoa Assistance Ethics Committee) and with the 1964 Helsinki Declaration and its later amendments.

Informed consent Informed consent was obtained from all individual participants included in the study.

References

1. Lawton, M. P. (2001). Quality of life and the end of life. In J. E. Birren & K. W. Schaie (Eds.), *Handbook of the psychology of aging* (5th ed., pp. 593–616). New York: Academic Press.
2. Lim, L. L., & Fisher, J. D. (1999). Use of the 12-item short form (SF-12) health survey in an Australian heart and stroke population. *Quality of Life Research, 8,* 1–8.
3. Al-Windi, A., Elmfeldt, D., Tibblin, G., & Svärdsudd, K. (1999). The influence of sociodemographic characteristics on well-being and symptoms in a Swedish community. *Scandinavian Journal of Primary Health Care, 17,* 201–209.
4. Pinquart, M. (2001). Correlates of subjective health in older adults: A meta-analysis. *Psychology and Aging, 16*(3), 414–426.
5. Tajvar, M., Arab, M., & Montazeri, A. (2008). Determinants of health-related quality of life in elderly in Tehran, Iran. *BMC Public Health, 22*(8), 323. https://doi.org/10.1186/1471-2458-8-323.
6. Gallicchio, L., Hoffman, S. C., & Helzlsouer, K. J. (2007). The relationship between gender, social support, and health-related quality of life in a community-based study in Washington County Maryland. *Quality Life Research, 16,* 777–786. https://doi.org/10.1007/s11136-006-9162-4.
7. Bowling, A. (2005). *Aging well, quality of life in older age* (1st ed.). Maidenhead: Open University Press.
8. Sivertsen, H., Bjørkløf, G. H., Engedal, K., Selbæk, G., & Helvik, A. S. (2015). Depression and quality of life in older persons: A review. *Dementia and Geriatric Cognitive Disorders, 40*(5–6), 311–339. https://doi.org/10.1159/000437299.
9. Zaninotto, P., Falaschetti, E., & Sacker, A. (2009). Age trajectories of quality of life among older adults: Results from the English Longitudinal Study of Ageing. *Quality of Life Research, 18*(10), 1301–1309.
10. Gouveia, É. R. Q., Gouveia, B. R., Ihle, A., Kliegel, M., Maia, J. A., Badia, S. B., et al. (2017). Factors associated with health related quality of life (HRQoL) in young-old and oldest-old community-dwelling adults. *Quality of Life Research, 26,* 1561–1569. https://doi.org/10.1007/s11136-017-1502-z.
11. Li, C. I., Lin, C. H., Lin, W. Y., Liu, C. S., Chang, C. K., Meng, N. H., et al. (2014). Successful aging defined by health-related quality of life and its determinants in community-dwelling elders. *BMC Public Health, 28,* 14. https://doi.org/10.1186/1471-2458-14-1013.
12. Hawton, A., Green, C., Dickens, A. P., Richards, S. H., Taylor, R. S., Edwards, R., et al. (2011). The impact of social isolation on the health status and health-related quality of life of older people. *Quality of Life Research, 20*(1), 57–67. https://doi.org/10.1007/s11136-010-9717-2.
13. Ferrer, A., Formiga, F., Cunillera, O., Megido, M. J., Corbella, X., & Almeda, J. (2015). Predicting factors of health related quality of life in octogenarians: A 3 year follow up longitudinal study. *Quality of Life Research, 24,* 2701–2711.
14. Gu, L., Cheng, Y., Phillips, D. R., & Rosenberg, M. (2019). Understanding the wellbeing of the oldest-old in China: A study of socio-economic and geographical variations based on CLHLS Data. *International Journal of Environmental Research and Public Health, 16*(4), 601. https://doi.org/10.3390/ijerph16040601.
15. Hong, E. (2015). Age differences in health-related quality of life among south Korean elderly. *Research & Reviews: Journal of Child and Family Studies, 1*(4), 34–39.
16. Giovannini, S., Macchi, C., Liperoti, R., Laudisio, A., Coraci, D., Loreti, C., et al. (2019). Association of body fat with health-related quality of life and depression in nonagenarians: The Mugello Study Working Group. *Journal of the American Medical Directors Association*. https://doi.org/10.1016/j.jamda.2019.01.128.
17. Brett, C. E., Gow, A. J., Corley, J., Pattie, A., Starr, J. M., & Deary, I. J. (2012). Psychosocial factors and health as determinants of quality of life in community-dwelling older adults. *Quality of Life Research, 21*(3), 505–516. https://doi.org/10.1007/s11136-011-9951-2.
18. Brett, C. E., Dykiert, D., Starr, J. M., & Deary, I. J. (2019). Predicting change in quality of life from age 79 to 90 in the Lothian Birth Cohort 1921. *Quality of Life Research, 28,* 737–749. https://doi.org/10.1007/s11136-018-2056-4.
19. Andersson, L., Marcusson, J., & Wressle, E. (2014). Health related quality of life and activities of daily living in 85-year-olds in Sweden. *Health and Social Care in the Community, 22*(4), 368–374.
20. Ware, J., & Sherbourne, C. (1992). The MOS 36-item short form health survey (SF-36). Conceptual framework and item selection. *Medical Care, 30,* 473–483.
21. Vilagut, E., Ferrer, M., Rajmil, L., Rebollo, P., Permanyer-Miralda, G., Quintana, J., et al. (2005). El cuestionario de salud SF-36 español: Una década de experiencia y nuevos desarrollos. *Gaceta Sanitaria, 19*(2), 135–150. https://doi.org/10.1157/13074369.
22. Mahoney, F. I., & Barthel, D. W. (1965). Functional evaluation: The Barthel Index. *Maryland State Medical Journal, 14,* 61–65.
23. Baztán, J. J., Pérez del Molino, J., & Alarcón, T. (1993). Índice de Barthel: instrumento válido para la valoración funcional de pacientes con enfermedad cerebrovascular. *Revista Española de Geriatría y Gerontología, 28,* 32–40.
24. Lawton, M. P., & Brody, E. M. (1969). Assessment of older people: Self-maintaining and instrumental activities of daily living. *The Gerontologist, 9*(3), 179–186.
25. Vergara, I., Bilbao, A., Orive, M., Garcia-Gutierrez, S., Navarro, G., & Quintana, J. M. (2012). Validation of the Spanish version of the Lawton IADL Scale for its application in elderly people. *Health Quality of Life Outcomes, 10*(1), 130. https://doi.org/10.1186/1477-7525-10-130.
26. Charlson, M. E., Pompei, P., Ales, K. L., & MacKenzie, C. R. (1987). A new method of classifying prognostic comorbidity in longitudinal studies: Development and validation. *Journal of Chronic Diseases, 40*(5), 373–383. https://doi.org/10.1016/0021-9681(87)90171-8.
27. Lobo, A., Saz, P., Marcos, G., Día, J. L., De la Cámara, C., Ventura, T., et al. (1999). Revalidación y normalización del Mini-Examen Cognoscitivo (primera versión en castellano del Mini-Mental Status Examination) en la población general geriátrica. *Medicina Clínica (Barcelona), 112*(20), 767–774.
28. Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *A Global Journal of Child Research, 12*(3), 189–198.
29. Costa, P. T., Jr., & McCrae, R. R. (1997). Stability and change in personality assessment: the revised NEO Personality Inventory in the year 2000. *Journal of Personality Assessment, 68*(1), 86–94. https://doi.org/10.1207/s15327752jpa6801_7.
30. Cordero, A., Pamos, A., Seisdedos, N., Avia, M. D., & Costa, P. T. (2008). *Inventario de personalidad neo revisado (NEO PI-R), inventario neo reducido de cinco factores (NEO-FFI): Manual profesional*. Madrid: TEA.
31. Bellón, J., Delgado, A., Luna del Castillo, J., & Lardelli, P. (1996). Validez y fiabilidad del cuestionario de apoyo social funcional Duke-UNC-11. *Atención Primaria, 18*(4), 153–163.
32. Watson, D., Clark, L., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology, 54*(6), 1063–1070. https://doi.org/10.1037/0022-3514.54.6.1063.
33. Sandín, B., Chorot, P., Lostao, L., Joiner, T., Santed, M., & Valiente, R. (1999). Escala PANAS de afecto positivo y negativo:

validación factorial y convergencia transcultural. *Psicothema, 11*(1), 37–51.
34. Diener, E., Emmons, R., Larsen, R., & Griffin, S. (1985). The satisfaction with life scale. *Journal of Personality Assessment, 49,* 71–75. https://doi.org/10.1207/s15327752jpa4901_13.
35. Pons, D., Atienza, F., Balaguer, I., & García-Merita, M. (2002). Propiedades psicométricas de la escala de satisfacción con la vida en personas de tercera edad. *Revista Iberoamericana de Diagnóstico y Evaluación Psicológica, 13,* 71–82.
36. Rowe, J. W., & Kahn, R. L. (1997). Successful ageing. *The Gerontologist, 37,* 433–440.
37. Rosén, M., & Haglund, B. (2005). From healthy survivors to sick survivors-implications for the twenty first century. *Scandinavian Journal of Public Health, 33*(2), 151–155. https://doi.org/10.1080/14034940510032121.
38. Young, Y., Frick, K., & Phelan, E. (2009). Can successful aging and chronic illness coexist in the same individual? A multidimensional concept of successful aging. *Journal of the American Medical Directors Association, 10,* 87–92. https://doi.org/10.1016/j.jamda.2008.11.003.
39. Baltes, P. B., & Smith, J. (1999). Multilevel and systemic analyses of old age: Theoretical and empirical evidence for a fourth age. In V. L. Bengston & K. W. Schaie (Eds.), *Handbook of theories of aging* (pp. 153–173). New York, NY: Springer.
40. Smith, J., & Baltes, P. B. (1999). Trends and profiles of psychological functioning in very old age. In P. B. Baltes & K. U. Mayer (Eds.), *The Berlin Aging Study: Aging from 70 to 100* (pp. 197–226). New York: Cambridge University Press.
41. Canada, B., Stephan, Y., Jaconelli, A., & Duberstein, P. R. (2016). The moderating effect of chronological age on the relation between neuroticism and physical functioning: Cross sectional evidence from two French samples. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences, 71*(1), 35–40. https://doi.org/10.1093/geronb/gbu083.
42. Terracciano, A., Stephan, Y., Luchetti, M., Gonzalez-Rothi, R., & Sutin, A. R. (2017). Personality and lung function in older adults. *The Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 72*(6), 913–921. https://doi.org/10.1093/geronb/gbv161.
43. Terracciano, A., Schrack, J. A., Sutin, A. R., Chan, W., Simonsick, E. M., & Ferrucci, L. (2013). Personality, metabolic rate and aerobic capacity. *PLoS ONE, 8*(1), e54746. https://doi.org/10.1371/journal.pone.0054746.
44. Stephan, Y., Sutin, A. R., Canada, B., & Terracciano, A. (2017). Personality and frailty: Evidence from four samples. *Journal of Research in Personality, 66,* 46–53. https://doi.org/10.1016/j.jrp.2016.12.006.
45. Sutin, A. R., Stephan, Y., Luchetti, M., Artese, A., Oshio, A., & Terracciano, A. (2016). The five-factor model of personality and physical inactivity: A meta-analysis of 16 samples. *Journal of Research in Personality, 63,* 22–28. https://doi.org/10.1016/j.jrp.2016.05.001.
46. Etxeberria, I., Etxebarria, I., & Urdaneta, E. (2018). Subjective well-being among the oldest old: The role of personality traits. *Personality and Individual Differences, 1,* 1. https://doi.org/10.1016/j.paid.2018.04.042.
47. Facal, D., Iglesias, A., González, M. F., & Galdona, N. (2010). La influencia de los afectos sobre la salud percibida de las personas mayores. In R. González, A. Valle, R. Arce, & F. Fariña (Eds.), *Calidad de Vida, Bienestar y Salud* (p. 127). A Coruña: Psicoeduca.
48. Steptoe, A., O'Donnell, K., Marmot, M., & Wardle, J. (2008). Positive affect and psychosocial processes related to health. *British Journal of Psychology, 99*(2), 211–227. https://doi.org/10.1348/000712607X218295.
49. Xu, J., & Roberts, R. E. (2010). The power of positive emotions: It's a matter of life or death-subjective well-being and longevity over 28 years in a general population. *Health Psychology, 29*(1), 9–19. https://doi.org/10.1037/a0016767.
50. Montiel, A., Nuñez, A. J., Martín, E., Canca, J. C., Toro, M. C., González, J. A., et al. (2017). Medication related factors associated with health-related quality of life in patients older than 65 years with polypharmacy. *PLoS ONE, 12*(2), e0171320. https://doi.org/10.1371/journal.pone.0171320.