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Association between physical, psychological and social frailty and health-related quality of life among older people

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Background: Studies on the association between frailty and health-related quality of life (HRQoL) are scarce and show contradictory results. This study aimed to evaluate the association between physical, psychological and social frailty and HRQoL among community-dwelling older people. **Methods:** A cross-sectional study was performed with baseline data collected in 2015 from the Urban Health Centers Europe (UHCE) project in five European countries, the United Kingdom, Greece, Croatia, The Netherlands and Spain. A total of 2325 participants were included in the baseline measurements of the Urban Health Centers Europe project; 2167 participants (mean age = 79.7; SD=5.6) were included in the analyses after excluding participants with missing data. The Tilburg Frailty Indicator measured overall frailty as well as physical, psychological and social frailty. The 12-Item Short-Form Health Survey was used to measured physical and mental HRQoL. **Results:** Regarding physical HRQoL, a large difference (d=1.29) between physically and not physically frail participants was observed. Regarding mental HRQoL, a large difference (d=1.20) between psychologically and not psychologically frail participants was observed. In the full model with all three domains of frailty and the covariates to explain physical HRQoL, physical (P <0.001) and social frailty (P <0.001) remained significant. In the full model to explain mental HRQoL, all three domains of frailty remained significant (P <0.001). **Conclusion:** Physical frailty had the strongest association with physical HRQoL, and psychological frailty had the strongest association with mental HRQoL. The associations between social frailty and both physical and mental HRQoL remain significant when controlling for physical and psychological frailty.

Introduction

Health-related quality of life (HRQoL) is a multidimensional construct that specifically focuses on health-related aspects of well-being. It includes elements about physical and mental functioning, as well as a person's subjective appraisal of their effect on daily life and social functioning.[1] For frail people, HRQoL may be restricted. Frailty is a multidimensional syndrome characterized by the loss of reserves including energy, physical ability, cognition and health and is highly prevalent with increasing age.[2–4] As the proportion of the European citizens aged 65 years and older is expected to further rise from 18% in 2013 to 27% in 2040,[5] more people will suffer from frailty in the near future.[4,6] Therefore, the literatures of studies regarding the HRQoL of frail people increase.[6,7]

However, studies on the association between frailty and HRQoL are still scarce and show contradictory results.[8] Several cross-sectional studies using generic or specific instruments for measuring HRQoL reported that frailty is associated with poorer HRQoL among older people.[3,4,8–12] Where some studies found that poor endurance and energy had the strongest effect,[3,4,12] another study observed slowness and poor endurance to have the strongest effect on poorer HRQoL.[9]

Because of its multidimensional nature, it has been suggested to consider frailty broadly from a physical, psychological and social perspective when examining the association between frailty and HRQoL.[10] However, there is yet no consensus on the associations between the three domains of frailty and HRQoL. Some studies suggest that psychological and social frailty had a significant *negative* effect on HRQoL.[10,13,14] For example, a cross-sectional study in The Netherlands found that psychological and social frailty significantly contributed to the ability of physical frailty to predict HRQoL.[10] However, one longitudinal study found no significant effect of social frailty on HRQoL.[15] Thus, more studies on this topic are needed to clarify the association between the three domains of frailty and HRQoL.

Frailty is a common problem among older people, and study to explore the association between frailty and HRQoL could provide insight needed for further development of effective interventions to improve HRQoL.[16] It might provide professionals with starting points to optimize the (timely) choice of interventions and to establish tailored support for frail people at risk for suboptimal HRQoL. Understanding HRQoL in frail people could finally help policy makers develop more precise policies for healthy aging.

The aim of this study is to evaluate the association between physical, psychological and social frailty and HRQoL among community-dwelling older people in five European countries. We hypothesize that overall frailty is associated with poorer physical and mental HRQoL. Also, we hypothesize that physical frailty is associated with poorer physical HRQoL, psychological frailty with poorer mental HRQoL and social frailty with poorer physical and mental HRQoL.

Methods

Participants

This study was performed within the framework of the Urban Health Centers Europe (UHCE) project. The project was funded by the European Commission Executive Agency for Health and Consumers and aimed to promote healthy life styles, health and HRQoL of older people in the UK, Greece, Croatia, The Netherlands and Spain.[5] The recruitment procedure has been described in detail elsewhere.[5,17] In short, the pre-post controlled intervention study measured 2325 participants at baseline and 12 months later in 2015 and 2017. Persons were invited when they were at least 70 years, lived independently and were expected to be able to participate in the study for at least 6 months. Persons were excluded if they lacked the basic knowledge of local language or if they were not expected to be able to make an informed decision regarding participation in the project. Ethical committee procedures have been followed in all cities and approval has been provided.[5,17] Written informed consent was obtained from all participants.[5,17] The study was registered as ISRCTN52788952.

This study is a cross-sectional study using baseline data from UHCE project. Supplementary figure S1 presents the population of the present analysis. Participants with missing data on HRQoL (n = 127), frailty and the three domains of frailty (n = 27) and on age or sex (n = 4) were excluded. Hence, 2167 participants were included in the analyses of this study.

Procedure

The data collection was done by means of a questionnaire. A trained researcher conducted a face-to-face self-reported semi-structured interview at the home of the participant in UK, Croatia, The Netherlands and Spain. In Greece, the interview was taken at community centers and the Municipal health Center. More details could be found elsewhere.[5,17] The interview included, among others, the 12-Item Short-Form Health Survey (SF-12)[18] and the Tilburg Frailty Indicator (TFI).[19,20]

Frailty

The TFI is a questionnaire based on a multidimensional approach to frailty and was made and validated for use in primary care. Part B consist of 15 self-reported questions covering three domains: physical (eight items, score range 0–8), psychological (4; 0–4) and social frailty (3; 0–3).[19,20] Items have answer categories 0 (no) and 1 (sometimes or yes). Participants with total score of at least 5 were diagnosed as being frail.[19] The cut points for physical, psychological and social frailty were 3, 2 and 2, respectively.[19,21]

HRQoL

The SF-12 is a widely used patient-reported survey for measuring general HRQoL.[18] The SF-12 consists of 12 questions covering eight health domains, including general health, mental health, vitality, social functioning, role limitation due to physical health problems, role limitation due to emotional problems, bodily pain limiting usual activities and physical functioning. The eight domains of SF-12 can be summarized in the Physical Component Summary (PCS) and Mental Component Summary (MCS), both ranging from 0 (lowest) to 100 (highest level of health).[18,22]

Covariates

Various socio-demographic characteristics were assessed at baseline and incorporated as covariates,[23,24] including age (in years), sex and country. Education level concerned the highest level of education the participant completed and was categorized according to the 2011 International Standard Classification of Education (ISCED) into primary or less (ISCED 0–1), secondary or equivalent (ISCED 2–5) and tertiary or higher (ISCED 6–8). Living situation was categorized into living with others ('with partner, no child', 'with partner and children', 'without partner, with children' or 'in a household shared with others') or not living with others. With respect to life style, three aspects were measured. Firstly, three items of the AUDIT-C measured high-risk alcohol use on a scale ranging from 0 (lowest risk) to 12 (highest risk).[25] A score of 4 or more in men and a score of 3 or more in women indicate hazardous drinking or active alcohol use disorders.[25] Secondly, one item on exercise assessed the frequency of a person being engaged in activities that require low or moderate energy (once a week or less vs. more than once a week). Thirdly, one item on smoking assessed whether a person smoked. Finally, multi-morbidity was defined as having at least two of 14 common chronic conditions,[26] including heart attack, hypertension, diabetes, stroke, high blood cholesterol, asthma, arthritis,

osteoporosis, chronic lung disease, cancer or malignant tumor, stomach or duodenal ulcer, Parkinson's disease, cataract and hip or femoral fracture.[27]

Statistical analyses

In order to examine mean differences in PCS and MCS scores between frail and not frail groups, effect sizes were estimated by dividing the difference in mean scores between subgroups by the largest SD. Cohen's effect sizes (d) were used for the interpretation of relevant differences: $0.20 \leq d < 0.50$ was considered a small difference; $0.50 \leq d < 0.80$ was considered a moderate difference; $d \geq 0.80$ was considered a large difference.[28]

To control for the cluster effect of countries, we performed multilevel linear regression models as well as multivariate linear regression models, but found similar results (data not shown). Hence, we chose three multivariate linear regression models to investigate the independent contribution of frailty on HRQoL. PCS and MCS scores were included as the dependent variable. The first model regarded only frailty, physical, psychological or social frailty as determinant (*crude model*). The second model additionally included the covariates as determinants (*adjusted model*). To explore the contribution of the three domains of frailty on HRQoL, the third model included all three domains of frailty and the covariates as determinants (*full model*). Regression diagnostics included tests for linearity between the determinants and dependent variables and tests for normality of residuals with kernel density plots. Variance inflation factors were adopted for tests of multicollinearity. No violation of basic assumptions for regression and no multicollinearity problems were found.

Finally, we assessed interactions between frailty as well as three domains of frailty and socio-demographic variables including age, sex, country, education level and live situation in the association between frailty as well as three domains of frailty and HRQoL. UNIANOVA was adopted for interaction analyses. After applying Boneferroni correction for multiple testing ($P = 0.05/40 = 0.001$), no statistically significant interaction was found. All P-values of the interaction analyses are presented in Supplementary table S2.

Analyses were performed with SPSS version 23.0 (IBM SPSS Statistics for Windows, Armonk, NY: IBM Corp). A P-value <0.05 was considered as statistically significant.

Results

Participants characteristics

Table 1 summarizes the general characteristics of the study population. The mean age of participants was 79.7 (SD 5.6) years and 60.6% were female. Among the 2167 participants, 1195 (55.1%) were frail. Compared with participants who were not frail, frail participants were older ($P < 0.001$), more often female ($P < 0.001$), more often had a secondary or lower education level ($P < 0.001$), more often lived alone ($P < 0.001$), less often were at risk for alcohol use ($P < 0.001$), less often did exercise more than once a week ($P < 0.001$) and more often had multi-morbidity ($P < 0.001$).

Supplementary table S1 shows the general characteristics distributed by domain of frailty. Among the 2167 participants, 1173 (54.1%) were physically frail, 843 (38.9%) were psychologically frail and 629 (29.0%) were socially frail.

Table 1 Characteristics of study population (n=2167)

Items	Total (n = 2167) Mean ± SD *N* (%)	Frailty		
		Yes (n = 1195) Mean ± SD *N* (%)	No (n = 972) Mean ± SD *N* (%)	*P-value*
Age	79.7±5.6	80.4±5.8	78.7±5.3	**<0.001**
Sex				**<0.001**
Male	854 (39.4)	363 (30.4)	491 (50.5)	
Female	1313 (60.6)	832 (69.6)	481 (49.5)	
Country				**<0.001**
UK	537 (24.8)	248 (20.8)	289 (29.7)	
Greece	327 (15.1)	214 (17.9)	113 (11.6)	
Croatia	476 (22.0)	356 (29.8)	120 (12.3)	
The Netherlands	331 (15.3)	133 (11.1)	198 (20.4)	
Spain	496 (22.9)	244 (20.4)	252 (26.9)	
Education level[a]				**<0.001**
Primary or less	586 (27.3)	352 (29.8)	234 (24.3)	
Secondary or equivalent	1361 (63.5)	746 (63.2)	615 (63.9)	
Tertiary or higher	196 (9.1)	83 (7.0)	113 (11.7)	
Living situation[a]				**<0.001**
Living with others	1341 (62.0)	641 (53.8)	700 (72.1)	
Living alone	822 (38.0)	551 (46.2)	271 (27.9)	
Life style-alcohol[a]				**<0.001**
No alcohol risk	1520 (73.6)	903 (80.2)	617 (65.8)	
Alcohol risk	544 (26.4)	223 (19.8)	321 (34.2)	
Life style-exercise[a]				**<0.001**
Once a week or less	609 (28.3)	484 (40.9)	125 (12.9)	
More than once a week	1544 (71.7)	700 (59.1)	844 (87.1)	
Life style-smoking[a]				0.467
Not smoking	2005 (92.7)	1102 (92.4)	903 (93.2)	
Smoking	157 (7.3)	91 (7.6)	66 (6.8)	
Multi-morbidity[a]				**<0.001**
No	195 (9.0)	50 (4.2)	145 (14.9)	
Yes	1971 (91.0)	1145 (95.8)	826 (85.1)	

Note: Significant P-values in bold.

a: Missing items: Education level = 24; Living situation = 4; Life style-alcohol = 103; Life style-exercise = 14; Life style-smoking = 5; Multi-morbidity = 1.

SD, standard deviation.

Compared to persons included in the analysis (Supplementary figure S1; $n = 2167$), persons excluded due to missing information ($n = 158$) were more often smoker ($P = 0.01$) and had lower MCS scores ($P = 0.001$). No other significant differences were found between these two groups.

Table 2 Frailty and HRQoL scores (*n*=2167)

Items	HRQOL scores Mean ± SD	
	PCS	MCS
Total (*n*=2167)	41.77±12.07	50.27±10.70
Frailty		
Yes (*n*=1195)	36.62±11.84	46.10 ±11.22
No (*n*=972)	48.11±8.93	55.41±7.27
Effect size[b]	1.10[a]	0.98[a]
Physical frailty		
Yes (*n*=1173)	35.81±11.40	47.12±11.45
No (*n*=994)	48.81± 8.54	54.00±8.33
Effect size[b]	1.29[a]	0.69[a]
Psychological frailty		
Yes (*n*=843)	38.39±12.39	43.32±10.69
No (*n*=1324)	43.93±11.35	54.70±8.03
Effect size[b]	0.47[a]	1.20[a]
Social frailty		
Yes (*n*=629)	38.50±12.13	46.25±11.04
No (*n*=1538)	43.11±11.79	51.92±10.11
Effect size[b]	0.39[a]	0.54[a]

a: $P < 0.001$, *P*-values are based on independent *t*-test for frail and not frail groups.
b: Cohen's effect size (*d*) for differences in HRQOL between frail and not frail groups; $0.20 \leq d < 0.50$ is considered a small difference; $0.50 \leq d < 0.80$ a moderate difference; $d \geq 0.80$ a large difference.
SD, standard deviation.

Frailty and HRQoL

Table 2 presents the comparison of HRQoL scores among different frailty groups. Compared with participants who were not frail, frail participants had significantly lower scores for both PCS ($P < 0.001$) and MCS ($P < 0.001$) and the differences in physical HRQoL ($d = 1.10$) as well as mental HRQoL ($d = 0.98$) were large.

Participants who were physically, psychologically or socially frail had significantly lower scores for both PCS and MCS ($P < 0.001$).

With respect to physical HRQoL, a large difference ($d = 1.29$) between physically and not physically frail participants was observed, a small difference ($d = 0.47$) between psychologically and not psychologically frail participants and a small difference ($d = 0.39$) between socially and not socially frail participants.

Regarding mental HRQoL, a large difference ($d = 1.20$) between psychologically and not psychologically frail participants was observed and moderate differences between physically and not physically frail participants ($d = 0.69$) and between socially and not socially frail participants ($d = 0.54$).

Multivariate linear regression models

Table 3 presents the multivariate linear regression models for frailty and HRQoL. Being frail was significantly associated with lower HRQoL scores ($P < 0.001$). The associations were partly explained by the covariates. With respect to physical HRQoL, living in Greece (vs. Spain), having completed secondary education or equivalent (vs. tertiary education or higher) and smoking were not significantly associated. The amount of variance explained by the crude model was 23.2% and was 38.2% in the adjusted model. Regarding mental HRQoL, living in The Netherlands (vs. Spain), having completed secondary education or equivalent (vs. tertiary education or higher), high-risk alcohol use, smoking and multi-morbidity were not significantly associated. The amount of variance explained by the crude model was 19.3% and was 27.2% in the adjusted model.

Table 3 Multivariate linear regression model (frailty and HRQoL)

	PCS		MCS	
Items	Crude model	Adjusted model	Crude model	Adjusted model
Frailty				
Yes vs. No	**−11.69**[c]	**−8.49**[c]	**−9.47**[c]	**−7.30**[c]
Age		**−0.17**[c]		**0.13**[b]
Sex				
Female vs. male		**−1.55**[b]		**−1.18**[a]
Country				
UK vs. Spain		**−5.42**[c]		**−1.87**[a]
Greece vs. Spain		−0.12		**−1.86**[a]
Croatia vs. Spain		**−4.58**[c]		**−6.35**[c]
The Netherlands vs. Spain		**−5.43**[c]		0.19
Education level				
Primary or less vs. tertiary or higher		**−1.95**[a]		**−2.50**[b]
Secondary or equivalent vs. tertiary or higher		0.34		−1.35
Living situation				
Living alone vs. living with others		**1.22**[a]		**0.98**[a]
Life style				
Alcohol risk vs. no alcohol risk		**1.34**[b]		0.71
Exercise once a week or less vs. more than once a week		**−7.50**[c]		**−3.71**[c]
Smoking vs. not smoking		0.97		−0.25
Multi-morbidity				
Yes vs. No		**−4.64**[c]		0.09
Adjusted R^2, %	23.2	38.2	19.3	27.2

Note: The crude model is the unadjusted model with frailty as determinant.
The adjusted model is the adjusted model with frailty and the covariates as determinants.
a: $P < 0.05$.
b: $P < 0.01$.
c: $P < 0.001$, significant *P*-values in bold.

Table 4 Multivariate linear regression model (three domains of frailty and HRQoL)

Items	PCS							MCS						
	Crude model	Adjusted model	Crude model	Adjusted model	Crude model	Adjusted model	Full model	Crude model	Adjusted model	Crude model	Adjusted model	Crude model	Adjusted model	Full model
Frailty (yes vs. no)														
Physical frailty	**−13.06**[c]	**−9.94**[c]					**−9.71**[c]	**−7.04**[c]	**−4.08**[c]					**−1.50**[c]
Psychological frailty			**−5.65**[c]	**−3.21**[c]			−0.47			**−11.46**[c]	**−9.58**[c]			**−8.59**[c]
Social frailty					**−4.86**[c]	**−2.54**[c]	**−1.37**[a]					**−5.73**[c]	**−5.87**[c]	**−3.76**[c]
Age		**−0.15**[c]		**−0.26**[c]		**−0.26**[c]	**−0.15**[c]		**0.10**[a]		0.07		0.07	**0.09**[a]
Sex														
Female vs. male		**−1.33**[b]		**−2.31**[c]		**−2.68**[c]	**−1.33**[b]		**−1.59**[b]		**−1.11**[a]		**−2.20**[c]	**−1.07**[a]
Country														
UK vs. Spain		**−5.00**[c]		**−5.01**[c]		**−4.78**[c]	**−5.05**[c]		−1.40		**−2.06**[b]		−1.36	**−2.05**[b]
Greece vs. Spain		−0.54		−0.87		−1.19	−0.24		**−2.70**[c]		−0.92		**−2.16**[b]	−0.37
Croatia vs. Spain		**−4.09**[c]		**−5.32**[c]		**−5.58**[c]	**−3.88**[c]		**−6.74**[c]		**−5.80**[c]		**−6.77**[c]	**−5.25**[c]
The Netherlands vs. Spain		**−5.11**[c]		**−4.78**[c]		**−4.19**[c]	**−5.01**[c]		0.77		0.00		**1.59**[a]	0.35
Education level														
Primary or less vs. tertiary or higher		−1.29		**−2.27**[a]		**−2.60**[b]	−1.22		**−2.56**[b]		**−1.91**[a]		**−2.96**[b]	**−1.71**[a]
Secondary or equivalent vs. tertiary or higher		0.63		0.40		0.11	0.60		−1.30		−0.87		**−1.66**[a]	−0.98
Living situation														
Living alone vs. living with others		−0.29		−0.04		**1.30**[a]	0.36		−0.16		−0.33		**2.82**[c]	**1.46**[b]
Life style														
Alcohol risk vs. no alcohol risk		**1.00**[a]		**1.82**[b]		**1.98**[c]	**0.99**[a]		0.86		0.75		**1.24**[a]	0.64
Exercise once a week or less vs. more than once a week		**−7.07**[c]		**−9.12**[c]		**−9.48**[c]	**−6.96**[c]		**−4.50**[c]		**−3.98**[c]		**−5.17**[c]	**−3.51**[c]
Smoking vs. not smoking		1.23		0.33		0.39	1.16		−0.37		−1.05		−0.84	−0.99
Multi-morbidity														
Yes vs. no		**−4.58**[c]		**−6.23**[c]		**−6.24**[c]	**−4.46**[c]		−0.72		−0.77		−0.96	−0.21
Adjusted R^2, %	29.0	42.4	5.1	30.2	3.3	29.4	42.6	10.7	21.3	27.0	34.7	5.8	22.7	36.8

Note: The crude model is the unadjusted model with one domain of frailty (physical, psychological or social frailty) as determinant.
The adjusted model is the adjusted model with one domain of frailty (physical, psychological or social frailty) and the covariates as determinants.
The full model is the adjusted model with physical, psychological and social frailty and the covariates as determinants.
a: $P < 0.05$.
b: $P < 0.01$.
c: $P < 0.001$, significant P-values in bold.

Table 4 presents the multivariate linear regression models for the domains of frailty and HRQoL. Physical frailty had the strongest association with physical HRQoL. In the adjusted models, the mean PCS score of physically frail participants was 9.94 lower than that of not physically frail participants ($P < 0.001$). The mean PCS score of psychologically frail participants was 3.21 lower than that of not psychologically frail participants ($P < 0.001$) and the mean PCS score of socially frail participants 2.54 lower than that of not socially frail participants ($P < 0.001$). Among the three adjusted models, the amount of variance explained was largest for physical frailty (42.6%).

In the full model, only physical ($P < 0.001$) and social frailty ($P < 0.05$) remained significant. Living in Greece (vs. Spain), having completed primary education or less/secondary education or equivalent (vs. tertiary education or higher), living alone and smoking were not significantly associated with the PCS score.

Psychological frailty had the strongest association with mental HRQoL. In the adjusted models, the mean MCS score of physically frail participants was 4.08 lower than that of not physically frail participants ($P < 0.001$). For psychologically frailty this figure amounted to 9.58 ($P < 0.001$) and for social frailty to 5.87 ($P < 0.001$). Among the three adjusted models, the amount of variance explained was largest for psychological frailty (36.8%).

In the full model, physical, psychological and social frailty each remained significant ($P < 0.001$). Living in Greece or The Netherlands (vs. Spain), having completed secondary education or equivalent (vs. tertiary education or higher), high-risk alcohol use, smoking and multi-morbidity were not significantly associated with the MCS score.

Discussion

The aim of this study was to explore the association between physical, psychological and social frailty vs. HRQoL among community-dwelling older people in five Europe countries. Consistent with previous studies, our results show that frail people have a poorer physical and mental HRQoL than not frail people.[3,4,8,16,29] This also holds for physical, psychological and social frailty separately.[29,30]

Physical frailty

Our findings confirm that physical frailty has the strongest association with physical HRQoL. Also, the addition of physical frailty contributed to the ability of psychological frailty to explain mental HRQoL. A study in The Netherlands also found that the prevalence rate of physical frailty among depressed participants was higher than that of non-depressed participants, and physical frailty was associated with more severe depressive symptoms, which might because physical frailty may result in more severe mental disorders due to its association with chronic somatic disease and functional limitations.[31] However, studies on this topic are scarce, and studies on physical frailty and mental HRQoL are needed to confirm our findings.

Psychological frailty

Psychological frailty had the strongest association with mental HRQoL. However, psychological frailty did not contribute to the ability of physical frailty to explain physical HRQoL. The latter is in contrast to earlier studies,[10,15] which may be explained by the fact that previous studies adopted the WHOQOL-BREF instead of SF-12 to measure HRQoL and did not classify HRQoL into physical and mental HRQoL. More studies are still needed to clarify these findings.

Social frailty

Furthermore, this research found that social frailty contributed to the ability of physical frailty to explain physical HRQoL and to the ability of psychological frailty to explain mental HRQoL, which was not reported by previous studies. Some studies reported that poor social contact and support could influence HRQoL negatively.[10,32] A qualitative study for older people in The Netherlands found that 'when participants' health was poor, there was a shift from health to social contacts as the most important aspect to quality of life'.[33] Other studies proved that increasing social contact and social support were associated with better health behavior and HRQoL.[34,35] In frail people, where physical interventions are not practical, increasing social contact or social support to reduce social frailty could be a proper choice to positively influence HRQoL.[36] A previous study suggested that early identification and intervention can enable frail people to maintain control over their HRQoL for longer.[21] Our findings suggest that considering social frailty is important to improve both physical and mental HRQoL. They implicate that health professionals and policy makers should pay more attention to social frailty among older persons and could consider improving social support or social contact to improve HRQoL of older people in Europe in the future.

Our study has some limitations. Although we made use of two validated questionnaires, cultural differences in the interpretation of questions might still have caused some variation between countries. In addition, the SF-12 has been validated in UK, Greece, Croatia, The Netherlands and Spain,[37] but the TFI has not been validated in all the five countries yet. Currently, TFI is validated in The Netherlands[19] and Spain.[38] Nevertheless, our results indicate that the TFI is a suitable screening instrument for assessing overall frailty as well as the three domains of frailty in order to maintain or improve HRQoL. Secondly, we adopted cut points of frailty and its three domains instead of exact scores to explore the association between frailty and HRQoL which might cause information loss. However, we performed analyses on the association between exact frailty scores and HRQoL (see Supplementary tables S3 and S4). The only difference was that the score of social frailty was negatively associated with PCS score in the full model but no longer significant. All other significant results remained significant in the same direction. Thirdly, relatively healthy participants may have enrolled to the study which potentially caused selection bias. However, due to the inclusion of the rich data of 2327 participants at baseline, we do not expect that this limitation changed our findings. Finally, the cross-sectional design of this study did not allow to establish the causal relationship between frailty and HRQoL. Our results support the need for further research on evaluating the effects of frailty as well as the three domains of frailty on HRQoL.

Conclusion

Physical, psychological and social frailty each has a negative association with both physical and mental HRQoL. The addition of physical frailty contributed to the ability of psychological frailty to explain mental HRQoL. The associations between social frailty and both physical and mental HRQoL remain significant when controlling for physical and psychological frailty, which implicates the importance of improving social support or social contact to improve HRQoL. In summary, our results confirm the importance of considering the three domains of frailty to improve physical and mental HRQoL.

Supplementary data

Supplementary data are available at *EURPUB* online.

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Conflicts of interest None declared.

Key points

- Physical, mental and social frailty are negatively associated with HRQoL.
- The association between social frailty and HRQoL remains significant when controlling physical and psychological frailty.
- Health professionals and policy makers could consider improving social support or social contact among older people to improve their HRQoL in the future.

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