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The association between frailty and quality of life when aging in place

Patricia Vanleerberghe[a,*], Nico De Witte[a,b], Claudia Claes[a,c], Dominique Verté[b]

[a] Faculty of Education, Health and Social Work, University College Ghent, Valentin Vaerwyckweg 1, 9000 Ghent, Belgium
[b] Faculty of Psychology and Educational Sciences, Vrije Universiteit Brussel, Pleinlaan 2, 1050 Brussel, Belgium
[c] Faculty of Psychology and Educational Sciences, University Ghent, Henri Dunantlaan 2, 9000 Ghent, Belgium

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ABSTRACT

Background and objectives: Advanced age is often associated with frailty, which in turn is associated with low quality of life. This study explores to what extent multidimensional frailty is associated with multidimensional quality of life.

Material and methods: A cross-sectional survey study was conducted in a sample of 336 Flemish older people aging in place. Data were collected between 2014 and 2016 using two multidimensional self-reporting instruments; the Comprehensive Frailty Assessment Instrument to assess frailty and the World Health Organization Quality of Life Instrument-Short Version to assess quality of life. Bivariate analyses were used to explore the relationship between quality of life, associated factors of quality of life and frailty.

Results: The mean age of the respondents was 74.9 years and 71.7% were woman. An inverse correlation was found between frailty and quality of life ($r = -.683$) and the corresponding subdomains. Nevertheless, some respondents perceived their quality of life as high, although they were defined as mild to high frail. Further analysis indicated that neither socio-demographic factors nor being ill contributed to quality of life.

Discussion and implications: Psychological frailty contributed the most to quality of life. However, the results indicate that frailty does not inevitably leads to a lower quality of life and that other factors, besides frailty, play an important role in determining quality of life. Knowledge about these factors and their mutual relationship can help policymakers and services in providing client-centered care to increase or maintain the quality of life of people aging in place.

1. Introduction

Better living conditions and improvements in medicine and technology have increased longevity globally (United Nations, 2017). In Europe, this led to an increase of 2.4% of people aged 65 and over in the last decade and the latest demographic projections indicate that this trend will continue (Eurostat Statistics Explained, 2017). The United Nations forecast that in Europe, people aged 60 and over will reach 35% of the population in 2050 and 36% in 2100, compared to 25% in 2017. In addition to this, there is a progressive aging of the older population and the segment of very old people will grow even faster (United Nations, 2017). For 2080, the share of people aged 80 and over will more than double, i.e. from 5.4% in 2016 to 12.7% in 2080 (Eurostat Statistics Explained, 2017).

In Belgium 24.5% of the population is aged 60 and over and 5.5% is aged 80 and over (FOD Economie, 2016). Similar with other Western countries, the majority of Belgian older people live in their own familiar environment and prefer to stay there as long as possible (De Witte et al., 2012). The ability to remain in the current setting while aging is described by Cutchin (2003) as “aging in place”. The World Health Organization (WHO Centre for Health Development, 2004, p 13) broadens this concept by defining it as; ‘*meeting the desire and ability of people, through the provision of appropriate services and assistance, to remain living relatively independent in the community in his or her current home or an appropriate level of housing*’. Governments promote aging in place to prevent or delay (the high costs of) residential care (Sixsmith & Sixsmith, 2008). By offering a continuum of care, policies and services try to contribute to a good quality of life for older people aging in place. This current policy objective causes, however, a changing landscape of care, in which informal care, volunteers and homecare will play a more prominent role (Vandeurzen, 2014).

According to The WHOQOL Group (1998, p. 1570) quality of life is a multidimensional concept defined as “*individuals’ perception of their position in life in the context of the culture and value systems in which they*

* Corresponding author at: Keramiekstraat 80, 9000 Ghent, Belgium.
E-mail addresses: patricia.vanleerberghe@hogent.be (P. Vanleerberghe), nico.dewitte@hogent.be, nico.de.witte@vub.ac.be (N. De Witte), claudia.claes@hogent.be, claudia.claes@UGent.be (C. Claes), dverte@vub.ac.be (D. Verté).

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live and in relation to their goals, expectations and concerns. It is a broad ranging concept affected in a complex way by the persons' physical health, psychological state, level of independence, social relationships and their relation to salient features of their environment". Aging in place affects the quality of life of individuals positively (Bowling et al., 2003) because one's autonomy is preserved (Sixsmith & Sixsmith, 2008) as well as one's social connections (Horner & Boldy, 2008). In addition, older people feel attached to their home and neighborhood (Oswald, Jopp, Rott, & Wahl, 2011). However, there are some potential negative side effects that need to be considered. Internal and external factors such as weak health and lacking informal support, unfitting physical living conditions in the house as well as in the neighborhood, a poor social network and inadequate health- and social care can jeopardize an individual's quality of life. Consequently, aging in place becomes a challenge. Governments encouraging aging in place have the responsibility to monitor the quality of life of these older people (Vanleerberghe, De Witte, Claes, Schalock, & Verté, 2017). Often, advanced age is associated with frailty (Fried et al., 2001). Gobbens, Luijkx, and van Assen, (2013 p. 85) define frailty as: 'a dynamic state affecting an individual who experiences losses in one or more domains of human functioning (physical, psychological, social) that are caused by the influence of a range of variables and which increases the risk of adverse outcomes. Studies on the topic of frailty and quality of life indicate that both frailty and a low quality of life are connected with adverse outcomes such as institutionalization or even death (Bilotta et al., 2011; Fried, Ferrucci, Darer, Williamson, & Anderson, 2004; Sánchez-García, García-Peña et al., 2017). Mostly frailty is seen as a biomedical state and associated with health-related (Sánchez-García, Gallegos-Carrillo et al., 2017) or multidimensional quality of life (Bilotta et al., 2010; Chang & Wen, 2016; Henchoz, Büla, Guessous, & Santos-Eggimann, 2016; Kojima, Iliffe, Jivraj, & Walters, 2016; Kojima, Iliffe, Morris et al., 2016; Puts et al., 2007; Sánchez-García, Gallegos-Carrillo et al., 2017; Sánchez-García, García-Peña et al., 2017). All authors conclude that frailty correlates negatively with quality of life. However, more and more researchers emphasize the need to approach frailty in older people as a multidimensional concept where physical, psychological, social and environmental factors interact (Gobbens et al., 2013; Markle-Reid & Browne, 2003). In line with this, Gobbens and van Assen (2017) explored the association between multidimensional quality of life and frailty, the latter based on a model using physical, psychological and social indicators. They confirmed the negative correlation between frailty and quality of life. Within the context of aging in place, older adults' meaning of 'place' does not only cover the house but also the environment and has not only a physical or material, but also a social and symbolic dimension (Wiles, 2005). Recognizing the importance of the home and environment for older people and their impact on quality of life (Bowling et al., 2003; Gabriel & Bowling, 2004; Puts et al., 2007) within the context of aging in place De Witte et al. (2013) developed the Comprehensive Frailty Assessment Instrument (CFAI), a multidimensional model consisting of a physical, psychological, social and environmental component of frailty.

Although there is consensus on the negative correlation between quality of life and frailty, environment as component of frailty, was not yet included in any research. The objective of this study is to explore the relationship between multidimensional frailty (i.e. physical, psychological, social and environmental frailty) and multidimensional quality of life (i.e. physical, psychological, social and environmental quality of life) in older people aging in place. Considering the risk of adverse outcomes of frailty in older adults' aging in place, its impact on quality of life and acknowledging the role of the environment within this context we hypothesize that comprehensive frailty, with environment as a component, correlates negatively with the quality of life of older people aging in place. In this study we used two multidimensional instruments; the Comprehensive Frailty Assessment Instrument (CFAI) developed by De Witte et al. (2013) and the World Health Organization Quality of Life Instrument- Short Version (WHOQOL-BREF) by the WHO (Harper & Power, 1998; Skevington, Lofty, & O'Connell, 2004). To the best of our knowledge this is the first research focusing on frailty and quality of life in older people aging in place using two instruments both containing physical, psychological, social and environmental components.

2. Material and methods

2.1. Study population and data collection

A cross-sectional survey study was conducted, and the respondents were collected based on convenience sampling. From October 2014 till October 2016 students nursing ($N = 327$) enrolled in the first year and students occupational therapy ($N = 38$) enrolled in the second year of the bachelor program at University College Ghent, Faculty of Education, Health and Social Work participated in this research. As part of the nursing education and to increase the reliability of the results they received training in interviewing, including in the use of the questionnaires to be used. They were asked to select participants for this research, based on a proposed profile. The inclusion criteria were: people who were aging in place of at least 60 years old. The exclusion criteria were being a relative and living in a residential care setting. The students interviewed the respondents about demographic- and health variables and offered the WHOQOL and CFAI to fill in. If necessary, they helped the respondent to complete the questionnaires by reading the questions literally and explaining the response options.

This study was conducted according to the ethical guidelines laid down in the Declaration of Helsinki. As the research only comprises a self-reporting questionnaire, which had a low actual burden and no experiments were conducted, ethical approval was not necessary. Moreover, from each individual a confidentiality agreement and informed consent was obtained.

2.2. Measures

2.2.1. Description of the socio-demographic variables

Socio-demographic variables such as gender, age and living situation (with partner, family, others or alone) were questioned. The health status was determined by the question: 'Are you currently ill?' and the answer options were yes or no (World Health Organization, 1996). The respondents were divided into three age groups; young old (60–74) old old (75–84) and oldest old (≥ 85) as defined by the WHO (WHO Centre for Health Development, 2004).

2.2.2. Description of Comprehensive Frailty Assessment Instrument

Frailty was assessed by the Comprehensive Frailty Assessment Instrument (CFAI) which was developed to screen frailty in a multidimensional way by De Witte et al. This self-administrated instrument comprises 23 items capturing the physical domain (four items), the psychological domain (eight items), the social domain (six items) and environment (five items). For the physical domain the participants general health is assessed where for the psychological domain mood-disorders and emotional loneliness are captured. The social domain is measured by social loneliness and the received social support. Additionally, this instrument assesses the environmental domain by statements on the participants housing and environmental condition. The maximal score on the different domains is 25. The CFAI has shown good psychometric properties (De Witte et al., 2013). A full description of the instrument can be found in De Witte et al. (2013). The total CFAI score was computed after calculating the domain scores and summing the latter. This results in a score ranging from 0 to 100, where a high score refers to more frailty. Additionally, the participants were categorized into no-low, mild and high frailty, by using cut-offs for each domain (De Witte et al., 2018).

Table 1
Comparison of the domains questioned by CFAI and WHOQOL-BREF.

CFAI	WHOQOL-BREF
Physical domain (4 items)	Physical health (7 items)
Psychological domain (8 items)	Psychological health (6 items)
Social domain (6 items)	Social relationship (3 items)
Environment (5 items)	Environment (8 items)

2.2.3. Description of the Dutch version of WHOQOL-BREF

The Dutch version of the World Health Organization Quality of Life Instrument-Short Version or WHOQOL-BREF was used to screen quality of life in a multidimensional way. We chose the WHOQOL-BREF as it is a person-oriented, multilingual tool for subjective assessment of quality of life. Furthermore, it has a multi-dimensional profile, is designed for generic use and has been cross-cultural validated (Skevington, Lofty, & O'Connell, 2004). This self-administrated instrument comprises 26 items: twenty-four items capturing physical health (seven items), psychological health (six items), social relationships (three items), and environment (eight items) and two questions on overall quality of life and general health. The WHOQOL-BREF total with minimum 24 and maximum 100 can be obtained after calculating the domain scores, where a high score refers to a high quality of life. The WHOQOL-BREF has shown good psychometric properties (Skevington et al., 2004; Trompenaars, Masthoff, Van Heck, Hodiamont, & De Vries, 2004). A full description of the Dutch instrument can be found in De Vries and Van Heck (1996).

As previously mentioned, the CFAI and the WHOQOL-BREF assess the same domains, only the number of items differ, as can be seen in Table 1.

2.3. Statistical strategies

All responses were entered in an online survey tool, Qualtrics. First the total scores of the CFAI and the WHOQOL-BREF were calculated, and the physical, psychological, social and environmental subdomains scores for both instruments. Second, the characteristics of the respondents were determined by calculating means (normal distribution), medians (non-normal distribution) and standard deviations. Third Pearson and Spearman's rank correlation coefficients were calculated to examine the correlation between frailty and quality of life (CFAI and WHOQOL-BREF) and between the subdomains of quality of life and frailty. Forth, the respondents were classified as "no-low" frailty, "mild" frailty and "high" frailty in accordance with the classification of De Witte et al. (2018). This classification was created by using a two-step cluster analysis enabling the determination of cut-offs. Fifth, as previous research on frailty and quality of life pointed towards differences between age-(Pereira de Paiva, Pegorari, Nascimento, & da Silva Santos, 2016) and gender groups, we investigated whether these differences also occurred in this sample of Flemish people aging in place. The total scores on CFAI and WHOQOL-BREF were used as dependent variables. The independent variables of interest were gender, age group and degree of frailty. The group differences were explored using independent-samples t-tests (two groups) and one-way ANOVA (three groups). If a main effect was found in the latter, a post hoc Scheffe test was performed. Sixth, a multiple linear regression was carried out to identify the contribution of different independent variables. WHOQOL-BREF total and the four subdomains were used as dependent variables, the four frailty components and the four sociodemographic factors were used as independent variables. Dummies were created for the nominal variables gender ("1" man and "0" woman), living situation ("1" living with partner, family or others and "0" otherwise) and being ill ("1" yes and "0" no). All independent variables were included in the model at the same time and the adjusted coefficient of determination R^2_{adj} was calculated. The significance level was set at $p < 0.05$. All analyses were performed using IBM SPSS Statistics 25 (IBM, SPSS, Armonk, NY: IBM Corp).

Table 2
Characteristics of respondents.

Characteristics	n (%)
Gender, % of woman	241 (71.7)
Marital state	
Single	34 (10.1)
Married	156 (46.4)
Cohabiting	20 (6)
Living apart	2 (0.6)
Divorced	14 (4.2)
Widowed	110 (32.7)
Living situation	
Partner	175 (57.9)
Family	16 (5.3)
Others	28 (9.3)
Alone	83 (27.5)
Illness, % yes	58 (17.3)
Age: mean, ± *SD*, range	74.9, 6.5, 63-92

3. Results

3.1. Respondents characteristics

The questionnaire was completed by 336 respondents with a response rate of 95.7%. The age of the respondents was 74,9 ± 6.5 years old (range 63–92) and 71,7% was female. After dividing the respondents ($N = 277$) into age categories, 138 (49.8%) of them belonged to the youngest old, 110 (39.7%) to the old old and 29 (10.5%) to the oldest old group.

Regarding the marital status, almost half of the respondents (46.4%) was married and about a third (32.7%) was widowed. As to living situation, more than a quarter (27.5%) lived alone while the rest (72.5%) lived with partner, family or others. Concerning the health status, a small part of the respondents (17.3%) answered to be currently ill. Details about these characteristics are displayed in Table 2.

3.2. Scores on quality of life and frailty

The respondents had a mean score of 73.5 for quality of life (WHOQOL-BREF total) with a minimum of 37.4 and a maximum of 97.3. Regarding the scores on the subdomains, the mean scores were highest within the environmental domain ($M = 78.5$). For the psychological and social domain, the mean scores were 73.1 and 73.0 respectively. The lowest mean was found within the physical domain ($M = 69.5$). The respondents had a mean score of 24.5 on frailty (CFAI total) with a minimum of 1 and a maximum of 65.7. Concerning the subdomains of frailty (maximum 25 per domain), the highest score was found within the social domain ($M = 9.1$) and physical domain ($M = 8.0$) and the lowest within the psychological ($M = 4.6$) and the environmental domain ($Mdn = 2.7$). An overview of the scores on WHOQOL-BREF and CFAI is presented in Table 3.

3.3. Different scores on CFAI and WHOQOL-BREF between groups

3.3.1. Age

Concerning age, no significant statistical difference in total quality of life score was found ($F(2, 274) = 0.57$, $p = .565$). As can be seen in Fig. 1, the age groups have comparable medians, but different ranges for the young old [45.8–97.3], old old [37.4–93.7] and oldest old [55.28–88.73]. The smallest variability can be noticed within the oldest old, which indicates that the scores in latter group are more homogenous.

Focusing on frailty, a statistically significant difference was found

Table 3
Scores on WHOQOL-BREF and CFAI.

Scores	
Quality of life assessed with the WHOQOL-BREF	
QOL total (0-100), mean ± *SD*	73.5, ± 10.5
Physical domain (0-100), mean ± *SD*	69.5, ± 15.8
Psychological domain (0-100), mean ± *SD*	73.1, ± 11.9
Social domain (0-100), mean ± *SD*	73.0, ± 14.5
Environmental domain (0-100), mean ± *SD*	78.5, ± 12.5
Frailty assessed with the CFAI	
Frailty total (0-100), mean ± *SD*	24.5, ± 13.9
Physical frailty (0-25), mean ± *SD*	8.0, ± 8.6
Psychological frailty (0-25), mean ± *SD*	4.6, ± 4.3
Social frailty (0-25), mean ± *SD*	9.1, ± 4.2
Environmental frailty (0-25), median ± *SD*	2.7, ± 3.9

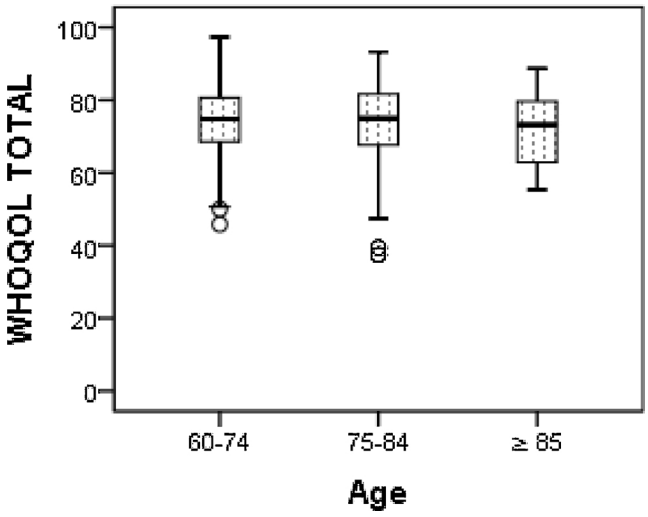

Fig. 1. Box plots of WHOQOL total score by different age groups.

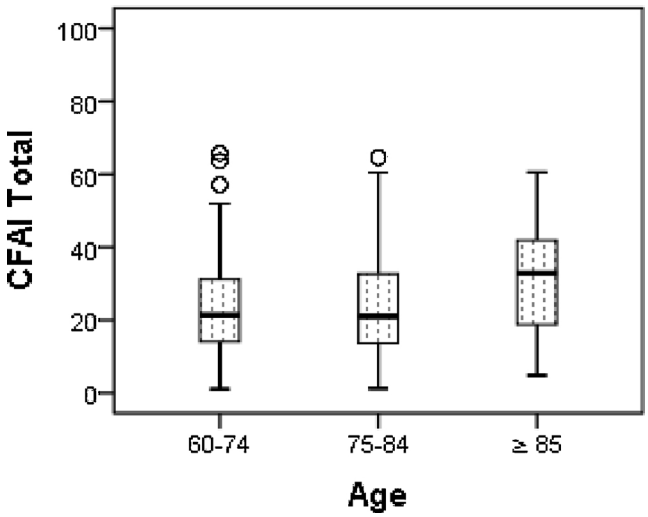

Fig. 2. Box plots of CFAI total score by different age groups.

between the age-groups ($F(2, 272) = 3.11$, $p = .046$). Moreover, as can be observed in Fig. 2, the variability is quite similar between the groups, but the medians are different. The youngest old score significant lower on frailty ($M = 23.47$, $SD = 13.38$) than the oldest old ($M = 30.63$, $SD = 14.87$).

3.3.2. Gender

For gender, independent *t*-test displayed differences in quality of life

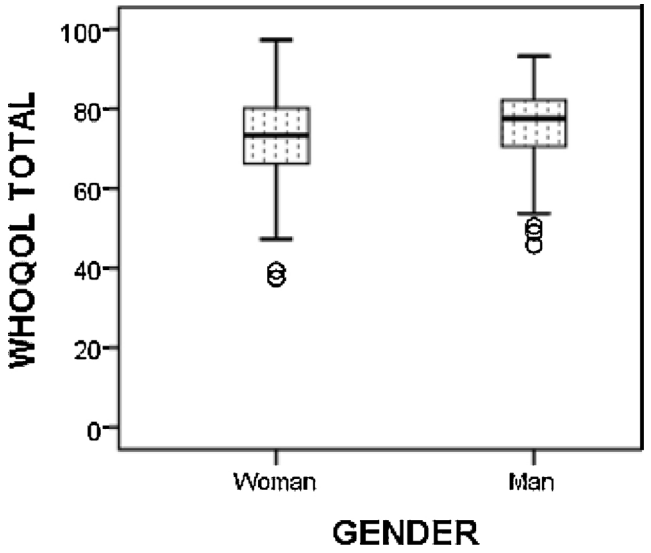

Fig. 3. Box plots of WHOQOL total score by different gender groups.

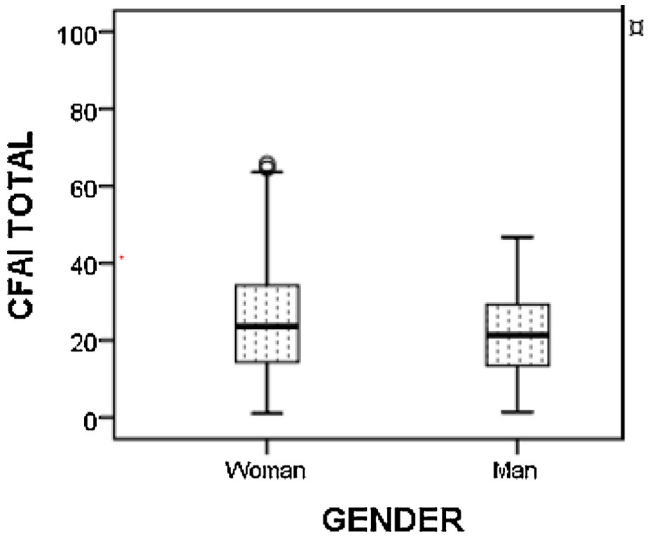

Fig. 4. Box plots of CFAI total score by different gender groups.

($t(334) = -2.37$, $p = .019$) and in frailty ($t(228) = 3.04$, $p = .003$), as can be seen in Figs. 3 and 4. Women score significant higher on frailty ($M = 25.73$, $SD = 14.72$) than man ($M = 21.25$, $SD = 10.92$) and reversely score lower on quality of life ($M = 72.67$, $SD = 10.62$) than man ($M = 75.68$, $SD = 10.27$).

3.3.3. Degree of frailty

After applying the cut-offs for the total frailty score, respondents were divided into three groups; no – low frailty ($n = 164$), mild frailty ($n = 115$) and high frailty ($n = 55$). Between these, we found a statistically significant difference in quality of life ($F(2, 331) = 104.7$, $p < .001$). As can be seen in Fig. 5, the no – low frailty group scored higher ($M = 79.12$, $SD = 7.95$) on quality of life than the mild frail ($M = 71.43$, $SD = 8.44$) and the high frail ($M = 60.83$, $SD = 9.10$).

Finally, we explored the differences in quality of life within the four subdomains of frailty. The graphical representation can be found in Fig. 6, the details are reported in Table 4.

It can be noted that the higher the degree of frailty, the lower the mean scores are in quality of life. This is most pronounced for the psychological domain of frailty.

The no-low frail respondents score significantly higher ($p < .001$) on quality of life than the mild and high frail respondents for all

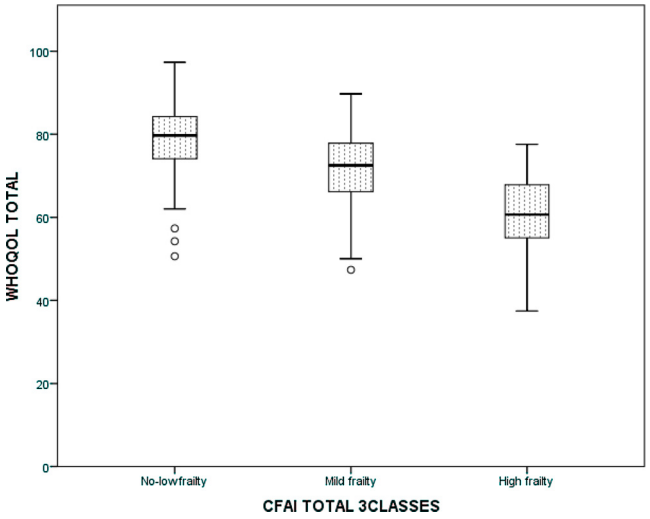

Fig. 5. Boxplots of WHOQOL total score by groups with different degree of frailty.

subdomains. Taking a closer look at Fig. 6 we can notice that, for the environmental domain, a large variability can be noted. This points towards the fact that, although the respondents are mild or high frail, some score high (92.67) on quality of life.

3.4. Correlations between quality of life and frailty

After calculating Pearson's correlation coefficient, a negative correlation between quality of life and frailty was found ($r = -.683$). Negative correlations were also found between the subdomains of QOL and frailty, and all were significant ($p < .001$). This implies that high scores on frailty corresponds with low scores on quality of life. The strongest correlation was found between the physical domains ($r = -.602$) of both measures, whereas the social domains have the weakest correlation ($r = -.353$). Between subdomains, the highest significant negative correlation was found between psychological frailty and the environmental domain of quality of life ($r = -0.472$). The correlations between WHOQOL and CFAI and the different subdomains are presented in Table 5 and illustrated in Fig. 7.

3.5. Multiple linear regression

Based on these analyses demonstrating an inverse association between quality of life and frailty, we explored the contribution of the independent variables age, gender, living together, being ill, physical, psychological, social and environmental frailty on quality of life, using a multiple linear regression. The results of these regression analyses are presented in Table 6.

The eight factors used in the model accounted for 51.4% of the variance of quality of life total. The sociodemographic factors (age, gender, living with partner, family or others) and being ill did not contribute to the quality of life total. The significant variables that contributed are physical frailty ($\beta = -.312$, $p < .001$), psychological frailty ($\beta = -1.095$, $p < .001$), social frailty ($\beta = -.412$, $p = .001$) and environmental frailty ($\beta = -.40$, $p = .001$). We noted that psychologically frailty had the highest regression coefficient, which emphasizes the impact on quality of life total. An increase in the score for psychological frailty by 1-point results in a decrease in the score on the quality of life total by 1.095. For the physical domain of quality of life these factors accounted for 50.1% of the variance. In this model only "being ill" ($\beta = -8.246$, $p < .001$), physical frailty ($\beta = -.879$, $p < .001$), and psychological frailty ($\beta = -.888$, $p < .001$) contributed significant. This model stresses the impact of "being ill" on the physical domain of quality of life because it decreases the score on this domain by 8.246. For the psychological domain of quality of life these factors accounted for 35.4% of the variance. In this model only physical frailty ($\beta = -.187$, $p = .016$), psychological frailty ($\beta = -1.315$, $p < .001$) and social frailty ($\beta = -.346$, $p = .023$) contributed significant to this domain. This model stresses the impact of being psychological frail on the psychological domain of quality of life because an increase in the score for psychological frailty by 1-point results in a decrease in the score on this domain by 1.314. For the social domain of quality of life these factors accounted for 27.2% of the variance. In this model only psychological frailty ($\beta = -1.327$, $p < .001$) and social frailty ($\beta = -.862$, $p < .001$) contributed significant to this domain. This model stresses the impact of being psychological frail on the social domain of quality of life because an increase in the score for psychological frailty by 1-point results in a decrease in the score on this domain by 1.327. For the environmental domain of quality of life these factors accounted for 35.1% of the variance. In this model only physical frailty ($\beta = -.195$, $p = .018$), psychological frailty ($\beta = -.852$, $p < .001$), social frailty ($\beta = -.362$, $p = .025$) and environmental frailty ($\beta = -.951$, $p < .001$) contributed significant to this domain. This model stresses the impact of being environmental frail on the environmental domain of quality of life because an increase in the score for environmental frailty by 1-point results in a decrease in the score on this domain by .951.

To summarize, the presented models indicate that frailty components are the only components to contribute to quality of life total. Sociodemographic variables do not contribute to quality of life except for "being ill" witch impacts only on the physical domain of quality of life. Environmental frailty only contributes to the environmental domain of quality of life while physical and social frailty contribute to three out of four domains of quality of life. Psychological frailty is the only component that contributes to all domains of quality of life.

4. Discussion

The present cross-sectional study examined the correlation between two closely linked multidimensional concepts; quality of life and frailty, in a sample of 336 Flemish older people aging in place. To do this, two validated multidimensional assessment instruments were used; the WHOQOL-BREF and the CFAI. To the best of our knowledge, this is the first time the association between these two concepts consisting of four

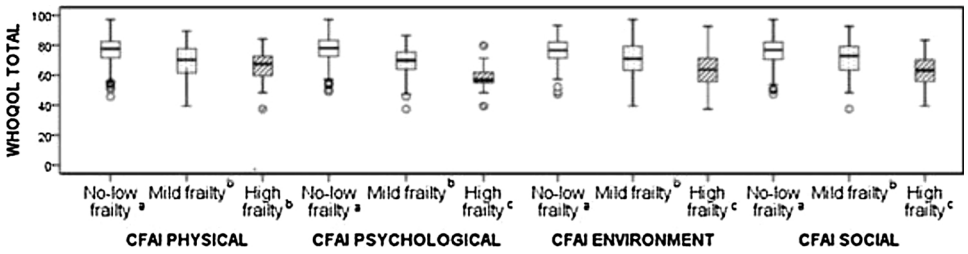

Fig. 6. Box plots of WHOQOL total score on the subdomains of frailty by groups with different degree of frailty.
Note: When no-low, mild and high frailty within the same domain do not share the same superscript, a significant difference was found at $p < .001$.

Table 4
Overview of WHOQOL total score on the subdomains of frailty by groups with different degree of frailty.

Subdomain CFAI	No-low frailty	Mild frailty	High frailty	Significance
Physical	M = 76.97	M = 69.16	M = 65.61	$F(2, 332) = 37.36$,
	SD = 9.19	SD = 10.26	SD = 10.24	$p < .001$
Psychological	M = 77.53	M = 69.06	M = 58.21	$F(2, 332) = 72.77$,
	SD = 8.75	SD = 9.33	SD = 7.87	$p < .001$
Social	M = 76.36	M = 71.19	M = 63.36	$F(2, 331) = 21.72$,
	SD = 9.47	SD = 10.45	SD = 11.34	$p < .001$
Environmental	M = 76.45	M = 70.77	M = 64.34	$F(2, 332) = 25.70$,
	SD = 8.71	SD = 11.45	SD = 11.02	$p < .001$

domains was explored. Previous findings identified the environmental domain as important to older people aging in place and was therefore retained in the assessment of quality of life by the World Health Organization. In line with this, the environmental domain was recently added as a domain of frailty in frailty assessment (De Witte et al., 2013).

The results of this study reinforce earlier findings on the consistent inverse correlation between quality of life and frailty (Bilotta et al., 2010; Chang & Wen, 2016; Henchoz et al., 2016; Kojima, Iliffe, Jivraj et al., 2016; Kojima, Iliffe, Morris et al., 2016; Puts et al., 2007; Sánchez-García, Gallegos-Carrillo et al., 2017; Sánchez-García, García-Peña et al., 2017), where a high score on frailty was associated with a low score on quality of life. Moreover, the degree of frailty turned out to make a significant difference in quality of life; the more severe frail the respondents were, the lower their score on quality of life. Kojima, Iliffe, Jivraj et al. (2016); Kojima, Iliffe, Morris et al. (2016) noted that less frail older people not only had a better quality of life at baseline, but also showed an improved quality of life over time, unlike frailer older people, whose quality of life was lower at baseline and continued to decline. The latter is a rationale for early detection of frailty in older people aging in place and this to stabilize or even reverse it, given its negative impact on quality of life. Next, we found a significant inverse correlation between the corresponding domains of quality of life and frailty. This negative correlation was found to be the strongest between the physical domains and the weakest between the social domains. Moreover, we noticed the strongest inverse correlation between psychological frailty and quality of life, which not only emphasizes that psychological frailty is an important issue within aging in place but is, to some extent, in line with the findings of De Witte et al. (2013), who found that the psychological domain added the most to the overall level of frailty.

The latter, along with our findings, may suggest that the psychological domain has a more prominent role than assumed, even more prominent than the physical domain, which is most documented. However, in their literature review of quality of life of older people aging in place, Vanleerberghe et al. (2017) noted that the psychological domain received little attention since it was least documented. Bearing this in mind, we recommend paying more attention to the psychological domain when caring for older people. With advanced age, higher scores on frailty were found, which is in line with the conclusions of Netuveli and Blane (2008). However, in respect to quality of life, we noticed that the older participants did not differ from the younger ones, which makes our results in line with Pasculin, Vianna, and Molzahn (2009) who reported a higher quality of life in the oldest participants compared with younger participants and in contrast to Pereira de Paiva et al. (2016) who reported old age associated with low quality of life.

After a more thorough investigation into the contribution of the associated factors of quality of life e.g. frailty, age, gender, living situation and health we concluded that only physical, psychological, social and environmental frailty impacted on quality of life (total). The impact of age was limited to the physical domain of quality of life. The earlier finding about the prominent role of psychological frailty was strengthened in view of its important contribution to all subdomains and total quality of life while physical, social and environmental frailty contributed respectively to three, two and one subdomain(s).

Generally, it is assumed that age inevitably implies decreased quality of life because of increasing frailty. This assumption fits completely into the deficit model were aging is seen as an irreversible decline. However, in this study, frailty explained 51.4% of the variance in quality of life. This points to the fact that both concepts, although closely related, differ to some extent. Consequently, it can be concluded that frailty does not inevitably leads to a lower quality of life. Some of the respondents perceived a good quality of life, although they were defined as mild and high frail. This finding was the clearest for the environmental domain but was also found for the other frailty domains. This phenomenon, where older persons experience high levels of wellbeing regardless of age-related declines, is known as the well-being paradox. Our results are in line with Dury et al. (2018), pointing towards the fact that older people use strengths to compensate their frailty to maintain their quality of life. The findings suggest that many other individual factors, such as coping and resilience, could play an important role in determining quality of life. Therefore, further research on factors determining quality of life of frail older people aging in place is recommended. Furthermore, an assessment instrument, tailored to the situation of older people aging in place should be developed and validated.

4.1. Strength and limitation

The aim of this study was to identify the association between frailty

Table 5
Overview of the correlations between quality of life and frailty.

	Physical frailty	Psychological frailty	Social frailty	Environmental frailty	Frailty total
QOL physical	−**.602*****	−.453***	−.250***	−.263***	−.664***
QOL psychological	−.267***	−**.579*****	−.325***	−.242***	−.517***
QOL social	−.128*	−.444***	−**.353*****	−.188**	−.383***
QOL environment	−.275***	−.472***	−.337***	−**.403*****	−.541***
QOL total	−.424***	−.622***	−.404***	−.352***	−**.683** ***

*$p < .05$.
** $p < .01$.
*** $p < .001$.

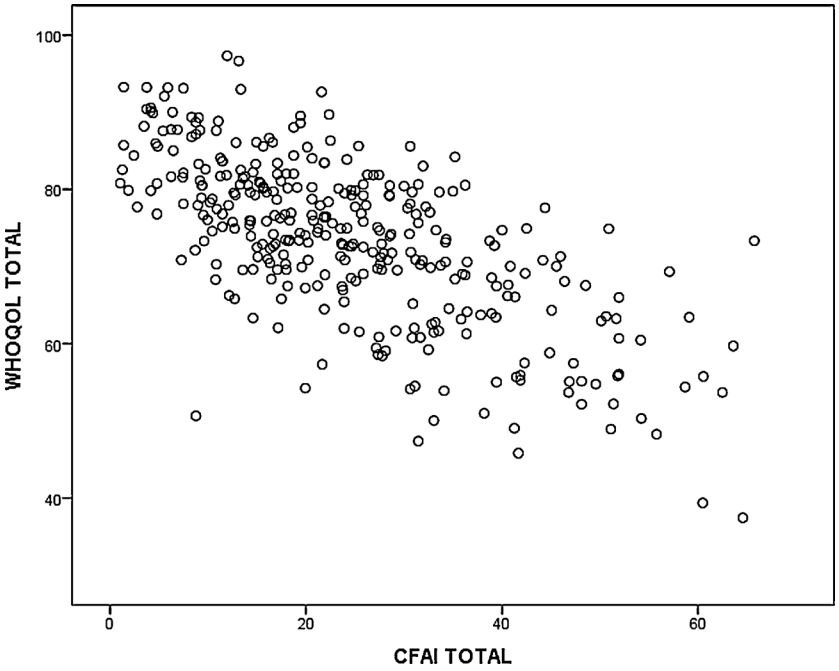

Fig. 7. Scatterplot for Frailty total and WHOQOL total.

and quality of life. The strength of this study is that this is the first time two concepts, containing the same domains, have been investigated in older people aging in place. Furthermore, the relation between the corresponding subdomains of the two concepts was explored. However, some limitations should be taken into account. A first limitation is that a convenience sample was used. Secondly, the cross-sectional nature of the data implies that no causality can be determined (Field, 2009). Also the use of students can, to some extent, be seen as a weakness as we have no data on comparability or reliability. However, the fact that both instruments are self-administered and that the students received training in interviewing and the use of the instruments, may have reduced their impact to a minimum given that our results are in line with earlier research.

A final limitation is the relatively low sample size. In order to obtain more evidence, future studies on the association of these two concepts should use a larger dataset.

5. Conclusion

This study was conducted to contribute to the body of knowledge concerning quality of life and frailty, in particular to identify the association between the two closely linked concepts. By using two multidimensional instruments we explored quality of life and frailty on the same domains. Although there is, to some degree, some overlap between the two concepts, which bring us closer to understanding the relationship between these concepts, further research is necessary to determine which factors contribute to quality of life within frail older people. Understanding these associations can help policymakers and services in providing client-centered care to increase or maintain the quality of life of people aging in place.

Declaration of competing interest

The authors declare that they have no conflict of interest.

Ethical approval

Because no experiments on humans were conducted, no ethics committee was involved.

Table 6
Multiple linear regression models for quality of life scores (WHOQOL-BREF) in relation to sociodemographic variables and frailty components.

WHOQOL-BREF										
Variables	QOL Total		Physical domain		Psychological domain		Social domain		Environmental domain	
	R^2_{adj} = .514 p < .001		R^2_{adj} = .501, p < .001		R^2_{adj} = .354 p < .001		R^2_{adj} = .272 p < .001		R^2_{adj} = .351 p < .001	
	β	p	β	p	β	p	β	p	β	p
Age	.070	.334	.046	.675	.081	.380	.099	.415	.055	.574
Gender/man	-.024	.982	-.546	.728	1.626	.224	−3.366	.056	1.289	.366
Living with partner, family or others	.978	.349	1.142	.465	.852	.521	.183	.916	1.735	.221
Being ill	−2.206	.088	−8.246	< **.001**	.241	.883	1.001	.642	−1.821	.298
Physical frailty	-.312	< **.001**	-.879	< **.001**	-.187	**.016**	.012	.908	-.195	**.018**
Psychological frailty	−1.095	< **.001**	-.888	< **.001**	−1.315	< **.001**	−1.327	< **.001**	-.852	< **.001**
Social frailty	-.412	**.001**	-.076	.671	-.346	**.023**	-.862	< **.001**	-.362	**.025**
Environmental frailty	-.40	**.001**	-.225	.238	-.125	.438	-.311	.143	-.951	< **.001**

R_{adj}^2 = Adjusted coefficient of determination; β = Unstandardized linear regression coefficients.

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