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Title: Identifying frailty risk profiles of home-dwelling older people: Focus on sociodemographic and socioeconomic characteristics

Abstract

Objectives. This paper investigates risk profiles of frailty among older people, as these are essential for detecting those individuals at risk for adverse outcomes and to undertake specific preventive actions. Frailty is not only a physical problem, but also refers to emotional, social, and environmental hazards.

Methods. Using data generated from the Belgian Ageing Studies, a cross-sectional study ($n=28,049$), we tested a multivariate regression model that included sociodemographic and socioeconomic indicators as well as four dimensions of frailty, for men and women, separately.

Results. The findings indicated that for both men and women, increased age, having no partner, having moved house in the previous 10 years, having a lower educational level and having a lower household income are risk characteristics for frailty. Moreover, when looking at the different frailty domains, different risk profiles arose, and gender-specific risk characteristics were detected.

Discussion. This paper elaborates on practical implications, and formulates a number of future research recommendations to tackle frailty in an aging society. The conclusion demonstrates the necessity for a thorough knowledge of risk profiles of frailty, as this will save both time and money and permit preventive actions to be more individually tailored.

Key-words

Frail Older Adults, Frailty, Multiple Linear Regressions, Populations at Risk, Risk Factors

Introduction

The world's population has been aging intensely over the last few decades (United Nations, 2013). The rising proportion of older persons in the total population has profound consequences on a wide range of social, economic, and political processes (Börsch-Supan et al., 2013; Kowal et. al., 2012). Therefore, in most developed countries, care for older people is an increasing priority for governments, with approaches such as “active aging” and “aging in place” gaining more and more support (Walker & Maltby, 2012). In line with these approaches, governments are making efforts to implement projects that help and motivate older people to remain living at home in order to prevent or delay the high costs of institutionalization (Scharlach, 2011). Aging in place is not only a governmental policy objective but also the preference of most older adults themselves (Löfqvist, 2013). As a consequence, both frail and non-frail older people are increasingly living at home for as long as possible and desirable (Löfqvist, 2013).

Frailty is an emerging concept that is often used in research as a (clinical) phenotype (Fried, 2001) or an accumulation of health deficits (Etman, Burdorf, Van der Cammen, Mackenbach, & Van Lenthe, 2012; Rockwood, Fox, Stolee, Robertson, & Beattie, 1994). Yet older people themselves, as well as researchers, perceive frailty not only as a physical problem, but also as emotional, social, and environmental issues (De Witte et al., 2013; Grenier, 2007). More recently, multidimensional approaches have defined frailty as “*a dynamic state that affects an individual who experiences losses in one or more domains (physical, psychological, social, and more recently, also environmental) (De Witte et al., 2013), which is caused by the influence of a range of variables and which increases the risk of adverse outcomes*” (De Lepeleire, Iliffe, Mann, & Degryse, 2009; Gobbens, van Assen, Luijkx, Wijnen-Sponselee & Schols, 2010). Physical frailty refers to a wide range of physical problems such as reduced endurance, mobility or physical activity (Fried et al., 2004; Studenski et al., 2004). A recent consensus group consisting of delegates from six major international, European, and US societies defined physical frailty as “*a medical syndrome with multiple causes and contributors that is characterized by diminished strength, endurance, and reduced physiologic function that increases an individual's vulnerability for developing increased dependency and/or death.*” (Morley et al., 2013, p. 393). Psychological or emotional frailty include depressive symptomatology and

negative affects, anxiety, or sadness (Bravell et al., 2011). Social frailty encompasses a lack of social support, the absence of emotionally rewarding social contacts or loneliness (Steverink, Slaets & Schuurmans, 2001), while environmental frailty includes frailty in terms of poor-quality housing and deprived living environments (De Witte et al., 2013).

Frailty has a negative impact on the independency and self-reliance of older people, and as a consequence, affects their ability to live self-reliantly at home (Buckinx, 2015). In order to be able to remain living at home for as long as possible, frailty needs to be detected in a timely manner, and the negative consequences have to be minimized. Therefore, an investigation of risk profiles leading to frailty in general and its different domains in particular (physical, psychological, social, and environmental) is essential for targeting those older individuals at risk for adverse outcomes and to undertake specific preventive actions (de Vries, van Ravensberg, Hobbelen, Olde Rikkert, & Nijhuis-van der Sanden, 2011; Hoogendijk et al., 2014; Strandberg & Pitkälä, 2007). A thorough knowledge of these risk profiles will also save time and money (Glynn et al., 2011; Mercer, Smitt, Wijke, O'Dowd, & Watt, 2009) and allows individually tailored interventions (Kelaiditi et al., 2013).

However, two important research gaps have been detected. First, most studies so far have focused on risk profiles for physical frailty (Etman, Kamphuis, van der Cammen, Burdorf, & van Lenthe, 2015), and knowledge about the risk profiles of the other domains of frailty are very rare. A notable exception can be found in a Portuguese study, which revealed that age only plays a role with regard to physical frailty, and that women are more likely to be frail in all three investigated dimensions (i.e., physically, psychologically, and socially) (Coelho, Paül, Gobbens, & Fernandes, 2015a). In addition, a lower income level, the recent death of a loved one, or recent divorce (Drubbel et al., 2013), lower education, dissatisfaction with their living environment, and self-reported comorbidity might be related to the physical, psychological, and social domains of frailty (Coelho et al., 2015a). However, these latter studies did not examine environmental frailty. Second, the risk profiles of comprehensive, multidimensional frailty among home-dwelling older adults are currently almost non-existent (Gobbens et al., 2010).

In order to prevent or delay frailty, better understanding of the dynamic processes leading to frailty in older people is of primary interest. The first step in this process is identifying risk profiles in order to find these people that are in need of care and support (Ferrucci et al., 2004). Moreover, separate risk profiles for men and women have proven to be necessary because previous frailty studies have shown that the aging process differs by gender (de Vries et al., 2011; Mercer et al., 2009; Syddall et al., 2010). Likewise, more insight is necessary on the risk profiles for each specific domain of frailty in order to provide accurate case-finding, to target resources at individuals or groups that are more at risk than others, and make proactive care and support possible. Therefore, the main objective of this study is to explore the risk profiles in terms of sociodemographic characteristics and socioeconomic status of the different frailty domains (physical, psychological, social, and environmental) among older people living self-reliantly at home.

Methods

Study design: Belgian Ageing Studies (BAS) survey

For this study, the data from the Belgian Ageing Studies (BAS) was used. BAS is a cross-sectional, large-scale survey that used a structured questionnaire to collect information on various aspects related to the quality of life of community-dwelling older people aged 60 years and over from the Dutch-speaking part of Belgium. In the BAS survey, participants were selected through a participatory peer-research method. Older people were embraced as essential partners of the project. For instance, as partners in the data collection, older volunteers were recruited through local authorities and associations, and trained on how to deliver and collect the questionnaires personally. The questionnaires were self-administered, but on request, the volunteers were allowed to clarify questions. The respondents were free to participate, and their anonymity was guaranteed. The respondents were assured of their right to refuse to answer and of their privacy. More information on the data collection method can be found in a methodological paper (De Donder et al., 2014). The ethical committee of the Vrije Universiteit Brussel approved the study protocol (B.U.N. 143201111521).

Participants

The current study was carried out in 83 municipalities between 2008 and 2014. The sampling fraction depended on the size of the municipality and varied between $N = 109$ and $N = 984$. In each municipality, addresses were randomly selected from the census records by the local authorities. The sample was stratified using quotas for gender and age (60–69, 70–79, and 80+ years) to ensure that the sample matched the makeup of the underlying population in the municipality. Inclusion criteria for the research were being older than 60 years and community dwelling (i.e. older people living in residential care facilities were excluded from the sample). The questionnaire was available in several languages (Dutch, French, English, German, Turkish, etc.) to ensure maximum participation of older migrants. If the respondents refused or were hampered to fill-in the questionnaire (e.g., due to cognitive impairment or hospitalization), the volunteers received replacement addresses in the same quota category to allow the intended sample size to be obtained.

In the following analyses, we excluded cases with missing responses to the main measures (described in greater detail in the next section), resulting in a final sample of 28,049 respondents, with a median age of 70 years: 54.3 per cent were women, 69.3 per cent were married, approximately 52.3 per cent of the households had a monthly income of less than €1500, and 66.2 per cent had a low educational profile.

Variables and measurement

The dependent variable frailty was measured using the Comprehensive Frailty Assessment Instrument (CFAI) (De Witte et al., 2013), which is a self-administered instrument, and measures four domains of frailty (i.e., outcome variables). For the physical domain of frailty, the respondent's general physical health was assessed (4 items, e.g. walking up a hill or stairs). The psychological domain was captured by measuring mood-disorders and emotional loneliness (8 items, e.g. losing self-confidence). The social domain of frailty was evaluated by older people's social loneliness (3 items, e.g. enough people I feel close to) and their social support (3 items, e.g. social support network). Finally, the environmental domain of frailty was assessed by propositions regarding the suitability of the physical housing environment; inadequacy in this area can threaten the mobility of aging individuals because of a lack of comfort (5 items, e.g. insufficient comfort in the house). The scores for the subscales were calculated by adding the scores of the specific items: all subscales ranged from 0 to 100. The total score of the CFAI was calculated by summing the scores for each indicator. The CFAI was previously validated (De Witte et al., 2013), using a second-order confirmatory factor analysis. The model showed good model fit indices, including the Root Mean Square Error of Approximation (RMSEA = 0.032; 90% interval = 0.032 to 0.033), Comparative Fit Index (CFI = 0.974) and Tucker-Lewis Index (TLI = 0.970). The CFAI also proved to be internally consistent, with a Cronbach's α of 0.812, explaining 63.6% of the variance in frailty.

Two categories of independent variables were included in the model: *socio-demographic characteristics*: age (measured per 5 years), gender (1 = male, 2 = female) and marital status (1 = married, 2 = cohabiting, 3 = widowed, 4 = divorced, 5 = never married). Whether the participants had moved house in the previous 10 years (1 = no, 2 = yes) and their country of birth were also recorded (1 = born in Belgium, 2 = born in Europe, 3 = born outside Europe). In terms of *socio-economic characteristics*, the level of education used the

highest level of education obtained (recoded into the categories: no degree or primary education; lower secondary; higher secondary; higher education), and the monthly household income (1 = < €999, 2 = between €1000 and €1499, 3 = between €1500 and €1999, 4 = > €2000) was also evaluated.

Statistical methods

The study tested 10 models regarding the influence of socio-demographic and socio-economic characteristics on 4 domains of frailty (physical, psychological, social, environmental) and total frailty, for men and women separately. Bivariate and multivariate linear regression models were applied for this study. First, to explore the differences in the CFAI scores between the groups, intergroup differences in the CFAI scores were examined using Mann-Whitney U or Kruskal-Wallis, due to non-normality of the data. Independent variables (socio-demographic and socio-economic characteristics) that were not significantly related to frailty were not included in the next step of the analysis. In order to check for problems related to intercorrelations between the independent variables, collinearity diagnostics were checked. The cut-off criterion was set at a variance inflation factor (VIF) of >10.0, which indicates a multicollinearity problem (Field, 2013). Finally, a multiple linear regression analysis for men and women separately was used to measure the relative importance of each independent variable. Given the large sample size, statistical significance was set at $p < .01$ and $p < .001$ for all the analyses. All analyses were performed in SPSS 22 (IBM Corp., Armonk, NY, USA)

Results

Table 1 presents the bivariate statistics for the relationships between the independent variables, sociodemographic and socioeconomic characteristics, and mean scores and standard deviation for each domain of frailty and multidimensional frailty included in our study. For the physical domain, only the country of birth showed no significant differences for men and women (respectively: *Kruskall-Wallis* $X^2(2)$ men=4.2, $p=.124$; $X^2(2)$ women=.09, $p=.956$). Furthermore, the social frailty domain showed no significant differences between the groups for country of birth between men and women ($X^2(2)$ =4.1, $p=.127$; $X^2(2)$ =0.7, $p=.716$) and the level of education only for men ($X^2(2)$ =10.8, $p=.013$). For the environmental frailty domain, both moved previous 10 years (*Mann-Whitney U*=1436292, $p=.887$) and the level of education ($X^2(2)$ =2.3, $p=.506$) among men showed no significant differences between groups. Finally, the country of birth indicated no significant differences only for women in multidimensional frailty ($X^2(2)$ =2.2, $p=.326$).

In the second phase, 10 multiple linear regression analyses were carried out to identify the risk profiles based on sociodemographic and socioeconomic characteristics for the four frailty domains and multidimensional frailty, for both men and women separately (Table 2). Across both gender groups, two variables remained significant in all models: having moved in the last 10 years and the monthly household income. Older people who had moved in the last 10 years appeared to be frailer compared to people who had not moved in the previous 10 years. However, there was one exception: women who had moved in the last 10 years experienced less environmental hazards. The role of household income was clear: men and women with a higher monthly household income were less likely to be frail, in all domains.

Additionally, in each frailty domain, specific risk characteristics emerged. Older people with higher levels of physical frailty were more likely to be older, have moved in the last 10 years, have a lower level of education and have a lower monthly household income. Physical frailty starts to increase already from as early as the age of 65 years.

Older people who had not moved in the last 10 years, had a partner, had attained the highest educational level, and had higher levels of household income were less likely to be psychologically frail. However, widowed, divorced, or never-married men and widowed and divorced women were more likely to be psychologically frail.

Regarding social frailty, the following risk characteristics were found: higher age, not being married, having moved in the last 10 years, and lower monthly household income.

For environmental frailty, people born outside Belgium, without a partner, with a lower educational level, and with a lower monthly household income experienced greater frailty. Men who were divorced or never married experienced more environmental frailty, while being widowed or divorced among women was associated with more environmental frailty.

The analysis of multidimensional frailty (CFAI total) demonstrated that the older, the lower the educational level, and the lower the household income of older people, the more likely they were to be frail. Men were less likely to be frail when they were married. For women, being married or cohabiting protected them from being frail. Men who were born outside Europe were also more likely to be frail.

Finally, considering the analyses on gender-specific risk profiles, the findings only demonstrate no different risk characteristics between men and women within the domain of physical frailty. As for the other domains of frailty gender-specific risk profiles emerged. Never-married men are at risk for psychological frailty; the age of onset for social frailty is earlier among women, and higher education is a protective factor for women (but not for men). Looking at environmental frailty, again never married men are an additional risk group, as well as migrant older men being born in and outside Europe. Considering the total frailty, cohabiting men, and older men born outside of Europe are at-risk.

Discussion

The main goal of this study was to explore which sociodemographic and socioeconomic characteristics are related to multidimensional frailty of older people in order to identify risk profiles. The growing number of potentially frail older people demands preventive initiatives to maintain qualitative independent living among older people (Stijnen, Jansen, Vrijhoef, & Duimel-Peeters, 2012). By gaining insight into the group of older people who are at risk of frailty, public policy and healthcare organizations can recognize and promote care and support that is more individually tailored to people's specific care and support needs (De Witte et al., 2013). However, experts in preventive elderly care have highlighted the difficulties in identifying the target group that would benefit the most from proactive delivery of care and support (Lette et al., 2015).

Knowledge about these risk target groups in this study will aid social and healthcare professionals to more accurately detect older people at risk of frailty.

A key finding of this study is that the risk profiles differ across the frailty domains, demonstrating that (prevention of) frailty should be perceived from a multidimensional perspective. Table 3 shows the risk profiles according to the four frailty domains and multidimensional frailty (all the domains of frailty assessed together).

Concerning age, negative gradients were found for physical, social and multidimensional frailty. This is partly in line with earlier research from Coelho, Paul, Gobbens, and Fernandes (2015b), in which also a negative association was also found, but only in the physical domain of frailty. The relationship between physical frailty and age has been thoroughly studied (Curcio, Henao, & Gomez, 2014; Garcia-Garcia, 2011) and these have studies confirmed that age has a negative impact on physical frailty. Our results add that physical frailty starts as early as from the age of 65 years, contributing to the findings of studies that have examined frailty only from the age of 75 years, (Gobbens & van Assen, 2014), and 85 years (Nicholson, Meyer, Flatley, Holman, & Lowton, 2012). The connection between social frailty and age may be clarified by the rationale that when people age, their social network decreases for reasons such as the loss of their partner, family, friends, divorce, and their children leaving the family home (van Groenou, Hoogendijk, & van Tilburg, 2013).

For the second sociodemographic characteristic, marital status, the observed relationship with the different frailty domains differed between men and women. Never-married men were more likely to be psychologically and environmentally frail compared to never-married women. For both men and women, being divorced or widowed was negatively associated with psychological frailty, which may be linked with the strong negative impact of losing one's partner through divorce or death on one's emotional wellbeing (Kamiya, Doyle, Henretta, & Timonen, 2013).

Country of birth, as the third sociodemographic characteristic, appeared to be associated with environmental frailty. Men originating from the European Union (EU) and both men and women originating from outside the EU appeared to be more environmentally frail compared to native Belgian older people. To our knowledge, the relationship between country of birth and environmental frailty is almost non-existent, and needs further research (Brothers, Theou, & Rockwood, 2014).

Moving house has been negatively associated with physical, psychological, social, and multidimensional frailty. The negative relationship with social frailty might imply that moving makes it challenging for older people in terms of creating new social contacts and integrating into a new neighborhood (Löfqvist et al., 2013). Conversely, women who moved in the last 10 years were less likely to be environmentally frail. In other words, among women, moving appeared to be a protective factor for environmental frailty. In line with our results, other studies have showed that women are more leniently to move to age adapted housing types (Tang & Lee, 2011).

Socioeconomic characteristics also play a strong role in frailty. In both men and women, lower levels of education and household income are related to increased levels of frailty. These results are related to the positive effect of education on health and health behaviors (Brunello, Fort, Schneeweis, & Winter-Ebmer, 2015; Silles, 2009). Likewise, older people who have higher levels of education are less likely to feel lonely (Hawkey et al., 2008; Victor & Yang, 2012).

Within this study, some limitations should be noted that warrant further consideration and research. First, this research had a small population of people older than 60 years born outside Belgium (1.2% of these older people were born in Europe and 0.4% outside Europe). Thus, the study population could be considered as

non-representative, since 2.16% of all Belgian older people (65+ years) in 2004 were born outside Belgium (BAS data: 1.5% of people older than 65 years) (Lodewijck, 2007). Moreover, this migrant older population is also mainly represented in the youngest older age group, from 60 tot 69 years. This could explain why country of birth has little significance for frailty in older people. Further studies could provide more evidence on this matter; Brothers et al. (2014) concluded that country of birth was associated with frailty. Second, cognitive frailty was not included in the CFAI, but is an important domain of multidimensional frailty (Qingwei et al., 2015). All the respondents were cognitively healthy. Third, understanding frailty from a multidimensional perspective among older adults requires more than only sociodemographic and socioeconomic characteristics; for example, life events (de Vries et al., 2011) or environmental influences such as the number of leisure activities that people are involved in may be potential variables (Chen, Chen, Lue, Tseng, & Wu, 2014). In addition, factors that may confound the relationships between social factors and frailty, such as lifestyle behaviors, were not controlled for. Fourth, because of the cross-sectional nature of this research, it is not possible to determine the temporality of the relationships between sociodemographic and socioeconomic characteristics and frailty in older people. Longitudinal or retrospective studies could give more detailed evidence on this matter, and could give more insights into the trajectories leading to frailty. Such information might be valuable for developing preventive actions such as preventive home visits (Elkan et al., 2001).

Conclusion

The current study indicates that in order to prevent frailty in later life, a multifaceted perspective is required. By examining the four domains of frailty separately as well as from a multidimensional perspective, the present study adds to the literature by showing a complex interplay between older individuals' sociodemographic and socioeconomic characteristics on the one hand and frailty and its domains on the other. A key finding is that the risk factors and risk profiles differ by frailty domain and gender. The results of this study may help determine domain-specific frailty profiles for the diverse group of older people.

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Appendix 1. The Comprehensive Frailty Assessment Instrument (CFAI)

1. Have the following activities been hampered by your state of health? If so, for how long? (Please tick all appropriate items)

	Not at all	3 months or less	More than 3 months
Less demanding activities like carrying shopping bags			
Walking up a hill or some stairs			
Bending or lifting			
Going for a walk			

2. Considering the last few weeks, to which extent do you agree with the following (please tick)

1 = not at all

3 = more than usual

2 = not more than usual

4 = considerably more than usual

	1	2	3	4
I feel unhappy and depressed				
I feel like I'm losing my self-confidence				
I feel like I cannot cope with problems				
I feel like I'm under constant pressure				
I feel like I'm not worth anything anymore				

3. To which extent do you agree with the following statements? (please tick all appropriate items)

1 = I completely disagree

4 = I agree

2 = I disagree

5 = I completely agree

3 = I neither agree nor disagree

	1	2	3	4	5
I experience a general sense of emptiness.					
I miss having people around me.					
I often feel rejected.					
There are enough people whom I can rely on when I am in trouble.					
I know many people whom I can totally trust.					
There are enough people with whom I feel a bond.					
My house is in a bad condition/poorly kept.					
My house is not very comfortable.					
It is difficult to heat my house.					
There is insufficient comfort in my house.					
I do not like my neighborhood.					

4. Suppose you are unable to carry out the activities you usually do in terms of housekeeping for a certain length of time; who would you be able to appeal to? (Please tick all appropriate items)

(More than one answer may be given)

Partner	
Son	
Daughter-in-law	
Daughter	
Son-in-law	
Grandchild	
Sister or brother (in-law)	
Family	
Neighbours	
Friends	

Table 1 Characteristics baseline and comparison within groups ($n = 28,049$)

	Percentage		Physical frailty		Psychological frailty		Social frailty		Environmental frailty		Frailty total	
	men	women	men	women	men	women	men	women	men	women	men	women
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
Total	45.7 %	54.3 %	24.1 (35.0)	35.4 (40.3)	16.2 (17.3)	19.7 (19.6)	49.0 (20.0)	50.7 (20.3)	13.0 (18.9)	13.3 (19.9)	25.3 (14.0)	29.5 (15.8)
Socio-demographic characteristics												
Age												
60-64	24.3%	21.3 %	13.8 (27.2)**	17.8 (30.8)**	15.2 (16.3)**	18.2 (19.9)**	47.3 (18.5)**	48.2 (19.2)**	13.2 (18.6)*	12.5 (18.9)**	22.4 (12.6)**	24.2 (13.7)**
65-69	24.5%	20.3 %	18.0 (30.9)**	23.5 (34.4)**	15.2 (17.0)**	18.4 (19.3)**	47.6 (19.6)**	47.9 (19.6)**	12.7 (18.2)*	12.8 (19.2)**	23.4 (13.5)**	26.6 (14.5)**
70-74	18.9%	18.4 %	23.7 (33.2)**	32.6 (38.1)**	15.9 (17.1)**	19.8 (19.2)**	46.9 (19.8)**	49.2 (19.3)**	13.6 (19.1)*	13.8 (20.2)**	25.0 (13.5)**	28.9 (15.3)**
75-79	16.8 %	17.6 %	30.6 (37.0)**	45.2 (41.0)**	17.0 (17.2)**	21.8 (20.1)**	48.5 (19.4)**	49.0 (19.6)**	14.1 (19.7)*	15.1 (20.4)**	27.6 (14.2)**	32.8 (15.8)**
80-84	9.7 %	13.8 %	42.0 (40.3)**	55.1 (40.8)**	19.3 (18.7)**	23.4 (20.4)**	47.9 (19.9)**	48.0 (19.3)**	14.0 (18.8)*	15.7 (19.8)**	30.8 (15.5)**	35.6 (15.7)**
85-89	4.6 %	6.5 %	51.4 (41.4)**	68.8 (37.8)**	21.7 (18.6)**	24.6 (21.3)**	48.6 (20.0)**	48.6 (17.9)**	16.0 (20.5)*	19.0 (22.7)**	34.4 (15.3)**	40.2 (15.9)**
90+	1.1%	2.0 %	63.2 (40.0)**	79.4 (34.6)**	21.8 (20.6)**	25.9 (20.8)**	45.9 (16.5)**	49.8 (19.3)**	19.3 (21.0)*	19.8 (23.8)**	37.6 (14.2)**	43.7 (14.3)**
Marital status												
Married	80.3 %	60.0 %	22.3 (33.7)**	29.5 (38.0)**	15.0 (16.4)**	17.5 (18.2)**	46.3 (19.4)**	47.3 (19.4)**	12.6 (18.2)**	12.6 (19.0)**	24.1 (13.6)**	26.7 (14.9)**
Cohabiting	2.5 %	1.5 %	22.8 (33.8)**	27.4 (35.7)**	15.4 (17.2)**	17.6 (18.8)**	52.1 (17.5)**	52.7 (18.2)**	14.8 (19.3)**	13.7 (18.2)**	26.3 (13.5)**	27.8 (14.1)**
Widowed	9.5 %	30.2 %	36.6 (39.9)**	47.5 (42.0)**	24.6 (20.2)**	25.6 (21.0)**	50.0 (18.6)**	48.5 (18.9)**	16.4 (20.4)**	16.3 (20.9)**	31.9 (15.5)**	34.5 (16.3)**

Divorced	3.7 %	4.8 %	23.9 (34.8)**	30.8 (38.8)**	20.3 (19.3)**	25.0 (24.0)**	54.4 (19.2)**	55.0 (19.9)**	16.4 (20.1)**	18.3 (22.6)**	28.8 (14.7)**	32.3 (17.2)**
Never married	4.1 %	3.4 %	23.2 (34.1)**	38.1 (39.6)**	19.5 (18.6)**	19.4 (18.8)**	57.8 (16.7)**	57.2 (16.4)**	21.4 (23.0)**	16.8 (21.6)**	30.5 (13.4)**	32.9 (15.4)**
Country of birth												
Belgium	98.1%	98.5 %	23.7 (34.6)	35.1 (40.1)	16.3 (17.2)*	20.3 (19.7)*	47.5 (19.3)	48.5 (19.3)	13.4 (18.8)**	14.0 (19.9)**	25.2 (14.0)*	29.5 (15.8)
In Europe	1.5 %	1.1 %	22.9 (36.2)	35.3 (39.9)	14.1 (17.9)*	17.1 (18.9)*	50.1 (18.6)	49.2 (18.5)	16.0 (21.3)**	17.4 (22.1)**	25.8 (13.6)*	29.7 (15.9)
Out Europe	0.4%	0.4 %	33.9 (38.9)	33.0 (36.0)	22.0 (25.7)*	22.9 (21.8)*	46.8 (20.3)	47.6 (18.9)	29.6 (27.0)**	24.7 (24.7)**	33.1 (18.6)*	32.0 (14.3)
Moved previous 10 years												
Yes	13.7 %	14.6%	26.0 (35.7)*	39.1 (40.7)**	17.7 (18.0)**	22.2 (21.3)**	50.4 (19.1)**	50.8 (19.3)**	14.0 (20.8)	13.4 (21.4)**	27.0 (14.8)**	31.4 (16.2)**
No	86.3 %	85.4 %	23.4 (34.5)*	34.4 (39.9)**	16.1 (17.1)**	20.0 (19.5)**	47.1 (19.3)**	48.1 (19.3)**	13.4 (18.6)	14.3 (19.7)**	25.0 (13.9)**	29.2 (15.7)**
Socio-economic characteristics												
Education												
No degree or primary educ.	32.4 %	42.0 %	33.1 (38.8)**	45.5 (42.3)**	17.9 (18.1)*	22.5 (20.9)**	46.9 (20.1)	48.2 (19.4)**	15.8 (20.9)	16.2 (21.4)**	28.4 (15.1)**	33.1 (16.5)**
Lower secondary	28.5 %	28.6 %	23.7 (34.4)**	33.4 (39.1)**	17.0 (17.9)*	19.8 (19.4)**	48.0 (19.4)	48.3 (19.4)**	13.4 (19.1)	14.0 (20.2)**	25.5 (14.0)**	28.9 (15.5)**
Higher secondary	21.0 %	18.1 %	20.4 (32.8)**	27.2 (36.5)**	15.5 (16.7)*	19.1 (18.7)**	48.0 (18.9)	49.4 (18.9)**	12.5 (18.0)	12.0 (17.6)**	24.1 (13.7)**	26.9 (14.4)**
Higher education	18.1 %	11.3 %	15.1 (27.6)**	20.2 (32.0)**	13.8 (15.4)*	16.6 (17.8)**	47.3 (18.4)	47.7 (19.4)**	11.5 (16.0)	11.2 (17.4)**	22.0 (12.1)**	23.9 (13.9)**
Income												
< €999	11.5 %	20.2 %	35.1 (39.3)**	47.4 (42.3)**	20.2 (20.0)**	24.9 (21.7)**	49.7 (19.9)**	50.3 (19.7)**	18.0 (22.1)**	18.3 (22.9)**	30.9 (15.7)**	35.2 (16.8)**
€1000 - €1499	33.4 %	38.7 %	28.6 (37.1)**	40.1 (41.0)**	18.4 (18.4)**	22.1 (20.5)**	47.8 (19.7)**	48.2 (19.3)**	15.6 (20.3)**	15.5 (20.6)**	27.6 (14.7)**	31.5 (16.0)**

€1500 - € 1999	24.9 %	20.0 %	23.6 (34.5)**	30.7 (38.2)**	16.1 (16.7)**	18.9 (18.5)**	46.9 (19.4)**	48.5 (19.1)**	13.3 (18.7)**	12.8 (18.5)**	25.0 (13.7)**	27.7 (14.8)**
> €2000	30.1 %	21.1 %	16.5 (29.1)**	22.1 (33.7)**	13.8 (16.6)**	16.1 (17.5)**	46.9 (18.5)**	47.5 (19.1)**	10.8 (16.1)**	10.9 (17.6)**	22.0 (12.3)**	24.1 (13.9)**

**p < .01; ** p < .001*

Table 2 Standardized results of the 10 linear regression models within the different frailty domains ($n=28,049$)

	Physical frailty		Psychological frailty		Social frailty		Environmental frailty		Frailty Total	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
	Std B	Std B	Std B	Std B	Std B	Std B	Std B	Std B	Std B	Std B
Socio-demographic characteristics										
Age (years): 60-64 (ref.)										
65-69	0.039**	0.043**	-0.004	-0.005	0.016	0.013	-0.020	-0.002	0.020	0.023
70-74	0.085**	0.119**	-0.006	0.000	0.003	0.042**	-0.011	-0.008	0.053**	0.082**
75-79	0.141**	0.208**	0.007	0.001	0.041**	0.042**	-0.011	0.004	0.098**	0.146**
80-84	0.202**	0.262**	0.022	0.007	0.03*	0.014	-0.020	0.009	0.135**	0.175**
85-89	0.197**	0.264**	0.031*	0.007	0.008	0.005	0.006	0.029	0.134**	0.185**
90 and over	0.127**	0.184**	0.010	0.018	-0.006	-0.004	0.020	0.020	0.082**	0.128**
Marital status: Married (ref.)										
Cohabiting	0.001	-0.003	0.008	0.003	0.044**	0.034**	0.017	0.003	0.028*	0.013
Widowed	0.013	0.011	0.127**	0.144**	0.055**	0.034*	0.023	0.036**	0.076**	0.065**
Divorced	0.015	0.010	0.047**	0.068**	0.074**	0.08**	0.026*	0.055**	0.053**	0.070**
Never married	-0.009	-0.002	0.038**	0.012	0.108**	0.089**	0.062**	0.018	0.065**	0.031**
Country of birth: Belgium (ref.)										

In Europe	-0.004	0.001	-0.017	-0.016	0.009	-0.004	0.023*	0.014	0.001	-0.001
Out Europe	0.013	-0.001	0.018	0.003	-0.011	0.003	0.057**	0.027*	0.031**	0.008
Moved previous 10 years: No (ref.)										
Yes	0.044**	0.052**	0.027*	0.028*	0.041**	0.034**	0.008	-0.027*	0.054**	0.043**

Socio-economic characteristics

Level of education: No degree/primary (ref.)

Lower secondary	-0.059**	-0.059**	0.002	-0.025	0.006	-0.008	-0.030**	-0.024	-0.040**	-0.062**
Higher secondary	-0.072**	-0.076**	-0.009	-0.020	0.01	0.007	-0.023*	-0.044**	-0.051**	-0.072**
Higher education	-0.097**	-0.095**	-0.031*	-0.043**	-0.005	-0.041**	-0.029*	-0.035**	-0.084**	-0.101**

Monthly household income: <€999 (ref.)

€1000-€1499	-0.045*	-0.042**	-0.015	-0.029	-0.028	-0.038*	-0.032	-0.028	-0.052*	-0.62**
€1500-€1999	-0.067**	-0.058**	-0.045*	-0.044**	-0.043*	-0.028	-0.053**	-0.055**	-0.089**	-0.079**
>€2000	-0.118**	-0.085**	-0.083**	-0.075**	-0.046*	-0.038*	-0.102**	-0.072**	-0.155**	-0.123**

* $p < .01$; ** $p < .001$

Std B= Standardized Beta regression coefficients

Table 3 Overview of the risk profiles for the frailty domains and multidimensional frailty

Physical frailty	Psychological frailty	Social frailty	Environmental frailty	Frailty total
Similar risk characteristics among older men and women				
Older		Unmarried	Born outside Belgium	Older Unmarried
Moved in the previous 10 years	Moved in the previous 10 years	Moved in the previous 10 years		Moved in the previous 10 years
Lower education	Lower education		Lower education	Lower education
Lower household income	Lower household income	Lower household income	Lower household income	Lower household income
Different risk characteristics among older men and women				
	Men living alone Widowed or divorced women		Divorced and widowed women Never-married and divorced men	Having moved in the previous 10 years was a protective factor for women

Annex 1. Table Characteristics baseline and comparison within groups (Kruskall-Wallis & Mann Whitney U test) ($n=28,049$)

	Physical frail		Psychological frail		Social frail		Environmental frail		Frailty total	
	X ² (2)/ U		X ² (2)/ U		X ² (2)/ U		X ² (2)/ U		X ² (2)/ U	
	Men	Women								
Socio-demographic characteristics										
Age	1360.3**	2582.3**	103.9**	144**	42.8**	50.3**	17.3*	68.2**	725.2**	1588.9**
Marital status	178.9**	650.1**	332**	499**	322.6**	238.3**	116**	123.8**	429.3**	714.8**
Country of birth	4.2	0.09	9.9*	7.9*	4.1	0.7	37.3**	18.6**	9.7*	2.2
Moved previous 10 years	11991990.5*	15455028**	13108419**	18209775**	1254726**	17914450**	1436292	19009227**	9670068**	12038409**
Socio-economic characteristics										
Education	440.3**	737.1**	59.9*	91.8**	10.8	29.2**	2.3	27**	340**	601**
Income	357.1**	613**	146.1**	237**	69**	70.3**	73.5**	95**	469.8**	721**

X²(2): Kruskal-Wallis

U: Mann Whitney; * $p < .01$; ** $p < .001$