

## **FRAILITY IN EUROPE: THE ROLE OF SOCIAL NETWORKS AND ACTIVITY PARTICIPATION**

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**Abstract.** Frailty represents a condition of increased vulnerability among elderly people due to losses in one or more domains of the human functioning. Population aging and the consequential increase in the proportion of elderly, are making frailty a public health priority, especially in the European Union, where the proportion of elderly is projected to increase significantly in the next 30 years. Despite the numerous studies on frailty and its determinants, scholarly interest towards the role of the social determinants, specifically, is recent, with most studies focusing on the Asian context. Thus, evidence on the social determinants of frailty in the European context is scarce. In light of this, the study we propose aims at evaluating the role of social connectedness and activity participation on frailty among the elderly in Europe, using suitable regression techniques. We employ data from the Survey on Health, Aging and Retirement in Europe (SHARE), providing information on the health, socioeconomic conditions and social life of community-dwelling individuals aged 50 or older in European countries. Specifically, we study how social networks (SN) and activity participation (AP) in wave 4 affect frailty of people aged 60 and over in wave 5 by gender, separately. We measure SN and AP via two indexes proposed in the literature. To measure frailty, we rely on Romero-Ortuno et al.'s SHARE Frailty Instrument, providing pre-calculated, population-representative and gender-specific frailty indexes. Our findings hint at the existence of a substantial association between both social connectedness and activity participation and frailty. However, this association appears to change across genders. When comparing the role of social connectedness and activity participation, a more prominent association with activity participation emerges.

### **1. Introduction**

The concept of frailty refers to a condition of increased vulnerability among older people, entailing a high risk of adverse health outcomes (such as falls, hospitalization and death) due to losses in one or more domains of the human functioning (Bessa et al., 2018). Population aging and the consequential increase in the proportion of elderly are making frailty a public health priority, especially in the European Union,

where the proportion of elderly is projected to increase significantly in the next 30 years (Gobbens et al., 2010).

Elderly's physical and mental health, mortality and their risk of entry into institutionalized care have all been shown to be strongly associated with aspects like social support, engagement, and network structure (Wenger, 1997). Numerous studies, in particular, have found a link between social networks, engagement and support and, respectively, health (Berkman et al., 2000; Seeman et al., 1996) and survival (Berkman, 1995; Eng et al., 2002). Possible mechanisms behind this association include physiological, behavioral, and mental/cognitive ones. At the physiological level, social isolation and disconnectedness are considered chronically stressful conditions to which the organism reacts via a higher rate of ageing and functional decline, thus influencing life expectancy and mortality (Berkman, 1988; Berkman et al., 2000). At the behavioral level, social engagement induces health-promoting behaviors, with social networks representing a relevant source of health-related information and advice, with consequential effects on individuals' decisions concerning their own health and wellbeing (Eriksson et al., 1999). For instance, there is evidence of positive associations between social support on the one hand and physical exercise (Treiber et al., 1991) and smoking cessation (Murray et al., 1995) on the other. Lastly, social networks and ties have been argued to affect individuals' mental health via the provision of self-esteem, self-efficacy, and sense of security (Thoits, 2011). In addition, they tend to enhance the perception of surrounding support and, where needed, company and assistance (Berkman et al., 2000; Garcia et al., 2005), consequentially buffering the negative effects of social isolation on depressive symptoms (Liu et al., 2016; Vance et al., 2005) and cognitive functioning (Miceli et al., 2019)

A strand of literature has further investigated the role played by engagement in social, physical, and cognitive activities and mental and physical health. For instance, beyond the documented positive effects of physical activity on health and cognitive functioning (Blake et al., 2009), participating to sport clubs entails a "social doing" that is argued to be especially beneficial thanks to aspects like reduction in social isolation and loneliness and the increase in the possibility for socialization (Jenkin et al., 2018). Similarly, various studies have highlighted a positive effect of volunteer work and charity activities on various health outcomes (Haski-Leventhal, 2009; Morrow-Howell et al., 2003). Mechanisms behind this effect include the provision of purpose, sense of fulfilment, direct social interaction, and reciprocal support to those engaged in these activities. Indeed, consistently with the "role theory" (Anderson et al., 2014; Choi & Kim, 2011), the active engagement entailed in volunteer and charity activities is especially important for elderly individuals, experiencing the cessation of life-long roles of paid workers, family caretaker or spouses due to events such as retirement, widowhood, and a reduction

in the (grand)parental responsibilities following the aging of both children and grandchildren. Related mechanisms are argued to be behind the association between “formal leisure activities” (Misener et al., 2010, p. 271), including participation in various kinds of clubs and organizations, and physical and mental health (Lei et al., 2022; Munford et al., 2017).

Despite the ample evidence concerning the role played by social support and engagement in various kinds of activities for health, mortality, and the risk of entry into institutionalized care, scholarly interest towards the role that these aspects play specifically for frailty is recent, with most studies exploring the association in the Asian context (Chen et al., 2014; Makizako et al., 2018; Sun et al., 2022; Takatori & Matsumoto, 2023; Xie & Ma, 2021) and very few works looking at the West (Etman et al., 2015; Watts et al., 2017). Thus, evidence on the social determinants of frailty in the European context is scarce. In light of this, relying on recent evidence of a substantial but different role of social connectedness and activity participation on cognitive functioning (Litwin & Stoeckel, 2016), this study aims at exploring the relative influence of social connectedness and activity participation on frailty among elderly in Europe, by relying on two distinct and comprehensive measures, to our knowledge never employed before in the study of frailty.

## **2. Data and methods**

We employ data from the 4<sup>th</sup> (2011) and 5<sup>th</sup> (2013) wave of the Survey on Health, Aging and Retirement in Europe (SHARE) (Börsch-Supan 2022a 2022b), a longitudinal survey providing information on health, socioeconomic conditions and social life of community-dwelling individuals aged 50 or older in European countries. Our sample considers a total of 8,677 men and 8,616 women aged 60 and older, across 13 European countries.

We measure social connectedness and activity participation via two indexes proposed by Litwin & Stoeckel (2016), namely the Social Network (SN) scale and the Activity Participation (AP) scale. The SN scale represents a composite measure including aspects regarding social network size, physical proximity, frequency of contacts, support, and number of types of relationships. The AP scale, rather, concerns the number of social, physical, intellectual, and recreational activities individuals participated to in the year before the survey. Activities included volunteer work, educational courses, sport, social, or any other kind of club, activities organized by religious organizations, political or community-related events, games that involve other people, reading, word or number games, physically vigorous sports, and moderate energy activities like gardening or going for walks. Individuals were identified as participating to the activity if they took part in it at

least once a month. The AP score ranged between 0 and 9, with higher scores representing a higher number of activities that participants engaged with.

We employ multinomial logistic regression analysis with country-fixed effects on a pooled sample of all the analyzed countries, separately for men and women, to assess and compare how social network and activity participation measured in wave 4 affect frailty status in wave 5. To measure frailty, we rely on Romero-Ortuno & Kenny's (2012) SHARE Frailty Instrument (SHARE-FI), providing pre-calculated, population-representative and gender-specific frailty index based on Fried et al.'s 2001 Phenotype Model. The index assesses frailty based on the presence of five main symptoms, namely unintended weight loss, weakness, slowness, self-reported exhaustion, and low physical activity. SHARE-FI has been validated as a reliable frailty index, classifying individuals into non-frail, pre-frail, and frail. We further included "deceased" as a fourth level of our outcome variable. Our models control for age, marital status, working status, country-specific wealth quintiles<sup>1</sup>, number of chronic conditions, verbal fluency, and EURO-D scale of depression<sup>2</sup>. We estimate three models: the first looks at the "crude" effect of social networks on frailty. The second includes controls for the above-mentioned factors, to assess the "net" effect of social networks. The third further adds the activity participation variable, to assess whether it plays any role and, if so, how it modifies the effect of social networks.

### 3. Results

The results from multinomial regressions are reported in Table 1, separately by gender and for the three possible transitions of frailty<sup>3</sup>, from non-frail to the other three considered levels of the outcome variable.

Among men, social connectedness is negatively associated with the risk of moving from a state of non-frail to one of pre-frail, while it does not seem to affect the risk of becoming frail, nor the risk of death. Rather, activity participation

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<sup>1</sup> In line with previous literature (Bono & Matranga, 2019; Miceli et al., 2019), we calculated wealth as the sum of household income and total assets. Total assets were computed as the sum of real assets (including the primary residence net of mortgage, the value of other real estate, owned share of own business and owned cars) and net financial assets (such as bank accounts, stocks, mutual funds, and so forth) (Miceli et al., 2019).

<sup>2</sup> As a robustness check, we further estimated models where we also controlled for education, whether the person lives alone and whether the person has living children. Since results of these alternative specification remained substantially unchanged, we decided to include in our main analysis the most parsimonious models.

<sup>3</sup> Due to space constraints, we include here only regression results. Descriptive analyses are available upon request.

influences all outcomes, so that higher scores on the AP scale are associated with a lower risk of pre-frailty, frailty, and death.

As for women, social network appears to be negatively associated with the risk of becoming pre-frail, while no association is found with the other outcomes; in addition, the statistical significance with the risk of pre-frailty disappears after the inclusion of the AP scale variable in the model. Activity participation, in turn, seems to be an important source of protection against the risk of becoming pre-frail, as well as against the risk of becoming frail and the risk of death.

Considering Litwin & Stoeckel, 2016's finding of a reciprocal compensatory role of social connectedness and activity participation on cognitive functioning, we further estimated an additional regression model where an interaction term between SN scale and AP scale was included, to test whether the association between activity participation and frailty changed at different levels of social connectedness. However, the interaction term was not statistically significant, signaling the absence of any reciprocal compensatory role of the two factors on frailty.

**Table 1** – Effect of SN and AP on the risk of pre-frailty, frailty, and death. Men.

	Men								
	Pre-frail		Frail		Deceased				
<b>SN Scale</b>	0.82*** (0.03)	0.83*** (0.04)	0.85*** (0.04)	0.88* (0.05)	0.94 (0.05)	0.98 (0.06)	0.94 (0.06)	1.02 (0.07)	1.05 (0.07)
<b>AP Scale</b>		0.84*** (0.03)			0.73*** (0.04)				0.81*** (0.03)
<b>Age (Cont.)</b>	1.06*** (0.01)	1.06*** (0.01)		1.11*** (0.02)	1.11*** (0.02)		1.10*** (0.01)	1.10*** (0.01)	
<b>Wealth quintile (Ref. 1<sup>st</sup>)</b>									
2 <sup>nd</sup>	1.20 (0.23)	1.26 (0.24)		1.00 (0.25)	1.09 (0.26)		0.85 (0.21)	0.90 (0.23)	
3 <sup>rd</sup>	1.09 (0.11)	1.15 (0.12)		0.95 (0.13)	1.05 (0.16)		0.64** (0.10)	0.69* (0.11)	
4 <sup>th</sup>	0.91 (0.09)	0.98 (0.11)		0.49** (0.12)	0.56* (0.13)		0.69 (0.18)	0.75 (0.20)	
5 <sup>th</sup>	0.84 (0.11)	0.92 (0.12)		0.52*** (0.08)	0.60** (0.09)		0.69 (0.21)	0.76 (0.24)	
<b>Married/in partnership (Ref. Single)</b>	0.89 (0.10)	0.91 (0.11)		1.12 (0.22)	1.16 (0.22)		0.64 (0.15)	0.65 (0.15)	
<b>Currently working (Ref. Not working)</b>	0.75 (0.12)	0.76 (0.12)		0.66 (0.18)	0.67 (0.19)		0.71 (0.15)	0.72 (0.15)	
<b>N. of chronic conditions</b>	1.24*** (0.03)	1.25*** (0.03)		1.24*** (0.01)	1.24*** (0.02)		1.08* (0.03)	1.08* (0.03)	
<b>Verbal Fluency score</b>	0.99* (0.01)	0.99 (0.01)		0.96** (0.01)	0.97* (0.01)		0.95*** (0.01)	0.96** (0.01)	
<b>EURO-D scale of depression</b>	1.16*** (0.04)	1.15*** (0.04)		1.19** (0.07)	1.18** (0.07)		1.10 (0.06)	1.09 (0.06)	

**Table 1** – Effect of SN and AP on the risk of pre-frailty, frailty, and death. Woman (continued).

	Women								
	Pre-frail			Frail			Deceased		
<b>SN Scale</b>	0.88*** (0.03)	0.92* (0.03)	0.94 (0.03)	0.85* (0.06)	0.94 (0.08)	0.99 (0.07)	0.82 (0.10)	0.96 (0.12)	1.02 (0.13)
<b>AP Scale</b>			0.87*** (0.03)			0.74*** (0.04)			0.67*** (0.06)
<b>Age (Cont.)</b>		1.07*** (0.01)	1.07*** (0.01)		1.09*** (0.01)	1.09*** (0.01)		1.10*** (0.01)	1.10*** (0.01)
<b>Wealth quintile (Ref. 1<sup>st</sup>)</b>									
2 <sup>nd</sup>		0.90 (0.06)	0.92 (0.06)		0.74 (0.12)	0.77 (0.12)		0.62 (0.23)	0.66 (0.24)
3 <sup>rd</sup>		0.82** (0.06)	0.85* (0.06)		0.63* (0.13)	0.67 (0.14)		0.83 (0.33)	0.89 (0.35)
4 <sup>th</sup>		0.76*** (0.06)	0.80*** (0.05)		0.40*** (0.06)	0.45*** (0.08)		0.89 (0.32)	1.01 (0.36)
5 <sup>th</sup>		0.67*** (0.06)	0.71*** (0.06)		0.40** (0.12)	0.45** (0.14)		0.83 (0.31)	0.96 (0.36)
<b>Married/in partnership (Ref. Single)</b>		1.04 (0.07)	1.02 (0.06)		1.18** (0.07)	1.13* (0.06)		0.74 (0.16)	0.69 (0.15)
<b>Currently working (Ref. Not working)</b>		0.92 (0.10)	0.92 (0.10)		0.45*** (0.11)	0.47** (0.11)		0.80 (0.19)	0.81 (0.19)
<b>N. of chronic conditions</b>		1.20*** (0.03)	1.21*** (0.03)		1.40*** (0.09)	1.41*** (0.09)		0.92 (0.09)	0.93 (0.09)
<b>Verbal Fluency score</b>		0.98*** (0.00)	0.99** (0.00)		0.93*** (0.01)	0.95*** (0.01)		0.96 (0.03)	0.97 (0.03)
<b>EURO-D scale of depression</b>		1.17*** (0.03)	1.16*** (0.03)		1.21*** (0.05)	1.20*** (0.05)		1.12 (0.08)	1.11 (0.08)

Source: Authors' elaborations on SHARE data. Notes: Results are reported in the form of Relative Risk Ratios (RRR). 95% C.I. \*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$

When it comes to the role played by health-related characteristics, our findings suggest that aspects like the number of chronic conditions of the individual and depression were significantly associated with higher-risks of pre-frailty and frailty, both among men and women. Similarly, verbal fluency was slightly negatively associated with both of such outcomes.

As for the role of socioeconomic characteristics, wealth appeared to be negatively associated with the risk of becoming frail, particularly for the 4<sup>th</sup> and 5<sup>th</sup> quintile. Importantly, while we found no difference between men who are working and those who are not, women who are still in the labor market were found to be substantially less likely to become frail. This aspect might depend on the fact that while working status possibly reflects available income (thus related to a monetary flow), our wealth variable is, rather, a “stock” indicator. Thus, our result might be driven by the fact that while among men the stock aspect might be a relevant determinant of frailty,

among women, rather, the presence or absence of an available income can operate as a determinant of frailty even at initial stages. Surprisingly, moreover, women in partnership were found to be more exposed to the risk of becoming frail, while this association was not significant among men.

Taken together, these results suggest that, among men, having strong social network resources is important to prevent the development of pre-frailty, less so among women. Rather, consistently with previous literature on the matter, participation to various kinds of activities appears to be a notably powerful protective aspect, negatively affecting the risk of becoming pre-frail, frail, as well as the risk of death, both among men and women.

#### **4. Conclusions**

The goal of this study was to investigate and compare the role of social connectedness and activity participation on frailty among community-dwelling individuals from 13 European countries, aged 60 and older. To measure social connectedness and activity participation we relied on two indexes employed in Litwin & Stoeckel (2016). Frailty was measured through Romero-Ortuno & Kenny's (2012) SHARE-FI. In our models, we controlled for several relevant demographic and health-related confounders.

Our findings reveal for both social connectedness and activity participation to be associated with frailty. However, comparing the role played by the two aspects, activity participation emerged as a more relevant determinant, strongly associated with the risk of moving from a state of non-frail to one of pre-frail and frail. Engaging in various kinds of activities, compared with maintaining relatively frequent interpersonal relationship, might benefit individuals to a greater extent, thanks to the “doing” component that it involves: the sense of purpose and self-efficacy provided by the involvement in community/political organizations, charity events or educational courses might be a more relevant protective factor for physical and mental health, thus contributing to buffer the negative effects of the cessation of key life roles of paid workers and family caretaker of elderly individuals. This is consistent with research comparing the effect of social connectedness and activity participation on frailty (Chen et al., 2014). Similar findings, with regards to cognitive functioning, are reported by Litwin & Stoeckel (2016) and Miceli et al., (2019).

Nevertheless, differences between man and women should be underlined. Indeed, in this study social connectedness matters mainly among men, with regards to the risk of moving from a state of non-frail to one of pre-frail. Moreover, activity participation was found to be especially relevant in protecting both genders from the risk of becoming pre-frail and frail, as well as from the risk of death.

Naturally, this study is not without limitations. First, social network is a dynamic concept that is subject to change as people age (Schwartz et Litwin 2017). Thus, a more in-depth analysis of these changes would be appropriate. Secondly, due to the lack of time-dependent variables in our data, our analytical strategy allows us to control for the substantial changes occurring in elderly individual's social network's composition and structure only partially. In addition, our measure of activity participation includes various kinds of activities, *i.e.*, "collective" ones such as participation to community/political and sport clubs as well as charity organizations, and more "solitary" ones, such as playing words or number games and reading books or newspapers. Hence, our measure incorporates together widely different types of activities, requiring different levels of social engagement and interaction with others. For this reason, future research should investigate whether there exists any difference in the role played by different kinds of activities, to assess whether it is the "social doing" entailed in the more interactive activities that protects against the risk of frailty, or whether the "solitary" activities, too, matter in preventing individuals from becoming frail.

Besides such limitations, our study has also various strengths. Among these, it is the first one, to our knowledge, exploring and comparing the role played by social connectedness and activity participation in protecting elderly Europeans against the risk of becoming pre-frail and frail. Understanding these aspects can inform about potentially important policy measures to ensure a healthy ageing, such as the implementation of programs aiming at promoting the involvement of the elderly in various kinds of activities.

### **Acknowledgements**

This research was funded by the 2020 PRIN-Research Project of National Relevance "SOCial and health Frailty as determinants of Inequality in Aging (SOFIA)".

We acknowledge co-funding from European Union – Next Generation EU, in the context of The National Recovery and Resilience Plan, Investment Partenariato Esteso PE8 "Conseguenze e sfide dell'invecchiamento", Project Age-It (Ageing Well in an Ageing Society).

This paper uses data from SHARE Waves 4 and 5. The SHARE data collection has been funded by the European Commission, DG RTD through FP5 (QLK6-CT-2001-00360), FP6 (SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857, SHARELIFE: CIT4-CT-2006-028812), FP7 (SHARE-PREP: GA N°211909, SHARE-LEAP: GA N°227822, SHARE M4: GA N°261982, DASISH: GA N°283646) and Horizon 2020 (SHARE-DEV3: GA N°676536, SHARE-

COHESION: GA N°870628, SERISS: GA N°654221, SSHOC: GA N°823782, SHARE-COVID19: GA N°101015924) and by DG Employment, Social Affairs & Inclusion through VS 2015/0195, VS 2016/0135, VS 2018/0285, VS 2019/0332, and VS 2020/0313. Additional funding from the German Ministry of Education and Research, the Max Planck Society for the Advancement of Science, the U.S. National Institute on Aging (U01\_AG09740-13S2, P01\_AG005842, P01\_AG08291, P30\_AG12815, R21\_AG025169, Y1-AG-4553-01, IAG\_BSR06-11, OGHA\_04-064, HHSN271201300071C, RAG052527A) and from various national funding sources is gratefully acknowledged (see [www.share-project.org](http://www.share-project.org)).

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