Received: 4 February 2020 | Revised: 4 May 2020 | Accepted: 26 May 2020

DOI: 10.1111/hsc.13064

ORIGINAL ARTICLE

Health and Social Care in the community

WILEY

Do European co-residential caregivers aged 50+ have an increased risk of frailty?

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Funding information
Calouste Gulbenkian Foundation; FCT/MCTES; European Regional Development Fund (ERDF), Grant/Award Number: 01/SAICT/2016; European Commission, Grant/Award Number: QLK6-CT-2001-00360, RII-CT-2006-062193, CIT5-CT-2005-028857, CIT4-CT-2006-028812, 211909, 227822 and 261982; Horizon 2020, Grant/Award Number: 676536 and 654221; DG Employment, Social Affairs & Inclusion; German Ministry of Education and Research; Max Planck Society for the Advancement of Science; U.S. National Institute on Aging, Grant/Award Number: U01_AG09740-13S2, P01_AG005842, P01_AG08291, P30_AG12815, R21_AG025169, Y1-AG-4553-01, IAG_BSR06-11, OGHA_04-064 and HHSN271201300071C

Abstract

One important health challenge associated with ageing is frailty, which has been acknowledged as a new public health priority. However, only a few studies have explored the relationship between providing care at older ages and frailty. The main objective of this study is to assess whether there is an association between providing co-residential care and frailty, according to gender and from a European cross-sectional perspective, among the population aged 50+. Data from 17 European countries that participated in wave 6 of the Survey of Health, Ageing and Retirement in Europe (SHARE) is used (N = 52,073). Multinomial logistic regressions were used to estimate caregivers' chances of frailty. The results show that the prevalence of pre-frailty and frailty differs according to the caregiver's status, gender and the European region. The highest prevalence of pre-frailty was found in the group of female caregivers from Northern countries (57.3%), and the highest prevalence of frailty was found in the group of female caregivers from Southern countries (29.3%). Providing co-residential care is positively associated with the risk of being pre-frail in women, in all European regions (Northern: OR 1.724, 95% CI 1.190–2.496; Central: OR 1.213, 95% CI 1.010–1.456; Eastern: OR 1.227, 95% CI 1.031–1.460; Southern: OR 1.343, 95% CI 1.103–1.634), and with being frail for both genders in the Southern region (female: OR 1.527, 95% CI 1.060–2.200; male: OR 1.644, 95% CI 1.250–2.164). The results of this study suggest that female co-residential caregivers are a greater risk of being pre-frail in all European regions except Southern Europe, where male and female co-residential caregivers are a greater risk of being frail, compared with non-caregivers. European policy makers should create political measures to prevent and reverse frailty among European co-residential caregivers.

KEYWORDS

co-residential caregivers, European Regions, frailty, gender, Survey of Health, Ageing and Retirement in Europe (SHARE)

1 | INTRODUCTION

The number of older people is rapidly increasing, bringing new challenges to health and social care systems (Clegg, Young, Iliffe, Rikkert, & Rockwood, 2013; WHO, 2015). One important health challenge associated with ageing is the geriatric syndrome of frailty (Buckinx et al., 2015), which has been acknowledged as a new public health priority (Cesari et al., 2016; Ofori-Asenso et al., 2019; Santos-Eggimann, Cuenoud, Spagnoli, & Junod, 2009). According to the literature, frailty is significantly associated with multimorbidity, hospitalisation, hospital readmission, institutionalisation, increased health care costs and mortality (Bock et al., 2016; Chang & Lin, 2015; Fried, Ferrucci, Darer, Williamson, & Anderson, 2004; Hanlon et al., 2018; Hao et al., 2019).

A recent systematic review and meta-analysis including data from more than 120,000 community-dwelling older adults (60+) from 28 countries concluded that frailty and pre-frailty incidence rates were approximately 43 and 151 new cases per 1,000 person-years respectively (Ofori-Asenso et al., 2019). In Europe, 42.2% of the population aged 50+ are pre-frail and 7.7% are frail (Manfredi et al., 2019). Moreover, the prevalence of frailty at the population level in Europe is expected to increase (Liotta et al., 2018), with Southern European countries presenting a higher prevalence of frailty and pre-frailty compared to their Northern counterparts (Manfredi et al., 2019; Santos-Eggimann et al., 2009).

Although there is no consensus on the definition of frailty (Buckinx et al., 2015; Dent, Kowal, & Hoogendijk, 2016), the description of the frailty phenotype by Fried and colleagues is widely used (Op het Veld et al., 2015). Fried et al. (2004) describe frailty as a state of high vulnerability for adverse health outcomes, such as disability, dependency, falls, the need for long-term care (LTC) and mortality.

Sociodemographic, biological, psychological and lifestyle factors contribute to the development of frailty (Feng et al., 2017). Research on frailty indicates that it is more common in older age, and among women and people with lower levels of education and lower levels of income (Ahrenfeldt, Möller, Thinggaard, Christensen, & Lindahl-Jacobsen, 2019; Collard, Boter, Schoevers, & Oude Voshaar, 2012; Fried et al., 2001; Gale, Cooper, & Sayer, 2015; Ottenbacher et al., 2009; Santos-Eggimann et al., 2009). According to Ofori-Asenso et al. (2019), the incidence of frailty varies by region, country, income level and the diagnostic criteria used. Having poor health, higher rates of comorbid chronic diseases and disability are also associated with this phenotype (Fried et al., 2001). Reporting persistent pain (a painful experience that continues for a prolonged period of time that may or may not be associated with a recognisable disease process; Saraiva et al., 2018), a higher inflammatory-related disease count (Chang, Weiss, Xue, & Fried, 2012), impairments in ADL and instrumental activities of daily living (IADL; Poli et al., 2017) and higher levels of loneliness (Gale, Westbury, & Cooper, 2018) are also important factors that contribute to frailty. Men aged 60+ who experience high levels of social isolation are also associated with an increased risk of becoming physically frail (Gale et al., 2018). In addition, nearly 20% of frail adults are themselves unpaid caregivers of another adult with frailty, a serious illness or disability (Lee et al., 2018). Nonetheless, a small number of studies analysed the association between providing care and frailty (Alves, Flesch, Cachioni, Neri, & Batistoni, 2018; Dassel & Carr, 2016; de Peretti & Villars, 2015; Potier et al., 2018; Tomomitsu, Lemos, & Perracini, 2010; Uccheddu, Gauthier, Steverink, & Emery, 2019) and no studies adopted an European cross-sectional perspective. Tomomitsu et al. (2010) found that caregivers had a high risk of developing frailty. Those caregivers who care for a person with Alzheimer's disease and experience multimorbidity and a high burden have a higher risk of developing frailty (Alves et al., 2018; de Peretti & Villars, 2015). With regard to spousal caregivers, Potier et al. (2018) stated that older spousal caregivers were more likely to be in a pre-frail stage and, using the health Frailty Index of 40 items, Uccheddu et al. (2019) concluded that transitions into spousal care-giving have a detrimental effect on health. Along the same lines, Dassel and Carr (2016) found that caring for a spouse with dementia at the end of life increases the odds of becoming frail.

With population ageing, informal care is becoming a key issue in the European policy aim of 'ageing in place' (Zigante, 2018). Taking into consideration the increasing demand for informal care (Petrini et al., 2019) and the fact that older adults are increasingly assuming the role of informal caregivers (Hosseinpoor, Bergen, & Chatterji, 2013), it is crucial to discover the current situation of European co-residential caregivers, as well as the risks associated with this activity. Recognising that frailty is an indicator of whether populations are ageing (Woo, 2018) and that frailty can be prevented and treated (Talley & Bernard, 2017), it is important to identify groups of people who are in need of extra care and attention (Buckinx et al., 2015) in order to implement measures to mitigate this situation. Considering that frailty is more prevalent in women (Ahrenfeldt et al., 2019; Ofori-Asenso et al., 2019; Rivas-Ruiz et al., 2019), the main objective of this study is to assess whether there is an association between providing co-residential care and frailty, according to gender, from an European cross-sectional perspective, among the population aged 50+.

What is known about this topic?

- Frailty has been acknowledged as a new public health priority.
- Many frail adults are themselves informal caregivers.

What this paper adds?

- In Europe, co-residential care-giving is associated with pre-frailty and frailty.
- Female and male co-residential caregivers from the Southern region show the highest prevalence of frailty.
- More than half of female co-residential caregivers aged 50+ from the Northern, Central and Eastern regions are pre-frail.

Due to the low prevalence of co-residential caregivers, countries are aggregated into four European regions (Eikemo, Huisman, Bambra, & Kunst, 2008; Jerez-Roig et al., 2018): Northern (Denmark and Sweden), Central (Austria, Germany, France, Switzerland, Belgium and Luxembourg), Eastern (Czech Republic, Poland, Slovenia, Estonia and Croatia) and Southern (Spain, Italy, Greece and Portugal). In the first phase, we analyse the prevalence of co-residential caregivers by gender and European region, we also compare the prevalence of frailty and pre-frailty among European men and women aged 50+ who provide co-residential care with that of those who do not provide co-residential care. In the second phase, we compare the sociodemographic, economic and health characteristics of co-residential caregivers and non-caregivers, by gender and European region. Lastly, we examine whether men and women who provide co-residential care have a higher risk of being pre-frail and frail, compared to their counterparts who do not provide co-residential care.

2 | MATERIALS AND METHODS

2.1 | Data

This article uses data from wave 6 (2015, release 7.0.0) of the Survey of Health, Ageing and Retirement in Europe (SHARE). SHARE is a multidisciplinary and cross-national panel database of microdata on health, socioeconomic status and social and family networks that covers 27 European countries and Israel. A probability sample of the target population, that is, individuals aged 50+, was interviewed in the SHARE project (Börsch-Supan et al., 2013). For more methodological details, please see Börsch-Supan et al. (2013). We restricted our sample to SHARE respondents aged 50+ from 17 European countries (Austria, Germany, Sweden, Spain, Italy, France, Denmark, Greece, Switzerland, Belgium, Czech Republic, Poland, Luxembourg, Portugal, Slovenia, Estonia and Croatia) who participated in wave 6 and answered the co-residential care question (sp018; *N* = 52,073). Analysing the population aged 50+ enabled us to capture three important life periods of the population (pre-retirement, post-retirement and oldest age; Börsch-Supan & Mariuzzo, 2005), which are also crucial when analysing co-residential caregivers' experiences.

2.2 | Measures

2.2.1 | Frailty

Frailty is our dependent variable and it was built according to the five dimensions (weight loss, weakness, exhaustion, slowness and low physical activity) of the phenotype created by Fried et al. (2001). To adapt the five dimensions of Fried and associates' frailty phenotype to the SHARE project content, we used the same procedures as Santos-Eggimann et al. (2009). For weight loss, the answer to the following question is taken into account: '*What has your appetite been like in the last month?*'. This question has three response options: (a) Diminished desire for food; (b) No diminution in desire for food and (c) Non-specific or uncodeable response. If a diminished desire for food is reported, we assumed weight loss. If the previous answer is non-specific or not codified, respondents are also asked if they are eating less than usual. For this second question, if respondents indicated that they were eating less than usual, weight loss was assumed. Weakness was measured using the highest measurement result of handgrip strength (two measurements from each hand), adjusted for gender and body mass index using the same cut-off set as Fried et al. (2001). Exhaustion was assessed through a positive answer to the question: 'In the last month, have you had too little energy to do things that you wanted to do?' Slowness was defined when the respondent reported difficulties walking 100 meters or climbing one flight of stairs without resting. Lastly, low physical activity is assumed when the respondent performs activities that require low or moderate energy, one to three times a month, hardly ever or never. Each positive answer to the previous questions is scored with a point. A total score of 0 point represents being non-frail, 1 or 2 points as being pre-frail and 3–5 points as frail.

2.2.2 | Co-residential care

The provision of informal care within the household (co-residential care) is analysed by question sp018_: *Is there someone living in this household whom you have helped regularly during the last twelve months with personal care, such as washing, getting out of bed, or dressing*? In this question, SHARE considers that regularly means daily or almost daily informal care provided for at least 3 months. We considered that all respondents who answered this question in the affirmative were co-residential caregivers.

2.2.3 | Sociodemographic, economic and health characteristics of individuals

Based on the literature review, we decided to include in our analysis several important confounders. Age was assessed using the age of respondent at the time of the interview, and gender was coded as 1 if female and 0 if male. Current job situation is coded as a dummy variable to distinguish between those who are retired (1) and those who are in another situation (0). Educational level was assessed using ISCED-97 divided into three categories: (a) primary education or less (ISCED-97 score = 0–2), (b) secondary education (ISCED-97 score = 3) and (c) post-secondary education (ISCED-97 score = 4–6). Income was analysed from the total household net income adjusted for purchasing power parity by country and household size and dividing it into tertiles. The lowest tertile was coded as 1, the middle as 2 and the highest as 3. The number of limitations in IADL includes the assessment of nine instrumental activities (using a map, preparing a hot meal, shopping, using a telephone, taking medication, doing housework or gardening, managing money, leaving the house

independently and accessing transportation services and doing personal laundry) for a period of more than 3 months. The number of limitations in activities of daily living (ADL) was assessed according to the presence of difficulties with dressing, walking, bathing, eating, getting in or out of bed and using the toilet, for a period of more than 3 months. The presence of chronic diseases was measured based on the multiple answer question '*Has a doctor ever told you that you had …*' that asks which of the listed chronic conditions the respondents had, according to their doctors. Pain was assessed using two questions: *'Are you troubled with pain'* (ph084_) and *'How bad is the pain most of the time? Is it mild, moderate, or severe?'* (ph085_). If the respondent said yes to the first question, SHARE also asked for information about the level of pain (ph085_). Based on both these questions, we constructed a new variable, called *level of pain*, which was categorised as no pain (0), mild pain (1), moderate pain (2) or severe pain (3). Social isolation was constructed according to Shankar, McMunn, Banks, and Steptoe (2011), Shankar, Rafnsson, and Steptoe (2015) using procedures based on five conditions: not living with a partner (scored as 1), not belonging to any organisations, clubs or religious groups (scored as 1) and having less than monthly contact with friends, family or children (each scored as 1). The total score ranges from 0 to 5, with higher scores representing a higher level of social isolation. Respondents with a score of 0 were categorised as having a low level of social isolation (a), those with a score of 1 as having an intermediate level of social isolation (b) and those with a score of 2 or more as having high levels of social isolation (c).

Lastly, the responses to the shortest version of the Revised-University of California at Los Angeles Loneliness scale (Hughes, Waite, Hawkley, & Cacioppo, 2004) harmonised for use in SHARE (Malter & Börsch-supan, 2013) were also taken in account. This scale includes three questions: *How much of the time do you feel a lack of companionship?; How much of the time do you feel left out?* and *How much of the time do you feel isolated from others?* The response categories were coded from 1 to 3 (1 = often; 2 = some of the time and 3 = hardly ever or never). The total score ranges from 3 to 9, with higher scores indicating higher levels of loneliness. Considering that the distribution of the responses is not a normal distribution, procedures from Niedzwiedz et al. (2016) were used. Firstly, we calculated quartiles by countries and then we categorised all those in the fourth quartile as lonely individuals (1) and the others (first, second and third quartiles) as individuals who were not lonely (0).

2.3 | Analysis

Firstly, we performed a missing data analysis for each model variable. As the missing data are residual (lower than 5%) or non-existent, we decided to proceed with the statistical analysis without imputations (Jakobsen, Gluud, Wetterslev, & Winkel, 2017).

Secondly, the prevalence of co-residential caregivers aged 50+ was assessed. Thirdly, we compared the percentage of pre-frail and frail non-caregivers with pre-frail and frail informal co-residential caregivers aged 50+. Fourthly, tests for a two-group comparison (*T* test (*t*) and chi-square (χ^2) tests) were carried out to assess significant sociodemographic, economic and health differences between non-caregivers and co-residential caregivers. Lastly, multinomial logistic regressions controlled for sociodemographic, economic and health characteristics were conducted to explore the relationship between providing co-residential care and pre-frailty and frailty (reference category: non-frail). The option of conducting multinomial logistic regressions instead of ordinal logistic regression was due to the fact that the assumptions of the parallel-lines model were violated in the latter. In this sense, to avoid incorrect, incomplete or misleading results, multinomial logistic regressions were performed (Williams, 2006).

All analyses were made by gender and European region. Statistical analyses were performed using IBM SPSS Statistics for Windows (V. 25). *p* Values equal or less than 0.050 were considered statistically significant.

3 | RESULTS

The prevalence of co-residential care-giving according to gender and European region is shown in Figure 1. The results indicate that there is a higher significant percentage of female co-residential caregivers than male co-residential caregivers in the Central (8% compared to 6.5%), Eastern (9.8% compared to 6.2%) and Southern (10.7% compared to 7.2%) regions. In the Northern region, no significant differences in prevalence were found between male (5.1%) and female (5%) co-residential caregivers. Women in Eastern and Southern countries are the ones who take on more co-residential care. Therefore, the percentage of women of Southern European countries who provide co-residential care is about twice that of the Northern countries (10.7% compared to 5%).

Figure 2 shows the prevalence of pre-frailty in caregivers and non-caregivers by gender and European region. In Central and Southern regions, the group of men who provided co-residential care present higher significant percentages of pre-frailty compared to the group of men who do not provide care (Central: 44.1% compared to 36%; Southern: 47.2% compared to 38.5%). Among men, these differences were not statistically significant in the Northern and Eastern regions. With regard to women, the data show that the caregiver group presents higher significant percentages of pre-frailty compared to non-caregivers in Northern (57.3% compared to 39.7%), Central (52.4% compared to 43.6%) and Eastern regions (56.6% compared to 44.4%). In the Southern region, no statistically significant differences in the prevalence of pre-frailty were found between groups of women who provide care and those who do not provide it. Overall, Figure 2 also reveals that, considering both genders, the group of women from the Northern region are the ones who presented the highest percentage of pre-frailty (57.3%).

Regarding frailty status, Figure 3 highlights that men who provide care had higher significant percentages of frailty, in comparison with men who do not provide care, in Central (11.3% compared to 4%), Eastern (10.8% compared to 6.9%) and Southern regions (13.6%

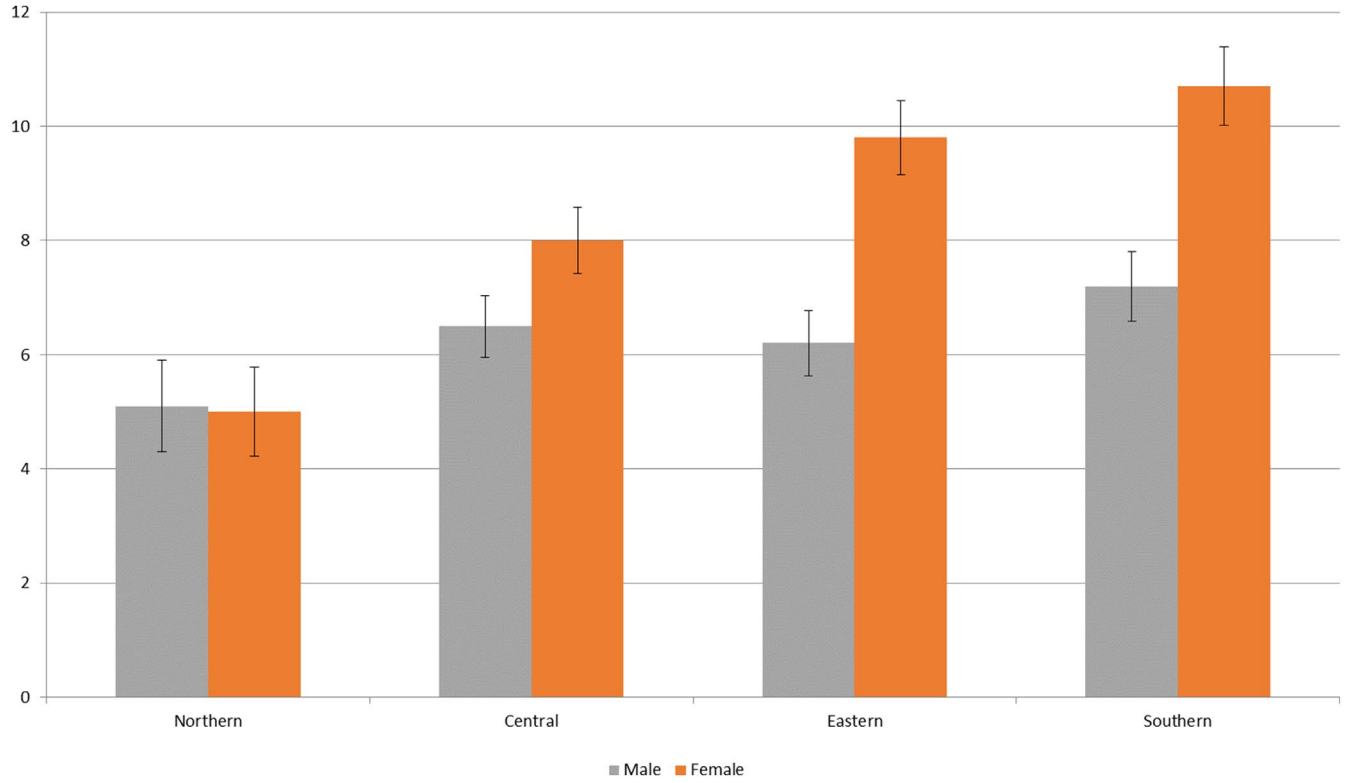

FIGURE 1 The prevalence of co-residential care-giving according to gender and European region.
Source: SHARE, release 7.0.0., Wave 6, weighted data, *N* = 52,073 (unweighted). *Notes*. Brackets denote a 95% confidence interval [Colour figure can be viewed at wileyonlinelibrary.com]

compared to 6%). As far as women are concerned, in the Central (13.1% compared to 7.2%) and Southern (29.3% compared to 14.6%) regions, the group who provide care had statistically higher percentages of frailty compared to those who do not provide care. The group of women who provide care in Southern countries shows the highest percentages of frailty (29.3%).

The results of the comparison between male caregivers and male non-caregivers in terms of sociodemographic and economic characteristics by European region are shown in Table 1. In all the regions analysed, male caregivers are older than non-caregivers. Additionally, male caregivers from southern European countries show the highest average age (69 years). The male caregivers' group has higher percentages of retired individuals than male non-caregivers in all regions except the Northern one. In the Central, Eastern and Southern regions, male caregivers have lower levels of education compared to non-caregivers. No differences in educational levels between caregivers and non-caregivers were found in the Northern region. The male caregivers' group has a higher percentage of low-income individuals than the male non-caregiver group in the Northern and Eastern regions, while in the Central and Southern regions, no differences were found between groups. With respect to IADL and ADL limitations, in all the regions analysed, male caregivers have a higher number of these kinds of limitations. In male caregiver groups in the Central, Eastern and Southern regions, there is a higher number of chronic diseases, higher percentages of moderate and severe pain, loneliness and high levels of social isolation.

Table 2 show the results of the comparison between female caregivers and female non-caregivers in terms of sociodemographic and economic characteristics by European region. Among women, the group of co-residential caregivers from the Northern, Central and Southern regions are older than non-caregivers. Conversely, in the Eastern region, the group of co-residential caregivers is younger than the group of non-caregivers. In the Northern, Central and Eastern regions, female caregivers are predominantly retired, in contrast to the Southern region where female caregivers are predominantly not retired. With respect to education and income, in all European regions the female caregiver group has higher percentages of primary or less educational level and a lower income. In the Northern region, the differences in educational level were only marginally significant. The results also show that, in all regions, women who provide care have a higher number of IADL limitations. Regarding ADL limitations and pain, the Central and Southern regions have a higher number of ADL limitations and a higher percentage of severe pain in the group of co-residential caregivers. This contrasts with the Eastern region, where female caregivers report a lower number of ADL limitations and a lower percentage of severe pain. In the Northern, Central and Southern regions, female caregivers report a higher number of chronic diseases and higher levels of loneliness. The opposite results were found in the Eastern region, where the group of female caregivers, compared to female non-caregivers, reports a lower number of chronic diseases and lower levels of loneliness.

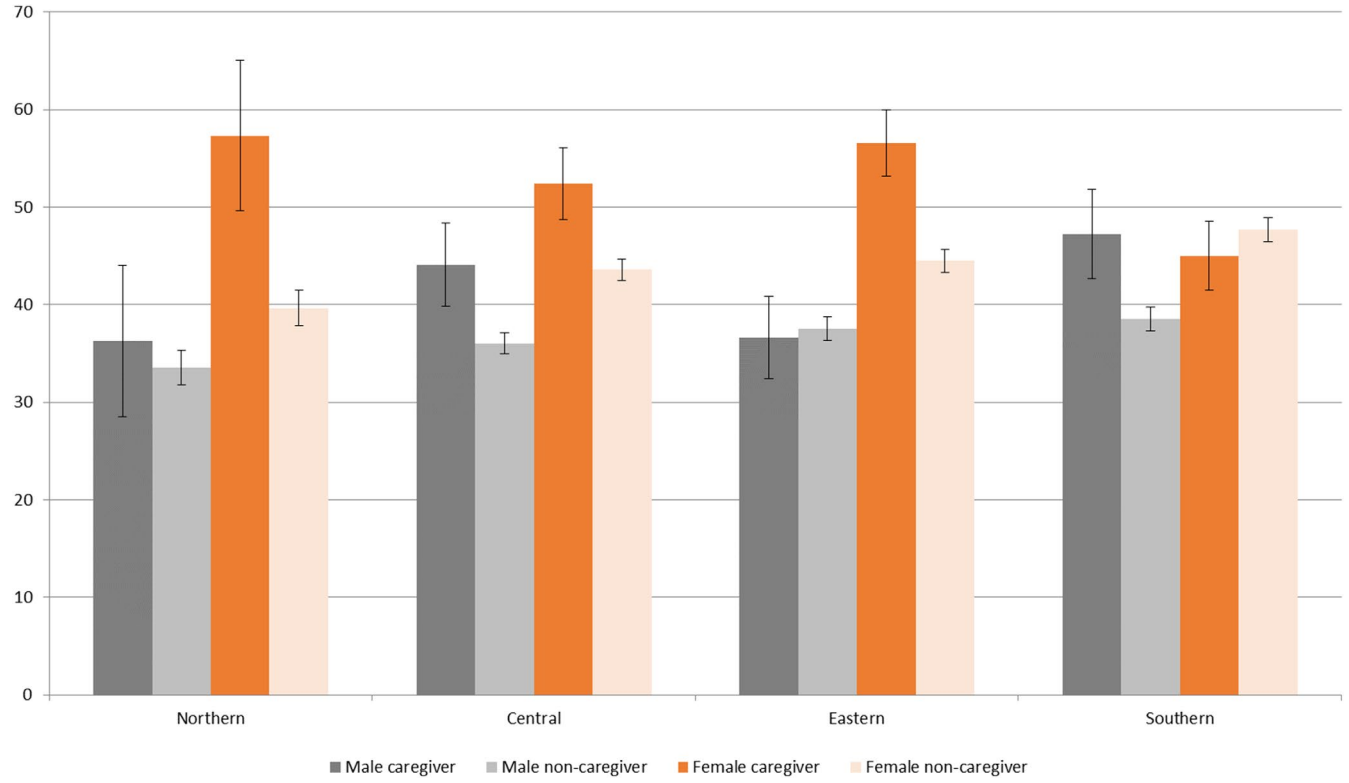

FIGURE 2 Prevalence of pre-frailty in caregivers and non-caregivers by gender and European region.
Source: SHARE, release 7.0.0., Wave 6, weighted data, *N* = 49,754 (unweighted). *Notes*. Brackets denote a 95% confidence interval [Colour figure can be viewed at wileyonlinelibrary.com]

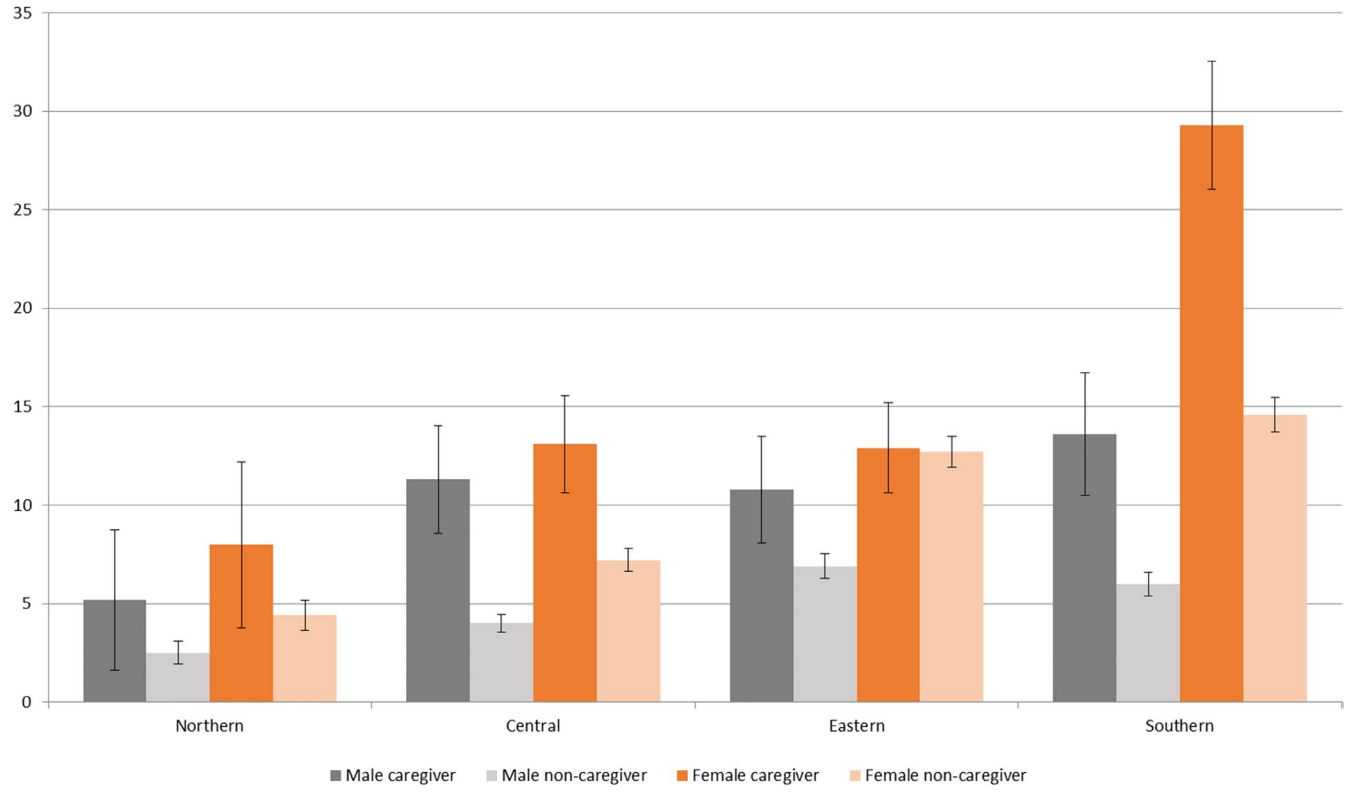

FIGURE 3 Prevalence of frailty in caregivers and non-caregivers by gender and European region.
Source: SHARE, release 7.0.0., Wave 6, weighted data, *N* = 49,754 (unweighted). *Notes*. Brackets denote a 95% confidence interval [Colour figure can be viewed at wileyonlinelibrary.com]

TABLE 1 Descriptive statistics of male individuals aged 50+

	Northern				Central				Eastern				Southern			
	Caregivers	Non-caregivers			Caregivers	Non-caregivers			Caregivers	Non-caregivers			Caregivers	Non-caregivers		
	N = 156	*N* = 2,761	T/χ^2	*p*-value	*N* = 551	*N* = 7,434	T/χ^2	*p*-value	*N* = 537	*N* = 6,401	T/χ^2	*p*-value	*N* = 527	*N* = 6,426	T/χ^2	*p*-value
Age, *M* (*SD*)	66.64 (11.15)	64.80 (9.40)	−2.56	0.011	68.54 (11.17)	64.66 (9.69)	−7.72	<0.001	66.50 (9.75)	63.50 (9.40)	−4.38	<0.001	69.00 (10.39)	65.20 (10.10)	−7.13	<0.001
Retired (%)																
No	48.20	53.10	1.64	0.200	31.20	44.90	25.99	0.001	38.00	48.70	9.08	0.003	31.10	44.80	20.34	<0.001
Yes	51.80	46.90			68.80	55.10			62.00	51.30			68.90	55.20		
Education (%)			3.54	0.171			24.83	<0.001			8.48	0.014			14.33	0.001
Primary or less	25.10	22.30			22.30	16.20			35.40	28.50			67.60	67.10		
Secondary	37.70	34.90			45.40	47.10			46.40	53.60			18.40	20.00		
Post-secondary	37.20	42.80			32.30	36.70			18.20	17.90			13.90	12.90		
Income (%)			6.45	0.040			3.18	0.204			16.98	<0.001			1.50	0.471
Low	32.60	27.80			35.40	32.10			35.50	33.30			34.10	33.90		
Medium	25.60	32.50			32.30	33.40			32.20	38.00			38.30	34.90		
High	41.80	39.70			32.30	34.50			32.30	28.70			27.60	31.10		
IADL, *M* (*SD*)	0.36 (1.37)	0.20 (0.90)	−2.81	<0.001	0.71 (1.71)	0.29 (1.17)	−6.05	<0.001	0.83 (1.67)	0.47 (1.58)	−3.32	<0.001	1.01 (2.24)	0.35 (1.40)	−6.35	<0.001
ADL, *M* (*SD*)	0.23 (0.87)	0.12 (0.54)	−2.73	0.006	0.44 (1.09)	0.19 (0.77)	−5.70	<0.001	0.44 (0.97)	0.27 (0.94)	−2.61	0.009	0.59 (1.39)	0.18 (0.80)	−5.95	<0.001
Chronic diseases, *M* (*SD*)	0.99 (1.20)	0.94 (1.13)	−1.11	0.268	1.30 (1.33)	1.11 (1.22)	−4.63	<0.001	1.33 (1.26)	1.09 (1.20)	−3.46	<0.001	1.43 (1.35)	1.11 (1.19)	−4.31	<0.001
Level of pain (%)			4.09	0.251			39.30	<0.001			11.46	0.009			51.67	<0.001
No pain	64.30	71.10			52.10	61.10			50.20	53.20			47.40	63.60		
Mild pain	16.00	10.20			7.60	7.70			11.40	9.50			9.70	11.90		
Moderate pain	13.60	14.50			25.10	21.40			27.20	26.60			31.60	18.40		
Severe pain	6.10	4.20			15.20	9.80			11.20	10.70			11.30	6.10		
Loneliness (%)			1.53	0.217			32.39	<0.001			11.53	0.001			21.34	<0.001
No	86.00	87.70			77.50	86.90			82.00	86.20			79.60	90.30		
Yes	14.00	12.30			22.50	13.10			18.00	13.80			20.40	9.70		
Social isolation (%)			1.53	0.465			10.55	0.005			9.07	0.011			10.48	0.005
Low	66.80	66.20			44.50	51.60			26.50	22.80			31.20	24.90		
Intermediate	30.50	31.40			49.10	44.80			56.00	66.00			62.20	69.80		
High	2.70	2.40			6.40	3.60			17.50	11.20			6.60	5.30		

Note: Tests for two-group comparison (i.e. *T* test for independent samples (*t*); chi-square tests (χ^2)).

Abbreviations: ADL, activities of daily living; IADL, instrumental activities of daily living; SHARE, Survey of Health, Ageing and Retirement in Europe.

Source: SHARE, Wave 6, release 7.0.0., weighted data, unweighted *N*.

Finally, in the Northern and Central regions, we observed higher percentages of female caregivers experiencing high levels of social isolation, compared with female non-caregivers. In the Southern region, no differences were found between groups in terms of social isolation; and in the Eastern region, female caregivers experience lower levels of social isolation compared to their non-caregiver counterparts.

The results of the multinomial logistic regressions by gender and European region, to test the association between providing co-residential care and pre-frailty and frailty, are shown in Table 3. In the male gender group, pre-frailty is not associated with care-giving in all the European regions. Nevertheless, male caregivers from the Southern European region are more likely to be frail (OR 1.527, 95% CI 1.060–2.200; $p = 0.023$).

In all European regions, co-residential care provided by women is positively associated with the risk of pre-frailty (Northern: OR 1.724, 95% CI 1.190–2.496; $p = 0.004$; Central: OR 1.213, 95% CI 1.010–1.456; $p = 0.039$; Eastern: OR 1.227, 95% CI 1.031–1.460; $p = 0.021$; Southern: OR 1.343, 95% CI 1.103–1.634; $p = 0.003$). Only in the Southern European region is co-residential care provided by women significantly associated with frailty (OR 1.644, 95% CI 1.250–2.164; $p = <0.001$).

4 | DISCUSSION

This study provides important findings regarding pre-frailty and frailty among European co-residential caregivers, according to gender and European region. Firstly, this research highlights that, in the Central, Eastern and Southern European regions, co-residential caregivers aged 50+ are predominantly women, with the percentage of female co-residential caregivers in the Eastern and Southern regions being considerably higher than in the Northern and Central regions. The results are in line with several studies that support the fact that women remain the main informal caregivers (Rodrigues, Huber, & Lamura, 2012; Sharma, Chakrabarti, & Grover, 2016) and that co-residential care is more prevalent in Southern and Eastern European countries (Alber & Köhler, 2004; Lyberaki, Tinios, Mimis, & Georgiadis, 2013), which are characterised as familistic (Mair, 2013) and where the responsibility for LTC is mainly assumed by families (Laferrère & Van den Bosch, 2015).

Our study also found significantly higher percentages of pre-frailty in female caregivers from the Northern, Central and Eastern regions compared to non-caregivers.

More than half of female co-residential caregivers aged 50+ from Northern, Central and Eastern regions are pre-frail. With regard to men, only in the Central and Southern regions were significant higher percentages of pre-frailty found in caregivers, as compared to non-caregivers. Insofar as, according to Fried et al. (2001), those who are in the pre-frail stage have a higher risk of becoming frail, these findings raise many issues related to the health of caregivers. Furthermore, higher percentages of frailty were found in male caregivers from the Central, Eastern and Southern regions and in female caregivers from the Central and Southern region compared to their counterparts who do not provide care. Considering that frailty is an indicator of 'low' health status in old age, the results show that these caregivers are in a vulnerable situation for developing increased dependency and/or dying (Morley et al., 2013).

Irrespective of gender, caregivers are older than non-caregivers (with the exception of female caregivers from Eastern countries). They have more IADL limitations and more ADL limitations (with the exception of female caregivers from Northern countries, where no significant differences were found, and female caregivers from the Eastern region, who conversely show lower ADL limitations). They have more chronic diseases (with the exception of male caregivers from Northern countries, where no significant differences were found, and female caregivers from the Eastern region, who show a lower number of chronic diseases). They suffer the highest levels of pain (with the exception of both male and female caregivers from Northern countries, where no significant differences were found, and female caregivers from the Eastern region who show a lower percentage of severe pain). They experience loneliness more often (with the exception of male caregivers from Northern countries, where no significant differences were found, and female caregivers from the Eastern region, who show a lower percentage of loneliness). They are also more socially isolated (with the exception of male caregivers from Northern countries and female caregivers from Southern countries, where no significant differences were found, and female caregivers from the Eastern region, who show a lower percentage of high social isolation). Overall, these findings highlight informal care provision as a selection process whereby the individuals in worse health provide care inside the household rather than outside the household (Kaschowitz & Brandt, 2017). Furthermore, co-residential care-giving is significantly associated with more hours of care and more chronic stress that may lead to physical and emotional exhaustion, as well as to worse self-perceptions of physical and mental health (de Peretti & Villars, 2015; Kaschowitz & Brandt, 2017; Kumagai, 2017).

Nonetheless, the group of female caregivers from Eastern countries shows, overall, higher levels of health compared with their female non-caregiver group counterparts. These results may be associated with the lower average age of this group.

With regard to women, providing co-residential care is positively associated with pre-frailty in all European regions, and with frailty in Southern European countries. In the male group, no significant association is found between care-giving and pre-frailty. However, care-giving is associated with frailty in Southern European countries. Our results indicate that women who provide co-residential care have a higher risk of experiencing pre-frailty, and that caregivers from Southern European countries, regardless of gender, are at a higher risk of being frail. These findings are in line with other studies that stressed that the incidence of pre-frailty is significantly higher in women and in countries with lower or middle incomes (Ofori-Asenso et al., 2019). Previous studies have shown that individuals from Southern European countries have higher percentages of frailty (Manfredi et al., 2019; Santos-Eggimann

TABLE 2 Descriptive statistics of female individuals aged 50+

	Northern				Central				Eastern				Southern			
	Caregivers	Non-caregivers			Caregivers	Non-caregivers			Caregivers	Non-caregivers			Caregivers	Non-caregivers		
	N = 162	*N* = 2,794	T/χ^2	*p*-value	*N* = 729	*N* = 7,802	T/χ^2	*p*-value	*N* = 854	*N* = 7,220	T/χ^2	*p*-value	*N* = 844	*N* = 6,875	T/χ^2	*p*-value
Age, *M* (*SD*)	68.71 (10.21)	64.11 (9.32)	−4.31	<0.001	68.32 (11.03)	64.06 (10.15)	−7.49	<0.001	64.25 (10.90)	64.78 (10.03)	−2.76	0.006	69.17 (11.09)	65.21 (10.77)	−6.76	<0.001
Retired (%)																
No	36.00	52.60	6.10	0.013	40.30	52.50	10.30	0.001	39.20	43.00	13.13	<0.001	65.90	69.60	5.17	0.023
Yes	64.00	47.40			59.70	47.50			60.80	57.00			34.10	30.40		
Education (%)			5.73	0.057			31.58	<0.001			11.40	0.003			20.27	<0.001
Primary or less	31.00	21.70			38.30	26.10			43.00	38.70			79.90	73.10		
Secondary	28.60	27.90			42.80	46.50			39.30	48.10			11.10	16.30		
Post-secondary	40.40	50.40			18.90	27.50			17.70	13.20			9.00	10.60		
Income (%)			15.62	<0.001			23.57	<0.001			46.50	<0.001			15.76	<0.001
Low	47.80	31.40			52.00	36.40			48.20	43.90			46.10	38.90		
Medium	29.60	32.10			30.00	32.10			29.50	29.60			31.20	33.80		
High	22.60	36.50			18.00	31.50			22.30	26.50			22.70	27.2		
IADL, *M* (*SD*)	0.67 (1.49)	0.29 (1.02)	−2.46	0.015	0.77 (1.67)	0.43 (1.41)	−5.81	<0.001	0.73 (1.79)	0.70 (1.82)	−2.42	0.016	1.62 (2.84)	0.69 (1.91)	−7.28	<0.001
ADL, *M* (*SD*)	0.37 (1.16)	0.12 (0.60)	−1.48	0.139	0.38 (0.95)	0.21 (0.82)	−5.80	<0.001	0.28 (0.87)	0.36 (1.13)	−2.88	0.004	0.77 (1.56)	0.33 (1.10)	−5.86	<0.001
Chronic diseases, *M* (*SD*)	1.19 (1.25)	0.80 (1.08)	−2.65	0.009	1.29 (1.29)	0.95 (1.12)	−6.22	<0.001	1.24 (1.27)	1.26 (1.26)	−4.43	<0.001	1.44 (1.34)	1.06 (1.19)	−6.24	<0.001
Level of pain (%)			3.04	0.385			49.39	<0.001			29.21	<0.001			68.33	<0.001
No pain	54.40	60.10			42.20	52.60			34.80	43.60			27.70	43.30		
Mild pain	7.80	10.70			7.80	7.60			14.20	8.50			13.60	14.60		
Moderate pain	26.40	23.00			26.20	25.80			42.70	33.30			33.70	27.00		
Severe pain	11.40	6.20			23.60	14.00			8.30	14.60			25.00	15.10		
Loneliness (%)			37.69	<0.001			59.64	<0.001			14.27	<0.001			42.25	<0.001
No	61.00	83.80			66.60	80.50			87.50	82.20			67.60	77.10		
Yes	39.00	16.20			33.40	19.50			12.50	17.80			32.40	22.90		
Social isolation (%)			9.03	0.011			21.12	<0.001			11.55	0.003			0.340	0.844
Low	51.70	65.50			36.60	46.80			11.70	15.30			16.90	17.20		
Intermediate	42.40	31.00			54.00	45.20			65.10	55.30			63.60	64.80		
High	5.90	3.50			9.40	8.00			23.20	29.40			19.50	18.00		

Note: Tests for two-group comparison (i.e. *T* test for independent samples (*t*); chi-square tests (χ^2)).

Abbreviations: ADL, activities of daily living; IADL, instrumental activities of daily living; SHARE, Survey of Health, Ageing and Retirement in Europe.

Source: SHARE, Wave 6, release 7.0.0., weighted data, unweighted *N*.

TABLE 3 Multinomial logistic regressions by gender and European region to evaluate the relationship between providing co-residential care and pre-frailty and frailty (reference category non-frail)

	Pre-frail versus non-frail				Frail versus non-frail			
	Male							
Regime	Coefficient	*SE*	OR 95% CI	*p* value	Coefficient	*SE*	OR 95% CI	*p* value
Northern	0.181	0.189	1.198 (0.828–1.734)	0.339	0.660	0.440	1.935 (0.818–4.580)	0.133
Central	0.156	0.106	1.169 (0.950–1.440)	0.141	0.302	0.213	1.352 (0.890–2.055)	0.157
Eastern	0.089	0.109	1.094 (0.883–1.355)	0.413	0.223	0.210	1.250 (0.828–1.886)	0.289
Southern	0.170	0.116	1.186 (0.945–1.487)	0.141	0.423	0.186	1.527 (1.060–2.200)	0.023
	Female							
Regime	Coefficient	*SE*	OR 95% CI	*p* value	Coefficient	*SE*	OR 95% CI	*p* value
Northern	0.544	0.189	1.724(1.190–2.496)	0.004	0.063	0.420	1.065 (0.467–2.426)	0.882
Central	0.193	0.093	1.213 (1.010–1.456)	0.039	0.000	0.171	1.000 (0.716–1.397)	0.999
Eastern	0.205	0.089	1.227 (1.031–1.460)	0.021	0.189	0.157	1.208 (0.887–1.644)	0.230
Southern	0.295	0.100	1.343 (1.103–1.634)	0.003	0.497	0.140	1.644 (1.250–2.164)	<0.001

Note: Results adjusted for: age, gender, current job situation, education, income, IADL, ADL, number of chronic diseases, pain, loneliness and social isolation.

Abbreviations: ADL, activities of daily living; CI, confidence interval; IADL, instrumental activities of daily living; OR, odds ratio; SHARE, Survey of Health, Ageing and Retirement in Europe.

Source: SHARE, Wave 6, release 7.0.0., *N* = 49,569.

et al., 2009) and poor health (Eriksen, Vestergaard, & Andersen-Ranberg, 2013). According to Verbakel (2018), intensive care-giving is more common in countries with strong family care norms, such as Southern countries where there is less LTC provision. Nevertheless, the consequences of providing intensive care and the existence of lower LTC provision can be burdensome for caregivers (Verbakel, 2018). In view of these circumstances, co-residential caregivers in Southern countries may have a more limited or no choice when taking on the role of co-residential caregiver.

Considering the highest percentages of co-residential caregivers (Barbosa & Matos, 2014; Kaschowitz & Brandt, 2017) and the greater need for LTC in Southern European countries (Laferrère & Van den Bosch, 2015), policy makers from these countries should implement social and health policies to support co-residential caregivers.

The absence or existence of inadequate social and health policies to support informal caregivers in Southern countries can jeopardise the continuation of care by informal caregivers.

The results of this study stress that European co-residential caregivers aged 50+ are incurring serious health risks, as a large number are in a pre-frail or frail situation, which is associated with an intermediate and a high risk, respectively, of incident falls, worsening mobility or ADL disability, hospitalisation and death (Fried et al., 2001). Therefore, policy makers should be aware of the risks faced by co-residential caregivers and should develop social and health interventions to prevent and reduce frailty in this population. Nevertheless, although frailty is considered an important issue in old age, there seem to be many challenges to overcome. According to Ambagtsheer et al. (2019), in today's society there is a low level of awareness of frailty and screening for frailty is still in the early stages. Results from Gwyther et al. (2018) recommend implementing campaigns to raise awareness of the malleability and preventability of frailty in health and social care professionals, healthcare policy makers and in older adults themselves. In addition, some researchers have suggested that frailty needs to be urgently implemented in clinical practice worldwide, with measuring frailty being part of routine clinical care for older patients (Dent et al., 2016; Morley et al., 2013). In line with Morley et al. (2013), the use of rapid screening frailty tests and the promotion of health resistance and aerobic exercises, plus the reduction in polypharmacy, alongside vitamin D and protein-calorie supplementation, can prevent or treat physical frailty. In this sense, it is critical to re-imagine and reconfigure healthcare services to better meet the needs of increasingly complex patient populations (Hanlon et al., 2018), and patient-centred assessment by primary care services is required (Lee et al., 2018) to prevent and reverse frailty.

This study has strengths and weaknesses. To our knowledge, it is the first cross-sectional study using representative data to assess whether there is an association between providing co-residential care and pre-frailty and frailty status in Europe in the population aged 50+. However, this study has some limitations. Firstly, because of the low number of co-residential caregivers in each country, we had to perform a regional analysis instead of a country one. Secondly, the SHARE study does not ask about the number of hours of care provided by the caregiver, or about the health status of all individuals who receive informal co-residential care (we only have access to the health status of the spouse of co-residential caregiver). These restrictions prevent us from deepening our analyses. Lastly, because the current study is cross-sectional, we cannot assume causality.

This study adds to the evidence suggesting that providing co-residential care is positively associated with pre-frailty for women in all European regions and with frailty for men and women in the Southern region.

Policy makers should create and tailor policies that address the different social and health needs of European co-residential caregivers. The existence of appropriate public policies to support informal caregivers will help to fulfil the 'ageing in place' aim of European policies by providing adequate support to informal caregivers, which can prevent and reverse the frailty and pre-frailty stages. The association between the frailty of co-residential caregivers and social and health policies should be explored in future analysis.

ACKNOWLEDGEMENTS

The authors are grateful for the funding awarded to SHARE-Portugal by Calouste Gulbenkian Foundation and by FCT/MCTES through National Funds (PIDDAC) and co-financed by the European Regional Development Fund (ERDF), through the Operational Program PORNorte and PORLisboa, AACN° 01/SAICT/2016, Application n° 022209 – DATALAB. This study uses data from SHARE Wave 6 (https://doi.org/10.6103/SHARE.w6.700), see Börsch-Supan et al. (2013) for methodological details (Börsch-Supan et al., 2013). The SHARE data collection has been funded by the European Commission through FP5 (QLK6-CT-2001-00360), FP6 (SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857, SHARE LIFE: CIT4-CT-2006-028812), FP7 (SHARE-PREP: GA n° 211909, SHARE-LEAP: GA n° 227822, SHARE M4: GA n° 261982) and Horizon 2020 (SHARE-DEV3: GA n° 676536, SERISS: GA n° 654221) and by DG Employment, Social Affairs & Inclusion. 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 and HHSN271201300071C) and from various national funding sources is gratefully acknowledged (see www.share-project.org).

CONFLICT OF INTEREST

The authors have no conflict of interest to report.

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How to cite this article: Barbosa F, Voss G, Delerue Matos A. Do European co-residential caregivers aged 50+ have an increased risk of frailty? *Health Soc Care Community*. 2020;28:2418–2430. https://doi.org/10.1111/hsc.13064