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## Is loneliness a new Geriatric Giant? Analysis from the Survey of Health, Ageing, and Retirement in Europe

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Maria Giné-Garriga<sup>1,2</sup>, Javier Jerez-Roig<sup>3</sup>, Laura Coll-Planas<sup>4</sup>, Dawn A. Skelton<sup>5</sup>, Marco Inzitari<sup>6,7</sup>,  
Joanne Booth<sup>5</sup>, Dyego L. B. Souza<sup>8</sup>

1 Department of Physical Activity and Sport Sciences, Faculty of Psychology, Education and Sport Sciences (FPCEE) Blanquerna, Ramon Llull University, Barcelona, Spain

2 Department of Physiotherapy, Faculty of Health Sciences Blanquerna, Ramon Llull University, Barcelona, Spain.

3 Research group on Methodology, Methods, Models and Outcome of Health and Social Sciences (M<sub>3</sub>O), Faculty of Health Sciences and Welfare, University of Vic - Central University of Catalonia (UVIC-UCC), 08500 Vic, Spain

4 Fundació Salut i Envel·liment (Foundation on Health and Ageing), Universitat Autònoma de Barcelona, Barcelona, Spain

5 Centre for Living, School of Health and Life Sciences, Glasgow Caledonian University, Cowcaddens Road, Glasgow G4 0BA, UK

6 Intermediate Care Hospital, Parc Sanitari Pere Virgili, Avinguda de Vallcarca 169-205, 08023 Barcelona, Spain

7 RE-FiT Barcelona Research Group, Vall d'Hebrón Institute of Research (VHIR), Passeig de la Vall d'Hebron 119-129, 08035 Barcelona, Spain

8 Federal University of Rio Grande do Norte, Department of Collective Health, Postgraduate Programme in Collective Health, Natal, Brazil

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**Corresponding author:** Javier Jerez-Roig, Research group on Methodology, Methods, Models and Outcomes of Health and Social Sciences (M<sub>3</sub>O). Faculty of Health Sciences and Welfare. Centre for Health and Social Care Research (CESS). University of Vic-Central University of Catalonia (UVic-UCC), e-mail: javier.jerez@uvic.cat, +34938816025, C. Sagrada Família, 7, 08500 Vic, Spain.

## Abstract

1 Introduction. Modern geriatric giants have evolved to encompass four new syndromes of  
2 frailty, sarcopenia, anorexia of ageing, and cognitive impairment. In parallel, loneliness has  
3 been established as a risk factor for adverse mental and physical health outcomes among older  
4 adults.  
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8 Aim. To analyse loneliness as a predictor of the modern geriatric giants in older adults, using a  
9 longitudinal design of nationally representative data.  
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12 Study design. Longitudinal population-based cohort study, using data from waves 5, 6 and 7 of  
13 the Survey of Health, Ageing, and Retirement in Europe project. Data from countries that  
14 participated in waves 5, 6 and 7 were considered. Loneliness as measured at wave 5 was the  
15 independent variable of interest. The dependent variables were incidence of sarcopenia,  
16 anorexia of ageing, physical inactivity, fatigue, and cognitive impairment from wave 5 to either  
17 wave 6 or 7. Poisson regression models were used for multivariate analysis, obtaining Relative  
18 Risk (RR) and confidence intervals (CI) at 95%.  
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23 Results. The incidence of anorexia of aging was 6.9% (95% CI: 6.6-7.2), fatigue 18.9% (95% CI:  
24 18.5-19.4), sarcopenia 7.0% (95% CI: 6.8-7.4), physical inactivity 10.0% (95% CI: 9.6-10.4) and  
25 cognitive decline 12.9% (95% CI: 12.4-13.4). The multivariate analysis showed that loneliness  
26 was a predictive factor for physical inactivity, cognitive decline and fatigue.  
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31 Conclusions. Loneliness is an independent risk factor for physical inactivity, cognitive  
32 impairment and fatigue in older adults. Anorexia of ageing and sarcopenia were not predicted  
33 by loneliness during the 4-year observation period.  
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### Keywords:

39 Cohort studies, loneliness; modern geriatric giants; SHARE.  
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## Introduction

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In 1965, Bernard Isaacs coined the term “Geriatric Giants” to describe the conditions of immobility, instability, incontinence, and impaired intellect/memory.<sup>1</sup> Similarly, the Geriatric 5Ms were proposed in 2017 by Mary Tinetti as a simple construct to define core competencies of geriatric medicine, including mind, mobility, medications, multi-complexity and matters most (e.g. shared goals of care), although incontinence was excluded from the model.<sup>2</sup> Modern geriatric giants have evolved over the past 50 years to encompass four new syndromes of frailty, sarcopenia, anorexia of ageing, together with cognitive impairment (impaired intellect according to Isaacs).<sup>3</sup> These syndromes are risk factors of falls, hip fractures, affective disorders and delirium, with their associated increase in morbidity and mortality.<sup>3</sup> Overall, the modern geriatric giants are associated with high costs for health and social care systems. Their presence increases the risk for hospitalisation and cost of care during hospitalisation.<sup>4</sup>

If we focus on the modern geriatric giants, a person may have a frailty phenotype when three or more of the following criteria are present: unintentional weight loss, self-reported exhaustion (e.g. fatigue), weakness, slow walking speed, and low levels of physical activity.<sup>5</sup> Unintentional weight loss is highly correlated to anorexia of aging, defined as the loss of appetite and/or decreased food intake in late life. Similarly, weakness is closely related to sarcopenia. In the revised guidelines of the European Working Group on Sarcopenia in Older People,<sup>6</sup> muscle strength comes to the forefront of the definition of sarcopenia as it is recognised that strength is better than muscle mass in predicting adverse outcomes.<sup>7,8</sup>

Many risk factors had been associated with anorexia of ageing, such as physical function impairment, social and environmental conditions, as well as acute and chronic diseases.<sup>9</sup> Sarcopenia is a progressive and generalised skeletal muscle disorder that is associated with increased likelihood of adverse outcomes including falls, fractures, ability to perform activities of daily living, physical disability and mortality.<sup>10</sup> Sarcopenia is also associated with cognitive impairment,<sup>11</sup> and contributes to lowered quality of life and loss of independence.<sup>12</sup>

Mild cognitive impairment (MCI) starts as a syndrome defined as cognitive decline greater than expected for an individual's age and education level, but without impairments in the individual's functional abilities. Individuals with MCI are more than twice as prone to develop dementia in the future.<sup>13</sup> Available evidence indicates that the prevalence of MCI ranges from 7.7% to 42.0% depending on the age group, the country where the study was conducted, and the diagnostic criteria used to make the diagnosis.<sup>13</sup> Increasing age is the strongest risk factor

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for cognitive impairment, along with other chronic conditions (e.g. diabetes, high blood pressure), depression, insufficient physical activity, low educational level, and infrequent participation in mentally or socially stimulating activities.<sup>14</sup>

Loneliness had been defined as a subjective feeling of limited or lost companionship or social support.<sup>15</sup> Loneliness is a condition in which an individual perceives himself or herself to be socially isolated even when among other people. Loneliness is present over the lifespan but increases with the experience of growing old due to reduced social interactions—particularly with family, friends, and community networks—caused by their retirement, physical changes (cognitive and physical disabilities), loss of peers -spouse and friends- (shrinking network size), and/or living alone or in institutions.<sup>15</sup>

Loneliness has been established as a risk factor for the adverse mental and physical health events among older adults,<sup>15,16</sup> leading to depression and dementia,<sup>17</sup> a higher level of cognitive and physical disability,<sup>18</sup> and increased mortality.<sup>15</sup> Loneliness is significantly and negatively correlated with cognitive function in several studies.<sup>19</sup> According to one meta-analysis,<sup>20</sup> adults with adequate or strong social relationships had a 50% increased likelihood of survival compared with those with weaker or insufficient relationships. Loneliness is emerging as a public health issue,<sup>21</sup> and is associated with a 26% increase in the risk of premature mortality.<sup>22</sup>

Therefore, our main aim was to analyse loneliness as a predictor of the modern geriatric giants (frailty, sarcopenia, anorexia of ageing, and cognitive impairment) in older adults, using a longitudinal design of nationally representative data.

## Methods

We present a longitudinal population-based cohort study using data from waves 5, 6 and 7 of the Survey of Health, Ageing, and Retirement in Europe (SHARE) project ([www.share-project.org](http://www.share-project.org)). The aforementioned study is the largest multidisciplinary, cross-country, longitudinal research project conducted in Europe. The SHARE Project respects the Helsinki Declaration, in terms of anonymity of the participants and obtaining of written consent. Wave 4 and following waves have been reviewed and approved by the Ethics Committee of the Max Planck Society. Furthermore, individual country implementation of SHARE was reviewed and approved by the respective ethics committees or institutional review boards. Further details

1 about data collection, sampling procedures and other methodological aspects are available in  
2 the project's website ([www.share-project.org](http://www.share-project.org)).<sup>23</sup>  
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5 Data from 16 countries that participated in waves 5, 6 and 7 were considered: Austria,  
6 Germany, Sweden, Netherlands, Spain, Italy, France, Denmark, Switzerland, Belgium, Israel,  
7 Czech Republic, Poland, Luxemburg, Slovenia and Estonia. Due to data incompleteness, the  
8 subsample was reduced to 10 countries (Austria, Germany, Sweden, Spain, Italy, France,  
9 Denmark, Switzerland, Belgium and Czech Republic) for the analysis of physical inactivity and  
10 cognitive impairment. Although sampling differed slightly, all countries obtained probability  
11 samples.<sup>24</sup>  
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19 The main inclusion criterion was being 65 years and older. Cases with incomplete data on age  
20 and loneliness were excluded from this study. Individuals that presented the outcome  
21 (sarcopenia, anorexia of ageing, physical inactivity, fatigue, and cognitive impairment) at  
22 baseline were also excluded from the analysis. The dependent variables were incidence of  
23 sarcopenia, anorexia of ageing, physical inactivity, fatigue, and cognitive impairment from  
24 wave 5 to either wave 6 or 7. Loneliness as measured at wave 5 was the independent variable  
25 of interest.  
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33 Loneliness was measured using the short version of the Revised University of California at Los  
34 Angeles Loneliness scale (R-UCLA),<sup>25</sup> which is a frequently used and validated indicator of  
35 loneliness.<sup>26</sup> The scale was recently harmonised for use in SHARE.<sup>27</sup> While the UCLA scale is  
36 among the most internationally applied scales to assess loneliness, few studies have used the  
37 R-UCLA in a cross-national context.<sup>28</sup> It includes the following three questions: how much of  
38 the time do you feel a lack of companionship; how much of the time do you feel left out; how  
39 much of the time do you feel isolated from others? The answers are recorded using three  
40 categories: often, some of the time, hardly ever/never. These items form a scale that ranges  
41 from three to nine, whereby three corresponds to not feeling lonely and nine indicates the  
42 highest level of loneliness. Previous research has often treated the measure as continuous,<sup>25</sup>  
43 however, the distribution of responses was not normal. Therefore, we converted it to a binary  
44 measure. We defined those who fell into the first, second and third quartiles as "not lonely"  
45 and those in the fourth quartile as "lonely", similar to the method used by Niedzwiedz  
46 (2016).<sup>28</sup>  
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1 Sarcopenia was measured by grip strength, with cut-offs for the continuous variable following  
2 the new revised European Consensus on Sarcopenia, e.g. <27 kg and <16 kg for men and  
3 women, respectively.<sup>6</sup> Anorexia of ageing/unintentional weight loss was assessed using the  
4 self-reported question: “In the last year, have you lost more than (>) 4,5kg (10 pounds) or at  
5 least 5% of the previous year’s body weight unintentionally (e.g., not due to dieting or more  
6 exercising)?”. Answering ‘yes due to health-related issues’ (e.g. illness) was considered to  
7 represent anorexia of ageing.  
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14 Physical inactivity was defined as ‘never or hardly ever engaging in’: moderate-intensity  
15 activities such as gardening, cleaning the car or going for a walk or vigorous physical activities  
16 such as sports, heavy housework or a job that involves physical labour.<sup>29</sup>  
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21 The SHARE protocol included performance-based cognitive tests.<sup>30</sup> Performance on verbal  
22 fluency is a sensitive measure for discriminating between cognitively healthy individuals and  
23 those with MCI or dementia.<sup>31</sup> Threshold performance scores for being coded as “yes”  
24 (indicating impairment) were set in relation to scores previously shown to be indicative of MCI,  
25 as follows: verbal fluency scores < 15.<sup>31</sup>  
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32 Other variables included were gender, age, educational level and presence of chronic diseases.  
33 Regarding the latter, the following conditions were considered: heart attack, hypertension,  
34 high blood cholesterol, stroke or cerebral vascular disease, diabetes, chronic lung disease,  
35 cancer, Parkinson disease, cataracts, hip fracture, other fractures, dementia,  
36 affective/emotional disorders (including anxiety, nervous or psychiatric problems) and  
37 rheumatoid arthritis/osteoarthritis. The educational level categories from the International  
38 Standard Classification of Educational Degrees (ISCED) of 1997 and 2011 were considered.<sup>32</sup>  
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46 Initially, a descriptive analysis was performed for each sub-sample (anorexia of ageing, fatigue,  
47 sarcopenia, physical inactivity and cognitive decline), indicating absolute and relative  
48 frequencies and mean and standard deviation for categorical and continuous variables,  
49 respectively. Poisson regression models were used for multivariate analysis, obtaining Relative  
50 Risk (RR) and confidence intervals (CI) at 95%. Multivariate models were adjusted by age,  
51 gender, education, number of chronic diseases and depression. Statistical analysis was  
52 conducted using STATA (Stata Corp. Inc. TX, USA, version 14).  
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## Results

Among 68,188 individuals that participated in the SHARE's wave 5, the samples selected for each analysis were: anorexia 33,089; fatigue 27,554; sarcopenia 28,530; physical inactivity 22,375; cognitive decline 18,328. The details of the sampling process are depicted in Figure 1.

Figure 1. Flow chart of the study sampling process.

The incidence of anorexia of aging was 6.9% (95% CI: 6.6-7.2), fatigue was 18.9% (95% CI: 18.5-19.4), sarcopenia was 7.0% (95% CI: 6.8-7.4), physical inactivity was 10.0% (95% CI: 9.6-10.4), and cognitive decline was 12.9% (95% CI: 12.4-13.4).

Figure 2. Incidence of anorexia of ageing, fatigue, sarcopenia, physical activity and cognitive decline among older adults during the 4-year period.

Table 1 describes the sample characteristics for each outcome by independent variable. Subjects that presented with anorexia of ageing, fatigue, physical inactivity and cognitive decline during the period were older, had lower educational level and reported a higher number of chronic diseases. The proportion of women, loneliness and depression was higher among individuals that reported these four outcomes. The same pattern was observed for sarcopenia, except that the proportion of men was slightly higher than for women.

Table 1 here

The bivariate and multivariate analysis (Table 2) shows that loneliness was a predictive factor for fatigue, physical inactivity and cognitive decline. The predictive factors for anorexia were age, chronic diseases, education and depression, adjusted by gender. The predictive factors for fatigue were age, gender, chronic diseases, depression and loneliness, independent of education. Predictive factors for sarcopenia were age, gender, education, chronic diseases and depression. For physical inactivity, the predictive factors were age, gender, education, chronic diseases, depression and loneliness. The predictive factors for cognitive decline were age, gender, education, chronic diseases, depression and loneliness.

Table 2 here

## Discussion

1 This study aimed to assess loneliness as a predictor of the modern geriatric giants of frailty  
2 (unintentional weight loss, self-reported exhaustion, weakness, and low levels of physical  
3 activity)<sup>5</sup> and cognitive impairment. The results indicate that loneliness is a risk factor for  
4 insufficient physical activity, cognitive impairment and fatigue/self-reported exhaustion,  
5 regardless of age, sex, number of chronic conditions, educational background and depression.  
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7 However, loneliness was not associated with anorexia of ageing/unintentional weight loss and  
8 sarcopenia/weakness.  
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14 Fatigue showed the highest incidence rate (18.4%), in the 4 years follow-up, among the  
15 different outcomes taken into account , followed by cognitive decline (12.9%), physical  
16 inactivity (10%), anorexia of ageing and sarcopenia (both  $\leq 7\%$ ).  
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23 Loneliness is highly prevalent in the population, with 80% of those under 18 years of age and  
24 40% of adults over 65 years of age reporting being lonely at least sometimes.<sup>33,34</sup> For as many  
25 as 15–30% of the general population, however, loneliness can be a transient or a chronic state,  
26 being the latter one the most problematic.<sup>35</sup> Several authors have posited that loneliness is the  
27 social equivalent of physical pain, hunger, and thirst; the pain of social disconnection and the  
28 hunger and thirst for social connection.<sup>36</sup>  
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34 In our study, loneliness was found to be a moderate predictor for insufficient physical activity,  
35 cognitive impairment and fatigue/self-reported exhaustion. Being physically active requires a  
36 positive attitude towards voluntary participation, which is enhanced or reduced depending on  
37 social and cultural determinants. Compromised regulation of emotion in lonely individuals  
38 might explain their diminished likelihood of performing any physical activity, and loneliness  
39 has predicted a decrease in physical activity over time.<sup>37</sup> Likewise, an individual with more  
40 social connections, thus related with lower perception of loneliness, may have more occasions  
41 to be physically active. Physical activity is a well-known protective factor for physical health,  
42 mental health, and cognitive functioning,<sup>38</sup> suggesting that poorer self-regulation may  
43 contribute to the greater health risk associated with loneliness, via diminished likelihood of  
44 engaging in health-promoting behaviors. In clinical populations, lower levels of physical activity  
45 have been shown to be related to general feelings of fatigue.<sup>39</sup> In an attempt to avoid  
46 excessive fatigue, individuals may reduce their physical activity, which could yield a weak  
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1 Loneliness has been shown to have a strong association with depression in multiple  
2 studies.<sup>36,40</sup> Evidence has shown that higher levels of loneliness are consistently associated  
3 with higher incidence of depression and elevated depressive symptoms across different age  
4 groups,<sup>41</sup> even after controlling for socio-demographic factors and other relevant  
5 covariates.<sup>42</sup> Findings of prior research among older adults have indicated that loneliness is  
6 more hazardous to depression than social isolation.<sup>43</sup> Furthermore, compared to social  
7 isolation, loneliness has a much stronger association with depressive symptoms in adults aged  
8 21 and above.<sup>44</sup> Loneliness predicts increases in depressive symptoms over 1-year intervals,  
9 but depressive symptoms do not predict increases in loneliness over those same intervals.<sup>45</sup>  
10 One of the social and emotional-related symptoms of depression is the feeling of self-  
11 exhaustion and perceived fatigue in carrying out usual activities of daily living.<sup>46</sup> Studies  
12 highlight the negative impact of self-perceived fatigue on mental and physical health,  
13 functional disability and performance restriction in activities of daily living in the older adult  
14 population,<sup>46</sup> which is in line with our findings.  
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26 The impact of loneliness on cognition was assessed in a recent review of the literature.<sup>47</sup>  
27 Loneliness has been associated with impaired cognitive performance and cognitive decline  
28 over time.<sup>48</sup> Other studies, however, have indicated that loneliness is a precursor to cognitive  
29 decline. For instance, the cognitive functioning of 75–85-year-olds (as assessed by the Mini-  
30 Mental State Examination) did not differ as a function of loneliness at baseline but diminished  
31 to a greater extent among those with high rather than low reported loneliness over a 10-year  
32 follow-up.<sup>49</sup>  
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41 As mentioned, insufficient physical activity, cognitive impairment and fatigue have strong  
42 social and emotional components, and so has loneliness. We tend to analyze these outcomes  
43 independently yet their interconnections should also be acknowledged. Loneliness had a weak  
44 association with anorexia of ageing/unintentional weight loss and sarcopenia/weakness, which  
45 are physical and functional-related components of frailty. Even though the aforementioned  
46 socially-focused outcomes are strongly associated with the functional-related components of  
47 frailty, we only analyzed the data over a four-year period, and therefore could have missed  
48 changes that require a longer period of time to become evident.<sup>50</sup> These two variables showed  
49 the lowest incidence rate in waves 5 and 7, suggesting we would need more time to show a  
50 higher incidence, as they both worsen with age.<sup>50</sup>  
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Studies show that once social and emotional-related health problems appear, it takes some time for effects to show on physical-related conditions, such as a decline in functional performance.<sup>50</sup> Being physically active might act as a mediator which requires a voluntarily action to being able to have an impact (if practiced with sufficient dose, intensity and frequency) on physical function in the longer term.<sup>51</sup>

The present study has some limitations; most of the outcomes of the SHARE survey are self-reported, which could have biased our results. It is worth commenting that gait speed, which is also an indicator of physical frailty,<sup>5</sup> could not be included in the analysis due to >80% missing values in the three included waves. The same limitation was also found in cognitive variables such as the self-reported memory item and the memory performance task (e.g. assesses ability to immediately recall as many words as possible) in wave 6. In contrast, this study has strength in the high-quality data set and sample size. As far as we know, this is the first study to underline the relevance of loneliness as a predictor of the modern geriatric giants in older adults by using a longitudinal design of nationally representative data.

It can be concluded that loneliness is an independent risk factor for physical inactivity, cognitive impairment and fatigue in older adults. Anorexia of ageing/unintentional weight loss and sarcopenia/weakness were not predicted by loneliness during the 4-year observation period. However, future longitudinal studies with longer periods are warranted to further analyze the association of loneliness with these physical health-related issues. These conclusions should inform the design of interventions to target loneliness if physical activity, cognitive impairment and fatigue are to be improved in the older adult population.

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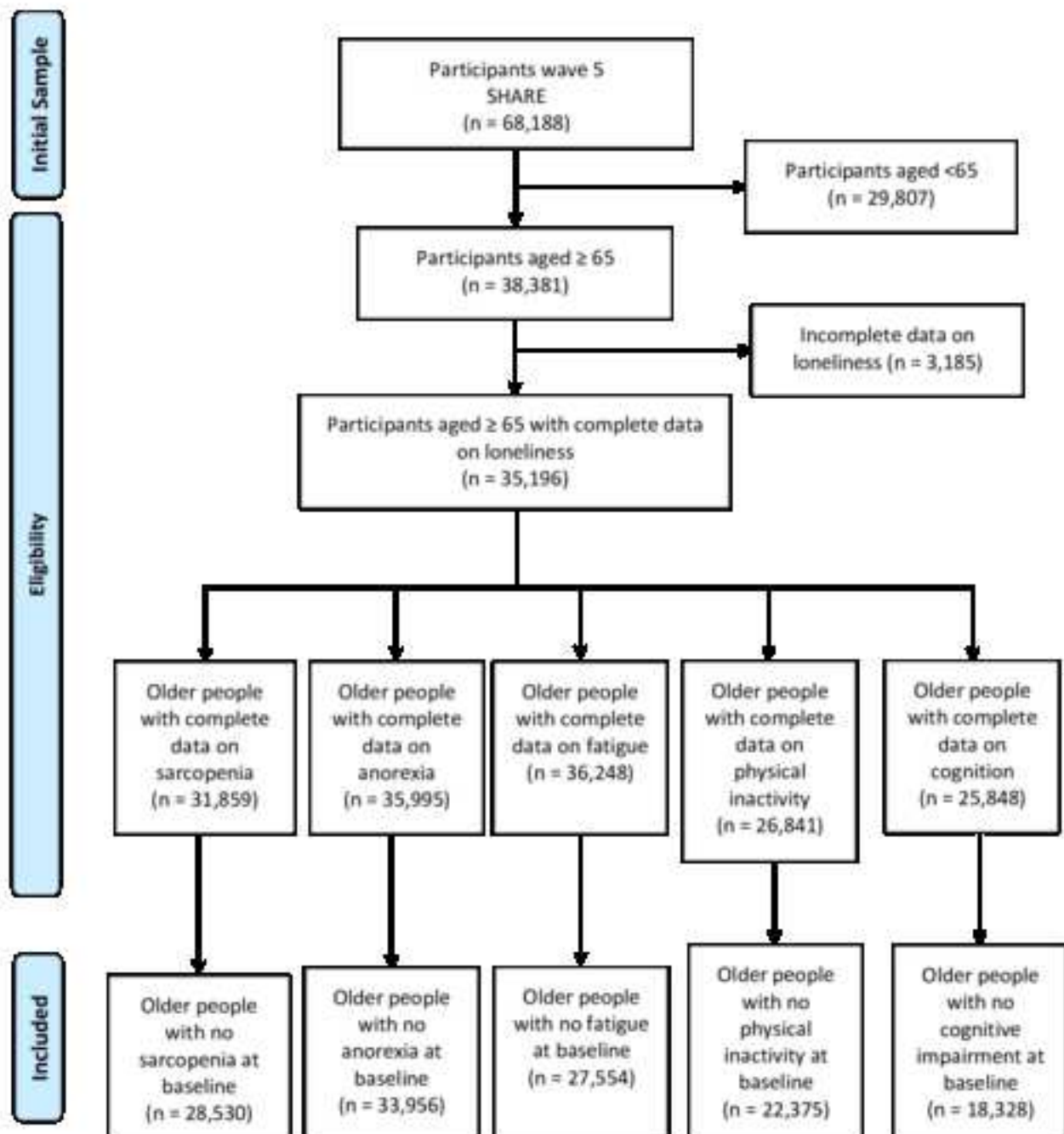
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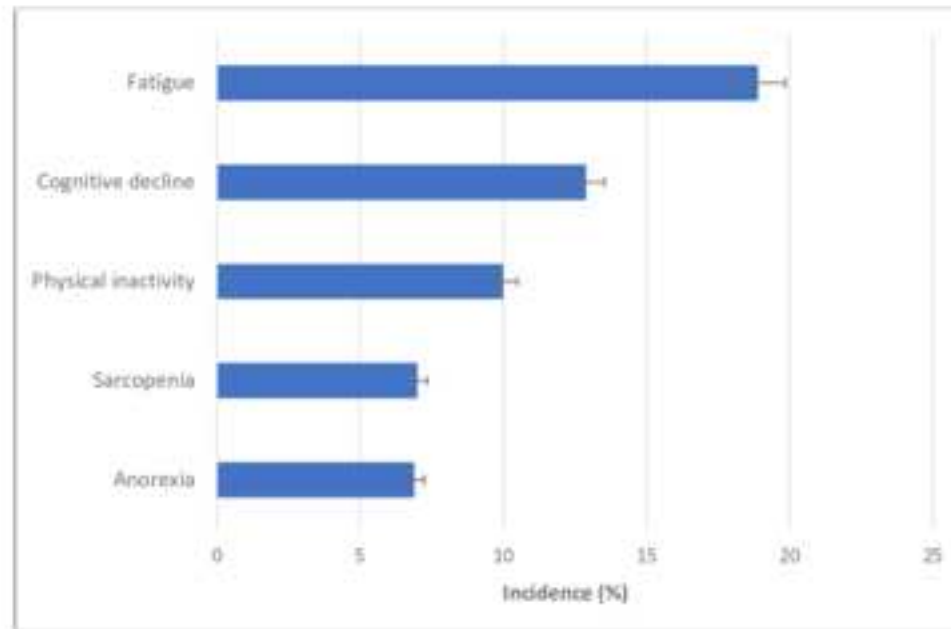
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**Table**

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**Table**

Table2.docx



**Declaration of interests**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

## **Ethical statement**

The SHARE Project respects the Helsinki Declaration, in terms of anonymity of the participants and obtaining of written consent. Wave 4 and following waves have been reviewed and approved by the Ethics Committee of the Max Planck Society. Furthermore, individual country implementation of SHARE was reviewed and approved by the respective ethics committees or institutional review boards. Further details about data collection, sampling procedures and other methodological aspects are available in the project's website ([www.share-project.org](http://www.share-project.org)). Therefor, informed consent for experimentation with human subjects was obtained. The privacy rights of human subjects were observed.