


# A multidimensional perspective of the relation between social isolation and depression among Portuguese older adults

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## Abstract

We aimed to explore how different social isolation components were associated with depression among older adults in Portugal. We analysed data collected through structured questionnaires in 2017 from 643 Portuguese adults aged 60 and over. Depression was assessed using the Geriatric Depression Scale (Short-Form). Social isolation was operationalised using objective indicators – living alone, marital status, leisure activities – and subjective indicator – perceived social support. Because social isolation is a multidimensional construct that is likely to be more than the sum of its components, cluster analysis was conducted to group individuals into social isolation profiles. Associations were estimated using adjusted odds ratios (ORs) and 95% confidence intervals (CIs). Five profiles were identified: Cluster 1 (partnered; high social support; high variety of leisure activities); Cluster 2 (partnered; high social support; few leisure activities); Cluster 3 (not partnered; low social support; few leisure activities); Cluster 4 (living alone; high social support; high variety of leisure activities); Cluster 5 (partnered; high social support; limited variety of leisure activities). Compared with Cluster 1, participants in Cluster 2 were three times more likely to have depression, independent of age, gender, education, comorbidities and self-rated health (OR = 3.04; 95% CI: 1.38–6.71). Participants in Cluster 3 presented the highest probability of depression that was not explained by any of the confounders (OR = 4.74; 95% CI: 2.15–10.44). Older adults living alone are not necessarily more prone to depression, with social support and leisure activities playing an important role. To disentangle how social isolation affects health, objective and subjective isolation measures should be considered.

## KEYWORDS

ageing, depression, leisure activities, social isolation, social support

## 1 | INTRODUCTION

Globally, the population of adults aged 65 and over is growing faster than all other age groups, with Europe presenting one of the highest proportions of older adults (United Nations Department of Economic and Social Affairs, 2019). In Portugal, 22.4% of the population is 65 and over and this is expected to rise to 35% by 2050 (European Commission, 2017).

The lack of social networks among older adults is increasingly being recognised as an important risk factor for poor physical and mental health (Leigh-Hunt et al., 2017; Santini et al., 2020), namely in a time where the feeling of isolation might be more exacerbated for reasons of decreasing economic and social resources, functional limitations and changes in family structure (Courtin & Knapp, 2017). Previous work has demonstrated a link between social network ties and participation in social activities with better mental health (Cornwell & Laumann, 2015). Also, those individuals who feel lonely or isolated, who report low social support and who experience strain in their relationships are more prone to depression (Chen & Feeley, 2014).

Depression is one of the most prevalent conditions among mental disorders in individuals over 65 (Chu et al., 2019; Fiske et al., 2009). Prevalence estimates vary broadly depending on the definition, method of assessment and sample characteristics (Balsamo et al., 2018; Sjöberg et al., 2017) and more information about this disease and how it is related to social isolation is needed to optimise mental healthcare and to provide adequate services for this population.

Nevertheless, important questions remain unanswered. Majority of studies define social isolation as a unidimensional concept based on the number of social contacts with family and/or friends (Courtin & Knapp, 2017). Research that disentangles the specific contributions of objective aspects of social disconnectedness (e.g. small social network) from the more subjective aspects of relationship is scarcer (Santini et al., 2020). Additionally, recent studies have reported stronger effects in health of subjective measures of social isolation, such as companionship or social support, than of objective social isolation (Choi et al., 2015). In fact, examining social disconnectedness and perceived isolation together is important because perceptions of isolation can be entirely unrelated to an individuals' objective network structures and the time that they spend alone or with others (Santini et al., 2020).

In addition, participation in leisure activities can be important to reduce social isolation in later life, as social relations are a fundamental part of many leisure activities (Toepoel, 2013). A recent study showed that a social participation typology, comprising social connection frequency and social activity level, is essential for older people's well-being (van Hees et al., 2020), but its relation with depression was not assessed and their measure of social participation did not comprise individual perceptions of social support.

A better understanding of the multiple aspects of isolation in depression, and how they organise themselves into patterns, is essential for informing public health interventions aimed to prevent

### What is known about this topic

- The lack of social networks among older adults is increasingly being recognised as an important risk factor for poor physical and mental health.
- The majority of studies define social isolation as a unidimensional concept, based on the number of social contacts and few studies have considered, simultaneously, multiple or prototypical profile aspects of isolation.

### What this paper adds

- Older adults living alone are not necessarily the ones more prone to depression.
- Those who perceived their social support as low, and did not practise leisure activities were more vulnerable to depression, independently of their age, gender, education and health quality.
- To understand how social isolation affects mental health, objective and subjective isolation measures should be considered simultaneously.

mental disorders in this population. Because social isolation is a multidimensional construct that is likely to be more than the sum of its components, the aim of this study was to describe and analyse how different social isolation indicators intertwine and are associated with depressive symptoms among community-dwelling older adults in Portugal.

## 2 | MATERIAL AND METHODS

### 2.1 | Study design and participants

The present study is part of the HARMED project – Socioeconomic and Health Determinants of Elder Abuse – a cross-sectional study carried out during January and July 2017 with participants from the EPIPorto cohort, a population-based cohort of adults (18–92 years) living in Porto, Portugal. A detailed description of the cohort study has been previously published (Ramos et al., 2004).

The main goal of HARMED was to analyse the phenomenon of elder abuse, with a special interest on factors of social exclusion and vulnerability, taking into consideration the 2009 economic crisis and several psychosocial aspects were evaluated. In 2017, the 1,222 eligible individuals of the EPIPorto cohort aged 60 years and over were invited to participate in the HARMED study: 281 could not be reached, 244 refused to participate and 697 were evaluated. However, 54 participants were excluded from analysis because of significant cognitive impairment (Mini-Mental State Examination score < 24; Folstein et al., 1975;  $n = 22$ ), missing data on depression ( $n = 27$ ) and missing data on any of the isolation variables ( $n = 5$ ). Thus, the final analytic sample consisted of 643 participants.

When comparing our study sample with the remaining eligible participants, there were no statistically significant differences regarding gender, but our sample comprised younger and more educated individuals.

## 2.2 | Data collection and variables definition

Data were collected by trained interviewers, at the research centre, using structured questionnaires and computer-assisted personal interviewing. Self-reported data on socio-demographic characteristics, medical history, health behaviours and perceived social support were collected; participants with mobility limitations were interviewed in their homes ( $n = 71$ ).

### 2.2.1 | Social isolation variables

Social isolation was analysed using a set of indicators comprising objective and subjective measures. Living alone, marital status and leisure activities were considered objective measures of isolation, while perceived social isolation was a subjective measure of isolation. Living alone was defined based on the answer to the question 'with whom do you live most of time?' and only those who specifically referred to living alone were classified as 'yes'. Marital status distinguished between partnered (married or cohabiting) and non-partnered participants (divorced, widowed, and single). A list of leisure activities was considered a priori, including spending time with family, taking care of grandchildren, participating in social activities with friends, leisure activities outside the home, religious activities, travelling and volunteering. For each activity, individuals rated their frequency on a seven-point Likert scale, from never (0) to daily (6). Each leisure activity was then dichotomised into 'never/ever' responses. Perceived social support was measured using the Multidimensional Scale of Perceived Social Support (MSPSS) (Zimet et al., 1990), previously validated for the Portuguese population (Carvalho et al., 2011). It contains 12 items to measure perceived social support from family, friends and a significant other. Participants rated their level of agreement with each statement (e.g. 'There is a special person who is around when I am in need') on a Likert scale, from 1 (very strongly disagree) to 7 (very strongly agree). Item scores were summed to provide a total score (range 12–84), with higher scores indicating higher levels of perceived social support.

### 2.2.2 | Depression variable

Depressive symptoms were assessed using the Geriatric Depression Scale (GDS-Short form; Sheikh & Yesavage, 1986), previously validated for the Portuguese population (Apóstolo et al., 2014). It comprises 15 items rated in a 'yes/no' format, each one of which refers to psychological symptoms that a person experienced during the past week. A score of 5 or greater indicates depression. A recent

systematic review has concluded that for the 15-item version of the GDS the recommended cut-off point is 5, with a pooled sensitivity of 0.89 and specificity of 0.77 (Pocklington et al., 2016).

### 2.2.3 | Covariates

Age at interview was collected as complete years and classified into three categories: 60–69, 70–79 and >79 years. Education was assessed through the question 'What is the highest complete educational level you have?' and, based on the sample distribution, answers were categorised as ≤elementary, secondary and >secondary. A binary variable for retirement was also computed. Perceived income adequacy was measured by asking respondents the following question: 'How do you consider your household income?'; the answer options were: (a) insufficient; (b) cautious with expenses; (c) enough to make ends meet; and (d) comfortable. Participants' perception of their health was assessed using a five-point scale through the question 'Overall, how do you rate your health?'. Answers varied from very good to good, reasonable, bad or very bad. Participants were asked about the presence of specific chronic diseases encompassing any doctor-diagnosed disease that required medical care. Based on the information collected, we classified chronic conditions into different groups: cerebrovascular/cardiovascular (stroke, dyslipidaemia, hypertension and any cardiac pathology), neurological (Parkinson), cancer (any type), musculoskeletal (rheumatoid arthritis and osteoporosis) and respiratory (asthma and other lung diseases).

## 2.3 | Statistical analysis

Because social isolation is a multidimensional construct that is likely to be more than the sum of its components, cluster analysis was used to group participants into prototypical profiles formed by the objective and subjective indicators of social isolation, all dichotomised: marital status, living alone, each of the seven leisure activities (being with family; taking care of grandchildren; participating in social activities with friends; activities outside the home; religious activities; travelling; and volunteering), and perceived social support (least favourable tertile versus others). Gower distance was used to measure dissimilarity between individuals: it consisted of the proportion of indicators that a pair of individuals had in common, with 0 indicating no commonality and 1 indicating identical indicators (Gower, 1971). All 10 indicators listed above were treated as symmetric binary variables and were given equal weight in the distance calculation.

A preliminary hierarchical clustering solution computed by complete linkage, where dissimilarity between clusters is the maximum of dissimilarities between members, was used to determine the number of clusters ( $k = 5$ ) and initial cluster centres (Venables, 2002). The  $k$ -medoids algorithm, which takes as input all the pairwise distances previously described as well as the initial cluster centres, was then used to determine an optimal partition of the data into five clusters (Kaufman & Rousseeuw, 1990). Clusters were subsequently

validated using a model-based instead of a dissimilarity-based approach, using mixtures of multinomial distributions (results not shown).

Logistic regression models were used to evaluate the association between social isolation profiles and depression (dichotomous variable), taking the cluster that presents the most favourable isolation profile as the reference class of exposure. Adjusted coefficients were calculated with the respective 95% confidence intervals (95% CI). Separate models were built to disentangle the effect of demographic (Model 1), educational (Model 2) and health aspects (Model 3).

Statistical analyses were conducted using Stata, version 15.0 (College Station, TX, 2017) and R, version 4.0.1 (R Core Team, 2020).

## 2.4 | Ethics statement

The Joint Ethics Committee of Hospital S. João and University of Porto Medical School approved this study protocol (CES-320/2016). Written informed consent was obtained from the participants.

## 3 | RESULTS

Overall, 27.4% of the participants presented depression, which was significantly more frequent in women than in men (30.2% vs. 22.5%,  $p = .033$ ).

Both women and men who presented depression were likely to be older, with lower levels of education, more often recognised their health as bad/very bad and they suffered more often from respiratory diseases. Also, depressed participants presented lower levels of perceived social support, less often participated in social activities with friends, practised activities outside of the home and travelled. In both genders, no differences in reporting depression were found when considering retirement status, living with a partner, cerebrovascular/cardiovascular diseases and cancer, living alone, taking care of grandchildren and participating in religious activities (Table 1).

The cluster analysis identified five clusters that are depicted in Figure 1, numbered 1–5. Both Clusters 1 and 5 comprised participants who did not live alone and were characterised by a high level of social support and spending time with their families; however, Clusters 1 and 5 differed in the proportion of individuals who took care of grandchildren (25.6% vs. 74.0%), participated in religious activities (16.5% vs. 76.4%), outside activities (84.3% vs. 18.9%) and travel (88.4% vs. 59.8%). Cluster 2 was also characterised by individuals who did not live alone (94.7%), but with almost a third of them showing low social support (31.1%) and the lowest proportions of several types of activities, namely social activities (18.5%) and activities outside the home (8.6%), taking care of grandchildren (17.2%) and travelling (8.0%). Cluster 3 had the highest proportion of individuals with low social support (77.6%) and lowest proportion of individuals spending time with their family (69.2%). Although Cluster 4 contrasted with the rest of the clusters by showing the highest

proportion of people who lived alone (81.2%) and who did not have a partner (95.0%), this cluster consisted of individuals who referred a high proportion of social support (79.2%) and participation in several leisure activities (Figure 1).

Table 2 displays the main socio-demographic and health-related characteristics of the five social isolation clusters. Demographic variables were not used as inputs to the clustering algorithm. Nonetheless, Cluster 1 comprised female and male participants who were relatively younger, non-retired individuals, with higher levels of education, who more often rated their health as very good/good and reported one or less comorbidities. In contrast, Clusters 2 and 3 represented individuals who were older, less educated and with worst health, although Cluster 3 comprised even more men than Cluster 2. Cluster 4 also had a higher proportion of men, but it differed from Cluster 3, in that it comprised individuals who were more educated and tended to consider themselves healthier. Cluster 5 represented a similar pattern to Cluster 1, differing essentially in age, education and the retirement variables (Table 2).

Table 3 presents the results from the multivariate models for the association between the five social isolation profiles and depression. Considering Cluster 1 as the reference category, individuals in Cluster 2 were three times as likely to have depression, independent of age, gender, education, number of comorbidities and self-rated health (Model 3: OR = 3.04; 95% CI: 1.38–6.71). The odds of depression for participants in Cluster 3 was four times greater than among participants from Cluster 1 and was not explained by the demographic, social and health factors considered as potential confounders (Model 3: OR = 4.74; 95% CI: 2.15–10.44). No statistically significant differences were found for participants from Cluster 4 (Model 3: OR = 0.82; 95% CI: 0.32–2.12) and Cluster 5 (Model 3: OR = 1.36; 95% CI: 0.58–3.17; Table 3).

## 4 | DISCUSSION

This cross-sectional study shows that, among Portuguese men and women aged 60 and over, both objective and subjective measures of social isolation are associated with depression. When grouping individuals in social isolation profiles, those who lived alone were not necessarily more prone to depression, with perceived social support and leisure activities playing an important role in its occurrence. Older individuals who lived alone, perceived their social support as low, and did not practise leisure activities were more vulnerable to depression, independently of their age, gender, education and health quality.

As a result of the current societal ageing, an increasing number of older adults live alone (Tamminen et al., 2019). Although it varies widely throughout the world, women, the highly educated, single, divorced or widowed, those with economic independence, good health and low kin availability are the most likely to live alone in the developed world are all important factors in shaping preferences and residential options as people age (Reher & Requena, 2018).

**TABLE 1** Characterisation of participants with and without depression, according to gender (n = 643)

	n (%)					
	Women			Men		
	Without depression n = 284 (69.8)	With depression n = 123 (30.2)	p	Without depression n = 183 (77.5)	With depression n = 53 (22.5)	p
Age (years)						
60–69	142 (77.6)	41 (22.4)		96 (87.3)	14 (12.7)	
70–79	103 (68.2)	48 (31.8)		59 (72.0)	23 (28.0)	
≥80	39 (54.2)	33 (45.8)	0.001	28 (63.6)	16 (36.4)	0.002
Education						
≤Elementary	81 (54.7)	67 (45.3)		58 (70.7)	24 (29.3)	
Secondary	66 (71.7)	26 (28.3)		39 (72.2)	15 (27.8)	
>Secondary	136 (81.9)	30 (18.1)	<0.001	86 (86.0)	14 (14.0)	0.028
Retired						
No	85 (72.6)	32 (27.4)		38 (82.6)	8 (17.4)	
Yes	199 (68.6)	91 (31.4)	0.423	145 (76.3)	45 (23.7)	0.359
Marital status						
Not partnered	137 (68.2)	64 (31.8)		30 (68.2)	14 (31.8)	
Partnered	147 (71.4)	59 (28.6)	0.482	153 (79.9)	39 (20.3)	0.099
Self-rated health						
Very good/Good	136 (91.2)	13 (8.7)		124 (86.1)	20 (13.9)	
Reasonable	145 (63.9)	82 (36.1)		58 (70.7)	24 (29.2)	
Bad/Very bad	3 (9.7)	28 (90.3)	<0.001	1 (10.0)	9 (90.0)	<0.001
Cerebrovascular/ cardiovascular diseases <sup>a</sup>	208 (67.3)	101 (32.7)	0.054	138 (76.3)	43 (23.8)	0.386
Neurological diseases <sup>b</sup>	0 (0.0)	5 (100.0)	0.001	2 (100.0)	0 (0.0)	0.445
Cancer	6 (66.7)	3 (33.3)	0.837	5 (55.6)	4 (44.4)	0.107
Musculoskeletal diseases <sup>c</sup>	78 (60.9)	50 (39.1)	0.009	9 (60.0)	6 (40.0)	0.092
Respiratory diseases <sup>d</sup>	28 (53.8)	24 (46.2)	0.007	14 (58.3)	10 (41.7)	0.017
Living alone	91 (74.6)	31 (25.4)	0.167	15 (62.5)	9 (37.5)	0.062
Social support (tertiles)						
1 (low)	80 (51.3)	76 (48.7)		39 (61.9)	24 (38.1)	
2	100 (75.2)	33 (24.8)		75 (79.0)	20 (21.0)	
3 (high)	104 (88.1)	14 (11.9)	<0.001	69 (88.5)	9 (11.5)	0.001
Being with family	251 (74.9)	84 (25.1)	<0.001	160 (79.2)	42 (20.8)	0.135
Cares for grandchildren	98 (73.1)	36 (26.9)	0.302	64 (82.1)	14 (18.0)	0.244
Social activities	204 (79.4)	53 (20.6)	<0.001	133 (82.1)	29 (17.9)	0.013
Religious activities	119 (71.7)	47 (28.3)	0.487	61 (84.7)	11 (15.3)	0.080
Outside house activities	131 (87.3)	19 (12.7)	<0.001	68 (85.0)	12 (15.0)	0.049
Travelling	151 (90.4)	16 (9.6)	<0.001	99 (87.6)	14 (12.4)	0.001
Volunteering	39 (90.7)	4 (9.3)	0.002	20 (87.0)	3 (13.0)	0.255

Note: In each variable, the total may not add up to 643 because of missing data.

<sup>a</sup>Includes stroke, dyslipidaemia, hypertension, any cardiac pathology.

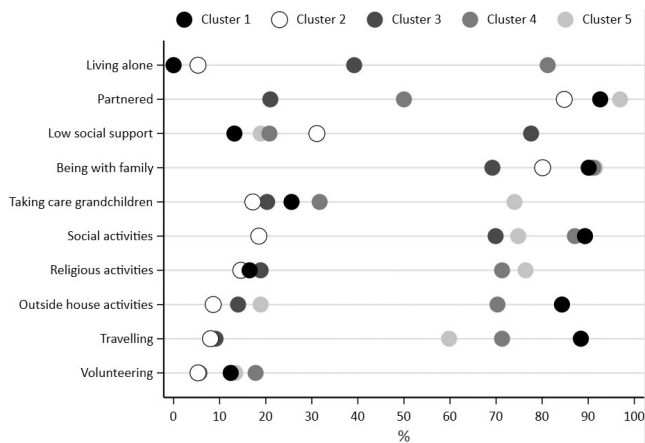
<sup>b</sup>Includes Parkinson disease.

<sup>d</sup>Includes asthma and any lung disease.

<sup>c</sup>Includes rheumatoid arthritis and osteoporosis.

Research on the impact of social isolation in health is recent and, despite its growth since 2000, there is a lack of consistency in the definition and measurement of this multidimensional, cross-disciplinary construct (Courtin & Knapp, 2017). Previous

research has identified a wide range of indicators of social isolation that pose health risks, including living alone, having a small social network, infrequent participation in social activities, and feelings of loneliness. Nonetheless, multiple forms of isolation



**FIGURE 1** Characterisation of the five social isolation profiles that emerged from cluster analysis. For some categories, dots from the former clusters are on top of dots from the latter clusters

are rarely studied together, making it difficult to determine which aspects of isolation are most deleterious to health (Cornwell & Waite, 2009). This work tries to fill this gap by analysing simultaneously ten indicators of social isolation associated with depression, adding knowledge about how they intertwine and relate to depression at older ages.

Another important aspect that this work highlighted is that living alone in itself is not necessarily linked to worse mental health. We found that individuals from Cluster 4, who mostly live alone, did not have a significantly different probability of presenting depression when compared with those from Cluster 1, who did not live alone. There is a considerable amount of literature stating that living alone is associated with worse mental (Tamminen et al., 2019) and physical health (Jensen et al., 2019), but other studies found no differences between measures of objective and subjective social isolation (Holt-Lunstad et al., 2015) and yet others assume that living alone is not always a social risk factor for poor health (Sakurai et al., 2019). The results of this work reinforce that social isolation is a multidimensional construct and that only one question might not be sufficient to capture a complete view. Individuals from Cluster 2 (partnered; high social support; few leisure activities) are a good case in point: they were similar to individuals from Cluster 1 when only living alone is considered, but their probability of presenting depression was much higher. Thus, this study showed that one dimension of social isolation (e.g. living alone) can be compensated by another (e.g. having several leisure activities), suggesting that a multidimensional perspective of social isolation should be considered when studying this phenomenon among older people.

Taking care of grandchildren was included in the leisure activities domain and was present in a similar proportion in the clusters with the best (Cluster 1) and worst mental health (Clusters 2 and 3). These results might be a reflection of how research to date on the relationship between grandparental childcare and health and well-being is inconclusive (Di Gessa et al., 2016). On the one hand, studies suggest a negative relationship between grandparent childcare and health, with co-residing grandparents and intense numbers of hours of care

playing an important role (Hughes et al., 2007), while a positive impact of grandparental childcare on health has been found, namely among grandparents providing lower intensity levels of care (Tsai et al., 2013). In our study, we did not collect information about the number of hours or intensity of care but, as research on this theme is still inconclusive, future studies should deepen the study of the levels of grandchild care and its impact on mental health.

These results also demonstrated the importance of individual perceptions of social support and leisure activities in health and well-being, which has been already suggested in previous research (Henriques et al., 2020; Sala et al., 2019). From a public health perspective, given the modifiable nature of social support and leisure activities, its potential for the prevention of depression and mental health among older people is vast. Moreover, the effectiveness of previous interventions targeting social isolation and loneliness still provides inconsistent results (Gardiner et al., 2018; Poscia et al., 2018), partly because it is very difficult to engage those who need the interventions the most. Moreover, a recent review highlights that there is no one-size-fits-all approach to address social isolation, and hence the need to tailor interventions to suit the needs of individuals, specific groups or the type of isolation experienced is essential (Fakoya et al., 2020). This work is able to provide important clues about what type of individual characteristics could be incorporated in these interventions to be more successful in targeting social isolation in older adults.

In this study, it was also observed that more than one quarter presented depression, which is in line with previous research conducted in Europe that showed a high variability in the prevalence of depressive symptoms, ranging from 18% in Denmark and Portugal (Gonçalves-Pereira et al., 2019) to 37% in Spain (Castro-Costa et al., 2007). At least part of this variation can be arising from different methodologies for case definition and data collection procedures. Thus, an improvement to the methodology that addresses the challenges of older age and produces comparable data is advised (Volkert et al., 2013), as it will facilitate addressing depression as a public health issue (Cassano & Fava, 2002).

To further explore the multidimensionality of social isolation, qualitative analyses could deepen the knowledge regarding the quality of relationships and social connections. A mixed-methods approach to this theme is almost inexistent (Courtin & Knapp, 2017) and would allow to pay particular attention to older people's subjective experience of isolation and to account for their thoughts and feelings.

This study has several strengths. First, the use of one of the most common instruments to measure depression at older ages (Volkert et al., 2013) encourages comparisons with other studies. Moreover, the GDS-SF has good psychometric properties and offers an added value in the primary care detection of late-life depression (Pocklington et al., 2016). Also, the use of multiple measures of social isolation, objective and subjective, is an advantage as living alone and feeling isolated are distinct conditions (Klinenberg, 2016) and single measures might not be enough to evidence adverse health outcomes (Sakurai et al., 2019). Almost 14% of our final

**TABLE 2** Socio-demographic and health-related characteristics of the five social isolation clusters

	n (%)				
	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
	121 (18.8)	151 (23.5)	143 (22.2)	101 (15.7)	127 (19.8)
Gender					
Female	61 (50.4)	85 (56.3)	110 (76.9)	86 (85.2)	65 (51.2)
Male	60 (49.6)	66 (43.7)	33 (23.1)	15 (14.8)	62 (48.8)
Age (years)					
60–69	85 (70.3)	61 (40.4)	54 (37.7)	36 (35.6)	57 (45.2)
70–79	31 (25.6)	62 (41.1)	46 (32.2)	44 (43.6)	50 (39.7)
≥80	5 (4.1)	28 (18.5)	43 (30.1)	21 (20.8)	19 (15.1)
Education					
≤Elementary	16 (13.2)	80 (53.0)	63 (44.0)	23 (23.0)	48 (37.8)
Secondary	24 (19.8)	37 (24.5)	30 (21.0)	24 (24.0)	31 (24.4)
>Secondary	81 (66.9)	34 (22.5)	50 (35.0)	53 (53.0)	48 (37.8)
Retired					
No	48 (39.7)	31 (20.5)	37 (25.9)	18 (17.8)	29 (22.8)
Yes	73 (60.3)	120 (79.5)	106 (74.1)	83 (82.2)	98 (77.2)
Self-rated health					
Very good/Good	83 (68.6)	64 (42.4)	43 (30.1)	39 (38.6)	64 (50.4)
Reasonable	38 (31.4)	76 (50.3)	78 (54.6)	60 (59.4)	57 (44.9)
Bad/Very bad	0 (0.0)	11 (7.3)	22 (15.4)	2 (2.0)	6 (4.7)
Number of comorbidities <sup>a</sup>					
0	36 (29.8)	21 (13.9)	20 (14.0)	11 (10.9)	25 (19.7)
1	66 (54.6)	84 (55.6)	80 (55.9)	57 (56.4)	71 (55.9)
≥2	19 (15.7)	46 (30.5)	43 (30.1)	33 (32.7)	31 (24.4)

Note: Cluster 1 (partnered; high social support; high variety of leisure activities); Cluster 2 (partnered; high social support; few leisure activities); Cluster 3 (not partnered; low social support; few leisure activities); Cluster 4 (living alone; high social support; high variety of leisure activities); Cluster 5 (partnered; high social support; limited variety of leisure activities).

<sup>a</sup>Includes cerebrovascular/cardiovascular, neurological, cancer, musculoskeletal and respiratory diseases.

analytic sample self-reported the regular use of medication for depression. To examine if medication had influence in the results, a sensitivity analysis was performed considering only individuals who were not taking drugs for depression, and the results remained the same (data not shown). We also performed sensitivity analyses separately for each subscale of social support (family, friends and significant other), but their relation with depression was similar; therefore, only the total score of social support was used (data not shown).

On the other hand, some limitations can be pointed. The EPIPorto cohort had differential losses to follow-ups throughout time, with particular loss of those individuals who were less educated, which may underestimate the prevalence of social isolation and depression. Also, this work did not include residents of long-term care facilities. Knowing that in this context, prevalence of depression might be even higher (Djernes, 2006; Fiske et al., 2009),

future research still needs to consider older adults besides those living in the community. Moreover, the cross-sectional study design limited our ability to make inferences about causal relationships between isolation and depression, when literature emphasises a strong degree of interconnectedness between these two constructs, suggesting bi-directional influences (Santini et al., 2020).

Future longitudinal studies should analyse the age at onset of depression and make a distinction between those individuals who have already experienced mental illness earlier in life and those whose first encounter with mental illness occurs in old age, as they might have distinctive risk factors (Heun et al., 2001). Another key question for future research is to investigate whether social isolation and loneliness are two independent processes or whether loneliness provides a mechanism through which social isolation affects health (Steptoe et al., 2013). Moreover, the emergence of coronavirus disease 2019 has magnified the experience of social

Social isolation profiles	OR (95% CI)		
	Model 1	Model 2	Model 3
Cluster 1	1	1	1
Cluster 2	5.59 (2.67–11.67)	4.17 (1.95–8.90)	3.04 (1.38–6.71)
Cluster 3	8.81 (4.19–18.52)	7.39 (3.48–15.70)	4.74 (2.15–10.44)
Cluster 4	1.25 (0.51–3.05)	1.18 (0.48–2.90)	0.82 (0.32–2.12)
Cluster 5	2.34 (1.06–5.17)	1.91 (0.85–4.27)	1.36 (0.58–3.17)

Note: Cluster 1 (partnered; high social support; high variety of leisure activities); Cluster 2 (partnered; high social support; few leisure activities); Cluster 3 (not partnered; low social support; few leisure activities); Cluster 4 (living alone; high social support; high variety of leisure activities); Cluster 5 (partnered; high social support; limited variety of leisure activities).

Model 1: age and gender.

Model 2: Model 1 and education.

Model 3: Model 2 and number of comorbidities<sup>a</sup> and self-rated health.

<sup>a</sup>Includes cerebrovascular/cardiovascular, neurological, cancer, musculoskeletal and respiratory diseases.

isolation because of mandated measures of social distancing, which led to long periods of self-isolation, especially among older adults (Armitage & Nellums, 2020). Thus, assuming that feelings of isolation and loneliness might be even more exacerbated, efforts and investment should be made to ensure that physical isolation does not exacerbate social isolation under such pandemic conditions.

To conclude, these findings reinforce the importance of looking at social isolation from a multidimensional perspective, considering simultaneously its objective and subjective aspects, to better tackle older people's mental health. We also believe that these results highlight key information for clinicians when identifying older people at risk of depression by using social isolation profiles based in their household composition, perceived social support and level of leisure activities. To understand if an older person lives alone, his/her level of social support and if he/she practises leisure activities that involve interpersonal contacts have the potential to identify individuals who are more susceptible to being depressed and, therefore, to contribute to prevent the rising rates of this disorder.

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**TABLE 3** Multivariate models for the association between social isolation profiles and depression

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## CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

## AUTHOR CONTRIBUTION

Each author participated sufficiently in the work to take public responsibility for its content and believes that the manuscript represents honest work. Henriques conceptualised and designed the study, conducted the initial analysis and interpretation of the data and wrote the original draft of the article. Talih was responsible for the main formal analysis and interpretation of the data, and reviewed the article critically. Pastor-Valero, Fraga, Matijasevich and Dias collaborated, reviewed and edited the article with important intellectual content. Barros conceptualised the study, was responsible for funding acquisition, supervision and reviewed and edited the article with important intellectual content.

## DATA AVAILABILITY STATEMENT

Data supporting the findings of this study are available from the corresponding author on request.

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## REFERENCES

- Apóstolo, J., Loureiro, L., Reis, I., Silva, I., Cardoso, D., & Sfetcu, R. (2014). Contribution to the adaptation of the Geriatric Depression Scale -15 into portuguese. *Revista De Enfermagem Referência*, 4(3), 65–73. <https://doi.org/10.12707/RIV14033>
- Armitage, R., & Nellums, L. B. (2020). COVID-19 and the consequences of isolating the elderly. *Lancet Public Health*, 5(5), e256. [https://doi.org/10.1016/s2468-2667\(20\)30061-x](https://doi.org/10.1016/s2468-2667(20)30061-x)
- Balsamo, M., Cataldi, F., Carlucci, L., Padulo, C., & Fairfield, B. (2018). Assessment of late-life depression via self-report measures: A review. *Clinical Interventions in Aging*, 13, 2021–2044. <https://doi.org/10.2147/cia.s178943>
- Carvalho, S., Pinto-Gouveia, J., Pimentel, P., Maia, D., & Mota-Pereira, J. (2011). Características psicométricas da versão portuguesa da Escala Multidimensional de Suporte Social Percebido [Psychometric properties of Portuguese version for the Multidimensional Scale of Perceived Social Support (MSPSS)]. *Psychologica*, 54, 331–357. [https://doi.org/10.14195/1647-8606\\_54\\_13](https://doi.org/10.14195/1647-8606_54_13)
- Cassano, P., & Fava, M. (2002). Depression and public health: An overview. *Journal of Psychosomatic Research*, 53(4), 849–857. [https://doi.org/10.1016/s0022-3999\(02\)00304-5](https://doi.org/10.1016/s0022-3999(02)00304-5)
- Castro-Costa, E., Dewey, M., Stewart, R., Banerjee, S., Huppert, F., Mendonca-Lima, C., Bula, C., Reisches, F., Wancata, J., Ritchie, K., Tsolaki, M., Mateos, R., & Prince, M. (2007). Prevalence of depressive symptoms and syndromes in later life in ten European countries: The SHARE study. *British Journal of Psychiatry*, 191, 393–401. <https://doi.org/10.1192/bjp.bp.107.036772>
- Chen, Y., & Feeley, T. H. (2014). Social support, social strain, loneliness, and well-being among older adults: An analysis of the Health and Retirement Study. *Journal of Social and Personal Relationships*, 31(2), 141–161. <https://doi.org/10.1177/0265407513488728>
- Choi, H., Irwin, M. R., & Cho, H. J. (2015). Impact of social isolation on behavioral health in elderly: Systematic review. *World Journal of Psychiatry*, 5(4), 432–438. <https://doi.org/10.5498/wjp.v5.i4.432>
- Chu, W., Chang, S. F., Ho, H. Y., & Lin, H. C. (2019). The relationship between depression and frailty in community-dwelling older people: A systematic review and meta-analysis of 84,351 older adults. *Journal of Nursing Scholarship*, 51(5), 547–559. <https://doi.org/10.1111/jnu.12501>
- Cornwell, B., & Laumann, E. O. (2015). The health benefits of network growth: New evidence from a national survey of older adults. *Social Science and Medicine*, 125, 94–106. <https://doi.org/10.1016/j.socscimed.2013.09.011>
- Cornwell, E. Y., & Waite, L. J. (2009). Social disconnectedness, perceived isolation, and health among older adults. *Journal of Health and Social Behavior*, 50(1), 31–48. <https://doi.org/10.1177/002214650905000103>
- Courtin, E., & Knapp, M. (2017). Social isolation, loneliness and health in old age: A scoping review. *Health and Social Care in the Community*, 25(3), 799–812. <https://doi.org/10.1111/hsc.12311>
- Di Gessa, G., Glaser, K., & Tinker, A. (2016). The impact of caring for grandchildren on the health of grandparents in Europe: A lifecourse approach. *Social Science and Medicine*, 152, 166–175. <https://doi.org/10.1016/j.socscimed.2016.01.041>
- Djernes, J. K. (2006). Prevalence and predictors of depression in populations of elderly: A review. *Acta Psychiatrica Scandinavica*, 113(5), 372–387. <https://doi.org/10.1111/j.1600-0447.2006.00770.x>
- European Commission. (2017). *2018 Ageing report: Underlying assumptions and projection methodologies*. European Commission, Directorate-General for Economic and Financial Affairs.
- Fakoya, O. A., McCorry, N. K., & Donnelly, M. (2020). Loneliness and social isolation interventions for older adults: A scoping review of reviews. *BMC Public Health*, 20(1), 129. <https://doi.org/10.1186/s12889-020-8251-6>
- Fiske, A., Wetherell, J. L., & Gatz, M. (2009). Depression in older adults. *Annual Review of Clinical Psychology*, 5, 363–389. <https://doi.org/10.1146/annurev.clinpsy.032408.153621>
- Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*, 12(3), 189–198. [https://doi.org/10.1016/0022-3956\(75\)90026-6](https://doi.org/10.1016/0022-3956(75)90026-6)
- Gardiner, C., Geldenhuys, G., & Gott, M. (2018). Interventions to reduce social isolation and loneliness among older people: An integrative review. *Health and Social Care in the Community*, 26(2), 147–157. <https://doi.org/10.1111/hsc.12367>
- Gonçalves-Pereira, M., Prina, A. M., Cardoso, A. M., da Silva, J. A., Prince, M., & Xavier, M. (2019). The prevalence of late-life depression in a Portuguese community sample: A 10/66 Dementia Research Group study. *Journal of Affective Disorders*, 246, 674–681. <https://doi.org/10.1016/j.jad.2018.12.067>
- Gower, J. C. (1971). A general coefficient of similarity and some of its properties. *Biometrics*, 27(4), 857–871. <https://doi.org/10.2307/2528823>
- Henriques, A., Silva, S., Severo, M., Fraga, S., & Barros, H. (2020). Socioeconomic position and quality of life among older people: The mediating role of social support. *Preventive Medicine*, 135, 106073. <https://doi.org/10.1016/j.ypmed.2020.106073>
- Heun, R., Papassotiropoulos, A., Jessen, F., Maier, W., & Breitner, J. C. (2001). A family study of Alzheimer disease and early- and late-onset depression in elderly patients. *Archives of General Psychiatry*, 58(2), 190–196. <https://doi.org/10.1001/archpsyc.58.2.190>
- Holt-Lunstad, J., Smith, T. B., Baker, M., Harris, T., & Stephenson, D. (2015). Loneliness and social isolation as risk factors for mortality: A meta-analytic review. *Perspectives on Psychological Science*, 10(2), 227–237. <https://doi.org/10.1177/1745691614568352>
- Hughes, M. E., Waite, L. J., LaPierre, T. A., & Luo, Y. (2007). All in the family: The impact of caring for grandchildren on grandparents' health. *Journals of Gerontology. Series B: Psychological Sciences and Social Sciences*, 62(2), S108–119. <https://doi.org/10.1093/geronb/62.2.s108>
- Jensen, M. T., Marott, J. L., Holtermann, A., & Gyntelberg, F. (2019). Living alone is associated with all-cause and cardiovascular mortality: 32 years of follow-up in the Copenhagen Male Study. *European Heart Journal - Quality of Care and Clinical Outcomes*, 5(3), 208–217. <https://doi.org/10.1093/ehjqcco/qcz004>
- Kaufman, L., & Rousseeuw, P. J. (1990). *Finding groups in data: An introduction to cluster analysis*. Wiley.
- Klinenberg, E. (2016). Social isolation, loneliness, and living alone: Identifying the risks for public health. *American Journal of Public Health*, 106(5), 786–787. <https://doi.org/10.2105/ajph.2016.303166>
- Leigh-Hunt, N., Bagguley, D., Bash, K., Turner, V., Turnbull, S., Valtorta, N., & Caan, W. (2017). An overview of systematic reviews on the public health consequences of social isolation and loneliness. *Public Health*, 152, 157–171. <https://doi.org/10.1016/j.puhe.2017.07.035>
- Pocklington, C., Gilbody, S., Manea, L., & McMillan, D. (2016). The diagnostic accuracy of brief versions of the Geriatric Depression Scale: A systematic review and meta-analysis. *International Journal of Geriatric Psychiatry*, 31(8), 837–857. <https://doi.org/10.1002/gps.4407>
- Poscia, A., Stojanovic, J., La Milia, D. I., Duplaga, M., Grysztar, M., Moscato, U., Onder, G., Collamati, A., Ricciardi, W., & Magnavita, N. (2018). Interventions targeting loneliness and social isolation among the older people: An update systematic review. *Experimental Gerontology*, 102, 133–144. <https://doi.org/10.1016/j.exger.2017.11.017>
- R Core Team. (2020). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. Retrieved from <https://www.R-project.org/>
- Ramos, E., Lopes, C., & Barros, H. (2004). Investigating the effect of non-participation using a population-based case-control study on myocardial infarction. *Annals of Epidemiology*, 14(6), 437–441. <https://doi.org/10.1016/j.annepidem.2003.09.013>

- Reher, D., & Requena, M. (2018). Living alone in later life: A global perspective. *Population and Development Review*, 44(3), 427–454. <https://doi.org/10.1111/padr.12149>
- Sakurai, R., Kawai, H., Suzuki, H., Kim, H., Watanabe, Y., Hirano, H., Ihara, K., Obuchi, S., & Fujiwara, Y. (2019). Poor social network, not living alone, is associated with incidence of adverse health outcomes in older adults. *Journal of the American Medical Directors Association*, 20(11), 1438–1443. <https://doi.org/10.1016/j.jamda.2019.02.021>
- Sala, G., Jopp, D., Gobet, F., Ogawa, M., Ishioka, Y., Masui, Y., Inagaki, H., Nakagawa, T., Yasumoto, S., Ishizaki, T., Arai, Y., Ikebe, K., Kamide, K., & Gondo, Y. (2019). The impact of leisure activities on older adults' cognitive function, physical function, and mental health. *PLoS One*, 14(11), e0225006. <https://doi.org/10.1371/journal.pone.0225006>
- Santini, Z. I., Jose, P. E., York Cornwell, E., Koyanagi, A. I., Nielsen, L., Hinrichsen, C., Meilstrup, C., Madsen, K. R., & Koushede, V. (2020). Social disconnectedness, perceived isolation, and symptoms of depression and anxiety among older Americans (NSHAP): A longitudinal mediation analysis. *Lancet Public Health*, 5(1), e62–e70. [https://doi.org/10.1016/s2468-2667\(19\)30230-0](https://doi.org/10.1016/s2468-2667(19)30230-0)
- Sheikh, J. I., & Yesavage, J. A. (1986). Geriatric Depression Scale (GDS): Recent evidence and development of a shorter version. *Clinical Gerontologist*, 5(1–2), 165–173. [https://doi.org/10.1300/J018v05n01\\_09](https://doi.org/10.1300/J018v05n01_09)
- Sjöberg, L., Karlsson, B., Atti, A. R., Skoog, I., Fratiglioni, L., & Wang, H. X. (2017). Prevalence of depression: Comparisons of different depression definitions in population-based samples of older adults. *Journal of Affective Disorders*, 221, 123–131. <https://doi.org/10.1016/j.jad.2017.06.011>
- Stephoe, A., Shankar, A., Demakakos, P., & Wardle, J. (2013). Social isolation, loneliness, and all-cause mortality in older men and women. *Proceedings of the National Academy of Sciences of the United States of America*, 110(15), 5797–5801. <https://doi.org/10.1073/pnas.1219686110>
- Tamminen, N., Kettunen, T., Martelin, T., Reinikainen, J., & Solin, P. (2019). Living alone and positive mental health: A systematic review. *Systematic Reviews*, 8(1), 134. <https://doi.org/10.1186/s13643-019-1057-x>
- Toepoel, V. (2013). Ageing, leisure, and social connectedness: How could leisure help reduce social isolation of older people? *Social Indicators Research*, 113(1), 355–372. <https://doi.org/10.1007/s11205-012-0097-6>
- Tsai, F. J., Motamed, S., & Rougemont, A. (2013). The protective effect of taking care of grandchildren on elders' mental health? Associations between changing patterns of intergenerational exchanges and the reduction of elders' loneliness and depression between 1993 and 2007 in Taiwan. *BMC Public Health*, 13, 567. <https://doi.org/10.1186/1471-2458-13-567>
- United Nations, Department of Economic and Social Affairs. (2019). *World population prospects 2019: Highlights (ST/ESA/SER.A/423)*. United Nations.
- van Hees, S. G. M., van den Borne, B. H. P., Menting, J., & Sattoe, J. N. T. (2020). Patterns of social participation among older adults with disabilities and the relationship with well-being: A latent class analysis. *Archives of Gerontology and Geriatrics*, 86, 103933. <https://doi.org/10.1016/j.archger.2019.103933>
- Venables, W. N. (2002). Exploratory multivariate analysis. In W. N. Venables & B. D. Ripley (Eds.), *Modern applied statistics with S* (4th ed., pp. 301–330). Springer.
- Volkert, J., Schulz, H., Härter, M., Włodarczyk, O., & Andreas, S. (2013). The prevalence of mental disorders in older people in Western countries – A meta-analysis. *Ageing Research Reviews*, 12(1), 339–353. <https://doi.org/10.1016/j.arr.2012.09.004>
- Zimet, G. D., Powell, S. S., Farley, G. K., Werkman, S., & Berkoff, K. A. (1990). Psychometric characteristics of the Multidimensional Scale of Perceived Social Support. *Journal of Personality Assessment*, 55(3–4), 610–617. <https://doi.org/10.1080/00223891.1990.9674095>

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