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## Can the internet reduce the loneliness of 50+ living alone?

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### ABSTRACT

Living alone has been indicated as a key variable to explain loneliness in older adults. In contemporary society, where technology has become one of the main means of communication and personal interaction, has the internet influenced the relationship between living alone and loneliness? This paper aims to answer this research question by using a sample of 64,297 individuals who were surveyed in SHARE project wave 6 – in European countries with different welfare regimes (Portugal, Greece, Italy and Spain, Denmark, Sweden, Austria, Belgium, France, Germany, Switzerland, Luxemburg, Poland, Czech Republic; Slovenia, Estonia, and Croatia).

The results of the regression analysis evidence the moderating role of the internet on the relationship between living alone and feelings of loneliness in individuals aged 50 and over, so that the impact of living alone on loneliness is diminished for internet users as compared to their peers who do not use the internet. The results therefore reinforce the importance of policies aimed at fostering e-inclusion as a way of reducing the loneliness of older adults.

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### KEYWORDS

Loneliness; living alone;  
internet; 50+ individuals;  
Europe

## Introduction

There is no consensual definition of loneliness in the literature, although many authors (Ong et al., 2016) consider that loneliness refers to a negative experience that occurs when there is a discrepancy between desired and established social relations (Domènech-Abella et al., 2017; Lasgaard et al., 2016; Perlaman & Peplau, 1981; Vozikaki et al., 2018). Loneliness has been associated with an increased risk of mortality (Holt-Lunstad et al., 2015; Luo et al., 2012; Perissinotto et al., 2012; Shiovitz-Ezra & Ayalon, 2010) and identified as an important risk factor for health (Courtin & Knapp, 2017; Holt-Lunstad et al., 2015). For older adults, loneliness has also been related to increased blood pressure (Hawkey et al., 2010), difficulties in carrying out activities, a decline in mobility (Perissinotto et al., 2012), a higher risk of inactivity, smoking (Shankar et al., 2011), and sleeping disorders (Cacioppo et al., 2002).

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According to the literature, loneliness becomes an important (or a major) issue as individuals grow older (Dahlberg et al., 2015; Savikko et al., 2005; Vozikaki et al., 2018) and is associated with a set of other sociodemographic, economic, health, social and cultural characteristics (Aartsen & Jylhä, 2011; Dahlberg et al., 2015; Dahlberg & Mckee, 2014; Drageset et al., 2012; Dykstra, 2009; Fokkema et al., 2012; Hansen & Slagsvold, 2016; Houtjes et al., 2014; Perissinotto et al., 2012; Pinquart & Sorensen, 2001; Prieto-Flores et al., 2011; Savikko et al., 2005; Shiovitz-Ezra, 2013; Vozikaki et al., 2018; Zebhauser et al., 2015).

More specifically, in the literature, female individuals (Aartsen & Jylhä, 2011; Cohen-Mansfield et al., 2009; Domènech-Abella et al., 2017; Dong & Chen, 2017), as well as people with lower socioeconomic status (Vozikaki et al., 2018), with depression (Dahlberg et al., 2015; Drageset et al., 2012; Houtjes et al., 2014; Prieto-Flores et al., 2011; Vozikaki et al., 2018), and with functional limitations (Aartsen & Jylhä, 2011; Perissinotto et al., 2012), are associated with a greater risk of loneliness. On the other hand, studies examining the predictors of loneliness in old age have identified social networks as important in reducing feelings of loneliness (Pinquart & Sorensen, 2001; Shiovitz-Ezra, 2013; Zebhauser et al., 2015).

The impact of living alone on loneliness has also been widely discussed (Jong Gierveld et al., 2012; Victor et al., 2000). Living alone, as an objective situation that refers to a household consisting of a single individual, is not necessarily related to loneliness, although these concepts sometimes appear in the literature, erroneously, as synonyms (Victor et al., 2000, 2002). There is no consensus in the findings from the research on older adults that focuses on the impact of living alone on loneliness. Hence, studies claiming that older individuals living alone are more likely to experience feelings of loneliness (Jong Gierveld et al., 2012; Savikko et al., 2005; Sundström et al., 2009; Victor et al., 2002; Yeh & Lo Kai, 2004) coexist with others that identify and reinforce positive aspects of living alone (Eshbaugh, 2008; Larson et al., 1985).

Studies have emphasised the importance of creating conditions for the maintenance of social networks amongst older adults who live on their own, as these networks are important protecting resources against loneliness (Zebhauser et al., 2015). On the other hand, the internet has been portrayed in the literature as an important technology for the maintenance of social networks and social participation (Pan et al., 2018), even when obstacles to their maintenance or development arise (Antonucci et al., 2017).

The impact of the internet on older adults in general, and on loneliness in particular, is increasingly gaining attention. According to the literature, increased age has been related to a lower probability of internet use (Gilleard & Higgs, 2008; König et al., 2018; Silva et al., 2017). Indeed, as noted by the Pew Research Center (2019), seniors are much more likely than younger adults to say they never go online. At older ages, there are frequently a number of obstacles to using this technology (König et al., 2018; Silva et al., 2017; van Deursen & van Dijk, 2014), which are related to sociodemographic, economic, health, social and cultural aspects (Carpenter & Buday, 2007; Friemel, 2014; König et al., 2018; Neves et al., 2018; Olsson et al., 2017; Silva et al., 2017). The influence of macro level variables has also recently been emphasised in older age (König et al., 2018).

Internet use has advantages and disadvantages for older adults (Antonucci et al., 2017), and its impact varies according to the characteristics of the users and the type of use made (Castellacci & Tveito, 2018).

Many studies have pointed out that the internet has a positive impact on older people's quality of life (QoL) (Khalaila & Vitman-Schorr, 2018; Silva et al., 2018), and on their mental health (Forsman & Nordmyr, 2017), as it benefits cognitive functioning (Kamin & Lang, 2018), and also their well-being (Hunsaker & Hargittai, 2018). The use of this technology also plays an important role in the lives of adults in residential care facilities (Seifert et al., 2017). However, using the internet can also generate negative feelings (Gatto & Tak, 2008) and some types of use have a negative impact on psychological well-being (Huang, 2010) or are not related to well-being, and further research in this area is necessary (Damant et al., 2017; Dickinson & Gregor, 2006).

As shown in a recent systematic review (Chen & Schulz, 2016), there is no consensus in the literature regarding the relationship between the internet and feelings of loneliness. This reinforces the need for further studies on the impact of new technologies on loneliness (Beneito-Montagut et al., 2018; Khosravi et al., 2016). Thus, on the one hand, several studies relate the use of the internet at older ages to decreased loneliness (Choi et al., 2012; Cotten et al., 2013; Fokkema & Knipscheer, 2007; Hagan et al., 2014; Khosravi et al., 2016; Şar et al., 2012), as well as with the opportunity to promote communication and reinforce bonds (Martinez-Pecino et al., 2013; Russell et al., 2008; Vroman et al., 2015). On the other hand, other investigations have also evidenced unrelated (Aarts et al., 2015), negative and inconclusive results with regard to loneliness (Chen & Schulz, 2016).

Given the existence of mixed results in the literature and the potential importance of the internet among older European adults who live alone and constitute a growing group (Barbosa et al., 2019), the main goal of this work is to analyse the importance of the internet and its potential moderating role on the relationship between living alone and loneliness in individuals aged 50 and over who are resident in Europe. Thus, we expect that:

H1- Individuals 50 and over using the internet experience reduced loneliness.

H2- The internet moderates the relationship between living alone and loneliness, so that the impact of living alone on loneliness is diminished for internet users aged 50+ as compared to those who do not use the internet.

## Materials and methods

### Sample

This study focuses on 64,297 individuals aged 50 and over who were interviewed as part of the SHARE – Survey of Health, Aging and Retirement in Europe (wave 6) (<http://www.share-project.org/data-access/citation-requirements.html>) in Portugal ( $N = 1634$ ) Greece ( $N = 4811$ ), Italy ( $N = 5146$ ), Spain ( $N = 5493$ ), Denmark ( $N = 3608$ ), Sweden ( $N = 3812$ ), Austria ( $N = 3315$ ), Belgium ( $N = 5554$ ), France ( $N = 3802$ ), Germany ( $N = 4300$ ), Switzerland ( $N = 2731$ ), Luxemburg ( $N = 1515$ ), Poland ( $N = 1785$ ), Czech Republic ( $N = 4722$ ); Slovenia ( $N = 4148$ ), Estonia ( $N = 5495$ ), and Croatia ( $N = 2426$ ). Details on the SHARE study in Europe have been described elsewhere (Malter & Börsch-Supan, 2017). Briefly, in wave 6 (2015), a survey was conducted in a representative sample of the non-institutionalised population aged 50 or over. Interviews were face-to-face and

took place in the household. Trained interviewers conducted interviews using a computer assisted personal interviewing programme (CAPI).

The SHARE project, coordinated internationally by the Max Planck Institute for Social Law and Social Policy (Germany), has been approved by the Ethics Council of the Max-Planck-Society for the Advancement of Science.

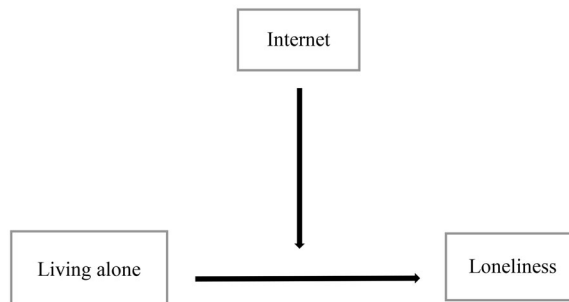
### Data analysis

Statistical analyses were performed using SPSS software, version 25. In the first stage, univariate descriptive analyses were conducted. We used the chi-square test to assess the interdependence between the two qualitative variables. The sample means were also compared using Student t-tests for independent samples. The statistical results of the tests with  $p < .05$  were considered significant. Results were also complemented with effect size measures (Cohen's  $d/\Phi$ , since large samples can lead to statistically significant results even if the differences between the groups are reduced (Marôco, 2014)). The interpretation of these results was based on Cohen (1988). Calibrated individual weights were used, as the SHARE survey did not have a uniform sample design (for further details, see Klevmarken et al., 2005; Lynn et al., 2013).

In the second stage, the internet's moderating role on the relationship between living alone and loneliness was tested (Figure 1). For this purpose, regression analyses were carried out using PROCESS software (<https://processmacro.org/index.html>) (Hayes, 2013). In the model that contains the interaction term the variables were centred.

### Measures

**Dependent variable:** loneliness, a short version of the R-UCLA scale (Malter & Börsch-Supan, 2013) is often used in studies on loneliness in older populations (Cotten et al., 2013; Shankar et al., 2011; Shiovitz-Ezra, 2013). The scale includes three questions: 'How much of the time do you feel you lack companionship?', 'How much of the time do you feel left out?' and 'How much of the time do you feel isolated from others?'. The answers range from 1 (hardly ever) to 3 (often). The three items form a scale that ranges from three to nine points, in which the high values represent higher levels of loneliness. The scale has a good internal consistency for the European countries considered in this article (Cronbach's Alpha = .751).



**Figure 1.** Analysis model.

**Moderating Variable:** dichotomous variable related to regular internet use: uses the internet (1); doesn't use the internet (0).

**Independent variable:** dichotomous variable distinguishing between: living alone in a private home (1) and living with one or more persons in a private home (0)

**Co-variables:** we have included variables mentioned in the introduction of this study that have traditionally been considered in the research on loneliness, such as sociodemographic, economic, health and cultural variables: age (50–105 years  $M = 66.05$ ,  $sd = 10.76$ ); gender: female (1) and male (0); years of schooling; and self-perception of financial stress: 'great difficulty' or 'some difficulty' in coping with monthly expenses (1), 'easy' or 'very easy' to handle monthly expenses (0). We also considered health variables: (i) depressive symptoms evaluated by the EURO-D scale (Prince et al., 1999). The EURO-D scale ranges from 0 to 12 points, referring to the presence or absence of 12 symptoms of depression (depressed mood, pessimism, suicidal thoughts, guilt, sleep, interest, irritability, appetite, fatigue, concentration, enjoyment, and tearfulness). As in previous studies (Schwartz & Litwin, 2017), this distinguishes between individuals with 4 or more symptoms (1) and individuals with lower scores (0) (Guerra et al., 2015); (ii) activities of daily living (ADLs) (limitations in ADLs) (Mehrbrodt et al., 2017) that refer to the presence or absence of difficulties in performing alone any of six ADLs – such as bathing, dressing and toileting. As in previous studies (Mehrbrodt et al., 2017), this makes a distinction between individuals who reported experiencing one or more limitations (1) and individuals who declared no limitations (0). These cut-offs are frequently used by the SHARE project (Ćwirlej-Sozańska et al., 2019; Verropoulou & Tsimbos, 2016).

Another co-variable is the Social Network Scale: a scale that combines the five main characteristics of the social network, i.e., size, geographical proximity, frequency of contact, emotional closeness and type of relationship. The scale has higher values for individuals with a larger network, with more people in the network who live up to 25 km away, with more people in the network who they contact weekly or more frequently, with more people in the network considered to be close or very emotionally close, and with more diversified networks, i.e., with a greater variety of relationship types. The scale ranges from 0 to 4 values (Litwin & Levinson, 2018; Litwin & Stoeckel, 2014).

Finally, in order to take into account the cultural context, we also considered the welfare regime as a co-variable of the model. As is usual in the literature (Niedzwiedz et al., 2014; Srakar et al., 2015; Vozikaki et al., 2016), we distinguished between Southern (Portugal, Greece, Italy and Spain), Northern (Denmark and Sweden); Central (Austria, Belgium, France, Germany, Switzerland, Luxemburg); and Eastern Europe (Poland, Czech Republic; Slovenia, Estonia, Croatia). In the regression analysis, the Southern is the reference category.

## Results

Table 1 indicates the sociodemographic, economic, and health characteristics of the interviewees.

In Europe, an average of 48.1% of adults aged 50+ use the internet. However, this percentage differs among the European countries under study. In this sense, the lowest rates of internet use are found in the Eastern and Southern European countries, 33.3% and

**Table 1.** Sociodemographic, economic, and health characteristics of Internet users and non-users.

Variables	Users (N = 31,373)	Non Users (N = 32,924)	$\chi^2/t$	Cohen's d /Phi
Internet (%)	48.1%	51.9%		
Welfare regime				
Southern	34.3	65.7		
Northern	80.8	19.2		
Central	59.8	40.2		
Eastern	33.3	66.7		
Sociodemographic and economic characteristics				
Average age (sd)	61.05(8.055)	70.66(10.882)	-115.915***	-.915***
Female (%)	48.6%	59.1%	258.247***	-.063
Male (%)	51.4%	40.9%		
Average years of schooling (sd)	12.95(4.074)	8.75(3.900)	115.990***	.935***
Positive financial situation (%)	71.5%	50.9%	4137.615***	.256*
Negative financial situation (%)	28.5%	49.1%		
Health				
With depressive symptoms ( $\geq 4$ )	22.1%	37.3%	1514.387****	-.157*
Without depressive symptoms	77.9%	62.7%		
1+ Adl (%)	5.6%	18.3%	2071.125***	-.179*
Without limitations (%)	94.4%	81.7%		
Social Network Scale (0-4)	2.15(0.837)	1.87(0.841)	34.666***	.295*
Living alone	20.5%	30.5%	659.887***	-.101*
Not Living alone	79.5%	69.5%		
Loneliness R-UCLA (3-9)	3.71(1.193)	4.23(1.61)	-47.024***	-.379*

Source: Source: SHARE wave 6, version 6.1.1 weighted data. N = 64,297 (N unweighted).

Notes:  $\chi^2/t = ***p < .001$ .

Cohen's d/Phi: small effect size\*; medium effect size\*\*; large or very large effect size\*\*\*.

34.3%, respectively. By contrast, 59.8% of those aged 50+ use the internet in Central European countries, while the highest percentage (80.8%) is found in Northern Europe.

There is no difference between internet users and non-users in terms of gender (trivial effect size) but they do vary in age, with users being younger (large effect size). The average years of schooling are higher for users (large effect size), and the percentage having a positive financial situation is higher for users (small effect size).

Regarding health, internet users aged 50+ show a lower percentage both of significant depressive symptoms (small effect size) and limitations in performing basic activities of daily living (small effect size). In the same table, it is also possible to observe that internet users have a higher social network score than non-users (small effect size).

Finally, concerning the main variables of interest of this study, Table 1 also shows that the percentage of those aged 50+ living alone is lower for the internet users (small effect size) and also that the internet users present lower levels of loneliness as compared with non-users (small effect size).

Table 2 shows the results of the regression analysis. Model 1 shows the impact of socio-demographic, economic and health characteristics on the loneliness of adults aged 50 and over. The results show that increased age, the number of years of schooling, and being a woman are related to higher loneliness levels. In a similar vein, the negative perception of the household's financial situation is also positively associated with loneliness.

With regard to mental and physical health, the existence of significant depressive symptoms, as well as limitations in performing activities of daily living, are associated with higher levels of loneliness. In contrast, having a social network is related to decreased feelings of loneliness.

**Table 2.** Moderating role of the Internet on the relationship between living alone and loneliness.

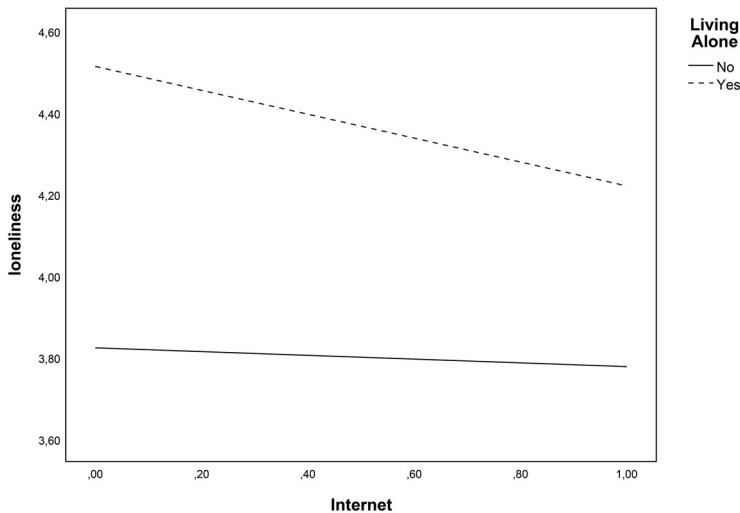
	Model 1			Model 2			Model 3		
	B	SE	95%CI	B	SE	95%CI	B	SE	95%CI
Constante	3.034***	.050	2.936; 3.133	3.520***	.053	3.416; 3.623	3.613***	.052	3.511; 3.714
Age	.011***	.001	.010; .013	.004***	.001	.002; .005	.003***	.001	.002; .005
Gender (Female)	.142***	.011	.120; .164	.057***	.011	.035; .079	.055***	.011	.033; .077
Years of schooling	.004**	.001	.001; .006	.005**	.001	.002; .008	.005**	.001	.002; .007
Negative financial situation	.341***	.013	.316; .366	.285***	.013	.261; .310	.289***	.013	.265; .314
Euro-D ( $\leq 4$ symptoms of depression)	.974***	.013	.949; 1.000	.961***	.013	.936; .986	.959***	.013	.934; .984
ADL (1+)	.425***	.019	.388; .4612	.401***	.019	.365; .438	.398***	.019	.361; .434
Social Network Scale	-.123***	.007	-.136; -.110	-.097***	.006	-.110; -.085	-.096***	.006	-.109; -.084
Northern (ref. Southern)	-.349***	.020	-.389; -.310	-.386***	.021	-.426; -.346	-.389***	.021	-.429; -.349
Central (ref. Southern)	-.273***	.016	-.304; -.243	-.334***	.016	-.365; -.304	-.338***	.016	-.368; -.307
Eastern (ref. Southern)	-.162***	.015	-.192; -.132	-.196***	.015	-.226; -.167	-.199***	.015	-.229; -.170
Living alone				.581***	.014	.554; .608	.566***	.014	.539; .593
Internet use				-.097***	.013	-.123; -.070	-.099***	.013	-.126; -.073
Internet* Living alone							-.247***	.027	-.299; -.195
	$R^2 = .199; p = < .001$			$R^2 = .227; p = < .001$			$R^2 = .228; p = < .001$		

Source: SHARE wave 6, version 6.1.1 nonweighted data.

Notes: N = 51,261 (N nonweighted).

\*\* $p < 0.01$ ; \*\*\*  $p < .001$ .





**Figure 2.** Association between living alone and loneliness, in function of internet use. Source: SHARE wave 6, version 6.1.1 unweighted data.

Regarding the place of residence, living in Northern, Central or Eastern Europe was associated with lower levels of loneliness as compared to living in Southern Europe.

After considering the impact of sociodemographic and economic characteristics, health, social network, and place of residence, Model 2 indicates that living alone is associated with higher loneliness levels ( $B = .581$ ;  $CI = .554$  to  $.608$ ;  $p < .001$ ) while Internet use is related to a decrease in loneliness levels ( $B = -.097$ ;  $CI = -.123$  to  $-.070$ ;  $p < .001$ ). However, the latter variables should be considered in the light of the interaction between them.

In Model 3, introduction of the interaction term ( $internet * living\ alone$ ), highlights the moderating role of the internet on the relationship between living alone and loneliness. In this model, it is observed that individuals living alone and using the internet are associated with a decrease in loneliness levels in the order of  $-.247$  ( $CI = -.299$ ;  $-.195$ ;  $p < .001$ ) compared to those living alone who do not use the internet.

The introduction of the interaction term slightly changes the extent of the variance explained by the regression. It therefore mainly serves to underscore the dynamics of the inter-relationship between living alone and internet use over loneliness, as can be observed in [Figure 2](#).

## Discussion

The results of this study are congruent with the literature that associates age increase with loneliness (Dahlberg et al., 2015; Savikko et al., 2005; Vozikaki et al., 2018) and that notes that, at more advanced ages, women experience higher levels of loneliness than men (Aartsen & Jylhä, 2011; Cohen-Mansfield et al., 2009; Domènech-Abella et al., 2017; Dong & Chen, 2017).

This research did not corroborate the conclusions of studies affirming that there is a negative correlation between education and loneliness (Savikko et al., 2005; Vozikaki

et al., 2018) but is in line with works by Dahlberg et al. (2015) and Dahlberg et al. (2018), which notice that is not always the case.

This work also corroborates studies that conclude that depression (Dahlberg et al., 2015; Drageset et al., 2012; Houtjes et al., 2014; Prieto-Flores et al., 2011; Vozikaki et al., 2018) as well as functional limitations (Aartsen & Jylhä, 2011; Perissinotto et al., 2012) are related to greater feelings of loneliness. By contrast, social networks help to reduce these feelings (Pinquart & Sorensen, 2001; Shiovitz-Ezra, 2013; Zebhauser et al., 2015).

The results of this study also showed that those living in southern European countries report higher loneliness levels compared to those living in northern, central or eastern Europe. This is in line with other studies which indicate that older adults in northern European countries experience less loneliness than those in southern Europe, which tend to be considered more familiaristic (Dykstra, 2009; Fokkema et al., 2012)

Another important conclusion of this study is that internet use is negatively associated with loneliness, which confirms hypothesis 1. This contributes to the debate about the relationship between this technology and feelings of loneliness (Chen & Schulz, 2016; Choi et al., 2012; Fokkema & Knipscheer, 2007; Hagan et al., 2014; Kraut et al., 1998; Sum et al., 2009; Şar et al., 2012). Finally, the results reveal that living alone is related to higher levels of loneliness, in line with the conclusions in other studies (Jong Gierveld et al., 2012; Savikko et al., 2005; Sundström et al., 2009; Victor et al., 2002; Yeh & Lo Kai, 2004).

This paper's main scientific contribution refers to the internet's moderating role on the relationship between living alone and loneliness. Consistent with hypothesis 2, it provides evidence that the impact of living alone on feelings of loneliness is diminished in users of this technology as compared to non-users.

This outcome may suggest that the internet can facilitate the maintenance and development of social relations (Antonucci et al., 2017; Vroman et al., 2015), which are essential to ensure that individuals who live alone feel less lonely (Zebhauser et al., 2015). Thus, the internet may constitute an important means of interaction at a stage in life when social networks undergo a restructuring process (Antonucci et al., 2014; Carstensen, 1995; Charles & Carstensen, 2010; Khan & Antonucci, 1980) and some events, such as the death of peers, the onset or worsening of health limitations as well as migration contexts (Antonucci et al., 2017; Beckenhauer & Armstrong, 2009; Cornwell & Laumann, 2015; Cudjoe et al., 2018; Steptoe et al., 2013) tend to affect social networks. Some studies in the European context have also shown that those with restricted networks tend to have poorer well-being (Djundeva et al., 2018). The internet may be an opportunity for those living alone to deal with loneliness and to promote their social networks. Similarly, in a non-European context, studies have shown that the internet can be helpful in mobilising social support as well as maintaining and strengthening existing relationships with geographically near and distant contacts (Quan-Haase et al., 2017).

This paper presents some limitations. One of them concerns the variable used to measure internet use. Internet use by older adults has often been measured by a yes/no response in terms of whether or not the internet is used regularly (Cotten et al., 2012, 2014; Hogeboom et al., 2010; König et al., 2018). This variable is the only measure of current internet use available in the SHARE project. However, this measure prevents us, for example, from analysing the impact that different types and times of internet use may have

on feelings of loneliness. This could be addressed by future research. Another limitation is the use of cross-sectional data for this study (SHARE, wave 6). Longitudinal analysis was not performed, as not all countries participated in all last three waves, the question regarding the internet was not asked to all respondents in wave 7 and the module of social networks was not included in wave 5. Future research, hopefully with data from wave 8, which are not yet available, would benefit from longitudinal analysis.

This study is innovative because it identifies the moderating role of the internet on the relationship between living alone and loneliness. It therefore suggests that public policies to foster older adults' e-inclusion are an important way to reduce loneliness, particularly for those living alone.

In this context, the literature has shown the importance of developing user-friendly designs for those older adults who are less familiar with the use of technology (Czaja et al., 2018). Another aspect that could be explored is the exposure of older adults to the role of older expert users of technology. They can serve as models who belong to the same age group and have mastered the challenge of modern technology, and could help to promote self-efficacy and reduce problems of alienation in rapidly changing modern societies (Doh et al., 2015). In addition, ensuring proper support with use processes may also be very important, as studies have found that older people who receive appropriate support with using technology are more likely to use more features as well as more technological devices in their daily lives (Kamin et al., 2019). It will be important in an inclusive society to develop strategies to promote older adults' e-inclusion as a way of dealing with loneliness.

### **Disclosure statement**

No potential conflict of interest was reported by the authors.

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