Dynamic Analysis of Loneliness at Older Ages in Europe by Gender

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Abstract

In this article, we analyse loneliness trajectories for older people aged 50 or more in selected European countries by gender. We also focus on the relationship between disability and loneliness trajectories. We use three waves of the longitudinal SHARE database. Loneliness trajectories are non-linear, increasing with age for both genders, and have the same shape irrespective of disability status but with different levels of loneliness. Loneliness persistence increases with disability and disability severity, especially for women. Worsening (improving) disability increases (decreases) the risk of loneliness persistence. We build rankings of the country's effects on loneliness persistence by gender. Mediterranean and Eastern European countries have the highest persistence rates, while the lowest rates are in Northern countries.

Keywords Loneliness persistence · Disability dynamics · Ageing · Cross-national comparison

Introduction

The objective of this research consists of analysing the trajectories of loneliness at older ages by gender in Europe. There is an extensive literature analysing the relationship that exists between different variables and feelings of loneliness (Dykstra, 2009). From this point of departure, a new line of research has developed a dynamic perspective to understand how and who leaves and enters into loneliness over time

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(Newall et al., 2014; Dahlberg et al., 2021). While static analyses on the prevalence of loneliness and the distribution by different socio-demographic variables are helpful to delimitate the problem, focusing on loneliness dynamics is useful for the design of social policies on how to prevent and reduce loneliness, and its harmful effects on life satisfaction (e.g., Hawkley & Cacioppo, 2007; Smith & Victor, 2019). In this research, we also remark the importance of disability and its relationship with loneliness dynamics. The prevalence of disability at older ages with differing degrees of severity is high and related to elevated levels of loneliness. For example, a report by the Jo Cox Loneliness Commission[1] concludes that more than half of people with disabilities in the UK experience higher levels of loneliness. However, to our knowledge, disability and disability trajectories are not usually considered in the analysis of loneliness trajectories or, at least, not as much as partner loss, limited social networks, self-perceived health or being depressed (Dahlberg et al., 2021).

Loneliness and age exhibit a non-linear relationship across the life cycle: levels are higher for young adults (late adolescence) and older people than for those who are middle-aged (Yang & Victor, 2011; Luhmann & Hawkley, 2016; Barreto et al., 2021). Although in this research we focus exclusively on those aged 50 or more, we also expect a non-linear relationship between loneliness feelings and age. The rationale behind this expectation is that for very old ages the prevalence of disability may affect social relationships beyond the limits of the household (Jylhä, 2004). Therefore, the analysis of loneliness trajectories will be a key component of our analysis.

There is also previous research analysing whether loneliness is more intense in individualistic countries than in collectivist ones (Yang & Victor, 2011; Lykes and Kemmelmeier, 2014; Barreto et al., 2021; Taniguchi & Kaufman, 2022). Focusing on older people in Europe, recent research shows that loneliness does not affect all older people equally in all countries. It was found to be more common in Southern and Eastern European countries (in order of prevalence, Greece, Italy, France and Spain), compared to countries in Central and Northern Europe, such as Switzerland, Denmark, Sweden and Germany (Dykstra, 2009). In fact, among those over 65, the lowest rates of loneliness are found in Denmark and Sweden (Sundstrom et al., 2009). Therefore, there is more to consider than the traditional divide between countries that are culturally individualistic or collectivist in what concerns Europe (Dykstra, 2009). Nevertheless, we do not know anything about country differences in terms of the dynamics of loneliness along time. Thus, we also provide a country ranking analysis to cover this caveat for the current international literature.

Our analysis will explicitly differentiate between men and women to take into account gender differences, as previous research has stressed the variation in the loneliness experience for women and men (Dodeen & Hassan, 2021; Hawkley et al., 2016). In particular, the relationship with disability may also differ for men and women, because of the well-known differences in the prevalence of disability by gender -see, for example, Merrill et al. (1997) or Leveille et al. (2000). At the same time, research on the experience of loneliness by gender reveals conflicting results,

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[1] Available at https://www.sense.org.uk/support-us/campaign/loneliness/.

probably related to confounding variables (Aartsen and Jylhä, 2011), although meta-analyses (such as Pinquart and Sörensen, 2001) find that women report higher levels of loneliness. When focusing on loneliness at older ages by gender in Europe, women report higher scores of loneliness (Vozikaki et al., 2018), especially in Southern and Central European countries (Fokkema et al., 2012; Vozikaki et al., 2018).

The database for our empirical analysis will be the *European Survey of Health, Aging and Retirement in Europe* (SHARE), for the years 2011, 2013 and 2015 -which correspond to waves 4, 5 and 6. This database has been widely used in previous research on loneliness (e.g., Angelini et al., 2011, 2012; Chatterji et al., 2015; Pagan, 2011, 2012, 2013; Pagán et al., 2014; Pego, et al., 2018; Seidel et al., 2011; and Van Oyen et al., 2018). The main advantage of using this multidisciplinary survey is that it includes a standardized variable on loneliness, the so-called R-UCLA. According to Peplau and Perlman (1982), loneliness can be defined as a negative feeling that occurs when a person's social needs do not correspond to their current levels of social relationships, in either quantity or quality. In other words, there is an imbalance between what one wants and what one has in terms of social relationships. The empirical challenge is defining this imbalance in an operative manner in a survey for individuals. The R-UCLA indicator provides a good solution to this challenge. This indicator is based on information related to intimate, relational and collective connectivity. These three elements are valued from 1 to 3, and this is summarized in the R-UCLA indicator. For first time, this indicator was included in the fourth wave of the SHARE (Hughes et al., 2004; Malter & Börsch-Supan, 2013). In addition, this survey includes harmonised information based on the same questionnaire about the socioeconomic, family, health, etc., of the population aged 50 and over, and for a large number of European countries. Our comparative analysis is based on 11 European countries: Austria, Belgium, Czech Republic, Denmark, France, Germany, Italy, Slovenia, Spain, Sweden, and Switzerland. This selection corresponds to available data on the loneliness variable and being fully included in the three waves in order to define our different loneliness trajectories.

Beyond the initial descriptive analysis of loneliness trajectories, we use two different empirical approaches. First, we estimate latent growth models by gender. These models will allow to take full advantage of the longitudinal database and showing how the trajectories of loneliness evolve across time according to the severity of disability. Second, we estimate separate ordered probit models by gender on the number and type of transitions from and to loneliness, with the objective of approaching to loneliness persistence. The ordered probit models are crucial to obtain the rankings of countries by gender.

The remainder of the article is as follows. In the next section, we review the literature, focusing on the dynamics of loneliness. After that, we present the technical details of our data and methods, explaining the definition of loneliness trajectories and the econometric specifications. We then develop the two empirical approaches focusing on the importance of disability to understand the loneliness trajectories, and the rankings of countries by gender. Finally, a conclusions section closes the article.

The Dynamics of Loneliness in Older Adults: Review of the Literature

Dykstra (2009) offers an excellent summary of the research on loneliness from a social perspective, focusing on how empirical evidence challenged previous conventional wisdom. First, loneliness increases with age among older people but not for all. This increase is mostly concentrated in those over 75–80 and is consistent with the non-linear U-shape association between age and loneliness identified in the literature (Pinquart and Sörensen, 2001). Second, country differences in loneliness do not fit well into the distinction of individualistic versus collectivist cultures. Traditionally, individualistic cultures have been associated with higher levels of loneliness, with the opposite occurring for collectivist countries. However, empirical evidence shows a more diverse picture, especially in Europe. In Southern European countries, usually associated with larger family and friendship networks, loneliness feelings are more prevalent than in Northern European countries, which have a more individualistic culture. In fact, the former Soviet countries in East-Central Europe display the largest prevalence of loneliness on the continent. Third, according to conventional wisdom we have moved towards more individualistic societies in the last decades with a simultaneous increase in ageism. Nevertheless, empirical evidence reveals no clear time trend. If anything, there is a decrease in loneliness. It is important to note that most of this empirical evidence on loneliness is cross-sectional or a time evolution of aggregate indicators, with a few exceptions which we will review a bit later on.

As for disability, there is scant previous research focusing directly on the relationship of disabilities with loneliness. Rather, the literature has considered everyday competence instead of a general definition of disability. In these terms, good levels of everyday competence facilitate social contact, thereby decreasing the risk of loneliness. In fact, Pinquart and Sörensen (2001) find in their meta-analysis that limitations in everyday competence is one of the key factors associated with loneliness. Moreover, Taniguchi and Kaufman (2019) point out the positive effect of interdependence on perceived supportive social connections. As for differences by gender, Aartsen and Jylhä (2011) consider the empirical evidence inconclusive, and that it is likely related to confounding variables such as unequal distribution of risk factors by gender. Many times, the differences by gender are rather small (Borys and Perlman, 1985; Maes et al., 2019), with males having slightly higher loneliness scores, although at the same time women more often admit to being alone in self-labelled loneliness (Borys and Perlman, 1985). Nevertheless, the meta-analysis by Pinquart and Sörensen (2001) finds that women report more intense feelings of loneliness, which seems related to the higher probability of being widowed for women, as they usually live longer. In fact, these authors explain that studies reporting higher loneliness levels for men are mostly based on students' samples, which are not suitable for predicting differences by gender among older adults. Therefore, the results reviewed by Pinquart and Sörensen (2001) give more support to women experiencing higher levels of loneliness than men do at older ages.

While there is extensive literature on loneliness and its correlation with different variables, there are fewer longitudinal studies on loneliness. This approach,

however, has recently been expanding, probably due to the increasing availability of longitudinal data that includes loneliness scales (Newall et al., 2014). Dahlberg et al. (2021) present a systematic review of this line of research encompassing 34 studies. They observe that while these investigations examine a wide range of factors, only a few reveal a consistent association with changes in loneliness over time: not being married or partnered and partner loss; a limited social network; a low level of social activity; poor self-perceived health; and depression/a depressed state and increased depression.

In general, longitudinal research on loneliness finds that increasing loneliness occurs mostly for the very old, as in Tijhuis et al (1999) for those aged between 75 and 85 at the beginning of the 10-year analysed period, following the pattern observed by Dykstra (2009). Other key factors to understand loneliness changes and related to our research are: increasing disability or functional limitations (Jylhä, 2004; Warner et al. 2016; Hawkley & Kocherginsky, 2018), becoming a widow/widower (Aartsen & Jylhä, 2011; Dykstra et al., 2005), material deprivation (Myck et al., 2021), and changes in institutionalisation (Tijhuis et al., 1999). In fact, changes in social and personal resources seem more important than their baseline levels for increasing loneliness (Aartsen & Jylhä, 2011). In a similar vein, Hawkley and Kocherginsky (2017) find that those with fewer functional limitations (a proxy for disabilities) were less likely to become lonely. When considering changes in functional limitations Jylhä (2004), Warner et al. (2016), and Hawkley and Kocherginsky (2018) find that increasing functional limitations is one of the key variables that increases loneliness for older adults. In our research, we contribute to this literature explicitly including disability status and disability trajectories (i.e., changes in the disability status), following Gannon and Munley (2009) to define disability trajectories.

Using latent class and latent growth models, Von Soest et al (2020) among others have analysed the development of loneliness across adolescence and young adulthood. They estimate clearly non-linear developmental trajectories with all their loneliness measures. In terms of loneliness feelings,[2] they increased from early adolescence to mid-20 s, slightly declining from 23 to 31 years old. Therefore, these models are very useful to know how the trajectory of loneliness evolve over time. The results by Von Soest et al (2020) also support the existence of differences between men and women, reporting women more loneliness than men at all ages.

We also add to this literature providing evidence on loneliness trajectories using three waves of the SHARE survey to build a comparative analysis of 11 European countries by gender. To our knowledge, there is no longitudinal research on loneliness that provides rankings of countries in terms of country effects on increasing loneliness. Although Myck et al (2021) use data from 13 countries of the SHARE survey to understand the change in loneliness between two waves of the survey, they do not go beyond introducing fixed effects by country in their estimations. In addition, we present this international comparative analysis of loneliness with separate

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[2] We refer to what Von Soest et al (2020) call "direct loneliness measure", which is the closest concept to the indicator we use in our research.

analyses by gender. Therefore, it will be possible to check whether the different variables affecting disability trajectories have the same effects for men and women.

Data and Methods

Database Description

To carry out this study we use data taken from the Survey of Health, Ageing and Retirement in Europe (SHARE) for the years 2011, 2013 and 2015 (i.e., waves 4, 5 and 6). The SHARE has been widely used by other researchers and is a well-known dataset within the academic community. Overall, the SHARE is a large cross-national panel database that includes information (harmonised and using a standard questionnaire for all European countries) for individuals aged 50 or over on health status, education, employment, social network and support, household composition, retirement, income, and financial transfers, among others. It began in 2004 and to date has conducted 480,000 in-depth interviews with 140,000 people from 28 European countries and Israel. Furthermore, it has a panel structure with biannual waves and includes ad-hoc modules on specific topics such as job episodes, political, economic, and societal environments, and COVID-19.[3] In our case, we use a sample of individuals aged 50 or over and for 11 European countries (Austria, Belgium, Czech Republic, Denmark, France, Germany, Italy, Slovenia, Spain, Sweden, and Switzerland). We have selected these countries according to the availability of data on our key variable (i.e., loneliness), and being fully included in the three waves (to define our different loneliness trajectories). As a result and after excluding those individuals with incomplete information, the final samples used in our estimation process for a balanced panel consist of 22,323 and 29,712 observations for males and females, respectively.

The Definition of Loneliness

As noted earlier, loneliness is a subjective and negative experience when feeling a mismatch between the quantity and quality of existing relationships with respect to some standard (Dykstra, 2009; Peplau & Perlman, 1982). Therefore, loneliness is always a subjective evaluation and depends on an individual standard about relationships with others (De Jong Gierveld & Van Tilburg, 2010). The first approaches to the study of loneliness measured it directly, that is, by asking about the personal feeling of loneliness. For example, the first two waves of the SHARE survey asked: *"How often have you felt lonely or lonely in the last week?"* This question was answered in the first wave of the SHARE on a scale of 1 to 4 according to the frequency of the sensation. In the second wave, the response was just binary -i.e.,

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[3] A full description of the SHARE (methodology, questionnaires, samples, release dates, special datasets, data documentation, etc.) are available in the work of Börsch-Supan y Jürges (2005) and Malter and Börsch-Supan (2013, 2015, 2017), and at http://www.share-project.org (retrieved 30/08/2021).

whether the person felt alone or not. This type of measurement is problematic. If the individual perceives loneliness as a stigma, the interviewee will give a false response as to having low levels of loneliness or not being alone at all (Crooker and Major, 1989; Victor et al. 2000, 2005).

To avoid this bias, information about loneliness is obtained in a more indirect way, by asking questions related to different dimensions of the subjective experience of loneliness and avoiding the words "loneliness", "single" or "alone" as much as possible. Probably the two most widely used indicators of this type are the De Jong Gierveld and the UCLA scales. The first one is an 11-item loneliness scale (De Jong Gierveld & Kamphuis, 1985; De Jong Gierveld & Van Tilburg, 1999) and is based on the distinction between social and emotional loneliness. For use in large surveys, there is a shorter version based on six items (De Jong Gierveld & Van Tilburg, 2010). The second one consists of 20 questions on the frequency of certain feelings related to some degree of loneliness (Hughes et al., 2004; Luo et al., 2012; Pikhartova et al., 2014; Steptoe et al., 2013; Shiovitz-Ezra, 2015; Wagner and Brandt, 2015; Niedzwiedz et al., 2016). In this case, the answers are on a scale of 1 to 4, depending on the intensity of these feelings. Later, this indicator was modified to facilitate responding in surveys, resulting in the indicator known as R-UCLA, with three elements valued on a scale of 1 to 3. These elements are related to intimate connectivity, relational connectivity and collective connectivity (collective identity and belonging to a group). The SHARE survey included the loneliness indicator R-UCLA for the first time in the fourth wave of the SHARE (Malter and Börsch-Supan, 2013; Hughes et al., 2004). Afterwards, it was also included in waves 5 and 6.[4]

Therefore, the SHARE questionnaire for waves 4, 5 and 6 includes the following three questions:

- *How often do you feel that you lack company?* (MH034)
- *How often do you feel left out?* (MH035)
- *How often do you feel isolated from others?* (MH036)

For the three questions, the possible answers are "*Almost never or never*", "*Sometimes*", and "*Often*", coded with the values 1, 2, and 3, respectively. From this information, the R-UCLA loneliness indicator is calculated as the arithmetic mean of the responses obtained from the three previous responses (Russell, 1996). As a result, this summary indicator ranges between 1 (the lowest level of loneliness self-evaluated by the individual) and 3 (the highest one). This scale has been widely used and validated in other previous studies on loneliness (e.g., Hughes et al., 2004; Cacioppo et al., 2010; Vander Weele et al., 2011; Pikhartova et al., 2014; Hawkley et al., 2016; Lee & Cagle, 2017; and Pagan, 2020). We will call this variable "loneliness score"

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[4] For comparisons between the De Jong Gierveld and UCLA scales, see, for example, De Jong Gierveld and Van Tilburg (2006) or Penning et al. (2014). For comparisons of both scales with other loneliness scales, see Cramer and Barry (1999).

Table 1 Loneliness persistence definition as trajectories for a 3-wave period (SHARE waves 4, 5, and 6)

Type of loneliness trajectory	Definition	Cases
0 = Never	Not lonely in any wave	000
1 = One-off	Be lonely in just one wave	100 010 001
2 = Two-off	Be lonely in two waves	110 101 011
3 = Always	Be lonely all waves	111

0 = Not lonely, 1 = Be lonely

and it will be our dependent variable in the estimated growth latent models. Using the estimated results, we predict the "loneliness score" from 50 to 85 years old.[5]

We also will create another version of the loneliness variable called "persistence of loneliness". In this case, we want to capture how many times (waves) we observe an individual reporting loneliness feeling. Following Luhmann and Hawkley (2016), we have defined a continuous variable called "loneliness" as the mean value of the responses to the above three questions. Then, we created a dichotomous variable called "lonely" that takes a value of 1 if the individual is lonely, and zero otherwise. To be considered as "lonely", we have followed the work of Hawkley and Kocherginsky (2018) and have imposed a frequency of the response "some of the time" for at least 2 items or "often" for at least 1 item, as well as a cut-off point of at least 1.5 points in our continuous variable "loneliness".

Using our variable "lonely" and the three waves available in the SHARE, we construct four different loneliness trajectories as shown in Table 1 to capture the "persistence of loneliness" across waves.

According to Table 1, we can distinguish a first trajectory called "Never" that includes all individuals who are not lonely in any wave (cases with the code: 000, where 0 means "Not lonely", and 1 "Being lonely"). In contrast, we can also identify those individuals who suffer from permanent loneliness, i.e., those being lonely in all waves (cases with the code 111 in Table 1). In addition, we also have two loneliness trajectories that represent transitory states of loneliness (but with different intensity) and have been defined as "One-off" (i.e., being lonely in just one wave), and "Two-off" (i.e., being lonely in two waves). The latter helps us distinguish individuals with more episodes of loneliness as compared to the loneliness trajectory "One-off", and thus being able to consider it as a different subgroup. For example, the case with the code "010" represents an individual who is not lonely in the first and third wave, but lonely in the second one, whereas the case with the code "011" indicates "not being lonely" in the first wave, followed by two waves "being lonely".

We have estimated "ordered probit models" (Greene, 2018) for the probability of being in each loneliness trajectory (breaking down the sample by gender status),

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[5] Because of the low number of cases, we aggregate all cases aged 85 or more when predicting loneliness trajectories.

wherein the ordered responses for our observed categorical variable, called "tra_i", is defined as follows:

$tra_i = 0$ if the individual "i" is observed in the loneliness trajectory "Never".
$tra_i = 1$ if the individual "i" is observed in the loneliness trajectory "One-off".
$tra_i = 2$ if the individual "i" is observed in the loneliness trajectory "Two-off".
$tra_i = 3$ if the individual "i" is observed in the loneliness trajectory "Always".

Therefore, when we estimate the ordered probit models, the dependent variable uses longitudinal information from the three waves. However, independent variables will be taken in the first wave, with the only exception of disability changes, defined comparing the disability status in the wave 4 and 6 -as we will explain later. This is not the optimal methodology to analyse loneliness persistence, but it is a simple way to capture what is behind loneliness persistence while we have more suitable databases to other econometric approaches.[6]

Disability Status

We use a definition of the disability status similar to Gannon and Munley (2009) and Pagan (2011). We distinguish between four categories: non-disabled, non-limited disabled, moderate limited disabled, and severe limited disabled. In the SHARE questionnaire (Health section), we have the following questions: "Do you have any long-term health problems, illness, disability or infirmity? (Yes/No)". Those who answer "Yes" can be defined as people with disabilities. In addition, the follow-up question, "For the past six months at least, to what extent have you been limited because of a health problem in activities people usually do? (Severely limited/Limited, but not severely/Not limited)" allows us to determine the degree of severity and limitation of the disability.

In the ordered probit models, we will also use a variable for changes in disability status between wave 4 and 6, similar to that of Dykstra et al. (2005). Comparing both waves, we consider three cases: the same, worse, and better.

Other Variables and Country Rankings

To estimate the latent growth models on the "loneliness score" and the ordered probit models on the "loneliness persistence", we have included the following explanatory variables in our models, traditionally used in other empirical studies on loneliness (e.g., Hawkley et al., 2010; Nicolaisen & Thorsen, 2014; Luhmann & Hawkley, 2016; and Pagan, 2020). These are disability status; age and age squared; marital status (i.e. married cohabitating, married living separated or divorced, never married, and widowed); educational level (i.e. primary, secondary, post-secondary and non-tertiary); household size, existence of children in the household, having been born in

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Table 2 Distribution of loneliness persistence (%) by gender, and loneliness score (means)

Type of loneliness trajectory	All	Mean loneliness score	Males	Females
Never	61.50	1.058	68.29*	55.88
One-off	20.51	1.376	18.73*	21.97
Two-off	10.97	1.692	7.95*	13.47
Always	7.02	2.169	5.02*	8.68
TOTAL	100		100	100
Mean loneliness score	1.271		1.211	1.321

Weighted data. Individuals aged 50 or over. *Difference between males and females is significant at $P < 0.05$. Number of observations: 62.487 (27.183 males + 35.304 females)

Survey of Health. Ageing and Retirement in Europe. SHARE (waves 4, 5, and 6)

country of residence, labour status (5 groups: retired, unemployed, employee, civil-servant and self-employed); household income (in quintiles); location of residence (5 groups: living in a big city, suburbs of big city, large town, small town, and rural area); participation in activities at least once in the last month (we include 7 activities: participation in volunteer work, educational and training courses, sports, political activities, reading (books, magazines, etc.), word or number games (crossword, puzzles, etc.), playing cards or similar games); and the year (wave) of interview.

From the results obtained for the ordered probit models and similar to Arezzo and Giudici (2017), we have also estimated the country effect on "loneliness persistence". To do this, we have first estimated linear regressions (OLS) from our ordered probit model for the male and female samples. We have then calculated the linear predictions and residuals. Finally, we have run a linear regression using these estimated residuals on a set of dummy country variables (and excluding the constant). The outcome is a ranking of countries in increasing order of the likelihood to have a longer loneliness trajectory (i.e., more episodes of loneliness throughout our balanced panel).

Finally, we have used the statistical package STATA 17 to obtain all our descriptive and estimation results.

Results

Descriptive Analysis[7]

Table 2 shows the mean loneliness score and the frequency distribution of our sample according to the "loneliness persistence" variable (i.e., "Never", "One-off",

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[7] In the descriptive section all results have been obtained using the sample weight available in the SHARE for the period analysed.

Table 3 Distribution of loneliness persistence trajectories (%) and loneliness score (means), by age groups and gender

Type of loneliness trajectory	Males				Females			
	50–64	65–74	75+	Mean loneliness score	50–64	65–74	75+	Mean loneliness score
Never	71.78*	69.56*	57.78*	1.051 1.355	61.03	56.96	45.02	1.063
One-off	17.09*	18.60*	22.97*	1.355	20.28	22.16	24.89	1.374
Two-off	6.66*	7.61*	11.65*	1.639	12.78	12.20	16.26	1.699
Always	4.47*	4.23*	7.60*	2.070	5.90	8.67	13.83	2.184
TOTAL	100	100	100		100	100	100	
Mean loneliness score	1.187	1.190	1.261		1.269	1.307	1.392	

Weighted data. Individuals aged 50 or over. *Difference between males and females is significant at $P < 0.05$. Number of observations: 62.487 (27.183 males + 35.304 females)

Survey of Health. Ageing and Retirement in Europe. SHARE (waves 4, 5, and 6)

"Two-off" and "Always") and breaking down the sample by gender (male *versus* female). In general, and as we expected, we find that the loneliness score increases with the persistence of loneliness. We also have a higher concentration of individuals in the first loneliness trajectory "Never". On average, 61.50% of all individuals do not have any loneliness episode in our 3-wave panel. In contrast, we find a clear decreasing trend in this percentage for the remaining loneliness trajectories. Namely, 20.51% for the trajectory "One-off", followed up by 10.97 and 7.02% for the trajectories "Two-off" and "Always", respectively. This finding means that the majority of the loneliness episodes are transitory (i.e., 31.48% = 20.51% + 10.97%), whereas the permanent episodes only represent 7.02% of all individuals. Jylhä (2014) found similar results with cross-sectional and longitudinal data from Finland, ranging between 60 and 70 per cent of older people never feeling lonely.

By gender, females have a higher loneliness score than men, which is coherent with previous literature. We also find the same pattern for the distribution of trajectories of loneliness persistence for males and females, but we detect some differences in terms of the magnitude of these percentages in each loneliness trajectory. According to a test of equality of percentages, we find a higher number of males located in the trajectory "Never" as compared to that found for the female sample (68.29% *versus* 55.88%, i.e., a differential of 12.41 percentage points in favour of males). In contrast, the opposite result is found for the remaining loneliness trajectories. For example, 8.68% of females are found to be always lonely for all waves, whereas only 5.02% is found for males. Looking at the transitory loneliness trajectories (i.e., "One-off" and "Two-off"), we observe that the total sum of both trajectories is higher for females as compared to that for males (35.44% *versus* 26.68%). Additionally, we find a significant differential in favour of females for the loneliness trajectory "Two-off", i.e., 5.52 percentage points.

Previous studies have found a significant relationship between gender and age in terms of loneliness (e.g., Koenig & Abrams, 1999; Yang & Victor, 2011; Nicolaisen & Thorsen, 2014; Luhmann & Hawkley, 2016; and Barreto et al., 2021). To shed further light, we have calculated the loneliness score and the distribution of the trajectories of persistence by age and gender. According to Table 3 and in line with the existing empirical evidence, the loneliness score increases with age for both genders, being always greater for females than males. In the same vein, we find that ageing reduces the likelihood to be found in the trajectory "Never". For males, this reduction goes from 71.78% for those individuals aged 50–64 to 57.78% for those aged 75 or more (i.e., a drop of 14 percentage points, whereas for females these percentages vary from 61.03% to 45.02%, respectively (i.e., a drop of 16.01 percentage points, and slightly higher than that previously found for males). In addition and after using a test of equality of percentages for this trajectory "Never", we detect that males have higher percentages in all age groups as compared to females, i.e. the percentage of males aged 50 or more who have never suffered from a loneliness episode within our panel is relatively higher that that found for their female counterparts. This decreasing trend in the loneliness trajectory "Never" both for males and females is compensated by increases in the rest of trajectories as age increases. For example, the percentage of males and females found in the transitory loneliness trajectories, "One-off" and "Two-off", increases with age, and they are all always higher for females than for males in all age groups. Finally, the prevalence of the loneliness trajectory "Always" (permanently lonely) increases with age (and once again is higher among females compared to males), and with significant percentages for those individuals aged 75 or more (7.6 and 13.83% for males and females, respectively).

Table 4 shows the distribution of loneliness persistence and loneliness score considering the change in his/her disability status between waves 4 and 6. We distinguish three cases:

a) The "same" disability status in waves 4 and 6.
b) A "worse" disability status, that is, an increase in the limitations to performing daily activities because of a health problem lasting at least 6 months (e.g., from moderate limited disability in wave 4 to severe limited disability in wave 6).
c) A "better" disability status, that is, a reduction in limitations to carrying out daily activities (e.g., from moderate limited disability to non-disabled).

We find that the mean loneliness score increases for those with a deterioration in their disability status (i.e., "worse" category) and decreases when there is an improvement ("better" category) respect to those not changing their disability status for females, but not for males, who have a mean loneliness score lower for those worse than for those not changing their disability status. In terms of loneliness persistence, the percentages of those not changing their disability status are decreasingly important among males, while this decrease is not so clear for females. For males there is an increasing importance of those worsening when

Table 4 Distribution of loneliness persistence (%) and loneliness score, by change in disability status (i.e., worse. the same and better) and gender

Type of loneliness trajectory	Males				Mean loneli-ness score	Females				Mean Loneliness score
	Change in disability status					Change in disability status				
	Worse	Same	Better	TOTAL		Worse	Same	Better	TOTAL	
Never	22.24*	57.67	20.08*	100	1.045	24.19*	55.35	20.46*	100	1.061
One-off	27.32*	53.22	19.46*	100	1.336	26.99*	50.56	22.45*	100	1.367
Two-off	34.73*	41.07	24.20*	100	1.520	25.40*	51.28	23.32*	100	1.574
Always	31.05*	40.03	28.92*	100	2.058	22.75*	51.84	25.41*	100	2.125
TOTAL	24.75*	54.46	20.79*	100		24.85*	53.45	21.71*	100	
Mean loneliness score	1.167	1.221	1.138			1.284	1.255	1.242		

Weighted data. Individuals aged 50 or over. *Difference between the category "same" and the others is significant at $P < 0.05$. Number of observations: 21.369 (9.061 males + 11.768 females)

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loneliness persistence increases, and the same for those improving but not so clearly. For females, there is a slightly decrease with loneliness persistence of the percentage of those worsening and an increase with loneliness persistence of those improving. These results are in line with Jylhä (2004), who found that increasing disability is behind the rise in loneliness for older adults, together with weakening social integration, but we do not clearly find the same pattern for both genders.

Finally, one of the main advantages of using the SHARE is the availability of harmonised data for a set of European countries which allows us to carry out comparative studies on a same phenomenon or variable (in our case loneliness). Looking at the previous literature on country differences in loneliness, Reher (2008) observed that Central and Northern Europe are characterized by weak family links (wherein individualistic values tend to dominate), whereas the Mediterranean is distinguished by strong family ties (wherein collectivistic values predominate). In the same vein, Dykstra (2009) found that loneliness is more common in Southern European countries (in order of prevalence, Greece, Italy, France, and Spain) as compared to Northern and Central European countries such as Switzerland, Denmark, Sweden and Germany. In fact, among those individuals over 65, the lowest prevalence of loneliness is found in Denmark and Sweden (Sundström et al., 2007). Table 5 shows the distribution of the four loneliness trajectories by country of residence (i.e. 11 European countries) and gender. For males, we find the highest percentages for the loneliness trajectory "Never" in Austria (81.52%), Denmark (81.03%), and Switzerland (80.14%), whereas the lowest ones are in Czech Republic (48.84%), Italy (57.40%), and Belgium (63.56%). For females, we find results like those found for males, with Denmark (79.71%), Switzerland (76%), and Austria (73.52%) at the top of the ranking, and Italy (35.11%), Czech Republic (42.52%), and Belgium (54.46%) in the last positions.

On the other hand, the European countries with the highest percentages of individuals being fully lonely in all waves, i.e., "Always", are Italy (8.09 and 15.68% for males and females, respectively), Belgium (6.51 and 10.52% for males and females, respectively), and Czech Republic (6.3 and 9.71% for males and females, respectively). With regard to the transitory loneliness trajectories, we find higher percentages of "One-off" in Czech Republic with 31.06% (26.66%) of males (females), followed by Italy with 23.55% (29.74%) of males (females), and Belgium with 21.04% (22.52%) of males (females). A similar pattern is found for the loneliness trajectory "Two-off". Furthermore, Austria, Denmark, and Switzerland are the countries with the lowest rates of transitory loneliness for both males and females. Once again, it is worthwhile mentioning the gender differences by country in terms of loneliness trajectories. For example, the gender gap is significantly high for the loneliness trajectory "Never" in Italy (57.4 *versus* 35.11) and Spain (76.79 *versus* 58.4) in favour of males, and for the trajectory "Always" once again in Italy (8.09 *versus* 15.68) and Sweden (2.67 *versus* 9.79).

Overall, all these findings reveal the need to take into account these country-level differences in loneliness and order our European countries into different subsamples or groups that reflect the dichotomy between "individualistic countries" *versus* "family-oriented countries" (Fokkema et al., 2012). This analysis may also help

Table 5 Distribution of loneliness persistence (%) by country of residence and gender

Type of loneliness trajectory	Austria	Denmark	Switzerland	Spain	Sweden	Slovenia	France	Germany	Belgium	Italy	Czech Republic
A) Males
Never	81.52	81.03	80.14	76.79	73.48	68.84	68.75	65.87	63.56	57.40	48.84
One-off	11.65	11.15	12.93	15.39	17.09	20.40	18.13	19.60	21.04	23.55	31.06
Two-off	4.17	4.43	4.88	4.99	6.76	8.47	7.43	9.71	8.89	10.97	13.80
Always	2.65	3.39	2.05	2.83	2.67	2.29	5.69	4.82	6.51	8.09	6.30
TOTAL	100	100	100	100	100	100	100	100	100	100	100
B) Females
Never	73.52	79.71	76.00	58.40	61.57	65.51	57.52	64.71	54.46	35.11	42.52
One-off	15.83	12.13	13.30	22.69	18.99	16.84	20.55	18.40	22.64	29.74	26.66
Two-off	7.19	4.47	7.19	11.88	9.64	13.04	14.03	10.82	12.37	19.48	21.11
Always	3.45	3.69	3.51	7.04	9.79	4.61	7.91	6.07	10.52	15.68	9.71
TOTAL	100	100	100	100	100	100	100	100	100	100	100

Weighted data. Individuals aged 50 or over. Number of observations: 62.487 (27.183 males + 35.304 females) Survey of Health. Ageing and Retirement in Europe. SHARE (waves 4, 5, and 6)

increase our understanding on the variations in the levels of wellbeing reported by older people and the importance of enacting different public health policies aimed at boosting this group's quality of life (Hansen & Slagsvold, 2016). At first glance, the general pattern follows conventional wisdom: higher loneliness (here, loneliness persistence) for Southern and Eastern countries and lower for Northern countries. However, there are countries that do not fit this pattern, such as Spain and Sweden. We will come back to the international comparison later, estimating a ranking of country effects on loneliness persistence by gender thanks to the ordered probit models.

Estimations: Latent Growth Models on the "Loneliness Score" and Loneliness Trajectories

In order to take full advantage of the longitudinal nature of our data, we estimate a latent growth model on the "loneliness score". Mainly, we follow Von Soest et al. (2020) and Pakpahan et al. (2017). The first one analyses the development of loneliness through adolescence and young adulthood, i.e., individuals aged 13 to 31 years, and the second one compares different longitudinal models in life course research. The focus of a latent growth model is on changes or development over time (Pakpahan et al., 2017), and, therefore, this model explicitly takes into account the order of events. We estimate separate models for males and females, assuming random effects. Full estimations are shown in Table 6 in the Appendix.

As we expected, when disability is more severe, the loneliness score is higher with respect to not being disabled, although non-limiting disability is hardly significant for males and not statistically significant for females at conventional levels.

The results for age and age squared show a sort of U-shaped non-linear relationship between loneliness and age for both genders. Using different values for age, we can obtain the loneliness trajectories from 50 years old onward. As we are interested in the importance of disability in these trajectories, we present in Fig. 1 the estimated loneliness trajectory for disability status, by gender. For males and females, loneliness increases with age, but this increase is different depending on disability status. In addition, the non-disabled and non-limited disabled have very similar trajectories, especially for males. Those with higher levels of loneliness, whatever their age, are people with severe limitations. The non-linearity of the trajectory for this group is very clear for males, who experience an increase at 70 with a peak at 80 and a slight decrease later. For females with the same disability status, there is an increasing trend with age, but there are some ups and downs, being only coincident with males the down after 80. At an intermediate level of the loneliness score, we have those who are moderately disabled, with an increasing trajectory from 65 for females and from 70 for males. Some previous literature (as Dykstra, 2009, or Jylhä, 2004) remarks that ageing increases loneliness not per se but because of increasing disability and decreasing social integration. However, our analysis shows an increase of loneliness of age even considering each disability status. Finally, the loneliness score is at similar levels for both genders when considering those disabled
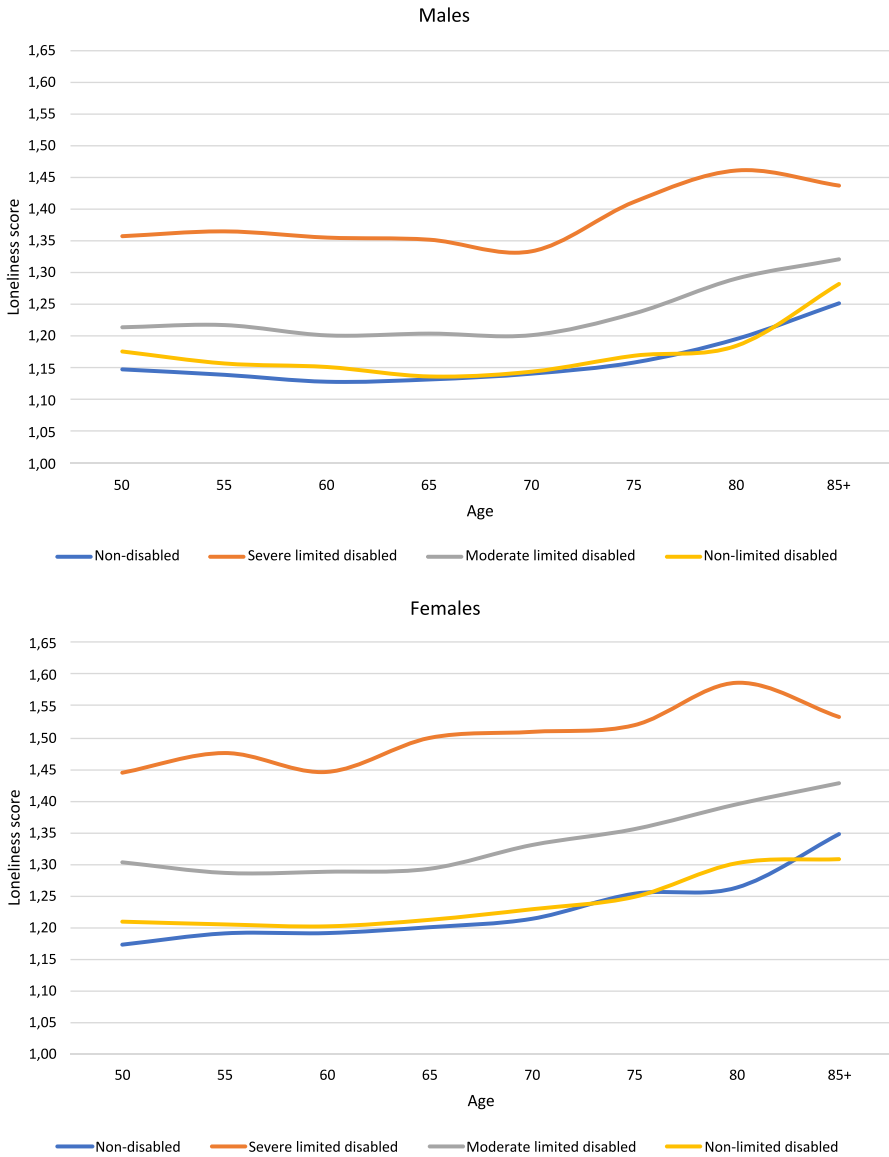
Fig. 1 Estimated trajectories of loneliness according to the individual's disability status and age. Source: Estimates of the random intercepts and random slopes from the Latent Growth Model (LGM) included in Appendix Table 6

with severe limitations, but it is higher for females in the whole trajectory in the rest of cases.

Therefore, we find that disability status is an important variable for understanding loneliness for older people, which is roughly coincident with the results of the systematic review by Dahlberg et al (2021), who showed that different studies found an

association between limitations in activities of daily living (ADL) and instrumental activities of daily living (IADL) and loneliness risk. Nevertheless, Dahlberg et al (2021) also insist that sometimes this relationship is found in bivariate analyses but not in multivariate ones, and they consider that the evidence for this association is consistent for ADL but not for IADL.

Regarding marital status, we find that those married living separated or divorced, never married and widows/widowers suffer more loneliness than those married and cohabiting with a partner. The size of the effects is increasing with widows/widowers suffering the highest levels of loneliness. The size of the coefficients is greater for females. This is in line with the fact that women usually report more loneliness (Aartsen & Jylhä, 2011) and becoming widowed as a crucial event increasing loneliness (Dahlberg et al., 2021), especially for women (Aartsen & Jylhä, 2011).

Education beyond the primary level protects again loneliness and this effect increases with educational level, especially stronger for women. In any case, for men the only significant educational level is post-secondary studies.

As for household size, when its size is two or more loneliness is lower for both genders, although all these effects are usually larger for men. On the other hand, it is not a clear pattern decreasing loneliness with the household size. The existence of children in the household is not significant for either males or females, showing that for those over 50 the household size is more important than the household type to understand the determinants of loneliness.

Being born in the country of residence is hardly significant for either men or women, but it decreases loneliness. Probably, immigrants who remain in the host country when they are aged 50 or more have developed long-term social relationships, but not so large as native people.

The results of the labour status are as expected. Those working experience lower levels of loneliness persistence. The results are not very different by gender, but more clearly significant for females. Myck et al. (2021) report similar results: working decreases the probability of becoming lonely, although this effect is not significant for entering into severe loneliness.

Household income does not protect against loneliness persistence for men and women, although for females we obtain a significant (negative) result the fifth quintile (the highest). Myck et al. (2021) find a clearer relationship of the quintiles of material deprivation with increasing loneliness between two waves of the SHARE, although they do not present different estimations by gender.

With regard to the location of residence, no category has been found to be statistically significant at conventional levels.

As for participation in social activities, for both genders these categories decrease loneliness: "Voluntary and charity work", "Sports, social and other kind of club activities", "Reading books, magazines or newspapers", and "Playing cards or games such as chess"). These results are as expected according to social capital literature for bridging activities (Arezzo & Giudici, 2017; Pagán, 2016): they protect from loneliness. However, we also obtain for men a positive effect on loneliness for "Word or number games crosswords puzzles". Probably, this type of activity is more

linked to people living alone than the other activities, which require social interaction -maybe with the exception reading books, magazines or newspapers.

Estimations: Ordered Probit Models on "Loneliness Persistence" and Country Rankings

Table 7 in the Appendix shows the estimated ordered probit models on loneliness persistence by gender. The results of the main variables are in line with the results we have obtained for the latent growth model. Considering the disability status, increasing severity is related with more persistence for both genders. Interestingly, the change in the disability status from wave 4 to 6 shows that worsening (improving) increases (decreases) loneliness persistence respect to those remaining in the same disability status. These results are coherent with respect to Jylhä (2004) or Aartsen and Jylhä (2011), who obtained that increasing disability increased loneliness.

About the rest of variables, we obtain results in line with the latent growth model except for the household income and being unemployed. Now, we see that being about the second quintile is related to lower loneliness persistence for males, while for females the results are as before. Therefore, the household income seems more "protective" against loneliness for men than for women. About being unemployed, this labour status increases the loneliness persistence for males but not significantly for females.

Therefore, we confirm the results obtained with the latent growth model, but now in terms of loneliness persistence.

Age is only significant for males, although the sign is coherent with the latent growth model (negative for age and positive for age squared).

As we explained above, the ordered probit models have been instrumental for the estimation of country rankings by gender. The conventional wisdom about international differences in loneliness was that people in individualistic societies are lonelier than in collectivist societies or in societies with strong family ties (Dykstra, 2009). However, the empirical evidence in Europe contradicts this simple pattern. In fact, there is a sort of North–South divide showing that loneliness is usually higher in Mediterranean countries than in Northern (mainly Scandinavian) countries, when the first group is viewed as countries having strong family ties and the second as individualistic. Eastern European countries are also among those with the highest loneliness levels (Fokkema et al., 2012; Yang & Victor, 2011), showing higher levels of loneliness in countries with a collectivistic culture with respect to individualistic societies (Lykes and Kemmerlmeier, 2014). The higher loneliness levels in Southern and Central Europe are largely associated to not being married, economic deprivation and poor health (Fokkema et al., 2012).

While most of this literature compares aggregated indicators of loneliness by country and estimates how different variables determine the loneliness level by
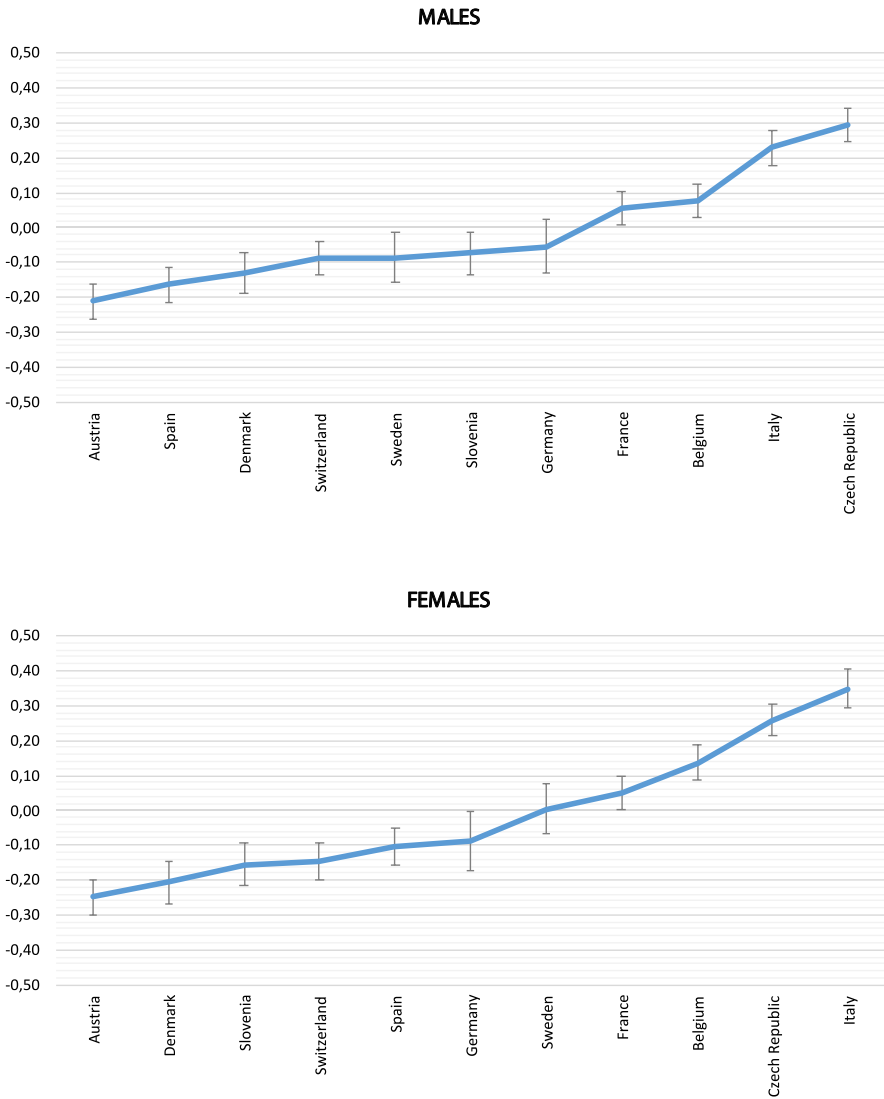
Fig. 2 Ranking by country. Source: Own calculations from Appendix Table 7

country, here we adopt a different empirical strategy. As we explained in the data and methods section, we estimated an ordered probit regression on the different loneliness trajectories with country fixed effects, and then we recover the country fixed effects to elaborate a ranking of countries. Therefore, what we have is the

effect of living in each country on the persistence of loneliness, ceteris paribus. In addition, we have different estimations for males and females, and, therefore, we have different rankings by gender.

We show the country rankings by gender in Fig. 2. They are somewhat similar in the extremes: Austria and Denmark are among the countries with the lowest fixed effect, while the Czech Republic, Italy and Belgium are the countries with the highest fixed effect. At first glance, the relative positions of the Czech Republic and Italy would confirm that Eastern and Southern European countries are related to higher loneliness levels (here, a higher loneliness persistence), and the low position of Denmark would confirm the lower levels for Northern countries. However, we also see Spain with just the second lowest rank for males and in the middle for females, in other words, a very different position with respect to Italy. In addition, Sweden is in a low-middle position for males and a high-middle position for females.

Therefore, the country effects on loneliness persistence do not closely follow the patterns of the previous literature for aggregate loneliness levels, although there are some "typical" countries of Southern, Northern and Eastern countries in the extremes of the rankings for both genders in line with the European pattern of high, low and high effects, respectively. As a novelty, the results by gender are not coincident, but at the extremes are rather similar. In general, we must be cautious when extending the comparative results obtained from past literature on loneliness to the loneliness dynamics.

Conclusions

In this article, we have analysed the loneliness trajectories for older adults in some European countries by gender. We use an especially suitable database for this objective, such as the SHARE, specifically three waves of this international survey with information about loneliness with the R-UCLA indicator, disability and the rest of variables considered in our analysis. At a descriptive level, we show that loneliness in the three considered waves is experienced by 5 per cent of males and 7 per cent of women aged 50 or more in Europe (Table 2). Therefore, the full persistence of loneliness is not generalised among older people (Jylhä, 2004), but 31 per cent of older males and 44 per cent of older women report suffering from loneliness in at least one of the three waves, which covers a period of 6 years. By gender, we find that women present higher levels of the loneliness score in cross-section data, but also when considering loneliness persistence.

We find that disability is related to higher loneliness scores and persistence. More limitations and more severity increase the risk of loneliness persistence and decreases the probability of never feeling alone. Regarding disability trajectories, when there is a worsening (an improvement) in disability across time, loneliness

persistence increases (decreases). We have shown that the loneliness trajectories are non-linear, increasing with age, especially beyond 70 for males. In addition, loneliness trajectories have a similar shape by disability status but at different levels of the loneliness score, except for the non-limited disabled and non-disabled people, who share almost the same trajectory at the same levels.

We have also estimated country rankings of loneliness persistence by gender. These rankings capture the isolated effect of the country on loneliness persistence, which is a novelty in the research on loneliness. Our rankings are only partially in line with previous results. We find that some Southern (Italy) and Eastern (Czech Republic) countries have the highest effect on loneliness persistence and a typical Northern country such as Denmark has low positions in the rankings. These results are in line with the recent comparative literature on loneliness (Dykstra, 2009). However, we also find that another Southern country such as Spain has very different positions than Italy in the rankings, and the same holds for Sweden with respect to Denmark, with the positions of these two countries being markedly different by gender. Beyond the methodological differences in our estimation of the country rankings, we consider that we likely need to enrich the previous explanations of loneliness variation by country considering that international variation in loneliness persistence is not the same as in the case of loneliness levels.

We also find that living alone (especially widows/widowers), ageing, a lower educational level, being retired or not working, or not participating in some social activities have an increasing effect on loneliness and loneliness persistence. The significant effect of ageing even controlling by disability (and disability changes in the analysis of loneliness persistence) is against the results of some authors as Jylhä (2004), who finds that ageing is not related to an increase in loneliness but rather to problems correlated with ageing, such as losing a partner or having a disability. Maybe, the differences in the definition of the disability status and the time span considered are behind these contradictory results.

Finally, we consider that an important implication for social policy of these results is not merely focusing on target groups defined by age, but on the characteristics (for example, disabilities) and some changing characteristics (for example, being widowed), and not merely considering any type of participation in social activities equally effective to prevent loneliness persistence. Our results also support adjusting some social interventions by gender, with different emphasis on specific variables. For example, living alone seems riskier for females in terms of loneliness persistence, while losing a job has a greater effect for males.

Appendix

Tables 6 and 7

Table 6 Latent growth model (LGM) on "*loneliness score*"

	Males			Females		
	Mean	Coeff	SE	Mean	Coeff	SE
Disability status						
Non-disabled (*ref.*)	0.537	-	-	0.511	-	-
Non-limited disabled	0.145	0.010	0.004	0.126	0.010	0.007
Moderate limited disabled	0.222	0.051 **	0.007	0.257	0.068 ***	0.009
Severe limited disabled	0.095	0.162 ***	0.012	0.106	0.168 ***	0.015
Age	67.61	-0.027 ***	0.005	67.10	-0.023 ***	0.006
Age²	4,652.7	0.0002 ***	0.00003	4,587.9	0.0002 ***	0.00005
Marital status						
Married cohabiting with partner (*ref.*)	0.829	-	-	0.641	-	-
Married living separated spouse or divorced	0.016	0.045 **	0.020	0.021	0.075 ***	0.021
Never married	0.087	0.068 ***	0.016	0.121	0.101 ***	0.014
Widowed	0.068	0.106 ***	0.039	0.217	0.123 ***	0.016
Educational level						
Primary (*ref.*)	0.179	-	-	0.249	-	-
Secondary	0.535	-0.004	0.021	0.521	-0.058 **	0.026
Post-secondary and non-tertiary	0.039	-0.044 **	0.023	0.029	-0.055 *	0.032
Tertiary	0.247	-0.017	0.022	0.201	-0.075 ***	0.028
Household size						
1 (*ref.*)	0.114	-	-	0.267	-	-
2	0.634	-0.142 ***	0.024	0.539	-0.054 ***	0.013

Table 6 (continued)

	Males			Females		
	Mean	Coeff	SE	Mean	Coeff	SE
3	0.152	-0.130 ***	0.027	0.124	-0.049 **	0.022
4 o more	0.100	-0.132 ***	0.030	0.069	-0.055 **	0.025
Existence of children in the household	0.309	0.001	0.007	0.295	-0.013	0.008
Born in country of residence	0.930	-0.039 *	0.021	0.926	-0.029 *	0.017
Labour status						
Retired (*ref.*)	0.721	-	-	0.771	-	-
Unemployed	0.027	0.008	0.018	0.021	0.013	0.027
Employee	0.149	-0.025 **	0.011	0.122	-0.039 ***	0.013
Civil servant	0.049	-0.011	0.012	0.061	-0.042 **	0.022
Self-employed	0.053	-0.045 ***	0.014	0.024	-0.074 ***	0.017
Household income						
Quintile 1 (*ref.*)	0.124	-	-	0.224	-	-
Quintile 2	0.186	-0.012	0.010	0.218	0.000	0.005
Quintile 3	0.229	-0.011	0.008	0.201	-0.009	0.010
Quintile 4	0.234	-0.012	0.009	0.188	0.001	0.009
Quintile 5	0.227	-0.012	0.011	0.168	-0.018 *	0.011
Location of residence						
Big city (*ref.*)	0.106	-	-	0.114	-	-
Suburbs of big city	0.109	0.012	0.013	0.110	0.010	0.023
Large town	0.142	0.010	0.013	0.149	-0.001	0.025
Small town	0.260	0.000	0.017	0.258	0.005	0.023
Rural area	0.382	-0.010	0.016	0.369	-0.004	0.023
Participation in activities at least once a month						
Voluntary and charity work	0.171	-0.021 **	0.009	0.156	-0.036 ***	0.011

Table 6 (continued)

	Males			Females		
	Mean	Coeff	SE	Mean	Coeff	SE
Educational and training courses	0.051	0.009	0.010	0.077	-0.004	0.005
Sports. social and other kind of club activities	0.317	-0.025 ***	0.008	0.272	-0.031 ***	0.009
Political activities	0.070	-0.010	0.010	0.035	-0.006	0.011
Read books. magazines or newspapers	0.747	-0.028 *	0.015	0.787	-0.045 **	0.021
Word or number games crossword. puzzles. etc	0.381	0.014 **	0.007	0.517	-0.010	0.008
Played cards or games such as chess	0.293	-0.014 **	0.006	0.282	-0.029 ***	0.005
Constant	-	2.232 ***	0.183	-	2.192 ***	0.225
Random effects parameters						
sd(age)		0.010 ***	0.001		0.010 ***	0.001
sd(constant)		0.695 ***	0.086		0.608 ***	0.111
corr(age. constant)		-0.967	0.010		-0.920	0.026
Sd(residual)		0.267 ***	0.017		0.312 ***	0.020
Number of observations		22.323			29.712	
Log pseudolikelihood		-5.981.57			-13.455.6	

Individuals aged 50 or more. Standard errors are clustered by country. *** $p<0.01$. ** $p<0.05$. * $p<0.1$

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Table 7 Ordered probit regressions on "*loneliness persistence*"

	Males			Females		
	Mean	Coeff	SE	Mean	Coeff	SE
Disability status						
Non-disabled (*ref.*)	0.547	-		0.524	-	
Non-limited disabled	0.144	0.0979	0.0701	0.121	0.1273 ***	0.0357
Moderate limited disabled	0.221	0.3461 ***	0.0801	0.256	0.3788 ***	0.0550
Severe limited disabled	0.089	0.7922 ***	0.0630	0.099	0.7844 ***	0.0609
Change in disability status (wave 4 → wave 6)						
Same (*ref.*)	0.553	-		0.552	-	
Worse	0.244	0.2075 ***	0.0276	0.248	0.1484 ***	0.0219
Better	0.203	-0.1233 ***	0.0381	0.201	-0.1488 ***	0.0389
Age	65.8	-0.0977 ***	0.1218	65.3	-0.0214	0.0203
Age^2	4403.6	0.0007 ***	0.0554	4343.2	0.0001	0.0001
Marital status						
Married cohabiting with partner (*ref.*)	0.837	-		0.658	-	
Married living separated spouse or divorced	0.017	0.1404	0.1218	0.021	0.3606 ***	0.0794
Never married	0.087	0.2520 ***	0.0554	0.121	0.3300 ***	0.0264
Widowed	0.059	0.2986 ***	0.0790	0.200	0.3556 ***	0.0463
Educational level						
Primary (*ref.*)	0.180	-		0.251	-	
Secondary	0.536	-0.0424	0.0825	0.520	-0.1807 ***	0.0704
Post-secondary and non-tertiary	0.039	-0.2962 ***	0.0937	0.029	-0.1876 **	0.0945
Tertiary	0.245	-0.0631	0.0906	0.200	-0.2166 ***	0.0624
Household size						
1 (*ref.*)	0.107	-		0.250	-	
2	0.614	-0.3386 ***	0.0629	0.533	-0.0519	0.0670
3	0.165	-0.2945 ***	0.1104	0.138	-0.0027	0.1098
4 o more	0.114	-0.3060 ***	0.1065	0.079	-0.0215	0.0854
Existence of children in the household	0.339	0.0404	0.0718	0.328	-0.0544	0.0635
Born in country of residence	0.930	-0.1338	0.1092	0.927	-0.0081	0.0626
Labour status						
Retired (*ref.*)	0.668	-		0.728	-	
Unemployed	0.033	0.1404 **	0.0663	0.025	-0.0213	0.0893
Employee	0.198	-0.1130 **	0.0504	0.178	-0.1450 **	0.0677
Civil servant	0.039	-0.0735	0.1145	0.040	-0.1368 **	0.0620
Self-employed	0.063	-0.2729 ***	0.1066	0.030	-0.2165 ***	0.0826
Household income						
Quintile 1 (*ref.*)	0.121	-		0.211	-	
Quintile 2	0.183	-0.1051	0.0710	0.217	-0.0283	0.0486
Quintile 3	0.224	-0.1885 ***	0.0556	0.198	-0.0641	0.0430
Quintile 4	0.239	-0.1691 ***	0.0569	0.193	0.0180	0.0358

Table 7 (continued)

	Males			Females		
	Mean	Coeff	SE	Mean	Coeff	SE
Quintile 5	0.234	-0.1496 ***	0.0528	0.181	-0.1402 ***	0.0368
Location of residence						
Big city (ref.)	0.107	-		0.115	-	
Suburbs of big city	0.101	-0.0503	0.0921	0.104	-0.0096	0.0905
Large town	0.152	0.1129	0.0897	0.163	0.0737	0.0910
Small town	0.256	-0.0165	0.0894	0.250	0.0387	0.1023
Rural area	0.383	-0.0945	0.0884	0.368	0.0101	0.0778
Participation in activities at least once a month						
Voluntary and charity work	0.173	-0.1530 **	0.0770	0.155	-0.1006 *	0.0545
Educational and training courses	0.055	0.0122	0.0469	0.082	0.0315	0.0428
Sports. social and other kind of club activities	0.326	-0.1197 ***	0.0436	0.271	-0.1709 ***	0.0518
Political activities	0.065	0.0535	0.0728	0.031	0.0663	0.0795
Read books. magazines or newspapers	0.736	-0.1242 *	0.0724	0.772	-0.2520 ***	0.0670
Word or number games crossword. puzzles. etc	0.364	0.0377	0.0643	0.493	-0.0265	0.0397
Played cards or games such as chess	0.286	-0.0618	0.0554	0.268	-0.1938 ***	0.0468
$\mu 1$		-3.123 ***	0.8241		-0.739	0.636
$\mu 2$		-2.386 ***	0.8346		-0.067	0.6491
$\mu 3$		-1.753 **	0.8450		0.5926	0.6762
Number of observations		7.554			10.018	
Pseudo R^2		0.060			0.060	

Individuals aged 50 or more. Standard errors are robust. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Survey of Health, Ageing and Retirement in Europe (SHARE)

Declarations

Conflicts of Interest The authors have no conflicts of interest to declare.

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