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Chronic and transient loneliness in Western countries: risk factors and association with depression. A two-year follow-up study.

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Contributors

The study design was planned by JD-A, AG-P, JMH, JM, and TVV. JD-A conducted the data analyses. JD-A, AG-P, and TVV drafted the article. TVV and JD-A supervised the data analyses and development of the paper. The paper was edited and reviewed by all the authors.

1 **Abstract**

2 **Introduction**: Our aim was to test risk factors for chronic and transient loneliness as well as cross-
3 sectional and longitudinal associations of courses of loneliness with depression.

4 **Methods**: Responses from participants in Wave 5 (T1, 2013) and Wave 6 (T2, 2015) of The Survey
5 of Health, Ageing and Retirement in Europe (SHARE) (N=45,490) were analyzed. The existence
6 of clinically significant symptoms of depression was defined as reporting a value≥4 on the Euro-D
7 scale. Loneliness was measured through the 3-item UCLA loneliness scale and a single question.
8 Both measures were tested in separate regression models to identify risk factors for transient
9 (loneliness at T1) and chronic (loneliness at T1 and T2) loneliness as well as their associations with
10 depression.

11 **Results**: Chronic loneliness was observed in 47% to 40% of the cases, according to the UCLA scale
12 and the single question, respectively. Risk factors for chronic loneliness in both models were being
13 female, not being married, having a low educational level, having poor mental and physical health,
14 being limited in activities, having a poor social network, and living in a culturally individualistic
15 country. Risk factors for transient loneliness were less robust and no significant effects were found
16 for variables such as sex and physical health, education level in the UCLA measure model, and
17 social network size in the single question model. Chronic loneliness also showed a strong
18 association with depression in the cross-sectional model and a marked one in the longitudinal model.

19 **Conclusion**: The courses of loneliness are relevant in the study of its risk factors and association
20 with depression.

21

22 **Keywords:** chronic loneliness; transient loneliness; depression; risk factors; Western countries.

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Introduction

Depression is one of the most prevalent mental disorders and one that contributes substantially to the global burden of disease. The prevalence of the global population with depression in 2015 was 4.4% [1]. Among the main predictors of depressive disorders and symptoms in the elderly, lack or loss of close social contacts and, particularly, feelings of loneliness have a stronger association with depression than do other modifiable risk factors [2-4]. While the relationship between loneliness and depression might be bidirectional, prior research indicates that the prospective association between loneliness and depression is clearly stronger with loneliness as the origin [4, 5].

One of the earliest definitions of loneliness is provided by social needs theory [6], according to which loneliness is the consequence of being without some social needs or set of social needs provided by social relationships such as attachment, social integration, nurturance, reassurance of worth, sense of reliable alliance, and guidance. The first two social needs define two kinds of loneliness: deficits in attachment are linked to emotional loneliness, whereas deficits in social integration are linked to social loneliness [6]. According to the European Social Survey data, in 2018 the prevalence of frequent loneliness was 5.2% in Northern Europe, 6.6% in Western Europe, 8.9% in Southern Europe, and 10.8% in Eastern Europe [7]. Since these prevalences are based on direct questions about the frequency of feelings of loneliness, the real prevalences could be higher since there is a reluctance to admit these feelings due to social stigma [8]. For this reason, researchers have created scales to measure loneliness that did not include the word 'loneliness', such as the commonly used UCLA [9] and de Jong-Gierveld [10] loneliness scales. However, some researchers consider that the use of scales to measure loneliness imposes the researcher's conception of loneliness over that of the person feeling alone [11].

Cognitive approaches to loneliness have attempted to overcome this limitation by defining loneliness as an unpleasant discrepancy between the desired and real social relationships in a qualitative and quantitative sense [12], and as something that should be considered as a

multidimensional phenomenon [13]. One central dimension of loneliness refers to the time perspective. De Jong-Gierveld and Raadschelders [14] identified three types of lonely people according to this dimension: the temporarily lonely, the resigned lonely, and the hopelessly lonely. The temporarily lonely understand their feelings as transient. In contrast, resigned and hopelessly lonely individuals understand their loneliness as chronic. The main difference between resigned lonely and hopelessly lonely individuals lies in their attitudes and beliefs about their loneliness. Resigned individuals have accepted their loneliness and may have found ways to cope. In contrast, hopelessly lonely individuals believe that their loneliness is unchangeable, leading to a more severe emotional state. The impact of loneliness on mood is greater in the resigned and, particularly, the hopelessly lonely individuals. Young [15] distinguishes between transient and chronic loneliness. While transient loneliness refers to feelings that last for a short time, chronic loneliness alludes to feelings that persist over years. Regardless of theoretical constructs on how temporal variations in loneliness are classified, it is crucial to recognize chronicity as a significant dimension due to its direct implications for both causes and treatment. Transient loneliness can appear after stressful life events such as retirement and loss of close social connections whereas chronic loneliness is more strongly related to maladaptive social cognition, poor social support, and lack of intimate relationships [16].

According to the evolutionary theory [17], loneliness promotes short-term survival through neural changes, and it depends on situational and dispositional factors. Among other consequences, loneliness increases depressive symptomatology which in the short term produces lethargy that facilitates social withdrawal and reduces the likelihood of conflict in a potentially hostile social environment. In the medium and long terms, loneliness increases the motivation to reconnect, prompting people to repair social bonds or establish new relationships. Weiss (1982) argued that the capacity to feel emotional loneliness was evolutionarily selected, as it introduces pressure to search for an emotional partner [18]. However, loneliness becomes chronic when individuals do not

1 manage to establish or re-establish social contacts, resulting in adverse processes for physical and
2 mental health such as increased maladaptive social cognition and further social withdrawal [19].
3 Researchers comparing transient and chronic loneliness found a greater impact of chronic
4 trajectories of loneliness on health status [20], depression [21], and all-cause mortality [22].

5 The aim of the present study was to investigate potential differences in risk factors for
6 chronic and transient loneliness. Female gender, non-married status, older age, poor income, lower
7 educational level, living alone, low quality and quantity of social relationships, poor self-reported
8 health, and poor functional status are risk factors for loneliness in older adults [4, 23]. Additionally,
9 the social norms and cultural values of a society such as cultural individualism-collectivism may
10 moderate the risk of becoming lonely [24, 25]. As far as we know, there is no evidence regarding
11 differences between the risk factors for chronic and transient loneliness.

12 Another objective of this study was to analyze the relationship between chronic and transient
13 loneliness and depression. This analysis was conducted longitudinally at Wave 6 (T2, interviewed
14 in 2015), where only participants with chronic loneliness reported frequent loneliness, and cross-
15 sectionally at Wave 5 (T2, interviewed in 2013), where all participants with transient and chronic
16 loneliness reported frequent loneliness. This discrepancy in the findings could potentially be
17 explained by differences in the time perspective dimension, suggesting that factors related to the
18 duration and stability of loneliness experiences may play a role in the association with depression.

19 Our hypotheses are: (1) since chronic and transient loneliness have different causes and
20 consequences, there may also be differences in risk factors.; and (2) chronic loneliness is more
21 strongly associated with depression than transient loneliness, both cross-sectionally and
22 longitudinally. We tested our hypotheses with participants in two consecutive waves of The Survey
23 of Health, Ageing and Retirement in Europe (SHARE) cohort. The analyses were conducted using
24 two frequently employed measures of loneliness (direct question and the three-item UCLA
25 Loneliness Scale) to assess potential differences in risk factors. In line with the suggestions of other

researchers, the stigmatization of loneliness could lead to a reduced predisposition to acknowledge it through a direct question. This reduction would occur in varying ways depending on sociodemographic characteristics, as loneliness is more socially accepted in certain profiles, such as widowed individuals compared to married ones or women compared to men [11].

Methods

Study design

The Survey of Health, Ageing, and Retirement in Europe (SHARE) is a multidisciplinary longitudinal study on aging providing comparative data across European countries and Israel [26]. In general, population-based samples of the noninstitutionalized population aged 50 years and older are included in the study. When individuals had cognitive impairment that rendered them unable to be interviewed, a shortened version of the questionnaire was administered to a proxy. These participants were not included in the study sample as they were not queried about loneliness and the other main variables. For the present study, further measures of cognitive functioning were not taken into account. We used data from participants aged 50 and older in 14 countries (Austria, Belgium, Czechia, Denmark, Estonia, France, Germany, Israel, Italy, Luxembourg, Slovenia, Spain, Sweden, and Switzerland) that participated in Wave 5 (T1, interviewed in 2013) and Wave 6 (T2, interviewed in 2015) (N=46,735). These waves are the most recent of The Survey of Health, Ageing and Retirement in Europe (SHARE) cohort that have the data needed to carry out this study. We excluded responses from participants with missing values on loneliness at T1 and those who reported loneliness at T1 and had missing values on loneliness at T2. The final sample size of the study is 45,490. However, we conducted sensitivity analysis using the initial sample (N=46,735) and imputed missing values through multiple imputation by chained equations.

Ethics statement

The SHARE Project respects the Helsinki Declaration, and data are anonymous. All participants provided written informed consent. Waves 5 and 6 have been reviewed and approved by the Ethics Committee of the Max Planck Society. Furthermore, individual country implementation of SHARE was reviewed and approved by the respective ethics committees or institutional review boards.

Measures

Outcomes

Depression was measured using the EURO-D scale, an instrument validated in Europe that includes twelve dichotomous items (0/1) and results in a scale from 0 to 12, where higher scores mean greater depressive symptoms. The presence of clinically significant depressive symptoms is defined by a score of ≥4 [27, 28].

Loneliness was assessed with the three-item UCLA Loneliness Scale [29], which consists of the following items: "How often do you feel that you lack companionship?"; "How often do you feel left out?"; "How often do you feel isolated from others?". Each item is answered on a 3-point scale (1 = hardly ever or never; 2 = some of the time; 3 = often). The UCLA Loneliness Scale has shown satisfactory reliability and both concurrent and discriminant validity [29]. The scores for each item were added up to produce a loneliness score of from 3 to 9, with higher scores indicating a greater degree of loneliness. The cutoff point for frequent loneliness was set at ≥6, following previous studies [30, 31].

To investigate the impact of loneliness measure, loneliness was also assessed through a direct single-item question "How much of the time do you feel lonely?" answered with the same three point Likert scale as the UCLA loneliness scale (hardly ever or never; some of the time; often), enabling us to contrast the effects of distinct measures. Frequent loneliness was defined as answering "often".

Finally, transient loneliness was defined as reporting loneliness only in 2013 (Wave 5, T1), while chronic loneliness was defined as reporting loneliness in both 2013 (Wave 5, T1) and 2015 (Wave 6, T2).

Risk factors

1 Sociodemographic and cultural factors, as well as health measures potentially confounding the
2 investigated associations [23, 24, 31], were adjusted for in all models.
3 The sociodemographic factors used as covariates in our analysis were sex, age group (50-
4 59; 60-69; 70-79; +80 years and older), marital status (married or with partnership; never married;
5 divorced or separated; widowed), and years of education (primary or less -0 to 6 years of education-
6 ; secondary -7 to 9-; upper secondary -10 to 12-; tertiary -13 and more-).
7 The measurement of social network size was based on a name-generating inventory utilized
8 for compiling social networks [32]. According to the name generator probe, "Most people discuss
9 with others the good or bad things that happen to them, problems they are having, or important
10 concerns they may have." Following this statement, participants were asked, "Looking back over
11 the last 12 months, who are the people with whom you most often discussed important things?"
12 Individuals were allowed to provide names of up to six individuals referred to as ‘confidants’.
13 Additionally, participants had the option to name an additional person who was important to them
14 "for any other reason." The size of the network was assessed by adding up the number of individuals
15 named and categorizing them as "none", "one", "two", "three", and "more than three”.
16 Previous research has confirmed the centrality of individualism–collectivism in cross-
17 cultural differences and its impact on loneliness and health, which is why cultural individualism
18 versus collectivism was operationalized using the scores of Hofstede’s Individualism Index [24, 25].
19 The index ranges from 0 to 100, where 0 means completely collectivistic and 100 means completely
20 individualistic. Accordingly, Sweden, Italy, France, Denmark, and Czechia are the most
21 individualistic countries of the sample, with scores from 70 to 80, whereas Slovenia and Spain are
22 the most collectivistic countries of the sample with scores of 27 and 51, respectively [33].
23 Chronic conditions were assessed through binary (0/1) questions about several diagnosed
24 chronic conditions, including heart disease, lung disease, arthritis, osteoporosis, cancer, ulcer,
25 Parkinson’s disease, cataracts, and hip complaints. All responses were added up and the variable

'physical chronic conditions' was categorized as "none", "one", "two", and "more than two". Activity limitations were assessed by asking participants whether they were limited because of a health problem in activities people usually do. Response categories were "not limited", "limited but not severely", and "severely limited".

Statistical analysis

Descriptive analyses were conducted to characterize the study sample. These analyses included frequencies and proportions for categorical variables, and means and standard deviations for continuous variables.

Chronic loneliness was represented by individuals reporting loneliness at both time points, while transient loneliness was represented by those who reported loneliness at T1 but not T2. Separate analyses were conducted for each measure of loneliness (UCLA loneliness scale and single question).

To evaluate risk factors for chronic and transient loneliness, logistic regression models were constructed with transient loneliness and chronic loneliness as outcomes in separate models. We tested sex, age group, marital status, education level, physical chronic conditions, activity limitations, social network size, depression at T1, and cultural individualism-collectivism as risk factors. We constructed bivariate and multivariate models. Odds ratios (OR) with 95% confidence intervals (CI) were reported.

To evaluate the association between chronic and transient loneliness with depression at T1 and T2, logistic regression models were constructed with an independent variable distinguishing among "no loneliness", "transient loneliness" and "chronic loneliness" and depression at T1 and depression at T2 as outcomes in separate models. Models were adjusted for sex, age group, marital status, education level, physical chronic conditions, activity limitations, social network size, and cultural individualism-collectivism. In the model with depression at T2 as outcome, depression at

T1 was included as a risk factor. ORs with 95% CIs were reported. To interpret our results, probabilities (with 95% CI) for depression depending on loneliness course and stratified by time point were calculated through margins [34]. Control variables were centered at mean according to their distribution in the sample.

Finally, we conducted sensitivity analyses by imputing the missing values, which did not exceed 5% for any variable (see Supplementary material, **Table S3**). We assumed that data were missing at random (probability of a record having a missing value depends on the observed data) [35]. Missing values were imputed using multiple imputation by chained equations (MICE) with the predictive mean matching method. The imputation model included all covariates and outcomes. Additionally, we included a self-reported general health variable that exhibited a strong association with the outcomes. Twenty-five imputed databases were created. The number of imputations (M) was calculated using a rule of thumb with respect to the fraction of missing information (FMI) according to which M > (100 x FMI) [36].

All reported p-values were based on two-sided tests, where the level of statistical significance was set at $\alpha<0.05$. Stata version SE 13 [37] was used to analyze the survey data.

Results

The characteristics of the study sample are illustrated in **Table 1**. A total of 45,490 participants aged≥50 years was included in the analysis. Approximately 25% of the participants reported clinically significant symptoms of loneliness at both time points. 5.58% of the participants experienced chronic loneliness, while 4.97% reported transient loneliness when assessed using the UCLA loneliness scale. In contrast, when the direct question was used to measure loneliness, the percentages were 3.21% for chronic loneliness and 2.16% for transient loneliness.

Tables 2 and Table **3** show results from the adjusted logistic regression models of factors related to chronic and transient loneliness according to UCLA scale and single question, respectively. Risk factors for chronic loneliness in both models were being female, not being married, having a low educational level, having poor mental and physical health, being limited in activities, having a small social network, and living in a culturally individualistic country. Risk factors for transient loneliness were less robust and no significant effects were found from sex and physical health in both models, education level in the UCLA measure model, and social network size and cultural-individualism-collectivism index in the single question model. In the UCLA measure model, living in a culturally individualistic country was associated with lower odds for depression.

Results from unadjusted logistic regression models (see supplementary material, **Table S1** and **Table S2**) were consistent with those from adjusted models except for age groups and cultural individualism-collectivism index. Being an older adult was found to be a risk factor for both loneliness courses using any loneliness measure, and living in a culturally individualistic country was not found to be a protective factor for loneliness in any case.

Table 4 reports the logistic regression model results of the association between loneliness course and depression at T1 and T2 for each measure of loneliness separately. In both cases, the depression risk of participants reporting chronic loneliness was slightly higher at Wave 5 and much

1 higher at Wave 6 than was the risk of participants reporting transient loneliness. In the model
2 including loneliness addressed through a single question, the association between loneliness
3 trajectories and depression was greater in magnitude than in the model with loneliness assessed
4 through the UCLA scale.

5 **Table 5** represents the probability of having depression according to loneliness trajectory
6 and time point. In both models, chronic loneliness showed a strong association with depression at
7 both Wave 5 and Wave 6, while transient loneliness showed a weaker cross-sectional association at
8 Wave 5 and particularly at Wave 6.

9 The sensitivity analyses, including imputed missing data, indicate that the reported results
10 remained largely unaffected by the missing data. This is evident from the comparable distribution
11 of outcome variables (see Supplementary material, **Table S4**). The identified risk factors for
12 loneliness exhibit similar magnitudes (see Supplementary material, **Table S5**), and the association
13 between loneliness trajectories and depression consistently demonstrates strong correlations (see
14 Supplementary material, **Table S6**).

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Discussion

To the best of our knowledge this is the first study to analyze differences in risk factors for transient and chronic loneliness and their effect on depression in a sample of people from several Western countries.

Between 47% and 40% of the cases of loneliness were chronic according to the UCLA scale and the single question, respectively. Both loneliness courses shared risk factors such as being female, not being married, having a low educational level, having poor physical health, having a poor social network, and living in a culturally individualistic country. However, the risk factors for chronic loneliness were stronger, particularly those related to gender, health status, and social networks. Chronic loneliness showed a strong association with depression both cross-sectionally and longitudinally, whereas transient loneliness showed a weaker cross-sectional association and a markedly weaker longitudinal association.

Previous studies used the three-item UCLA Loneliness Scale and compared the prevalence of chronic and transient loneliness in Western countries. Although they analyzed other countries and used other cutoff points than the usual (≥6) [38], and therefore the prevalence of loneliness was distinct, the proportion of people with chronic loneliness among people with loneliness was very similar to that reported in the present study, ranging between 46% and 47% [39, 40].

Almost twice as many participants were classified as frequently feeling lonely using the loneliness scale compared to the direct question at the first wave, and these individuals also reported frequent loneliness with a higher proportion at the following wave. This could be due to the social stigma which may lead lonely people not to acknowledge feelings of loneliness through a direct question, but then doing so in response to indirect questions without the word "loneliness" [8, 41].

According to our hypothesis, and in line with previous research, a favorable course of loneliness is related to a favorable course of depression [21, 42]. This observation holds true even when chronically and transiently lonely people are at the same level of loneliness (i.e., feeling

1 frequent loneliness), which highlights the need for including new factors in loneliness measures
2 capable of addressing its effects on mental health. These factors could be related to genetic
3 characteristics of lonely people predisposing them to prolonged feelings of loneliness [16], as well
4 as to the perception of the temporality of their own loneliness in lonely people [14]. Moreover, the
5 association between loneliness and depression was stronger when loneliness was measured through
6 the direct question. This is likely because the direct question tends to capture more severe cases of
7 loneliness, thus reflecting a stronger link between loneliness and depression.
8 The risk factors detected were similar to those from previous studies [23, 24, 31]. However,
9 a notable observation is the stronger association of certain risk factors, such as those related to health
10 and social networks, with chronic loneliness compared to transient loneliness. This finding supports
11 the proposition that transient loneliness is influenced by contextual factors and can be overcome
12 when these factors change or improve, whereas chronic loneliness is more closely tied to a lack of
13 social support and significant health problems [18-22].
14 A study conducted in 1985 analyzed gender differences in loneliness using a direct question
15 and the UCLA scale. According to the findings, the difference between genders was more
16 pronounced when loneliness was measured through the direct question. This was attributed to the
17 fact that men were more reluctant to admit feeling lonely due to the stigma associated with male
18 loneliness [43]. However, our own results do not align with these findings. We did not observe any
19 significant differences based on the measurement method used, which suggests that there may have
20 been changes that reduced this inequality over time. In addition, the observation that women are
21 more susceptible to chronic loneliness as compared to transient loneliness in both measures could
22 be attributed to variations in the socialization process based on gender. This might lead women to
23 require more complex social interactions to maintain their psychosocial well-being. Additionally,
24 women may more frequently exhibit risk factors for chronic loneliness, such as advanced age or
25 widowhood [44].

It is worth highlighting that being older is not a significant risk factor for loneliness in adjusted models, but it is in unadjusted models. This suggests that older individuals, despite more frequently experiencing stressors such as widowhood or serious health problems, also demonstrate higher levels of psychological resilience towards these factors [45]. Consequently, these factors act as confounding variables in the relationship between age and loneliness.

Finally, risk factors such as not being married and poor physical and mental health demonstrate a stronger association with loneliness when assessed through direct question. Previous research has shown that loneliness is more socially accepted in widowed individuals, which may lead married individuals to be more reluctant to admit feeling lonely when the question is asked directly [11]. It is possible that people with poorer health status may be in a similar situation compared to those with better health, which could explain these differences.

This study contributes to highlighting the importance of the courses of loneliness in the study of its risk factors and its association with depression. This suggests the need to attempt to approach the temporal dimension of loneliness through well-validated measures to achieve more precise results. These measures should be taken into account together with objective aspects of social relationships such as the availability of social support and social network size [31], and environmental factors such as cultural [24], socioeconomic, and social exclusion [46] risks that clearly condition people's loneliness and shape their mental health.

Strengths and limitations

The strengths of this study include its large sample size with wide heterogeneity, including good stratification across several Western countries and all major sociodemographic groups. Moreover, our study was based on longitudinal data of the same population, allowing us to control for confounding factors, and for the assessment of the study variables with a range of validated scales. Nevertheless, these results must be interpreted in light of a few limitations. The study used precise

and unambiguous questions that were related to the current circumstances of the participants. This approach aimed to ensure that participants could provide accurate and reliable responses without the need for extensive recall of past events. In addition, while the cut-off point for determining a clinically significant level of depression is well validated [27, 28], there is no unanimity among the scientific community regarding the cut-off point for loneliness. Depending on the cut-off point established, the results could vary. To minimize this bias, we tested two measures of loneliness and applied cut-off points used by previous researchers [30, 31]. Finally, while most studies use two or three follow-up points to identify chronic loneliness like the present study, this remains a limitation since studies with more follow-up points could provide more information about different loneliness trajectories and define cases of chronic loneliness more precisely. Future studies that allow for longer follow-ups of loneliness and mental health should replicate the proposed analyses to corroborate our conclusions.

Conclusions

A favorable course of loneliness is associated with lower odds of depression. The identification of risk factors for chronic loneliness allows for the design of more specific strategies to fight the adverse short-term and long-term mental health effects resulting from relational difficulties and social exclusion. Our findings suggest the need for strategies focused on lonely people among vulnerable sectors of the population such as individuals with limited social support and poor health conditions, as well as the need for the development of new loneliness measures to distinguish between the dimensions of loneliness, particularly those based on the time perspective.

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Data Statement

The data have not been previously presented orally or by poster at scientific meetings.

1 **Table 1**. Characteristics of the study sample.

Characteristic	(N=45,490) N(%), Mean[SD]
Sex	
• Male	19,864 (43.67)
• Female	25,626 (56.33)
Age groups	
• 50-59	11,940 (26.25)
• 60-69	16,517 (36.31)
• 70-79	11,827 (26.00)
• 80+	5,206 (11.44)
Marital status	
• Married	31,635 (70.30)
• Never married	2,550 (5.67)
• Separated	4,662 (10.36)
• Widowed	6,151 (13.67)
Education level	
• Tertiary	16,194 (37.11)
• Upper secondary	13,028 (29.86)
• Secondary	8,465 (19.40)
• Primary or less	5,948 (13.63)
Social network size	
• More than three	11,891 (26.74)
• Three	9,663 (21.73)
• Two	11,277 (25.36)
• One	10,526 (23.67)
• None	1,113 (2.50)
Physical chronic conditions	
• None	27,936 (61.47)
• One	12,192 (26.83)
• Two	3,951 (8.69)
• More than two	1,370 (3.01)
Limited in activities	
• Not limited	25,766 (56.65)
• Moderately limited	13,806 (30.36)
• Severely limited	5,907 (12.99)
Cultural individualism-collectivism index (0-100)	62.95 [11.80]
Loneliness (UCLA scale) [a]	
• No loneliness	40,689 (89.45)
• Transient	2,540 (5.58)
• Chronic	2,261 (4.97)
Loneliness (single question) [b]	
• No loneliness	43,047 (94.63)
• Transient	1,461 (3.21)
• Chronic	982 (2.16)
Depression (at Wave 5, T1)	
• No	33,899 (75.32)
• Yes	11,106 (24.68)
Depression (at Wave 6, T2)	
• No	33,101 (75.08)
• Yes	10,985 (24.92)

2 The frequency (N), proportions (%), and means with standard deviations (SD) are displayed. In some cases, certain categories of variables do not
3 include all cases due to missing values. Frequent loneliness was measured using two criteria: (a) a cutoff point of 6 on the 3-item UCLA Loneliness
4 Scale, and (b) a single question. Participants were categorized into three groups: 'No loneliness' included those who did not experience loneliness at
5 Wave 5 (T1), 'transient loneliness' included those who reported loneliness at T1 but not at Wave 6 (T2), and 'chronic loneliness' included those who
6 reported loneliness at both time points.
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1 **Table 2**. Logistic regression models of factors related to transient and chronic loneliness measured by
2 UCLA scale

Characteristic	Transient loneliness		Chronic loneliness	
	Wald	OR (95% CI)	Wald	OR (95% CI)
Intercept		0.03 (0.02, 0.03)		0.00 (0.00, 0.00)
Sex				
• Male	Reference		Reference	
• Female	0.16	1.02 (0.93, 1.12)	22.57	1.29 (1.16, 1.43)***
Age groups				
• 50-59	Reference		Reference	
• 60-69	1.19	0.94 (0.84, 1.05)	0.62	0.95 (0.83, 1.08)
• 70-79	0.01	0.99 (0.88, 1.12)	1.54	1.09 (0.95, 1.25)
• 80+	0.01	1.01 (0.86, 1.17)	0.76	1.08 (0.91, 1.27)
Marital status				
• Married	Reference		Reference	
• Never married	41.24	1.72 (1.46, 2.03)***	95.57	2.35 (1.98, 2.79)***
• Separated	70.82	1.72 (1.52, 1.95)***	124.74	2.15 (1.88, 2.46)***
• Widowed	112.82	1.88 (1.68, 2.12)***	164.62	2.24 (1.98, 2.54)***
Education level				
• Tertiary	Reference		Reference	
• Upper secondary	0.76	1.05 (0.94, 1.17)	0.07	1.02 (0.90, 1.15)
• Secondary	2.21	1.10 (0.97, 1.24)	1.17	1.08 (0.94, 1.23)
• Primary or less	3.25	1.13 (0.99, 1.29)	30.46	1.48 (1.29, 1.70)***
Social network size				
• More than three	Reference		Reference	
• Three	6.56	1.18 (1.04, 1.34)*	2.69	1.13 (0.98, 1.31)
• Two	9.86	1.22 (1.08, 1.37)**	21.04	1.37 (1.20, 1.57)***
• One	15.66	1.29 (1.14, 1.46)***	49.24	1.63 (1.42, 1.87)***
• None	3.49	1.27 (0.99, 1.62)	49.70	2.31 (1.83, 2.92)***
Physical chronic conditions				
• None	Reference		Reference	
• One	1.58	1.06 (0.96, 1.18)	4.61	1.13 (1.01, 1.26)*
• Two	0.95	1.07 (0.93, 1.23)	14.88	1.33 (1.14, 1.53)***
• More than two	0.05	1.02 (0.83, 1.26)	10.54	1.38 (1.14, 1.68)**
Limited in activities				
• Not limited	Reference		Reference	
• Moderately limited	58.64	1.50 (1.35, 2.02)***	74.64	1.68 (1.50, 1.89)***
• Severely limited	117.10	1.97 (1.78, 2.22)***	217.58	2.67 (2.35, 3.05)***
Depression at wave 5				
• No	Reference		Reference	
• Yes	614.36	3.18 (2.90, 3.48)***	870.58	4.63 (4.18, 5.12)***
Cultural individualism-collectivism index (0-100)	6.90	0.99 (0.99, 0.99)**	62.37	1.02 (1.01, 1.02)***

3 Both models are adjusted for all variables included in the Table. Frequencies (N) are shown in Table 1. OR: odds ratio; CI: confidence interval. df=1
4 for the Wald χ^2 tests. Values with asterisk show statistical significance after Bonferroni correction: * p <0.05; ** p<0.01; *** p<0.001
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1 **Table 3**. Logistic regression models of factors related to transient and chronic loneliness measured by a
2 single question

Characteristic	Transient loneliness		Chronic loneliness	
	Wald	OR (95% CI)	Wald	OR (95% CI)
Intercept		0.01 (0.00, 0.01)		0.00 (0.00, 0.00)
Sex				
• Male	Reference		Reference	
• Female	0.66	0.95 (0.83, 1.08)	4.57	1.19 (1.01, 1.40)*
Age groups				
• 50-59	Reference		Reference	
• 60-69	0.28	0.96 (0.82, 1.12)	0.01	1.01 (0.83, 1.23)
• 70-79	1.09	0.91 (0.77, 1.08)	1.13	1.12 (0.91, 1.38)
• 80+	0.15	0.96 (0.79, 1.18)	0.83	1.12 (0.88, 1.43)
Marital status				
• Married	Reference		Reference	
• Never married	63.59	2.42 (1.95, 3.01)***	92.98	3.48 (2.70, 4.48)***
• Separated	113.15	2.47 (2.09, 2.92)***	162.89	3.61 (2.96, 4.39)***
• Widowed	309.76	3.71 (3.21, 4.30)***	242.86	4.18 (3.49, 5.00)***
Education level				
• Tertiary	Reference		Reference	
• Upper secondary	0.40	1.05 (0.90, 1.22)	1.76	1.14 (0.94, 1.37)
• Secondary	3.57	1.17 (0.99, 1.38)	2.18	1.16 (0.95, 1.42)
• Primary or less	33.78	1.65 (1.40, 1.96)***	14.81	1.51 (1.22, 1.87)***
Social network size				
• More than three	Reference		Reference	
• Three	0.08	1.02 (0.86, 1.22)	8.49	1.39 (1.11, 1.74)**
• Two	1.21	1.09 (0.93, 1.29)	13.30	1.48 (1.20, 1.83)***
• One	2.89	1.15 (0.98, 1.36)	29.22	1.80 (1.46, 2.23)***
• None	1.06	1.18 (0.86, 1.60)	45.05	2.97 (2.16, 4.08)***
Physical chronic conditions				
• None	Reference		Reference	
• One	1.16	1.08 (0.94, 1.23)	7.03	1.25 (1.06, 1.48)**
• Two	2.08	1.14 (0.95, 1.37)	13.80	1.49 (1.21, 1.83)***
• More than two	2.19	1.21 (0.94, 1.54)	23.42	1.89 (1.46, 2.45)***
Limited in activities				
• Not limited	Reference		Reference	
• Moderately limited	16.21	1.34 (1.16, 1.54)***	10.36	1.35 (1.12, 1.62)**
• Severely limited	40.56	1.69 (1.44, 1.98)***	56.91	2.10 (1.73, 2.55)***
Depression at wave 5				
• No	Reference		Reference	
• Yes	615.01	4.98 (4.38, 5.65)***	553.66	7.95 (6.69, 9.45)***
Cultural individualism-collectivism index (0-100)	1.94	1.00 (0.99, 1.01)	45.80	1.02 (1.02, 1.03)***

3 Both models are adjusted for all variables included in the Table. Frequencies (N) are shown in Table 1. OR: odds ratio; CI: confidence interval. df=1
4 for the Wald χ^2 tests. Values with asterisk show statistical significance after Bonferroni correction: * p <0.05; ** p<0.01; *** p<0.001
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1 **Table 4**. Logistic regression models of the association between loneliness status and depression at wave 5
2 and wave 6

Characteristic	Depression at wave 5		Depression at wave 6	
	Wald	OR (95% CI)	Wald	OR (95% CI)
UCLA loneliness scale				
• No loneliness	Reference		Reference	
• Transient	776.22	3.66 (3.34, 4.07)***	7.65	1.14 (1.04, 1.27)**
• Chronic	1001.97	5.21 (4.70, 5.77)***	484.70	3.00 (4.59, 3.73)***
Single question				
• No loneliness	Reference		Reference	
• Transient	683.78	5.43 (4.79, 6.17)***	20.95	1.34 (1.18, 1.52)***
• Chronic	596.72	8.70 (7.31, 10.35)***	265.44	4.26 (3.58, 5.07)***

3 All models are adjusted for sex, age group, marital status, education level, physical chronic conditions, activity limitations, social network size and
4 cultural individualism-collectivism. Model with depression at wave 6 as outcome was also adjusted for depression at wave 5. Frequencies (N) are
5 shown in Table 1. OR: odds ratio; CI: confidence interval. df=1 for the Wald χ^2 tests. Values with asterisk show statistical significance after Bonferroni
6 correction: * p <0.05; ** p<0.01; *** p<0.001
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Table 5. Estimated probabilities of depression according to loneliness status

Characteristic	Depression at wave 5 pr (95% CI)	Depression at wave 6 pr (95% CI)
UCLA loneliness scale		
• No loneliness	0.19 (0.18, 0.19)	0.20 (0.19, 0.20)
• Transient	0.46 (0.43, 0.48)	0.22 (0.20, 0.24)
• Chronic	0.54 (0.52, 0.57)	0.45 (0.42, 0.48)
Single question		
• No loneliness	0.20 (0.19, 0.20)	0.20 (0.20, 0.21)
• Transient	0.57 (0.54, 0.60)	0.25 (0.23, 0.28)
• Chronic	0.68 (0.64, 0.72)	0.52 (0.48, 0.56)

2 Estimated probabilities (pr) from the adjusted logistic regression models of the Table 4. Covariates (sex, age group, marital status, education level,
3 physical chronic conditions, activity limitations, social network size and cultural individualism-collectivism. Depression at wave 5 was included as
4 covariate in the model with depression at wave 6 as outcome) were centered at mean according to the distribution of the sample. CI: confidence
5 interval.
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