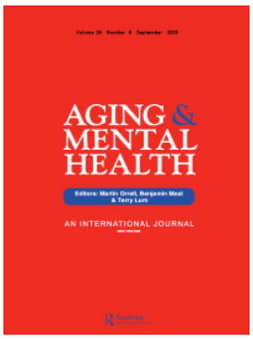

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Psychometric validation of the Portuguese ALONE scale and analysis of factors associated with severe loneliness in a sample of community-dwelling older adults

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ABSTRACT

Objectives: Severe loneliness poses a significant risk to older adults' health and quality of life. This study assessed the psychometric properties (reliability and validity) of the Portuguese version of the ALONE scale in community-dwelling older adults and explored the scale's associations with sociodemographic, social isolation, depression, life satisfaction, and daily functioning.

Method: A descriptive, correlational study was conducted with 285 Portuguese older adults. The questionnaire included sociodemographic and health data, the ALONE scale, Social Isolation Scale (SIS), Satisfaction with Life Scale (SWLS), Geriatric Depression Scale (GDS-15), UCLA Loneliness Scale (UCLA-16), and Lawton and Brody IADL Scale. Analyses included confirmatory factor analysis, internal consistency, group comparisons, correlations, and logistic regression.

Results: The confirmatory factor analysis supported a unidimensional model with satisfactory fit indices and internal consistency ($\alpha = 0.743$). Severe loneliness correlated positively with social isolation and depression and negatively with life satisfaction and daily functioning. Participants experiencing severe loneliness were likely older, female, living alone, socially isolated, depressed, and dependent in daily activities. Significant predictors included social isolation (OR = 0.806) and depression (OR = 1.131).

Conclusion: The ALONE scale demonstrated validity and reliability for assessing loneliness in older adults, making it a suitable, efficient tool for clinical practice.

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ALONE scale; community dwelling; loneliness; older adults; psychometric properties

Introduction

Loneliness has been referred to as a new 'geriatric giant' (Freedman & Nicolle, 2020). In 2023, the World Health Organization (WHO, 2024) designated loneliness a global health priority and established the Commission on Social Connection (2024–2026). Loneliness affects individuals at all life stages. However, older adults are particularly vulnerable due to significant life transitions, such as retirement, the loss of a spouse or partner and friends, the onset of chronic illness, progressive loss of functional independence (ADL and IADL) and driving cessation, that compromise their capacity to maintain daily activities and engagement with society (Barjaková et al., 2023; Savoie et al., 2024; Tiilikainen et al., 2024; WHO, 2021).

Loneliness is currently defined according to how individuals perceive and evaluate their situations (Guerra et al., 2024). Gierveld (1998) conceptualised loneliness as an individual's experience of an unpleasant or lack of (quality of) certain relationships. McKenna-Plumley et al. (2020) defined loneliness as an unpleasant and distressing phenomenon arising when a person perceives a mismatch between their actual and ideal social relations. Experts by experience (older adults that self-identify as feeling lonely) have described loneliness 'as a detrimental state of the soul that incorporates feelings of sadness, emptiness, and abandonment and that they often feel forgotten' Guerra et al., 2022, p. 731).

Loneliness as a whole has been addressed, while levels of loneliness have received less attention. Das (2021) indicated that moderate experiences of loneliness indicate missing social connections and serve as incentives to seek closeness with other people. Therefore, moderate experiences of loneliness are common in all age groups and are not harmful per se. However, severe or prolonged loneliness acts as a chronic stressor that can damage well-being and health (Huxhold & Henning, 2023).

Thus, it is relevant to have instruments that accurately assess loneliness and severe loneliness. In recent decades, numerous tools have been developed to assess loneliness. In Portugal, a recent scoping review by Carvalho et al. (2023) identified two validated instruments—the University of California, Los Angeles (UCLA) loneliness scale, and the Social and Emotional Loneliness Scale for Adults (SELSA)—but stressed the need to validate the De Jong-Gierveld (1987) scale, due to its worldwide use, and the ALONE scale (Deol et al., 2022), because it is brief and has an established cut-off for severe loneliness (Bugallo-Carrera et al., 2023). The ALONE scale (Deol et al., 2022) is a short (five items), valid, and reliable measure of loneliness developed in the United States for use in clinical settings. Its concise and easily understandable structure reduces the burden of

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administration, making it particularly suitable for research and clinical settings, facilitating the early identification of older adults at risk of severe loneliness, and allowing for targeted interventions and better follow-up (Deol et al., 2022). In addition, this scale stands out for having a cut-off for severe loneliness. The ALONE scale has demonstrated high validity in assessing severe loneliness in older adults, showing a strong correlation with the UCLA-20 Loneliness Scale ($r = .81$, $p < .001$) and excellent test-retest reliability ($r = .89$, $p < .001$). Unlike other measures that avoid the term lonely due to its stigma, the ALONE Scale explicitly uses it. However, loneliness stigma may have diminished in recent years, particularly post-pandemic, making direct questioning about loneliness a potential catalyst for individuals to seek help (Deol et al., 2022).

Loneliness in older adults can be influenced by a multitude of factors, including sociodemographic, psychological, physical, and environmental factors (Dahlberg et al., 2022). Vulnerability to loneliness tends to be higher among the following groups (Boehlen et al., 2022; De Witte & Van Regenmortel, 2022): (i) women, often due to lower education and widowhood; (ii) those without partners, particularly widows, divorcees, and singles; (iii) those who are older; (iv) individuals with lower levels of education, mostly due to lower salaries and limited literacy, which often limits their ability to engage in social activities; and (v) those living in rural areas, who usually feel greater loneliness due to restrictions imposed on social networks. Loneliness is associated with deteriorated mental and physical health, including poor self-rated health (Holt-Lunstad et al., 2015; Karska et al., 2023).

Studies with older adults have consistently report that loneliness is positively associated with social isolation and depression and negatively associated with satisfaction with life (Donovan & Blazer, 2020; Gierveld, 1998; Nicholson et al., 2020; Park et al., 2020; Petitte et al., 2015). The use of anti-depressants is common in the presence of loneliness and has been associated with persistent and severe loneliness, since prior loneliness predicts contemporaneous regular use of anti-depressants (Lam & Vuolo, 2023; Tiilikainen et al., 2024). Loneliness has been associated with decreasing functioning in activities of daily living (ADL), and instrumental activities of daily living (IADL), that have been described as moderator factors (Qi et al., 2023; Sieber et al., 2023; Tomioka et al., 2016). However, limitations in IADLs tend to contribute to social isolation and reduced participation in meaningful activities, which may exacerbate feelings of loneliness (Zhao et al., 2025).

This study analysed the psychometric properties (reliability and validity) of the Portuguese version of the ALONE scale in a sample of community-dwelling older adults. In addition, the study examined the association between severe loneliness and sociodemographic, social isolation, depression, satisfaction with life, and daily functioning.

Methods

Design

A descriptive, correlational study was conducted as part of the project 'Translation, adaptation and validation of the ALONE scale for the Portuguese older population'. The study was approved by the Ethics Committee of the Nursing School of Coimbra (P906_10_2022).

Study settings and participants

A non-probabilistic convenience sampling method was used to recruit community-dwelling older adults in Portugal. The inclusion criteria were ≥65 years and having no cognitive impairment. The exclusion criteria included the inability to communicate orally; residence in a nursing home or intermediate care unit, attendance at a day-care centre (as the social interaction in these centres tends to be structured around the users and staff);); and those with cognitive impairment (had a positive result for cognitive deficit on the Mini-Cog: a score ≤ 2). To determine the sample size, a participant-to-item ratio of 10:1 is recommended (Hair et al., 2019). As the ALONE scale consists of five items, a minimum of 50 participants would be required. However, to conduct a confirmatory factor analysis (CFA), a sample size of at least 200 participants is necessary to ensure model adequacy (Hair et al., 2019). Therefore, the target sample size for this study was set at $n \geq 200$.

Instruments

The questionnaire included the following instruments.

Mini-Cog

This instrument developed by Borson et al. (2000) for rapidly screening cognitive impairment is available in various languages (Mini-Cog© – Quick Screening for Early Dementia Detection), including European Portuguese. It consists of two tasks: (i) recalling three words (one point awarded for each word correctly recalled) and (ii) drawing a clock showing a specific time (two points awarded for a correct drawing, whereas an incorrect drawing is awarded no points). Scores range from 0 to 5: a recall of three words indicates no cognitive deficit; a recall of 1–2 words with a normal clock indicates no cognitive deficit; a recall of 1–2 words with an abnormal clock indicates a positive result for cognitive deficit; a recall of 0 words indicates a positive result for cognitive deficit.

Sociodemographic questionnaire

This instrument comprises questions on sex; age; marital status; living arrangements (spouse/partner, extend family, alone); for those who answer 'alone', for how long (in months); area of residence (rural, peripheral, urban); living in a house or apartment; income; number of children, grandchildren, and great-grandchildren; professional status; experience of the death of someone significant in the last six months and one year; having a driving licence (yes/no), and able to drive (yes/no); use of anti-depressants (yes/no/I do not know).

Self-perception of health

Participants had to respond to the question 'In general, would you say your health is …' using the following categories: 1 = excellent, 2 = very good, 3 = good, 4 = fair, 5 = poor. Lower values indicate better perceived health.

Self-perception of loneliness

Participants were asked 'Do you usually feel lonely?' and were given four response options (1: always, 2: many times, 3: sometimes, 4: never). Higher scores mean less loneliness.

ALONE scale

This instrument was developed by Deol et al. (2022) for the U.S. context to assess loneliness in older adults. This scale is unidimensional and comprises five items: 1. A-item ('Are you emotionally appealing to others as a friend?'); 2. L-item ('Are you Lonely?'); 3. O-item ('Are you Outgoing/friendly?'); 4. N-item ('Do you feel you have No friends?'); 5. E-item ('Are you Emotionally upset/sad?'). The L-, N-, and E-items are negatively worded and are reversely scored. Each item is evaluated on a three-point verbally labelled Likert-type scale, with responses of 1 (yes), 2 (sometimes), and 3 (no). Scores range from 5 to 15, with a higher score indicating increased loneliness. UCLA loneliness scale scores of 50 and greater have been used as a cutoff for severe loneliness (Deol et al., 2022). ROC curve analysis to optimise sensitivity and specificity, showed that ALONE scores of 8 and greater fit similar criteria for severe loneliness (sensitivity = 0.944, specificity = 0.855, Deol et al., 2022). The ALONE original scale showed strong correlations with the UCLA-20 ($r = .81$), excellent test-retest reliability ($r = .89$), and an internal consistency of Cronbach's alpha = 0.69 (Deol et al., 2022).

The translation and cultural adaptation process followed the International Society for Pharmacoeconomics and Outcomes Research (ISPOR; Wild et al., 2005) and comprised three main phases: (i) The translation and cultural adaptation received approval from Dr Ekamjit Deol. The linguistic validation followed six steps: forward translation, reconciliation, back-translation, harmonisation, cognitive debriefing, and proofreading; (ii) The content validity assessment involved 15 experts, and comprised three rounds of evaluation; consensus-building were conducted. Consensus was obtained at the end of the third round (CVI-$I < 80\%$); and (iii) Face validity was carried out with a convenience sample of eight participants. Semi-structured interviews were conducted focusing on clarity and understanding, as well as collecting suggestions. Findings indicate that the ALONE Scale captures the feelings of loneliness, which is useful and easy to understand and complete.

UCLA loneliness scale (UCLA-16)

The UCLA-20, created in 1978 by David Russel and later refined, has been validated in Portugal, resulting in a 16-item version (Pocinho et al., 2010) measuring two dimensions: social isolation and affiliation. The scale consisted of 16 self-report items, with response options rated on a four-point scale: never (1), rarely (2), sometimes (3), and often (4). The social dimensions comprise 12 items (such as, 'I feel isolated from other people', 'It feels like no one really understands me', 'I feel abandoned', 'I do not feel intimate with anyone'), and the affinities dimension involves 4 items ('I feel lack company', 'I am feeling unhappy to do many things alone', 'I feel that I do not have someone to talk', 'My social relationships are superficial'). All items are negatively worded, simplifying the response process. Scores range from 16 to 64, with a score above 32 indicating a negative feeling of loneliness. In its Portuguese version, the internal consistency shows a Cronbach's alpha for the total scale of 0.905, for the factor social isolation of 0.920 and for the factor affinities were 0.824 (Pocinho et al., 2010).

Social Isolation Scale (SIS)

This scale was developed by Nicholson et al. (2020) and was validated for Portuguese older adults by blinded for review. Tavares et al. (2023) SIS has two dimensions: objective connectedness and subjective belongingness. The connectedness (3 items) questions ask participants to indicate frequencies (on a Likert scale from 0 to 6 or more) related to contact with family, friends, and neighbours. The belongingness (3 items) ask participants to rate agreement (on a Likert scale from strongly disagree to strongly agree) with questions regarding relationships and activities (being fulfilled, belonging, and time spent on social activities). Lower scores indicate higher levels of social isolation, characterised by three levels: ≤ 9 experiencing social isolation; 10–15 risk of social isolation; ≥ 16 no risk of social isolation. The Portuguese validation showed the same two-factor model with excellent fit indices, a composite reliability of 0.708, inter-class correlation coefficients ranging from 0.84 to 0.98, and Cohen's kappa coefficient from 0.936 to 1 (Tavares et al., 2023).

Satisfaction with Life Scale (SWLS)

This scale was developed by Diener et al. (1985) to evaluate life satisfaction, and it was validated for the Portuguese population by Simões (1992). The scale consists of five items ('In most ways my life is close to my ideal', The conditions of my life are excellent, 'I am satisfied with my life', 'So far I have gotten the important things I want in life', 'If I could live my life over, I would change almost nothing') on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). Scores range from 5 to 25, with higher scores indicating greater life satisfaction. It has good internal consistency (Cronbach's $\alpha = 0.77$) and good convergent validity (Simões, 1992).

Geriatric Depression Scale-15 (GDS-15)

GDS-15 is a self-report scale developed to screen depression in older adults. It was developed as a 30-item form by Yesavage et al. (1982). Burke et al. (1991) performed the validity and reliability study of the 15-item short form. Apóstolo et al. (2014) performed the Portuguese validity and reliability study of the 15-item short form (Cronbach's α: 0.83). The GDS-15 consists of 15 dichotomous questions (such as, 'Do you prefer to stay at home, rather than going out and doing new things?', 'Do you feel that your situation is hopeless?', 'Do you often get bored?', 'Do you feel that your life is empty?') scored from 0 (no) to 1 (yes) point. The total score ranges from 0 to 15 points. A score of 0–5 indicates the absence of depressive symptoms, whereas a score >5 suggests the presence of depressive symptoms.

Lawton and Brody Instrumental Activities of Daily Living Scale (IADL scale)

This scale evaluates instrumental activities of daily life, such as using the telephone, shopping, food preparation, housekeeping, laundry, transport, medication, and finances. The Portuguese version, developed by Azeredo and Matos (2023), uses a three-point Likert scale (0 = total or severe dependency, 1 = needs some help, 2 = independent or slight loss of independence). Scores range from 0 to 16, with a value of 0–5 indicating severe or total dependence, 6–11 indicating moderate dependence, and 12–16 indicating slight dependence or independence. Both the original and the Portuguese versions demonstrate high internal consistency, as evidenced by Cronbach's alpha values of 0.96 and 0.94, respectively.

Data collection

Data were collected between September and November 2023 by a team of six trained researchers (three gerontologists, one

psychologist, and two nurses). Recruitment involved two main strategies: (i) older adults from the researchers' social networks were approached, and (ii) contact was made with community institutions, including municipalities, cultural and recreational associations, and senior universities, through existing protocols with University of Aveiro (Portugal). Potential participants were identified, and meetings were arranged to provide detailed explanations of the project, including its objectives, methodology, and the nature of the collaboration required. Written informed consent was obtained from all individuals who agreed to participate. Participants were fully informed about the purpose of the study, their role, and their rights, ensuring compliance with ethical standards.

Subsequently, the interviewer administered a cognitive screening test (Mini-Cog) to ascertain eligibility. If the screening for cognitive impairment yielded a negative result, the researcher proceeded with data collection. In cases where the screening indicated cognitive impairment, the assessment was concluded with an expression of gratitude for the participant's willingness to collaborate. Upon completion of the questionnaire, the interviewer expressed thanks for the participant's contribution.

Data analysis

Construct validity

The sample adequacy was assessed using the Kaiser-Meyer-Olkin (KMO) criterion (> 0.5) and Bartlett's test of sphericity ($p < .01$; Hair et al., 2019). The dimensionality of the ALONE scale was assessed through a parallel analysis to determine the number of factors to be retained, with factor loadings (> 0.30) and variance (> 40%; Hair et al., 2019) serving as criteria. The CFA included multiple fit indices: χ^2, comparative fit index (CFI ≥ 0.9), goodness of fit index (GFI ≥ 0.9), root mean square error of approximation (RMSEA < 0.08), standardised root mean square residual (SRMR), Akaike information criterion (AIC), normed fit index (NFI ≥ 0.9), Tucker-Lewis index (TLI ≥ 0.9); and Bayesian information index (BIC; Marôco, 2021).

Convergent, divergent, and criterion validity

Convergent validity was evaluated by correlating the ALONE scale scores with those from the UCLA-16 and SIS. Divergent validity was evaluated by calculating the correlations between ALONE scores and the SWLS, while criterion validity was assessed by calculating correlations between the ALONE scale and the GDS. Correlations were measured using Spearman's rank correlation coefficient, with the following interpretations: 0–0.39 = weak correlation; 0.40–0.69 = moderate correlation; 0.70–0.89 = strong correlation; ≥ 0.90, very strong correlation). To determine the cut-off score for the ALONE scale to identify severe loneliness, a receiver operator characteristic (ROC) curve analysis was conducted based on the Youden index. This approach revealed the most favourable combination of sensitivity and specificity.

Internal consistency reliability

This was evaluated using two different indices: Cronbach's alpha and the omega coefficient. Furthermore, the attenuation index was calculated.

Descriptive and inferential statistics

The following statistics descriptions were calculated: frequency (n) and percentage (%) for categorical variables, and mean (M) and standard deviation (SD) for continuous variables. Inferential statistics were calculated to analyse the relationships that loneliness (severe vs non-severe) has with sociodemographic, social isolation, depression, satisfaction with life, and daily functioning. A Chi-squared test was used to evaluate the association between the categorical sociodemographic variables and loneliness ('no severe loneliness' and 'severe loneliness" groups). Non-parametric tests (Mann Whitney and Kruskal-Wallis) were applied (Levene's homogeneity test and the residuals' normality by visual inspection of Q–Q plots were not verified). For the continuous variable, non-parametric tests were applied. The correlation between two continuous variables was tested using Spearman's test. A binary logistic regression was performed between the loneliness categories (group of reference - non-severe loneliness) and the SIS, SWLS, GDS, and IADL Scales. Significant variables in a univariate analysis were included in the multivariable model. Subsequent models were used that included sex and age as control variables. The results were shown through the odds ratios (OR) and their 95% confidence interval (95% CI). Finally, a likelihood ratio test and the Hosmer-Lemeshow test for goodness of fit were verified and no evidence of multicollinearity or overdispersion were found in any of the proposed models.

The data were analysed using FACTOR software, SPSS Version 28 (IBM, Armonk, NY, USA) and IBM SPSS AMOS software. A significance level of $p < .05$ was used for all comparisons.

Results

Characteristics of the sample

The initial sample comprised 328 participants; however, 43 were excluded due to cognitive impairment, resulting in a final sample of 285 older adults. The participants' ages ranged from 65 to 93 years (mean age = 73.9, *SD* = 6.37), and 66.3% were women. The mean number of years spent in formal education was 6.13 (*SD* = 3.99), with a range of 0 to 18 years; six years of formal education meaning elementary school. Most participants were married or cohabiting (60%), with 47% living with a spouse or partner and 26% with extended family. Approximately half the participants resided in rural areas (48.1%), while 39.6% lived in urban settings, and most participants (75.4%) lived in houses. The majority were retirees or pensioners (95.4%). At the end of the month, 47.4% of participants had sufficient funds to meet their basic needs, while 39.3% reported having 'some money left over'. A significant proportion of participants had children (93.7%; *M* = 2.83; *SD* = 0.24) and grandchildren (84%; *M* = 1.16; *SD* = 1.28) but not great-grandchildren (86.3%). Most participants (85.6% in the past six months and 82.7% in the past year) had not experienced the death of a significant person. The mean score on the health status self-assessment was 3.7 (*SD* = 0.80) out of 5, indicating that participants perceived their health to be good. Most participants indicated that they seldom experienced feelings of loneliness (*M* = 3.4; *SD* = 0.70 out of 4). At the time of data collection, 70.5% of participants were not receiving treatment with antidepressant medication. More than a half (63.2%) held a driving licence and 81.1% were still driving. The details are described in Table 1.

Construct validity

Before conducting the CFA, the KMO test (0.61) and Bartlett's test of sphericity ($p < .01$) were assessed, with results demonstrating the suitability of the sample for analysis. The result of the optimal parallel analysis yielded a unifactorial structure, with an eigenvalue of 2.18 and a total variance explained of 54.6%. Factor loadings ranged from 0.512 to 0.931. The H-latent BC bootstrap at 90% was 0.901 (CI: 0.818–1.144; high H values (>0.80) suggest a well-defined latent variable). The CFA results for the ALONE scale indicated an inadequate fit for most parameters, including the X^2/gl, CFI, NFI, TLI, and SRMS. Following an inspection of the modification indices, a second model was specified with correlated error covariances between e5 and e2 (re5e2 = 0.17), and e5 and e4 (re5e4 = 0.06). The revised model fit the data well according to conventional fit criteria: χ^2/gl = 2.24, CFI = 0.982, NFI = 0.970, TLI = 0.941, FI = 0.991, AIC = 30.723, BIC = 74.553, RMSEA = 0.066 (CI: 0.00–0.134), $p = .272$, and SRMS = 0.039.

The UCLA loneliness scale (score > 32 has been proposed as an indicator of severe loneliness) was used as the gold standard to determinate the ROC curve of the ALONE scale, as in the original study. The ROC curve analysis showed an area of 0.821 ($p < .01$; 95% CI: 0.754–0.889), with a standard error of 0.034. The optimal cut-off point for sensitivity and specificity was identified as ≥ 8 on the ALONE scale, with sensitivity, specificity, positive predictive value, and negative predictive value of 0.70, 0.81, 0.43, and 0.93, respectively.

Table 1. Characteristics of the sample ($n = 285$).

Sociodemographics	
Sex (n, %)	
Female	189 (66.3)
Male	96 (33.7)
Age (*M*, *SD*)	73.97 (6.13)
Years of formal education (*M*, *SD*)[a]	6.13 (3.99)
Marital status (n, %)	
Married/cohabiting	171 (60)
Widowed	80 (28.1)
Separated/divorced	24 (8.4)
Single	10 (3.5)
Living arrangements (*n*, %)	
With spouse/partner	133(47)
With extended family	74 (26)
Alone	78 (27.4)
If answered 'alone', for how long (months); *n* = 78; (*M*, *SD*)	95.54 (94.72)
Residence area (*n*, %)	
Rural	137 (48.1)
Peripheral	35 (12.3)
Urban	113 (39.6)
Live in (*n*, %)	
House	215 (75.4)
Apartment	70 (24.6)
Income (*n*, %)	
Not enough to make ends meet	38 (13.3)
Just enough to make ends meet	135 (47.4)
Some money left over	112 (39.3)
Children (*n*, %)	
Yes	267 (93.7)
No	18 (6.3)
Number of children (*M*, *SD*)	1.06 (0.24)
Grandchildren (*n*, %)	
Yes	239 (84)
No	46 (16.1)
Number of grandchildren (*M*, *SD*)	2.38 (1.28)
Great-grandchildren (*n*, %)	
Yes	39 (14)
No	246 (86.3)
Number of great-grandchildren (*M*, *SD*)	1.86 (0.34)
Professional status (*n*, %)	
Employed	9 (3.2)
Unemployed	3 (1.1)
Retired/pensioner	272 (95.4)
Self-perception of loneliness (*M*, *SD*)	3.40 (0.70)
Self-perception of health status (*M*, *SD*)	3.70 (0.80)
Antidepressant use ($n = 278$)[b] (*n*, %)	
Yes	75 (27)
No	196 (70.5)
I don't know	7 (2.5)
Driving licence (*n*, %)	
Yes	180 (63.2)
No	105 (37)
Able to drive (*n*, %)	
Yes	147 (81.7)
No	33 (18.3)

Note: n: total sample number; %: percentage; *M*: mean; *SD*: standard deviation.
[a]Six years of formal education means elementary school.
[b]Missing data.

Convergent, divergent, and criteria validity

Moderate, positive, and statistically significant correlations were observed between the ALONE scale and the UCLA scale and subscales (social isolation and affinities; Table 2). The ALONE scale's correlations with both the total SIS scale and the SIS belongingness subscale were moderate, negative, and statistically significant. The correlation between the ALONE scale and the SIS connectedness subscale was moderate, negative, and statistically significant (Table 2). Additionally, the correlation between the ALONE scale and the GDS was moderate, positive, and statistically significant. Furthermore, the ALONE scale exhibited moderate, positive correlations with the SWLS, which were also statistically significant (Table 2).

Reliability

The internal consistency results, analysed using FACTOR software with BOOTSTRAP and a 90% CI, were as follows: Cronbach's alpha of 0.744, Omega coefficient of 0.743, and an attenuation index of 5% (indicating that Cronbach's alpha was not significantly distorted).

Severe vs non-severe loneliness: sociodemographic variables

The results of the association between sociodemographic variables and severe versus non-severe loneliness showed significant differences for (cf. Table 3) (i) gender—women exhibited greater levels of severe loneliness compared to men (32.8% vs 15.6%); (ii) marital status—individuals who were not living with a partner demonstrated higher rates of severe loneliness compared to those who were living with a partner (33.6% vs 19.5%); (iii) age—severe loneliness was more frequent in older adults with a higher average age (73.46 ± 6.18 vs 75.38 ± 5.48); and

Table 2. Analysis of convergent, divergent, and criteria validity.

	UCLA	UCLA-SI	UCLA-A	SIS	SIS- B	SIS-C	GDS	SWLS
ALONE scale	0.692*	0.671*	0.639*	−0.509*	−0.488*	−0.347*	0.555*	−0.465*

Note: ULCA-SI: University of California, Los Angeles Loneliness scale - Social Isolation; UCLA-A: University of California, Los Angeles Loneliness scale – Affinity; SIS-B: Social Isolation Scale- Belongingness; SIS-C: Social Isolation Scale - Connectedness; GDS: Geriatric Depression Scale; SWLS: Satisfaction with Life Scale. *$p < .01$.

(iv) living arrangements—the percentage of individuals with severe loneliness was higher among those living alone compared to those living with a partner (39.7% vs 19.5%), and higher among those living alone for less time (58.57 ± 54.74 vs 120.2 ± 107.6). No significant associations or differences were found between the ALONE categories and other sociodemographic variables.

Older adults experiencing severe loneliness exhibited higher scores on self-perception of loneliness (1= always, 4 = never; 2.83 ± 0.68 vs 3.61 ± 0.59) and reported poorer self-perception of their health (4.00 ± 0.63 vs 3.6 ± 0.83). The results also indicated that individuals who were taking antidepressants exhibited a higher prevalence of severe loneliness compared to those who were not taking antidepressants (48% vs 18.9%). Additionally, older adults who did not possess a driving licence demonstrated a greater likelihood of experiencing severe loneliness compared to those who had a licence (35.2% vs 22.2%). Furthermore, older adults who were unable to drive, despite having a licence, exhibited a higher prevalence of severe loneliness compared to those who were still able to drive (48.8% vs 17.0%). No significant associations or differences were found between the ALONE categories and other related variables.

Severe vs non-severe loneliness: social isolation, satisfaction with life, depressive symptoms, and IADL scale

A statistically significant difference was observed between those who did and did not experience severe loneliness regarding social isolation, satisfaction with life, depression, and IADL (cf. Table 4). The findings revealed that older adults experiencing severe loneliness exhibited a heightened risk of global social isolation when compared to those who did not report severe loneliness (22.23 ± 4.48 vs 26.00 ± 3.05). The connectedness (10.78 ± 2.71 vs 12.59 ± 2.23) and belongingness (11.45 ± 2.68 versus 13.41 ± 1.82) subscales also demonstrated statistically significant differences between the two groups. Older adults with severe loneliness showed lower levels of satisfaction with life (16.69 ± 4.98 vs 20.25 ± 3.65), higher levels of depression (5.48 ± 3.84 vs 2.03 ± 2.49), and greater dependence/loss of autonomy in IADLs (14.27 ± 2.57 vs 14.68 ± 2.69).

Table 3. Severe vs non-severe loneliness and sociodemographic variables (only significant results).

Sociodemographic variables	ALONE scale categories: Non-severe loneliness, <8 (*n* = 208) *N* (%)	Severe loneliness, ≥8 (*n* = 77) *N* (%)	Statistics result
Sex			
Male (*n* = 96)	81 (84.4)	15 (15.6)	$X^2(1) = 9.529$
Female (*n* = 189)	127 (67.2)	62 (32.8)	*p* = .002
Marital status			
Married/cohabiting (*n* = 133)	107 (80.5)	26 (19.5)	$X^2(1) = 7.055$
Not married (*n* = 152)	101 (66.4)	51 (33.6)	*p* = .008
Living arrangements			
Couple (*n* = 133)	107 (80.5)	26 (19.5)	$X^2(2) = 10.169$
Extend family (*n* = 74)	54 (73.0)	20 (27.0)	*p* = .006
Alone (*n* = 78)	47 (60.3)	31 (39.7)	
If answered 'alone', for how long (months)	120.2 ± 107.6	58.57 ± 54.74	*U* = 363.0 *p* = .007
Antidepressant use			
Yes (*n* = 75)	39 (52.0)	36 (48.0)	$X^2(1) = 24.111$
No (*n* = 196)	159 (81.1)	37 (18.9)	*p* < .001
Driving licence			
Yes (*n* = 180)	140 (77.8)	40 (22.2)	$X^2(1) = 5.698$
No (*n* = 105)	68 (64.8)	37 (35.2)	*p* = .017
Able to drive			
Yes (*n* = 147)	136 (92.5)	11 (7.5)	$X^2(1) = 20.169$
No (*n* = 33)	21 (63.9)	12 (36.4)	*p* < .001
	M ± *SD*	*M* ± *SD*	Statistics result
Age	73.46 ± 6.18	75.38 ± 5.84	*U* = 6408.5 *p* = .010
Self-perception of loneliness	3.61 ± 0.59	2.83 ± 0.68	*U* = 3365.0 *p* < .001
Self-perception of health status	3.60 ± 0.83	4.00 ± 0.63	*U* = 6051.5 *p* < .001

Note: *n*: total sample number; %: percentage; *M*: median; *SD*: standard deviation; U: Mann–Whitney test.

Multivariate binary logistic regression

Table 5 summarises the findings of the logistic regression analysis for loneliness assessed using the ALONE scale, which incorporated control variables for age and sex as well as their interactions. As observed, the SIS belongingness subscale and the GDS revealed statistically significant associations with loneliness in all models, including the interactions with age and sex. In the regression model, when controlling for age and sex, the results demonstrated that severe loneliness in older adults was significantly associated with social isolation, belongingness (OR = 0.806; 95% CI = 0.669–0.970), and depression (OR = 1.131; 95% CI = 1.146–1.503).

Discussion

The objective of this study was to assess the psychometric properties and validity of the ALONE scale among community-dwelling older adults in Portugal. The scale's brevity and efficiency render it a valuable tool for use in clinical settings. In accordance with Boateng et al. (2018) recommendations for validation, the study employed a range of validity approaches, including construct, divergent, and convergent validity. The study also examined the association of severe loneliness with sociodemographic, social isolation, depression, satisfaction with life, and daily functioning.

Psychometric proprieties of the ALONE scale

This study represents an initial investigation into the construct validity of the ALONE scale for Portuguese community-dwelling older adults. The psychometric analysis indicated that the sample size was adequate for conducting a CFA, thereby supporting the unifactorial structure of the scale. Following the adjustment for correlated error covariances, the fit indices were considered good. According to Marôco (2021), this methodology can refine the model and significantly improve the fit.

Table 4. Loneliness versus scales (SIS, GDS, SWLS, IADL).

Measures	ALONE scale: Non-severe loneliness (*n* = 208) *M* ± *SD*	Severe loneliness (*n* = 77) *M* ± *SD*	Statistics result
SIS	26.00 ± 3.05	22.23 ± 4.48	*U* = 4002.0; *p* < .001
Total	12.59 ± 2.23	10.78 ± 2.71	*U* = 4857.5; *p* < .001
Connectedness	13.41 ± 1.82	11.45 ± 2.68	*U* = 4421.0; *p* < .001
Belongingness			
SWLS	20.25 ± 3.65	16.69 ± 4.98	*U* = 4644.5; *p* < .001
GDS	2.03 ± 2.49	5.48 ± 3.84	*U* = 3421.5; *p* < .001
IADL Scale	14.68 ± 2.69	14.27 ± 2.57	*U* = 6347.0; *p* = .002

Note: ULCA: University of California. Los Angeles Loneliness scale; SIS: Social Isolation Scale; GDS: Geriatric Depression Scale; SWLS: Satisfaction with Life Scale; IADL: Instrumental Activities of Daily Living (IADL) Scale.

The ALONE scale was found to demonstrate convergent validity, as evidenced by a moderate correlation with the Portuguese UCLA-16, suggesting that both instruments measure the same construct. The original study (Deol et al., 2022) revealed a strong correlation with the UCLA-20 scale ($r = .81$, $p < .001$). The different versions of the UCLA scale used (20 items in the original study vs 16 items in our study) may account for some variation. Consistent with prior research, the ALONE scale was found to be negatively associated with social isolation, reflecting the close relationship between loneliness and social isolation. Older adults with severe loneliness have a higher risk of social isolation (Courtin & Knapp, 2017; Shankar et al., 2017; Steptoe & Kivimäki, 2013). Criterion validity was supported by the moderate positive correlation between the ALONE scale and the GDS, indicating that individuals with severe loneliness tend to have more depressive symptoms (Deol et al., 2022; Erzen & Çikrikci, 2018). The scale demonstrated reliability through the presentation of good internal consistency, as indicated by the values of Cronbach's alpha, ordinal alpha, and omega coefficient, which all suggest a consistently correlated set of scale items. The original study reported a Cronbach's alpha of 0.69 (Deol et al., 2022), whereas this study showed slightly higher values, thereby corroborating the scale's validity for assessing loneliness.

The study established a cut-off point of ≥ 8 as indicating severe loneliness (ROC curve = 0.821). This aligns with Deol et al. (2022) original study, in which the ROC curve analysis demonstrated a sensitivity of 0.944 and specificity of 0.855, which was slightly higher than that observed in the present study (sensitivity = 0.70, specificity = 0.81). The differences observed may be attributed to the use of different versions of the UCLA scale (16 items in our study vs 20 items in the original study) and distinct data collection contexts (community in our study vs outpatient clinics in the original study). Additionally, the mean loneliness score in the original study was higher (34.47 vs 24.83 in our study), which may account for the greater sensitivity observed.

Severe loneliness and sociodemographic, social isolation, depression, satisfaction with life, and daily functioning

This study included a range of sociodemographic variables associated with severe loneliness, as reported in the literature. Consistent with previous studies, our findings suggest that severe loneliness is more likely to be experienced by women, individuals who are not married or in a civil union, older individuals, and those living alone, particularly when living alone for less time (Boehlen et al., 2022; Dahlberg et al., 2022). Our findings indicate that individuals who were living alone for a shorter period reported higher levels of severe loneliness, possibly due to lower resilience and a paucity of coping strategies related to living alone (Guerra et al., 2022). Living alone for a shorter time may be a consequence of widowhood in later life, a known risk factor for loneliness (Freak-Poli et al., 2022). Nevertheless, the ALONE scale likely does not discriminate between long-term persistent severe loneliness and situational severe loneliness. Future studies and scales measuring loneliness could be developed to incorporate the distinction between chronic versus situational severe loneliness. Situational severe loneliness may be reaction to an event (eg the death of a partner and commencement of living alone) and evolve either to persistent severe loneliness or trigger actions to reorganise social relations probably after a period of mourning. Trajectories of severe loneliness should be studied further (Tiilikainen et al., 2024). Our findings suggest that the use of antidepressants is associated to a higher prevalence of severe loneliness, consistent with previous literature (Lam & Vuolo, 2023).

Our findings indicated an association between having a driving licence and the ability to drive and feelings of severe loneliness. Individuals in possession of a driving licence reported lower levels of severe loneliness, potentially due to easy engagement in out-of-home and social activities (Spinney et al., 2020). Conversely, older adults who ceased driving (having a driving licence but no longer being able to drive) experienced severe loneliness, aligning with previous studies associating driving cessation with increased social isolation (Qin et al., 2020). The cessation of driving results probably in a reduction of social activity, which then leads to a decline in the quantity and quality of support networks. Future research should further explore the relationship between driving cessation and loneliness.

Our findings also revealed that older adults experiencing severe loneliness exhibited a range of adverse outcomes, including poorer self-perception of health, elevated risk for social isolation, diminished life satisfaction, heightened depressive symptoms, and increased dependence in instrumental activities of daily living (IADLs). These findings are consistent with existing literature that links loneliness with adverse health outcomes, including functional decline and mental health issues, such as depression (Hawkley, 2022; Park et al., 2020).

In the multivariable model (adjusted for age-sex) only social isolation (specifically, the belongingness subscale) and depressive symptoms were found to be significantly associated with severe loneliness. The results obtained in the logistic regression adjusted for sex and to age were consistent with the results of the model adjusted for sex-age. The likelihood of severe loneliness was found to reduce (19.4%) among older adults who

Table 5. Multivariate binary logistic regression results for the variable 'loneliness' assessed by the ALONE scale ($n = 241$[a]).

	Univariate models		Multivariate adjusted for age-sex	
Scales	OR	95% CI	OR	95% CI
SIS - connectedness	0.781	0.689–0.885	0.911	0.778–1.067
SIS - belongingness	0.675	0.584–0.779	0.806**	0.669–0.970
SWLS	0.818	0.757–0.883	0.995	0.891–1.112
GSD	1.442	1.290–1.611	1.313**	1.146–1.503
IADL	0.904	0.819–0.998	0.978	0.861–1.110
Cox & Snell R2	n.a.		0.209	

Note: SIS: Social Isolation Scale; GDS: Geriatric Depression Scale; SWLS: Satisfaction with Life Scale; IADL: Instrumental Activities of Daily Living (IADL) Scale; CI: confidence interval; OR: odds ratio.

[a]This sample size is the result of some missing data, that were not included in the calculation of the regression model.

*$p < .05$. **$p < .01$.

reported higher scores on the belongingness subscale (SIS). Belongingness is related to the quality of relationships and activities, representing a more subjective evaluation of the relationships (Perlaman & Peplau, 1984) that influences the perception of loneliness. The prevalence of severe loneliness is higher among older adults who experience depressive symptoms (the addition of a single GDS unit is associated with a 31.3% increase in the risk of loneliness). As evidenced in the literature, loneliness is a risk factor for depressive symptoms (Erzen & Çikrikci, 2018; Van As et al., 2022). However, it is probable that there is a bidirectional relationship between loneliness and depression. As Groarke et al. (2021) argued, depression can damage relationships through interpersonal conflict, thereby reducing relationship quality and leading to increased feelings of loneliness.

Practical implications

Loneliness is a major issue of public health, particularly among older adults. The validation of the ALONE scale for the Portuguese community-dwelling older adults provides an important contribution to the assessment of loneliness namely (i) brief assessment, (ii) measuring severe loneliness, (iii) friendly and rapid screening in clinical, research and community settings. It provides frontline professionals (health and psychosocial) as well as researchers with a concise, psychometrically robust, and clinically sensitive tool to identify people at risk of loneliness, including severe loneliness. Additionally, the scale's applicability in different settings—primary care, social services, and ageing research—enhances its practical value. The ALONE Scale may also be valuable to assess interventions targeting minimisation of loneliness providing an easy measure of loneliness that can be used in follow-up. The short format of this scale makes it easy to use in digital versions that can enlarge its use.

Limitations and future research perspectives

This study had limitations. First, our sample, despite providing valuable insights, could be further improved by ensuring greater representativeness. For instance, the sample comprised older adults from the northern and central regions of Portugal, thus limiting the generalisability to other regions. Future studies should aim for a stratified sample that considers age groups, educational levels, sex, and regional variations (eg interior vs littoral regions) to gain a more nuanced understanding of the factors that contribute to perceptions of loneliness in different contexts. Second, this study assessed the reliability of the ALONE scale through internal consistency only, without evaluating stability (eg test-retest) or equivalence (eg inter-observer test). Although the original study reported a strong test-retest correlation ($r = .887$; $p < .01$), suggesting good stability, future research should address these aspects. Third, it is possible that severely lonely older adults were underrepresented in our sample as our sample comprised individuals showing characteristics associated with protective factors against loneliness, such as cohabitation, lower dependency, and adequate family income. Fourth, while this study focused on severe loneliness in a community setting, it is important to consider other contexts, such as long-term care facilities, to gain a comprehensive understanding of severe loneliness across environments.

Conclusion

This study validated the ALONE scale for use with community-dwelling older adults in Portugal. The psychometric evaluation demonstrated the scale's unifactorial structure and its validity and reliability. The confirmatory model indicated that the scale exhibited an adequate fit to the data, and internal consistency was considered acceptable. The optimal cut-off for severe loneliness was found for scores > 8 on the ALONE scale. The study identified key variables associated with severe loneliness. Older adults who experienced severe loneliness were predominantly older women, living alone, and living alone for shorter periods, who either did not have a driving licence or who had ceased driving. Severe loneliness was associated with higher risks of social isolation, depression, poor self-perception of health, reduced life satisfaction, and increased dependence on daily activities. The ALONE scale is a valuable tool for identifying loneliness and severe loneliness, given its brevity and ease of use. The ALONE scale could be integrated into routine clinical practice to better identify loneliness and severe loneliness among older adults.

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Data availability statement

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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