Systematic review of psychometric properties and cross-cultural adaptation of the University of California and Los Angeles loneliness scale in adults

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Abstract

This systematic review assessed the psychometric properties and the cross-cultural adaptation of the University of California and Los Angeles Loneliness scale (UCLA-LS) in adults. A systematic search of four electronic databases (PubMed, EMBASE, Scopus, and PsycINFO) was conducted from inception until March 2021. We followed the Consensus-Based Standards for the Selection of Health Measurement Instruments (COSMIN) guidelines for data extraction and evidence synthesis. Eighty-one studies assessed the validity and reliability of the UCLA-LS, translated into many languages, and applied across several countries/societies. Three versions of the 20-item and nine short versions of the UCLA-LS with 3 to 20 questions were identified. High-quality evidence supported the internal structure of the UCLAs: 4, 6, 7 and 10, while low-to-moderate-quality evidence supported the construct validity of the UCLAs: 3, 4, 6, 8, 16 and 20. Moderate-quality evidence supported the test-retest reliability of version 3 UCLA-20 with excellent interclass coefficients values of 0.76–0.93. The UCLAs: 4, 6, 7 and 10 had the most robust internal structure and may therefore be the most useful for informing clinicians and social psychologists engaged in assisting those with loneliness.

Keywords Adults · Cross-cultural adaptation · Loneliness · Psychometric properties · UCLA

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Introduction

Loneliness is defined as an unpleasant feeling arising from a discrepancy between desired and perceived levels of social connectedness (Perlman & Peplau, 1981). Loneliness can be classified into social loneliness, characterized by the lack of social networks or sense of community, and emotional loneliness, characterized by the absence of a personal, intimate relationship (Perlman & Peplau, 1981). Although inconclusive, loneliness tends to be more common in older adults, patients with chronic diseases, with rates ranging from 21 to 34%, men than women, and vary across different cultures (Lasgaard et al., 2016; Rokach, 2018; Yang & Victor, 2011). However, more conclusive research has shown significant differences between married or having a partner than unmarried and singles (Park et al., 2019; Rokach, 2018; D Russell et al., 1980; Stephan et al., 1988).

In the general population loneliness is a major public health issue associated with poor mental and physical health outcomes (Gerst-Emerson & Jayawardhana, 2015). It has also been linked to poor structural social relationships, including being single and living alone as well as

social problems such as alcoholism and suicide, which increase mortality risk (Rico-Uribe et al., 2018; Rokach, 2019; D Russell et al., 1980).

Given the above negative impact of loneliness on mental, physical, and social health, it is important that it be assessed using valid and reliable instruments. The University of California and Los Angeles Loneliness scale (UCLA-LS) is the most used scale for assessing loneliness in the general population. It was developed by Russell and colleagues in 1978 to assess social and emotional dimensions of loneliness (Dan Russell et al., 1978). It has become a key clinical and research questionnaire, and reports of its application have come from several countries/societies. The original scale consisted of 20 negatively worded self-reported questions designed to identify feelings of loneliness in college students (Dan Russell et al., 1978). To reduce possible systematic response bias, it was revised in 1980 to include a mix of ten negatively and ten positively worded items (D Russell et al., 1980). It was revised again (version 3) in 1996 (Russell, 1996) to create a simplified response format for easier use in broader groups of respondents, including older adults, and to be administered by mail, surveys and personal interviews. Participants respond to each item on a 1–4 Likert scale, from "never" to "always" The scale has a possible total score of 20 to 80 points, with a higher score indicating greater loneliness (Russell, 1996).

Several short versions of the UCLA-LS, named by the number of the included questions: UCLA−16 (Faustino et al., 2019), UCLA-11 (Lee & Cagle, 2017), UCLA-10 (Knight et al., 1988; Russell, 1996), UCLA−8 (Hays & DiMatteo, 1987), UCLA-7 (Oshagan & Allen, 1992), UCLA-6 (Neto, 2014; Niu et al., 2018), UCAL-5 (Lamm & Stephan, 1987), UCLA-4 (D Russell et al., 1980), and UCLA- 3 (Hughes et al., 2004) were developed to reduce questionnaire length and increase the response rate in clinical practice and longitudinal studies. The psychometric properties of the 20-item and all short forms of the UCLA-LS have been reported by several studies, and one systematic review (Vassar & Crosby, 2008) summarized the internal consistency reliability coefficients (alpha range, 0.71–0.95) of the UCLA-20 and concluded that the UCLA-20 was reliable for use in the general population (Vassar & Crosby, 2008). However, Vassar & Crosby, 2008 did not assess or report validity results and test-retest reliability of the UCLA-20 and the short versions of the UCLA-LS.

In this systematic review, we aimed to assess the validity (structural, construct, criterion, cross-cultural), reliability (internal consistency, test-retest), and the cross-cultural adaption of the 20-item and the short versions of the UCLA-LS. Such information will assist clinicians, especially those involved in social psychology, to select the most appropriate version of the UCLA-LS to be used in their population.

Methods

The systematic review was conducted according to the Consensus-based Standards for the Selection of Health Measurement Instruments (COSMIN) guidelines for systematic reviews (Mokkink et al., 2018; Prinsen et al., 2018; Terwee et al., 2018). The cross-cultural adaptation was assessed using the Guidelines for the Process of Cross-Cultural Adaptation of Self-report Measures (Beaton et al., 2000). The manuscript was reported following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021) The protocol registration number on PROSPERO is CRD42021241610.

Inclusion and Exclusion Criteria

Inclusion Criteria

(1) Studies describing the development and assessing the psychometric properties (reliability, validity, responsiveness) of the UCLA-LS in adults.
(2) Studies published in a peer-reviewed journal from inception until March 2021,
(3) Studies that report the process of culturally adapting or translating the UCLA-LS into another language and evaluating its psychometric properties.

Exclusion Criteria

(1) Studies that validated the UCLA-LS in children and adolescents,
(2) Interventional studies that used UCLA-LS as an outcome measure,
(3) Non-psychometric studies of the UCLA-LS such as qualitative studies,
(4) Conference publications, abstracts, posters, editorials, and commentaries of the UCLA-LS.

Search Methods for Identification of Studies

We conducted electronic searches in PubMed, EMBASE, Scopus, and PsycINFO databases from inception until March 2021, using the following keywords: Reliability OR validity OR responsiveness OR psychometric properties OR measurement properties OR translation OR cross-cultural adaptation AND UCLA loneliness scale OR UCLA-LS OR University of California, Los Angeles Loneliness Scale. In addition, each of the selected studies' reference

lists was manually searched to identify further studies. An example of the search strategy conducted on PubMed is reported in Online Resource 1.

Study Selection

Two authors (SA and RH) independently carried out systematic electronic searches in each of the four databases. The same authors independently performed the screening of the titles and abstracts of the identified articles. Studies deemed to be relevant to the review were retrieved and assessed for eligibility. Disagreements between the two authors were resolved by discussion until consensus was reached.

Data Extraction

Two authors (SA and AO) performed the data extraction. The extracted data from individual studies included the author, year, country or society, UCLA-LS characteristics, sample size, age, sex/gender, recall period, original language and the available translations, and the psychometric properties of the UCLA-LS (validity, reliability, responsiveness). Furthermore, data on the translation and cross-cultural adaptation process were also extracted to examine each design.

Assessing Methodological Quality

The methodological quality of each selected study was independently evaluated by two authors (SA and AO) using the COSMIN Risk of Bias (RoB) checklist (Mokkink et al., 2018; Prinsen et al., 2018; Terwee et al., 2018). This checklist distinguishes three main domains: reliability, validity, and responsiveness and seven sub-domains: content validity, structural validity, hypothesis testing for construct validity, cross-cultural validity, criterion validity, internal consistency, reliability, measurement error, and responsiveness.

The quality of the individual studies was rated on a 4-point scale as very good, adequate, doubtful, or inadequate, and the overall rating of the quality of each study was based on the lowest rating of any standard (the worst score count principle) (Mokkink et al., 2018; Prinsen et al., 2018; Terwee et al., 2018). The result of each psychometric property was assessed against the updated criteria for good psychometric properties and was rated as sufficient (+), insufficient (−), or indeterminate (?). A detailed description of the quality criteria and the rating system is published (Mokkink et al., 2018; Prinsen et al., 2018; Terwee et al., 2018).

The results of the psychometric properties were qualitatively summarized and compared against the criteria for good psychometric properties to rate the overall summary result of the scale as sufficient (+), insufficient (−), indeterminate (?), or inconsistent (±). In case of inconsistent results, the overall rating was based on only high-quality studies and the quality of evidence was downgraded for inconsistency (Mokkink et al., 2018; Prinsen et al., 2018; Terwee et al., 2018).

Assessing Cross-Cultural Adaptation

The translation methodology of the included studies was categorized according to the Guidelines for the Process of Cross-Cultural Adaptation of Self-report Measures (Beaton et al., 2000). These guidelines indicate that an optimal (accurate) adaptation must include five processes: an initial translation, synthesis of translations, back translations, reviews by the expert committee and finally, the pre-test of the instrument. A detailed description of the cross-cultural adaptation process is published (Beaton et al., 2000).

Hypothesis Testing for Construct Validity

To interpreting the results of hypothesis testing and assessing the quality of evidence for construct validity, the review team formulated a set of hypotheses about the expected relationships (direction and magnitude) of the UCLA-LS and other instruments and variables. These hypotheses were based on the literature and the clinical experiences of the review team. For the convergent and divergent validity, the review team expected strong correlations ($r \geq 0.50$) between the UCLA-LS and other loneliness scales (similar construct), moderate correlations ($0.30 \leq r < 0.50$) between the UCLA-LS and related constructs such as positive and negative affect, weak or no correlations (< 0.30) for unrelated constructs such as demographics. For discriminative validity, the review team expected non-significant differences between groups except for marital status. These hypotheses are summarized in Online Resource 2. Lastly, the term criterion validity was used only when a short version of the UCLA-LS was compared to the 20-item version, as recommended by COSMIN (Mokkink et al., 2018; Prinsen et al., 2018; Terwee et al., 2018).

Assessing Overall Quality of Evidence

The overall quality of the evidence was graded as high, moderate, low, or very low, using the modified Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach, which considers methodological quality of studies, inconsistency, imprecision, and indirectness to provide a rating of evidence quality. A detailed description

of the evidence quality rating is published (Mokkink et al., 2018; Prinsen et al., 2018; Terwee et al., 2018).

The quality of evidence was downgraded by one, two or three levels based on the risk of bias, imprecision, and results inconsistency as shown in Online Resource 3 (Mokkink et al., 2018; Prinsen et al., 2018; Terwee et al., 2018).

Results

Study Selection

The database and reference list search yielded 575. After removing duplicates, 464 citations were screened, leaving 256 studies for full-text screen for eligibility. Of these, 81 studies were considered eligible (Adams et al., 2004; Allen & Oshagan, 1995; Anderson & Malikiosi-Loizos, 1992; Anderssen et al., 2020; Arimoto & Tadaka, 2019; Auné et al., 2019; Austin, 1983; Balandin et al., 2006; Boffo et al., 2012; Britton & Conner, 2007; Caballer et al., 2020; Chalise et al., 2007, 2010; Chang et al., 2017; Chou, 2005; Çinar & Toker, 2019; Cole et al., 2015; Doğan et al., 2011; Durak & Senol-Durak, 2010; Dussault et al., 2009; Elemo et al., 2020; Elphinstone, 2018; Ergün et al., 2020; Faustino et al., 2019; Gan et al., 2015; Gillespie et al., 2021; Grey et al., 2020; Hackett et al., 2012, 2019; Hagger & Riley, 2019; Hansen et al., 2012; Hartshorne, 1993; Hawkley et al., 2020; Hays & DiMatteo, 1987; Heisel et al., 2016; Hojat, 1982; Hughes et al., 2004; Igarashi, 2019; Igbokwe et al., 2020; Jakobsen et al., 2020; O. Kim, 1999a, 1999b; Y. Kim et al., 2020; Knight et al., 1988; Kong et al., 2015; Kurina et al., 2011; Lamm & Stephan, 1987; Lee & Cagle, 2017; Lukács et al., 2019; Matthews-Ewald & Zullig, 2013; McWhirter, 1990; Nazzal et al., 2018; Neto, 2014; Niu et al., 2018; Oshagan & Allen, 1992; Park et al., 2019; Penning et al., 2014; Pretorius, 1993; Robinson-Whelen et al., 2016; Russell, 1996; Russell et al., 1980; Dan Russell et al., 1978; Saito et al., 2019; Sancho et al., 2020; Shi et al., 2016; Shorey et al., 2019; Solano, 1980; Stancliffe et al., 2014; Stephan et al., 1988; Steptoe et al., 2004; Sun & Chang, 2021; Velotti et al., 2021; Wang et al., 2018; Wang et al., 2001; Wilson et al., 1992; Wittenborn et al., 2020; Wongpakaran et al., 2020; Wu & Yao, 2008; Yu et al., 2020; Zakahi & Duran, 1982; Zarei et al., 2016). The PRISMA flow diagram of the study selection process with reasons for excluding studies is shown in Fig. 1.

Characteristics of Included Studies

The 81 eligible studies were conducted between 1978 and 2021 and included 104,387 participants aged 18–97 years. The study sample size ranged from 20 to 50,054 participants. A summary description of the included studies is presented in Table 1 per version of the UCLA-LS, and Online Resource 4 per study.

Description of UCLA Loneliness Scale

Three versions of the 20-item (original, revised, and version 3) and nine short versions, UCLA-16, UCLA-11, UCLA-10, UCLA-8, UCLA-7, UCLA-6, UCLA-5, UCLA-4, and UCLA-3 of the UCLA-LS were identified in the 81 included studies. The characteristics and assessment of the UCLA-10 and UCLA-6 were divided into sub-versions because each study included a different set of items. A detailed description of each scale is presented in Table 1 and Online Resource 4.

Methodological Quality and Psychometric Properties of the Studies

A qualitative synthesis was used to report the results on the psychometric properties of the included studies. Results of the included studies were summarized based on the assessed psychometric measures (validity and reliability) and the study quality ratings. The UCLA-LS development process was rated as inadequate due to the lack of information on the comprehensiveness and comprehensibility of the instrument, as well as the lack of content validity studies.

Validity of Long and Short Versions of UCLA-LS

Results on validity assessment are presented in Online Resource 5, and the overall quality assessment is summarized in Table 2. The structural validity was assessed for all UCLA-LS versions except the original UCLA-20 (Dan Russell et al., 1978; Solano, 1980) and UCLA-5 (Lamm & Stephan, 1987). Based on the confirmatory factor (CFA) and Rasch analyses, high-quality evidence of sufficient structural validity was available for the UCLA-11(Lee & Cagle, 2017) and UCLA-10 (all sub-versions) (Elphinstone, 2018; Knight et al., 1988; Russell, 1996) on a multidimensional scale (two-factor model) and the UCLA-7 (Allen & Oshagan, 1995; Elphinstone, 2018; Oshagan & Allen, 1992), UCLA-6 (Nazzal et al., 2018; Neto, 2014; Wongpakaran et al., 2020; Wu & Yao, 2008), and UCLA-4 (Elphinstone, 2018) on a unidimensional scale (one-factor model). Low to moderate-quality evidence of sufficient structural validity was available for the Revised UCLA-20 (Çinar & Toker, 2019; Dussault et al., 2009; Hartshorne, 1993; Park et al., 2019; Penning et al., 2014) and version 3 UCLA-20 (Boffo et al., 2012; Durak & Senol-Durak, 2010; Elphinstone, 2018; Russell, 1996; Sancho et al., 2020; Zarei et al., 2016) on a multidimensional scale (three-factor model) and for the UCLA-8 (Doğan et al., 2011; Elphinstone, 2018; Wu & Yao, 2008) on a unidimensional scale (one-factor model). Low to moderate-quality evidence of insufficient structural

Fig. 1 PRISMA flow diagram showing study selection process
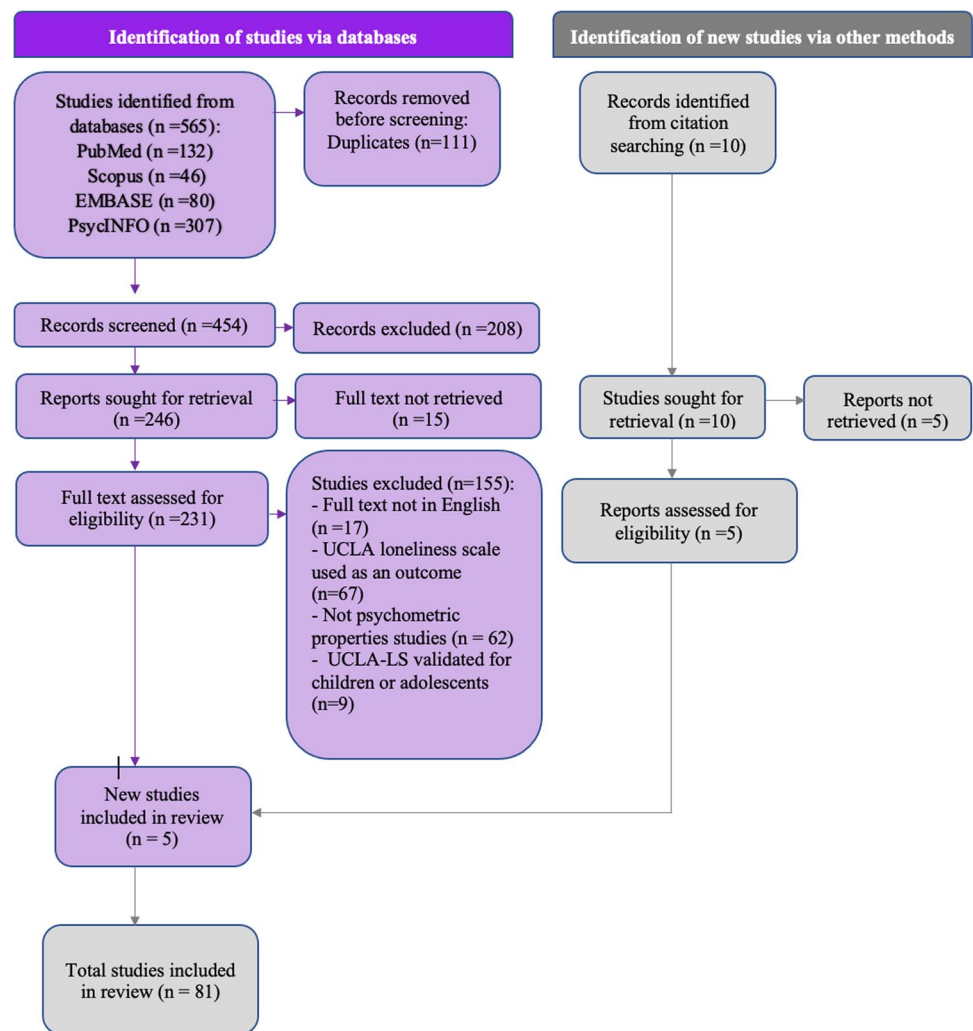
validity was available for the UCLA-6 (Niu et al., 2018), UCLA-3 (Chalise et al., 2007, 2010; Jakobsen et al., 2020; Matthews-Ewald & Zullig, 2013), and UCLA-16 (Faustino et al., 2019) as indicated by the Rasch and exploratory factor analyses (EFA) (Online Resource 5).

Construct validity was assessed for all UCLA-LS versions except UCLA-11. Moderate quality evidence of sufficient convergent validity was available for the original UCLA-20 (Dan Russell et al., 1978; Solano, 1980), UCLA-16 (Faustino et al., 2019), and UCLA-6 (Nazzal et al., 2018; Neto, 2014). Moderate quality evidence of sufficient discriminative validity was available for the original UCLA-20 (Dan Russell et al., 1978; Solano, 1980), UCLA-16 (Faustino et al., 2019), UCLA-10 (Knight et al., 1988; D. W. Russell, 1996), UCLA-8 (Hays & DiMatteo, 1987; Wilson et al., 1992), UCLA-4 (Hays & DiMatteo, 1987; Wilson et al., 1992), and UCLA-3 (Chalise et al., 2007; Hawkley et al., 2020; Igarashi, 2019; Matthews-Ewald & Zullig, 2013; Robinson-Whelen et al., 2016). Low quality evidence of sufficient criterion validity was available for the revised

UCLA-20 (Anderson & Malikiosi-Loizos, 1992), UCLA-8 (Doğan et al., 2011; Hays & DiMatteo, 1987; Wilson et al., 1992), UCLA-6 (Nazzal et al., 2018; Neto, 2014), and UCLA-3 (Arimoto & Tadaka, 2019; Hughes et al., 2004; Igarashi, 2019), and lastly, high quality evidence of sufficient cross-cultural validity was available for the UCLA-6 (Wongpakaran et al., 2020) (Table 2, Online Resource 5).

Reliability of Long and Short Versions of UCLA-LS

The internal consistency (Cronbach's Alpha) was assessed for all UCLA-LS versions. Results revealed sufficient internal consistency of all versions except for the original UCLA-20 (Ergün et al., 2020; Gillespie et al., 2021; Dan Russell et al., 1978; Solano, 1980) and UCLA-5 (Lamm & Stephan, 1987) due to lack of studies on structural validity. The quality of evidence ranged from high (UCLA-7 (Elphinstone, 2018; Oshagan & Allen, 1992) and UCLA-6 (Elemo et al., 2020; Nazzal et al., 2018; Neto, 2014)) to very low. Test re-test reliability was assessed for the revised UCLA-20

Table 1 Characteristics of UCLA-LS per Version

Scale version (References)	Countries / Societies	Population: N, M:F, Age	Scale characteristics: Number of items, Response options, Range of scoring
Original UCLA-20 (Ergün et al., 2020; Gillespie et al., 2021; Dan Russell et al., 1978; Solano, 1980)	USA, UK, Turkey	N=2372 M:F=1008:1342 Age, range=18–70 years	- 20 items, all negatively worded - 4-point scale (1: I never feel this way; 2: I rarely feel this way; 3: I sometimes feel this way; 4: I often feel this way) - 20–80 points, high scores indicate greater loneliness
Revised UCLA-20 (Anderson & Malikiosi-Loizos, 1992; Auné et al., 2019; Austin, 1983; Chang et al., 2017; Chou, 2005; Çınar & Toker, 2019; Dussault et al., 2009; Hackett et al., 2012, 2019; Hartshorne, 1993; Hays & DiMatteo, 1987; Hojat, 1982; Hughes et al., 2004; O. Kim, 1999b, 1999a; Y. Kim et al., 2020; Knight et al., 1988; Lamm & Stephan, 1987; McWhirter, 1990; Nazzal et al., 2018; Neto, 2014; Park et al., 2019; Penning et al., 2014; Pretorius, 1993; D Russell et al., 1980; Stephan et al., 1988; Steptoe et al., 2004; Wilson et al., 1992; Zakahi & Duran, 1982)	USA, Iran, Germany, New Zealand, Greece, Zimbabwe, South Africa, Korea, UK, China, Canada, Portugal, Hungary, Palestine, Argentina, Turkey	N=12,601 M:F=5680:6403 Age, range=16–90 years	- Revised version of the original UCLA-LS Russell et al., 1978 - Ten negatively & ten positively worded items - Positively worded items to be reversed before scoring
Version 3 UCLA-20 (Adams et al., 2004; Arimoto & Tadaka, 2019; Balandin et al., 2006; Boffo et al., 2012; Britton & Conner, 2007; Durak & Senol-Durak, 2010; Elphinstone, 2018; Hagger & Riley, 2019; Kong et al., 2015; D. W. Russell, 1996; Saito et al., 2019; Sancho et al., 2020; Shi et al., 2016; Stancliffe et al., 2014; Sun & Chang, 2021; Velotti et al., 2021; Wang et al., 2001; Zarei et al., 2016)	USA, Taiwan, Australia, Turkey Italy, China, Iran, Japan, UK Spain	N=8355 M:F=2789:5141 Age, range=18–98 years	- 20-item, 4-point scale from never (1) to always (4) - 20-80 points, high scores indicate greater loneliness - Consists of 11 negatively worded items and nine positively worded items with reverse scoring - Replaced difficult words with simple ones, added the statement "How often do you feel" at the beginning of each question
UCLA-16 (Faustino et al., 2019)	Portugal	N=154 M: F=63:91 Age, range=61–98 years	-16-item, derived from the Version –3 UCLA-20 - Divided into two factors: social isolation & affinity - 4-point scale from never (1) to often (4)
UCLA-11 (Lee & Cagle, 2017)	USA	N=3806 M: F=1598: 2208 Age, mean (SD)=75 (7) years	- 11-item derived from the Revised UCLA-20 - Seven positively and four negatively worded items - 4-point scale from never (1) to often (4) - 11–44, high scores indicate greater loneliness
UCLA-10 From A (Elphinstone, 2018; Knight et al., 1988)	New Zealand Australia	N=1736 M: F=795:941 Age, range=16–89 years	- 10-item, derived from the Revised UCLA-20 - Each form comprised of five positively and five negatively worded items - Items number 1, 2, 4, 6, 7, 8, 11, 16, 18, & 19

Table 1 (continued)

Scale version (References)	Countries / Societies	Population: N, M:F, Age	Scale characteristics: Number of items, Response options, Range of scoring
UCLA-10 From B (Elphinstone, 2018; Knight et al., 1988)	New Zealand Australia	N=1736 M: F=795:941 Age, range=16–89 years	- 10-item, derived from the Revised UCLA-20 - Each form comprised of five positively and five negatively worded items - Items number 3, 5, 9, 10, 12, 13, 14, 15, 17, & 20
UCLA-10 (Arimoto & Tadaka, 2019; Elphinstone, 2018; Hansen et al., 2012; Heisel et al., 2016; Russell, 1996; Shorey et al., 2019; Wittenborn et al., 2020)	USA, Canada, Australia, Japan Singapore	N=2060 M: F=747:1313 Age, range=18–95 years	- 10-item, derived from the Version-3 UCLA-20 - Items #: 2, 6, 10, 11, 13, 14, 16, 18, 19, & 20 - 4-point scale from never (1) to always (4) - 10–40 scores, high scores indicate greater loneliness
UCLA-8 (Doğan et al., 2011; Elphinstone, 2018; Gan et al., 2015; Hays & DiMatteo, 1987; Igbokwe et al., 2020; Wang et al., 2018; Wilson et al., 1992; Wu & Yao, 2008)	USA, Zimbabwe, Taiwan, Turkey, China, Australia, Nigeria	N=4027 M:F=2194:1831 Age, range=17–94 years	- 8-item, derived from the Revised UCLA-20 - Six negatively and two positively worded items - 4-point scale (1–4) - 8 – 32, high scores indicate greater loneliness
UCLA-7 (Allen & Oshagan, 1995; Elphinstone, 2018; Oshagan & Allen, 1992)	USA Australia	N=1691 M:F=659:1032 Age, range=18–87 years	- 7-item, derived from the Revised UCLA-20 - All negatively worded items (2, 3, 11, 12, 13, 14, & 18)
UCLA-6 (Wu & Yao, 2008)	Taiwan	N=130 M: F=58:72 Age, mean (SD)=20 (2) years	- 6-item derived from the 8-item scale - Items #: 2, 3, 11, 24, 15, & 17
UCLA-6 (Elemo et al., 2020; Nazzal et al., 2018; Neto, 2014)	Portugal Palestine Ethiopia	N=1749 M: F=832:917 Age, range=18–90 years	- Six items derived from the Revised UCLA-20 - Items #: 2, 5, 11, 14, 17, & 18 - Item two should be reversed before scoring - 4-point scale from never (1) to often (4) - 6-24 scores, high scores indicate greater loneliness
UCLA-6 (Niu et al., 2018)	China	N=484, M: F=272:212 Age, mean (SD)=74 (8) years	- 6-item, derived from the 8-item scale (Hays & DiMatteo, 1987) - Items #: 2, 3, 11, 14, 17, & 18
UCLA-6 (Wongpakaran et al., 2020)	Thailand	N=719 M: F=280:439 Age, mean (SD)=28 (8) years	- 6-item, derived from version-3 UCLA-20 - Includes items number 2, 4, 7, 11, 13 & 18
UCLA-5 (Lamm & Stephan, 1987)	Germany	N=154, M: F=56:98 Age, mean=23	- 5-item, derived from the Revised UCLA-20 - Items number 2, 13, 14, 17, & 18
UCLA-4 (Elphinstone, 2018; Hays & DiMatteo, 1987; Russell et al., 1980; Wilson et al., 1992)	USA, Zimbabwe Australia	N=1873 M: F=1003:870 Age, range=17–72 years	- 4 items, derived from the revised UCLA-20 - Items #: 1, 13, 15, & 18 - 4-point scale (from 1 to 4) -4-16 points, high scores indicate greater loneliness

Table 1 (continued)

Scale version (References)	Population: N, M:F, Age	Countries / Societies	Scale characteristics: Number of items, Response options, Range of scoring
UCLA-3 (Anderssen et al., 2020; Arimoto & Tadaka, 2019; Caballer et al., 2020; Chalise et al., 2007, 2010; Cole et al., 2015; Elphinstone, 2018; Grey et al., 2020; Hawkley et al., 2020; Hughes et al., 2004; Igarashi, 2019; Jakobsen et al., 2020; Kurina et al., 2011; Lukács et al., 2019; Matthews-Ewald & Zullig, 2013; Robinson-Whelen et al., 2016; Saito et al., 2019; Yu et al., 2020)	N = 79,261 M: F = 23,071:44627 Age, range = 18–97 years	USA, Nepal, Australia, Japan, Hungary, Norway Spain, Lebanon UAE, UK, Denmark	- 3-item, derived from the revised UCLA-LS (How often do you feel lack of companionship?/ How often do you feel left out? & How often do you feel isolated from others?) - 3-point scale: hardly ever (1), some of the time (2), & often (3); 3–9, high scores indicate greater loneliness

UCLA-LS: University of California, Los Angeles- loneliness scale, N: sample size, M: male, F: female, SD: standard deviation, USA: United States, UK: United Kingdom, UAE: United Arab Emirates

(Hartshorne, 1993; Hojat, 1982; Stephan et al., 1988), version 3 UCLA-20 (Balandin et al., 2006; Britton & Conner, 2007; Russell, 1996; Zarei et al., 2016), and UCLA-3 (Cole et al., 2015). Moderate quality evidence of sufficient reliability was available for version 3 UCLA-20 (Balandin et al., 2006; Britton & Conner, 2007; Russell, 1996; Zarei et al., 2016) with excellent Interclass Correlation Coefficient (ICC) values of 0.76–0.93. A summary of results for internal consistency and test re-test reliability is presented in Online Resource 6, and the overall quality evidence is summarized in Table 3.

Cross-Cultural Adaption of UCLA-LS

Table 4 displays the ratings of the translation and cross-cultural adaptations of 12 studies across ten countries and societies including Iran, Greece, Korea, Taiwan, Nepal, Turkey, Italy, Japan, Spain, and Thailand. None of these studies followed 100% of the recommended cross-cultural adaptation guidelines when performing the initial translation, synthesis, back-translation, and expert committee review. However, two studies (Sancho et al., 2020; Zarei et al., 2016) followed the guidelines for the initial translation of version 3 UCLA-LS, and one study (Zarei et al., 2016) included an expert committee to review version 3 UCLA-LS (Table 4).

Discussion

Selecting the most appropriate instrument to assess loneliness and to evaluate the outcome of approaches to its management is essential in clinical research and practice. Information on the methodological quality of such instruments helps inform which outcome measures have the most robust psychometric properties. In this systematic review, we evaluated the psychometric properties and cross-cultural adaptation of the 20-item and all short forms of the UCLA-LS. We synthesized the current evidence from 81 studies and identified three versions of the 20-item and nine short versions of the UCLA-LS. Validity and reliability studies were supportive of the use of the UCLA-LS for assessing loneliness in adults.

Content validity is especially important as it reflects how items are representative of the construct to be measured (Mokkink et al., 2018; Prinsen et al., 2018; Terwee et al., 2018). However, the lack of studies on the scale developmental process and content validity prevented an assessment of content validity. The internal structure of the outcome measure was determined from its structural validity, internal consistency, and cross-cultural validity. To assess the structural validity of a scale, CFA and EFA are the commonly used statistical methods. However, CFA is preferred over the EFA because it tests whether measures

Table 2 Validity results summary and evidence quality of UCLA-LS versions

Scale version	Structural N (n)	Structural RoB RR	Structural GRADE	Conv & div N (n)	r, conv	Conv RoB RR	Conv GRADE	Discrim N (n)	Discrim RoB RR	Discrim GRADE	Cross-cultural N (n)	CC RoB RR	CC GRADE	Criterion N (n)	Crit RoB RR	Crit GRADE
Original UCLA-20				497 (2)	0.30–0.79	A +	M[4]	497 (2)	D +	M[1]						
Revised UCLA-20	2525 (5)	Vg +	L[5]	2837 (11)	0.30–0.71	A +	L[5]	2275 (6)	A +	L[5]	1648 (3)	D +	VL[1,5]	127 (1)	D +	L[2]
Version 3 UCLA-20 One-dimension	248 (1)	Vg -	H	4445 (4)	0.30–0.71	Vg +	L[5]	1754 (5)	D +	L[1,4]						
Multi-dimensions	3487 (6)	+	L[5]													
UCLA-16	154 (1)	A -	M[1]	154 (1)	0.31–0.48	A +	M[1]	154 (1)	A +	M[1]						
UCLA-11	3706 (1)	Vg +	H													
UCLA-10, A (Knight et al., 1988)	758 (1)	Vg +	H	758 (1)	0.34–0.71	A -	L[1,4]	978 (1)	A +	M[1]				978 (1)	I +	VL[3]
UCLA-10, B (Knight et al., 1988)	758 (1)	Vg +	H	758 (1)	0.36–0.74	A -	L[1,4]	978 (1)	A +	M[1]				978 (1)	I +	VL[3]
UCLA-10 (Russell et al., 1996)	1074 (2)	Vg +	H	1322 (3)	0.31–0.70	A -	L[5]	316 (1)	A +	M[1]				248 (1)	I +	VL[3]
UCLA-8	1441 (3)	Vg +	M[4]	1640 (4)	0.31–0.64	A +	L[5]	953 (1)	A +	M[1]				1506 (3)	I +	L[2]
UCLA-7	1691 (3)	Vg +	H	758 (1)	0.30–0.67	A -	L[1,4]	619 (1)	D +	VL[2,5]	933 (2)	D +	M[1]			
UCLA-6 (Wu & Yao, 2008)	130 (1)	Vg +	H													
UCLA-6 (Neto, 2014)	1442 (2)	Vg +	H	1442 (2)	0.40–0.66	A +	M[4]	1442 (1)	A +	L[1,4]				1442 (2)	I +	L[2]
UCLA-6 (Niu et al., 2018)	484 (1)	D -	L[2]	484 (1)	0.34–0.52	A +	VL[1,5]	484 (1)	A +	L[1,4]						
UCLA-6 (Wongpakaran et al., 2020)	719 (1)	Vg +	H	719 (1)	0.30–0.77	A -	VL[1,5]	719 (1)	Vg -	H	719 (1)	Vg +	H	719 (1)	I +	VL[3]
UCLA-5				154 (1)	0.36–0.71	A +	L[1,4]									
UCLA-4	758 (1)	Vg +	H	957 (2)	0.30–0.67	A +	L[5]	953 (1)	A +	M[1]				953 (2)	I +	VL[2,4]
UCLA-3	1672 (4)	D -	M[1]	10,020 (9)	0.32–0.65	A +	L[5]	175 (1)	Vg +	M[4]	9263 (1)	Vg -	H	977 (3)	I +	L[2]

RR: Results rating: (+) sufficient, (−) insufficient, (?) indeterminate. The quality of evidence was downgraded for: 1. Serious risk of bias, 2. Very serious risk of bias, 3. Extremely serious risk of bias, 4. Serious inconsistency, 5. Very serious inconsistency, 6. Based on structural validity. UCLA-LS: University of California, Los Angeles Loneliness Scale, N: sample size, (n): number of studies included in the decision process, RoB: risk of bias (Vg: very good, A, adequate, D: doubtful, I: inadequate), GRADE: Grading of Recommendations Assessment, Development, and Evaluation (H: high, M: moderate, L: low, VL: very low), r: Pearson's correlation for convergent validity

Table 3 Reliability results summary and evidence quality of UCLA-LS versions

Scale version	Internal consistency				Test-retest			
	Cronbach's Alpha	N (n)	RoB RR	GRADE	ICC/ r	N (n)	RoB RR	GRADE
Original UCLA-20	0.82–0.96	2372 (5)	D ?	M[1]				
Revised UCLA-20	0.79–0.90	1474 (4)	Vg +	L[6]	r=0.72–0.85	113 (2)	D ?	M[1]
Version 3 UCLA-20	0.71–0.95	1279 (3)	Vg +	L[6]	ICC=0.76–0.93	738 (4)	D +	M[1]
UCLA-16	0.92–0.93	154 (1)	Vg +	M[6]				
UCLA-11	0.87	3706 (1)	I +	VL[3]				
UCLA-10 (Knight et al., 1988, A)	0.86–0.89	1736 (2)	I +	L[2]				
UCLA-10 (Knight et al., 1988, B)	0.83–0.90	1736 (2)	I +	L[2]				
UCLA-10 (Russell et al., 1996)	0.85–0.97	986 (5)	D +	M[1]				
UCLA-8	0.57–0.90	4027 (8)	Vg +	L[4,6]				
UCLA-7	0.85–0.90	1072 (2)	Vg +	H				
UCLA-6 (Neto, 2014)	0.73–0.82	1749 (3)	Vg +	H				
UCLA-6 (Niu et al., 2018)	0.91–0.94	484 (1)	Vg +	L[6]				
UCLA-6 (Wongpakaran et al., 2020)	0.72–0.84	719 (1)	Vg +	H				
UCLA-5	0.84	154 (1)	D ?	L[2]				
UCLA-4	0.38–0.94	1873 (4)	Vg +	M[4]				
UCLA-3	0.67–0.88	72,111 (17)	Vg +	L[4,6]	r=0.62	108 (1)	D ?	L[2]

RR: Results rating: (+) sufficient, (−) insufficient, (?) indeterminate. The quality of evidence was downgraded for: 1. Serious risk of bias, 2. Very serious risk of bias, 3. Extremely serious risk of bias, 4. Serious inconsistency, 5. Very serious inconsistency, 6. Based on structural validity. UCLA-LS: University of California, Los Angeles Loneliness Scale, N: sample size, n: number of studies included in the decision process, RoB: risk of bias (Vg: very good, A, adequate, D: doubtful, I: inadequate), GRADE: Grading of Recommendations Assessment, Development, and Evaluation (H: high, M: moderate, L: low, VL: very low), ICC: interclass correlation coefficient, r: Pearson's correlation

of a construct are consistent with a priori hypotheses and confirm the factor structure of a set of observed variables (model fit). Besides, the internal consistency assesses the degree of the interrelatedness among the items on a scale while the cross-cultural validity examines whether respondents from different groups respond similarly to a particular item (measurement invariance) (Mokkink et al., 2018; Prinsen et al., 2018; Terwee et al., 2018). Based on these parameters, high to moderate-quality evidence supported sufficient internal structure of the short versions UCLA-10, UCLA-8, UCLA-7, UCLA-6, and UCLA-4, while low-quality evidence supported sufficient internal

structure of the long versions (Revised UCLA-20 and version 3 UCLA-20) of the UCLA-LS, to encourage the use of these versions in loneliness-related research and clinical practice.

Good test re-test reliability reflects the internal validity of the outcome measure and ensures that the repeated measurements are stable over time (Mokkink et al., 2018; Prinsen et al., 2018; Terwee et al., 2018). There were limited and indeterminate reports on test re-test reliability because of unclear test conditions, lack of ICC values, and inadequate measurement intervals between the two administrations of the scale. However, only version 3 UCLA-20

Table 4 Cross-cultural adaptations of UCLA-LS into different languages

Author & year (Countries/Societies, Languages)	UCLA-LS	Forward translation	Synthesis	Back translation	Expert committee review	Pretesting	Submission to developers or coordinating committee
Hojat 1980 (Iran, Persian)	Revised UCLA-20	?	0	0	0	?	?
Anderson & Malikiosi-loizos, 1992 (Greece, Greek)	Revised UCLA-20	?	0	?	0	?	0
Kim, 1999 (Korea, Korean)	Revised UCLA-20	?	0	?	0	0	?
Wang et al., 2001 (Taiwan, Chinese)	Version-3 UCLA-20	0	0	0	0	?	0
Chalise et al., 2007 (Nepal, Nepalese)	UCLA-3	?	0	?	0	?	0
Wu & Yao, 2008 (Taiwan, Chinese)	UCLA-8	0	0	0	0	0	0
Durak & Senol-Durak, 2010 (Turkey, Turkish)	Version-3 UCLA-20	?	0	?	?	0	0
Boffo et al., 2012 (Italy, Italian)	Version-3 UCLA-20	?	0	?	0	0	0
Zarei et al., 2016 (Iran, Farsi)	Version-3 UCLA-20	+	?	?	+	?	0
Igarashi, 2019 (Japan, Japanese)	UCLA-3	?	0	?	?	0	0
Sancho et al., 2020 (Spain, Spanish)	Version-3 UCLA-20	+	?	?	?	?	0
Wongpakaran et al., 2020 (Thailand, Thai)	Revised UCLA-20	?	0	?	0	?	?

(+): Positive rating; (0): no information available, (?): indeterminate [inadequate methods used or insufficient scoring on subcategories to obtain positive rating]. UCLA-LS: University of California, Los Angeles Loneliness Scale

demonstrated moderate-quality evidence of sufficient test re-test reliability with excellent ICC values.

Sufficient construct validity is necessary to ensure that the intended theoretical construct and results are consistent with the hypotheses (Mokkink et al., 2018; Prinsen et al., 2018; Terwee et al., 2018). Although we noted low- to moderate-quality evidence of sufficient construct validity for some of the scales, the quality of evidence was reduced due to the risk of bias and inconsistency of study results.

Many of the UCLA-LS versions such as the revised UCLA-20, version 3 UCLA-20, UCLA-8, and UCLA-3 were translated into multiple languages (e.g., Chinese, Turkish, Persian, Spanish, and Thai) and culturally adapted across several countries and societies (e.g., Greece, Italy, Japan, Taiwan, Korea, and Nepal). Additionally, the psychometric properties of the translated UCLA-LS versions were evaluated and reported by several studies. However, there was insufficient information about their cross-cultural adaptation because many of these studies were not available in English (Çinar & Toker, 2019; Lamm & Stephan, 1987; Nazzal et al., 2018; Stephan et al., 1988).

The UCLA-LS has been validated for use in individuals with different clinical conditions. For instance, the validity and reliability of version 3 UCLA-20 and UCLA-3 were assessed in patients with cerebral palsy (Balandin et al., 2006), opioid dependence (Britton & Conner, 2007), physical and mental disabilities (Stancliffe et al., 2014), stroke and brain tumors (Hagger & Riley, 2019). It has also been assessed among those with obesity, hypertension and sleep apnea (Chalise et al., 2007; Kurina et al., 2011). Besides, the internal consistency of the original UCLA-20, revised UCLA-20, UCLA-10 and UCLA-8 were assessed in patients with COVID-19 (Gillespie et al., 2021), diabetes (Hackett et al., 2019), hypertension and cardiovascular diseases (Gan et al., 2015), and AIDS (Hansen et al., 2012). However, the insufficient information in these studies precluded a robust conclusion about the suitability of these versions for use in the corresponding clinical populations. Studies among those with chronic medical conditions such as chronic lung disease are lacking despite the high prevalence of loneliness among such patients (Reijnders et al., 2018).

Despite the large number of studies on physical, mental, and social interventions on loneliness (Ma et al., 2020), information on responsiveness has been consistently lacking. Such information is valuable when tracking change with time (Mokkink et al., 2018; Prinsen et al., 2018; Terwee et al., 2018).

Review Limitations

A limitation of this review is the exclusion of 17 non-English articles, which might have yielded important additional information regarding scale development, content validity, cross-adaptation, and translation. Direct comparisons were limited by the many sub-versions of the UCLA-10 and UCLA-6, thereby preventing clear conclusions regarding their psychometric properties. We were aware of the small risk of publication bias by excluding conference posters and abstracts. However, the results of this systematic review were qualitatively summarized. As a result, no meta-analysis was conducted, and the possibility of publication bias was not assessed.

Conclusion

This is the first systematic review that provides a detailed assessment of the psychometric properties of the 20-item UCLA-LS and its subsequent abbreviated versions, spanning multiple languages, cultures, and social circumstances. High-quality evidence supports sufficient internal structure of the UCLAs: 10, 7, 6, and 4, suggesting that these short versions would best serve those interested in loneliness-related research and clinical practice. Future studies are required to assess the responsiveness, cross-cultural and criterion validity of the UCLA-LS among a broad variety of clinical and social populations. This information will further increase our understanding of the psychometric properties of this outcome measure.

Declarations

References

Adams, K. B., Sanders, S., & Auth, E. A. (2004). Loneliness and depression in independent living retirement communities: Risk and resilience factors. *Aging & Mental Health, 8*(6), 475–485.

Allen, R. L., & Oshagan, H. (1995). The UCLA loneliness scale: Invariance of social structural characteristics. *Personality and Individual Differences, 19*(2), 185–195.

Anderson, L. R., & Malikiosi-Loizos, M. (1992). Reliability data for a Greek translation of the revised UCLA loneliness scale: Comparisons with data from the USA. *Psychological Reports, 71*(2), 665–666.

Anderssen, N., Sivertsen, B., Lønning, K. J., & Malterud, K. (2020). Life satisfaction and mental health among transgender students in Norway. *BMC Public Health, 20*(1), 1–11.

Arimoto, A., & Tadaka, E. (2019). Reliability and validity of Japanese versions of the UCLA loneliness scale version 3 for use among mothers with infants and toddlers: A cross-sectional study. *BMC Women's Health, 19*(1), 1–9.

Auné, S. E., Abal, F. J. P., & Attorresi, H. F. (2019). Construction and psychometric properties of the loneliness scale in adults. *International Journal of Psychological Research, 12*(2), 82–90.

Austin, B. A. (1983). Factorial structure of the UCLA loneliness scale. *Psychological Reports, 53*(3), 883–889.

Balandin, S., Berg, N., & Waller, A. (2006). Assessing the loneliness of older people with cerebral palsy. *Disability and Rehabilitation, 28*(8), 469–479.

Beaton, D. E., Bombardier, C., Guillemin, F., & Bosi Ferraz, M. (2000). Guidelines for the process of cross-cultural adaptation adaptation of self-report measures. *SPINE, 25.* https://doi.org/10.1097/00007632-200012150-00014

Boffo, M., Mannarini, S., & Munari, C. (2012). Exploratory structure equation modeling of the UCLA loneliness scale: A contribution to the Italian adaptation. *TPM: Testing, Psychometrics, Methodology in Applied Psychology, 19*(4), 345–363.

Britton, P. C., & Conner, K. R. (2007). Reliability of the UCLA loneliness scale in opiate dependent individuals. *Journal of Personality Assessment, 88*(3), 368–371.

Caballer, A., Belmonte, O., Castillo, A., Gasco, A., Sansano, E., & Montoliu, R. (2020). Equivalence of chatbot and paper-and-pencil versions of the De Jong Gierveld loneliness scale. *Current Psychology*, 1–8.

Chalise, H. N., Saito, T., & Kai, I. (2007). Correlates of loneliness among older Newar adults in Nepal. *Nihon Koshu Eisei Zasshi (Japanese Journal of Public Health), 54*(7), 427–433.

Chalise, H. N., Kai, I., & Saito, T. (2010). Social support and its correlation with loneliness: A cross-cultural study of Nepalese older

adults. *The International Journal of Aging and Human Development, 71*(2), 115–138.

Chang, E. C., Chang, O. D., Martos, T., Sallay, V., Lee, J., Stam, K. R., Batterbee, C. N.-H., & Yu, T. (2017). Family support as a moderator of the relationship between loneliness and suicide risk in college students: Having a supportive family matters! *The Family Journal, 25*(3), 257–263.

Chou, K.-L. (2005). Assessing shyness in Chinese older adults. *Aging & Mental Health, 9*(5), 456–460.

Çinar, F., & Toker, K. (2019). An examination of the effect of loneliness on the innovative behavior of health science faculty students. *Chinese Medical Journal, 132*(2), 171.

Cole, S. W., Levine, M. E., Arevalo, J. M. G., Ma, J., Weir, D. R., & Crimmins, E. M. (2015). Loneliness, eudaimonia, and the human conserved transcriptional response to adversity. *Psychoneuroendocrinology, 62*, 11–17.

Doğan, T., Çötok, N. A., & Tekin, E. G. (2011). Reliability and validity of the Turkish version of the UCLA loneliness scale (ULS-8) among university students. *Procedia-Social and Behavioral Sciences, 15*, 2058–2062.

Durak, M., & Senol-Durak, E. (2010). Psychometric qualities of the UCLA loneliness scale-version 3 as applied in a Turkish culture. *Educational Gerontology, 36*(10–11), 988–1007.

Dussault, M., Fernet, C., Austin, S., & Leroux, M. (2009). Revisiting the factorial validity of the revised UCLA loneliness scale: A test of competing models in a sample of teachers. *Psychological Reports, 105*(3), 849–856.

Elemo, A. S., Satici, S. A., & Griffiths, M. D. (2020). The fear of COVID-19 scale: Psychometric properties of the Ethiopian Amharic version. *International Journal of Mental Health and Addiction*, 1–12.

Elphinstone, B. (2018). Identification of a suitable short-form of the UCLA-loneliness scale. *Australian Psychologist, 53*(2), 107–115.

Ergün, N., Göksu, İ., & Sakız, H. (2020). Effects of phubbing: Relationships with psychodemographic variables. *Psychological Reports, 123*(5), 1578–1613.

Faustino, B., Lopes, P., Oliveira, J., Campaioli, G., Rondinone, M., Bomfim, H., & Germano, L. (2019). Psychometric and rash analysis of the UCLA loneliness Scale-16 in a Portuguese sample of older adults. *Psychological Studies, 64*(2), 140–146.

Gan, P., Xie, Y., Duan, W., Deng, Q., & Yu, X. (2015). Rumination and loneliness independently predict six-month later depression symptoms among Chinese elderly in nursing homes. *PLoS One, 10*(9), e0137176.

Gerst-Emerson, K., & Jayawardhana, J. (2015). Loneliness as a public health issue: The impact of loneliness on health care utilization among older adults. *American Journal of Public Health, 105*(5), 1013–1019.

Gillespie, S. M., Jones, A., Uzieblo, K., Garofalo, C., & Robinson, E. (2021). Coping using sex during the coronavirus disease 2019 (COVID-19) outbreak in the United Kingdom. *The Journal of Sexual Medicine, 18*(1), 50–62.

Grey, I., Arora, T., Thomas, J., Saneh, A., Tohme, P., & Abi-Habib, R. (2020). The role of perceived social support on depression and sleep during the COVID-19 pandemic. *Psychiatry Research, 293*, 113452.

Hackett, R. A., Hamer, M., Endrighi, R., Brydon, L., & Steptoe, A. (2012). Loneliness and stress-related inflammatory and neuroendocrine responses in older men and women. *Psychoneuroendocrinology, 37*(11), 1801–1809.

Hackett, R. A., Poole, L., Hunt, E., Panagi, L., & Steptoe, A. (2019). Loneliness and biological responses to acute stress in people with type 2 diabetes. *Psychophysiology, 56*(6), e13341.

Hagger, B. F., & Riley, G. A. (2019). The social consequences of stigma-related self-concealment after acquired brain injury. *Neuropsychological Rehabilitation, 29*(7), 1129–1148.

Hansen, N. B., Harrison, B., Fambro, S., Bodnar, S., Heckman, T. G., & Sikkema, K. J. (2012). The structure of coping among older adults living with HIV/AIDS and depressive symptoms. *Journal of Health Psychology, 18*(2), 198–211.

Hartshorne, T. S. (1993). Psychometric properties and confirmatory factor analysis of the UCLA loneliness scale. *Journal of Personality Assessment, 61*(1), 182–195.

Hawkley, L. C., Steptoe, A., Schumm, L. P., & Wroblewski, K. (2020). Comparing loneliness in England and the United States, 2014–2016: Differential item functioning and risk factor prevalence and impact. *Social Science & Medicine, 265*, 113467.

Hays, R. D., & DiMatteo, M. R. (1987). A short-form measure of loneliness. *Journal of Personality Assessment, 51*(1), 69–81.

Heisel, M. J., Neufeld, E., & Flett, G. L. (2016). Reasons for living, meaning in life, and suicide ideation: Investigating the roles of key positive psychological factors in reducing suicide risk in community-residing older adults. *Aging & Mental Health, 20*(2), 195–207.

Hojat, M. (1982). Psychometric characteristics of the UCLA loneliness scale: A study with Iranian college students. *Educational and Psychological Measurement, 42*(3), 917–925.

Hughes, M. E., Waite, L. J., Hawkley, L. C., & Cacioppo, J. T. (2004). A short scale for measuring loneliness in large surveys: Results from two population-based studies. *Research on Aging, 26*(6), 655–672.

Igarashi, T. (2019). Development of the Japanese version of the three-item loneliness scale. *BMC Psychology, 7*(1), 1–8.

Igbokwe, C. C., Ejeh, V. J., Agbaje, O. S., Umoke, P. I. C., Iweama, C. N., & Ozoemena, E. L. (2020). Prevalence of loneliness and association with depressive and anxiety symptoms among retirees in northcentral Nigeria: A cross-sectional study. *BMC Geriatrics, 20*(1), 1–10.

Jakobsen, I. S., Madsen, L. M. R., Mau, M., Hjemdal, O., & Friborg, O. (2020). The relationship between resilience and loneliness elucidated by a Danish version of the resilience scale for adults. *BMC Psychology, 8*(1), 1–10.

Kim, O. (1999a). Mediation effect of social support between ethnic attachment and loneliness in older Korean immigrants. *Research in Nursing & Health, 22*(2), 169–175.

Kim, O. (1999b). Predictors of loneliness in elderly Korean immigrant women living in the United States of America. *Journal of Advanced Nursing, 29*(5), 1082–1088.

Kim, Y., Vakula, M. N., Waller, B., & Bressel, E. (2020). A systematic review and meta-analysis comparing the effect of aquatic and land exercise on dynamic balance in older adults. *BMC Geriatrics, 20*(1), 1–14.

Knight, R. G., Chisholm, B. J., Marsh, N. V, & Godfrey, H. P. D. (1988). Some normative, reliability, and factor analytic data for the revised UCLA loneliness scale. Journal of Clinical Psychology, 44(2), 203–206.

Kong, X., Wei, D., Li, W., Cun, L., Xue, S., Zhang, Q., & Qiu, J. (2015). Neuroticism and extraversion mediate the association between loneliness and the dorsolateral prefrontal cortex. *Experimental Brain Research, 233*(1), 157–164.

Kurina, L. M., Knutson, K. L., Hawkley, L. C., Cacioppo, J. T., Lauderdale, D. S., & Ober, C. (2011). Loneliness is associated with sleep fragmentation in a communal society. *Sleep, 34*(11), 1519–1526.

Lamm, H., & Stephan, E. (1987). Loneliness among German university students: Some correlates. *Social Behavior and Personality: An International Journal, 15*(2), 161–164.

Lasgaard, M., Friis, K., & Shevlin, M. (2016). "Where are all the lonely people?" a population-based study of high-risk groups across the life span. *Social Psychiatry and Psychiatric Epidemiology, 51*(10), 1373–1384.

Lee, J., & Cagle, J. G. (2017). Validating the 11-item Revised University of California los Angeles scale to assess loneliness among older adults: An evaluation of factor structure and other measurement properties. *The American Journal of Geriatric Psychiatry, 25*(11), 1173–1183.

Lukács, A., Sasvári, P., Varga, B., & Mayer, K. (2019). Exercise addiction and its related factors in amateur runners. *Journal of Behavioral Addictions, 8*(2), 343–349.

Ma, R., Mann, F., Wang, J., Lloyd-Evans, B., Terhune, J., Al-Shihabi, A., & Johnson, S. (2020). The effectiveness of interventions for reducing subjective and objective social isolation among people with mental health problems: A systematic review. *Social Psychiatry and Psychiatric Epidemiology, 55*(7), 839–876.

Matthews-Ewald, M. R., & Zullig, K. J. (2013). Evaluating the performance of a short loneliness scale among college students. *Journal of College Student Development, 54*(1), 105–109.

McWhirter, B. T. (1990). Factor analysis of the revised UCLA loneliness scale. *Current Psychology, 9*(1), 56–68.

Mokkink, L. B., Prinsen, C., Patrick, D. L., Alonso, J., Bouter, L. M., de Vet, H. C., Terwee, C. B., & Mokkink, L. (2018). COSMIN methodology for systematic reviews of patient-reported outcome measures (PROMs). *User Manual, 78*, 1.

Nazzal, F. I., Cruz, O., & Neto, F. (2018). Psychometric analysis of the short-form UCLA loneliness scale (ULS-6) among Palestinian university students. *Interpersona, 11*(2), 113–125.

Neto, F. (2014). Psychometric analysis of the short-form UCLA loneliness scale (ULS-6) in older adults. *European Journal of Ageing, 11*(4), 313–319.

Niu, L., Jia, C., Ma, Z., Wang, G., Yu, Z., & Zhou, L. (2018). The validity of proxy-based data on loneliness in suicide research: A case-control psychological autopsy study in rural China. *BMC Psychiatry, 18*(1), 1–8.

Oshagan, H., & Allen, R. L. (1992). Three loneliness scales: An assessment of thier measurement properties. *Journal of Personality Assessment, 59*(2), 380–409.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., & Brennan, S. E. (2021). THE PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ, 372*(n71). https://doi.org/10.1136/bmj.n71

Park, I. H., Rachmatullah, A., Park, I.-S., & Liu, Y. (2019). Assessment of the quality and generalizability of the revised UCLA loneliness scale in Chinese and Korean community-dwelling elderly populations using item response theory (IRT)-Rasch modeling and hybrid IRT-logistic regression. *Educational Gerontology, 45*(10), 581–599.

Penning, M. J., Liu, G., & Chou, P. H. B. (2014). Measuring loneliness among middle-aged and older adults: The UCLA and de Jong Gierveld loneliness scales. *Social Indicators Research, 118*(3), 1147–1166.

Perlman, D., & Peplau, L. A. (1981). Toward a social psychology of loneliness. *Personal Relationships, 3*, 31–56.

Pretorius, T. B. (1993). The metric equivalence of the UCLA loneliness scale for a sample of South African students. *Educational and Psychological Measurement, 53*(1), 233–239.

Prinsen, C. A. C., Mokkink, L. B., Bouter, L. M., Alonso, J., Patrick, D. L., De Vet, H. C. W., & Terwee, C. B. (2018). COSMIN guideline for systematic reviews of patient-reported outcome measures. *Quality of Life Research, 27*(5), 1147–1157.

Reijnders, T., Schuler, M., Jelusic, D., Troosters, T., Janssens, W., Schultz, K., & von Leupoldt, A. (2018). The impact of loneliness on outcomes of pulmonary rehabilitation in patients with COPD. *COPD: Journal of Chronic Obstructive Pulmonary Disease, 15*(5), 446–453.

Rico-Uribe, L. A., Caballero, F. F., Martín-María, N., Cabello, M., Ayuso-Mateos, J. L., & Miret, M. (2018). Association of loneliness with all-cause mortality: A meta-analysis. *PLoS One, 13*(1), e0190033.

Robinson-Whelen, S., Taylor, H. B., Feltz, M., & Whelen, M. (2016). Loneliness among people with spinal cord injury: Exploring the psychometric properties of the 3-item loneliness scale. *Archives of Physical Medicine and Rehabilitation, 97*(10), 1728–1734.

Rokach, A. (2018). The effect of gender and culture on loneliness: A mini review. *Emerging Science Journal, 2*(2), 59–64.

Rokach, A. (2019). Loneliness in pre and post-operative cancer patients: A mini review. *Emerging Science Journal, 3*(1), 53–57.

Russell, D. W. (1996). UCLA loneliness scale (version 3): Reliability, validity, and factor structure. *Journal of Personality Assessment, 66*(1), 20–40.

Russell, D., Peplau, L. A., & Ferguson, M. L. (1978). Developing a measure of loneliness. *Journal of Personality Assessment, 42*(3), 290–294.

Russell, D., Peplau, L., & Cutrona, C. (1980). The revised UCLA loneliness scale: Concurrent and discriminant validity evidence. *Journal of Personality and Social Psychology, 39*(3), 472.

Saito, T., Cable, N., Aida, J., Shirai, K., Saito, M., & Kondo, K. (2019). Validation study on a Japanese version of the three-item UCLA loneliness scale among community-dwelling older adults. *Geriatrics & Gerontology International, 19*(10), 1068.

Sancho, P., Pinazo-Hernandis, S., Donio-Bellegarde, M., & Tomás, J. M. (2020). Validation of the University of California, Los Angeles Loneliness Scale (version 3) in Spanish older population: An application of exploratory structural equation modelling. *Australian Psychologist, 55*(3), 283–292.

Shi, R., Zhang, S., Zhang, Q., Fu, S., & Wang, Z. (2016). Experiential avoidance mediates the association between emotion regulation abilities and loneliness. *PLoS One, 11*(12), e0168536.

Shorey, S., Chee, C. Y. I., Ng, E. D., Lau, Y., Dennis, C.-L., & Chan, Y. H. (2019). Evaluation of a technology-based peer-support intervention program for preventing postnatal depression (part 1): Randomized controlled trial. *Journal of Medical Internet Research, 21*(8), e12410.

Solano, C. H. (1980). Two measures of loneliness: A comparison. *Psychological Reports, 46*(1), 23–28.

Stancliffe, R. J., Wilson, N. J., Bigby, C., Balandin, S., & Craig, D. (2014). Responsiveness to self-report questions about loneliness: A comparison of mainstream and intellectual disability-specific instruments. *Journal of Intellectual Disability Research, 58*(5), 399–405.

Stephan, E., Fäth, M., & Lamm, H. (1988). Loneliness as related to various personality and environmental measures: Research with the German adaptation of the UCLA loneliness scale. *Social Behavior and Personality: An International Journal, 16*(2), 169–174.

Steptoe, A., Owen, N., Kunz-Ebrecht, S. R., & Brydon, L. (2004). Loneliness and neuroendocrine, cardiovascular, and inflammatory stress responses in middle-aged men and women. *Psychoneuroendocrinology, 29*(5), 593–611.

Sun, J.-J., & Chang, Y.-J. (2021). Associations of problematic binge-watching with depression, social interaction anxiety, and loneliness. *International Journal of Environmental Research and Public Health, 18*(3), 1168.

Terwee, C. B., Prinsen, C. A. C., Chiarotto, A., Westerman, M. J., Patrick, D. L., Alonso, J., Bouter, L. M., De Vet, H. C. W., & Mokkink, L. B. (2018). COSMIN methodology for evaluating the content validity of patient-reported outcome measures: A Delphi study. *Quality of Life Research, 27*(5), 1159–1170.

Vassar, M., & Crosby, J. W. (2008). A reliability generalization study of coefficient alpha for the UCLA loneliness scale. *Journal of Personality Assessment, 90*(6), 601–607.

Velotti, P., Rogier, G., Zobel, S. B., Castellano, R., & Tambelli, R. (2021). Loneliness, emotion dysregulation, and internalizing

symptoms during coronavirus disease 2019: A structural equation modeling approach. *Frontiers in Psychiatry, 11*, 581494.

Wang, J.-J., Snyder, M., & Kaas, M. (2001). Stress, loneliness, and depression in Taiwanese rural community-dwelling elders. *International Journal of Nursing Studies, 38*(3), 339–347.

Wang, H.-Y., Sigerson, L., Jiang, H., & Cheng, C. (2018). Psychometric properties and factor structures of Chinese smartphone addiction inventory: Test of two models. *Frontiers in Psychology, 9*, 1411.

Wilson, D., Cutts, J., Lees, I., Mapungwana, S., & Maunganidze, L. (1992). Psychometric properties of the revised UCLA loneliness scale and two short-form measures of loneliness in Zimbabwe. *Journal of Personality Assessment, 59*(1), 72–81.

Wittenborn, A. K., Natamba, B. K., Rainey, M., Zlotnick, C., & Johnson, J. (2020). Suitability of the multidimensional scale of perceived social support as a measure of functional social support among incarcerated adults with major depressive disorder. *Journal of Community Psychology, 48*(3), 960–976.

Wongpakaran, N., Wongpakaran, T., Pinyopornpanish, M., Simcharoen, S., Suradom, C., Varnado, P., & Kuntawong, P. (2020). Development and validation of a 6-item revised UCLA loneliness scale (RULS-6) using Rasch analysis. *British Journal of Health Psychology, 25*(2), 233–256.

Wu, C., & Yao, G. (2008). Psychometric analysis of the short-form UCLA loneliness scale (ULS-8) in Taiwanese undergraduate students. *Personality and Individual Differences, 44*(8), 1762–1771.

Yang, K., & Victor, C. (2011). Age and loneliness in 25 European nations. *Ageing & Society, 31*(8), 1368–1388.

Yu, K., Wu, S., Jang, Y., Chou, C. P., Wilber, K. H., Aranda, M. P., & Chi, I. (2020). Longitudinal assessment of the relationships between geriatric conditions and loneliness. *Journal of the American Medical Directors Association*, 1–7. https://doi.org/10.1016/j.jamda.2020.09.002

Zakahi, W. R., & Duran, R. L. (1982). All the lonely people: The relationship among loneliness, communicative competence, and communication anxiety. *Communication Quarterly, 30*(3), 203–209.

Zarei, S., Memari, A. H., Moshayedi, P., & Shayestehfar, M. (2016). Validity and reliability of the UCLA loneliness scale version 3 in Farsi. *Educational Gerontology, 42*(1), 49–57.