RESEARCH ARTICLE

Psychometric Properties of the Hungarian UCLA Loneliness Scale Among Adolescents: A Search for the Meaning of Loneliness in the Young Population

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Introduction: Loneliness has been considered a major public health and policy concern, with substantial physical and mental health impacts. The University of California and Los Angeles Loneliness Scale (UCLA-LS) is one of the most widely used scales for measuring loneliness but it does not have robust psychometric properties among adolescents.

Aims: To evaluate the psychometric properties of the Hungarian UCLA-LS among adolescents.

Methods: The sample includes a total of 2508 students, 57.3% females, aged between 14 and 21 years. Studying psychometric properties, internal reliability and criterion-related validity were measured. The sample was randomly divided into two parts to examine the factorial structure: one part was used for exploratory factor analysis (EFA) and the other was used for confirmatory factor analysis (CFA).

Results: The UCLA-LS showed good internal consistency. Its total score and the single-item measure showed a small correlation, and also indicated a significant moderate association with hopelessness and self-reported well-being. Based on the EFA, we identified two factors with 51.7% of the total variance explained. In the CFA, the two-factor model demonstrated a good fit.

Conclusions: The findings suggested that the Hungarian UCLA-LS can be a reliable and valid tool for adolescents to measure some dimensions of loneliness. We confirmed the non-normal, relatively skewed distribution of the scale. We can conclude that the UCLA-LS measures a trait characteristic of loneliness. In the adolescent population, it is recommended to use further measures of loneliness to gain more information about the frequency and nature of the multi-faceted mental representation of loneliness.

Keywords: loneliness, adolescence, validity, reliability, UCLA Loneliness Scale

Introduction

The term loneliness is one of the uniquely human states which are hard to define but appear universal, it seems to be present in all cultures (Jones et al., 1985; Wilson et al., 1992). Although the commonly used definitions may differ somewhat, most of them incorporate certain elements such as an unpleasant subjective experience, when an

individual perceives that the quality and/or quantity of their social network is insufficient (Hawkley & Cacioppo, 2010; Peplau & Perlman 1979). Based on recent studies, loneliness is a common experience worldwide with a pooled prevalence of 9.2% to 14.4% for adolescents, and the COVID-19 pandemic resulted in a small increase in loneliness (Barreto et al., 2021; Ernst et al., 2022; Surkalim et al., 2022).

Loneliness might be interrelated with living alone and social isolation, but it is distinct from these conditions (Lee & Ko, 2018), which are more objective, referring to the quantity of individuals' social interactions, and lack of or infrequent social connections. Based on a recently proposed conceptual model, different triggers, risk factors and correlates exist, such as demography, health, and socio-environmental factors, which can lead to "problematic" loneliness (Lim et al., 2020). At the same time, as loneliness is a subjective construct, while assessing loneliness, the phenomenological perspective of the individual must also be assessed (Peplau, 1985).

Most studies consider loneliness as trait-like since individual differences in loneliness showed stability similarly to personality traits (Mund et al., 2019). At the same time, based on the differential reactivity hypothesis (Cacioppo et al., 2003), the question has arisen: Do individuals who reported a higher level of loneliness in a questionnaire measure trait-like loneliness, experience loneliness constantly or does it manifest as a "different reactivity" to situations which sustains loneliness (Matthews et al., 2022; van Roekel et al., 2013)? Previous studies demonstrated that there is a difference between trait and state loneliness, and trait loneliness is affected by state loneliness in various social contexts, especially among adolescents (van Roekel et al., 2013, 2018).

Loneliness occurs across the entire lifespan (Franssen et al., 2020; Qualter et al., 2015); however, it tends to be more prevalent and severe during adolescence and in old age (Laasgard et al., 2016; Yang & Victor, 2011). Adolescence has special neurological and developmental changes, which may increase the risk of loneliness among adolescents. Adolescent loneliness is closely related to poor mental health, including depression, anxiety and even suicidal behaviour (Ladd & Ettekal, 2013; Lasgaard et al., 2011; Matthews et al., 2022). Furthermore, loneliness is not only linked to poor mental health but is also one of its risk factors (Lyyra et al., 2021).

Considerations regarding the Loneliness Measured by the University of California and Los Angeles Loneliness Scale (UCLA-LS)

The difficulties in conceptualizing loneliness are reflected in the operationalization of loneliness, that is: how to measure loneliness precisely and accurately? It is the subjective nature of loneliness that causes problems during self-reporting, i.e., it is affected by social desirability concerns (Russell et al., 1978).

Assessments of loneliness use either multiple items that do not explicitly use the words "lonely" or "loneliness", or single-item measures that directly ask the subjects to rate the frequency and/or severity of "feeling lonely" (Lee & Ko, 2018). These assessments use negative and/or positive wording, which may lead to problems during self-reporting, causing a systematic bias in responses (Russell et al., 1980). The choice of the test format also influences the interpretation of loneliness, because women are more likely to report loneliness answering a direct question, while men appear more "lonely" on the multiple-item scale, although only in the younger age groups (Nicolaisen & Thorsen, 2014).

The UCLA-LS is one of the most widely used scales for measuring loneliness. The scale has been adapted and validated in many different languages. Russell et al. (1978) developed the original UCLA-LS from an existing instrument of measuring loneliness by Sisenwein (1964), who espoused the view that loneliness is a perceived lack of meaningful personal relationships (Mahon & Yarcheski, 1990). The original version of UCLA-LS consisted of 20 statements that measured how lonely individuals described their experiences (Russell et al., 1978). Russel et al. (1980) revised the UCLA-LS including positively worded and non-lonely items, which do not include any reference to the words lonely or loneliness, to avoid systematic biases in responding such as acquiescence and social desirability due to the negative/ "lonely" direction. The final revised version, the UCLA-LS version 3 (Russel, 1996) contains more readable questions, having simplified the response format and wording of items. The UCLA-LS has a total score of 20 to 80 points, with higher scores indicating greater loneliness (Russel, 1996). Loneliness scores are not normally distributed, only a relatively small proportion of individuals receive high scores on the scale.

Theoretically, the UCLA-LS assumed the unidimensionality of loneliness; it may be a global measure concerning the subjective experiences of loneliness (Russell et al., 1980); however, several studies examined the factorial structure of loneliness, which remains rather controversial (Boffo, et al., 2012; Hartshorne, 1993; Mahon & Yarcheski, 1990). Based on the factorial results that have been conducted with a diverse population but have primarily involved college students and adults over the last few decades, researchers suppose that the scale might be multi-dimensional. The studies on factorial structure have found mostly two- or three-factor solutions. In the

two-factor solutions, the names of the factors were very similar, distinguishing the factors of intimate and social others (Mahon, et al., 1995; Wilson et al., 1992). However, a method artefact can also be assumed: a response set if the negatively or positively worded items consequently load on different factors (Mahon & Yarcheski, 1990). In the case of three-factor solutions, the names of the factors were different, which suggests some conceptual confusion (Hartshorne, 1993). The factors described different aspects of loneliness such as psychological, psychosocial, social loneliness and relational/collective connectedness (Adams et al., 1988; Austin, 1983; Boffo et al., 2012; Dussault et al., 2009; McWhirter, 1990). In sum, these studies raised the possibility that the UCLA-LS does not assess a general experience of loneliness, but rather a multi-faceted mental representation of social connection (Hawkley et al., 2005).

Due to the simple rating and the easy-to-use format of the UCLA-LS scale, it is also widely used in Hungary. Although an officially translated version of the UCLA-LS exists in Hungarian (Csóka et al., 2007), the scale has not been validated yet. Thus, it is commonly used as part of the validation regarding different measurements, but the lack of a valid Hungarian version of the UCLA-LS poses an important limitation on the studies.

The present study aims to evaluate the psychometric properties, reliability and validity of the UCLA-LS in Hungarian for adolescents, which is one of the most popular measures of loneliness for adolescents; although, for this measure, no robust psychometric properties have been proven in this age group (Cole et al., 2021). Another goal was to provide further results for the factorial structure of the UCLA-LS among adolescents.

Methods

Study Sample

A total of 2556 secondary school students participated in the survey from 66 public schools in 37 cities in nine regions of Hungary. 48 students were excluded because of missing data or lack of parental agreement, so the study sample includes a total of 2508 students, 57.3% (n = 1436) females. Due to the structure of the Hungarian education system, the age of secondary school students was between 14 and 21 years (M = 17.29, SD = 1.32).

Procedure

The schools that participated in the survey were selected by personal contacts and with the assistance of the National Faculty of Education (Nemzeti Pedagógus Kar). The questionnaire was made available to secondary school students after the approval granted by the school principals or the heads of the institutions. The survey was conducted during the second and third waves of the COVID-19 pandemic when public education in Hungary took the form of digital distance learning.

The 15-minute online survey was shared on a webpage and remained accessible for six weeks during the lockdown. The research team kept in contact with school principals and teachers who encouraged the students to complete the questionnaire. Consent information about the aims of the research was given online and parental consent was requested before completion. We excluded those students who did not have parental consent or submitted a negative parental response. This research was approved by the Ethical Committee of the Medical Research Council (TUKEB), Hungary, under ETK TUKEB ethical permission No. IV/3067- 3/2021/EKU.

Measurements

We used the revised UCLA Loneliness Scale (UCLA-LS, Version 3, Russell, 1996) which is officially translated into the Hungarian language (Csóka et al., 2007). The UCLA-LS consists of 20 items with a 4-point rating scale (1: never, 2: rarely, 3: sometimes, 4: always). The total score ranges from 20 to 80; the higher scores indicate greater loneliness.

For convergent validity, we used the Beck Hopelessness Scale (BHS) and self-reported well-being as well as the number of close friends.

BHS (Beck et al., 1974; Beck & Steer, 1988) is a self-report measure of the level of negative expectations about the future. The Hungarian version of BHS is a valid and reliable measure of hopelessness (Cronbach α = .91) in the Hungarian population, which demonstrated a one-factor model; the higher the total BHS score, the higher levels of hopelessness it reflects (Perczel-Forintos et al., 2001).

Self-reported well-being was measured with the question "How do you feel in general?" on a 4-point scale (1: I never feel well, 2: I am not really feeling well, 3: I feel somewhat well, 4: I feel very well).

For congruent validity, we used a single-item measure of loneliness, the question "Do you feel lonely?" on a 4-point scale (1: no, 2: sometimes, 3: quite often, 4: very often).

Data Analysis

Descriptive statistics were reported in mean, standard deviation and relative frequencies. First, we examined the UCLA-LS internal consistency reliability and the effects of gender and age on the loneliness score. To examine criterion-related validity, for congruent validity, we calculated correlation coefficients between the scale and the items as well as the single-item measure of loneliness ("I feel lonely"). For convergent validity, we examined the relationship between loneliness and hopelessness, the number of close friends and self-reported well-being.

To examine the factorial structure, the sample was randomly divided into two parts: one part was used for exploratory factor analysis (EFA), and the other part was used for confirmatory factor analysis (CFA). EFA was conducted with Maximum Likelihood as the factor extraction method, and Kaiser criterion, Kaiser's eigenvalue-greater-than-one rule, was used for electing the numbers of factors retained. During EFA, to explore the dimensionality of the scale, first we used oblique rotation (Direct Oblimin), and the selection of factor numbers was verified using orthogonal rotation (Varimax) as recommended by Mahon et al. (1995). During CFA, with maximum likelihood with a robust standard errors (MLR) estimator, we tested the two- and three-factor solutions revealed in previous studies and compared them to the factorial structure explored in EFA. We used the test for exact fit (χ^2), SRMR (standardized root mean square residual) and RMSEA (root mean square error of approximation) for testing the fit of the model in CFA. To test and compare the previous two- and three-factor models in the Hungarian young sample, we used AIC (Akaike information criterion), BIC (Bayes information criterion), CFI (Comparative fit index) and TLI (Tucker–Lewis index). We used the following cut-off criteria for fit indexes by Hu and Bentler (1999), MacCallum et al. (1996), and Schreiber et al. (2006): CFI ≥ .95 for acceptance, TLI ≥ .95, SRMR ≤ .08, RMSEA ≤ .06 to .08 with confidence interval; for AIC and BIC, there is no cut-off value, the smaller the better.

The level of significance was set at α = .05 (statistically significant results $p < .05$). For practical significance, we used effect size measurements for all statistical tests. Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 25.0 (IBM Corp. Released 2017, Armonk, NY, USA) and jamovi (Version 2.2.2, The jamovi project, 2021).

Results

Descriptive Statistics and Reliability of Hungarian UCLA-LS

The descriptive statistics for items are presented in Table 1, for the frequency distribution of UCLA-LS scale scores, see Supplementary Table 1.

The UCLA-LS showed good internal consistency, Cronbach's alpha coefficient was .87[.87; .88]. The correlation coefficients for the items' score and the total score of the UCLA-LS ranged from .25 to .71, from small to large correlation, except for Item 2, which showed a significant but very small correlation with the total score (.12). Intercorrelations among 20 items were small among most of the items with .27[.26; .28] of average inter-item correlation (see Supplementary Table 2).

Table 1. Descriptive statistics for items of the UCLA-LS

	M	SD	Skewness	Kurtosis
UCLA-LS1	1.67	0.82	0.99	0.11
UCLA-LS2	3.13	0.95	-0.78	-0.44
UCLA-LS3	1.66	0.88	1.15	0.30
UCLA-LS4	2.38	1.12	0.12	-1.35
UCLA-LS5	1.75	0.98	1.07	-0.07
UCLA-LS6	1.92	0.92	0.65	-0.55
UCLA-LS7	1.56	0.84	1.37	0.87
UCLA-LS8	2.14	0.96	0.42	-0.80
UCLA-LS9	1.72	0.92	1.05	0.03
UCLA-LS10	1.33	0.66	1.98	3.29
UCLA-LS11	1.92	0.91	0.69	-0.44
UCLA-LS12	1.89	0.91	0.71	-0.40
UCLA-LS13	2.06	1.06	0.54	-0.99
UCLA-LS14	1.86	0.98	0.84	-0.43
UCLA-LS15	2.26	1.02	0.27	-1.06
UCLA-LS16	1.55	0.82	1.35	0.87
UCLA-LS17	1.81	0.99	0.94	-0.32
UCLA-LS18	1.98	0.98	0.66	-0.65
UCLA-LS19	1.33	0.66	2.04	3.61
UCLA-LS20	1.37	0.71	1.91	2.83

Notes. Sample size, N = 2508.

The total score of UCLA-LS ranged from 20 to 77 (M = 37.29, SD = 9.87, Skewness *(SE)* = .78(.05), Kurtosis *(SE)* = .18(.10). Gender showed a statistically significant main effect (F (1, 2504) = 9.82, p = .002, η^2_p = .004) but the mean difference (1.37) between females (M = 37.87, SD = 9.88) and males (M = 36.50, SD = 9.82) was negligible. Age revealed a non-significant main effect (F (1, 2504) = 3.60, p =.058, η^2_p =.001), and Gender x Age interaction was also non-significant (F (1, 2504) = 3.20, p = .074, η^2_p = .001).

Criterion-Related Validity of Hungarian UCLA-LS

For criterion-related validity, convergent and congruent validity were examined. For congruent validity, assessing the similarity of UCLA-LS to other constructs that it theoretically should be similar to, a single-item measure of loneliness was used. For convergent validity, the association of the UCLA-LS with constructs that are theoretically distinct from hopelessness but should still be related to it, such as the number of close friends and self-reported well-being, was examined.

First, we examined the gender and age differences on the single-item measure of loneliness, hopelessness, as well as the number of close friends and self-reported well-being. Very small/small differences emerged between gender and age groups in these measurements (Supplementary Table 3 and Table 4); thus, we examined the criterion-related validity using the total sample of the Hungarian young population.

Congruent validity

We calculated correlation coefficients between the UCLA-LS total and items score as well as the single-item measure of loneliness. The UCLA-LS total score and the single-item measure indicated a statistically significant, positive small correlation (ρ (2506) = .39, p < .001). Examining the correlation between the UCLA-LS items and the single-item measure, six items showed a statistically significant but very small/small association. Further items revealed a small to moderate correlation with the single-item measure, correlation coefficients ranged from .21 to .39 (Supplementary Table 5).

Convergent validity

The total score of the UCLA-LS suggested a significant positive moderate correlation with hopelessness (ρ (2506) = .46, p < .001), for the items, correlation coefficients ranged from .08 to .33. The total score revealed a significant negative small/moderate correlation with the number of close friends (ρ (2506) = −.33, p < .001) and self-reported well-being (ρ (2506) = −.49, p < .001). In the case of items, correlation coefficients ranged from −0.33 to 0.04 with the number of close friends and ranged from −0.44 to −0.09 with self-reported well-being (Supplementary Table 5).

The Factorial Structure of the Hungarian UCLA-LS

Based on the previous findings, the factorial structure of the UCLA-LS still remains in question, i.e., how many factors exist and which items are related to these factors; there is no strong model assumption for CFA. Thus, in line with the recommendations for adaptation and scale development studies (Bandalos & Finney, 2010; Kline, 2011), EFA was run first and then CFA to prove the validity of the structure.

The sample was divided into two parts randomly; one part was used for EFA, and one part was used for CFA. For the random samples' characteristics, see Table 2.

Table 2. Characteristics of the random samples

	Random sample 1 EFA (n = 1239)		Random sample 2 CFA (n = 1269)	
Females, n (%)	717	(57.9)	719	(56.7)
Age, $M(SD)$	17.29	(1.32)	17.28	(1.28)
UCLA-LS, $M(SD)$	37.77	(9.95)	36.82	(9.77)
UCLA-LS, Cronbach's α	.87		.87	

Exploratory factor analysis

The UCLA-LS items were subjected to exploratory factor analysis (maximum likelihood extraction). At first, we used an oblique rotation (Direct Oblimin), and then we used Varimax orthogonal rotation to verify the selection of the factor numbers. Items were excluded during factor extraction if their communalities were below 0.25. We used a rotated factor matrix to interpret the extracted factors, and items were excluded at this step if they did not meet the following criteria for item factor loadings by Pedhauser and Schemklin (1991): each item has high loading on one factor only and each factor has high loading for only some of the items.

Based on the results of the EFA, we identified two factors with 51.7% of the total variance explained. After rotation, Factor 1 explained 26.8% of the total variance and Factor 2 explained 24.9% of the total variance. The goodness-of-fit test was significant, but the chi-squared value was relatively low ($\chi^2(26) = 131.60$, $p < .001$). Factor 1 can be interpreted as Social Isolation and Factor 2 as Social Connectedness. The factorial solution is presented in Table 3.

Table 3. Factor structure of the Hungarian UCLA-LS and psychometric characteristics of the factors

	Factors	
	1	2
	Social Isolation	Social Connectedness
UCLA-LS11 - I feel left out	**.686**	.180
UCLA-LS12 - My social relationships are superficial	**.522**	.159
UCLA-LS13 - No one really knows me well	**.572**	.209
UCLA-LS14 - I feel isolated from others	**.774**	.189
UCLA-LS17 - I am unhappy being so withdrawn	**.561**	.135
UCLA-LS18 - People are around me but not with me	**.712**	.206
UCLA-LS10 - There are people I feel close to (R)	.189	**.692**
UCLA-LS16 - There are people who really understand me (R)	.272	**.666**
UCLA-LS19 - There are people I can talk to (R)	.183	**.809**
UCLA-LS20 - There are people I can turn to (R)	.213	**.848**
M(SD)	11.74(4.28)	5.63(2.43)
Skewness	0.63	1.69
Kurtosis	-0.26	2.31
Cronbach's α	.82	.86

Notes. (R): revised items during coding.

Confirmatory factor analysis

In the CFA, the two-factor model showed a good fit. The chi-square value was 199 (*df* = 34) with a relatively low χ^2/df (5.85). The SRMR was below .08 (.03) and the RMSEA was below .06 to .08 with the confidence interval [.06 (.05;.07)] representing a good fit.

Based on the result of the testing, comparing the two-factor structure explored in EFA with previous two-, and three-factor models, the two-factor model revealed the smallest value of AIC, BIC, and ≥ 0.95 CFI (.97), TLI (.96) values (Supplementary Table 6).

Finally, we also examined the EFA factors' correlation with hopelessness, the number of close friends, and self-reported well-being. All correlations were statistically significant (*p* < .001), but the magnitude of correlations between factors and the number of close friends was small (Social isolation: −.28, Social connectedness: −.25). The Social isolation factor revealed a positive moderate correlation with hopelessness (.44) and a negative moderate correlation with self-reported well-being (−.51). The Social connectedness factor's correlations with hopelessness (.35) and self-reported well-being (−.28) were also small. The factors showed a statistically significant, positive small correlation with the single-item measure of loneliness (Social isolation: ρ (2506) = .39, *p* < .001; Social connectedness: ρ (2506) = .26, *p* < .001).

Discussion

The present study's main aim was to evaluate the psychometric properties of UCLA-LS in Hungarian. The UCLA-LS is the most widely used measure of loneliness in adolescents, but it does not have robust psychometric properties (Cole et al., 2021). We used a relatively large sample of adolescents; thus, our study provides further results for the psychometric properties of the UCLA-LS in this age group.

The findings suggested that the Hungarian UCLA-LS can be a reliable and valid tool for adolescents to measure some dimensions of loneliness. Among adolescents, we did not find gender and age (early vs. late adolescence) differences. Previous studies examining gender differences demonstrate mixed findings; it can be assumed that mean levels of loneliness are similar for males and females across the lifespan (Maes et al., 2019; Vanhalst et al., 2013). In the case of age differences, a U-shaped age distribution was found in the loneliness frequency from young adulthood to old age. However, loneliness can be relatively stable from mid-to-late adolescence (Vanhalst et al., 2013; Yang & Victor, 2011).

Based on the results of the factor analysis, we identified two factors, Social isolation and Social connectedness. Our results suggest that the UCLA-LS measures some dimensions of loneliness among adolescents, not loneliness per se. We also experienced wording problems, namely items that loaded on one factor were negatively worded and items that loaded on the other factor were positively worded. We assumed that it was not due to method artefact, response set as suggested by Mahon et al. (1995). At the same time, these results pose the question of why negatively worded items relate to the term isolation and positively worded items relate to the term connectedness. We can hypothesize the possibility of some cognitive bias among adolescents such as negativity bias. Further studies revealed that significant attentional and memory biases exist in lonely individuals which induce passive behaviour and social withdrawal (Bangee & Qualter, 2018; Spithoven et al., 2017). In our sample, we also compared adolescents who reported "very/quite often feel lonely" to adolescents who reported "sometimes feel lonely" on the single-item measure of loneliness. Based on the results, "very/quite often feel lonely" adolescents showed significantly higher scores than those who "sometimes feel lonely" on the Social isolation factor which contains negatively worded items. The difference between these groups was small in the case of the Social connectedness factor which includes positively worded items.

The Hungarian UCLA-LS has a good internal consistency, consistent with previous studies (Adams et al., 1988; Austin, 1983; Boffo et al., 2012; Dussault et al., 2009; Mahon et al., 1995; McWhirter, 1990; Wilson et al., 1992;), but the intercorrelation among items was only small/moderate. In line with previous studies (Mahon et al., 1995; Russell, 1996; Wongpakaran et al., 2020) and providing further results, we found associations between the loneliness scale and some related constructs such as hopelessness and self-reported well-being. At the same time, contrary to our expectations, we found a small to moderate correlation between loneliness and the number of friends. It is important to outline that examining the two factors revealed in EFA and confirmed in CFA, the Social isolation factor indicated a large association with hopelessness and self-reported well-being, and the correlations with the Social connectedness factor were small/very small.

Contrary to some previous empirical results revealing a large association between loneliness measured by the UCLA-LS and the single-item measure, we found a very small to moderate relationship between these measurements of loneliness. Our results may suggest that the construct measured by the UCLA-LS is different from what a direct question of loneliness, the term lonely means for adolescents. The scale items do not refer specifically to loneliness; thus Russell (1982) observed that the scale does not directly measure states that people might label lonely. It is important to highlight that the time of the survey was during the COVID-19 pandemic, the period of school closures and distance learning. It can be assumed that in this critical situation, students would be more "sensitive" to the questionnaire's wording and were more likely to experience what it means to "feel lonely". Furthermore, it can also be supposed that the findings can represent more realistically what loneliness means for adolescents as measured by the UCLA-LS. These assumptions were partially demonstrated by the results of the single-item loneliness measure, which did not show a higher frequency of "loneliness" among adolescents.

Theoretically, loneliness is a single and unitary, i.e., unidimensional phenomenon (Russel, 1982) but based on the results of previous research (Adams et al., 1988; Austin, 1983; Dussault et al., 2009; Mahon et al., 1995; McWhirter, 1990; Wilson et al., 1992) our results also raised the possibility of the dimensionality of loneliness. Different commonly used definitions of loneliness share some same elements, but the term loneliness has a significant subjective nature; thus, it is not surprising that our results are only partially consistent with the previous studies on the scale's psychometric properties.

A further issue that arises in the literature is whether the construct assessed by loneliness questionnaires represents a trait or a state (Matthews et al., 2022; van Roekel et al., 2013, 2018). Based on our results, we can conclude that the direct question, the single-item measure of loneliness can refer to the state of loneliness, and the UCLA-LS can rather measure the trait loneliness. The previous studies (Hartshorne, 1993; Russell, 1996) on the psychometric characteristics of the UCLA-LS such as non-normal, bimodal characteristics of the scale may support this assumption, i.e., a relatively small proportion of individuals receive a high score as we also experienced in the present study. On the UCLA-LS, it is difficult to give meaning to a middle score, that is: a medium/moderate amount of loneliness (Cacioppo & Patrick, 2008). There is a need for further results to confirm bimodal characteristics of loneliness or provide meaningful cut-offs using a clinical sample with prolonged/chronic loneliness and suffering from personality disorders such as borderline and schizoid personality disorders.

Irrespective of the dimensionality of UCLA-LS, it has been not clear yet whether loneliness is unidimensional or multidimensional; furthermore, loneliness could be a form of, a contributor to, or a result of mental ill health. With a stronger base for understanding the nature of loneliness, we could screen and identify those in need of extra support and prevent the concurrent and prolonged mental health problems that are linked to loneliness (Cole et al., 2021), especially at a young age.

Strenghts and Limitations

The strength of the present study is that it uses a relatively large sample of adolescents and the secondary school students who participated in the survey belonged to 66 public schools in 37 cities in nine regions of Hungary which enhances the generalizability of the present findings.

There are also some limitations of the present study. These include the fact that all data were collected online, and the students completed the questionnaires voluntarily in a cross-sectional survey; thus, it is not possible to make any causal inferences. Besides selection bias, further response bias may be caused by misinterpreting the questions, and giving socially acceptable responses, consent responses or even extreme responses.

In the present study, we could not provide results on the test-retest reliability which is a further limitation of our study. It is recommended to examine test-retest reliability not only for UCLA-LS but also for the single-item measures of loneliness. Such analyses could support the trait characteristics of the UCLA-LS and the state characteristics of a single-item measure of loneliness. This assumption is partly proved by the results of congruent validity in the present study.

It is important to highlight the fact that, although we consider this to be a strength rather than a weakness in searching for the meaning of the UCLA-LS construct, the questionnaire was completed on one of the most vulnerable populations, adolescents. Furthermore, the time of the survey was during a pandemic, during the period of school closures and distance learning. It is assumed that in this critical situation, in a crisis, the results of the questionnaire are more indicative, more realistic, of what loneliness means for adolescents. They would be more "sensitive" to the wording of the questionnaire, and social isolation, especially in the case of those students who have more fragile, illusory friendships. They were more likely to experience what it means to feel lonely compared to normal times. It is recommended to examine the psychometric properties of the UCLA-LS in another less sensitive period. At the same time, it is important to note that they did not report loneliness with a higher frequency on the single-item measure of loneliness; thus, we assume that the UCLA-LS items have a different meaning for adolescents than the meaning of the direct question on the term lonely.

Conclusion, Implications, and Future Directions

Given the increasing prevalence of loneliness among adolescents and young people, there is a need for effective interventions and for this, we have to use a reliable and valid assessment of loneliness for the young population to screen and identify those who need special support. Thus, the main purpose of the present study was to evaluate the psychometric properties, reliability and validity, of the UCLA-LS in Hungarian for adolescents, and another aim was to provide further results for the factorial structure of the UCLA-LS among adolescents. The survey was conducted during the second and third waves of the COVID-19 pandemic when public education in Hungary took the form of digital distance learning. The present findings show high internal consistency and convergent validity of the Hungarian UCLA-LS among adolescents. We also confirmed the non-normal, relatively skewed distribution of the scale, consistent with previous studies. We demonstrated a two-factor

model from which we can conclude that UCLA-LS measures some dimensions of loneliness such as Social isolation and Social connectedness. Based on the results of validity, we suggest that the UCLA-LS measures a trait characteristic of loneliness. The direct question, the single-item measure of loneliness may refer to rather a state of loneliness, which is recommended to be measured to gain more information about the nature and frequency of loneliness among adolescents. Irrespective of the controversial dimensionality of the scale, the Hungarian UCLA-LS has good reliability and validity; thus, it can be used in measuring loneliness among Hungarian adolescents.

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Author contribution

Johanna TAKÁCS: conceptualization, design, methodology, formal analysis, interpretation, writing original draft.
Zsolt Bálint KATONA: conceptualization, design, methodology, investigation, data management, writing review and editing.
Ferenc IHÁSZ: conceptualization, design, methodology, supervision, writing review and editing.

Declaration of interest statement

The authors have no conflicts of interest to disclose.

Ethical statement

The authors assert that all procedures contributing to this study comply with the ethical standards of the relevant national and institutional committees on human experiments and with the Helsinki Declaration of 1975, as revised in 2008. This research was approved by the Ethical Committee of the Medical Research Council (TUKEB), Hungary, under ETK TUKEB ethical permission No. IV/3067- 3/2021/EKU. Informed consent to participate was taken from all participants and their parents for minors to participate in the study. Their data are stored in coded materials and databases without personal data.

Data availability statement

Datasets presented in this article are available from the corresponding author upon reasonable request.

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Supplementary tables

Supplementary Table 1. Frequency distribution UCLA-LS scale scores

UCLA-LS total score	Frequency	Percent	Cumulative Percent	UCLA-LS total score	Frequency	Percent	Cumulative Percent
20	6	.24	.24	47	47	1.87	82.97
21	6	.24	.48	48	39	1.56	84.53
22	26	1.04	1.52	49	49	1.95	86.48
23	30	1.20	2.71	50	69	2.75	89.23
24	55	2.19	4.90	51	34	1.36	90.59
25	69	2.75	7.66	52	33	1.32	91.91
26	94	3.75	11.40	53	35	1.40	93.30
27	98	3.91	15.31	54	17	.68	93.98
28	88	3.51	18.82	55	19	.76	94.74
29	136	5.42	24.24	56	15	.60	95.33
30	117	4.67	28.91	57	19	.76	96.09
31	145	5.78	34.69	58	12	.48	96.57
32	109	4.35	39.04	59	8	.32	96.89
33	105	4.19	43.22	60	15	.60	97.49
34	94	3.75	46.97	61	14	.56	98.05
35	88	3.51	50.48	62	8	.32	98.37
36	76	3.03	53.51	63	8	.32	98.68
37	103	4.11	57.62	64	3	.12	98.80
38	89	3.55	61.16	65	9	.36	99.16
39	79	3.15	64.31	66	5	.20	99.36
40	74	2.95	67.26	67	4	.16	99.52
41	73	2.91	70.18	68	4	.16	99.68
42	67	2.67	72.85	69	2	.08	99.76
43	57	2.27	75.12	70	1	.04	99.80
44	62	2.47	77.59	71	2	.08	99.88
45	40	1.59	79.19	72	2	.08	99.96
46	48	1.91	81.10	77	1	.04	100.00

Supplementary Table 2. Total-item and inter-item Pearson's correlations of UCLA-LS

	UCLA-LS total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	.65 (<.001)	1																		
2	.12 (<.001)	-.07 (.001)	1																	
3	.64 (<.001)	.33 (<.001)	.19 (<.001)	1																
4	.25 (<.001)	.12 (<.001)	-.02 (.232)	.07 (<.001)	1															
5	.61 (<.001)	.45 (<.001)	-.06 (.002)	.29 (<.001)	.16 (<.001)	1														
6	.65 (<.001)	.53 (<.001)	-.05 (.013)	.31 (<.001)	.12 (<.001)	.51 (<.001)	1													
7	.53 (<.001)	.28 (<.001)	.04 (.041)	.39 (<.001)	.14 (<.001)	.27 (<.001)	.25 (<.001)	1												
8	.39 (<.001)	.20 (<.001)	.03 (.097)	.24 (<.001)	-.01 (.530)	.14 (<.001)	.25 (<.001)	.22 (<.001)	1											
9	.52 (<.001)	.45 (<.001)	-.20 (<.001)	.18 (<.001)	.07 (.001)	.38 (<.001)	.44 (<.001)	.21 (<.001)	.15 (<.001)	1										
10	.59 (<.001)	.44 (<.001)	-.16 (<.001)	.29 (<.001)	.14 (<.001)	.42 (<.001)	.42 (<.001)	.26 (<.001)	.13 (<.001)	.40 (<.001)	1									
11	.65 (<.001)	.33 (<.001)	.15 (<.001)	.46 (<.001)	.04 (.029)	.29 (<.001)	.32 (<.001)	.32 (<.001)	.26 (<.001)	.21 (<.001)	.24 (<.001)	1								
12	.55 (<.001)	.28 (<.001)	.06 (.003)	.33 (<.001)	.03 (.119)	.28 (<.001)	.26 (<.001)	.29 (<.001)	.23 (<.001)	.19 (<.001)	.23 (<.001)	.43 (<.001)	1							
13	.61 (<.001)	.28 (<.001)	.07 (.001)	.40 (<.001)	.07 (.001)	.27 (<.001)	.33 (<.001)	.39 (<.001)	.27 (<.001)	.26 (<.001)	.25 (<.001)	.42 (<.001)	.38 (<.001)	1						
14	.71 (<.001)	.38 (<.001)	.14 (<.001)	.45 (<.001)	.03 (.120)	.34 (<.001)	.35 (<.001)	.35 (<.001)	.26 (<.001)	.32 (<.001)	.28 (<.001)	.57 (<.001)	.44 (<.001)	.48 (<.001)	1					
15	.48 (<.001)	.34 (<.001)	.06 (.004)	.20 (<.001)	.06 (.002)	.32 (<.001)	.33 (<.001)	.11 (<.001)	.09 (<.001)	.35 (<.001)	.28 (<.001)	.27 (<.001)	.12 (<.001)	.15 (<.001)	.28 (<.001)	1				
16	.64 (<.001)	.42 (<.001)	-.12 (<.001)	.35 (<.001)	.15 (<.001)	.40 (<.001)	.44 (<.001)	.28 (<.001)	.14 (<.001)	.37 (<.001)	.56 (<.001)	.29 (<.001)	.28 (<.001)	.38 (<.001)	.34 (<.001)	.28 (<.001)	1			
17	.55 (<.001)	.26 (<.001)	.24 (<.001)	.40 (<.001)	.05 (.022)	.21 (<.001)	.21 (<.001)	.24 (<.001)	.16 (<.001)	.10 (<.001)	.18 (<.001)	.44 (<.001)	.28 (<.001)	.31 (<.001)	.49 (<.001)	.20 (<.001)	.23 (<.001)	1		
18	.68 (<.001)	.38 (<.001)	.12 (<.001)	.44 (<.001)	.07 (<.001)	.32 (<.001)	.36 (<.001)	.34 (<.001)	.28 (<.001)	.25 (<.001)	.29 (<.001)	.52 (<.001)	.42 (<.001)	.45 (<.001)	.56 (<.001)	.24 (<.001)	.31 (<.001)	.48 (<.001)	1	
19	.59 (<.001)	.45 (<.001)	-.14 (<.001)	.31 (<.001)	.16 (<.001)	.43 (<.001)	.41 (<.001)	.23 (<.001)	.09 (<.001)	.35 (<.001)	.60 (<.001)	.26 (<.001)	.21 (<.001)	.22 (<.001)	.29 (<.001)	.30 (<.001)	.55 (<.001)	.24 (<.001)	.28 (<.001)	1
20	.65 (<.001)	.44 (<.001)	-.13 (<.001)	.40 (<.001)	.15 (<.001)	.42 (<.001)	.43 (<.001)	.28 (<.001)	.14 (<.001)	.38 (<.001)	.60 (<.001)	.31 (<.001)	.25 (<.001)	.29 (<.001)	.32 (<.001)	.29 (<.001)	.62 (<.001)	.26 (<.001)	.34 (<.001)	.73 (<.001)

UCLA-LS items

Supplementary Table 3. Association between the single-item measure of loneliness *("I feel lonely")* and gender as well as age

	"I feel lonely", n (%)			χ^2	p	V
	Sometimes	Quite often	Very often			
females (n = 1436)	1208 (84.1)	156 (10.9)	72 (5.0)	10.73	.005	.07
males (n = 1072)	949 (88.5)	78 (7.3)	45 (4.2)			
14–17 yrs (n = 1413)	934 (85.3)	113 (10.3)	48 (4.4)	2.48	.289	.03
18–21 yrs (n = 1095)	1223 (86.6)	121 (8.6)	69 (4.9)			

Note. V: Cramer's V.

Supplementary Table 4. Gender and age differences in hopelessness, the number of close friends and self-reported well-being

	Females (n = 1436)		Males (n = 1072)		t	p	g
	M	SD	M	SD			
Number of close friends	2.53	0.78	2.65	0.99	-3.20	.001	.14
Hopelessness	6.14	3.48	5.68	3.22	3.42	.001	.14
Self-reported well-being	3.40	0.86	3.63	0.74	-7.14	< .001	.28
	14–17 yrs (n = 1413)		18–21 yrs (n = 1095)		t	p	g
	M	SD	M	SD			
Number of close friends	2.56	0.79	2.59	0.94	-0.77	.443	.03
Hopelessness	6.15	3.43	5.79	3.32	2.61	.009	.11
Self-reported well-being	3.44	0.84	3.54	0.80	-3.11	.002	.12

Note. g: Hedges' g.

Supplementary Table 5. Correlation coefficients between UCLA-LS items and single-item measure of loneliness, hopelessness, the number of close friends, self-reported well-being

		UCLA-LS1	UCLA-LS2	UCLA-LS3	UCLA-LS4	UCLA-LS5	UCLA-LS6	UCLA-LS7	UCLA-LS8	UCLA-LS9	UCLA-LS10[a]
Single-item measure of loneliness	rho	.25**	.17**	.35**	.12**	.21**	.24**	.23**	.12**	.11**	.21**
	p	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Hopelessness	rho	.33**	.08**	.33**	.12**	.28**	.28**	.28**	.13**	.25**	.25**
	p	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Number of close friends	rho	-.24**	.04*	-.18**	-.01	-.33**	-.25**	-.17**	-.13**	-.25**	-.25**
	p	<.001	.043	<.001	.602	<.001	<.001	<.001	<.001	<.001	<.001
Self-reported well-being	rho	-.34**	-.16**	-.38**	-.09**	-.28**	-.28**	-.28**	-.16**	-.20**	-.22**
	p	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001

		UCLA-LS11[a]	UCLA-LS12[a]	UCLA-LS13[a]	UCLA-LS14[a]	UCLA-LS15	UCLA-LS16[a]	UCLA-LS17[a]	UCLA-LS18[a]	UCLA-LS19[a]	UCLA-LS20[a]
Single-item measure of loneliness	rho	.34**	.19**	.25**	.34**	.20**	.22**	.39**	.33**	.25**	.25**
	p	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Hopelessness	rho	.33**	.20**	.28**	.32**	.24**	.28**	.31**	.32**	.28**	.29**
	p	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Number of close friends	rho	-.21**	-.21**	-.19**	-0.24**	-.20**	-.21**	-.15**	-.24**	-.22**	-.22**
	p	<0.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Self-reported well-being	rho	-.39**	-.24**	-.33**	-0.43**	-.23**	-.26**	-.44**	-.40**	-.25**	-.29**
	p	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001

Notes. rho: Spearman's rank order correlation coefficients. * Correlation is significant at .05 level (2-tailed). ** Correlation is significant at .01 level (2-tailed). Significant but small correlations are in italics. [a] Items in the two-factor model of the Hungarian UCLA-LS.

Supplementary Table 6. Testing and comparing the two- and three-factor models of Hungarian UCLA-LS

Models	Two-factor model		Austin [37]		Adams et al. [36]				McWhirter [39]			Wilson et al. [2]		Mahon et al. [35]		Dussault et al. [38]			Boffo et al. [33]		
Factors/ Items	SI	SC	IO	SO	BA	PL	PSL	SL	IO	SO	AE	IO	SO	IO	SO	I	RC	CC	I	RC	TL
1(R)		*			*						*		*	*	*			*			
2	×		×				×		×			×			×	×			×		
3	×		×			×			×			×		×	×	×					
4(R)		*			*						*		*	*	*			*	*		
5(R)		*			*						*		*	*				*		*	
6(R)		*			*						*		*	*				*			
7	×		×			×			×			×		×		×					
8	×		×			×			×			×			×	×					
9	×				×						×			×				×			×
10(R)		*		*			*			*			*	*			*				*
11	×		×					×	×			×			×	×			×		
12	×		×			×			×			×			×	×				×	
13	×		×			×			×			×		×	×	×					
14	×		×					×	×			×		×	×	×					
15(R)		*		*			*			*			*	*	*			*			
16(R)		*		*			*			*			*	*			*			*	
17	×		×					×	×			×			×	×					×
18	×		×			×			×			×		×	×	×					
19(R)		*		*			*			*			*	*			*				
20(R)		*		*			*			*			*	*			*			*	
AIC	26808		54710		37008				57483			58350		57815		57571			33063		
BIC	26968		55029		37235				57808			58663		58150		57895			33248		
CFI	.97		.92		.94				.92			.83		.89		.91			.79		
TLI	.96		.91		.93				.91			.81		.87		.90			.72		

Notes. SI: social isolation, SC: social connectedness, IO: intimate others, SO: social others, BA: belonging and affiliation, PL: psychological loneliness, PSL: psychosocial loneliness, SL: social loneliness, AE: affiliative environment, I: isolation, RC: relational connectedness, CC: collective connectedness, TL: trait loneliness, * (R): reversed items.