

UCLA Loneliness Scale (Version 3): Reliability, Validity, and Factor Structure

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In this article I evaluated the psychometric properties of the UCLA Loneliness Scale (Version 3). Using data from prior studies of college students, nurses, teachers, and the elderly, analyses of the reliability, validity, and factor structure of this new version of the UCLA Loneliness Scale were conducted. Results indicated that the measure was highly reliable, both in terms of internal consistency (coefficient α ranging from .89 to .94) and test-retest reliability over a 1-year period ($r = .73$). Convergent validity for the scale was indicated by significant correlations with other measures of loneliness. Construct validity was supported by significant relations with measures of the adequacy of the individual's interpersonal relationships, and by correlations between loneliness and measures of health and well-being. Confirmatory factor analyses indicated that a model incorporating a global bipolar loneliness factor along with two method factors reflecting direction of item wording provided a very good fit to the data across samples. Implications of these results for future measurement research on loneliness are discussed.

Since the publication of the seminal work by Weiss (1973) over two decades ago, there has been a substantial increase in research on loneliness. The large number of papers and citations of research on loneliness that have appeared in personality and social psychology journals is one indicator that loneliness has become a "respectable" topic (see Periman, 1983).

RELIABILITY AND VALIDITY EVIDENCE

One factor that has stimulated interest in loneliness has been the development of reliable and valid measures of this construct. A number of different instruments have been developed that approach the topic from differing

perspectives (for reviews, see Marangoni & Ickes, 1989; Russell, 1982; Shaver & Brennan, 1991). Most research on loneliness has been based on one instrument, the UCLA Loneliness Scale (Russell, Peplau, & Cutrona, 1980; Russell, Peplau, & Ferguson, 1978), which has come to be viewed as the "standard" scale in the area (see discussion by Shaver & Brennan, 1991). Despite the wide use of the UCLA Loneliness Scale, problems with this measure have become apparent, especially as researchers have begun to study loneliness in populations other than college students. The purpose of this article is to describe a new version of the UCLA Loneliness Scale, and present evidence regarding the reliability, validity, and factor structure of the scale.

The initial version of the UCLA Loneliness Scale consisted of 20 statements that reflected how lonely individuals described their experience (Russell et al., 1978). Although scores on the original scale were found to be highly reliable and valid, the fact that all items were worded in a negative or "lonely" direction created the possibility that loneliness scores would be affected by systematic biases in responding, such as an acquiescent response set. Furthermore, issues of discriminant validity were raised due to the high correlations (ranging from .40 to .50) between loneliness and scores on measures of related constructs, such as depression and self-esteem.

To address these concerns, Russell and colleagues (1980) developed a revised version of the UCLA Loneliness Scale that included positively worded or non-lonely items. In constructing the revised UCLA Loneliness Scale, Russell and colleagues selected 10 negatively worded and 10 positively worded items that had the highest correlations with a set of questions that explicitly asked about loneliness. Despite the addition of these opposite-worded items, scores on the revised scale remained highly reliable. Furthermore, analyses presented by Russell and colleagues (1980) supported the discriminant validity of the revised UCLA Loneliness Scale against measures of personality, social desirability, and depression.

UCLA LONELINESS SCALE (VERSION 3)

Much of our early research with the UCLA Loneliness Scale as well as that of other researchers involved college student samples. In more recent research, we have begun to use the instrument with other populations, such as the elderly (e.g., Cutrona, Russell, & Rose, 1986). In this research, we have also used other methods of administering the instrument, including mail surveys and personal interviews. A problem that emerged in using the revised loneliness scale involved the wording of the items. Some words or phrases, such as those containing double negatives (e.g., responding "never" to the statement, "I do not feel alone"; see also Hartshorne, 1993), were difficult for elderly respondents to understand. As a result, the reliability of the measure suffered when the scale was used to assess loneliness among these individuals.

These problems with the instrument were not limited solely to studies of loneliness among the elderly. Other researchers have indicated problems in using the instrument with college student populations, related to the readability of the questions. For example, some students did not understand the meaning of "superficial" in the item, "My social relationships are superficial."

To address these problems, we have developed a simplified version of the scale, the UCLA Loneliness Scale (Version 3). This scale is presented in Table 1. In constructing this new version of the scale, we attempted to simplify the response format and wording of the items. For one item (#4), it was necessary to reverse the content of the item (from positive to negative) in constructing a simplified version. Thus, there are 11 negatively worded (lonely) and 9 positively worded (non-lonely) items in the new version of the UCLA Loneliness Scale. For all of the items, we added the statement, "How often do you feel ..." at the beginning of each question, in order to facilitate administering the scale via personal or telephone interviews. So, for example, the item, "I feel in tune with the people around me," was changed to, "How often to you feel that you are 'in tune' with the people around you?"

The purpose of this article is to present analyses of the psychometric properties of the UCLA Loneliness Scale (Version 3). To date, we have used Version 3 in studies of a variety of populations, including college students (Russell, Kao, & Cutrona, 1987), hospital-based nurses (Constable & Russell, 1986), public school teachers (Russell, Altmaier, & Van Velzen, 1987), and elderly individuals (Russell & Cutrona, 1991). These studies used a variety of data-collection methods, including self-report questionnaires, mail surveys, and personal interviews. Using these data, analyses are presented in this article that evaluate the reliability, validity, and factor structure of the UCLA Loneliness Scale (Version 3).

METHOD

The psychometric analyses presented here involve data collected in four previous studies. Therefore, only a brief overview of the methodology involved in each investigation is provided. More detail on the methods used in each study can be found in the original articles.

College Students

This sample consisted of 489 students (203 males, 286 females) who participated in the study for partial course credit. The purpose of this investigation was to evaluate whether measures of loneliness and social support assess opposite ends of the same underlying continuum (see Russell, Kao, et al.,

TABLE 1
UCLA Loneliness Scale (Version 3)

Instructions: The following statements describe how people sometimes feel. For each statement, please indicate how often you feel the way described by writing a number in the space provided. Here is an example:

How often do you feel happy?

If you never felt happy, you would respond "never"; if you always feel happy, you would respond "always."

<u>NEVER</u>	<u>RARELY</u>	<u>SOMETIMES</u>	<u>ALWAYS</u>
1	2	3	4
*1. How often do you feel that you are "in tune" with the people around you?			_____
2. How often do you feel that you lack companionship?			_____
3. How often do you feel that there is no one you can turn to?			_____
4. How often do you feel alone?			_____
*5. How often do you feel part of a group of friends?			_____
*6. How often do you feel that you have a lot in common with the people around you?			_____
7. How often do you feel that you are no longer close to anyone?			_____
8. How often do you feel that your interests and ideas are not shared by those around you?			_____
*9. How often do you feel outgoing and friendly?			_____
*10. How often do you feel close to people?			_____
11. How often do you feel left out?			_____
12. How often do you feel that your relationships with others are not meaningful?			_____
13. How often do you feel that no one really knows you well?			_____
14. How often do you feel isolated from others?			_____
*15. How often do you feel you can find companionship when you want it?			_____
*16. How often do you feel that there are people who really understand you?			_____
17. How often do you feel shy?			_____
18. How often do you feel that people are around you but not with you?			_____
*19. How often do you feel that there are people you can talk to?			_____
*20. How often do you feel that there are people you can turn to?			_____

Scoring:

Items that are asterisked should be reversed (i.e., 1 = 4, 2 = 3, 3 = 2, 4 = 1), and the scores for each item then summed together. Higher scores indicate greater degrees of loneliness.

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1987). As a consequence, students completed anonymous questionnaires that included two other loneliness scales in addition to the UCLA Loneliness Scale (Version 3): The NYU Loneliness Scale (Rubenstein & Shaver, 1982) and the Differential Loneliness Scale (Schmidt & Sermat, 1983). The students also completed three different measures of social support: The Social Provisions Scale (Cutrona & Russell, 1987), the Social Support Questionnaire (Sarason, Levine, Basham, & Sarason, 1983), and the Inventory of Socially Supportive Behavior (Barrera, Sandler, & Ramsey, 1981). Finally, students completed several personality and mood measures that would be expected to be associated with loneliness and social support. These included the Neuroticism and Introversion–Extroversion scales from the Eysenck Personality Inventory (Eysenck & Eysenck, 1975), the Marlowe–Crowne Social Desirability Scale (Crowne & Marlowe, 1960), the Beck Depression Inventory (Beck, 1967), and the Rosenberg Self-Esteem Scale (Rosenberg, 1965).

Nurses

Participants in this investigation were 310 nurses (109 males, 201 females) employed at a military hospital (see Constable & Russell, 1986). Questionnaires were distributed to all nursing staff; 79% of the questionnaires were completed and returned via mail to the investigators. In addition to the UCLA Loneliness Scale (Version 3), the nurses completed the Maslach Burnout Inventory (Maslach & Jackson, 1981) and two measures of social support: The scale developed by House (1981) to assess the availability of support from different network members (e.g., supervisors, coworkers, friends, and spouse) and the Social Provisions Scale (Cutrona & Russell, 1987).

Teachers

The teacher sample was drawn from a mail survey of public school teachers in Iowa (see Russell, Altmaier, et al., 1987). Completed questionnaires were received from 316 teachers (94 males, 222 females), for a response rate of 53%. Due to concerns over the length of the mail survey, teachers completed a shortened 10-item version of the loneliness scale (see subsequent discussion regarding item selection). The specific items that were included are indicated in Table 2. As was true of the sample of nurses described earlier, the teachers completed the Maslach Burnout Inventory and the measures of social support developed by House (1981) and Cutrona and Russell (1987).

Elderly

This sample included 301 individuals (121 males, 180 females) over 65 years of age who were participants in a 1-year longitudinal study of the

impact of psychosocial factors on the health and well-being of the elderly (see Russell & Cutrona, 1991). The full investigation involved biannual personal interviews, completion of monthly mail questionnaires, and the collection of extensive medical information. These participants were initially screened to ensure they were in good health and capable of understanding the questions that would be asked during the interviews and on the monthly questionnaires; 63% of eligible individuals agreed to participate in this intensive investigation.

During the baseline personal interviews, the UCLA Loneliness Scale (Version 3) was administered to participants. In addition, interviewers gathered data regarding characteristics of the participant's social network (including number of kin and non-kin in the network, average frequency of contact, and network density) as well as the perceived availability of social support (Social Provisions Scale; Cutrona & Russell, 1987). We administered measures of well-being including life satisfaction (see Cutrona et al., 1986) and depression (Zung Depression Scale; Zung, 1965, 1967). Participants' health status was assessed by measures of prescription medication use, number of chronic medical conditions, functional status (Physical Functioning subscale of the Duke-UNC Health Profile; Parkerson et al., 1981), and global self-ratings of health status.

At the final wave of personal interviews 12 months later, participants were once again administered the UCLA Loneliness Scale (Version 3).

RESULTS

Descriptive Statistics

Table 2 presents descriptive statistics for total scores on the UCLA Loneliness Scale (Version 3). It should be noted that the scores for the teacher sample are based on the 10-item version of the scale they completed. Consistent with a number of other studies (e.g., Perlman, Gerson, & Spinner, 1978), the elderly received lower average loneliness scores than members of the other samples. Within all four samples, the mean, median, and mode were very similar, suggesting that the distribution of scores was fairly normal. However, scores were positively skewed, indicating that relatively few respondents received high scores on the scale. Loneliness scores in the elderly sample also demonstrated positive kurtosis, reflecting the fact that the distribution of scores was "too flat" relative to a normal distribution (i.e., the proportion of scores in the tail of distribution was too large).

Analyses were also conducted within each of the four samples to test for possible sex differences in scores on Version 3 of the loneliness scale. On the basis of their review of the literature, Borys and Perlman (1985) concluded that sex differences in loneliness are typically not found unless the measure explicitly includes the word "loneliness" in the assessment, in which case

TABLE 2
Descriptive Statistics for the UCLA Loneliness Scale (Version 3)

Statistic	Sample ^a			
	Students	Nurses	Teachers ^b	Elderly
<i>N</i>	487	305	311	284
<i>M</i>	40.08	40.14	19.22	31.51
<i>SD</i>	9.50	9.52	5.11	6.92
Median	40.00	39.00	18.00	30.50
Mode	41	42	15	30
Skew	.34*	.41*	.57*	1.16*
Kurtosis	-.05	.37	.07	2.07*
Range	20-74	20-75	10-37	20-59
Average <i>r</i>	.36	.43	.46	.29
α	.92	.94	.89	.89

^aThe number of cases varied from the overall sample size due to missing data. ^bThese statistics are based on the 10-item version of the scale completed by the teachers, which included Items 2, 5, 10, 11, 13, 14, 16, 18, 19, and 20.

* $p < .05$.

men tend to report lower levels of loneliness than women. Significant mean differences in loneliness scores were found between male ($M = 41.88$) and female ($M = 38.81$) college students, $t(386) = 3.45$, $p < .01$. These two groups of students also differed significantly in the variation of loneliness scores within each group (Men: $SD = 10.22$; Women: $SD = 8.75$), $F(200, 285) = 1.37$, $p < .05$. These sex differences in loneliness scores were limited to the college student sample. For the other three groups, none of the mean (all $t < 1.0$) or variance differences (F values ranged from 1.01 to 1.31) approached statistical significance.

Reliability

Version 3 of the loneliness scale appears to be very reliable; coefficient alpha ranged from .89 to .94 across the samples (see Table 2). In our elderly sample, the UCLA Loneliness Scale was readministered 12 months later, with a test-retest correlation of .73. A paired t test indicated that loneliness scores did not change significantly over this 1-year period, $t(283) = 1.23$. In summary, the reliability of the UCLA Loneliness Scale (Version 3) appears to be quite comparable to results for the two earlier versions of the scale.

We have used shortened versions of the UCLA Loneliness Scale when the research methodology precluded use of the full 20-item instrument. One example of this is provided by the teacher sample, wherein the nature of the mail survey necessitated using a smaller set of items to assess loneliness. In selecting items for inclusion in these versions of the scale, we used information on the corrected item-total correlations from previous studies. Items

were selected that had the highest item-total correlations, with the constraint that an equal number of negatively worded (lonely) and positively worded (non-lonely) items be included to minimize the possible influence of response sets on loneliness scores. To assist investigators in selecting items for shortened versions of the scale, Table 3 presents item-total correlations for the three samples where the full 20-item version of the measure was administered as well as for the teacher sample that completed the 10-item version of the scale.

Validity

College students. As noted earlier, the study of college students by Russell, Kao, et al., (1987) was designed to evaluate whether or not measures of loneliness and social support assess distinct constructs. Convergent validity for the UCLA Loneliness Scale (Version 3) is provided by correlations with the other measures of loneliness included in that study. As indicated in Table 4, scores on Version 3 of the loneliness scale were found to be strongly related to scores on the NYU Loneliness Scale and the Differential Loneliness Scale. Consistent with expectations, loneliness scores were also negatively associated with the measures of social support. Supporting the discriminant validity of the loneliness measures, confirmatory factor analy-

TABLE 3
Corrected Item-Total Correlations for the UCLA Loneliness Scale (Version 3)

<i>Item</i>	<i>College Students</i>	<i>Nurses</i>	<i>Teachers</i>	<i>Elderly</i>
1	.49	.44		.52
2	.59	.66	.61	.35
3	.65	.69		.44
4	.62	.67		.28
5	.55	.61		.61
6	.56	.60	.63	.51
7	.62	.73		.52
8	.50	.60		.41
9	.46	.53		.35
10	.60	.68	.69	.62
11	.56	.72	.71	.53
12	.59	.70		.56
13	.66	.64	.60	.59
14	.69	.75	.73	.57
15	.56	.63		.40
16	.63	.62	.63	.67
17	.32	.39		.36
18	.56	.63	.64	.52
19	.59	.69	.56	.62
20	.62	.65	.58	.63

TABLE 4
Correlations With Other Measures of Loneliness, Social Support, Personality,
and Mood Among College Students

<i>Variable</i>	<i>Correlation^a</i>	<i>n</i>
NYU Loneliness Scale	.65	485
Differential Loneliness Scale	.72	489
Social Provisions Scale	-.68	489
Social Support Questionnaire:		
Support Number	-.48	478
Support Satisfaction	-.56	479
Supportive Behavior	-.39	489
Eysenck Personality Inventory:		
Neuroticism	.49	488
Introversion-Extroversion	-.40	488
Social Desirability	-.21	488
Depression	.52	487
Self-Esteem	-.60	486

^aAll correlations were statistically significant, $p < .001$.

ses conducted by Russell, Kao, et al., (1987) indicated that the measures of loneliness and social support defined distinct factors, which although highly intercorrelated, related differently to the other mood and personality measures that were included in the study. Further supporting the construct validity of the loneliness scale, scores were significantly related to the personality traits of Neuroticism and Introversion-Extroversion. As was found for previous versions of the UCLA Loneliness Scale (Russell, 1982), strong correlations were found between loneliness and the measures of self-esteem and depression. However, the magnitude of these correlations was less than the association with the other measures of loneliness, supporting the discriminant validity of the measure. Finally, although the correlation with social desirability was statistically significant, the magnitude of the relation was low, suggesting that loneliness scores are not seriously affected by social desirability concerns on the part of the respondent.

Nurses and teachers. The samples of nurses and teachers completed parallel measures of burnout and social support, although they differed in the assessment of loneliness, with the teachers completing a shortened version of the loneliness scale. Table 5 presents correlations between these measures and scores on the UCLA Loneliness Scale (Version 3) for these two samples. Supporting the construct validity of the scale, loneliness was positively related to burnout, with the correlations found to be identical across the two samples. Further supporting the validity of the measure, statistically significant negative correlations were found between loneliness scores and all of the measures of social support.

Elderly. Theoretical models of loneliness have emphasized the importance of perceived inadequacies in interpersonal relationships as the source of feelings of loneliness, in contrast to objective characteristics of the person's relationships with others, such as the number of friends or frequency of social contact (Cutrona, 1982; Peplau & Perlman, 1982). Consistent with these theoretical perspectives, loneliness scores were found to be only weakly related to such relationship characteristics as the number of kin and non-kin in the social network, and were found to be unrelated to the average frequency of social contact and network density (see Table 6). By contrast, loneliness scores were much more strongly related to the perceived

TABLE 5
Correlations With Measures of Burnout and Social Support Among Nurses and Teachers

Variable	Nurses		Teachers	
	<i>r</i>	<i>n</i>	<i>r</i>	<i>n</i>
Burnout	.45	280	.45	307
Social support from:				
Supervisor	-.19	296	-.23	312
Coworkers	-.33	296	-.43	312
Friends	-.25	297	-.43	313
Spouse	-.21	303	-.35	253
Social provisions	-.61	300	-.68	313

Note. All correlations were statistically significant, $p < .001$.

TABLE 6
Correlations With Measures of Relationships, Well-Being, and Health Among the Elderly

Variable	Correlation	<i>n</i>
Relationships		
Number of kin	-.17**	301
Number of non-kin	-.21***	301
Frequency of contact	-.15*	301
Network density	-.06	301
Social provisions	-.54***	301
Well-being		
Life satisfaction	-.36***	301
Depression	.45***	301
Health		
Number of prescription medications	-.05	288
Numer of chronic illnesses	.18**	301
Functional status	.05	301
Self-rated health	-.18**	301

* $p < .05$. ** $p < .01$. *** $p < .001$.

quality of the person's interpersonal relationships, as reflected by scores on the Social Provisions Scale.

Previous research has indicated that loneliness is an important etiological factor in the health and well-being of a variety of populations (e.g., Kiecolt-Glaser et al., 1984a; Kiecolt-Glaser et al., 1984b; Russell & Cutrona, 1985). Loneliness was significantly related to the measures of well-being (life satisfaction and depression) among elderly participants. Concerning physical health, loneliness was unrelated to the more objective measures of health status (i.e., number of prescription medications and functional status), but was significantly related to reports of chronic illnesses and self-ratings of health status.

Factor Structure

One criticism of the revised UCLA Loneliness Scale has involved the assumption that loneliness is a unidimensional construct (e.g., Marangoni & Ickes, 1989). I have argued elsewhere that the construct assessed by the UCLA Loneliness Scale reflects a unitary state, which can be reached via deficits in a variety of relationships and can have a variety of different consequences (Russell, 1982). From this perspective, multidimensional measures of loneliness reflect either assessments of different relationship deficits that may lead to the common state we term loneliness, such as the Differential Loneliness Scale developed by Schmidt and Sermat (1983) or the Social and Emotional Loneliness Scale for Adults developed by DiTommaso and Spinner (1993), or assessments of the different consequences that follow from becoming lonely, such as the Loneliness Rating Scale developed by Scalise, Ginter, and Gerstein (1984).

Studies of the factor structure of the UCLA Loneliness Scale have raised questions regarding this unidimensional conceptualization of the construct being assessed by the measure. A number of researchers have reported exploratory factor analyses of the loneliness scale (Austin, 1983; Hays & DiMatteo, 1987; Hojat, 1982; Knight, Chisholm, Marsh, & Godfrey, 1988; Mahon & Yarcheski, 1990; McWhirter, 1990; Miller & Cleary, 1993; Wilson, Cutts, Lees, Mapungwana, & Maunganidze, 1992; Zakahi & Duran, 1982), finding evidence of more than a single factor underlying the measure. A careful review of these results suggests that the derived factors reflect at least in part the direction of item wording. So, for example, Factor 1 found by Austin (1983) involves all of the negative or lonely items, whereas Factors 2 and 3 involve a separation of the positive or non-lonely items into two groups based on serial position; McWhirter (1990) reported identical results. Analyses presented by Knight and colleagues (1988) and Miller and Cleary (1993) indicated the existence of two factors corresponding to the lonely (negative) and non-lonely (positive) items. As discussed by Miller and Cleary (1993), these results suggest that responses

to the loneliness scale items are affected by acquiescence or other similar response styles.

Two recent studies have used confirmatory factor-analytic procedures to evaluate the factor structure of the UCLA Loneliness Scale. Oshagen and Allen (1992) found that a model hypothesizing a single factor provided an excellent fit to their data. However, their analysis involved a subset of 7 items from the scale, with all of the selected items being worded in the same negative or lonely direction. Hartshorne (1993) presented a series of confirmatory factor analyses, using all 20 items from the scale in his analysis. An initial analysis using unweighted least squares estimation of a one-factor bipolar model fit to the tetrachoric correlations among the items indicated that model provided a very good fit to the data (i.e., Adjusted Goodness of Fit Index [AGFI] = .96). However, a more traditional analysis of the variances and covariances among the items using maximum likelihood (ML) estimation indicated that this one-factor model did not fit the data very well (AGFI = .75). Instead, the three-factor model found by Austin (1983) provided a reasonably good fit to the data (AGFI = .80).

These results suggest that individuals completing the UCLA Loneliness Scale show consistent patterns of responding as a function of item wording. However, it is unclear whether there exists a general or global loneliness factor, in addition to these two method factors. That is, there may be three factors underlying responses to the UCLA Loneliness Scale: A general bipolar loneliness factor, on which all 20 items load significantly, in addition to two method factors that correspond to the negatively worded (lonely) and positively worded (non-lonely) items. To test such a model, it is necessary to use confirmatory factor analysis procedures, in which the "fit" of the hypothesized model can be directly evaluated (see Bentler, 1980). Prior studies of the factor structure of the UCLA Loneliness Scale cannot rule out the possibility that a three-factor model, involving a single bipolar global loneliness factor and two method factors reflecting item wording, may not fit the data well because such a model was not explicitly tested.

A good example of such an analysis is provided by a recent study of the structure of affect measures reported by Green, Goldman, and Salovey (1993). Prior factor-analytic research on mood has suggested that measures of affect reflect two independent dimensions, corresponding to positive and negative emotions (e.g., Watson & Tellegen, 1985). Green and colleagues (1993) demonstrated that these results reflect the influence of systematic errors of measurement or method variance. After removing the influence of method variance by specifying method of assessment factors, they demonstrated that measures of affect reflect a single bipolar dimension, with negative emotions loading on one end of this dimension and positive emotions loading on the other end of this dimension. I am hypothesizing that a similar structure underlies responses to the UCLA Loneliness Scale: Once method variation is controlled by specifying two orthogonal method factors that correspond to the negatively worded and the positively worded items, a

single bipolar loneliness factor will emerge, with the negative or lonely items loading on one end of the factor and the positive or non-lonely items loading on the other end of the factor.

To evaluate the factor structure of the UCLA Loneliness Scale (Version 3), confirmatory factor analyses were conducted that evaluated the fit of three different models to the data. The first model hypothesized that a single bipolar factor could account for the covariation among responses to items on the scale. Model 2 hypothesized that two factors underlay responses to the scale, corresponding to the negative (lonely) and positive (non-lonely) items; these factors were allowed to correlate with one another (i.e., oblique factor structure). This factor structure corresponds to the results reported by Knight and colleagues (1988) and Miller and Cleary (1993) for the prior version of the loneliness scale. Finally, Model 3 hypothesized that a single bipolar loneliness factor in addition to the two method factors influenced responses to the scale. This latter model therefore included a global bipolar loneliness factor, on which all 20 items were allowed to load, along with a negative item factor and a positive item factor. These three factors were constrained to be orthogonal or uncorrelated with one another.

Using data from all four samples, analyses were conducted to test the fit of these three-factor models to the data using the ML estimation methods of LISREL VIII (Jöreskog & Sörbom, 1993). These confirmatory factor analyses were based on the variances and covariances of the items on the loneliness scale. To evaluate the fit of the factor structure to the data, the LISREL program provides a chi-square test that reflects the extent to which the hypothesized model is able to account for relations among items on the loneliness scale. Because the chi-square goodness-of-fit statistic is sensitive to sample size and, in the case of ML estimation, violations of the assumption of multivariate normality, evaluation of model fit was based on considerations beyond the statistical significance of the chi-square. This involved the AGFI and the Comparative Fit Index (CFI) reported by LISREL VIII. AGFI represents the proportion of the variances and covariances of the variables being analyzed, which is explained by the factor structure, with an adjustment for the size or number of parameters being estimated as part of the model (Tanaka & Huba, 1985). Thus, this statistic represents a multivariate extension of the adjusted R^2 values derived from a multiple regression analysis. Values of AGFI can range between 0 and 1.0, with values of .90 or greater generally indicating a model that accounts for the data well (Tanaka, 1987). The CFI (Bentler, 1990) is based on the noncentral chi-square index for two models: The model that is being tested, and a "null" model that specifies that the variables are uncorrelated with one another. CFI can be interpreted as reflecting the proportional improvement in model fit, on a continuum ranging from a model that is unable to account for the associations among the variables (the null model) to a model that can completely account for the associations among the variables. Simulation data presented by Bentler (1990) indicated that the CFI provided a very accurate reflection

of model fit, across samples that varied in size. As is true for the GFI, values of CFI above .90 are generally viewed as indicating a model that provides an adequate fit to the data (Bentler, 1990).

Results of the confirmatory factor analyses using data from all four samples are presented in Table 7. For the three samples wherein the full 20-item version of the scale was administered, the model hypothesizing a single bipolar loneliness factor did not fit the data very well, with the AGFI ranging from .73 to .76 and CFI ranging from .74 to .83. This model was found to provide a better fit to the 10-item version of the scale administered to the teachers. This improvement in model fit is probably due to the item-selection criteria that were used in choosing that subset of items.

The second model that was tested hypothesized two factors corresponding to item wording (i.e., a negative or lonely factor and a positive or non-lonely factor), with the two factors allowed to correlate with one another. As can be seen in Table 7, separating the items on the basis of item wording greatly improved the fit of the model to the data. For the full 20-item version of the measure, the AGFI ranged from .80 to .86 and the CFI ranged from .84 to .89 for this model. Results for the 10-item version of the scale completed by the teachers were very good, with a AGFI of .90 and a CFI of .95. As would be expected, these two factors were strongly and inversely related, with the inter-factor correlation ranging from $-.72$ to $-.82$ across the four samples.

The final model that was tested involved adding the two method factors to the bipolar loneliness factor, with the three factors constrained to be uncorrelated

TABLE 7
Results of the Confirmatory Factor Analyses

<i>Sample</i>	<i>Statistic</i>	<i>One Factor</i>	<i>Two Factors</i>	<i>Three Factors</i>
College students	χ^2	918.53*	588.10*	391.46*
	<i>df</i>	170	169	150
	AGFI	.76	.86	.90
	CFI	.81	.89	.94
Nurses	χ^2	724.27*	530.87*	398.93*
	<i>df</i>	170	169	150
	AGFI	.73	.80	.84
	CFI	.83	.89	.93
Teachers ^a	χ^2	209.88*	99.77*	58.34*
	<i>df</i>	35	34	25
	AGFI	.78	.90	.92
	CFI	.88	.95	.98
Elderly	χ^2	657.30*	482.45*	397.52*
	<i>df</i>	170	169	150
	AGFI	.73	.81	.84
	CFI	.74	.84	.89

^aThese subjects completed a shortened 10-item version of the loneliness scale. As a consequence, the *df* associated with the factor models are reduced.

* $p < .001$.

with one another. As can be seen in Table 7, this model led to an improvement in fit for all four samples. The AGFI indicated that this three-factor model provided an adequate fit to the data, with the index ranging from .84 to .92 across the four samples; the CFI ranged from .89 to .94 for this model.

Given the confirmatory factor analysis results reported by Hartshorne (1993), analyses were also conducted evaluating the fit of the three-factor model identified by Austin (1983) as underlying responses to Version 2 of the UCLA Loneliness Scale. This factor model was fit to the data from the three samples (i.e., students, nurses, and the elderly) who had completed the full 20-item version of the scale. In fitting this model to the data, I allowed the three factors to be correlated with one another (i.e., oblique factor structure). Across the three samples, the results consistently indicated that the model described by Austin did not fit the data as well as the three-factor model shown in Table 7. For example, the results for the Austin model when fit to the student data were $\chi^2(166, N = 487) = 590.16, p < .001$, AGFI = .86, CFI = .89. Furthermore, the three factors were found to be strongly related to one another; the absolute magnitude of the correlations ranged from .72 to .76. Thus, it appears that the three-factor orthogonal model, which included a bipolar global loneliness factor and two method factors, provided a better fit to the data than the model described by Austin (1983).

Comparison of the chi-square statistics associated with these models also indicates that the three-factor model provides a better fit to the data than the other two models. As noted by Bentler and Bonett (1980), the difference in the chi-square statistics for two nested models is itself distributed as a chi-square. The three-factor model was found to fit significantly better than the two-factor and one-factor models across all four samples. For example, among college students the difference in the chi-square values associated with one- and three-factor models was $\chi^2(20, N = 487) = 527.07, p < .001$. Similarly, the difference in the chi-square values associated with the two-factor oblique model and three-factor orthogonal models was also significant, $\chi^2(19, N = 487) = 196.64, p < .001$.

Table 8 presents the loadings of the loneliness items on the three factors for students.¹ All of the loadings on the global loneliness factor were found to be statistically significant. As would be expected, this factor was bipolar, with the negative or lonely items loading positively and the positive or non-lonely items loading negatively. The results also indicated that the factor loadings on this global factor associated with the individual items varied across the samples. The absolute value of the average factor loadings on this global factor for teachers ($M = .64$) was identical to that found for nurses ($M = .64$), and was greater than the average loading for students ($M = .55$) or elderly participants ($M = .50$). Clearly, measurement invariance,

¹The loadings of the items on the three factors for the other three samples can be obtained by writing to Daniel W. Russell.

TABLE 8
Factor Loadings for the Student Sample

<i>Item</i>	<i>Global Factor</i>	<i>Negative Items</i>	<i>Positive Items</i>
1	-.56*	.00	.40*
2	.45*	.50*	.00
3	.61*	.31*	.00
4	.48*	.49*	.00
5	-.62*	.00	.28*
6	-.61*	.00	.45*
7	.53*	.43*	.00
8	.40*	.39*	.00
9	-.51*	.00	.27*
10	-.67*	.00	.18*
11	.40*	.51*	.00
12	.44*	.51*	.00
13	.59*	.39*	.00
14	.56*	.50*	.00
15	-.61*	.00	-.06
16	-.69*	.00	-.08
17	.21*	.31*	.00
18	.42*	.46*	.00
19	-.76*	.00	-.18*
20	-.79*	.00	-.25*

* $p < .05$.

wherein the factor loadings are constant across samples, does not hold for these data. This suggests that the nature of the underlying construct (i.e., loneliness) varies somewhat across the four groups, although the underlying structure (i.e., number and nature of the factors) is consistent across groups.

Also presented in the table are the loadings of the items on the two method factors, corresponding to the negative (lonely) and positive (non-lonely) items. For none of the samples was there evidence of a consistent response tendency across both method factors. Instead, there was evidence of a consistent response set in one direction or the other within each sample. For example, as can be seen in Table 8 among college students there was evidence of a consistent response set associated with the negative or lonely items, with all of these items loading significantly on the "negative item" factor. By contrast, loadings of the positive items on the "positive item" factor were not all significant for students. Indeed, in the case of Items 19 and 20, the loadings on the positive item factor were significantly negative. The teacher sample also showed evidence of a consistent response set associated with the negative items, whereas the nurses and the elderly showed a consistent response set associated with the positive items.

In summary, the factor analysis results provide support for viewing the UCLA Loneliness Scale as a unidimensional measure. All of the items were found to load significantly on a bipolar global loneliness factor. Although the

results involving the two method factors varied across samples, the addition of these factors to the global loneliness factor provided a good fit to the data from all four samples.

DISCUSSION

The psychometric data presented here support the reliability and validity of the UCLA Loneliness Scale (Version 3) in assessing loneliness in a variety of populations, ranging from college students to the elderly. Data on the reliability of this new version of the scale are comparable to values reported for the two earlier versions of the scale. As one might expect, loneliness scores were not normally distributed; relatively few individuals receive high scores on the measure. This was particularly true of the elderly, who reported the lowest levels of loneliness of the four groups studied. Due to these distributional problems, researchers studying loneliness should carefully consider how this lack of normality may affect the results of statistical tests involving loneliness scores.

Analyses of data from our four diverse samples also support the validity of Version 3 of the loneliness scale. Results from the college student sample support the convergent validity of the loneliness scale, revealing highly significant correlations with other measures of loneliness. As expected, loneliness was found to be negatively associated with measures of the adequacy of the individual's interpersonal relationships, particularly measures of social support. Indeed, one of the strongest correlates of loneliness scores was the Social Provisions Scale, a measure of perceived social support, with the correlations ranging from $-.54$ (elderly) to $-.68$ (students and teachers). Despite the strong association among these measures, other results presented by Russell, Kao, et al., (1987) support the discriminant validity of these two instruments. Specifically, although the latent loneliness and social support variables were found to be highly intercorrelated, the results also indicated that the latent loneliness variable was more strongly related to the personality and mood measures included in that study than was the latent social support variable.

Other analyses supported the construct validity of the UCLA Loneliness Scale (Version 3), providing evidence consistent with theoretical models of the determinants and consequences of loneliness. Loneliness was found to be significantly related to such trait dimensions as Neuroticism and Introversion-Extroversion. Concerning consequences of loneliness, strong associations were found between loneliness scores and dimensions of adjustment or well-being, including depression, life satisfaction, and job-related burnout. Finally, although the correlations were generally lower in magnitude, loneliness was found to be significantly related to perceived health status and the number of chronic illnesses among the elderly.

The final validity issue addressed by these analyses concerned the factor structure of the UCLA Loneliness Scale (Version 3). In contrast to most

previous factor-analytic studies of the loneliness scale, we conducted confirmatory factor analyses to evaluate the factor structure. A model that hypothesized a single bipolar global loneliness factor along with two orthogonal method factors (one for the positive items, another for the negative items) was found to provide an excellent fit to the data from all four samples.

These factor-analytic results are at variance with analyses that have been reported involving earlier versions of the UCLA Loneliness Scale. One possible explanation for the differences in findings involves changes that have been made in item wording. Alternatively, it is possible that confirmatory factor analyses of data from these prior studies would find that the model tested here, which incorporated a global loneliness factor along with two orthogonal method factors, provides an adequate fit to those data. To explore this possibility, a reanalysis of data from these prior studies testing this three-factor model would be useful, to evaluate whether or not those findings hold for the earlier version of the loneliness scale.²

In summary, the results of our psychometric analyses indicate that the UCLA Loneliness Scale (Version 3) provides a reliable and valid assessment of loneliness across a variety of populations and data-collection methods. This does not mean, however, that future modifications and improvements to the instrument will not be made. The process of scale development is never ending, with alterations in instruments continually being made as new information becomes available. Investigators are encouraged to use this instrument in their research, and to keep the scale developer informed as to their findings so that continued improvements in the scale may occur.

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²To evaluate the fit of this three-factor model to the second version of the loneliness scale, a confirmatory factor analysis was conducted using data collected by Russell, Cutrona, Rose, and Yurko (1984) using the Revised UCLA Loneliness Scale. The results indicated that this factor model also provided a good fit to the data for Version 2 of the scale. $\chi^2(150, N = 486) = 570.70$, AGFI = .85, CFI = .90

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