Adapting the UCLA 3-item loneliness scale for community-based depressive symptoms screening interview among older Chinese: a cross-sectional study

Tianyin Liu, Shiyu Lu, Dara K Y Leung, Lesley C Y Sze, Wai Wai Kwok, Jennifer Y M Tang, Hao Luo, Terry Y S Lum, Gloria H Y Wong

ABSTRACT

Objective Loneliness is a significant and independent risk factor for depression in later life. Particularly in Asian culture, older people may find it less stigmatising to express loneliness than depression. This study aimed to adapt a simple loneliness screen for use in older Chinese, and to ascertain its relevance in detecting depressive symptoms as a community screening tool.

Design, setting and participants This cross-sectional study was conducted among 1653 older adults aged 60 years or above living in the community in Hong Kong. This was a convenient sample recruited from four local non-governmental organisations providing community eldercare or mental healthcare services. All data was collected by trained social workers through face-to-face interviews.

Measures Loneliness was measured using an adapted Chinese version of UCLA 3-item Loneliness Scale, depression symptoms were assessed using the Patient Health Questionnaire-9 (PHQ-9), and social support with emotional and instrumental support proxies (number of people who can offer help). Basic demographics including age, gender, education and living arrangement were also recorded.

Results The average loneliness score was 3.9±3.0, and it had a moderate correlation with depressive symptoms (r=0.41, p<0.01). A loneliness score of 3 can distinguish those without depression from those with mild or more significant depressive symptoms, defined as a PHQ-9 score of ≥5 (sensitivity 76%, specificity 62%, area under the curve=0.73±0.01). Loneliness explained 18% unique variance of depressive symptoms, adding to age, living arrangement and emotional support as significant predictors.

Conclusion A 3-item loneliness scale can reasonably identify older Chinese who are experiencing depressive symptoms as a quick community screening tool. Its wider use may facilitate early detection of depression, especially in cultures with strong mental health stigma.

Trial registration number ClinicalTrials.gov NCT03593889

INTRODUCTION

Loneliness is a common human experience. Distinct from objective social isolation, loneliness reflects the individual’s experienced dissatisfaction with one’s relationships, and it is a distressing feeling that arises from self-assessed discrepancy between actual and desired companionship and/or emotional support. Because of its subjective nature, loneliness is inevitably affected by the cultural context, and some of the objective risk factors of isolation, for example, living alone, are not necessarily associated with loneliness. For instance, cross-cultural research of loneliness in Europe found that older adults in Eastern Europe had higher loneliness score than those in Western Europe, despite that co-residence is more common in Eastern Europe; and this phenomenon was explained by the interplay of individual and societal factors, for example, filial norms are weaker in Western Europe and hence lower co-residence rate fits the norm and does not contribute to higher loneliness.

In eastern cultures, such as Chinese culture that traditionally emphasises family and social cohesion, loneliness may be more profound...
in situations where family support and social network are weak. A systematic review on loneliness and social support in older Chinese has identified family as the most important source of social support, followed by friends. Family structure and cohesiveness is rapidly changing in Chinese communities, with increasing number of older persons living alone. While living alone can be a separate construct from social isolation and loneliness, empirical studies among Chinese older adults suggested that living alone is associated with stronger feeling of loneliness and higher risk for developing depressive symptoms. In addition, living alone has more of a negative stigma in Chinese communities than in Western communities, and is associated with a lower level of perceived social support. These traditional values and filial expectation are still being held by older persons while more of them are living alone, loneliness is thus expected to be highly prevalent in this population. In earlier cohorts (between 2002 and 2008) of a nationally representative sample of older adults in China, about 28% reported feeling lonely.

Loneliness is a known risk factor for depression, independent of other demographic and risk factors. Depression is a common mental health problem in older persons and it poses great burden on healthcare and social care systems, either directly due to the disability it causes or indirectly by complicating other physical health problems and care. Prevention and early intervention are effective in reducing suffering and societal costs from major depressive disorder; however, it is often under-recognised and undertreated. The fact that later-life depression is under-recognised and undertreated may be attributed to stigma and low awareness. In the USA, for example, older adults were generally worse than younger persons at identifying depressive symptoms, and it was suggested that greater efforts are needed in educating them about the symptoms. This challenge is particularly prominent in Asian cultures, where stigma towards mental illness may be more severe because it is attached to the family as a whole. In developing countries in Asia, social disapproval and devaluation of families with mentally ill individuals are important barriers to help-seeking. The more severe and integrated stigma to mental illness can help understand lower reported prevalence rates in these populations. For example, an earlier meta-analysis revealed a much lower prevalence of depression among elders in China, at only 3.86% compared with 12% in Western Europe, and this low prevalence rate may be partly attributed to strong stigma of mental illness.

Loneliness and depression are also conceptually related, although researchers have also taken care to distinguish between the two concepts. For older persons, the word lonely was highly salient when asked to free-list words describing a depressed person or themselves when depressed; they also saw loneliness as less stigmatising than depression, and recognised loneliness as a gateway to depression if left unattended. In Chinese, the common translation of loneliness is jimo (寂莫), which has meanings of silent, still and desolate; these concepts are distinct from those of depression, yiyu or youyu (抑鬱/憂鬱), which is a newer term in Chinese combining character that have connotations of repression, sadness and melancholy. Depression and loneliness are highly associated, particularly in older adults, with a magnitude of association ranging between 0.40 and 0.65.

In view of the role of loneliness in depression among older people, the screening of loneliness is important for detecting and preventing depression. Commonly used validated scales include: the 20-item Revised UCLA Loneliness Scale (R-UCLA), the 6-item De Jong Gierveld Loneliness Scale; and the UCLA 3-item Loneliness short scale (UCLA 3-item). Among these, the UCLA 3-item scale has gained popularity in large scale surveys, for instance, the Health and Retirement Study and the English Longitudinal Study of Ageing, as it is sufficiently sensitive to detect loneliness, simple to administer and also less prone to response bias than a single question. UCLA 3-item assesses subjective feelings of loneliness through questions that avoid using the word ‘lonely’ or ‘loneliness,’ but asks about the frequency of feeling. To our knowledge, the potential of using a loneliness screen to detect depressive symptoms in older population is unexplored, and this study aims to examine the utility of a culturally adapted UCLA 3-item scale in detecting depressive symptoms.

METHODS
Sampling and procedures
Data used in this study came from a preventive care for community-dwelling older adults at risk of or with subclinical depressive symptoms living in Hong Kong. The inclusion criteria were: (1) aged 60 years or above; (2) living in the service catchment area; and (3) having mild or above depressive symptoms (defined as a score of >4 on the Patient Health Questionnaire-9 (PHQ-9)) and/or having at least one risk factor of depression in old age, including report of loneliness, lack of social interaction, lack of meaningful/enjoyable activities, chronic pain, more than four common chronic diseases and/or recent bereavement. The exclusion criteria were: (1) a known history of autism, intellectual disability, schizophrenia spectrum disorder, bipolar disorder, Parkinson’s disease or dementia; and/or (2) significant suicidal risk. Eligible older persons were asked to give consent for participation in the service and the research study. The current analysis used screening data collected from 1807 community-dwelling elders for entry into the service between October 2017 and January 2019. All participants were recruited from four non-governmental organisations providing community eldercare or mental healthcare services by trained social workers through face-to-face interviews.

Instruments and measures
The locally adapted UCLA 3-item loneliness scale
Participants’ loneliness was measured using a locally adapted version of UCLA 3-item. As UCLA 3-item was originally developed in the West and in English, both the cultural context and language, are different from...
the norms in Chinese. Therefore, cross-cultural adaptation is needed. For example, in a Japanese version of the UCLA 3-item scale, one of the items required using a passive voice. Although there were existing Chinese versions, for this study, a spoken Chinese (Cantonese) version is required for the interview, given that a substantial proportion of older persons in Hong Kong had no formal education and cannot read, and the spoken language has terms and usages that differ from the written form. We adopted a five-stage process to ensure that the Cantonese version is a faithful adaptation (see online supplemental table 1 for details). The three items are: in the past 2 weeks, how often do you feel (i) lack of companionship, (ii) left out and (iii) isolated. The 3-point response scale for each item ranges from ‘hardly ever or never’ (1 point) to ‘often’ (3 points), and the total score is the sum of all items, which ranges from 3 to 9, with higher scores indicating a higher level of perceived loneliness. We adopted the 4-point Likert scale that was used in the R-UCLA from which UCLA 3-item was derived.

The Patient Health Questionnaire-9
Depressive symptoms were assessed using the PHQ-9, a 9-item instrument that incorporates depression diagnostic criteria, and rates symptom frequency of each factor into the scoring severity index. A PHQ-9 score of 0 to 4 signals no depression, 5 to 9, 10 to 14, 15 and above indicate mild, moderate, and moderately severe depressive symptoms, respectively.

Social support questions
Social support is a multidimensional construct. In this study, we focussed on emotional and instrumental support, following previous literature on their roles in social support among older Chinese. We did not include the subjective evaluation as it overlaps with the concept of loneliness. We used a name generation method following the exchange approach, which has been used in community-dwelling older persons in Hong Kong to understand the role of social support in ageing-in-place preference and depressive symptoms. We first assessed the presence of helping figure, and then used the number of helpers as proxies for emotional and instrumental support. The questions were ‘Do you have someone to talk to when you feel down?’ and ‘Do you have someone to help you with trivial things (e.g., change the bulb)?’ If they answered yes, we then asked them to list out the people who offer them help with a maximum number of five people.

The Montreal Cognitive Assessment 5-minute protocol
Cognition was measured using the Montreal Cognitive Assessment 5-minute protocol (MoCA 5-min) to screen out probable cognitive impairment. Participants who scored below the second percentile by age and education on MoCA 5-min were excluded from later analyses to avoid potential insight problems.

General information questionnaire
We used a self-designed questionnaire to collect demographic information, including age, gender, education (years and highest level attained), work years and living arrangement (living alone versus otherwise).

Statistical methods
Confirmatory factor analysis (CFA) was used to examine whether the data fitted the theoretically hypothesised one-factor model of UCLA 3-item. Cronbach’s alpha estimates and Spearman’s item-total correlations were performed to examine the internal consistency and reliability of the scale. Bivariate correlation analyses were used to test the convergent and discriminant validity of the scale with conceptually related variables, that is, depressive symptoms and social support. Multiple regressions with PHQ-9 score as the dependent variable were performed to demonstrate the incremental validity of loneliness in explaining depressive symptoms after controlling for other risk/protective factors, including demographics (female gender and living alone) and social support (emotional and instrumental support).

Finally, we used receiver operating characteristic (ROC) curve analyses to identify the cut-off points of loneliness scores in detecting: (a) mild and more serious depressive symptoms using a PHQ-9 score of 5 as gold standard; (b) moderate and more serious depressive symptoms using a PHQ-9 score of 10 as the cut-off; and (c) moderately severe and more serious depressive symptoms using a PHQ-9 score of 15. The Youden Index was used to define the optimal cut-offs, a method that has been frequently utilised in biomedical diagnostic practices. The Youden Index (J)=Sensitivity+Specificity−1; thus by maximising J across various cut-offs, the optimal cut-off point is calculated. CFA was undertaken using the lavaan package in R for latent variable analysis, and all other analyses were conducted using SPSS V.25.0 (IBM Corporation, Armonk, New York, USA).

Patient and public involvement
Patients and public (older adults with or without depression) advised the cultural adaptation of the UCLA 3-item scale (see online supplemental table 1). Patients and the public were not involved in reporting of the present research.

RESULTS
Demographic characteristics
Participants’ sociodemographic and clinical characteristics are reported in table 1. The mean age of participants was 77.98 (SD=8.24) years. This cohort had low education, 35% had no formal education, and average years of schooling was 4.86 (SD=4.40). Nearly half of them lived alone (n=742, 44.9%) (table 1).

Correlations between loneliness, depression and social support
The mean total score of the Chinese UCLA 3-item 3.91 (SD=3.02) with the possible score ranging from 0 to 9,
and the frequency and percentage of response categories of individual items are summarised in online supplemental table 2. In the CFA results, all factor loadings exceeded 0.80, and the goodness-of-fit indexes, including comparative fit index (CFI), Tucker Lewis index (TLI), root-mean-square error of approximation (RMSEA), and standardised root-mean-square residual (SRMR), showed that the model had very good fit (CFI=1.0; TLI=1.0; RMSEA=0.00; SRMR=0.00), which confirmed the structural validity of the translated scale.49 CFA and the item-total correlations were all above 0.70 (p<0.01).

The Cronbach’s alpha coefficient for the scale was 0.87, indicating that it has good internal consistency.49 The mean PHQ-9 score was 6.62 (SD=4.13), according to the validated cut-off scores, 468 (28.3%) of the participants had no depressive symptoms, nearly half (n=874, 52.9%) had mild depressive symptoms, 239 (14.5%) exhibited moderate depressive symptoms, and 72 (4.4%) might have moderately severe and more serious depressive symptoms. In terms of social support, close to one-third (n=457, 27.7%) reported having no one to help with trivial things, the average number of people they could turn to for help was 0.98 (SD=0.87); over one-third (n=569, 34.4%) reported having no one to talk to when they felt down, and the average number of people they can talk to was also close to one (mean=0.94, SD=0.87).

Correlational analyses were performed between UCLA 3-item, PHQ-9, social support proxies, living arrangement and age, and the results (Spearman’s or Pearson’s correlation coefficients) are summarised in table 2. The Spearman’s correlation of Chinese UCLA 3-item with PHQ-9 scores was 0.42 (p<0.01), suggesting a moderate positive association between loneliness and depression. Loneliness was negatively correlated with emotional support (ρ=−0.13), instrumental support (ρ=−0.09), and age (r=−0.05), and positively with living alone (ρ=0.17); the correlations were all significant (p<0.01) but weak.

Two ROC curve analyses were performed using PHQ-9 depressive symptoms. Optimal cut-off scores of loneliness scale for detecting psychological distress explaining 18% unique variance, and age and emotional support remaining significant predictors.

Our final model (Model 3) explained 19% of the variance in PHQ-9 scores (F(6, 1646)=67.44, p<0.001), with loneliness explaining 18% unique variance, and age and emotional support remaining significant predictors.

Optimal cut-off score of loneliness scale for detecting depressive symptoms

Three ROC curve analyses were performed using PHQ-9 scores of 5, 10 and 15 as cut-offs, respectively, to detect mild, moderate and moderately severe depressive symptoms using loneliness scores. Applying this method, we calculated the optimal cut-offs with highest J for mild, moderate and moderately severe and more serious depressive symptoms. The results are summarised in Table 4 and ROC curves shown in figure 1. To detect mild and more serious depressive symptoms, the optimal cut-off of loneliness score was 3 (sensitivity 76%, specificity 62%, positive predictive value (PPV) 84%, negative predictive value (NPV) 51%), the area under the ROC curve (AUC; SD) was 0.73±0.01 (Figure 1A) and significant (z=17.17, p<0.001). To detect moderate and more severe depressive symptoms, a cut-off of 4 was identified (sensitivity 69%, specificity 55%, PPV 26%, NPV 88%), the AUC (SD) was 0.66±0.02 (Figure 1B) and significant (z=9.01, p<0.001). The same cut-off of 4 was chosen by J in detecting moderately severe and more serious depression symptoms (sensitivity 82%, specificity 52%, PPV 7.2%, NPV 98.4%), the AUC (SD) was 0.73±0.03 (Figure 1C) and significant as well (z=7.45, p<0.001). A UCLA 3-item cut-off of 3 showed satisfactory sensitivity and specificity in detecting mild depressive symptoms among community-dwelling older adults, and a cut-off of 4 showed high sensitivity but low specificity in detecting moderately severe depressive symptoms.

**Table 2** Correlations between UCLA 3-item loneliness scale and selected variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficients</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Scale item 1: lack companionship (0 to 3)</td>
<td>0.90*</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>2. Scale item 2: feel left out (0 to 3)</td>
<td>0.88*</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>3. Scale item 3: feel isolated from others (0 to 3)</td>
<td>0.89*</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>4. PHQ-9 score (0 to 27)</td>
<td>0.42*</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>5. Emotional support (0 to 5) (No. of people to talk to when feeling down)</td>
<td>−0.13†</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>6. Instrumental support (0 to 5) (No. of people to help with everyday tasks)</td>
<td>−0.09†</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>7. Living arrangement (0 to 1) (Living with someone versus living alone)</td>
<td>0.17†</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>8. Age</td>
<td>−0.05*</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*Pearson’s correlation coefficients show individual item correlations with the 3-item loneliness scale. †Spearman’s correlation coefficients show the associations between the 3-item loneliness scale and related variables.

**Table 3** Regression models on PHQ-9 scores with different predictors

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>10.44***</td>
<td>9.96***</td>
<td>6.27***</td>
</tr>
<tr>
<td>Age (range: 60 to 106 years)</td>
<td>−0.05**</td>
<td>−0.05**</td>
<td>−0.05**</td>
</tr>
<tr>
<td>Female (ref: male)</td>
<td>0.30</td>
<td>0.22</td>
<td>0.13</td>
</tr>
<tr>
<td>Living alone (0 to 1)</td>
<td>−0.36</td>
<td>−0.30</td>
<td>−0.09***</td>
</tr>
<tr>
<td>Emotional support (0 to 5)</td>
<td>0.34†</td>
<td>0.34†</td>
<td>0.55***</td>
</tr>
<tr>
<td>Instrumental support (0 to 5)</td>
<td>−0.07</td>
<td>−0.07</td>
<td>−0.07</td>
</tr>
<tr>
<td>UCLA 3-item score (0 to 9)</td>
<td>0.59***</td>
<td>0.59***</td>
<td>0.59***</td>
</tr>
<tr>
<td>R²</td>
<td>0.01**</td>
<td>0.02†</td>
<td>0.19***</td>
</tr>
<tr>
<td>F(df)</td>
<td>7.95 (3 to 1649)</td>
<td>6.26 (5 to 1647)</td>
<td>67.44 (6 to 1646)</td>
</tr>
<tr>
<td>Δ R²</td>
<td>0.01**</td>
<td>0.004†</td>
<td>0.19***</td>
</tr>
</tbody>
</table>

***p<0.000; **p<0.01; *p<0.05.

PHQ-9, Patient Health Questionnaire-9.
which revealed its incremental validity in its association with depression. The cut-off point of 3 on UCLA 3-item may signal mild depressive symptoms in community-dwelling older Chinese.

UCLA 3-item was designed and has been used in large scale surveys to detect loneliness; however, there are different ways of classifying ‘lonely’ about which there has been no consensus. For instance, some researchers classified ‘lonely’ as those who score in the top quintile of the total score, that is, 6 to 9, while others classified those who answer ‘some of the time’ or ‘often’ to any item as lonely. Loneliness per se is a high risk factor for poor ageing outcomes and warrants attention; while the current findings further suggest its function to detect depressive symptoms. A cut-off point of 3 had the best balance between specificity and sensitivity to signal mild or more serious depressive symptoms in this sample of vulnerable and deprived community-dwelling older adults in an Asian community, and this cut-off point is lower than either the total quintile cut-off of 6 or the item-by-item cut-off (minimum score 4) in detecting loneliness. It is possible that the lower cut-off found in this study is due to the expansion from three to four response categories, hence increasing the score range from 3 to 9.

Table 4  Sensitivity, specificity, AUC, PPV, NPV with 95% CI for each optional cut-off based on Youden’s criterion

<table>
<thead>
<tr>
<th>Cut-off</th>
<th>≥mild depressive symptoms</th>
<th>≥moderate depressive symptoms</th>
<th>≥moderately severe depressive symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity (95% CI)</td>
<td>76.4 (73.8 to 78.8)</td>
<td>68.8 (63.3 to 73.9)</td>
<td>81.9 (71.1 to 90.0)</td>
</tr>
<tr>
<td>Specificity (95% CI)</td>
<td>62.2 (57.6 to 66.6)</td>
<td>54.7 (52.0 to 57.4)</td>
<td>51.7 (49.2 to 54.2)</td>
</tr>
<tr>
<td>PPV (95% CI)</td>
<td>83.6 (80.9 to 85.4)</td>
<td>26.0 (24.0 to 31.1)</td>
<td>7.2 (6.5 to 13.3)</td>
</tr>
<tr>
<td>NPV (95% CI)</td>
<td>51.0 (47.6 to 55.8)</td>
<td>88.3 (85.6 to 89.4)</td>
<td>98.4 (97.2 to 98.6)</td>
</tr>
<tr>
<td>J</td>
<td>0.39</td>
<td>0.24</td>
<td>0.34</td>
</tr>
<tr>
<td>AUC (95% CI)</td>
<td>0.73 (0.70 to 0.75)</td>
<td>0.66 (0.62 to 0.69)</td>
<td>0.73 (0.67 to 0.79)</td>
</tr>
<tr>
<td>SE</td>
<td>0.01</td>
<td>0.02</td>
<td>0.03</td>
</tr>
<tr>
<td>z</td>
<td>17.17***</td>
<td>9.01***</td>
<td>7.45**</td>
</tr>
</tbody>
</table>

***p<0.000; **p<0.01.
AUC, area under the curve; J, Youden’s index; NPV, negative predictive value; PPV, positive predictive value.

Figure 1  Receiver operating characteristic curve of the UCLA 3-item loneliness scale for the detection of (A) mild and more serious depressive symptoms (PHQ-9 ≥5), (B) moderate and more serious depressive symptoms (PHQ-9 ≥10), and (C) moderately severe and more serious depressive symptoms (PHQ-9 ≥15). PHQ-9, Patient Health Questionnaire-9.
the current study did not focus on engaging service users in service development per se, it embodied the concept of bridging the gap between research and service, and opened up windows to develop the partnership between researchers, service providers and service users in a meaningful manner.

With serious underdiagnosis of depression in older adults, methods to promote early detection is imperative. To achieve this, it is vital to detect mild depressive symptoms in the targeted population using easy-to-administer, culturally sensitive and validated assessment tools. This Chinese version of UCLA 3-item serves this purpose, and can easily be incorporated into a public education programme as a self-assessment tool to screen for depressive symptoms without mentioning the word depression, and a standardised protocol to use this scale is also in place and has been tested in training the social workers. In addition to detection of depressive symptoms in the community, loneliness is also associated with many other negative physical and mental health outcomes in older people, such as increased systolic blood pressure, increased anxiety and cognitive impairment. Future studies could explore the nature of relationship and relevance of the UCLA 3-item as a quick screening tool for related health risks.

This study has several limitations. First, this sample of older adults was not randomly selected. Participants were recruited from community centres and through public education events among those who were suspected to be at risk of or with mild depressive symptoms. Although the profile of participants’ PHQ-9 scores follows a normal distribution, this sample is more vulnerable than the normal population to other risk-prone demographic indicators. Therefore, whether data collected from the general population that includes mentally resilient older adults would shift the cut-off score remains unclear, and future studies are needed to affirm this using random sampling. Second, our measurement of social support provided information only on the number of available helping figures for emotional and instrumental support, and did not provide more detailed information about the frequency of help or contact. Third, this is a cross-sectional study; despite the positive association between loneliness and depression, no causal relationship between loneliness and depression can be inferred with this data set. Future longitudinal data from this sample can provide further empirical evidence about the role of loneliness in predicting depression trajectory, which has implication values as when to intervene.

**CONCLUSION**

Loneliness is a unique risk factor for depressive symptoms in older adults, and Chinese older adults immersed in Asian Culture are more open to express and discuss about it than depression. Assessing loneliness may give us an invaluable opportunity for early detection and prevention of depression in old age. This study adapted the UCLA 3-item loneliness scale for use in Chinese community, and this brief scale is well-suited as a screening tool for probably depression in the community. We have also developed and implemented the standardised protocol for training social workers to use the scale, and this protocol could be used for training other mental health service providers or community members who care about mental wellness of older people. This package of adapted loneliness scale, the training protocol and the cut-off scores can be used for task shifting and preventive care in mental health services.

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**Contributors** TL and GW conceived the study and obtained funding. TL and WWK implemented the cultural adaptation of the UCLA 3-item scale. DKYL and LS coordinated scale adaptation, data input and data preparation. TL analysed and interpreted the data, wrote the first draft, which was refined in discussion with JYMT and HL for statistical analyses, and with SL for interpretation. GHKW and SL revised the draft further for intellectual consent. All authors read and approved the final manuscript.

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**Competing interests** None declared.

**Patient consent for publication** Not required.

**Ethics approval** This study was approved by the Human Research Ethics Committee (HREC) of the University of Hong Kong (HREC’s reference number: EA1709021). Each participant provided written informed consent before participating in the study.

**Provenance and peer review** Not commissioned; externally peer-reviewed.

**Data availability statement** No data are available. The ethical approval and participant consent for this study do not allow sharing of data beyond the research team.

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**REFERENCES**


Supplementary Table 1

Five stages of locally adapting the UCLA 3-item Loneliness Scale into spoken Chinese (Cantonese)

<table>
<thead>
<tr>
<th>Stage</th>
<th>Task</th>
</tr>
</thead>
</table>
| 1     | • A working group was established comprising two experienced researchers in the fields of psychology and gerontology respectively, two clinical psychologists, and one translator.  
      • The standard “forward-backward” method was applied to translate the questionnaire from English to Chinese. One clinical psychologist translated the items and the response categories and created a provisional version of the Cantonese scale. |
| 2     | • The provisional version was back translated into English by the researcher in gerontology, and the linguistic validity of the forward and backward translated versions of the scale was examined by the translator.  
      • Consensus was achieved in the working group on the translation of items 1 and 2; however, the group disagreed on the translation of item 3, specifically regarding the word ‘isolated’, which is an ambiguous term in Chinese and a literal translation from English sounds inauthentic in Chinese without a passive voice.  
      • Working group members consulted other stakeholders. |
| 3     | • Cultural adaption of the word choice was done through review within the working group, consultation with older adults, and final modification by the working group.  
      • The other clinical psychologist and psychology researcher who were not involved in the translation reviewed the draft and made suggestions. Take into consideration the low education level of the Hong Kong cohort, they provided two alternatives other than the literal translation to test which wording is more comprehensible: 1) paraphrase “isolated” to a Chinese term similar to “lonely”, and 2) use more colloquial language to express “isolated”. |
| 4     | • Cultural adaption was done with the response categories. The working group reviewed the response categories, and considered a 3-point scale (1 = hardly ever; 2 = some of the time; 3 = often) versus a 4-point scale (0 = never; 1 = rarely; 2 = sometimes; 3 = always).  
      • The 4-point Likert scale was used in the R-UCLA from which UCLA 3-item was derived, and the reason for narrowing it originally was to fit the telephone interview protocol and to ensure that participants could remember the categories. The working group adopted the 4-point responses in the current study, which did not involve telephone survey. |
| 5     | • The working group consulted potential participants of the study. A convenient sample of 11 older adults with normal cognitive ability (one man and 10 women; mean age = 79.8±6.5; average years of education = 3.5±4.2) were recruited from the community aged care centres to provide their opinions on the translated versions of the scale.  
      • From consultation with these participants, it was found that four people (36%) perceived the three translated versions of item 3 to be similar or identical, five people (45%) preferred the word “lonely“ because it was more comprehensible, and two people (18%) perceived slight differences in the three versions, whereas “isolated” was more objective and “lonely” was their subjective feeling. They all preferred the 4-point scale over the 3-point scale because it enabled more precision in answering, and six (55%) mentioned explicitly that they needed the category “never” to be at least one item in the scale.  
      • The working group made a collective decision on the translation of item 3, using the Chinese term similar to “lonely”, and expanding the number of response categories to four. |
## Supplementary Table 2

### Analysis of the UCLA 3-item Chinese version (n = 1,653)

<table>
<thead>
<tr>
<th>How often do you feel: [frequency (%)]</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Always</th>
<th>Item-total correlation</th>
<th>Factor loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) lack of companionship</td>
<td>553 (33.5)</td>
<td>367 (22.2)</td>
<td>411 (24.9)</td>
<td>322 (19.5)</td>
<td>.78</td>
<td>.87</td>
</tr>
<tr>
<td>(ii) left out</td>
<td>659 (39.9)</td>
<td>364 (22.0)</td>
<td>382 (23.1)</td>
<td>248 (15.0)</td>
<td>.74</td>
<td>.82</td>
</tr>
<tr>
<td>(iii) isolated</td>
<td>491 (29.7)</td>
<td>316 (19.1)</td>
<td>422 (25.5)</td>
<td>424 (25.7)</td>
<td>.74</td>
<td>.81</td>
</tr>
</tbody>
</table>

SD, standard deviation.