Detecting depression in Chinese adults with mild dementia: Findings with two versions of the Center for Epidemiologic Studies Depression Scale

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Abstract

This study investigates the extent to which the diagnostic performance of the Center for Epidemiologic Studies Depression Scale (CES-D; both 20- and 10-item versions) varies with cognitive status, and whether the same threshold can be applied regardless of cognitive status. Three hundred and ninety-six persons aged 60+ referred for psychiatric assessment were broken down into four groups depending on age (<70 and ≥70) and dementia status (mild vs. none). All were independently interviewed using the CES-D before their first evaluation by a psychiatrist. Receiver operating characteristic curves showed that both versions of the CES-D produced essentially identical results, regardless of age and dementia status. Both versions were more or less robust to the effect of mild dementia but were vulnerable to the effect of age itself. Furthermore, the optimal threshold for the 20-item version varied somewhat across the different age–dementia groups, and no clear-cut threshold existed in old-old persons with dementia. On the contrary, the same threshold of 12 can be adopted for the 10-item version, regardless of age and dementia status. Compared with the full 20-item scale, the 10-item version has the added advantage of an identical threshold across age and cognitive status.

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1. Introduction

Researchers and clinicians are increasingly concerned with the identification of depression in persons with dementia (e.g., Cheng and Chan, 2005a; Rosenberg et al., 2005). While unidentified and untreated depression increases the elderly person’s vulnerability to cognitive deterioration and dementia (Blazer, 2003; Van Reekum et al., 2005), it may be difficult to recognize depression in persons with dementia due to overlapping symptoms (Kales and Mellow, 2003).

To the best of our knowledge, no study to date has examined the extent to which the presence of dementia affects the diagnostic validity of the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977). Moreover, for practical purposes, we are interested to see if the same threshold can be applied to cognitively intact and impaired populations. This is a different question from the one about diagnostic performance. A scale may be robust to cognitive impairment, but if the optimal threshold shifts from one population to another, actual...
applications will become very difficult because it would require prior knowledge of the cognitive status of the person under assessment (Cheng and Chan, 2005a).

Recently, Cheng and Chan (2005b) evaluated the diagnostic performance of the full 20-item version of the CES-D (hereafter called CESD-20), as well as a shorter 10-item version of the scale (hereafter called CESD-10; Andresen et al., 1994), in a sample of older Chinese persons aged 60 or older. Similar to other studies, they found that the optimal cutoff for the CESD-20 in older people was higher than the conventional cutoff of 16 as recommended by Radloff (1977). Moreover, the optimal threshold at 22 (i.e., a score of 22 or above) in Chinese people aged 60 or above is remarkably consistent with those reported for some European samples as well as Hispanics in the United States (for review, see Cheng and Chan, 2005b). The cross-cultural generalizability of such findings seems to lend support for a score slightly above 20 as the optimal threshold for older people.

The performance of the 10-item version was of particular interest because it is well-known that older people may not have the cognitive resources to stay focused on a lengthy instrument (Kohout et al., 1993). This is especially true for most Asian populations as older people have been deprived of educational opportunities, and many are in fact illiterate (Cheng et al., in press). A shorter instrument is therefore more acceptable to this population. The study by Cheng and Chan (2005b) found that the 10-item version performs equally well as the 20-item version in terms of predicting clinical diagnosis, and reported an optimal threshold of 12. A confirmatory factor analysis showed that these 10 items represent three distinguishable, yet correlated, factors—depressed affect, somatic symptoms and positive affect—which together tap a common underlying construct of depression (Cheng et al., 2006).

Using the same sample as in Cheng and Chan (2005b), this study examines the comparative diagnostic performance of the 10- and 20-item versions of the CES-D in mildly demented and nondemented Chinese elderly. To accomplish this, persons with and without dementia were further subdivided by age categories (i.e., young-old and old-old) so that variations in the scales’ diagnostic performance that are due to age and dementia can be isolated. That is, because persons with dementia tend to be older than those without, it is important that age differences can be minimized when comparing demented with nondemented persons so that any effects observed can be attributed to dementia rather than age. This is especially important because both cognitive impairment and age are associated with an increase in depressive symptoms (Davey et al., 2004; Gabryelewicz et al., 2004; Gilley et al., 2004). [See Cheng and Chan (2005a) for a more thorough discussion on this issue.]

2. Methods

2.1. Participants and procedure

Participants were 398 persons aged 60 or over who were consecutively referred for psychiatric evaluation at major outpatient clinics in Hong Kong over a 1-year period. All participants provided consent to participate and ethics approval was obtained from the internal review panel of the Medical and Health Department that ran these clinics. Nurses received training from the second author on using the interview instrument. Participants were individually interviewed by a psychiatric nurse at intake on a questionnaire that contained the Mini-Mental State Examination (MMSE; Folstein et al., 1975) and the full CES-D. Subsequently, they were given an intake assessment by an experienced psychiatrist, who was blind to the nurse interview, and were given a primary diagnosis on the basis of DSM-III-R criteria (American Psychiatric Association, 1987). A range of clinically significant states of depression (e.g., major depression, dysthymia, and adjustment disorder with depressed mood) were included in case definition (Lavretsky and Kumar, 2002). Similarly, a range of dementia-related diagnoses (e.g., primary degenerative dementia of the Alzheimer type, multi-infarct dementia, and senile dementia not otherwise specified) was used to indicate the presence of dementia. Dementia severity was rated by the psychiatrist with reference to DSM-III-R criteria. All diagnoses were confirmed in in-house case conferences.

2.2. Measures

The CES-D, developed at the Center for Epidemiologic Studies, National Institute of Mental Health (Radloff, 1977), contains 20 items describing mood, somatic symptoms, interpersonal problems, sense of worthlessness, and psychomotor functioning. Respondents were asked to indicate the frequency of the symptoms using a scale of 0 ‘less than a day,’ 1 ‘1–2 days,’ 2 ‘3–4 days’ and 3 ‘5–7 days’ against a time frame of the past week. In this study, the Chinese version of the CES-D (Boey, 1999) was used.

In addition, the Chinese version of the Mini-Mental State Examination (MMSE; Chiu et al., 1994) was used to screen for cognitive impairment. Those scoring below 20 were excluded from the study.
2.3. Statistical analysis

The sample was divided into four groups: young-old persons with dementia ($n=70$), old-old persons with dementia ($n=84$), young-old persons without dementia ($n=148$) and old-old persons without dementia ($n=94$). Receiver operating characteristic (ROC) curves were plotted for each of these groups using the psychiatric assessment as the ‘gold standard’ for depression diagnosis. The ROC curve is one of the most commonly used method to describe the performance of a diagnostic test by plotting its sensitivity against the false positives (1 — specificity). It therefore shows how a decrease or increase in false positives is traded for a corresponding change in sensitivity. The optimal threshold of a test, typically identified by the point on the curve that is closest in distance to the upper left corner of the graph, represents the optimal mix of hits and false positives (i.e., maximal hits with minimal false positives). The area under the curve (AUC) is the single most powerful summary of the diagnostic performance of a test, with a

<table>
<thead>
<tr>
<th></th>
<th>Young-old</th>
<th>Old-old</th>
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<tbody>
<tr>
<td>Demented</td>
<td>CESD-10</td>
<td>0.71±0.12</td>
</tr>
<tr>
<td></td>
<td>CESD-20</td>
<td>0.72±0.12</td>
</tr>
<tr>
<td>Nondemented</td>
<td>CESD-10</td>
<td>0.73±0.08</td>
</tr>
<tr>
<td></td>
<td>CESD-20</td>
<td>0.73±0.08</td>
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Note. The CESD-10 and CESD-20 are the 10- and 20-item versions of the Center for Epidemiologic Depression Scale, respectively.
larger area indicating better performance (Hanley and McNeil, 1982). In general, errors of estimation of the AUC are inversely related to the sample size, which affects the degree to which the difference between two AUCs can be detected. In this study, the Z statistic, with adjustment for correlated data where appropriate (Hanley and McNeil, 1983), is used to test if two AUCs are significantly different from each other.

3. Results

Two persons were excluded from the analysis because of missing information on age. The remaining 396 cases contained 64.2% women and had a mean age of 70.03 (S.D.=7.21). Over half (54.6%) were married whereas 37.3% were widowed. Typical of this cohort of older persons in Hong Kong, 47.4% had received no formal education and 40.3% some primary education. All participants had an MMSE score of 20 or above, and those having a dementia diagnosis had significantly lower MMSE scores than those without (M=21.59 vs. 26.74; d=1.48; t(387.91) =23.31, P<0.001).

No age difference was observed between those with and without dementia in the young-old category (M=65.21 vs. 64.53; t(216) =1.63, ns), but a significant age difference did exist in old-old persons (M=77.70 vs. 75.18; d=0.45; t(160.08) =3.01, P<0.01). Although the contribution of an age difference cannot be entirely eliminated, comparing demented to nondemented persons in specific age groups is a way to reduce the potential confounding effects of age. Moreover, the absence of a significant age difference in the young-old subgroups permits an estimation of the effects of dementia that are independent of those of age in this age bracket.

The ROC curves for CESD-10 and CESD-20 are displayed in Fig. 1, and AUCs are shown in Table 1, separately for the four age–dementia groups. Several observations can be made. First, the results of the two scales were virtually indistinguishable from each other within each age–dementia subgroup (Zs= 0.03, 0.00, −0.09 and 0.06 for young-old demented, old-old demented, young-old nondemented, and old-old nondemented, respectively; all Ps>0.05). Second, regardless of age, both scales performed equivalently across dementia groups (for the young-old and the old-old respectively, Zs=0.27 and −0.23 for the CESD-10, and 0.14 and 0.35 for the CESD-20; all Ps>0.05). Note that those with dementia were older than those without in the old-old category, and thus the former were subject to a stronger (negative) age trend in diagnostic performance; therefore the findings suggest that the CES-D is rather robust to the effect of mild dementia. Third, when AUC comparisons were carried out for different age groups
that corresponded to the same dementia category, there also were no significant differences, although the point estimates differed somewhat (for persons with and without dementia, respectively, $Zs=0.18$ and $1.30$ for CESD-10, and $0.32$ and $1.01$ for CESD-20; all $P$s $>0.05$). Thus the CES-D appears to be applicable to the old-old as well as to the young-old. Nonetheless, it is worthwhile to note that, due to a smaller sample size, both old age and dementia are associated with a larger margin of error in the AUC estimates (see Table 1). This did not create a problem for the young-old demented because the lower bound estimate was still well above 0.50 (when diagnostic performance was no better than chance). Among the old-old, the lower bounds of the estimates were generally above 0.50, regardless of scale and dementia status, but it was right at 0.50 when the CESD-20 was used with demented persons. Overall, these results suggest that the 10-item version is comparable to the full version in screening for depression in those suffering from mild dementia.

To further examine the performance of the scales at specific thresholds, values of sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and total correct percentage were computed for each age—dementia subgroup (see Table 2). We will not discuss each of these statistics individually but will draw our discussion from the overall picture. Consider the CESD-20 first. One can see that the optimal thresholds were 21, 22 and 20, respectively, for the young-old demented, young-old nondemented and old-old nondemented, respectively. As suggested by the ROC curve itself, there was no clear-cut threshold for the old-old demented, and this was a bit disturbing, especially given the standard error of the estimate as noted above.

The optimal thresholds for the CESD-10 were 12 and 13, respectively, for young-old and old-old persons with dementia. Either 11 or 12 appeared equally suitable thresholds for persons without dementia, regardless of age, with some tradeoff between sensitivity and specificity. Overall, the results suggest that the same threshold of 12 can be applied regardless of age and dementia status, and this is further support for the short version’s superiority over the long one. Finally, with the exception of the old-old demented group, the performance of the CESD-10 was basically indistinguishable from that of the CESD-20, at the respective optimal thresholds.

4. Discussion

The results suggest that the CES-D, irrespective of length, is by and large robust to the effect of mild dementia. There was some drop in diagnostic performance from the young-old to the old-old regardless of dementia status, but this drop was not statistically significant as revealed by the Z test. As a result, values of sensitivity, specificity, PPV and NPV varied substantially across age—dementia groups. For example, at threshold $=12$, the CESD-10 produced performance indices that were in the range of 0.67–0.88 for sensitivity, 0.44–0.74 for specificity, 0.40–0.69 for PPV, and 0.60–0.90 for NPV, across the four groups. In general, among those with dementia, the scales were much more accurate in a negative result than in a positive result, regardless of age. For old-old persons with dementia, the PPV fell below 0.50, meaning that not even half of the positive predictions were actually (clinically) depressed. This would limit the application of these screening scales, but the problem is not specific to the CESD-10.

Furthermore, among those aged 70 or over, whether they were cognitively impaired or not, the scales were much better at screening for depressive cases than screening out non-cases, hence producing a lot of false positives. Perhaps, there are other factors associated with aging, or other cohort effects, that were not accounted for in this study. There may also be subtle cognitive impairments not picked up either by the MMSE or the psychiatric diagnosis. In any case, our findings paralleled those of Garrard et al. (1998) who reported that the Geriatric Depression Scale did not work as well with very old as with not so old people, and those of Cheng and Chan (2005a) who examined the Geriatric Depression Scale in a similar sample. Further research should shed light on possible explanations for these findings and suggest ways to improve the way depression is measured and detected in very old adults.

Two potential limitations of the present study need to be mentioned. First, the diagnostic system used in Hong Kong at the time was still DSM-III-R. Hence one might argue that the findings do not inform current practice. Nevertheless, significant changes in results would be unlikely if the study were to be repeated using DSM-IV (American Psychiatric Association, 2000) because the diagnostic criteria for various depressive conditions are essentially the same between the two versions. Having said this, data based on DSM-IV as the diagnostic system will provide more definitive conclusions on the relative effectiveness of the two scales. Second, the sizes of the four subsamples varied, with a lot more young-old persons without dementia than in the other three groups. As the AUC estimates have larger margins of error in smaller sample sizes, thus reducing the power of the Z test, future research should recruit larger samples for a more powerful analysis.
To conclude, the 10-item version is an excellent alternative to the full scale. In fact, with equivalent performance to the full scale but the added advantage of an identical threshold across age and cognitive status, the 10-item short form will prove to be an instrument of choice for researchers and practitioners. The fact that all major psychiatric outpatient clinics in Hong Kong participated in the study lends support to the generalizability of this conclusion to the Chinese population above age 60, at least that in Hong Kong. To what extent will these findings still apply when criteria for depression in Alzheimer disease change (Olin et al., 2002; Rosenberg et al., 2005) is a subject for future research. Nevertheless, the findings further support the view that shorter versions of the CES-D are as valid as the full scale in older adults (e.g., Cheng and Chan, 2005b; Kohout et al., 1993; Lewinsohn et al., 1997).

Short instruments will also be more acceptable to older people with relatively limited cognitive resources. We hope that these comparative validity data can aid researchers and practitioners in making decisions about the choice of scales in the future.

References