

Evaluation of the center for epidemiologic studies-depression scale as an aiding instrument of the detection of depressed patients in Japanese outpatients

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Abstract

Objective The Center for Epidemiologic Studies-Depression Scale (CES-D) has been used as an instrument to screen depressed individuals among Japanese workers and patients with dementia, but it has not been applied in Japanese outpatients. The aims of this study were to examine the validity of the CES-D in Japanese outpatients and establish optimal cut-off scores.

Methods Data were collected from 6,938 outpatients aged 27-63 in our institution. Of these subjects, 4,805 outpatients completed the CES-D questionnaires including 1,714 patients in whom a diagnosis of depression was made based on the DSM-IV (Diagnostic and Statistical Manual of Mental Disorders, 4th Edition) and/or ICD-10 (the International Classification of Diseases, 10th). In this study, we first tested the optimal cut-off scores of CES-D in those depressed patients diagnosed by the "gold standard" (DSM-IV or ICD-10), and then re-evaluated the other cases of outpatients with mental disorders to detect those with depressive syndromes.

Results The CES-D, with an optimal cutoff score of 8.5 for no depression yielded a sensitivity of 98.7%, and a specificity of 91%. The results based on our cut-off score of the CES-D-8.5 showed that potential depression was also present in 30.5%, 16.2%, 3.7%, 23%, 38%, 26%, 17%, 19% of outpatients with sleeplessness, adjustment disorders, dysthymia, alcoholism, epilepsy, panic disorders, eating disorders and anxiety disorders, respectively.

Conclusion Using the CES-D may be helpful for physicians to detect depression not only in depressed patients but also in Japanese outpatients suffering from a variety of diseases.

Introduction

Depression is one of the most prevalent yet under-diagnosed psychiatric disorders in the general population¹⁾. It not only causes personal distress and social dysfunction, but also increases the likelihood of suicide. The effective management and treatment of depressed

individuals greatly depends on distinguishing depressed patients from non-depressed subjects and accurately assessing the extent of depression²⁾.

Two diagnostic systems, the International Classification of Diseases, 10th Revision (ICD-10) and the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV), are used to establish

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diagnoses in our department. The Center for Epidemiological Studies-Depression Scale (CES-D) was developed by Radloff to detect depressive symptoms in the general community. However, it has often been used in epidemiological studies³⁾. It is a convenient instrument, and has been widely used throughout the world to screen for depression. The CES-D is a self-rated 20-item instrument measuring the frequency of depressive symptoms with a four-point scale ranging from 0 (less than 1 day) to 3 (more than 5 days) reflecting depressed effect, well-being, somatic symptoms and interpersonal difficulties, respectively⁴⁾.

The CES-D has several advantages, including its ease of administration⁵⁾. The CES-D has been translated into a Japanese Version⁶⁾ and used as an instrument to screen the depressed individuals in Japanese workers⁷⁾, however, there are few reports with on its use in psychiatric patients in Japan⁸⁾. Providing a standardized instrument for screening individuals with depression in outpatients is very helpful in distinguishing depression from other psychiatric disorders. The aims of this study are to investigate the validity of the CES-D in Japanese outpatients and establish accurate cut-off scores.

Methods

Subjects

The data were collected from 6,938 outpatients aged 27–63 in our department from October 2002 to June 2006. Of these subjects, 4,805 outpatients completed the CES-D questionnaires including 1,714 cases in which depression was diagnosed by both the ICD-10 and the DSM-IV.

Measures

The CES-D is developed by the National Institute of Mental Health Center for Epidemiological Studies. It is a 20-item self-report inventory that has been widely used in assessing depressive symptomatology in community and population based studies (Murrell et al, 1983, Berkman et al, 1986). The CES-D was scored according to the conventional four-point method; each item was scored between 0–3 and the possible total score ranged between 0–60. The items “Just as good as others”, “Hopeful”, “Happy”, and “Enjoying life” are

reverse items.

The factor structure was tested in the Kaiser Rotation Program, and the sensitivity and specificity of the CES-D were calculated by receiver operating characteristic (ROC) analysis using the Statistical Package for Social Sciences (SPSS) 10.0J. (SPSS, 1999)

Statistical analysis

Data from the questionnaire paper and chart review for each outpatient were entered into the SPSS for statistical analysis. Relationships between the variables under study and factors selected were assessed using a variety of statistical tests including the chi-square test and One-Way ANOVA-LSD t-test. For all statistical analysis, *p*-values less than 0.05 were judged to indicate a statistically significant difference.

Results

The characteristics of the outpatients

General information concerning the investigated subjects is summarized in Table 1. The medical records from the 6,938 outpatients were reviewed by the authors. Of these cases, 4,805 outpatients cooperated in completing the CES-D questionnaires including 1,714 depressed patients in whom a diagnosis of depression was established by both the ICD-10 and the DSM-IV. The prevalence of depressed outpatients was 24.7% (1,714/6,938). There was a significant difference in the distribution of gender in depressed patients with patients suffering from other types of mental disorders (*p*<0.05). There were more men than women in the depression group, but less in the other mental disorder groups.

Factor structure analyses

Table 2 shows the principal component analysis. The CES-D items with higher factor loadings on the first factor include depressed mood (feeling blue, feeling depressed), psychomotor retardation (bothered by things, disturbed concentration, feeling the need to make an effort, talking less, hard to get going). The CES-D items with higher factor loadings on the second factor include depressed mood (feeling like a failure, fearful, lonely and crying spells) and interpersonal difficulties (unfriendly, people dislike me). The items, appetite, sleep problems and feeling sad, were present in the third

Table 1 The demographic characteristics of outpatients

| | Number | Age (Mean±SD) | Male | Female | P-value |
|-----------------------|--------|---------------|-------------------|-------------------|---------|
| Outpatients | 6,938 | 45±17.8 | 46% (3,182/6,938) | 54% (3,756/6,938) | |
| Non CES-D | 2,133 | | 48% (1,026/2,133) | 52% (1,107/2,133) | |
| CES-D | 4,805 | | 45% (2,156/4,805) | 55% (2,649/4,805) | |
| Depressed patients* | 1,714 | 44±16.7 | 52% (886/1,714) | 48% (828/1,714) | 0.03 |
| Other mental diseases | 3,091 | | 41% (1,270/3,091) | 59% (1,821/3,091) | |

*Diagnostic depression based on ICD-10 and/or DSM-IV Chi-square-test.

Table 2 Varimax Rotated Factor Loading Analysis of the CES-D Scale

| Item | Abbreviation | Factor | | | |
|--|----------------------|-------------|-------------|-------------|-------------|
| | | 1 | 2 | 3 | 4 |
| 1. I was bothered by things that usually do not bother me. | (Bothered by things) | 0.68 | 0.17 | 0.11 | −0.02 |
| 2. I did not feel like eating ; my appetite was poor. | (Appetite) | 0.34 | 0.05 | 0.51 | −0.07 |
| 3. I felt that I could not shake off the blues even with help from my family or friends. | (Feeling blue) | 0.63 | 0.23 | 0.29 | 0.08 |
| 4. I felt that I was just as good as other people. | (Felt good) | −0.10 | 0.25 | −0.30 | 0.47 |
| 5. I had trouble keeping my mind on what I was doing. | (Concentration) | 0.74 | 0.07 | 0.09 | 0.02 |
| 6. I felt depressed. | (Felt depressed) | 0.71 | 0.19 | 0.21 | 0.07 |
| 7. I felt that everything I did was an effort. | (Effort) | 0.76 | 0.16 | 0.09 | 0.07 |
| 8. I felt hopeful about the future. | (Hopeful) | 0.13 | 0.05 | −0.12 | 0.70 |
| 9. I thought my life had been a failure. | (Felt like failure) | 0.22 | 0.45 | 0.33 | 0.09 |
| 10. I felt fearful. | (Fearful) | 0.22 | 0.52 | 0.40 | 0.04 |
| 11. My sleep was restless. | (Sleep problem) | 0.10 | 0.10 | 0.67 | 0.01 |
| 12. I felt happy. | (Happy) | −0.03 | 0.06 | 0.17 | 0.64 |
| 13. I talked less than usual. | (Talked less) | 0.58 | 0.26 | 0.04 | 0.03 |
| 14. I felt lonely. | (Lonely) | 0.21 | 0.54 | 0.32 | 0.02 |
| 15. People were unfriendly. | (Unfriendly) | 0.23 | 0.76 | −0.13 | −0.01 |
| 16. I enjoyed life. | (Enjoyed life) | 0.24 | −0.09 | 0.11 | 0.63 |
| 17. I had crying spells. | (Cry spells) | 0.02 | 0.61 | 0.30 | 0.07 |
| 18. I felt sad. | (Felt sad) | 0.22 | 0.46 | 0.48 | 0.17 |
| 19. I felt that people disliked me. | (People disliked me) | 0.20 | 0.78 | −0.13 | 0.04 |
| 20. I could not get going. | (Hard to get going) | 0.61 | 0.04 | 0.10 | 0.19 |

Extraction Method : Principal Component Analysis. a. 4 components extracted. > 0.40 are boldfaced for clarity

factor, while only the items, feeling just as good as others, hopeful, happy and enjoying life, reflecting well-being symptoms were loaded in the fourth factor.

Comparison of mean CES-D score among mild, moderate and major depression

In our hospital, outpatients diagnosed with the criterion of the ICD-10 and the DSM-IV were divided into three groups (mild, moderate and major depressive episode). To further test the function of individual items in the CES-D score, we measured the mean value of each item in these three groups. As shown in Table 3, 9 of the 20 CES-D items exhibited significant differences among the groups. However, 11 items did not show significance. Also, except for “fearful”, most of the 20 items showed any significant difference between moderate and major¹¹⁾.

The characteristics of depressed outpatients

Table 4 shows the status of CES-D scores in these three groups. Statistical analysis with the One-Way ANOVA-LSD t-test revealed that there is a significant difference in the CES-D score between mild and moderate depression ($p < 0.001$) or mild and major depression ($p < 0.05$). However, no significant difference was found between moderate depression and major depression. The frequency of the CES-D distribution by gender in Figure 1.

The determination of optimal cut-off scores of the CES-D scale

One of the purposes of this study is to determine the optimal cut-off score when applying the CES-D scale. We hypothesized the outpatients with other mental disorders as negative controls for depressed patients, and then conducted ROC analyses. The sensitivity and specificity were calculated for several scores of the CES-D. As shown in Table 5, the specificity drops from 91% to 88.4% or less if the cut-off score was greater than 8.5. The corresponding ROC curve is shown in Figure 2. Moreover, the ROC curve analysis between mild and a combination of moderate and major suggested that a cut-off of 16.5 may be good to determine mild from moderate and major depression. Based on the newly established cut-off score 8.5 to 16.5, we re-evaluated those outpatients who suffered from other mental disorders. As shown in Table 6, a higher incidence of potential depression was detected in those outpatients with epilepsy (38%) and sleeplessness (30.5%), while incidence was lower in men with dysthymia (3.7%).

Discussion

Because of its ease of use, the CES-D scale has been used worldwide to screen for depressed individuals not only in the general population but also in those with

Table 3 CES-D item means (standard deviations) for mild, moderate and major depressed outpatients

| CES-D item(Abbreviation) | Mild (n=992) | P-value (a) | Moderate (n=333) | P-value (b) | Major (n=389) | P-value (c) |
|---------------------------|-----------------|----------------|---------------------|----------------|------------------|----------------|
| 1. Bothered by things | 1.70 (1.125) | <0.001 | 2.06 (1.043) | 0.27 | 1.93 (1.055) | <0.001 |
| 2. Appetite | 1.38 (1.202) | 0.13 | 1.49 (1.142) | 0.09 | 1.39 (1.184) | 0.08 |
| 3. Feeling blue | 1.92 (1.049) | 0.01 | 2.11 (1.030) | 0.43 | 2.02 (1.069) | 0.05 |
| 4. Just as good as others | 1.53 (1.198) | 0.35 | 1.57 (1.208) | 0.73 | 1.66 (2.026) | 0.15 |
| 5. Concentration | 2.09 (1.044) | 0.32 | 2.18 (1.021) | 0.58 | 2.13 (0.996) | 0.72 |
| 6. Feeling depressed | 2.34 (0.922) | 0.14 | 2.50 (0.865) | 0.30 | 2.42 (0.938) | 0.19 |
| 7. Effort | 2.03 (1.066) | 0.01 | 2.21 (0.952) | 0.58 | 2.15 (1.020) | 0.03 |
| 8. Hopeful | 2.00 (1.022) | 0.24 | 2.05 (1.046) | 0.20 | 1.97 (1.103) | 0.71 |
| 9. Feeling like a failure | 1.80 (1.163) | 0.06 | 1.90 (1.084) | 0.63 | 1.75 (1.115) | 0.75 |
| 10. Fearful | 1.39 (1.235) | <0.001 | 1.74 (1.151) | 0.001 | 1.42 (1.220) | 0.71 |
| 11. Sleep problems | 1.75 (1.183) | 0.41 | 1.84 (1.202) | 0.07 | 1.65 (1.205) | 0.17 |
| 12. Happy | 1.89 (1.121) | 0.08 | 2.04 (1.113) | 0.46 | 1.98 (1.102) | 0.35 |
| 13. Talking less | 1.72 (1.143) | 0.002 | 1.94 (1.088) | 0.31 | 1.89 (1.131) | 0.04 |
| 14. Lonely | 1.39 (1.215) | 0.02 | 1.56 (1.254) | 0.12 | 1.45 (1.208) | 0.60 |
| 15. Unfriendly | 1.01 (1.160) | 0.07 | 1.18 (1.247) | 0.90 | 1.20 (1.204) | 0.36 |
| 16. Enjoying life | 2.20 (1.044) | 0.74 | 2.22 (1.070) | 0.88 | 2.20 (1.083) | 0.59 |
| 17. Crying spells | 0.89 (1.075) | 0.01 | 1.08 (1.159) | 0.57 | 0.96 (1.160) | 0.03 |
| 18. Feeling sad | 1.48 (1.174) | 0.01 | 1.71 (1.154) | 0.26 | 1.57 (1.193) | 0.14 |
| 19. People dislike me | 0.89 (1.118) | 0.07 | 1.02 (1.182) | 0.69 | 1.06 (1.178) | 0.16 |
| 20. Hard to get going | 1.78 (1.159) | 0.06 | 1.91 (1.139) | 0.91 | 1.92 (1.161) | 0.03 |

(a) mild vs moderate ; (b) moderate vs major ; (c) major vs mild. One-Way ANOVA-LSD t-test.
 (a) The bold typed items are significantly different among groups.

Table 4 The characteristics of CES-D scores in depressed patients diagnosed by ICD-10 and/or DSM-IV

| | Number | Age (Mean±SD) | CES-D Score (Mean±SD) |
|---------------------|------------------|------------------|--------------------------|
| Mild depression | 992 | 45±17.8 | 32±11.5 ^a |
| Male | 51% (501/992) | 44±16.8 | |
| Female | 49% (491/992) | 45±17.7 | |
| Moderate depression | 333 | 46±16.6 | 34±11.36 ^b |
| Male | 48% (156/333) | 44±16.6 | |
| Female | 52% (177/333) | 48±16.6 | |
| Major depression | 389 | 43±17.6 | 34±12.43 ^c |
| Male | 56% (212/389) | 43±16.2 | |
| Female | 44% (177/389) | 44±19.4 | |

a, $p < 0.001$, mild vs moderate ; b, $p > 0.05$, moderate vs major ; c, $p < 0.05$ major vs mild.
 One-Way ANOVA-LSD t-test.

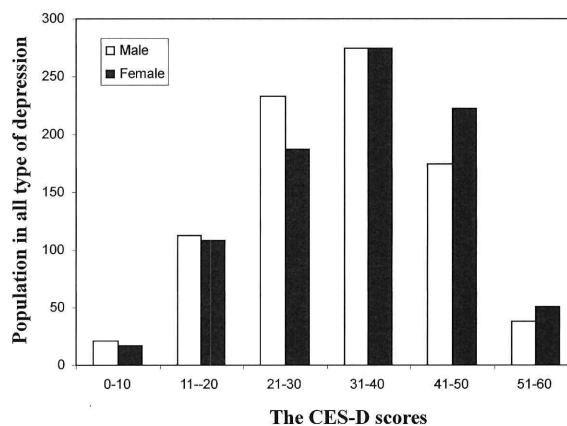


Fig. 1 The frequency of the CES-D distribution by gender

various medical conditions. However, many suggestions about the various optimal cut-off scores of CES-D also were mentioned. Hence, the problems that occurred in screening depression in Japanese outpatients were

what the differences between DSM-IV, ICD-10 and CES-D scale are and what the optimal cut off in Japanese outpatients is. To address these issues, we reviewed medical records from a very large group of Japanese psychiatric outpatients ($n=6,938$). Some of the outpatients ($n=4,805$) that completed the CES-D questionnaires given by psychiatrists consisted of depressed patients ($n=1,714$) and those with other mental disorders ($n=3,091$) diagnosed with the ICD-10 and the DSM-IV. The factor structure analyses revealed that all of the 20 items of the CES-D score were present in their loading factors. Our results were consis-

Table 5 Performance of the screening instrument at various cut-off scores*

| All depressed vs other mental disorder | | | Mild vs moderate & major | | |
|--|-----------------|-----------------|--------------------------|-----------------|-----------------|
| Cut-off score | Sensitivity (%) | Specificity (%) | Cut-off score | Sensitivity (%) | Specificity (%) |
| .50 | 1.000 | .986 | 8.50 | .983 | .987 |
| 1.50 | .999 | .981 | 9.50 | .979 | .983 |
| 2.50 | .999 | .978 | 10.50 | .978 | .978 |
| 3.50 | .996 | .965 | 11.50 | .972 | .970 |
| 4.50 | .996 | .958 | 12.50 | .965 | .957 |
| 5.50 | .993 | .950 | 13.50 | .957 | .946 |
| 6.50 | .991 | .934 | 14.50 | .945 | .934 |
| 7.50 | .989 | .921 | 15.50 | .942 | .916 |
| 8.50 | .987 | .910 | 16.50 | .932 | .903 |
| 9.50 | .983 | .884 | 17.50 | .917 | .890 |
| 10.50 | .980 | .867 | 18.50 | .898 | .866 |

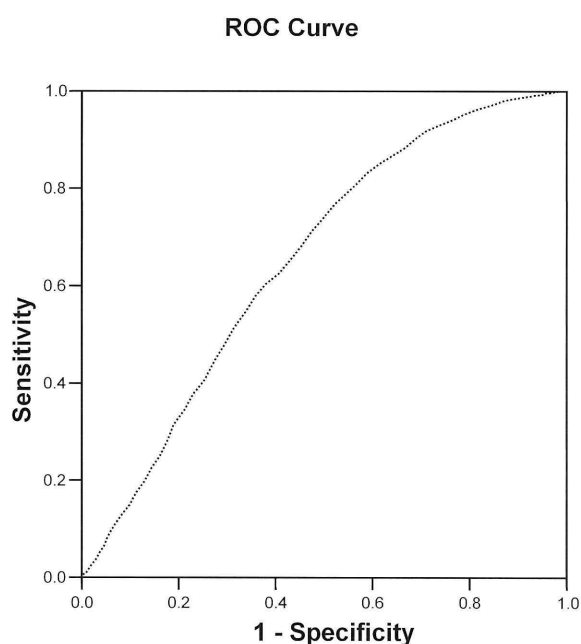


Fig. 2 Receiver Operating Characteristics (ROC) of the CES-D for screening instrument.

Table 6 The incidence of potential depression in several selected mental diseases

| | Number | CES-D score (Mean ±SD) | Depression (%) |
|---------------------|--------|------------------------|----------------|
| Insomnia | 236 | 19 ± 10.9 | 30.5% (72/236) |
| Adjustment disorder | 518 | 31 ± 13.2 | 16.2% (84/518) |
| Dysthymia | 54 | 34 ± 13.3 | 3.7% (2/54) |
| Alcoholism | 60 | 24 ± 14.4 | 23% (14/60) |
| Epilepsy | 63 | 12 ± 13 | 38% (24/63) |
| Panic disorder | 431 | 21 ± 12.6 | 26% (114/431) |
| Eating disorder | 147 | 31 ± 13.9 | 17% (25/147) |
| Anxiety disorders | 170 | 25 ± 13.4 | 19% (33/170) |

tent with those of studies supporting the original Radloff model, and replicated the general findings of (Sheehan et al.) Even so, we found that some of the 20 items of the CES-D score did not exhibit a significant difference among the mild, moderate and major subgroups. Also, there was no significant difference between moderate and major depression, not only in the mean value of the 20 CES-D items, but also in the CES-D scores (in Tables 3 and 4). These results suggested that the CES-D was not exactly consistent with the severity indicated by the ICD-10 and the DSM-IV in classification of depressed outpatients. We need to determine the optimal cut-off score. Here, our results indicated that the optimal cut-off score would be 8.5 to distinguish non-depression and depression in Japanese outpatients in our hospital, while a cut-off score of 16.5 could help to further classify the depressed patients into mild and moderate/severe. These findings differed in several reports. In different populations, there are different optimal cut-off scores. The traditional cut-off score that Radloff suggested was 16 for the general population in the U S. The optimal cutoffs suggested by the ROC analyses or otherwise in the literature varied widely, even when we restricted our literature search to well designed studies in which more than two cutoff scores of the CES-D are examined against some standardized psychiatric diagnoses. The conventional cut-off of 16, originally adopted as the lower band of the upper quintile of scores for the general population¹³⁾ and termed ‘arbitrary’ by the developer of the instrument herself (Radloff, 1977), was however found optimal in some communities (Katz et al., 1995; Myers and Weissman, 1980) and primary care settings (Parikh et al., 1988) as well as among psychiatric populations (Weissman et al., 1977). Several studies recommended higher cutoffs, based on the ROC. Other researchers proposed 17 for Japanese workers (Wada et al., 2007), 20 for the

medically ill elderly (Schein et al., 1997), 22 for older Chinese (Sheung et al., 2005) and 26 for psychiatry patients (Furukawa et al., 1997). Of note, the prevalence of depression depends on the optimal cut-off scores. In this study, the prevalence was 24.7% which was relatively high.

This study may be limited by the relatively large depressed population and by the fact that we were unable to randomize either group. A further limitation is that we were unable to pre-screen community participants using a structured diagnostic interview. However, further studies of late-life depression among community residents. The clinically depressed and among primary care patients are clearly needed in Japan.

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日本の外来患者に対する CES-D によるうつ病の評価研究

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 潘 | 園 | 園 | 丸 | 田 | 敏 | 雅 | 清 | 水 | 谷 | 真 | 宏 |
| 山 | 手 | 威 | 人 | 伊 | 藤 | 健 | 佐 | 藤 | 光 | 彦 | |
| 本 | 杉 | 真 | 帆 | 松 | 下 | 兼 | 田 | 原 | 雅 | 士 | |
| 松 | 本 | 恭 | 典 | 石 | 川 | 純 | 木 | 村 | 智 | 城 | |

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【要旨】 目的：CES-D (the center for epidemiologic studies depression scale) は、日本では主に職場におけるうつ病や認知症のスクリーニング検査として用いられてきたが、外来患者を対象としては使用されてこなかった。本研究の目的は、外来患者における CES-D の妥当性検討をすることと、外来患者における適切な区分点をもとめることである。対象は、27～63歳の外来患者 6,938名で、うち CES-D を施行したものが 4,805名であり、これらのうち米国精神医学会による「診断と統計のためのマニュアル、第4版 (DSM-V)」と第10回国際疾病分類 (ICD-10) の両者により、うつ病と診断されたものが 1,714名である。最初に上記2つの診断基準を指標に CES-D の区分点を検討し、次いで、うつ症状を伴った他の精神障害についてもこれを検討した。

結果：その結果、うつ病の適切な区分点は 8.5点であり、これの感受性は 98.7%、特異性 91%であった。これを用いると、睡眠障害、気分変調症、適応障害、アルコール依存症、てんかん、パニック障害、摂食障害、不安障害で、潜在的にうつ病であるものの割合は、それぞれ、30.5%、16.2%、3.7%、23%、38%、26%、17%、19%である。

考察：この結果から、一般医にとっても、CES-D を使用することがうつ病の鑑別に有益であると思われる。

〈キーワード〉 うつ病、CES-D、ICD-10、DSM-V、外来患者
