

## **Psychometric properties of Centre for Epidemiologic Studies Depression Scale for adolescents in Bulgaria**

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The present study assessed the psychometric properties of the Bulgarian version of the Centre for Epidemiologic Studies Depression Scale (CES-DC), which is a 20-item self-report scale designed to measure depressive symptoms in children and adolescents. A total of 700 (323 female, 377 male) adolescents, aged 13-17 years, participated in this study. In addition to the CES-DC, the adolescents also completed the Strength and Difficulties Questionnaire (SDQ) and the Spence Child Anxiety Scale (SCAS). The results of the confirmatory factor analysis yielded fit index values demonstrating viability of the four-dimensional solution as in the original. The CES-DC significantly correlated with SDQ total scores and its subscales, indicating that a high level of depressive symptoms was associated with high level of emotional and behavioral problems. Overall, the results provided evidence for the factor validity and reliability of Bulgarian version of the CES-DC when used among adolescents in Bulgaria.

**Keywords:** Depression, adolescents, psychometric properties, Centre for Epidemiologic Studies for Depression Scale.

*Propiedades psicométricas del Centro de Estudios Epidemiológicos, Escala de depresión para adolescentes en Bulgaria.* En el presente estudio se evaluaron las propiedades psicométricas de la versión búlgara de la “Centre for Epidemiological Studies Depression Scale” (CES-DC), una escala auto-informada de 20 ítems diseñada para medir síntomas depresivos en niños y adolescentes. Un total de 700 adolescentes (323 niñas y 377 niños), de 13 a 17 años, participaron en el estudio. Además de la escala CES-DC, los adolescentes también contestaron el “Strength and Difficulties Questionnaire” (SDQ) y el “Spence Child Anxiety Scale” (SCAS). Los resultados del análisis factorial confirmatorio mostraron índices de ajuste adecuados, demostrando la validez de las cuatro dimensiones de la escala original. La CES-DC correlacionó de manera significativa con las puntuaciones totales de la SDQ y sus subescalas, mostrando que niveles elevados de síntomas depresivos se asocian con niveles altos de problemas emocionales y conductuales. En general, los resultados evidencian la validez factorial y fiabilidad de la versión búlgara de la escala CES-DC en muestras adolescentes de Bulgaria.

**Palabras clave:** Depresión, adolescentes, propiedades psicométricas, Escala de Depresión del Centro de Estudios Epidemiológicos.

Depression is one of the most common psychiatric disorders among adolescents. According to numerous epidemiological studies, up to 20% of the adolescents in the general population in Western countries met the diagnosis of depression (Lewinsohn et al., 1997). Depression is not only common, it co-occurs commonly with several other psychiatric disorders such as with anxiety and conduct problems (Chen & Wei, 2011; Tsocheva, Sasagawa, Georgiou, & Essau, 2013). Of concern is also its link with suicide (Koplin and Agathen 2002). Additionally, adolescent depression is associated with significant impairments in several life domains and that these impairments often continue to adulthood (Rao, Hammen, & Daley, 1999). These findings emphasize the importance of early identification of depressive symptoms deemed as an important step to take appropriate intervention. However, the realization of this aim is the presence of a valid and reliable instrument to detect depressive symptoms. Therefore over the years, several self-report questionnaires have been developed to assess depressive symptoms in adolescents. Some examples include The Reynolds Child Depression Scale (Reynolds 1989; Reynolds and Graves 1989). The Depression Self-Rating Scale (Birleson 1981; Birleson et al., 1987). The Children's Depression Inventory (CDI; Kovacs, 1992). The Dimensions of Depression Profile for Children and Adolescents (DDPC; Harter and Nowakowski, 1987). The Children's Depression Scale (CDS; Lang and Tisher 1978; Tisher and Lang, 1983; Tisher et al., 1992). The Reynolds Adolescent Depression Scale (RADS; Reynolds, 1987). The Mood and Feelings Questionnaire (MFQ) is designed for used in the 8-18 year olds (Angold et al., 1987), and the Centre for Epidemiologic Studies Depression Scale (CES-DC; Radloff, 1977).

The CES-DC (Radloff 1977) is one of the most widely used self-report questionnaires for assessing depressive symptoms among children and adolescents in both the general population and clinical settings. It contains 20 items, which were selected from a pool of items from the Center for Epidemiologic Studies Depression Scale for Adults (CES-D) (Radloff, 1977), with some of the items were modified to use with children and adolescents (Weissman et al., 1980). The respondents are asked to indicate how strongly they have felt a certain way during the past week by using a 4-Point Likert scale from 0 to 3 (0=not at all; 1=a little; 2=some; 3=a lot). Four of its items (items 4, 8, 12 and 16) are reverse scored and the total score range from 0 to 60. The higher score reflect greater level of depressive symptoms. The score of 16 or higher has been identified as the cut-off point for high depressive symptoms (Radloff, 1977). The subscale scores are obtained by computing the relevant items.

The CES-DC has been translated in several languages, including German (Weyerer et al., 1992), French (Fuhrer and Rouillon 1989), Russian (Dershem et al., 1996), Italian (Fava, 1983), Chinese (Lin et al., 1996), Japanese (Iwata and Roberts 1994), and Korean (Noh et al., 1992). Numerous studies have been carried out to assess psychometric properties of the CES-DC with samples of children and adolescents.

According to a factor analytic study by Radloff (1977), CES-DC was found to have four factors: depressed affect, positive affect, somatic complaints, and interpersonal problems. Studies conducted by Olsson and von Knorring (1997) among Swedish adolescents, and by Barkmann et al. (2008) among German adolescents, and more recently by Li, Chung, and Ho (2010) among Chinese children provided support for the four-factor structure.

The CES-DC has been reported to be highly reliable and valid for assessing depressive symptoms across ethnic, gender and age groups (e.g., Dershem, Patsiorkovski, & O'Brien, 1996). Cronbach Alpha coefficient for the scale was reported to be .85 for the general population and .90 for the psychiatric population. In the recent studies Cronbach Alphas have been reported to range from .79 to .91 (Li et al., 2010; Olsson and von Knorring 1997). Test-retest reliability of the scale was reported to be .79 in 15 years old Guatemalan (Berganza and Aguilar 1992) adolescents. Concurrent, divergent and convergent validity of the CES-DC has also been reported in numerous studies (Li et al., 2010; Radloff, 1977).

To our knowledge, no studies have been conducted on the Bulgarian translation of the CES-DC. Bulgaria is located in the eastern part of the Balkan Peninsula, with a total population of 7.6 million. With the fall of the Eastern Bloc, Bulgaria had undergone a transition from a centralized government to a market economy. However, its health system is still described as economically unstable; its health care establishments, particularly the hospitals, are reported to suffer from underfunding. Among the most common problems and challenges in mental health care in Bulgaria include (a) lack of assessment instruments for early diagnosis, and (b) insufficient training and lack of mental health professionals (Ministry of Health 2008).

Information on the prevalence of depressive and other psychiatric disorders among adolescents in Bulgaria is lacking.

Among adults, it is estimated that about 20% of the adults in the general population in Bulgaria met the diagnosis of a mental disorder, with the most common being that of anxiety disorders (13.1%), followed by depressive disorders (8.5%) (Ministry of Health 2008). The prevalence of depression among adolescents is expected to be similarly high.

The limited studies conducted on depressive symptoms among adolescents in Bulgaria results in lack of knowledge in related area. We believe that the limited literature on depressive symptoms in adolescents in Bulgaria might be partly due to lack of instruments with sound psychometric properties to assess depression. Therefore, the aim of the present study is to examine the psychometric properties of CES-DC to measure depressive symptoms among Bulgarian adolescents.

## METHOD

### *Participants*

The sample consisted of a community sample of 700 adolescents (53.9% were boys and 46.1% were girls) who have been recruited from urban and suburban schools in Veliko Tarnovo city region in Bulgaria. They ranged in age from 13 to 17 years ( $M=15.31$ ,  $SD=1.2$ ).

Most of the participants reported their religious affiliation as Christian (83.6%), 6.4% were Islam, 0.1% Judaism, 0.1% Buddhism, and 9.7% reported that they were not affiliated with any religious organizations. Almost all of them were Caucasian (93.7%); 1.3% were Roma and 5% were Turkish or other ethnic groups.

Approval to conduct the present study was obtained from the University of Roehampton Ethic Board. School approval and parental written informed consent were obtained before participation in the study. Adolescents' participation was voluntary, and that they were not paid for participating in this study. The adolescents completed the questionnaires in a designated classroom and a research assistant was available to provide assistance if necessary and to ensure independent responding.

### *Instrument*

In addition to the CES-DC, the participants also completed the Strength and Difficulties Questionnaire and the Spence Children's Anxiety Scale.

*The Strengths and Difficulties Questionnaire* (SDQ; Goodman, 1997) assesses general difficulties and positive attributes. It contains 25 items which was used to measure conduct problems, hyperactivity-inattention, emotional symptoms, peer problems, and prosocial behaviour. Each of the items is rated on a 3-point scale, ranging from "not true" (0) to "certainly true" (2). Five items are negatively scored, and the rest are positively scored. The total difficulties score can be obtained by adding the items of the four problem scales, with the exception of the prosocial behaviour scale. The internal consistency and test-retest stability of the SDQ have been reported to be satisfactory (Goodman 1997). The SDQ correlated highly with other measures of child and adolescent psychopathology including the Youth Self-Report (Achenbach 1991). In the present study, the Cronbach Alpha for the total SDQ scores was .69.

*The Spence Children's Anxiety Scale* (SCAS; Spence, 1997) was used to measure symptoms of DSM-IV anxiety disorders, including separation anxiety, social phobia, obsessive-compulsive disorder (OCD), panic/agoraphobia, physical injury fears, and generalized anxiety disorder (GAD). Each of the 38 items is rated on a 4-point scale in terms of its frequency from "never" (0) to "always" (3). The 0-3 ratings of the items are summed to produce a total score, with higher scores indicating higher levels of anxiety symptoms. Spence (1997) reported the internal consistency and test-retest

reliability of the SCAS to be satisfactory, indicating Cronbach alphas well above .70 and a test–retest correlation coefficient of .60. The scale has acceptable convergent validity, suggesting a significant correlation with the Revised Children’s Manifest Anxiety Scale (RCMAS) ( $r=.71$ ). Cronbach Alpha for the SCAS was found to be .92 for the present sample.

*Translation of CES-DC.* A stepwise validation procedure was followed in translating and adapting the instrument into Bulgarian (Flaherty et. al. 1988; Hambleton, 2005). The semantic equivalence of the instrument was established through the translation-back-translation procedure (Canino and Bravo, 1999). In this respect, a bilingual translator who was also a native speaker and culturally aware blindly translated the scale from English to Bulgarian. The translated scale was then given to an English literature expert to translate the Bulgarian version of CES-DC Scale items back into English. Then back-translated items were given to experienced clinical psychologists to establish the content equivalence of the Bulgarian version of the scale. Differences in the original and the back-translated versions were discussed and resolved by joint agreement of the experts and the researchers. After establishing the construct validity of the instrument, criterion equivalence (concurrent validity) was examined.

## RESULTS

### *Confirmatory Factor Analysis of Bulgarian CES-DC*

A series of preliminary analyses were performed before conducting reliability and validity studies of Bulgarian version of CES-DC. Frequency analysis was first examined for the distribution of responses across the rating scale for each item. Screening of the data was also performed, including analysis of the normality of each study variable including SDQ and SCAS (skewness and kurtosis), outliers, and missing data analysis. Normality of each data was within the accepted level ( $\pm 3.29$ ) of skewness and kurtosis values. The statistical procedure permits to replace the missing value with mean if each variable has at least 5% missing value (Tabachnick and Fidel, 2001). Thereafter, a reliability analysis with the 20 items was performed. Corrected item-total correlations were also computed to highlight those items with poor reliability ( $<.30$ ). Item numbers 4 and 8 were detected as the lowest corrected item-total correlation (corrected item-total correlations=.22, and .12, respectively); both were related to the positive affect sub-scale.

A confirmatory factor analysis employing the maximum likelihood method by using the AMOS 22 program (Arbuckle and Wothke 1999) on original models. The tested model was the four factor-twenty-item model derived from the original theory of the scale. The adequacy of the models competed was evaluated using five different fit indices: first we checked (1) chi-square of the model, a measure of overall fit, with non-

significant  $\chi^2$  indicating good fit; then (2) the  $\chi^2$  divided by the degrees of freedom, with a ratio of between two and three signifying a good fit; and (3) the comparative fit index (CFI; Bentler 1990), with values above .95 representing a good fit; (4) the root mean square of approximation (RMSEA; with values over .10 leading to reject of the model, those from .05 to .08 acceptable, and values below .05 indicating a good fit; finally we checked (5) the Tucker-Lewis Index (TLI), which takes into account the degree of parsimony, with scores above .90 regarded as a reasonable fit (Schumacker and Lomax, 1996).

The results of the confirmatory factor analysis tested for the model showed that the chi-square test was significant indicating poor fit ( $\chi^2=875.4$ ,  $df=146$ ). Because the  $\chi^2$  statistic is easily influenced by the large sample sizes, multiple goodness of fit indices was used to evaluate the fit between the model and the sample data (Bentler and Bonett, 1980). Since the values of fit indices (CFI=.87; RMSEA=.09; TLI=.85) did not reach an acceptable level, the model was tested using item-parceling method. In the recent literature, item parceling is suggested over single items since some of the scholars indicate the latent construct of several important reason (Bandalos 2008; Nasser and Wisenbaker, 2003) as follows. First, they are more likely to be distributed normally. Second, 'the resulting reduction in the complexity of measurement models should lead to more parameter estimates' (Nasser and Wisenbaker, 2003; p. 730). Finally, since the parcels reduce the number of indicators in the modeling, researchers can use more realistic models. Thus item parceling was used to find better fitting model. Parceling the items resulted in a significant improvement in the model fit ( $\chi^2=116.943$ ,  $df=28$ ,  $\chi^2/df=1.59$ ; CFI=0.97; RMSEA=0.067; TLI=0.96).

#### *Reliability of the CES-DC*

In order to assess the reliability of the scale, internal consistency estimation of the scale was computed. The total CES-DC had good internal consistency, with Cronbach Alpha of .89. The results of the reliability analyses showed that the subscales had also adequate internal consistency. Specifically, Cronbach Alpha estimation was found to be .77 for the somatic symptoms subscale, the item-total correlations ranged from .35 to .56. Cronbach Alpha was .88 for the depressive affect subscale and the item-total correlations ranged from .42 to .76. Nevertheless, internal consistency estimation was found to be .55 for the positive affect subscale and the item-total correlations ranged from .12 to .57. Finally, Cronbach alpha estimation was .75 for the achievement subscale and the item-total correlations ranged from .62 to .71.

#### *Validity of the CES-DC*

To assess the validity of the scale, convergent validities were established by calculating a Pearson correlation coefficient between the SDQ scores, the SCAS and the

CES-DC scores. A positive and high correlation was found between the SDQ and the CES-DC scores ( $r=.61$ ;  $p<.01$ ) suggesting participants with a high depression score tended to obtain high scores on the SDQ. The analysis of the relationship between the subscales of Bulgarian CES-DC and SDQ showed that there was a positive correlation between the SDQ scores and somatic symptoms ( $r=.53$ ), depression affect ( $r=.58$ ), positive affect ( $r=.28$ ), and interpersonal relationship ( $r=.47$ ) subscales.

Regarding anxiety, there was a positive correlation between the SCAS and the CES-DC total scores ( $r=.53$ ,  $p<.01$ ) indicating participants with higher depression scores tended to obtain higher scores on the anxiety. Within the CES-DC subscales, somatic symptoms ( $r=.49$ ); depression effect ( $r=.50$ ); positive effect ( $r=.25$ ) and interpersonal relationship ( $r=.34$ ) subscales correlated significantly with the SCAS total scores.

#### *Gender and Age Difference in CES-DC*

Table 1 shows the mean and standard deviation of CES-DC total and its subscales for the total sample, separately for boys and girls, and for binary age (13-15 years old and 16-17 years old). The mean score of CES-D for the Bulgarian sample was 16.2 with a standard deviation of 10.2. Within CES-DC subscales, the highest score found in the total sample was for somatic complains, whereas the lowest score was obtained in the interpersonal subscale problem.

A 2 (gender) $\times$ 2 (age) analysis of variance (ANOVA) yielded a significant main effect for gender,  $F(1, 696)=12.13$ ,  $p<.05$ , partial  $\eta^2=.02$ , for the total score. Specifically, female participants ( $M=17.68$ ;  $SD=10.16$ ) had significantly more depressive symptoms than male participants ( $M=14.87$ ;  $SD=10.01$ ). However, the findings revealed no age difference in total depressive symptoms score. Similarly, no significant interaction effect was found in total depressive symptoms.

A 2 (gender) $\times$ 2 (age) multivariate analysis of variance (MANOVA) revealed a significant main effect for gender,  $F(4, 693)=4.160$ ,  $p<.05$ , partial  $\eta^2=.023$  in depressive symptoms. Follow-up univariate tests showed a significant main effect for gender,  $F(1, 696)=11.78$ ,  $p<.01$  partial  $\eta^2=.017$ . Female participants ( $M=5.56$ ;  $SD=3.81$ ) had higher *somatic symptom scores* than did males ( $M=4.48$ ;  $SD=4.12$ ). However, neither significant effects regarding age differences nor interaction effect was found in the somatic symptoms score. Regarding the *depressive affect*, follow-up univariate tests revealed a significant main effect for gender,  $F(1, 696)=8.11$ ,  $p<.01$  partial  $\eta^2=.012$ . Female participants ( $M=4.79$ ;  $SD=4.61$ ) had higher scores on the depression affect than did male participants ( $M = 3.72$ ;  $SD = 4.52$ ). However, no significant main effect regarding age differences in the depression affect was found. Similarly, no interaction effect was found. Regarding the *positive affect*, univariate tests showed a significant main effect for gender,  $F(1, 696)=7.55$ ,  $p<.05$ , partial  $\eta^2=.011$ , with female adolescents ( $M=6.29$ ;  $SD=2.47$ ) reporting higher positive affect scores than males ( $M=5.77$ ;

$SD=2.61$ ). No significant main effects in terms of age differences in positive affect were revealed. Similarly, no interaction effect was found. Regarding the last subscale, there were neither gender nor age differences found in terms of *interpersonal problem* score.

## DISCUSSION

The aim of the present study was to investigate the psychometric properties of the Bulgarian version of the CES-DC by examining its internal consistency, factor structure and validity. The finding revealed that Bulgarian version of scale has good internal validity. The Cronbach Alpha of the CES-DC in the present study was found for age to be .89 for the total CES-DC score. Also, consistent with previous studies (e.g., Essau et al. 2012), the CES-DC subscales with the lowest and highest Cronbach Alphas were those of “positive affect” and “depressed affect” subscales, respectively. Moreover, in line with the previous findings (e.g. Fendrich et al., 1990; Barkman et al., 2008), results of the confirmatory factor analysis supported the four-factor structure of the 20-item Bulgarian CES-DC in Bulgarian adolescents. The results supported the same item sequence as in the original scale (Rudloff, 1977). Besides the factor structure, the results regarding the correlations of Bulgarian version of CES-DC and subscale scores with the SDQ, the SCAS provided some evidence for convergent validity. Consistent with the previous studies (e.g., Essau et al., 2012; Tsocheva et al., 2013), scores on the SDQ and SCAS scales were found significantly associated with CES-DC scores in the expected directions in this sample of Bulgarian adolescents. The results showed that a high level of depression in adolescents is associated with high levels of emotional and behavioral problems. Consistent with previous studies (Cunningham and Ollendick, 2010; Kirkcaldy and Siefen, 1998), our finding showed children with high levels of depressive symptoms also reported to have high levels of anxiety, ADHD and conduct disorders. Overall findings related to correlation might provide evidence for the convergent validity of the Bulgarian version of the scale.

The present study indicated significant sex differences in participants' scores on the CES-DC, with the mean score for female students higher than that of the male students. In the original development studies, there were sex differences in depression (Radloff, 1977). A significant sex difference was also found in the previous studies conducted in various countries (e.g., Duggal et al., 2001; Essau et al., 2012; Li et al. 2010). This can be regarded as providing evidence for the validity and reliability of the scale when used in various cross-cultural settings.

Based on the evidence provided in the present study, the Bulgarian CES-DC scores appear to have reasonable preliminary validity and reliability for Bulgarian adolescents, although refinement of the scale could continue. The Bulgarian adaptation of the CES-DC may be useful in assessing depression among adolescent in Bulgaria.



Researchers and counselors working with high school students may find scores in determining children and adolescents who may need help to address their depression.

There are several limitations of the present study. The sample in the present study was collected from only one study site. Therefore, the convenient sampling might limit the generalization of the results. However, further studies with more demographically diverse population from different regions of Bulgaria would no doubt to validate the finding of the study. The present study is the first attempt to examine the psychometric properties of the CES-DC in a high school student population in Bulgaria. As such, the results are best considered as preliminary research in the process of establishing cross-cultural equivalency of the scale.

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