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PSYCHOMETRIC PROPERTIES OF THE CENTER FOR EPIDEMIOLOGICAL STUDIES-DEPRESSION SCALE (CES-D) - GREEK VERSION

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Abstract: A Greek translation of the Center for Epidemiological Studies-Depression Scale (CES-D) was examined in a sample of 221 Greek-Cypriots (*M* age 24.82 years). Results provide partial support for Radloff's original factor structure, the factors' internal reliability and independence, and the comparability of total scale means to the scale's normative data. Women scored higher on the total scale scores than men and also higher on the depressed, interpersonal and somatic factors, but not the positive factor, than men. The incidence of depression using Radloff's cut-point of 16 was lower in this Greek-Cypriot sample but aligned with Kessler's (2003) estimate of the incidence of depression in the general community.

Key words: Greek adaptation of CES-D, Cyprus, Depression, CES-D, Psychometric properties

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INTRODUCTION

Depressive disorders are among the most common psychological conditions affecting individuals in the Westernized world. Approximately 4% of men and 8% of women suffer from a clinically significant depressive disorder (Kessler, 2003) and larger numbers experience some symptoms of depression of a lesser or more episodic nature (Lewinsohn, Solomon, & Seeley, 2000; World Health Organisation [WHO], 2012). Despite public awareness-raising of depressive symptoms, training of health professionals, and the efficacy of treatments, including pharmacotherapies (Bauer, Whybrow, Angst, Versiani, & Möller, 2002) and cognitive-behavioural therapies (Chambless & Ollendick, 2001), the rate of undetected depression is high (Rostk et al., 1998). It is important therefore that inexpensive, brief and valid measures are available to screen for depression in the general community. It was the aim in this paper to assess the psychometric properties of a Greek translation of the Center for Epidemiologic Studies Depression Scale (CES-D) (Radloff, 1977), examine the data for gender differences, and compare our results with Radloff's normative data.

The term depression when used in a clinical context refers to a broad spectrum of criteria characterised by five or more of the following: depressed mood, lack of interest or pleasure in all or almost all activities, unplanned weight loss, insomnia or hypersomnia, psychomotor retardation or agitation, fatigue, feelings of worthless or inappropriate guilt, lack of concentration and recurrent thought of death or suicidal ideation (DSM-V, American Psychiatric Association [APA], 2013). While a clinical interview is essential in order to diagnose depression, there are several additional methods that researchers and clinicians use to assess levels of depression. These methods include observer-rated scales such as the Hamilton Depression Scale (Hamilton, 1960) that require the rater to be trained in their use, and self-report measures such as the Beck Depression Inventory (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961), and the Carroll Depression Scale (Carroll, Feinberg, Smouse, Rawson, & Greden, 1981). Other scales such as Profile of Mood States (POMS, McNair, Lorr, & Droppleman, 1971) and the Depression Anxiety Stress Scale (DASS, Lovibond & Lovibond, 1995) include depression as one of their subscales. The components of these scales vary to include some but not necessarily all the features associated with depression. They also vary in length as well as in cost to purchase and time to administer.

One brief publicly available self-report scale, designed to detect depressive symptomatology in the general population, is the Center for Epidemiological Studies-Depression Scale (CES-D, Radloff, 1977). The CES-D has 20 items drawn from clinical and factor analytic studies of extant depression scales of which four

items are reverse coded to reduce response bias. Radloff (1977) reported (1) internal consistency coefficients for the total scale with Cronbach's α =.85 and .90 in nonclinical and clinical samples, respectively; (2) moderate test-retest reliability ranging from r = .51 to .32 for time intervals of 2 weeks and 12 months, respectively; (3) good convergent validity with other measures of depression (e.g., r ≥ .70 with the Bradburn Balance Scale and the Lubin Depressive Checklist), and 4) divergent validity with measures of positive affect (e.g., r = -.55 with Bradburn Positive Affect). Radloff (1977) also reported that total scores on the CES-D differentiated between clinical and general populations with 70% of her clinical participants and only 21% of her general population sample scoring at or above an arbitrary cut-off point of 16 (p. 393).

A further analysis of the general population data by Radloff (1977) using Principal Components Analysis on the data from the general population revealed four factors which explained 48% of the variance. While she named these four factors independently: Depressed feelings, Positive feelings, Somatic symptoms, and Interpersonal, an examination of the table of factor loadings failed to reveal simple structure. It might be that the dual-loadings of several items is a function of true commonality of those items across factors or it might be that Radloff's use of Varimax rotation, rather than oblique rotation with correlated variables, failed to distinguish among the factors (Tabachnick & Fidell, 2007). Interestingly, Gomez and McLaren (2015) reported confirmation of the original four-factor structure in a large sample of older Australians using Mplus while Perreira, Deeb-Sossa, Harris, and Bollen (2005) were unable to support a four-factor solution among non-white groups living in the USA.

Despite these diverse findings, the CES-D has been translated into several languages other than English. For instance, Cheung and Bagley (1998) used a Chinese-language version of the scale with 138 couples in Hong Kong and reported the extraction of two highly correlated factors: Depressive symptoms and Interpersonal problems (r = .75). The two items on the latter were the same as on Radloff's Interpersonal factor but the former was an amalgam of the other three factors. In their Portuguese translation of the CES-D, Gonçalves and Fagulha (2004) reported that they could force a four-factor solution which had some overlap with Radloff's structure but their preference was for a more independent three-factor solution. A three-factor solution was also reported by Grzywacz, Hovey, Seligman, Arcury, and Quandt (2016) using a Spanish translation of the CES-D among Mexican immigrants living in the USA. Despite the lack of construct validity across samples, Fava (1983) in his comparison of depressed patients and controls, using an Italian translation of the CES-D, found that scores on the total scale significantly

differentiated between these two groups (M = 33.57 and 12.92, respectively). Clearly there are varying levels of support for the psychometric properties of the CES-D when used in other languages and cultures. The reasons for these equivocal findings are unclear although Auer, Hampel, Möller, and Reisberg (2000) argued that some scales may have been poorly translated. They also cautioned against drawing conclusions from scales which have not been validated in the second language.

Fountoulakis, Iacovides, Kleanthous, Samolis, Kaprinis, et al. (2001) administered a Greek version of the CES-D to a small sample comprised of both clinical and community participants. Their results failed to support Radloff's original four-factor solution. Rather they extracted three factors which they labeled: positive affect, irritability/interpersonal relationships, and depressed affect/ somatic symptoms. An examination of their factor table shows that 14 items cross-loaded onto at least one other factor ≥.30 and of these 14 items, seven items cross-loaded ≥.42. The authors did not report the correlations among these three factors. It is not clear whether the lack of a simple factor structure and their failure to replicate Radloff's factors was a function of 1) the small sample of combined clinical and non-clinical data, 2) the lack of robustness of this scale to yield a stable factor structure especially in a different cultural setting, or 3) a statistical artifact of using varimax rather than oblique rotation for correlated variables (Tabachnick & Fidell, 2007). As Trieman (1975) suggested, results from translated scales can also be confounded in bilingual populations. For instance, Marcos and Alpert (1976) found similarity in participants' responses to concrete words in each language but diversity in response to more abstract concepts. Certainly, figures from the Eurobarometer survey indicate that the majority of Greeks and Greek-Cypriots speak English in addition to their native tongue (Greek-Reporter, 2014).

Clearly the divergence of translated scales from the psychometric properties of the original scale is not uncommon. Although referring particularly to post-partum depression (PPD), Halbreich and Karkun (2006) found great variability in the prevalence of PPD across countries even when the same instruments were used. They suggested that this wide diversity might be due not just to reporting styles, but also to cross-cultural factors, differences in people's perception of mental illness and associated stigma, as well as the influence of diverse socio-economic circumstances. Whatever the reasons for Fountoulakis et al.'s (2001) results, we suggest there is a need for further evaluation of the CES-D in its Greek translation. It has the potential to be a brief, cost-effective screening instrument for depression in Greek-speaking populations but so far this has not been empirically supported.

Accordingly, the aim of the current study was two-fold: firstly, to confirm the factor structure of this translation of the CES-D in a community sample of Greek-

Cypriots and, secondly, to compare the scores on the CES-D from a community sample of Greek-Cypriots to the general population scores reported by Radloff (1977).

METHOD

Participants

Two hundred and twenty-one Greek-Cypriot university students (62 males) with a mean age of 24.82 years (*SD* = 4.97, *Range* 18 – 39 years) participated in the current study.

Measures

In addition to providing demographic data on their age and gender, participants completed the Center for Epidemiological Studies-Depression Scale (CES-D; Radloff, 1977) as translated into Greek by Fountoulakis et al. (2001). In accord with Auer et al.'s (2000) comment that poor translations might lead to divergent results, we submitted Fountoulakis et al.'s (2001) Greek translation of the CES-D to review by two psychologists who are native speakers and who have experience working with depressed people. Each of these reviewers back-translated the scale into English and confirmed the veracity of the translation prior to its administration in the current study.

The CES-D contains 20-items (e.g., I felt sad, I could not get going) rated on a 4-point Likert scale (0 = *Rarely or none of the time* to 3 = *Most or all of the time*) over the past week. There are four positively worded items (e.g., I enjoy life).
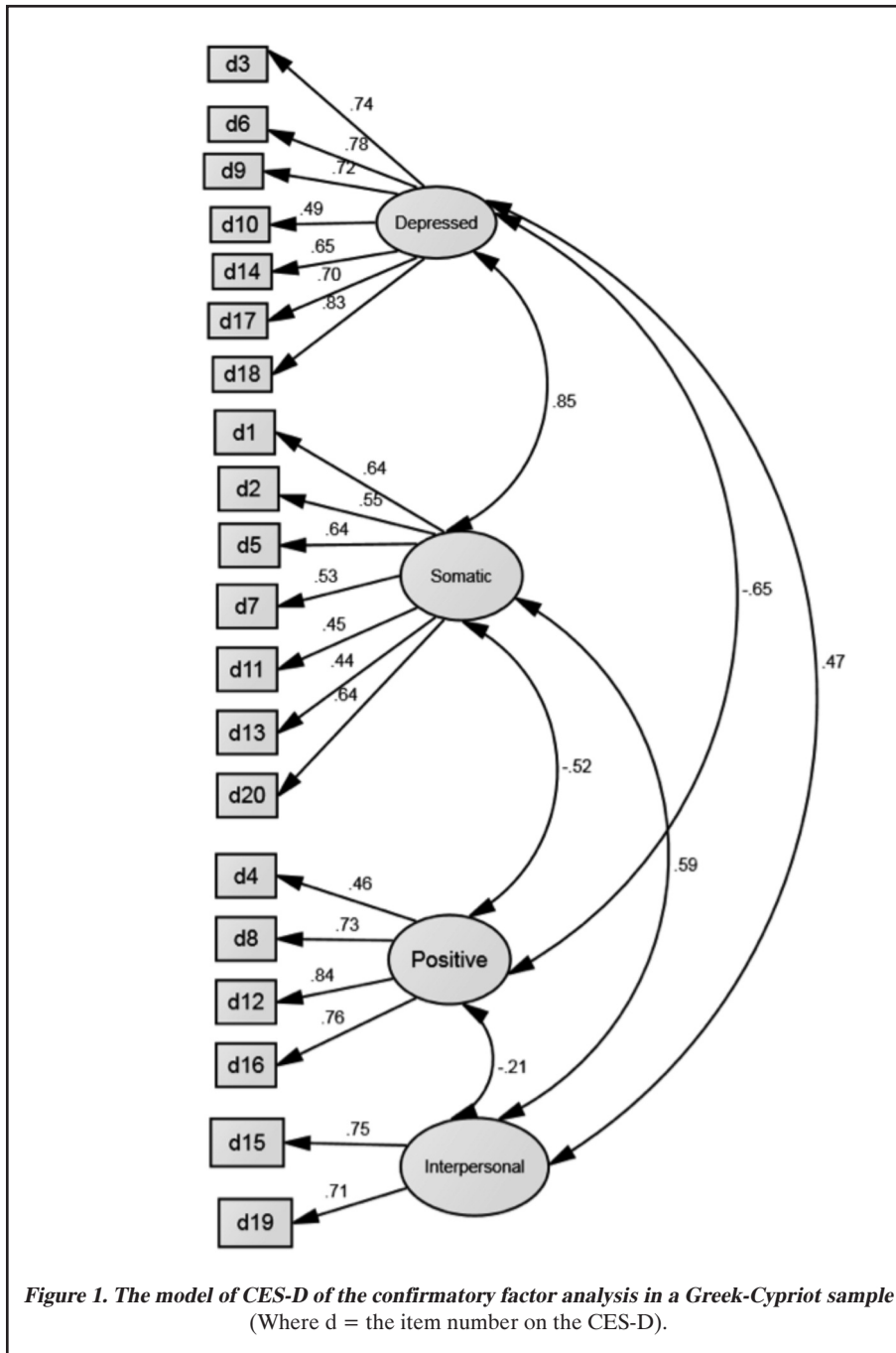
Procedure

Participants were recruited from the student body of a private university in Cyprus where programs are offered across a diverse range of disciplines at undergraduate and post-graduate levels. A global invitation was issued by email to the student body which outlined the requirements of the study, included a link to the website on which the survey resided, assured readers that all data collected were anonymous and, finally, advised potential participants that their submission of the completed questionnaire would constitute their informed consent. No incentives were offered for participation in the study.

RESULTS

The data were analysed using the Statistical Package for the Social Sciences and AMOS (SPSS Package, Version 22). Total scores on the CES-D, considering that items 4, 8, 12, and 16 on Radloff's positive factor are negative, ranged from -3 to 38 with a mean score of 8.60 (*SD* = 6.82) and a Cronbach's alpha = .89 in the current data. Ten per cent of all participants scored at or above the arbitrary cut-off score of 16 suggested by Radloff to be indicative of depression. When considered by gender, 3% of males and 15% of females scored at or above 16.

A Confirmatory Factor Analysis (CFA) was conducted using Amos (under SPSS V. 22) to determine the replicability of Radloff's four-factor structure in the current data. The correlation matrix revealed that all items correlated at least .3 or above with one other item and the Independence Chi Square (χ^2 = 1959.05, *p* <.001) in Amos confirmed the interrelationships among the items. The CFA revealed that each item loaded onto its relevant factor (≥ .44) although the inter-correlations among some of the factors were high (.21 to .85), the highest being between Depressed affect and Somatic symptoms (Figure 1). Overall the fit of the data to the model failed to support Radloff's structure (χ^2 = 403.82, *p* < .001; C/Min = 2.46; GFI = .85; AGFI = .80. IFI = .87, RMSEA = .082 and *p*/close < .001). The statistical modifications indicated in the output only added to the complexity of the structure. It was decided therefore, to explore the factor structure in the current data using Principal Components Analysis (PCA) with oblique rotation to account for correlated factors (Child, 1970; Tabacknick & Fidell, 2007).

The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) = .88 and Bartlett's Test of Sphericity, $F(190)$ = 1892.26, *p* <.001, both indicated the factorability of the correlation matrix (Hair, Anderson, Tatham, & Black, 1995; Tabachnik & Fidell, 2007). PCA revealed four factors with eigenvalues greater than one (Gorsuch, 1983) and all four factors uniquely explained 5% or more of the variance. The scree plot also indicated the presence of four factors which, although slightly divergent to Radloff's structure, were interpretable with her factor names: Depressed (9 items), Positive (5 items), Somatic (4 items) and Interpersonal (2 items). Together these four independent factors explained 57.76% of the variance. The factor structure, factor loadings, eigenvalues, per cent of explained variance, correlations, Cronbach's alphas and descriptive statistics are presented in Table 1. The three items which diverged from Radloff's factors are indicated in Table 1 by arrows from their current factor to that reported by her.

Figure 1. The model of CES-D of the confirmatory factor analysis in a Greek-Cypriot sample
(Where d = the item number on the CES-D).

Table 1. Factor weights, descriptive statistics and reliabilities for CES-D in a Greek-Cypriot sample

Item	Depressed	Positive	Somatic	Interpersonal
17. Ξεσπούσα σε κλάμα	.77			
I had crying spells				
18. Αισθανόμουν λυπημένος/η	.70			
I felt sad				
9. Πίστευα ότι η ζωή μου ολόκληρη ήταν μια αποτυχία	.68			
I thought my life had been a failure				
6. Αισθανόμουν κατάθλιψη	.65			
I felt depressed				
10. Αισθανόμουν γεμάτος/η φόβο	.57			
I felt fearful				
3. Αισθανόμουν ότι δε θα μπορούσα να ξεφύγω από «τις μαύρες μου», ακόμα ούτε και με τη βοήθεια της οικογένειάς μου ή των φίλων μου	.56			
I felt that I could not shake off the blues even with help from my family or friends				
11. Ο ύπνος μου ήταν ανήσυχος	.53			
My sleep was restless				
2. Δεν είχα διάθεση να φάω. Η όρεξή μου ήταν κακή	.47			
I did not feel like eating my appetite was poor				
14. Αισθανόμουν μοναξιά	.43			
I felt lonely				
16. Απολάμβανα τη ζωή	.87			
I enjoyed life				
12. ΄Ημουν χαρούμενος/η	.79			
I was happy				
8. Αισθανόμουν γεμάτος/ή ελπίδα για το μέλλον	.75			
I felt hopeful about the future				
13. Μιλούσα λιγότερο από το συνηθισμένο (R)	.42			
I (did not) talked less than usual				
4. Αισθανόμουν ότι είμαι το ίδιο καλά όπως οι άλλοι άνθρωποι	.34			
I felt that I was just as good as other people				
7. Αισθανόμουν τι οτιδήποτε έκανα απαιτούσε μεγάλη προσπάθεια		.83		
I felt that everything I did was an effort				

(Continue)

Table 1. **(Continue)**

Item	Depressed	Positive	Somatic	Interpersonal
5. Είχα πρόβλημα στο να κρατήσω το μυαλό μου		.75		
συγκεντρωμένο σ' αυτό που έκανα				
I had trouble keeping my mind on what I was doing				
1. Με ενοχλούσαν πράγματα που συνήθως δε		.69		
με ενοχλούν				
I was bothered by things that usually don't bother me				
20. Δεν μπορούσα να τα καταφέρω να ξεκινήσω		.39		
να κάνω πράγματα				
I could not get going				
15. *Οι άνθρωποι δεν ήταν φιλικοί μαζί μου*			.90	
People were unfriendly				
19. *Ένιωθα ότι οι άλλοι με αντιπαθούσαν*				
I felt that people disliked me				.81
Eigenvalues	7.26	1.92	1.28	1.10
Per cent of variance explained	36.29	9.59	6.42	5.46
Correlation matrix				
Depressed	1.00			
Interpersonal	-.35	1.00		
Somatic	.38	-.23	1.00	
Interpersonal	.39	-.08	.24	1.00
M	6.50	9.43	3.97	.69
SD	5.56	3.50	2.80	1.12
Cronbach's alpha	.86	.78	.76	.70

R = Item 11 recoded to read "Sleep not restless",

The arrows point to the Somatic factor on which the items loaded in Radloff's (1977) report.

An independent *t*-test revealed that females ($M = 8.91$, $SD = 7.78$) scored higher on the total CES-D than did males ($M = 5.22$, $SD = 5.40$), $t(220) = 3.36$, $p = .001$, Cohen's $d = .07$. A Multivariate Analysis of Variance with the factor scores as the dependent variables revealed a significant multivariate effect of gender, Pillai's Trace, $F(4, 216) = 4.38$, $p = .002$, partial $\eta^2 = .09$. Univariate comparisons using a Bonferroni Correction Factor indicated that female participants reported higher scores on the depressed, somatic and interpersonal factors than did males but there was no gender difference on the positive factor (Table 2).

Table 2. Comparison of CES-D factors by gender

	Male		Female		
Factor	*M*	*(SD)*	*M*	*(SD)*	Univariate *F* (1, 219)
Depressed	4.15	3.85	7.42	5.86	16.57***
Positive	10.16	3.10	9.15	3.61	3.77 *ns*
Somatic	3.34	2.60	4.22	2.84	4.48*
Interpersonal	.40	.91	.80	1.17	5.89*

* *p* < .05; *** *p* < .001

DISCUSSION

The aim in the current study was to confirm the factor structure of the Center for Epidemiological Studies Depression Scale (CES-D) of Radloff (1977), as translated into Greek by Fountoulakis et al. (2001), in a sample of Greek-speaking participants and to compare the ratings from this sample to Radloff's normative data. Prior to testing these aims, the comparability of the translated items to the original English items was confirmed by two psychologists who are native Greek speakers.

The mean in the current data for the CES-D scale of 8.60 was comparable to the means provided by Radloff: *M* = 9.25 (*SD* = 8.58, *N* = 2514) and *M* = 8.17 (*SD* = 8.23, *N* = 1060) in two white community samples. This finding suggests that scores on the total scale are applicable for use with Greek-speaking people.

Of interest to us is the finding that only 10% of current participants scored at or above the cut-off point of 16 which Radloff suggested was indicative of depression. When considered by gender, these figures were 3% and 15% for males and females, respectively. These figures are considerably less than the 21% (or 1/5th) in community samples reported by Radloff. The current sample of relatively young, university students may have fewer financial cares and experience more social support than older participants in Radloff's studies or, the cut-point of 16 may need to be reviewed. If, however, 16 is a valid marker, the current figures are aligned more with the 4% of men and 8% of women whom Kessler (2003) reported suffer a clinically significant depressive disorder. Interestingly, both Fava (1983) and Gonçalves and Fagulha (2004) suggested higher cut-off points at 23 and 20, respectively. It will be important in future studies to determine this cut-off figure in Greek-speaking populations and to determine any direct or buffering factors which might contribute to the lower incidence found here.

CFA failed to confirm the factor structure originally reported by Radloff (1977). While the data did not provide a statistical fit to the hypothesised model, each item did load onto its original factor although the CFA revealed high inter-correlations among the factors. The highest correlation was between depressed and somatic, *r* =

.85, which is not unexpected as somatic symptoms as well as features of lowered mood are both part of the diagnostic criteria for depression (DSM-V: APA, 2013). Not surprisingly, the depressed and positive factors also demonstrated a high negative correlation, $r = -.65$, indicative of the opposing feelings they each assess (e.g., I felt sad vs. I was happy).

The data were then submitted to an exploratory PCA to determine if a simple structure could be derived. An independent four-factor solution provided the optimal result and these factors were labelled as per Radloff: Depressed, Positive, Somatic, and Interpersonal. The total variance explained by these factors was substantial and each factor demonstrated good internal reliability. A comparison of our solution to Radloff's original factors revealed three potential discrepancies as indicated by the arrows in Table 1.

Specifically, disturbances in sleep and appetite both contributed to the depressed factor in the current data which is in line with DSM-V (APA, 2013) but in Radloff's report these variables both loaded onto Somatic. In her report, sleep, in addition to loading onto the somatic factor, also had a loading of .30 on the depressed factor. A further variation in our data was '[did not] talked less than usual' loaded onto Positive while Radloff showed this item as contributing to somatic symptoms although it also loaded .30 onto interpersonal. It seems congruent that 'not talking less than usual' would be a positive dimension as shown by our data.

Our current factor structure of the Greek translation of the CES-D is more aligned with that of Radloff than previous reports using other languages, for instance Chinese (Cheung & Bagley, 1998), Portuguese (Gonçalves & Fagulha, 2004) or Spanish (Grzywacz et al., 2016). It is also more aligned than Fountoulakis et al.'s (2001) original analysis of their Greek translation where they reported three complex factors: positive affect; irritability and interpersonal problems; and depressed affect and somatic symptoms. We suggest therefore that the factors extracted from the Greek translation of the CES-D in this study, are appropriate tools to assess these elements of depression and positivity among Greek-speaking people. This recommendation also applies to use of the total CES-D score which is largely unquestioned across studies.

Women in the current study scored higher on the total CES-D and higher on each factor other than positive than men. These differences support past findings with respect to gender (e.g., Somers, Goldner, Waraich, & Hse, 2004). Such differences might be a function of greater feelings of distress experienced by women than men, be a reporting artefact, or a reluctance by men to disclose or engage in some behavioural aspects assessed by these factors (e.g., had crying spells; everything I did was an effort; people were unfriendly).

The current study is limited by the use of a university sample although the age range of participants was quite diverse (18-39 years) and by a failure to address the convergent or divergent validity of the CES-D. It is noted, however, that previous studies have reported that total scores on the CES-D do correlate with previously established measures of depression (e.g., Fava, 1983; Radloff, 1997).

In conclusion, there is some divergence between the simple factorial structure extracted in our data and how Radloff allocated items she found 'cross-loaded' onto factors. However, the current pattern of loadings provides a meaningful and interpretable solution and reasonable support for the original factor structure as reported by Radloff (1977) but not for the three-factor structure reported by Fountoulakis et al. (2001). It might be that this divergence is because, as in the current study, Radloff used samples from the general population while Fountoulakis et al. analysed data using a combination of clinical and community participants.

The current findings offer confirmation for the translation of the CES-D items into Greek and its suitability for use with Greek-speaking populations. This claim is supported by comparable mean scores with the original English version and gender differences which support past research. The incidence of depression using Radloff's cut-point was less in the current Greek-Cypriot sample, however, the current figures support past reports from large epidemiological studies. It will be important for future studies to test which cut-points on the CES-D Greek version determine its utility as a screening instrument for depression in a different cultural context; to assess its sensitivity to treatment effects, and establish its invariance across people of diverse ages (e.g., adolescents and the elderly) in Greek and Greek-Cypriot populations bearing in mind the limitations of self-administered reports.

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