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Construct validity of the Centre for Epidemiologic Studies Depression Scale Revised – Vietnamese Version (CESDR-V) among adolescents

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Abstract

This study aimed to establish evidence of the construct validity of the Centre for Epidemiologic Studies Depression Scale Revised – Vietnamese Version (CESDR-V) and a 10-item version of this scale (CESDR-V-10) for use among Vietnamese adolescents. We selected 1084 Grade 10 students in Hanoi using a multiple-stage sampling method. Data supported that the CESDR-V was unidimensional. Cronbach's alpha coefficient of CESDR-V was 0.92 and CESDR-V-10 was 0.90. All levels of measurement invariance between male and female participants for both CESDR-V and CESDR-V-10 were supported well. Both CESDR-V and CESDR-V-10 were positively correlated with Depression Anxiety and Stress Subscales (DASS21)-Depression subscale at stronger levels (convergent pattern) than with DASS21-Anxiety /DASS21-Stress subscales (discriminant pattern). CESDR-V and CESDR-V-10 were negatively correlated with Mental Health Continuum Short Form (a measure of mental well-being) at lower levels than with the DASS21 subscales (discriminant pattern). This study strongly supports the use of the CESDR-V and CESDR-V-10 to screen for depression in Vietnamese adolescents who are attending school.

Keywords

CESD-R; depression; validation; adolescents; Vietnam

Depression in adolescence is an important public health problem worldwide (Liu et al., 2020). Depressive disorders are the fourth leading cause of disability-adjusted life-years (DALYs) in adolescents aged 10–24 years, according to the Global Burden of Disease Study 2019 (Abrams et al., 2020). The majority of first onset depression occurs during adolescence (Belfer, 2008; Kessler et al., 2005). Therefore, adolescence offers a crucial window for prevention, detection and early treatment of depression.

The Center for Epidemiologic Studies Depression Scale (CES-D) (Radloff, 1977) is a self-report screening instrument for depression that was created from a combination of Zung's Depression Scale (Zung, 1965), the Beck Depression Inventory (Beck et al., 1961), and the Minnesota Multiphasic Personality Inventory (MMPI) (Hathaway & McKinley, 1951). Eaton et al. (2004) developed a revised version of this scale (CESD-R) to reflect the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) definition of Major Depressive Disorder. The CESD-R includes 20 items that measure depressive symptoms in nine different groups including sadness (dysphoria), loss of interest or pleasure (anhedonia), appetite, sleep, movement, fatigue, guilt, thinking/concentration, and suicide. The CES-D and CESD-R are among the most widely-used screening tools for depressive symptoms among adults and adolescents in research and primary health care worldwide (Vilagut et al., 2016).

Evidence for validity of the English version of the CESD-R for use in the general population has been reported. Eaton et al. (2004) and Van Dam and Earleywine (2010) suggested a unidimensional model of the CESD-R. The data of these studies all support an excellent level of internal consistency for the CESD-R (Cronbach's alpha coefficients all above 0.90). The theoretical correlations between CESD-R and anxiety, schizotypy, and positive and negative affect were supported in those studies that indicated the external validity of the CESD-R.

Previous studies have provided some evidence of the validity of several translated versions of the CESD-R for use among adolescents in low- and middle-income countries. A study in Nigeria validated a Nigerian version among 502 university students (Kokou-Kpolou et al., 2021). Kokou-Kpolou and colleagues found that a three-factor model fitted the data well and the measurement of invariance across genders was partially supported. Rababah et al. (2020) examined the factorial structure of an Arabic version among 1,239 university students the using one-, two-, and four-factor models. They concluded that construct validity was not supported as no model fitted the data well. Tran et al. (2019) evaluated criterion validity of an Indonesian version among 189 adolescents aged 16-18 years attending senior high schools in Jakarta, Indonesia. The data supported the criterion validity of the Indonesian version, as the scale was found to detect depression with moderate accuracy.

There are several shortened versions of the CESD-R that have been developed for screening for depression in adolescents. Haroz et al. (2014) proposed a 10-item version; nine items were selected based on the highest factor loadings of each of the nine groups of symptoms in the CESD-R, and one item about irritability was included. This version was tested in two national adolescent samples in the United States. The construct validity was supported with a one-factor model showing good fit and full measurement invariance across sexes. Rababah et al. (2020) extracted 12 items from the Arabic version of the CESD-R based on two principles: selection of items with the highest factor loadings, and representation of all nine depression symptom groups. The construct validity of this shortened version, including its factorial structure and measurement invariance between sexes, was well supported by the data (Rabah et al., 2020).

Mental health problems among adolescents, particularly depression, are being recognised increasingly in Vietnam. Recent studies found that up to 23% of adolescents experienced clinically significant symptoms of depression (Thai et al., 2020). The CESD-R has great potential for use in research and screening in Vietnam to detect depression symptoms among adolescents. This study aimed to establish evidence of the construct validity of CESD-R and a shortened version of this scale for use among high school students in Vietnam.

Methods

Study design and Participants

This is a secondary analysis of baseline data collected in an intervention study for adolescent mental health in Vietnam (Tran et al., 2020). A total of 1084 adolescents aged 15-16 years participated in this study. The participants were selected using a multiple-stage sampling method. First, two urban districts (from a total of 12 districts) and two rural districts (from a total of 18 rural districts) in Hanoi were selected randomly. Then, in each of the selected districts, two high schools were randomly selected. Four grade 10 classes from each of the selected schools were randomly chosen. All students in the selected classes were invited to participate. The selection process was carried out by an independent statistician.

Settings

Vietnam, a lower-middle income country, is located in Southeast Asia with a population of 96 million. The average national per capita income was USD2,590 in 2019 (World Bank, 2021). Children and adolescents account for a third of the population. Hanoi, the capital city, is in the north of Vietnam, and has an area of 3,358.6 km². The population of Hanoi is 8 million people, with about half living in urban and half living in rural areas.

Data sources

Centre for Epidemiologic Studies Depression Scale Revised – Vietnamese Version (CESDR-V)

The Vietnamese version (CESDR-V) validated in this study was a translated version of the CESD-R developed by Eaton et al. (2004). Translation was conducted using a standardised procedure (translate, culturally verify and back-translate) that we have established and used in previous studies (Fisher et al., 2013; Tran et al., 2019; Tran et al., 2011). The CESDR-V assesses 20 depressive symptoms (items) in the past week or so, covering the nine symptom groups: dysphoria, anhedonia, appetite, sleep, movement, fatigue, guilt, thinking/concentration, and suicide. The responses to each of the items are rated on a 5-point scale from 0 = “Not at all or less than one day in the past week” to 4 = “Nearly every day for two weeks”.

Depression Anxiety and Stress Scales (DASS 21)

The DASS 21 (Lovibond & Lovibond, 1995) assesses the symptoms of depression, anxiety and stress. It comprises 21 items in three sub-scales (each has seven items): Depression (DASS21-D), Anxiety (DASS21-A), and Stress (DASS21-S). The four short response options to each item reflect the severity of the symptom and are scored from 0 = “Did not apply to me at all” to 3 = “Applied to me very much, or most of the time”. Evidence for the factorial structure and internal consistency of DASS 21 (Cronbach alphas of 0.835 for the Depression, 0.737 for the Anxiety and 0.761 for the Stress subscale) for use among Vietnamese adolescents has been established (Le et al., 2017).

Mental Health Continuum Short Form (MHC-SF)

The MHC-SF (Keyes, 2006; Keyes et al., 2008) is a 14-item scale assessing general mental well-being in three dimensions: positive emotional and life satisfaction; positive social functioning; and psychological well-being. Each item is scored from 0 = “Never” to 5 = “Every day” and all item scores

are summed to yield a global well-being score from 0 to 70. Higher global well-being scores reflect better mental well-being. The hypothesised factorial structure and a high level of internal consistency (Cronbach alphas of 0.88) were evidenced in a previous study among adolescents in Vietnam (Ha, 2020).

Procedure

Data were collected from participants using a self-completed questionnaire at school during a usual 45-minute class. Students were given instructions on how to complete the questionnaire and asked to return the questionnaire whether completed or not in a sealed envelope which was provided at the beginning of the session. The participants were supervised by two trained data collectors from the Hanoi University of Public Health (HUPH). Students whose parents did not grant consent for them to participate or who did not want to participate were invited to go to the school library to do their homework (44 students, 3.9%).

Analytical strategies

We used Messick's model (Flake et al., 2017) of construct validity that consists of six aspects: content, substantive (theoretical rationales), structural, external, generalisability, and consequential. In this study we evaluate the structural and external aspects of the CESDR-V.

Structural aspect

The empirical evidence of the structural aspect, including factorial structure, internal consistency, and measurement invariance, were examined.

The factorial structure of the CESDR-V was examined using exploratory factor analysis with principal factor extraction (free of distribution assumptions). The number of factors selected was decided based on the Kaiser criterion (eigenvalues > 1). The scree plot, total percent variance explained, and meaningful factors were used to select factors if more than one factor met the Kaiser criterion. After the number of factors was determined, an oblique rotation (promax) was applied if more than one factor was found. The items with factor loadings < 0.3 were interpreted as being not salient, and were omitted from the final version of the CESDR-V.

The internal consistency of the CESDR-V was tested using the Cronbach's alpha coefficient. The coefficient > 0.8 indicates high internal reliability.

For every psychological instrument, there are concerns about measurement non-equivalence; that the instrument does not measure the same construct(s) in the same way across subgroups of respondents. We tested *measurement invariance* between male and female participants for the CESDR-V by employing multiple group confirmatory factor analysis (MGCFA) (Brown, 2014; Wang et al., 2018). There are three levels of measurement invariance: configural; metric; and scalar invariance. Configural invariance is the lowest level that requires the number of factors and loading pattern to be the same across groups. The configural invariance holds if the overall MGCFA model fits the data well. The root mean square error of approximation (RMSEA) value of < 0.05, comparative fit index (CFI) > 0.95, and Tucker–Lewis index (TLI) > 0.95 indicates a good fit (Brown, 2014; Kline, 2015). In the metric invariance level, the factor loadings of the items of the instrument must be equivalent across groups. To assess metric invariance, the fit of the metric model was compared with the fit of the configural model. Finally, scalar invariance is a strong invariance level that requires the item intercepts to be equivalent across groups in addition to the metric invariance. To assess scalar invariance, the fit of the scalar model was compared with the fit of the metric model. To compare the fit of the models, the decreases of CFI values of less than or equal to 0.01 and increases in RMSEA values of less than or equal to 0.015 indicate that there is no difference between the models and invariance at that step is supported (Chen, 2007; Cheung & Rensvold, 2002; Dimitrov, 2010). Chi-square tests to test model fit

differences between models were not used in this study because this test is heavily influenced by the sample size (Brown, 2014).

External aspect

In this study, the external aspect of construct validity refers to the correspondence between CESDR-V and other measures of the same construct (convergent pattern), and the distinctness between CESDR-V and a measure of another construct (discriminant pattern). Pearson's correlation coefficients between CESDR-V and DASS21-D, DASS21-A, DASS21-S, and MHC-SF were calculated to evaluate the external aspect. It was expected that CESDR-V would be correlated with DASS21-D (convergent pattern) more strongly (closer to 1) than with the other three scales that measured other constructs (discriminant pattern).

Shortened version

A 10-item version (CESDR-V-10) was derived from the 20 items of the CESDR-V based on the result of the exploratory factor analysis. The 10 items with the highest factor loadings were selected.

We also examined the internal consistency, measurement invariance between sexes, and the external aspect of construct validity of the CESDR-V-10 as we did for the full version.

We used several methods to treat missing data. First, we excluded all cases with more than 20% CESDR-V data items missing. Second, we imputed scale item missing data if a case had missing data for less than or equal to 20% of the number of items of that scale (CESDR-V, DASS21-D, DASS21-A, DASS21-S, or MHC-SF). We used regression imputation, including all other items of the scales (CESDR-V, DASS21-D, DASS21-A, DASS21-S, and MHC-SF) and sociodemographic characteristics (school, sex, and age) as predictors, to impute the scale item missing data. Third, the remaining missing data were treated using full information maximum likelihood estimation under missing at random assumption in the MGCFA. Finally, we used the pairwise deletion approach in other analyses. MGCFA were conducted in Mplus Version 7.4 (Muthén & Muthén, 2015). All other analyses were carried out using Stata Version 16 (StataCorp, 2019).

Results

Samples

Among 1084 participated in this study. Of those, 45 (4.2%) had missing data in any CESDR-V item, 76 (7.0%) had missing any data in DASS item, and 59 (5.4%) had missing data MHC-SF. There were two participants excluded because of missing data in > 20% of CESDR-V items. Overall, data contributed by 1082 of the 1084 participants (99.8%) were included in the analyses.

A total of 656/1082 participants (60.6 %) were girls. The mean (standard deviation) of ages of the participants was 15.3 years (0.3).

Exploratory factor analysis and internal consistency

The exploratory factor analysis of the CESDR-V revealed that only factor 1 had an eigenvalue > 1 and it explained 84% of the total variance (Supplementary Table 1). Therefore, the data supported a

finding that the CESDR-V was unidimensional. All of the factor loadings of Factor 1 were > 0.3. The ten items of the CESDR-V-10 had factor loadings > 0.6 and covered six symptom groups: Dysphoria, Anhedonia, Thinking, Guilt, Fatigue, and Suicide. Cronbach's alpha coefficient of the CESDR-V was 0.92 and the CESDR-V-10 was 0.90.

Table 1 – Factor loadings from the exploratory factor analysis of the Centre for Epidemiologic Studies Depression Scale Revised - Vietnamese version (CESDR-V)

No.	Item	Group	Factor loading	Item selected for CESDR-V-10
1	My appetite was poor	Appetite	0.41	–
2	I could not shake off the blues	Dysphoria	0.77	Yes
3	I had trouble keeping my mind on what I was doing	Thinking	0.61	Yes
4	I felt depressed	Dysphoria	0.76	Yes
5	My sleep was restless	Sleep	0.51	–
6	I felt sad	Dysphoria	0.76	Yes
7	I could not get going	Fatigue	0.58	–
8	Nothing made me happy	Anhedonia	0.59	–
9	I felt like a bad person	Guilt	0.70	Yes
10	I lost interest in my usual activities	Anhedonia	0.70	Yes
11	I slept much more than usual	Sleep	0.39	–
12	I felt like I was moving too slowly	Movement	0.56	–
13	I felt fidgety	Movement	0.59	–
14	I wished I were dead	Suicide	0.63	Yes
15	I wanted to hurt myself	Suicide	0.60	–
16	I was tired all the time	Fatigue	0.74	Yes
17	I did not like myself	Guilt	0.68	Yes
18	I lost a lot of weight without trying to	Appetite	0.33	–
19	I had a lot of trouble getting to sleep	Sleep	0.43	–
20	I could not focus on the important things	Thinking	0.65	Yes

Measurement invariance

Configural multiple group confirmatory factor analysis models of the CESDR-V and the CESD-V-10 fitted the data well (Table 2), suggesting that the number of factors and loading patterns were the

same across males and females (configural invariance holds) for both CESDR-V and CESD-V-10. Metric and scalar invariance for both CESDR-V and CESD-V-10 were supported by the data as the criteria for the changes of CFI values and RMSEA values of the models were met.

Table 2 Model fit indices for multiple-group one-factor models testing measurement invariance between male and female participants of the Centre for Epidemiologic Studies Depression Scale Revised - Vietnamese version (CESDR-V) and CESDR-V-10

Model	CFI	TLI	RMSEA	P-value RMSEA ≤ 0.05	ΔCFI	ΔRMSEA
<u>CESDR-V</u>						
1.1 Configural	0.966	0.957	0.031	1.00	N/A	N/A
1.2 Metric	0.962	0.955	0.032	1.00	-0.004	0.001
1.3 Scalar	0.958	0.952	0.033	1.00	-0.004	0.001
<u>CESDR-V-10</u>						
2.1 Configural	0.976	0.957	0.048	0.607	N/A	N/A
2.2 Metric	0.975	0.962	0.045	0.753	-0.001	-0.003
2.3 Scalar	0.972	0.963	0.044	0.804	-0.003	-0.001

CFI: Comparative Fit Index; TLI: Tucker–Lewis index; RMSEA: Root Mean Square Error of Approximation; ΔCFI: CFI difference to previous model; ΔRMSEA: RMSEA difference to previous model; N/A: not applicable.

Correlations

The correlation between CESDR-V and CESDR-V-10 was almost perfect. Both CESDR-V and CESDR-V-10 were positively correlated with DASS21 Depression subscale at stronger levels than with DASS21 Anxiety and Stress subscales. CESDR-V and CESDR-V-10 were negatively correlated with MHC-SF at lower levels than with the DASS21 subscales (Table 4).

Table 4 – Correlations between Centre for Epidemiologic Studies Depression Scale Revised - Vietnamese version (CESDR-V), CESDR-V-10 and other scales

	CESDR-V	CESDR-V-10
CESDR-V-10	0.97	-
DASS21-D	0.78	0.80
DASS21-A	0.65	0.61
DASS21-S	0.71	0.71
MHC-SF	-0.47	-0.49

DASS21-D: Depression Anxiety and Stress Scales 21 items – Depression subscale; DASS21-A: Depression Anxiety and Stress Scales 21 items – Anxiety; DASS21-S: Depression Anxiety and Stress Scales 21 items – Stress; MHC-SF: Mental Health Continuum Short Form.

Discussion

This study examined the construct validity of the CESDR-V and a 10-item version of this scale for use among high school students in Vietnam. Our data strongly support that CESDR-V is a unidimensional measurement scale and all 20 items are salient. This study provides evidence of excellent internal consistency and measurement invariance for the CESDR-V and CESDR-V-10. In addition, the external aspect of construct validity of the CESDR-V and CESDR-V-10, including convergent and discriminant patterns, is demonstrated clearly.

The 20 items of the CESD-R are categorised into 9 different groups of depressive symptoms. The findings from this study are aligned with findings by Eaton et al. (2004) and Van Dam and Earleywine (2010), that the unidimensional model of the CESD-R is supported. Our findings are not consistent with the study in Nigeria (Kokou-Kpolou et al., 2021) that reported a three-factor model underlying the CESD-R, or the study in Jordan (Rabahah et al., 2020) that did not find evidence of construct validity for an Arabic version. This difference may be attributed to the variation in expression of depressive symptoms across different cultures. Our study strongly supports the construct validity of the CESDR-V among Vietnamese adolescents.

Measurement invariance is a vital aspect of the construct validity of any instrument. For all psychological instruments, there is generally a concern on measurement variance across genders. In line with previous studies (Haroz et al., 2014), data in our study support all levels of measurement invariance between male and female students for the CESDR-V. This allows the scale scores to be interpreted in the same way for both male and female students.

The CESDR-V-10 has six items overlapping with Haroz et al.'s (2014) 10 items and six items overlapping with Rababah et al.'s (2020) 12 items. The strategies to shorten the scale were different in these studies. We used an entirely data-driven approach. Haroz et al. (2014) used the data-driven approach, whilst taking into account the groups of depressive symptoms, specifically selecting the one item with the highest factor loadings from each of the nine symptom groups. Rababah et al. (2020) used a selection process consisting of the results of an exploratory factor analysis, and the groups of symptoms and cultural appropriateness but no specific criteria for the selection was provided. The CESDR-V-10 items cover the two most important groups of Major Depressive Disorder symptoms (dysphoria and anhedonia) and four other symptom groups (thinking, guilt, fatigue, and suicide) of the DSM 5 criteria (American Psychiatric Association, 2013). The correlation of the CESDR-V-10 and the full version is at almost the perfect level. The evidence for internal consistency, measurement invariance and convergent and discriminant validity for the CESDR-V-10 is strong. Thus, these results demonstrate that the selection approach we used in this study ensured that we could select the 10 most salient and relevant items for Vietnamese adolescents.

We acknowledge that this study only included adolescents attending school in Hanoi and in a narrow age range, and that this may affect the generalisation of the findings of this study to the general population of Vietnamese adolescents. Criterion validity (how well the scale scores agree with a 'gold standard', for example a competent psychiatrist's clinical diagnosis) was not evaluated in this study. In a resource-constrained setting, we were unable to conduct psychiatric diagnostic interviews for this sample. However, we evaluated a number of other important aspects of construct validity for the CESDR-V and the shortened CESDR-V-10 version.

Conclusion

This study strongly supports the use of the CESDR-V and CESDR-V-10 to screen for depression in Vietnamese adolescents who are attending school. These scales may be useful for school counsellors, school health and mental health programs, primary health care, and research. However, we suggest use of the continuous scores, rather than any categories, because validation against a diagnostic instrument has not been performed for either of these versions.

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Ethics approval and consent to participate

This study was a part of a trial study that has been approved by Monash University Human Research Ethics Committee (Certificate Number: 21455), Melbourne, Victoria, Australia; the Institutional Review Board of the Hanoi University of Public Health (488/2019/YTCC-HD3), Hanoi, Vietnam; and Queensland University of Technology's Office of Research Ethics and Integrity (2000000087). Written informed consent was obtained from a parent or guardian for participants under 16 years old.

Competing interests

None declared.

Trial registration numbers

Registered with the Australian New Zealand Clinical Trials Registry, registration number: ACTRN12620000088943 (3/2/2020). WHO Universal Trial Number: U1111-1246-4079.

Data sharing

The data, analytic methods (code) used in the analysis, and materials used to conduct the research will be made available to any researcher for purposes of reproducing the results or replicating the procedure on reasonable request to the corresponding author.

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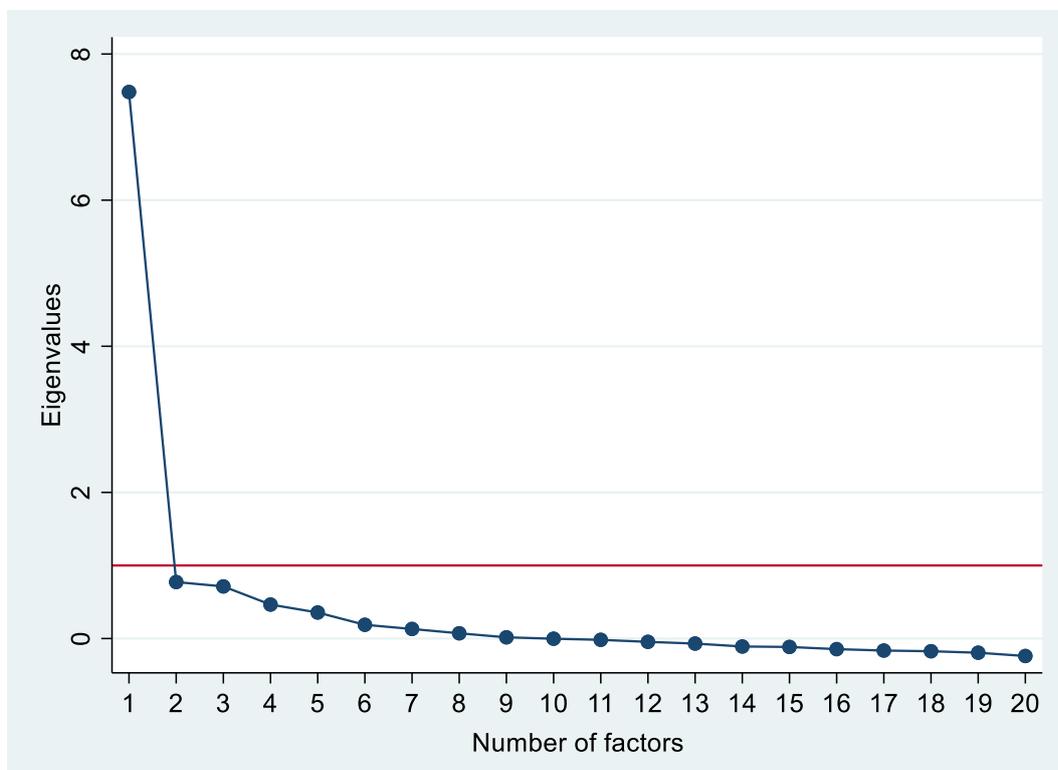
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Supplementary file

Appendix Table 1 Exploratory factor analysis of CESDR-V

	Eigenvalue	Total percent variance explained (%)
Factor 1	7.48	0.84
Factor 2	0.77	0.09
Factor 3	0.71	0.08
Factor 4	0.47	0.05
Factor 5	0.36	0.04



Appendix Fig. 1 Scree plot - Exploratory factor analysis of CESDR-V