Research article

Reliability and validity assessment of the Mental Health Continuum – Short Form for Bangladeshi adults

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ABSTRACT

There is a shortage of psychological tools to assess the mental well-being of Bangladeshi people covering the hedonic and the eudaimonic aspects of well-being. This study aimed to assess the reliability and validity of the Mental Health Continuum Short Form as this instrument assesses both the hedonic and the eudaimonic aspects of well-being. This study utilized online survey data (n = 361). Item analysis results showed that this scale had good discrimination indices, internal consistency reliability, and acceptable average inter-item correlations. Confirmatory factor analysis lent support to the three-factor correlated model with good model fits and sufficient factor loadings. Results from the multidimensional graded response model also supported the efficiency of this scale to assess the mental well-being of Bangladeshi adults. This scale had moderate correlations with perceived stress and anxiety. Overall, findings suggested this scale as a reliable and valid tool for assessing mental well-being. This scale would help mental health practitioners to assess mental well-being and formulate relevant interventions.

1. Introduction

The general view about the understanding of mental health is the 'absence of mental illnesses'. Last few decades, this understanding has been changing considerably. Mental health also includes well-being – emotional, social, and psychological (Keyes, 2007). The World Health Organization (WHO, 2004) states that mental health is "a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community" (p. 12). This definition covers both the positive dimension (well-being) and the negative dimension (distress).

Traditionally, well-being can be divided into two categories: hedonic and eudaimonic. In the hedonic approach, well-being includes satisfaction with life and experience of pleasant experience that includes both positive and negative affects (Diener, 1984; Keyes, 2005). This approach primarily focuses on the emotional well-being aspect of mental health. In the eudaimonic approach, well-being includes self-realization about own potential and how well an individual perceives him functioning in life (Ryff, 1989; Ryff and Keyes, 1995). This approach focuses on psychological well-being (Ryff, 1989) and social well-being (Keyes, 1998). Combining the both approaches, well-being can be recognized as a multidimensional construct that includes emotional, social, and psychological well-being (Gallagher et al., 2009).

There are several psychological assessment tools to assess well-being. However, some of these cover few aspects of well-being, or some of these are too long. Keyes et al. (2008) developed the Mental Health Continuum – Short Form (MHC-SF) to overcome these limitations. This scale is the shorter form of the Mental Health Continuum – Long Form (Keyes, 2002), a 40-item well-being assessment scale. The MHC-SF assesses emotional, social, and psychological well-being. This scale contains 14 items – three items assess emotional well-being (hedonic aspect of well-being), five items assess social well-being (eudaimonic aspect of well-being), and the rest of the six items assess psychological well-being (eudaimonic aspect of well-being). These items are derived from Ryff's psychological well-being model (Ryff, 1989), Keyes's social well-being model (Keyes, 1998), and Bradburn's affect balance scale (Bradburn, 1969). The MHC-SF has good psychometric properties across different cultures and age groups (i.e., Doŕe et al., 2017; Karás et al., 2014; Luijten et al., 2019). Most of the studies confirmed the three-factor structure of the scale, while some studies supported the bi-factor model (three specific factors along with one general factor) (see, Lamborn et al., 2018; Luijten et al., 2019; Machado and Banderia, 2015; Petrillo et al., 2014). The MHC-SF and its subscales have lower to moderate correlation with life

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satisfaction, psychological distress, anxiety, depression, etc. (Doŕe et al., 2017; Fonte et al., 2020; Karás et al., 2014; Machado and Banderia, 2015; Orpana et al., 2017; Perugini et al., 2017; Luijten et al., 2019).

In the current COVID-19 pandemic, mental health problems increased globally (see Ahmed et al., 2020a,b; Li et al., 2020). Life becomes stagnant due to pandemic waves that come one after one. Studies reported elevated perceived stress, anxiety and depression symptoms, sleep problems, etc. (i.e., Beck et al., 2021; Kowal et al., 2020; Ramiz et al., 2021; Wang et al., 2020). Researchers are utilizing a number of psychological scales to assess mental health (i.e., General Anxiety Disorder-7 [GAD-7: Spitzer et al., 2006], Patient Health Questionnaire – 9 [PHQ-9: Kroenke et al., 2001], Depression Anxiety Stress Scales [DASS: Lovibond and Lovibond, 1995], the Mental Health Continuum Short Form [MHC-SF: Keyes et al., 2008], etc.).

In this study, we examined reliability and validity of the MHC-SF for Bangladeshi adults. There are several adapted scales available for assessing the mental health of Bangladeshi people. For example – the General Health Questionnaire -28 (GHQ-28: Goldberg, 1978; Bangla version of GHQ-28: Banoo, 2001), the Strengths and Difficulties Questionnaire (SDQ: Goodman, 1997; Bangla version: Mullick and Goodman, 2001), the Warwick-Edinburgh Mental Well-being Scale (WEMWBS: Tennant et al., 2007; Bangla version: Rahman and Imran, 2013), etc. However, none of these assess the complete state of mental well-being. Therefore, we aimed to assess the psychometric features of the MHC-SF to assess the mental well-being of Bangladeshi adults. In this study, psychometric properties of the scales assess utilizing both classical and modern test theory approaches.

2. Methods

2.1. Data and participants

In the present study, we utilized the data of the cross-cultural collaborative project titled "COVID-19, Personality and Quality of Life: Self-enhancement in the time of Pandemic" (Żemojtel-Piotrowska et al., 2020). This project was conducted following the Declaration of Helsinki and other comparable ethical standards and informed consent was taken from participants. As part of this project, the data were collected from Bangladesh from 29/04/2020 to 25/05/2020 through 'Ariadna' (an online-based data collection platform). Before conducting the survey, the study questionnaire was translated into Bangla following the translation-back translation procedure. The survey link was distributed to Messenger and WhatsApp contacts. Besides, this link was on Facebook and invited to participate in this survey. A total of 1306 people responded to this survey. Among them, 321 participants completed the entire survey questionnaire. The rest of the data were incomplete or didn't meet the inclusion criterion (aged 18 or older).

The Ethical Review Committee of the Department of Psychology, University of Chittagong, Bangladesh approved this study (ERB-PSY-CU-51-2021). The present study data comprised responses from 361 participants (58.7% male). Their mean age was 24.74 years (standard deviation = 6.02 years). Among participants, 25.2% described their economic condition as below average, 62.6% average, and 12.2% above average. Regarding educational qualifications, 18.8% completed upper secondary education, 47.9% completed bachelor or equivalent education, 31.6% completed master or equivalent education.

2.2. Measures

2.2.1. Mental Health Continuum Short Form (MHC-SF)

The MHC-SF is the short form of the Mental Health Continuum Long Form (Keyes, 2002). This 14-item scale (termed MHC in the supplementary questionnaire [page 3]) assesses three aspects of well-being – emotional, social, and psychological. Participants rated their last month's experience using a six-point Likert-type scale ['never' (0) – 'every day']. Total scores ranged 0–15 for the emotional well-being subscale, 0–25 for the social well-being scale, 0–30 for the psychological well-being scale, and 0–70 for the full scale.

2.2.2. Perceived Stress Scale Short Form

The Perceived Stress Scale Short Form (PSS-SF: Cohen et al., 1983) is a valid tool for quick assessing perceived stress. This short version of the scale comprised four items (e.g., "In the last month, how often have you felt that you were unable to control the important things in your life?"). Based on their last month's experience, participants responded on this scale using a five-point Likert-type scale ['never' (0) – 'very often' (4)]. Total scores ranged from 0 to 40, and the higher the score, the higher the stress perception. Supplementary Table 1 presents the descriptive statistics of the PSS-SF. In this study, the PSS-SF had acceptable internal consistency reliability ($\omega = .693$; $\alpha = .686$). Confirmatory factor analysis suggested acceptable model fit of the PSS-SF Bangla version in the present study ($\chi^2 = 7.256$, $df = 2$, $p = .027$, CFI [comparative fit index] = .976, TLI [Tucker-lewis index] = .927, SRMR [standardized root mean square residual] = .051, and RMSEA [root mean square error of approximation] = .088).

2.2.3. State-Trait Anxiety Inventory Short Form

The State-Trait Anxiety Inventory (Spielberger, 1983) is a commonly used valid tool for assessing anxiety. This scale assesses state anxiety and trait anxiety. The short form of this scale (Marteau and Bekker, 1992) has 6 items – 3 items for assessing each type of anxiety. Based on their last month's experience, participants responded using a five-point Likert-type scale ['never' (0) – 'very often' (4)]. Higher scores suggest higher anxiety symptoms. Supplementary Table 1 presents the descriptive statistics of the STAI-SF. In this study, the STAI-SF had good internal consistency reliability ($\omega = .861$; $\alpha = .859$). Confirmatory factor analysis suggested acceptable model fit of the STAI-SF Bangla version in the present study ($\chi^2 = 4.611$, $df = 8$, $p = .798$, CFI = 1.00, TLI = 1.00, SRMR = .030, and RMSEA = .00).

2.2.4. Fear of COVID-19 scale

The Fear of COVID-19 Scale (Ahorsu et al., 2020a; Ahmed et al., 2021 [Bangla version]) is one of the widely used scale to assess the COVID-19 related fear. In the present study, participants rated their agreement on seven items utilizing a seven-point Likert-type scale, ranging from 'I strongly disagree' to 'I strongly agree'. Total scores ranged between 7 and 49. Supplementary Table 1 presents the descriptive statistics of the Fear of COVID-19 Scale. In the present study, the FCV-19SB had good internal consistency reliabilities ($\alpha = .895$, $\omega = .897$). Confirmatory factor analysis suggested acceptable model fit of the STAI-SF Bangla version in the present study ($\chi^2 = 34.298$, $df = 14$, $p = .002$, CFI = .990, TLI = .985, SRMR = .065, and RMSEA = .067).

2.3. Statistical analysis

The Rstudio, JASP 0.14.0.0, and Microsoft Excel 365 were utilized for the data management and analysis. We assessed reliability and validity of the Mental Health Continuum Short Form Bangla (MHC-SF-B) using both classical test theory (CTT) and item response theory (IRT) approaches. Under CTT, corrected item-total correlation, mean inter-item correlation, and internal consistency reliability [Cronbach's alpha and McDonald's omega] were computed. Using confirmatory factor analysis (CFA), three models of the MHC-SF-B version (one factor model, three-factor correlated model, and bi-factor model) were examined. Besides, average variance extracted (AVE), and composite reliability were computed.

Under the IRT, the multidimensional graded response model (MGRM) was utilized for item analysis. Before that, monotonicity (both statistically and graphically) and local independence (LD) [G^2 LD index; Chen and Thissen, 1997] were examined. In multidimensional GRM, slop coefficients (a) and threshold coefficients (b) were computed. The multidimensional GRM through the R package *mirt* version 1.32.1 provides intercepts (-d) that were transformed into threshold values for each item

using the following formula (-d/a). Besides, *Rho* coefficient and IRT reliability for each subscale were assessed.

Finally, correlation coefficients computed to assess the association of MHC-SF-B with stress, anxiety, and fear of COVID-19.

3. Results

Item-level properties of the MHC-14 are presented in Table 1. Skewness values (−1.02 – .22) and kurtosis values (−1.32 – .28) are lower than the suggested cut-off (±2 and ±7 respectively; Kim, 2013). These values indicated the normality of the data. Table 1 shows that all subscales had higher corrected item-total correlations (ranging between .58 and .72 for the emotional well-being subscale, between .54 and .71 for the social well-being subscale, and between .57 and .73 for the psychological well-being subscale). All of these values are above the suggested cut-off (.40).

Confirmatory factor analysis results (model fits and factor loadings) are presented in Table 2. From Table 2, bi-factor uncorrelated model (χ^2/df = 1.879, CFI = .996, TLI = .995, RMSEA = .049, SRMR = .043) model had good model fits compared to unifactor model (χ^2/df = 8.361, CFI = .963, TLI = .956, RMSEA = .143, SRMR = .092) and three-factor correlated model (χ^2/df = 3.085, CFI = .990, TLI = .988, RMSEA = .076, SRMR = .059). However, factor loading of item 3 and 4 in specific factor were negative and some other loadings were also substantially low. Therefore, bi-factor uncorrelated structure of the MHC-SF-B is not acceptable. Comparing the model fits and factor loadings, three factors correlated model is acceptable. Factor loadings were ranged between .715 and .887 for the emotional well-being subscale, between .640 and .794 for the social well-being subscale, and between .673 and .818 for the psychological well-being subscale. Correlations between factors ranged between .633 and .761.

Table 3 presents the scale-level psychometric properties of the MHC-SF-B. Floor (ranged between .3 to 1.9) and ceiling (ranged between 1.9 to 7.2) effects are between the suggested cut-off (<15%). Average inter-item correlations of the emotional and psychological well-being subscales were just above the recommended range. Table 3 also showed that the MHC-SF-B had good internal consistency reliability (alpha = .80 – .86, and omega = .81 – .86). The AVE values (.55 – .63) were above the recommendation cut-off (≥.5). Moreover, this scale had good composite reliability (.84 – .89), discrimination power (Ferguson delta = .97 – .99),

IRT reliability (.85 – .89), and *Rho* coefficient (.81 – .87). Table 3 also shows that the MHC-SF-B had an acceptable standard error of measurement (1.65–2.30).

Supplementary Table 2 presents the monotonicity results and local dependence results. From Supplementary Table 2, there was one violation in item 8 and item 10. But, these violations were non-significant. Crit values are 11 and 1 for item 8 and item 10, respectively. These values are below the suggested cut-off for the crit values (40; Molenaar and Sijtsma, 2000) to indicate the absence of monotonicity. Supplementary Figure 1 also shows the monotonicity of all items graphically. There was no substantial lower break to suggest the possible presence of monotonicity. Table 4 also presents G^2 *p* values. All of the *p* values are higher than .05. Therefore, there was no local dependence issue. Both monotonicity results and G^2 *p* values suggested that all assumptions for applying an IRT model were met.

Slope coefficient (discrimination parameters), from Table 1, ranged between 1.980 and 3.691 for emotional well-being subscale (mean = 2.547), between 1.371 and 2.260 for social well-being subscale (mean = 1.846), and between 1.703 and 2.771 for psychological well-being subscale (mean = 2.221). Among items, only item 8 had 'high' slope and rest of the items had 'very high' slope. All items of the MHC-SF-B provided sufficient information about mental health that this scale assesses and able to discriminate among people in terms of poor or better mental health. Results regarding the threshold coefficient in Table 1 shows that all subscales required a lower theta or latent trait to endorse items of these subscales. Item 12 had the lowest initial threshold value (−3.170), and item 6 had the highest initial threshold value (−1.335). It appears that fewer participants endorsed the initial response category for item 12 than for item 6. Similarly, item 14 had the lowest final threshold value (.515), and item 8 had the highest final threshold value (2.545). It appears from this result that fewer participants endorsed the last response option for item 8 than item 14. Threshold values suggested that the MHC-14 Bangla efficiently assesses lower to above average levels of latent traits, mental well-being. Supplementary Figure 2 presents the category characteristic curves of this scale.

Table 1 shows non-significant mean differences in emotional well-being (*t-value* = −.793, *p* = .428), social well-being (*t-value* = −1.545, *p* = .123), psychological well-being (*t-value* = −.235, *p* = .814), and mental well-being (*t-value* = −1.003, *p* = .316) between females and males. The total score of the MHC-14 Bangla had moderate correlation

Table 1. Item level properties of the Mental Health Continuum Short Form Bangla version.

Items	M	SD	Skewness	Kurtosis	Corrected item-total correlations	Slop coefficient	Threshold coefficient				
							b_1	b_2	b_3	b_4	b_5
Emotional well-being: M = 9.63, SD = 3.69; Female: M = 9.46, SD = 3.81; Male: M = 9.77, SD = 3.59; t-value = −.793, p = .428											
Item 1	2.92	1.50	−.54	−.81	.64	1.980 (.187)	−1.911	−1.012	−.756	.137	1.536
Item 2	3.40	1.41	−.87	−.17	.58	1.969 (.198)	−2.433	−1.410	−1.089	−.330	.999
Item 3	3.32	1.44	−.84	−.23	.72	3.691 (.539)	−1.856	−1.162	−.885	−.225	.918
Social well-being: M = 14.45, SD = 6.02; Female: M = 13.87, SD = 6.22; Male: M = 14.86, SD = 5.86; t-value = −1.545, p = .123.											
Item 4	3.27	1.55	−.63	−.76	.58	1.851 (.187)	−2.243	−1.286	−.799	−.169	.839
Item 5	3.50	1.52	−.84	−.46	.59	1.801 (.183)	−2.431	−1.484	−.925	−.468	.595
Item 6	2.71	1.75	−.23	−1.32	.71	2.260 (.238)	−1.335	−.769	−.311	.182	1.098
Item 7	2.93	1.52	−.26	−1.02	.63	1.947 (.190)	−2.173	−1.110	−.450	.288	1.159
Item 8	2.04	1.56	.22	−1.16	.54	1.371 (.154)	−1.399	−.387	.236	1.128	2.545
Psychological well-being: M = 20.86, SD = 6.14; Female: M = 20.77, SD = 6.20; Male: M = 20.92, SD = 6.11; t-value = −.235, p = .814.											
Item 9	3.26	1.36	−.74	−.28	.57	1.703 (.164)	−2.594	−1.548	−1.086	−.181	1.337
Item 10	3.37	1.35	−.82	−.08	.68	2.124 (.193)	−2.411	−1.526	−1.033	−.228	1.055
Item 11	3.43	1.29	−.86	.14	.68	2.277 (.214)	−2.430	−1.615	−1.015	.283	1.004
Item 12	3.58	1.25	−.84	.07	.60	1.869 (.185)	−3.170	−1.756	−1.269	−.384	.849
Item 13	3.61	1.36	−1.02	.28	.73	2.771 (.270)	−2.236	−1.484	−1.063	−.472	.602
Item 14	3.61	1.35	−.87	−.06	.69	2.579 (.240)	−2.425	−1.555	−1.026	−.406	.515
Mental well-being: M = 44.94, SD = 13.61; Female: M = 44.09, SD = 13.91; Male: M = 45.55, SD = 13.04; t-value = −1.003, p = .316.											

Table 2. Model of fits and factor loadings of unifactor, three factors and bi-factor models of the Mental Health Continuum Short Form Bangla version.

Items	Factor loadings							
	Unifactor	Three factors			Bi-factor			
	WB	EWB	SWB	PWB	EWB	SWB	PWB	WB
Item 1	.608	.715			.603			.503
Item 2	.656	.778			.354			.627
Item 3	.732	.887			.605			.666
Item 4	.726		.794			−.360		.805
Item 5	.690		.752			−.197		.739
Item 6	.732		.794			.316		.761
Item 7	.668		.730			.284		.697
Item 8	.590		.640			.497		.590
Item 9	.631			.673			.364	.554
Item 10	.718			.767			.424	.626
Item 11	.736			.787			.392	.658
Item 12	.638			.678			.515	.497
Item 13	.776			.818			.602	.612
Item 14	.766			.812			.461	.657
Model fits								
χ^2/df	8.361	3.085			1.879			
CFI	.963	.990			.996			
TLI	.956	.988			.995			
RMSEA	.143	.076			.049			
SRMR	.092	.059			.043			

Table 3. Scale level psychometric properties of the Mental Health Continuum Short Form Bangla version.

Psychometric properties	EWB	SWB	PWB	Total score	Suggested cut off
Floor effect	1.9	.8	.3	0%	<15%
Ceiling effect	7.2	1.9	5.5	.3%	<15%
Mean inter-item correlation	.57	.47	.51	.41	Between .15 and .50
Cronbach's alpha	.80	.82	.86	.91	≥.7
McDonald's Omega	.81	.82	.86	.91	≥.7
Average variance extracted	.63	.55	.57	-	≥.5
Composite reliability	.84	.86	.89	-	≥.7
Standard error of measurement	1.65	2.55	2.30	4.08	Smaller than SD/2
Ferguson delta	.97	.99	.98	.99	≥.9
IRT Reliability	.85	.86	.89	-	≥.7
Rho coefficient	.81	.82	.87	-	≥.7

with stress (−.488 [−.565, −.403], $p < .001$), and anxiety (−.454 [−.534, −.366], $p < .001$), and low correlation with Fear of COVID-19 (−.164 [−.265, −.060], $p = .002$) (Table 4). These results suggested the validity of this scale.

Table 4. Correlation coefficient between scores of the Mental Health Continuum Short Form, the Perceived Stress Scale Short Form, the State Trait Anxiety Scale Short Form, and the Fear of COVID-19 Scale.

Variables	MHC-SF	PSS-SF	STAI-SF
PSS-SF	−.488 [−.565, −.403], $p < .001$		
STAI-SF	−.454 [−.534, −.366], $p < .001$	.501 [.415, .577], $p < .001$	
FoCS	−.164 [−.265, −.060], $p = 002$	.251 [.148, .348], $p < .001$	.338 [.239, .429], $p < .001$

MHC-SF = Mental Health Continuum Short Form, PSS-SF = Perceived Stress Scale Short Form, STAI-SF = State Trait Anxiety Inventory Short Form, FoCS = Fear of COVID-19 Scale.

4. Discussion

In this study, we assess the psychometric properties of the MHC-SF Bangla version to estimate its efficiency to assess the well-being of Bangladeshi people. Items' of the MHC-SF-B had good discrimination indices (corrected item-total correlations). These items can differentiate effectively between having a higher well-being score (flourishing) and having a lower well-being score (languishing). Same as the original factor structure, MHC-SF-Bangla had three factors structure. This result about factor structure is consistent with other versions studies that assessed factor structure of this scale across different cultures and groups (i.e., Polish [Karaś et al., 2014], Canadian [Doré et al., 2017; Orpana et al., 2017], Irish [Donnelly et al., 2019], Portuguese [Fonte et al., 2020], etc.). This scale had good internal consistency reliability to assess mental health among Bangladeshi people. Other studies (i.e., Echeverría et al., 2017; Keyes et al., 2008; Rafey et al., 2017) also reported good internal consistency reliability of the MHC-SF. Besides, we also estimated the IRT reliability of this scale. Subscales of the MHC-SF-B had good IRT reliability. This type of reliability differs from alpha or omega as this is the ratio of explained variance in the response patterns to the error in the response patterns (Kim and Feldt, 2010; Sireci et al., 1991).

We also explored the efficiency of the MHC-SF-B through the multidimensional GRM of the item response theory. IRT assumption tests (local dependence and monotonicity) confirmed that there was no violation of assumptions. Slope parameters suggested that the emotional well-being subscale provides highest information, and the social well-being subscale provides least information. Results also showed that the social well-being scale items are more difficult than the other two subscale's items. Category characteristics curves (Supplementary Figure 2) show that the third response option 'About Once a Week' overlapped with other response options in most items. This overlapping suggested this option as redundant. Online data might be a possible reason for this overlapping. Moreover, this data is part of a cross-cultural COVID-19 project and collected during the first wave of the COVID-19 outbreak in Bangladesh. COVID-19 outbreak might have impacted the response pattern of participants on this scale. Further studies would be undertaken to cross-check this issue. This scale would be conducted offline first with

six-point Likert-type response option. If overlapping of this option would happen again, then this scale would be re-conducted again with a five-point Likert-type response option or with the same response options after completing re-translation.

Negative moderate correlations of MHC-SF-B with stress and anxiety suggested convergent validity of this scale (Fonte et al., 2020; Guo et al., 2015; Karaś et al., 2014; Machado and Bandeira, 2015). Overall, the MHC-SF-B is a psychometrically reliable and valid tool for assessing the positive mental health of Bangladeshi adults.

4.1. Limitations and recommendations

This study has several limitations. Firstly, we utilized online data in this study to assess the reliability and validity of the MHC-SF-B. Online data contain responses only from educated people who have internet and smartphone/computer facilities. Therefore, sample representation is in question. Secondly, the data utilized in this study were self-rated. Self-rated data might be subjected to biases (i.e., social desirability bias, memory recall, etc.). Thirdly, there is no information about the clinical sample in the data. How this scale will perform to assess the mental well-being of the clinical sample is unknown. These limitations would be overcome by conducting several studies with a representative sample of all ages and groups.

4.2. Conclusions

Despite the limitations, the findings show that the Mental Health Continuum – Short Form- Bangla is a reliable and valid tool to assess the mental well-being of Bangladeshi people. This measure will also be helpful to mental health practitioners assessing the mental health state of adult clients in Bangladesh. It would help to formulate necessary interventions to alleviate psychological distress and strengthen psychological well-being.

Declarations

Author contribution statement

Fatema Akhter Hiramoni and Oli Ahmed: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Data availability statement

Data will be made available on request.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

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References

Ahmed, M.Z., Ahmed, O., Aibao, Z., Hanbin, S., Siyu, L., Ahmad, A., 2020a. Epidemic of COVID-19 in China and associated psychological problems. Asian J. Psychiatr. 51, 102092.

Ahmed, O., Ahmed, M.Z., Alim, S.M.A.H.M., Khan, M.D.A.U., Jobe, M.C., 2020b. COVID-19 outbreak in Bangladesh and associated psychological problems: an online survey. Death Stud. 1–10.

Ahmed, O., Hossain, K.N., Siddique, R.M., Jobe, M.C., 2021. COVID-19 fear, stress, sleep quality and coping activities during lockdown, and personality traits: a person-centered approach analysis. Pers. Indiv. Differ. 178, 110873.

Ahorsu, D.K., Lin, C.-Y., Imani, V., Saffari, M., Griffiths, M.D., Pakpour, A.H., 2020. The fear of COVID-19 scale: development and initial validation. Int. J. Ment. Health Addiction.

Banoo, N., 2001. The Translated Bangla Version of GHQ-28. Department of Clinical Psychology, University of Dhaka.

Beck, F., Leger, D., Fressard, L., Peretti-Watel, P., Verger, P., Coconel, G., 2021. Covid-19 health crisis and lockdown associated with high level of sleep complaints and hypnotic uptake at the population level. J. Sleep Res. 30 (1), e13119.

Bradburn, N.M., 1969. The structure of Psychological well-being. Aldine.

Chen, W.H., Thissen, D., 1997. Local dependence indexes for item pairs using item response theory. J. Educ. Behav. Stat. 22, 265–289.

Cohen, S., Kamarck, T., Mermelstein, R., 1983. A global measure of perceived stress. J. Health Soc. Behav. 24 (4), 385–396.

Diener, E., 1984. Subjective well-being. Psychol. Bull. 95 (3), 542–575.

Donnelly, A., O'Reilly, A., Dolphin, L., O'Keeffe, L., Moore, J., 2019. Measuring the performance of the Mental Health Continuum-Short Form (MHC-SF) in a primary care youth mental health service. Ir. J. Psychol. Med. 36 (3), 201–205.

Doré, I., O'Loughlin, J.L., Sabiston, C.M., Fournier, L., 2017. Psychometric evaluation of the mental health continuum–short form in French Canadian young adults. Can. J. Psychiatr. 62 (4), 286–294.

Echeverría, G., Torres, M., Pedrals, N., Padilla, O., Rigotti, A., Bitran, M., 2017. Validation of a Spanish version of the mental health continuum-short form questionnaire. Psicothema 29 (1), 96–102.

Fonte, C., Silva, I., Vilhena, E., Keyes, C.L.M., 2020. The Portuguese adaptation of the mental health continuum-short form for adult population. Community Ment. Health J. 56 (2), 368–375.

Gallagher, M.W., Lopez, S.J., Preacher, K.J., 2009. The hierarchical structure of well-being. J. Pers. 77, 1025–1050.

Guo, C., Tomson, G., Guo, J., Li, X., Keller, C., Soderqvist, F., 2015. Psychometric evaluation of the mental health continuum-short form (MHC-SF) in Chinese adolescents - a methodological study. Health Qual. Life Outcome 13, 198.

Goldberg, D., 1978. Manual of the General Health Questionnaire. NFER-Nelson, Windsor.

Goodman, R., 1997. The strengths and difficulties questionnaire: a research note. JCPP (J. Child Psychol. Psychiatry) 38 (5), 581–586.

Karaś, D., Cieciuch, J., Keyes, C.L.M., 2014. The polish adaptation of the mental health continuum-short form (MHC-SF). Pers. Indiv. Differ. 69, 104–109.

Keyes, C.L., 2002. The mental health continuum: from languishing to flourishing in life. J. Health Soc. Behav. 43 (2), 207–222.

Keyes, C.L.M., 2005. Mental illness and/or mental health? Investigating axioms of the complete state model of health. J. Consult. Clin. Psychol. 73, 539–548.

Keyes, C.L.M., 2007. Promoting and protecting mental health as flourishing: a complementary strategy for improving national mental health. Am. Psychol. 62 (2), 95–108.

Keyes, C.L.M., 1998. Social well-being. Soc. Psychol. Q. 61 (2), 121–140.

Keyes, C.L.M., Wissing, M., Potgieter, J.P., Temane, M., Kruger, A., van Rooy, S., 2008. Evaluation of the mental health continuum-short form (MHC–SF) in setswana-speaking South Africans. Clin. Psychol. Psychother. 15, 181–192.

Kim, H.Y., 2013. Statistical notes for clinical researchers: assessing normal distribution (2) using skewness and kurtosis. Restor. Dent. Endodont. 38 (1), 52–54.

Kim, S., Feldt, L., 2010. The estimation of the IRT reliability coefficient and its lower and upper bounds, with comparisons to CTT reliability statistics. Asia Pac. Educ. Rev. 11, 179–188.

Kowal, M., Coll-Martín, T., Ikizer, G., Rasmussen, J., Eichel, K., Studzińska, A., Koszałkowska, K., Karwowski, M., Najmussaqib, A., Pankowski, D., Lieberoth, A., Ahmed, O., 2020. Who is the most stressed during the COVID-19 pandemic? Data from 26 countries and areas. Appl. Psychol.: Health Well-Being 12 (4), 946–966.

Kroenke, K., Spitzer, R.L., Williams, J.B.W., 2001. The PHQ-9. J. Gen. Intern. Med. 16 (9), 606–613.

Lamborn, P., Cramer, K.M., Riberdy, A., 2018. The structural validity and measurement invariance of the mental health continuum – short form (MHC-SF) in a large Canadian sample. J. Well-Being Assess. 2 (1), 1–19.

Li, Y., Qin, Q., Sun, Q., Sanford, L.D., Vgontzas, A.N., Tang, X., 2020. Insomnia and psychological reactions during the COVID-19 outbreak in China. Journal of Clinical Sleep Medicine 16 (8), 1417–1418.

Lovibond, P.F., Lovibond, S.H., 1995. Manual for the Depression Anxiety Stress Scales, second ed. Sydney Psychology Foundation.

Luijten, C.C., Kuppens, S., van de Bongardt, D., Nieboer, A.P., 2019. Evaluating the psychometric properties of the mental health continuum-short form (MHC-SF) in Dutch adolescents. Health Qual. Life Outcome 17 (1), 157.

Machado, W.d.L., Bandeira, D.R., 2015. Positive mental health scale: validation of the mental health continuum - short form. Psico-USF 20 (2), 259–274.

Marteau, T.M., Bekker, H., 1992. The development of a six-item short-form of the state scale of the Spielberger State-Trait Anxiety Inventory (STAI). Br. J. Clin. Psychol. 31 (3), 301–306.

Molenaar, I.W., Sijtsma, K., 2000. MSP5 for Windows. iec ProGAMMA, Groningen.

Mullick, M.S.I., Goodman, R., 2001. Questionnaire screening for mental health problem in Bangladeshi children: a preliminary analysis. Soc. Psychiatr. Psychiatr. Epidemiol. 36 (2), 94–99.

Orpana, H., Vachon, J., Dykxhoorn, J., Jayaraman, G., 2017. Measuring positive mental health in Canada: construct validation of the Mental Health Continuum-Short Form. Health Promot. Chronic. Dis. Prev. Can. 37 (4), 123–130.

Perugini, M.L.L., de la Iglesia, G., Solano, A.C., Keyes, C.L., 2017. The mental health continuum-short form (MHC-SF) in the argentinean context: confirmatory factor Analysis and measurement invariance. Eur. J. Psychol. 13 (1), 93–108.

Petrillo, G., Capone, V., Caso, D., Keyes, C.L.M., 2014. The mental health continuum–short form (MHC–SF) as a measure of well-being in the Italian context. Soc. Indicat. Res. 121 (1), 291–312.

Rafey, H., Alipour, F., LeBeau, R., Rarani, M., Salimi, Y., Ahmadi, S., 2017. Evaluating the psychometric properties of the mental health continuum-short form (MHC-SF) in Iranian earthquake survivors. Int. J. Ment. Health 46 (3), 243–251.

Rahman, S.T., Imran, M.A., 2013. Bangladeshi adaptation of Warwick-Edinburgh mental well-being scale. The Dhaka Univ. J. Psychol. 37, 49–60.

Ramiz, L., Contrand, B., Rojas Castro, M.Y., Dupuy, M., Lu, L., Sztal-Kutas, C., Lagarde, E., 2021. A longitudinal study of mental health before and during COVID-19 lockdown in the French population. Glob. Health 17 (1), 29.

Ryff, C.D., 1989. Happiness is everything, or is it? Explorations on the meaning of psychological well-being. J. Pers. Soc. Psychol. 57 (6), 1069–1081.

Ryff, C.D., Keyes, C.L.M., 1995. The structure of psychological well-being revisited. J. Pers. Soc. Psychol. 69 (4), 719–727.

Sireci, S.G., Thissen, D., Wainer, H., 1991. On the reliability of testlet-based tests. J. Educ. Meas. 28, 237–247.

Spielberger, C.D., 1983. Manual for the State-Trait Anxiety Inventory: STAI (Form Y). Consulting Psychologists Press.

Spitzer, R., Kroenke, K., Williams, J., Löwe, B., 2006. A brief measure for assessing generalized anxiety disorder: the GAD-7. Arch. Intern. Med. 166 (10), 1092–1097.

Tennant, R., Hiller, L., Fishwick, R., Platt, S., Joseph, S., Weich, S., Parkinson, J., Secker, J., Stewart-Brown, S., 2007. The Warwick-Edinburgh mental well-being scale (WEMWBS): development and UK validation. Health Qual. Life Outcome 5. Article 63.

Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C.S., Ho, R.C., 2020. Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. Int. J. Environ. Res. Publ. Health 17 (5), 1729.

World Health Organization, 2004. Promoting Mental Health: Concepts, Emerging Evidence, Practice: Summary Report. World Health Organization, Geneva.

Żemojtel, Piotrowska, M., Piotrowski, J., Sawicki, A., Maltby, J., Jonason, P., Sedikides, C., Milfont, T.L., Włodarczyk, A., Bălțătescu, S., Gouveia, V.V., Park, J., Ramos-Diaz, J., Gundolf, K., Espinosa, A.D., de Leon, P.P., Herrera, E.W., Fernandez, A.L., Bonato, M., Spoto, ., Jeong, H.K., 2020. COVID-19, Personality and Quality of Life: Self-Enhancement in the Time of Pandemic. Retrieved from. https://osf.io/hpwbj.