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Psychometric Properties of the Mental Health Continuum-Short Form (MHC-SF): A Study With Individuals With Schizophrenia Living in the Community

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Objective The Mental Health Continuum-Short Form (MHC-SF) is widely used to measure positive mental health. This study is the first to examine the psychometric properties of the MHC-SF in persons with schizophrenia living in the community.

Methods Two hundred thirty-one individuals with schizophrenia living in the community in South Korea filled out the MHC-SF. Confirmatory factor analysis (CFA), bifactor CFA, exploratory structural equation modeling (ESEM), and bifactor ESEM were undertaken to examine the factor structure of the MHC-SF.

Results Results showed that a three-factor bifactor ESEM model yielded better fit than the other alternative models. Indices of internal consistency reliability were acceptable.

Conclusion The results suggest that bifactor ESEM is an appropriate analysis for examining the factor structure of the MHC-SF in individuals with schizophrenia. The findings support the use of the overall MHC-SF scale rather than the use of the subscales in people with schizophrenia.
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Keywords Positive mental health; MHC-SF; Bifactor ESEM; Schizophrenia.

INTRODUCTION

For a long time, mental health has been recognized as having no mental disorder or mental illness. However, the recent concept of mental health refers to a condition in which an individual does not have mental illness and has positive mental health at the same time.[1]

Positive mental health includes three types of subjective well-being: emotional, social, and psychological well-being. Emotional well-being is a state of experiencing positive emotions and being satisfied with one's life, psychological well-being is a self-evaluation of optimal functioning in one's personal life, and social well-being is a self-evaluation of optimal functioning in one's social life.[2]

While the pursuit of positive mental health is regarded as an important human goal, there has been little interest in positive mental health among individuals with schizophrenia. Recently, Saperia et al.[3] reported that emotional well-being (a component of positive mental health) was not reduced in schizophrenia while patients with schizophrenia reported reduced life satisfaction and success compared to normal people. In addition, Edmonds et al.[4] reported that one-third of people with schizophrenia are similar in the mean self-reported levels of emotional well-being (a component of positive mental health), resilience, and optimism compared to normal people. In their study, it was reported that well-being levels were not related to the severity of psychopathology but were correlated with levels of biomarkers of inflammation and insulin resistance.

Recently, positive psychology interventions (PPIs), designed to improve the positive mental health of individuals with depression, have been applied to individuals with schizophrenia. PPIs for individuals with schizophrenia were developed to target negative symptoms, impaired cognition, and social impairment, on which traditional intervention methods did not show much effect for people with schizophrenia. Also,

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PPIs are intended to enhance positive mental health which is expected to play a role in the recovery of schizophrenia. PPIs studies in individuals with schizophrenia or psychosis[5-7] reported decrease in psychotic symptoms and elevation of positive mental health.

Currently, many assessing tools are being developed to measure positive mental health. The Mental Health Continuum-Short Form (MHC-SF) is one of the scales for assessing an individual's positive mental health. It covers most aspects of positive mental health (emotional well-being, social well-being, and psychological well-being) currently described in the literature. The MHC-SF is a proven reliable and valid tool for assessing positive mental health in normal adults.[8]

The psychological properties of the MHC-SF were already examined not only in nonclinical samples but also in clinical samples.[9-11] In most of the validating studies in clinical samples, reliability and validity of the MHC-SF were found to be sound and adequate. However, the factor structure of MHC-SF was not consistent across studies with clinical samples. For example, in a study of patients with affective disorders, the best-fitting model of the MHC-SF was one-factor model.[9] In a study of psychiatric outpatients, the three-factor structure was confirmed.[10] In a study of patients attending a psychiatric partial hospital program, the existence of a general factor was supported but there was only limited evidence for the existence of three specific factors.[11]

To date, there are no adaptations of the MHC-SF in individuals with schizophrenia and its psychometric properties have not been examined in individuals with schizophrenia, even though positive mental health is important for individuals with schizophrenia, and treatments have begun to elevate the positive mental health of individuals with schizophrenia. The aim of the present study was to validate the Korean version of MHC-SF in a sample of individuals with schizophrenia. Internal consistency and construct validity of the MHC-SF subscales and for the overall MHC-SF were examined.

METHODS

Participants

Two hundred thirty-one individuals with schizophrenia in South Korea participated in this study. The data was obtained from the two independent study projects that were aimed to examine the determinants of positive mental health in individuals with schizophrenia.[12,13] The participants were recruited via community mental health centers and were all living in the community. This study was approved by the Daegu University Institutional Review Board (no. 1040621-202207-HR-E004). All participants were introduced to the procedure and aim of the study, then gave informed consent to participation in the study. The mean age of the participants was 41.17 years (standard deviation [SD]=10.17). The illness duration was 14.73 years (SD=8.61). Ninety-four (40.7%) of the participants were females (Table 1).

Measure

The Mental Health Continuum-Short Form

Positive mental health was measured via the MHC-SF.[8] The MHC-SF consists of 14 items. Respondents were instructed to report on a 6-point scale, where 0=never and 5=every day. The items represent three dimensions of positive mental health (emotional, social, and psychological well-being). The three items (items 1−3) of emotional well-being denote satisfaction with life and positive affect. The five items (items 4−8) of social well-being represent five dimensions of positive social functioning, namely, social acceptance, social actualization, social contribution, social coherence, and social integration. The six items (items 9−14) for psychological well-being focus on six dimensions of positive personal functioning, that is, self-acceptance, environmental mastery, positive relations with others, personal growth, autonomy, and purpose in life. Total scores on the MHC-SF can range from 0 to 70. Higher scores indicate a higher level of positive mental health. The Cronbach's alpha of the Korean version of the MHC-SF was 0.91.[14]

Procedure

After receiving written informed consent from the partici-

Table 1. Demographic characteristics of participants (N=231)

	Value
Sex	
Female	94 (40.7)
Male	133 (57.6)
Unknown	4 (1.7)
Age (yr)	41.17±10.17 (20−67)
Illness Duration (yr)	14.73±8.61 (0−43)
Education (yr)	
≤6	9 (3.9)
>6 and ≤9	23 (10.0)
>9 and ≤12	112 (48.5)
>12 and ≤16	86 (37.2)
Unknown	1 (0.4)
Employment	
Employed	126 (54.5)
Unemployed	101 (43.7)
Unknown	4 (1.7)

Values are presented as mean±standard deviation (range) or N (%)

pants, they were asked to complete the MHC-SF using a pencil or pen. A researcher was present beside the participants to answer their questions. It took about 20–30 minutes to complete the scales.

Data analyses

Data analyses were performed using SPSS 21 (IBM Corp., Armonk, NY, USA) and Mplus 7.0 (Muthén & Muthén, Los Angeles, CA, USA). To investigate factor structure of the MHC-SF for individuals with schizophrenia, multivariate normality for the analyses was evaluated by Mardia's tests. The investigation of the factor structure of the MHC-SF was conducted using the maximum likelihood robust (MLR) estimation method and the weighted least square mean and variance adjusted (WLSMV) estimation method, which are robust to non-normality of the data. Although the items of the MHC-SF have been viewed as continuous in previous studies, floor effects were possible for the individuals with schizophrenia, so sensitivity tests were conducted using the WLSMV. Twelve alternative models were compared using confirmatory factor analysis (CFA), bifactor confirmatory factor analysis (bifactor CFA), exploratory structural equation modeling (ESEM) and bifactor exploratory structural equation modeling (bifactor ESEM): a two-factor model comprising emotional and eudaimonic well-being with CFA (model 1); a two-factor model comprising emotional and eudaimonic well-being with bifactor CFA (model 2); a two-factor model comprising emotional and eudaimonic well-being with ESEM (model 3); a two-factor model comprising emotional and eudaimonic well-being with bifactor ESEM (model 4); a two-factor model comprising social and hedonic well-being with CFA (model 5); a two-factor model comprising social and hedonic well-being with bifactor CFA (model 6); a two-factor model comprising social and hedonic well-being with ESEM (model 7), a two-factor model comprising social and hedonic well-being with bifactor ESEM (model 8); a three-factor model with CFA (model 9); a three-factor model with bifactor CFA (model 10); a three-factor model with ESEM (model 11); and a three-factor model with bifactor ESEM (model 12). From model 1 to model 4, the social well-being and psychological well-being items were specified to load on eudaimonic well-being. From model 5 to model 8, the emotional well-being and psychological well-being items were specified to load on hedonic well-being. In the CFA models, each item of the MHC-SF had a non-zero loading on the target factor and a zero loading on the other factors. In the bifactor-CFA models, each item of the MHC-SF had a loading on both the general factor and on the specific factor, no cross-loadings were allowed, and the factors were orthogonal to one another. In the ESEM models, cross-loadings were estimated through oblique target rotation. In the bifactor-ESEM models, each item of the MHC-SF was defined by the general factor and by the specific factor and cross-loadings were estimated through orthogonal bifactor-target rotation.

To examine the goodness of fit of the alternative models, the comparative fit index (CFI), the Tucker–Lewis Index (TLI), and root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR) were assessed. CFI and TLI values above 0.90 and RMSEA and SRMR values less than 0.08 indicate acceptable model fit.[15] Also, the improvement in model fit was examined with Akaike information criterion (AIC) and the sample size-adjusted Bayesian information criterion (SSABIC), with smaller values representing better fit.

In addition to fit indices, the mean and range of the target loadings from bifactor ESEM were examined. Mean target loadings should be equal to or above 0.50 and the lowest loading on a factor should be equal to or above 0.30 in a well-defined factor.[16]

For the best fitting model, McDonald's omega hierarchical (ωh) coefficients were calculated to evaluate the internal consistency reliability of the MHC-SF. The acceptable cut-off score of the McDonald's omega hierarchical coefficients was 0.50.[17]

RESULTS

Factor analysis

Because Mardia's multivariate normality test showed that both multivariate skewness and kurtosis were significant (Mardia skewness=41.39, $p<0.001$; and kurtosis=326.60, $p<0.001$), suggesting that the data failed to maintain normal distribution, the MLR estimator was employed for factor analysis. A sensitivity analysis was also conducted with the WLSMV estimator to compare with MLR, and no significant difference in results emerged.

Table 2 shows the fit indices for the twelve alternative models using the MLR. Of the twelve models, the three-factor bifactor CFA model was unacceptable because of the lack of positive definiteness of the covariance matrix.

As can be seen in Table 2, the CFI, TLI, SRMR, and RMSEA values for the two-factor models comprising emotional and eudaimonic well-being indicated sufficient fit (CFI=0.955–0.968; TLI=0.939–0.946; SRMR=0.024–0.039; RMSEA=0.061–0.064). Also, the CFI, TLI, SRMR, and RMSEA values for the two-factor models comprising social and hedonic well-being indicated acceptable fit (CFI=0.957–0.973; TLI=0.939–0.961; SRMR=0.024–0.033; RMSEA=0.051–0.064) except for the two-factor model comprising social and hedonic well-being with CFA (CFI=0.881; TLI=0.858; SRMR=0.053; RMSEA=0.098). In addition, the fit indices for the three-fac-

Table 2. Goodness-of-fit from factor analysis with robust maximum likelihood estimation

Model	χ^2	df	CFI	TLI	SRMR	RMSEA	90% CI	AIC	SSABIC
Model 1	140.848	76	0.955	0.946	0.039	0.061	0.045–0.076	9,530.021	9,541.760
Model 2	118.435	62	0.960	0.942	0.029	0.063	0.045–0.080	9,490.731	9,506.291
Model 3	125.026	64	0.957	0.939	0.033	0.064	0.047–0.081	9,525.591	9,540.605
Model 4	97.348	52	0.968	0.944	0.024	0.061	0.042–0.080	9,487.057	9,505.347
Model 5	245.839	76	0.881	0.858	0.053	0.098	0.085–0.112	9,690.064	9,701.802
Model 6	99.937	62	0.973	0.961	0.028	0.051	0.032–0.070	9,481.091	9,496.651
Model 7	125.026	64	0.957	0.939	0.033	0.064	0.047–0.081	9,525.591	9,540.605
Model 8	97.348	52	0.968	0.944	0.024	0.061	0.042–0.080	9,487.057	9,505.347
Model 9	117.196	74	0.970	0.963	0.035	0.050	0.032–0.067	9,496.557	9,508.841
Model 10*	87.025	60	0.981	0.971	0.029	0.044	0.021–0.064	9,474.543	9,490.649
Model 11	97.348	52	0.968	0.944	0.024	0.061	0.042–0.080	9,487.057	9,505.347
Model 12	64.984	41	0.983	0.963	0.017	0.050	0.025–0.073	9,464.532	9,485.825

*the latent variable covariance matrix (psi) is not positive definite. χ^2, chi-square goodness of fit test; df, degree of freedom; CFI, comparative fit index; TLI, Tucker–Lewis Index; SRMR, standardized root mean square residual; RMSEA, root mean square error of approximation; CI, confidence interval; AIC, Akaike information criteria; SABIC, sample size-adjusted Bayesian information criteria

tor models, except for the three-factor bifactor CFA model, indicated good fit (CFI=0.968–0.983; TLI=0.944–0.963; SRMR= 0.017–0.035; RMSEA=0.050–0.061).

The improvement in model fit was examined using AIC and SSABIC. The two-factor bifactor CFA model (model 2) had an improved fit over the two-factor CFA solution (model 1) (ΔAIC=-39.290, ΔSSABIC=-35.469). Regarding the two-factor ESEM solutions of the MHC-SF, the two-factor bifactor ESEM model (model 4) had a better fit than the two-factor ESEM model (model 3) (ΔAIC=-38.534, ΔSSABIC=-35.258). Also, the fit of the two-factor ESEM solution (model 3) was better than the two-factor CFA model (model 1) (ΔAIC=-4.430, ΔSSABIC=-1.155), though the difference was modest. Concerning the two-factor bifactor solutions of the MHC-SF, the fit of the two-factor bifactor ESEM (model 4) was superior to the two-factor bifactor CFA model (model 2) (ΔAIC=-3.674, ΔSSABIC=-0.944), though the difference was negligible.

Regarding the two-factor ESEM solutions of the MHC-SF, the two-factor bifactor ESEM solution (model 8) was better than the two-factor ESEM solution (model 7) (ΔAIC=-38.534, ΔSSABIC=-35.258). Concerning the two-factor bifactor solutions of the MHC-SF, the two-factor bifactor ESEM (model 8) had better fit than the two-factor bifactor CFA model (model 6) (ΔAIC=-5.966, ΔSSABIC=-8.696).

In addition, the three-factor bifactor ESEM model (model 12) had a better fit than the three-factor ESEM model (model 11) (ΔAIC=-22.525, ΔSSABIC=-19.522). Also, the fit of the three-factor ESEM solution (model 11) was better than the three-factor CFA model (model 9) (ΔAIC=-9.500, ΔSSABIC= -3.494), though the difference was small.

Regarding the CFA solutions of the MHC-SF, the three-factor CFA model (model 9) had a better fit than the two-factor CFA models (model 1 and 5) (ΔAIC=-33.464 and -193.507, ΔSSABIC=-32.919 and -192.961). Also, concerning the ESEM solutions of the MHC-SF, the three-factor ESEM model (model 11) showed a better fit than the two-factor ESEM models (model 3 and 7) (ΔAIC=-38.534, ΔSSABIC=-35.258). In addition, as to the bifactor ESEM solutions of the MHC-SF, the three-factor bifactor ESEM model (model 12) had a better fit than the two-factor bifactor ESEM models (model 4 and 8) (ΔAIC=-22.525, ΔSSABIC=-19.522).

These findings indicated that the bifactor models gave a more precise picture of the structure than the first-order models and three-factor models offered a more accurate representation of the data than the two-factor models. Of the eleven alternative models, the fit of the three-factor bifactor ESEM model was better than the other models.

Table 3 presents the standardized factor loadings of the three-factor bifactor ESEM model of the MHC-SF. Examining parameter estimates in the three-factor bifactor ESEM model, the best fitting model of the alternative models, revealed a well-defined general factor with all loadings above 0.50 (λ=0.638–0.825, M=0.725). The emotional well-being (λ=0.442–0.656, M=0.568) factor accounted for a significant amount of variance when controlling for the general factor, whereas mean target loadings were lower than 0.50 and the lowest loadings on a factor were lower than 0.30 in social well-being (λ=0.042–0.613, M=0.302), and psychological well-being (λ=-0.072–0.388, M=0.260) factors, indicating reduced specificity after controlling for the general factor. In social well-being factor, three social well-being items (items 6, 7, and 8) had a salient loading on this factor (λ≥0.30) while two

Table 3. Parameter estimates for the three-factor bifactor ESEM solution of the MHC-SF

Item	General factor	Factor I	Factor II	Factor III
1	0.659*	0.656*	-0.001	-0.065
2	0.692*	0.607*	0.024	0.066
3	0.638*	0.442*	-0.043	0.060
4	0.714*	-0.102	0.193*	0.039
5	0.825*	-0.050	0.042*	-0.051
6	0.695*	0.032	0.326*	0.071
7	0.675*	0.071	0.335*	-0.160
8	0.659*	-0.032	0.613*	0.049
9	0.819*	0.015	0.020	-0.072*
10	0.775*	0.077	-0.005	0.231*
11	0.788*	-0.053	-0.073	0.176*
12	0.788*	0.015	-0.023	0.366*
13	0.755*	-0.087	0.043	0.388*
14	0.668*	0.134	0.062	0.328*
ωh	0.895			
ωhs		0.385	0.135	0.095
ECV	0.779	0.104	0.067	0.051

*target loadings are shown. ESEM, exploratory structural equation modeling; MHC-SF, Mental Health Continuum-Short Form; Factor I, emotional well-being; Factor II, social well-being; Factor III, psychological well-being; ωh, omega hierarchical; ωhs, omega hierarchical subscales; ECV, explained common variance

social well-being items (items 4 and 5) did not load on the intended factor ($\lambda<0.30$). Three psychological well-being items (items 12, 13, and 14) had a salient loading on the psychological well-being factor ($\lambda\geq0.30$) while three psychological well-being items (items 9, 10, and 11) failed to load on the intended factor ($\lambda<0.30$).

Reliability analysis

As noted in Table 3, McDonald's coefficient ω-hierarchical for the general factor (14 items) was 0.895, whereas coefficient ω-specific for the emotional well-being factor (3 items) was 0.385, for the social well-being factor (5 items) was 0.135, and for the psychological well-being factor (6 items) was 0.095. Only McDonald's coefficient ω-hierarchical for the general factor achieved the recommended threshold level of 0.500.[17] The explained common variance (ECV) was estimated to assess common variance that can be explained by each factor. The ECV for the general factor was 0.779. On the other hand, the ECV for the emotional well-being factor (3 items) was 0.104, for the social well-being factor (5 items) was 0.067, and for the psychological well-being factor (6 items) was 0.051. Thus, the general factor explained a significantly larger amount of the common variance than the specific factors.

DISCUSSION

The current study is the first to examine the psychometric properties of the MHC-SF in individuals with schizophrenia using different analytic techniques. The results of the present study showed that the three-dimensional bifactor ESEM model yielded better fit than the other alternative models, indicating that the MHC-SF scores are better represented after the general factor is accounted for, and when cross-loadings are allowed to be estimated. Also, the results indicate that MHC-SF scores show a bifactor structure with a strong general factor. For example, two-factor bifactor CFA fitted better than two-factor CFA, two-factor bifactor ESEM model showed a better fit than two-factor ESEM, and three-factor bifactor ESEM model had a better fit than three-factor ESEM model. These findings are consistent with the previous studies suggesting that the three CFA factors were highly correlated, and that the bifactor structure of positive mental health with a strong general factor were underlying the MHC-SF.[9,11] In addition, the findings indicate that MHC-SF scores show a three-factor structure rather than a two-factor structure. For example, three-factor CFA had a better fit than two-factor CFA, three-factor ESEM model fitted better than two-factor ESEM, and three-factor bifactor ESEM model displayed a better fit than two-factor bifactor ESEM model.

In the three-factor bifactor ESEM model, five items (items 4, 5, 9, 10, and 11) from specific factors had low loading values. Also, the general factor had sufficient ωh scores, but the specific factor ωh scores were insufficient in the three-factor bifactor ESEM model. The low loading values of specific factors and the coefficient omega specific suggest that MHC-SF is not sufficient to measure the three specific factors of positive mental health when controlling for the variance of the general factor. The results mean that the items of the MHC-SF measure the general factor rather than the specific factors. Therefore, caution should be taken when interpreting the specific factor scores.

Regarding the fact that specific factors had low loading values and general factors showed strong loading values in studies with psychiatric patients, the previous researchers explained that it was because psychiatric patients could not distinguish the types of well-being due to their distress.[18] However, it is premature to conclude that the three types of positive mental health do not have specificity for psychiatric patients because all three types of well-being did not function as well-defined factors even in the study where the bifactor ESEM model of the MHC-SF was examined in a general population.[19]

The study results showing a strong general factor in the MHC-SF provide a rationale for using the MHC-SF total score in a study on positive mental health of the individuals with schizophrenia. In addition, the findings of the current study raise the possibility that statistical problems may occur when the three factor scores of the MHC-SF are input into the analysis together.[20]

There are some limitations to this study. First, there was no information on cognitive function, types of antipsychotic drugs, and severity of symptoms in the present study. Therefore, further research is needed to determine whether the same results could be obtained even after controlling the severity of symptoms, types of antipsychotics, and cognitive function. Second, the test-retest reliability was not examined in the current study. Because cognitive dysfunction, which is a core feature of schizophrenia, could be related with the test-retest reliability coefficients, future studies are also needed to examine test-retest reliability.

In conclusion, overall, the current study shows that there is limited support for the use of the MHC-SF subscales in people with schizophrenia, and the overall scale score appears to be most appropriate. Also, additional research is warranted to examine the test-retest reliability of the MHC-SF in individuals with schizophrenia and to examine the relationship between the MHC-SF and the symptoms severity of schizophrenia, cognitive symptoms, and types of antipsychotic medications.

Availability of Data and Material

The datasets generated or analyzed during the study are available from the corresponding author on reasonable request.

Conflicts of Interest

The author has no potential conflicts of interest to disclose.

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