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Research Article

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Influence of General Health on Quality of Life by the Caregiver and Burden Care as a Mediator: Bayesian Estimator Structural Equation Analysis

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Abstract

Objectives: *To test structural equation models of General Health on quality of life by the caregiver and burden care as a mediator.*

Methods: *The quality of life scale was administered to 297 caregivers of persons with schizophrenia. The models were examined using maximum likelihood confirmatory factor analysis (ML-CFA) and Bayesian structural equation modeling (BSEM). The path analysis with direct and indirect effects was discussed in the model.*

Results: *The results reveal that the models fit well for evidence-based. The BIC 1412.998 < 3161.387, DIC 1365.247 < 3094.673, and WAIC 1370.802 < 3094.651 were the lowest BIC of the models and displayed a simple and parsimonious factor-loading pattern.*

Conclusions: *Overall, both of the scales demonstrated excellent measurement properties supporting its relevance to comprehensively measure caregivers' impact and burden on persons with schizophrenia. Psychiatric and mental health care teams and clinical researchers could use the quality of life scale to generate strategies to support the family caregiver and measure the multidisciplinary treatment team interventions' outcomes.*

Keywords: Caregiver Burden, Quality of Life, Schizophrenia, Bayesian Estimator, Structural Equation Analysis.

1. Introduction

Schizophrenia is a severe psychiatric illness that can cause physical, psychological, and social problems, not only through its symptoms but also as a result of the side effects caused by its treatment medication [1, 2]. The impact of schizophrenia is usually not limited to those affected by the condition; it often also has a negative effect on the quality of life (QoL) of caregivers [3- 5]. Indeed, caregivers often experience significant burdens, a) economic burden (financial, career prospects), b) psychological burden (increased psychosomatic, stress, anxiety, depressive symptoms), and hopefulness, c) family burden (low-income family functioning, restricted roles and activities) and d) social burden (social relationships, sense of freedom) restricted roles and activities, and increased psychosomatic, anxiety, or depressive symptoms [6- 12]. Consequently, caregivers' negative experience may affect their ability to care for the patients.

Caregivers who are providing care to people with schizophrenia have to learn how to manage psychotic symptoms through a gradual process of trial and error. This experience includes cutting off the wind, checking aggressive and violent behaviors, protecting patients from harming themselves or others, preventing relapses, ensuring patients take their medication, returning to normality, and calming the mental state of patients' relatives.

A lack of family involvement in treatment planning is associated with medication compliance, continuity and sustaining of care, and social support. Therefore, assessing and preserving the caregivers' impact and the burden is a significant issue for the caregivers themselves and indirectly for the patients' health. The development of supporting activities for people with schizophrenia is also an important aspect, and family members' caution focusing solely on symptom reduction and relapse prevention is insufficient. There is a need for improved family intervention programs delivered by healthcare teams [13, 14]. According to this, providing a reliable and valid instrument for families caring for individuals with schizophrenia is necessary. Although many studies specifically on caregiving issues, little has explored the impact and burden among caregivers of individuals with schizophrenia [15]. Further, no impact and burden measurement scale has been developed explicitly for use with this population.

Bayesian analysis was used to assess the structural equation model (The First Order Confirmatory Factor Analysis). It has

a strange estimate multiparameter and tests in non-normality. Moreover, it is user-friendly when the sample size is small and when analyzing a new complex model. The QOL (Caregivers) scale used in this study aims to compare models' fitness and guide healthcare providers in selecting a suitable scale for their situation.

The QOL (Caregivers) scale is an innovative tool used in schizophrenia research; it is a self-administered instrument based on the caregivers' perspective. It is practical in a straightforward conceptual approach. Exploring and evaluating the caregivers' quality of life could help preserve caregivers' health and ability to care, which could also help improve patients' health. Besides, it could provide valuable information regarding caregivers' well-being, and a multidisciplinary treatment team could use this to develop new care strategies for this population. Therefore, this study aimed to test the QOL (Caregivers) scale's psychometric properties.

2. Methods

2.1. Participants

Caregivers of persons with schizophrenia at psychiatric hospitals were the target population in this study. The inclusion criteria were as follows: (1) having a family member with a diagnosis of schizophrenia or schizoaffective disorder, according to the DSM-V criteria; (2) being the family member of a patient; (3) being identified by the individual with schizophrenia as the primary caregiver; (4) being 18 years of age or older [16]. This project followed the Declaration of Helsinki and the French Good Clinical Practices DWT Decomposition model.

Based on such considerations, the algorithm uses a different-colored image multiplied by the weighting coefficients of different ways to solve the visual distortion. By embedding the watermark, wavelet coefficients of many forms enhance the robustness of the watermark.

2.2. Ethical Approval

Approval for ethical and data access was obtained from The Ethics Review Committee for Research Involving Human Research Participants (NPRPHEC 2559-009) of Nakhon Phanom Ratchanakarin Psychiatric Hospital, Thailand. The research teams explained the study's scope, risks, and benefits for the subjects. Before data collection, written consent was obtained directly from the PCPSs, participation was voluntary, and participant anonymity and confidentiality were guaranteed.

2.3. Procedure

For one month, personnel from each center identified inpatients and outpatients who had been given a diagnosis of schizophrenia and who were between 18 and 60 years of age. A medical or nursing staff asked each patient to name their primary caregiver. When the patient identified their parents, we asked if we could contact the caregiver. If the patient agreed and the caregiver met the inclusion criteria, the following information was collected via self-report questionnaires (completed by the caregivers) or routine clinical interviews (conducted with the patient by a psychiatrist).

2.4. Data Collection

The data collected included the following:

• Socio-demographic characteristics of the caregivers: gender, age, number of children, and employment status.

The QOL (Caregivers) scale was examined through maximum likelihood confirmatory factor analysis (ML-CFA) and Bayesian structural equation modeling (BSEM). The BSEM specified approximate zero cross-loadings and residual correlations using zero-mean, small-variance informative priors. The model comparison was based on the Bayesian information criterion (BIC).

• The BSEM Approach

This study used a methodology that draws on the approach described by Muthén and Asparouhov: the Bayesian analysis and its estimator used with BSEM to test very complex structures [17]. Besides, whether estimated through ML-CFA or BSEM, CFA relies on the distinction between the structural and measurement models. The former specifies the relationships among the observed and latent variables, and the latter determines the latent variables' relationships; both structural and measurement models reflect the underpinning theory. In other words, knowledge based on previous research is merged into the model's definition [18].

• Comparison of Model Fit

To Compare the Model fit, we checked with posterior predictive. The computed posterior predictive p-value (PPP) of model fit tested the structural model for misspecification. A small positive PPP value (e.g., .005) indicates a poor fit, whereas a value around .5 indicates an excellent fit. In contrast with the standard ML-CFA goodness-of-fit index, such as the root mean square error of approximation (RMSEA), no clear-cut PPP value may show whether or not the model fit is acceptable. Therefore, PPP should be interpreted like a structural equation modeling fit index, where a greater PPP indicates a better model. We used the deviance information criterion (DIC), which is a Bayesian generalization of the Akaike information criterion (AIC) that balances the largeness of the likelihood and adds a penalty for model complexity (number of parameters). The number of parameters used to penalize model complexity with the DIC is the effective number of parameters, known as pD. Models with smaller values of DIC should be preferred.

3. Results

3.1. Sample Characteristics

A total of 297 caregivers of persons with schizophrenia participated in this study. The findings revealed that the mean age of the participants was 48.68 years (SD = 9.91). They were predominantly female (67.34%), married (77.44%), had completed primary/elementary education (66.33%), and were employed (94.6%). More than half of the participants had insufficient income (65.32%), had no health problems (78.11%), and had been the caregiver for more than ten years. Regarding medical history, three-quarters of individuals with schizophrenia (89.90%) used universal healthcare coverage, nearly half had never been admitted to a hospital (46.46%), and more than half

had the onset of illness more than ten years (52.86%).

2.5.2 CFA and SEM consist of four variables. The analysis depicts that mean, standard deviation, skewness, kurtosis, and reliability of Cronbach's alpha were: 1) Mental Health State 1.1) Somatic Symptoms mean = 1.81, S.D. = .48, Cronbach's alpha = .85 1.2) Anxiety and insomnia mean = 1.60, S.D. = .52, Cronbach's alpha = .88, 1.3) Social dysfunction mean = 1.99, SD = 0.17, Cronbach's alpha = .62 and 1.4) Severe depression mean = 1.16, S.D. = .29, Cronbach's alpha = .85. All of indicators were normal distribution and Social dysfunction (kurtosis = 3.58) Severe depression (skewness = 2.32) and the distribution of data over the normal curve (kurtosis = 5.41) (Table 1)

	Mean	SD	Median	[Min, Max]	Range	Skew	Kurtosis	Reliability
1. Mental Health State								
1.1 Somatic Symptoms	1.81	.48	1.86	[1.00, 3.57]	2.57	.66	.55	.85
1.2 Anxiety and insomnia	1.60	.52	1.43	[1.00, 3.43]	2.43	.98	.42	.88
1.3 Social dysfunction	1.99	.17	2.00	[1.29, 2.57]	1.29	-.37	3.58	.62
1.4 Severe depression	1.16	.29	1.00	[1.00, 2.57]	1.57	2.32	5.41	.85
2. Impact & Burden								
2.1 Physical function	2.07	.97	1.83	[1.00, 4.17]	3.17	.62	-.94	.93
2.2 Role Self-esteem/ mastery	2.05	.99	1.75	[1.00, 4.12]	3.12	.61	-.96	.96
2.3 Role enjoyment	2.14	.93	1.92	[1.00, 4.25]	3.25	.70	-.72	.96
2.4 Relationship Satisfaction	2.11	.97	1.83	[1.00, 4.50]	3.50	.61	-.79	.94
3. QOL								
3.1 Psycho-physical	2.03	.60	2.00	[1.00, 4.12]	3.12	.34	-.20	.79
3.2 Burden care	1.77	.70	1.57	[1.00, 3.71]	2.71	.77	-.42	.88
3.3 Factors of care	2.52	.93	2.67	[1.00, 5.00]	4.00	.10	-.43	.88
3.4 Relationship to health care teams	3.50	.87	3.67	[1.00, 5.00]	4.00	-.69	.32	.88
3.5 Relationship to family	3.11	.96	3.00	[1.00, 5.00]	4.00	.06	-.61	.86
4. QOL (WHO)								
4.1 Physical	2.90	.47	2.86	[1.43, 4.29]	2.86	-.03	0.08	.61
4.2 Psychological	3.10	.53	3.00	[1.33, 4.67]	3.33	.14	0.33	.75
4.3 Social relationship	3.02	.64	3.00	[1.00, 5.00]	4.00	.38	0.23	.65
4.4 Environment	3.22	.54	3.00	[1.88, 5.00]	3.12	.35	-0.41	.88

Table 1: Analysis of Indicators

3.2. Construct Validity Testing of QOL (Caregivers) Scale

An analysis was conducted to compare the model fit of variables of the QOL (Caregivers) scale: a) QOL (Caregivers) of schizophrenia b) World Health Organization Quality of Life Brief – Thai (WHOQOL-BREF-THAI). The results follow.

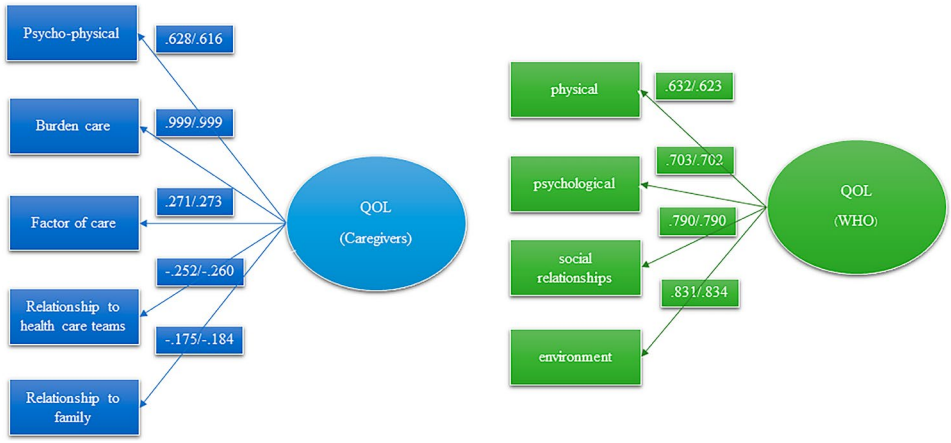

Figure 1: Confirmatory Factor Analysis of Quality of Life of Caregivers Of Schizophrenia (Left) and World Health Organization Quality of Life Brief – Thai, WHOQOL-BREF-THAI (Right)

3.2.1. Confirmatory Factor Analysis

We analyzed by Maximum Likelihood Estimator (MLE) and Bayesian Estimator (B.E.) with Uninformative prior 1,500 iterations three chains and all parameter estimates had Potential Scale Reduction Factors (PSRF) close to 1 that all parameters models of 3 chains were closely (Trace plot 1, 2) (Table 2).

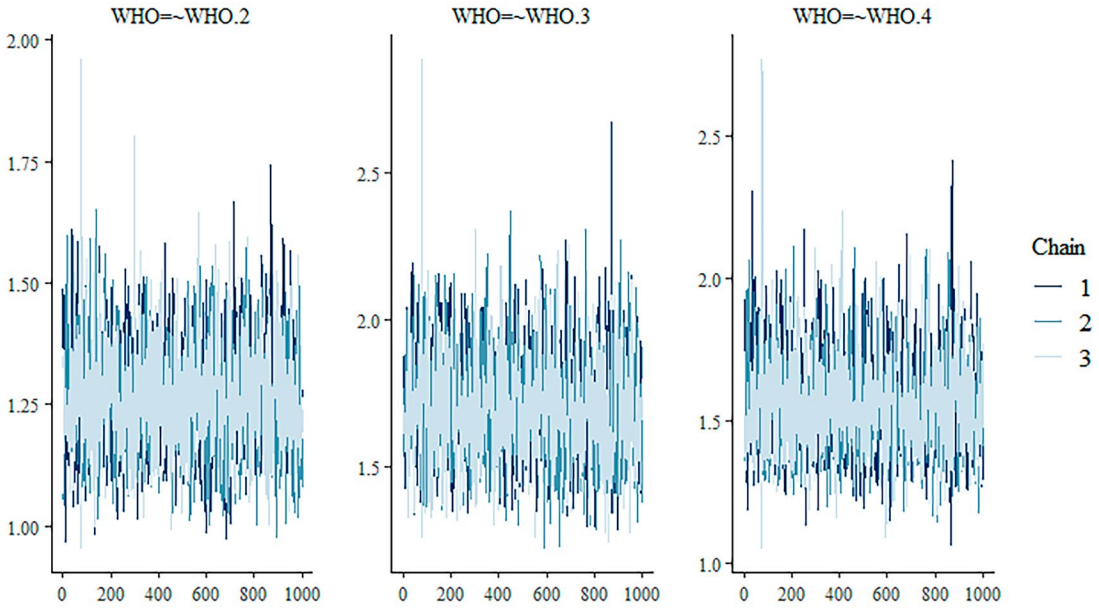

Figure 2: Trace Plot 1 Model of CFA 3 Chains of THAI BRIEF QOL (WHO)
(WHO.2 = Psychological; WHO.3 = Social Relationship, WHO.4 = Environment)

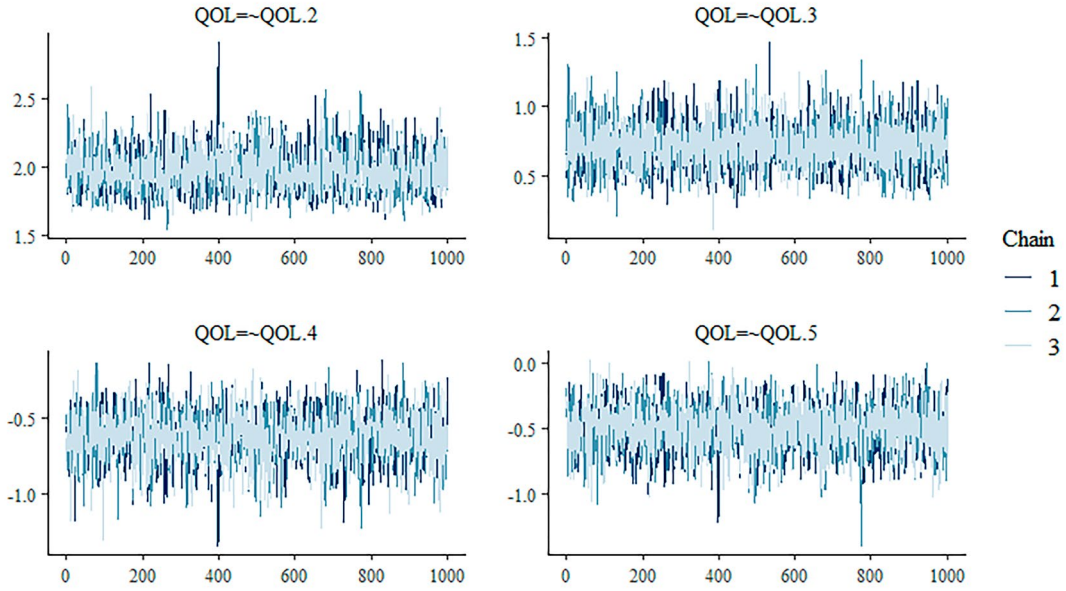

Figure 3: Trace Plot 2 Model of CFA 3 Chains of QOL of Schizophrenia
(QOL.2 = Burden Care; QOL.3 = Factor of Care, QOL.4 = Relationship to Health Care Teams; QOL.5 Relationship to Family)

	MLE				BE				
	Estimate	**S.E.**	**z-value**	**Std.**	**Estimate**	**S.E.**	**Credibility Interval**	**Std.**	**PSRF**
QOL									
Psycho-physical	1.000	-	-	.628	1.000			.616	
Burden care	1.922*	.140	13.703	.999	1.992*	.155	[1.727, 2.34]	.999	1.001
Factor of care	0.703*	.156	4.520	.271	.729*	.167	[0.410, 1.072]	.273	.999
Relationship to									
health care teams	-.597*	.151	-3.958	-.252	-0.633*	.159	[-0.971, -0.338]	-.260	1.000
Relationship to family	-.471*	.170	-2.766	-.175	-0.510*	.181	[-0.895, -0.175]	-.184	1.000
WHO									
Physical	1.000	-	-	.632	1.000	-	-	.623	
Psychological	1.245*	.103	12.125	.703	1.267*	.109	[1.073, 1.509]	.702	.999
Social relationship	1.667*	.167	9.956	.790	1.707*	.177	[1.391, 2.083]	.790	1.000
Environment	1.521*	.152	10.000	.831	1.565*	.171	[1.26, 1.931]	.834	.999

P = .05, QOL = quality of life of caregivers of schizophrenia
WHO = World Health Organization Quality of Life Brief – Thai, WHOQOL-BREF-THAI

Table 2: Confirmatory Factor Analysis of the QOL Scale

3.2.2. Fit Measures

Fit measures were divided into two groups as follows.

Group 1

Regarding the fit measures of quality of life of caregivers of people with schizophrenia by MLE, the results illustrate that Chi-Squared (2, n = 289) p-value = .226 (p-value > .05), SRMR = .029, RMSEA = .041, TLI = .984, CFI = .997. The analysis by B.E. depicts the PPP = .454, close to .50, > .05.

For the fit measures of the WHOQOL-BREF-THAI by MLE, the results illustrate that the model fit the empirical study: Chi-squared (1, n = 289) p-value = .084 (p-value > .05), SRMR = .011, RMSEA = .083, TLI = .976, CFI = .996. The analysis by B.E. shows PPP = .394, close to .50, > .05.

Group 2

After comparing the QOL (Caregivers) scale and the WHOQOL-BREF-THAI by non-nested model and MLE, we found that the WHOQOL-BREF-THAI fits better with the empirical study than the quality of life of caregivers of schizophrenia due to AIC. BIC of WHOQOL-BREF-THAI fits worse than the WOL (Caregivers) scale (AIC 1356.997 < 3084.736 and BIC 1389.995 < 3132). Furthermore, Vuong's test showed that W2 = 4.637, p-value < .001, meaning that the model had AIC and BIC significant differences (Table 3).

Measures	Overall Fit								Model Comparison†		
	SRMR	RMSEA	TLI	CFI	LogL	Chi-sq	p-value	df	AIC	BIC	Vuong's test
QOL(Caregivers)	.029	.041	.984	.997	-1529.37	2.970	.226	2	3084.736	3132.400	W^2 = 4.637* WHO < QOL
QOL (WHO)	.011	.083	.976	.996	-669.498	2.980	.084	1	1356.997	1389.995	

Table 3: Fit Measure by Maximum Likelihood Estimator
† non-nested model, * p= .05

The analysis of B.E. found that the result was similar to that of the MLE: QOL (WHO) fits with the empirical study more than the QOL (Caregivers) (BIC 1412.998 < 3161.387, DIC 1365.247 < 3094.673 and WAIC 1370.802 < 3094.651) (Table 4).

Measures	Overall Fit				Model Comparison†		
	LOOIC	marloglik	Logl	PPP	BIC	DIC	WAIC
QOL (Caregivers)	3094.707	1607.830	-1529.73	.454	3161.387	3094.673	3094.651
QOL (WHO)	1370.957	-736.428	-669.69	.394	1412.998	1365.247	1370.802

Table 4: Fit Measure by Bayesian Estimator
† non-nested model

4. Discussion

The analysis depicts that the CFA and SEM of four variables, mean (1.60-1.99), standard deviation (.17- .52), and reliability of Cronbach's alpha, were good (.62-.85). All of the indicators were normal distribution and social dysfunction (kurtosis = 3.58), severe depression (skewness = 2.32), and the distribution of data over the normal curve (kurtosis = 5.41) that mean sound good of scale [19].

Regarding the QOL (Caregivers) scale's construct validity testing, the CFA showed all parameter estimates had PSRF close to 1. All three chains' parameters models were comparable, indicating the right scale [20- 22].

For the fit measures of the QOL (Caregivers) by MLE, the result illustrates that Chi-Squared (2, n = 289) p-value = .226 (p-value > .05), SRMR = .029, RMSEA = .041, TLI = .984, and CFI = .997. The analysis by B.E. depicts the PPP = .454, which is close to .50, > .05, indicating a good model fit. Besides, the result of the fit measures of the WHOQOL-BREF-THAI by MLE illustrates that the model fist with the empirical study: Chi-squared (1, n = 289) p-value = .084 (p-value > .05), SRMR = .011, RMSEA = .083, TLI = .976, and CFI = .996. The analysis by B.E. showed PPP = .394, close to .50, > .05, which implies a good fit.

The analysis found that the WHOQOL-BREF-THAI fits with empirical study more than the QOL (Caregivers) scale due to AIC, and BIC of the WHOQOL-BREF-THAI fits less than the QOL (Caregivers) scale (AIC 1356.997 < 3084.736 and BIC 1389.995 < 3132). Additionally, Vuong's test showed that W2 = 4.637, p-value < .001, and the model had significantly different AIC and BIC. Finally, the analysis of B.E. found that the result was parallel with that of the MLE: QOL (WHO) fits with the empirical study more than the QOL (Caregivers) because BIC, AIC, and WAIC were lower (BIC 1412.998 < 3161.387, DIC 1365.247 < 3094.673, and WAIC 1370.802 < 3094.651).

5. Conclusion

The analysis of MLE and B.E. found that the results following the result of MLE: QOL (WHO) fit the empirical study more than the QOL (Caregivers). Overall, both scales demonstrated remarkable measurement properties, supporting their relevance to comprehensively measure the quality of life of caregivers of persons with schizophrenia. Furthermore, the QOL (Caregivers) scale could be used by psychiatric and mental health care teams and clinical researchers to generate strategies to support family caregivers and measure the outcomes of multidisciplinary treatment teams' interventions.

Conflicts of Interest: none

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