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Validity Test and Its Consistency In The Construction of Patient Loyalty Model

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Abstract. The main objective of this present study is to demonstrate the estimation of validity values and its consistency based on structural equation model. The method of estimation was then implemented to an empirical data in case of the construction the patient loyalty model. In the hypothesis model, service quality, patient satisfaction and patient loyalty were determined simultaneously, each factor were measured by any indicator variables. The respondents involved in this study were the patients who ever got healthcare at *Puskesmas* in Padang, West Sumatera. All 394 respondents who had complete information were included in the analysis. This study found that each construct; service quality, patient satisfaction and patient loyalty were valid. It means that all hypothesized indicator variables were significant to measure their corresponding latent variable. Service quality is the most measured by tangible, patient satisfaction is the most mesured by satisfied on service and patient loyalty is the most measured by good service quality. Meanwhile in structural equation, this study found that patient loyalty was affected by patient satisfaction positively and directly. Service quality affected patient loyalty indirectly with patient satisfaction as mediator variable between both latent variables. Both structural equations were also valid. This study also proved that validity values which obtained here were also consistence based on simulation study using bootstrap approach.

INTRODUCTION

Every company is faced with competitive rivalry and have to provide services that "special" from those offered by their rivals [1]. Service provider better to include the customer orientation in their product or service development process and both should built a kind of good relationship to each other. Good relationships between service provider and customer can lead to customer satisfaction which finally could affect the customer loyalty. To enhance the customer loyalty, the service provider should determine the values of the customer and incorporate them into marketing programs.These idea are also implemented to healthcare.

In the domain of healthcare that related to health services, the customer here is the patient, and the service provider is the hospital, clinic or others healthcare center such as *Puskesmas* (*Pusat Kesehatan Masyarakat*). These healthcare provider manage patient's need to recover from illnesses and patient's hope to receive good service. Good service quality from healthcare provider could improve patient satisfaction and could lead to patient loyalty as well.

The aims of this present study is to determine the causal effect between service quality to patient satisfaction and between patient satisfaction to patient loyalty and estimate the validity of these relationships. Since all three constructs are latent variables, thus structural equation model (SEM) analysis is suitable to be implemented here. SEM involves generalizations and extensions of first generation procedures, such as multiple regression, principal component analysis, discriminant analysis and factor analysis. In constructing the model, it needs validity and reliability test to make sure that the corresponding constructs acceptable. Yanuar et al. [2] has discussed on how to test the consistency of reliability test in SEM approach. This present study continuous previous study where focus on how to estimate the validity test and test its consistency.

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VALIDITY TEST IN SEM APPROACH

In SEM analysis, there are two kinds of variables involved in the model; structural and measurement equations. The structural equation is formulated as follows [2]:

$$\boldsymbol{\eta_i} = \boldsymbol{B\eta_i} + \boldsymbol{\Gamma\xi_i} + \boldsymbol{\delta}_{\mathrm{i}}, i = 1, \dots, n. \quad (1)$$

where $\boldsymbol{\eta_i}$ and $\boldsymbol{\xi_i}$ are endogenous latent variable and exogeneous latent variable respectively, meanwhile $\boldsymbol{B}$ and $\boldsymbol{\Gamma}$ are regression coefficients. The measurement equation is given by:

$$\boldsymbol{x_i} = \boldsymbol{\Lambda\omega_i} + \boldsymbol{\varepsilon_i}, \quad i = 1, \dots, n \quad (2)$$

with $\boldsymbol{\omega_i}$ is latent variable that contain $(\boldsymbol{\eta_i}, \boldsymbol{\xi_i})$ and $\boldsymbol{x_i}$ are indicator variables. Symbol $\boldsymbol{\Lambda}$ is representing the loading factors as obtained from the regressions of indicator variables $\boldsymbol{x_i}$ on latent variables $\boldsymbol{\omega_i}$.

In this approach, the researcher could collect data about perception of an individual and then fit the data to the hypothesis model. The researcher used to apply a measurement instrument or questionnaire. The consistency of the measurement instrument is represented by its validity and reliability. Validity here refers how accurate the values assigned in the measurement procedures reflect the actual conceptual variable measured. Invalid measurement means bias in estimates or leads to systematic error [3]. In this study, the concepts of construct validity is used to estimate the validity of a measurement instrument. For example λ is symbol for causal effect of exogeneous latent variable on endogenous latent variable, under the condition that the true scores represent the concept well, λ also measures the validity of corresponding relationship. If ε represent the measurement errors, the relationship between λ and ε is $\varepsilon = 1 - \lambda^2$, ε measures of invalidity. The higher value of λ and the lower the ε, meaning indicator variables is stronger to measure the latent variable. If $\lambda = 1$, this indicate perfect measurement without error.

In order to test the consistency of validity values, including its associate algorithm and covering the true value of parameter model, we do simulation study by applying bootstrap technique. Bootstrap technique is implemented to generate randomly with replacement the new data set that selected from original data. For each new data set, the validity values is determined and sampling distribution of parameter obtained from bootstrap approach is identified as well.

DATA AND METHODS

The data in this study are obtained by distributing the questionnaires to the patient of *Puskesmas* in Padang from March to August 2015. There are many *Puskesmas* in Padang but only three *Puskesmas* were selected. All 394 patients who filled complete information in questionnaire were involved in this analysis.

The data then fitted to the patient loyalty model. In this model, there are two hypotheses (hypothesis one or h_1) used in structural equation. Here are:

Hypothesis (1): There is significant affect of service quality on patient satisfaction.
Hypothesis (2): There is significant affect of patient satisfaction on patient loyalty.

In this study, patient satisfaction was the moderating variable, which could strengthen or weaken the relationship between variables service quality and patient loyalty. All three variables here, service quality, patient satisfaction and patient loyalty, are measured by others indicator variables or indicated as latent variables. The causal efects from latent variable to its indicator variables are represented in measurement equation. Following are the explanation about the indicator variables for each latent variable.

The hypotheses model for measurement equations in this research adopted from the model constructed by Yanuar et al. [2]. Service quality is assumed measured by reliability, responsiveness, assurance, emphaty and tangible. The indicator variables for mesuring patient satisfaction are price, competence of workers, satisfied on healthcare, satisfied on service and overall quality. Meanwhile patient loyalty is hypothezed measured by recommedation, good service quality, talk to others about positive things, suggest the others to get healthcare [4].

In this present study, the researcher implemented the RWLS (Robust weighted least square) estimation method to estimate the validity of the path coeffients in both equations [5]. Once the proposed model met the criteria, then overall model was tested based on goodness of fit model. The indicators of goodness of fit here are the root mean square error of approximation (RMSEA), comparative fit index (CFI) and Tucker Lewis Index (TLI).

RESULT

The data were analyzed using SEM with RWLS (Robust Weighted Least Square) estimation method since the data were not normal [5,6]. We first designed the measurement and structural model to determine the validity and reliability of the relationship betwen indicator and its latent variable and amongs latent variables simultaneously. Yanuar et al. [2] have discussed about reliability test in SEM model, meanwhile this paper focussed in estimating the validity and testing its consistency.

Table 1 shows the results of validity values, the value of coefficient contingency (R^2) and 95% confidence interval bootstrap (to consistency test) for both hypotheses in structural equation. According to Table 1, it's informed that Service quality positively affect the Patient satisfaction (validity value is 0.916, with standard error is 0.024), this indicates that Service quality had a significant affect on Patient satisfaction (significant at 5%). In terms of causal effect from Patient satisfaction to Patient loyalty, this study resulted that Patient satisfaction had positive and significant affect on Patient loyalty (validity value is 0.867 with standard error is 0.029). Table 1 also presents 95% confidence interval bootstrap, consist of lower bound and upper bound. It could be seen that validity value of Service quality on Patient satisfaction (0.916) is within 95% confidence interval bootstrap (0.776 ; 0.921). The validity value of Patient satisfaction on Patient loyalty (0.867) is also within 95% confidence interval bootstrap (0.711;0.878). It be concluded here that validity test has resulted the correct and acceptable value.

Table 1. Validity Values in Structural Model

Relationship	Validity (Standard Error)	R^2	95% Confidence Interval Bootstrap	
			Lower Bound	Upper Bound
Service quality → Patient Satisfaction	0.916 (0.024)**	0.840	0.776	0.921
Patient Satisfaction → Patient loyalty	0.867 (0.029)**	0.751	0.711	0.878

**significant at 5% level

Table 1 also presents the values for goodness of fit or coefficient contingency, R^2. The R^2 value of Service quality to Patient satisfaction is 0.84, it means that 84% of the variability in Patient satisfaction model can be explained by proposed model. Meawhile for Patient satisfaction to Patient loyalty, its R^2 value is 0.751 indicate that 75.1% of the variability in the Patient loyalty model was explained by relationship of Service quality and Patient satisfaction.

Table 2. Validity Values in Measurement Model

Latent Variable	Indicator Variable	Validity (Standard Error)	95% Confidence Interval Bootstrap	
			Lower Bound	Upper Bound
Service quality	Reliability	0.835 (0.017)**	0.717	0.934
	Responsiveness	0.773 (0.018)**	0.645	0.799
	Assurance	0.818 (0.018)**	0.789	0.901
	Empathy	0.779 (0.019)**	0.674	0.812
	Tangible	0.884 (0.015)**	0.799	0.921
Patient Satisfaction	Price	0.708 (0.028)**	0.689	0.802
	Competence of workers	0.644 (0.033)**	0.545	0.723
	Satisfied on healthcare	0.678 (0.031)**	0.596	0.765
	Satisfied on service	0.717 (0.026)**	0.676	0.819
	Overall quality	0.658 (0.035)**	0.590	0.711
Patient Loyalty	Recommendation	0.652 (0.037)**	0.640	0.732
	Good service quality	0.752 (0.032)**	0.701	0.845
	Talk to others about positive things	0.671 (0.039)**	0.603	0.781
	Suggest the others to get healthcare	0.712 (0.029)**	0.675	0.798

**significant at 5% level

Table 2 above describes the path coefficients of the model as a comprehensive dataset (394 samples). These path coefficients present the validity value in measurement model as well. Based on this table, all validity values are more than 0.6. If those values are compared to their standard error, it could be concluded that those validity values are valid (at 5% level of significant). The fourth and fifth columns in Table 1 present the 95% confidence interval obtained from bootstrap approach, consist of lower and upper bound. It could be identified here that validity value for reliability (0.835) is within 95% confidence interval bootstrap (0.717 ; 0.934). It means that validity value of reliability is correct. The same analysis then implemented for others validity values. It could be proved here that all validity values are in the range of 95% confidence interval bootstrap, it means the validity values are consistence. Therefore the proposed model could be accepted. Based on the result of goodness of fit test for overall model was also indicated that proposed model could be accepted.

The proposed model also informed us that all indicator variable measure latent variables each nearly as large, which is located between 0.545 dan 0.884. In the case of patient loyalty in Padang, service quality is the most affected by tangible (0.884). patient satisfaction is the most affected by satisfied on service (0.717). Meanwhile patient loyalty is the most affected by good service quality (0.752).

Based on result of this study, it was indicated that the factor loading could be represented as validity value which indicate the validity of an equation, as study done by Bakker [3].

CONCLUSIONS

This study demonstrated in how to do the validity test of model. The consistency of validity test was also examined. The empirical data about patient loyalty was used to examine the implementation of the validity test. All 394 respondents with complete information were involved in the analysis. Patient loyalty model involved three latent variables; service quality, patient satisfaction and patient loyalty. This research implemented the use of structural equation modeling approach to estimate the validity value of any constructs in the Patient loyalty model. The respondents in this study were the patients who had ever got healthcare from selected Puskesmas in Padang, West Sumatera. Only the respondents with complete information were involved in the analysis, they were 394 patients.

This present study found that validity values obtained in this research were all positive and significant or valid in both model, measurement and structural equations. This study informed that to increase the patient loyalty, the healthcare provider must increase their service quality which it could increase patient satisfaction as well. All indicator variables that assumed to measure the corresponding latent variables were all also positive and significant.

After examining all paths, the proposed model then was tested using indicators of goodness of fit model. Based on these test it was yielded that the proposed model fitted the data well and accordingly the proposed model could be accepted. The consistency of validity test was tested by using bootstrap technique. This study proved that validity test implemented here has resulted the correct value consistently.

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