Maternal Health Study In Province Lampung Based On Prediction Model Structural Equation Modeling-Partial Least Square

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1. INTRODUCTION

Maternal mortality has become an indicator of health and socioeconomic development and reflected by all national health systems and intersectoral collaborations. Health indicators are reflected the overall status of health system and various aspects of state structural. Decrease Maternal Mortality Ratio (MMR) is defined as the goal to improve maternal health, (WHO, 2019).

Maternal death has become a global health problem in both developed and developing countries, (Ibrahim, 2016). WHO estimated was 295.000 maternal deaths and 94% which occur in developing countries and majority of maternal deaths can be prevented but the efforts are unoptimal, (WHO, 2019). Achieving the SDG's is a challenge to the health system worldwide.

The global MMR reported reduce from 380 maternal deaths per 100.000 live births in 1990 to 211 maternal deaths per 100.000 live births in 2019 (WHO, 2013, 2019). Indonesia has MMR are 305 maternal deaths per 100.000 live births in 2015, (ASEAN, 2017; Badan Pusat Statistik, 2015). In 2015 United Nations Development Programs (UNDP) reported the risk of maternal death estimated at 20.000 maternal death from five million live births in Indonesia. Province Lampung has been 149 maternal deaths per 100.000 live birth in 2018, (Dinkes Provinsi Lampung, 2019). Therefore, needs optimal efforts to reduce of MMR and improve of maternal health until 2030, (Cameron & Cornwell, 2015; WHO, 2013; Yani & Duarsa, 2013).

The identification the factor which contribute of maternal death was important to reduce MMR because 94% of maternal death in the world occurred in low-resource settings and could have prevented, (WHO, 2019). Mc Carthy and Deborah (1992) in their study explained that maternal death is complex which caused due to medical or non-medical factors. Health care systems are a critical to decrease maternal death, (Sajedinejad et al., 2015). A systematic reviewed studies on basic public health there are four aspects to affect of health, such as environment, health behavior, health service, and genetic factors, (Blum, 1974; Tulchinsky & Varavikova, 2014).

Environment has the most influence on the public health, it has 40% influences of health. Environmental factors are thought to mechanism in mothrs death, (Arriaga & Davis, 1969; Mosley & Chen, 1984). Water quality and sanitation are an important environmental factors in health. Increasing the avaibility of clean water and sanitation is expected to reduce maternal death, (Carlson, 2011; Cheng, Schuster-Wallace, Watt, Newbold, & Mente, 2012; Meh, 2017). In addition, health behavior contributes 30% affects of health because a healthy environment is very dependent on behavior. Poor sanitation practices can increase risk of infection, induce stress during pregnancy and may contributed to risk pregnancy, (Padhi et al., 2015). It was estimated that women in households with poor sanitation had 3.07 (95% CI 1.72–5.49) higher odds to get health problems and maternal death, (Benova et al., 2014).

Health services supported the realization of health as 20%. Health facilities are available to improve maternal health but there are influencing factors such as a motivating factor to use health services and a facilitate the occurrence of an action where availability of health facilities and infrastructure as an assessment, (Rachmawati et al., 2017; Setiawan et al., 2016). The genetic factors only contibute 10% of health. However, genetic factor not explain clearly.

This study aimed to identify the significant effect of risk factor maternal health and incidence of maternal death. Since environment, health behavior, health service were latent variabels which couldn't be meassured directly. Structural Equation Modeling (SEM) was then required to analyze the effect rather than the ordinary regression model. The knowladge of how environment, health behavior, and health service will then be use usefull to reduce maternal death.

2. RESEARCH METHODOLOGY

Study Site and Sample

This study has been conducted in provience Lampung in 2020. Population of this research consisted of situation maternal health in provience Lampung. Sampel in this study are report of bacis health and SDGs series: districts/city readiness from 13 districts and 2 cities in Province Lampung. The studied indicators either were evaluated of environtment, health behavior, and health service for ech districts/city.

Research Variables

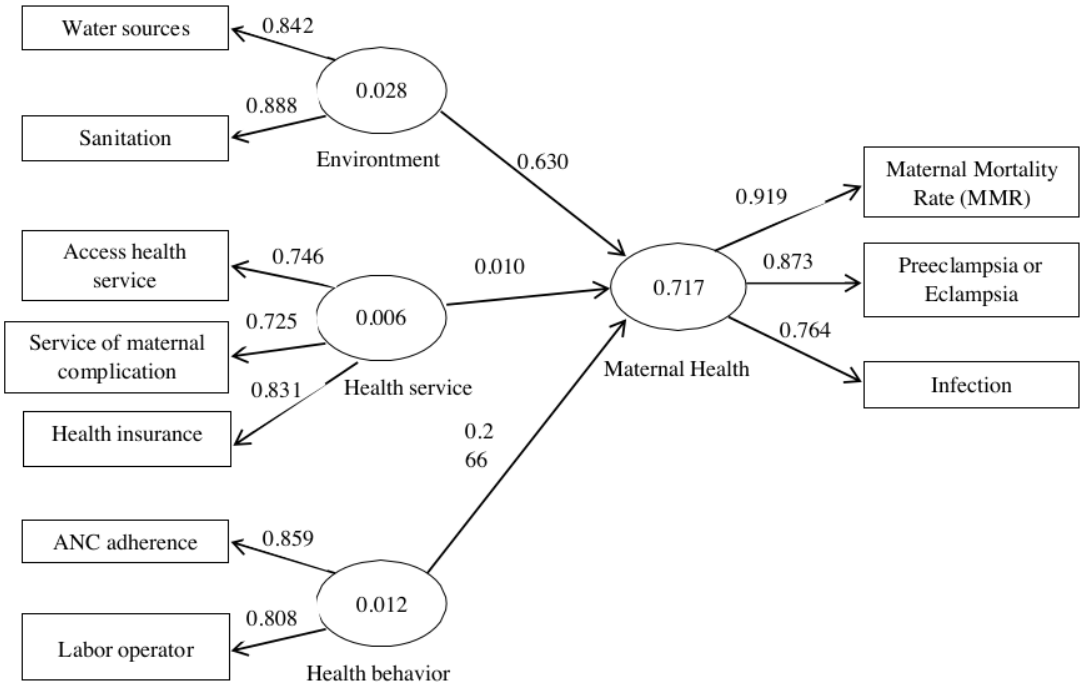
Research variabels in this study were latent variables, which cannot be measured directly and must be measured through their indicators. The dependent variable was maternal health status, which was measured by Maternal Mortality Rate (MMR), prevalence of bleeding, prevalence of hipertension in maternal (preeklamsia), prevalence of metabolic disorders (Diabetes Melitus (DM) in maternal, ect), prevalence of circulatory system disorders (Cardiac Heart Failure (CHF), stroke, ect), prevalence of infection, and prevalence of other diseases. The independent variabels consistes of environment, health behavior, and health services.

Data Collection and Analysis

Report of Lampung province basic health research (Riskesdas) in 2018 was performed in order to collect data in this research. The data collected were then analyzed using Structural Equation Modeling (SEM). SEM is a statistical method which can be used to measure not only relationship among all latent variabels but also measure relationship between latent variabels and indicators. This method provide relationship significance among latent variabels simultaneously (Sholiha & Salamah, 2015).

Partial Least Square (PLS) algorithm was chosen to set up SEM since the data was considered asn non-normal distribution and due to its multicolinerity. SmartPLS supporsts graphical modeling and carries out the bootstrapping procedure to generalate significance measurements. PLS algorithm evaluation consists of measurement model evaluation (outer model) and structural model evaluation (inner model), (Hair et al., 2013; Haryono, 2016). Measurement model evaluation was perform of evaluate goodness of concerned indicators to represent their latent variabels signified by loading indicators values. Meanwhile structural model evaluation to evaluate goodness of relatianship between independent laten variabels adan dependent laten variabels signified by value of both the path model coefficient and R^2. In this research, PLS analysis was performed by specifying the sampling number of 5000 for bootsrapping. Furthermore, the latent variabels of maternal status, environment, health behavior, and health services score were estimated for analysis.

3. RESULTS



PLS path model of maternal health has been developed, to identify relationship between latent variable and indicators as well as correlation among the concernes variabels namely environment, health behavior, and health services (**figure 1**). In this path model, environment, health behavior, and health services is predicted to affect maternal health directly. The significances of predicted simultaneous path were then analyze during the model runnging (measurement model and structural model evaluation). The path coefficient of the structure model and bootstrapping results test for outer loding of measurement model are presented at **Table 1** and **Table 2.**

Figure 1. PLS path model of environment, health behavior, health services

Table 1.
Bootstrapping Test for Path Coefficients

Indicators	*Original Sample*	*Mean*	*Standard Deviation*	*Standard Error*	*T-Statistic*	*P-Value*
Environment → maternal health	0.630	-0.514	0.286	0.296	2.201	0.028*
Health behavior → maternal health	0.266	0.272	0.108	0.126	2.467	0.012*
Health services → maternal health	0.010	-0.068	0.287	0.241	2.737	0.006*

*p value <0.05

Table 2.
Bootstrapping test for outer loadings

Indicators	*Original Sample*	*Mean*	*Standard Deviation*	*Standard Error*	*T-Statistic*	*P-Value*
Access to good water sources ← Environment	0.842	0.790	0.381	0.203	4.235	0.000*
Access to good sanitation ← Environment	0.888	0.834	0.273	0.265	3.251	0.001*
ANC adherence ← Health behavior	0.859	0.812	0.240	0.282	3.491	0.001*
Labor operator ← Health behavior	0.808	0.723	0.258	0.238	3.036	0.002*
Good access to health service ← Health services	0.746	0.683	0.268	0.303	2.786	0.006*
Service of maternal complication ← Health services	0.725	0.579	0.381	0.417	1.902	0.058*
Service health incurance ← Health services	0.831	0.765	0.290	0.310	2.869	0.004*
Maternal Mortality Rate (MMR) ← maternal health	0.919	0.906	0.129	0.192	7.099	0.000*
Preeklampsia or eclampsia ← maternal health	0.873	0.874	0.132	0.196	6.598	0.000*
Infection (Y_6) ← maternal health	0.764	0.643	0.341	0.362	2.240	0.026*

*p value <0.05

Table 1 shows that all of the paths in the model are considered significant indicated by their *t-value* which higher than 1.96 (significant level = 0.05). Three path lines have origin and destination respectively as the following "Environment → maternal health", "Health behaviour → maternal health", and "Health services → maternal health" have *t-value* of 2.201, 2.467, and 2.737 respectively. Refer to the result above which are schematized in **Figure 1**, it can be learned that environment, health behavior and health services present strong effets to maternal health.

Figure 1 and **Table 1** also show that standardized path coefficients of "environment", "health behavior" and "health services" are positive, which mean that effects of environment, health behavior and health services to maternal health are also associated as positif. The path coefficient of connecting paths originated was calculated 0.630, 0.266, and 0.010. The resultant of environment, health behavior, health services can explain 71.7% variation maternal helath, as showed in **Figure 1**.

Both Figure 1 dan **Table 2** show that most loading factors, except of Service of maternal complication are considered prominent to explain their latent variabel at 0.05 significant level (*t-value* > 1.96). It means that most of indicators, nine out of ten represent to explain their latent variable. **Figure 1** dan **Table 2** also show that acces to good sanitation is indicator with highest *loading factor value* ($\lambda = 0.888$), compared to other indicators in environment. Indicator with the highest loading factor value indicates that the indicator also has the strongest correlation to latent variabel. Meanwhile, ANC adherence ($\lambda = 0.859$) and Service health incurance ($\lambda = 0.831$) are indicators which have strongest correlation to their latent variables, those are health behavior and health services respectively.

4. DISCUSSIONS

This study assesses determinant variable to maternal health. The deteterminant were assessed in this study including environment, health behaviour, and health service. The SEM analysis pathway on this study show environment determinant have significantly impact to maternal health (T= 2.201 ; p= 0.028). The indicators of environments determinants on this study were water source quality and sanitation quality. Water and sanitation are two of many environment factors which have an important role in maternal health. Poor quality of water used in daily and sanitation were related to increased of maternal mortality rate due to some of direct and indirect mechanisms, (Benova et al., 2014; Cheng et al., 2012).

Poor quality of water could impact to poor hygiene at labor process, while infection to genitaltract due to poor handhygiene or contaminated surfaces was suggested. Infection and sepsis case due to poor water and sanitation wu[illegible]y in daily have been suggested as the mechanism to affect of maternal health (Cameron et al., 2019; Campbell et al., 2015; Cheng et al., 2012; WHO & UNICEF, 2012). A meta-analysis to analyze correlation of water and sanitation to ma[illegible]rnal mortality have conducted, the results shows that women with poor sanitation had3.[illegible](95% CI 1.72–5.49) higher odds to get health problems and maternal mortality, while effect of poor water quality showed a significant association with maternal [illegible]ortality by OR = 1.50, 95% CI 1.10–2.10 (Benova et al., 2014).

Poor sanitation practices can increase risk of infection, induce stress during pregnancy and may contribute to adverse pregnancy outcomes even death, (Padhi et al., 2015). There are alternative infectious mechanisms. Infections during pregnancy (e.g. hepatitis E) can be waterborne and are associated with a high risk of death (Emerson & Purcell, 2004). Poor sanitation can lead to hookworm infestation which causes anaemia and may thus increase the risk of maternal death (Brooker et al., 2008).

The result of SEM analysis on health service to maternal health show a significant effect (T= 2.737 ; p= 0.006). Health service determinants in this study were assessed by access to health service (p= 0.006), service of maternal complication (p= 0.058), health insurance coverage (p= 0.004). Health insurance is an important things to cover the use and quality health services and potentially improve maternal health outcomes. A systematic reviews conducted to analyze the effect oh health insurance coverage on the use and provision of maternal health services and maternal health outcomes. There is still relatively consistent evidence that prove [illegible]alth insurance was correlated with the use of maternal health services.

Financial barriers can play an important role in affecting timely access to maternal health (MH) services, which include ANC, skilled care at delivery, access to facility-based deliveries, and postnatal care (PNC). As a result, financial incentives, including health insurance, can address the demand-side and supply-side factors which affect the use and provision of MH services, thereby potentially influencing maternal and neonatal health outcomes(Comfort et al., 2013). Access to health service is related to materi[illegible]health services utilization which can affect to maternal health status on the population's. The utilization of maternal health services can increased accordingly by health insurance which provided by [illegible]overnance.

The utilization of maternal hea[illegible]h services did have significant association with MMR and could reduce MMR effectively with every 1% increase in utilization rate, the maternal death would decrease by 0.35 per[illegible]00,000 livebirths(Zhao et al., 2020).In other study use same population in c[illegible]na (2019), there has been a low utilization rate in the ethnic rural areas of western China. A total of 760 women only 68 villages were enrolled to acsess maternal health services. Given the long travel time and distance for these woman breaking down barriers to accesing health services (Wu et al., 2019). Health behaviour as a determinants to affect maternal health were assessed by the ANC adherence and labor operator which significantly by statistic (T= 2.467 ; p= 0.012). The behaviour to attending ANC program and about who is

the the operator to deliveries baby was known can affect the maternal health by screening among pregnancy. Low proportion of ANC and institutional births were to contribute the facility-based approach which the most commonly suggested determinants to affect maternal health (Kabali et al., 2011).

5. CONCLUSION

This study results show there are any correlation of variable determinannts; environment, health behavior, and health service to affect maternal health. This study used Structural Equation Modeling (SEM) relationship between latent variabels and indicators simultaneously by the pathway (Figure 1).

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