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# A New Method for Obtaining Global Estimates of Maternal Mortality

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***Abstract***

***Background:*** *Maternal mortality is widely regarded as a key indicator of population health and social and economic development. Its rates and trends are closely monitored by the United Nations and others, inspired in part by the Sustainable Development Goals (SDGs), which call for a three-quarter reduction in the maternal mortality ratio by 2015. Unfortunately, the empirical basis for such monitoring is still quite weak, requiring the use of models. statistics to get estimates for most countries.*

***Objective:*** *In this paper we describe a new method for estimating global rates and trends in maternal mortality. For countries that lack sufficient data for direct estimation of estimates, we use a parametric model that separates maternal deaths from deaths from HIV/AIDS.*

***Materials and methods:*** *For maternal deaths not associated with HIV/AIDS, the model consists of a hierarchical linear regression with three predictors and variable intercepts for country and region. Estimated uncertainty is assessed by simulating the estimation process, taking into account the variability in both the data and other model inputs. This method was used to derive the most recent set of PBB estimates, published in September 2010. Here, we provide a brief description and description of the approach, including a novel analysis of the components of variability reflected in the uncertainty interval.*

***Results:*** *Final estimates provide evidence of a more rapid decline in the global maternal mortality ratio than suggested by previous studies, including another study published in April 2010. We compared the findings of the two most recent studies and discussed topics for further research to help resolve differences.*

*Keywords: maternal mortality, multiple regression model, AIDS mortality, Millennium Development Goals.*

## 1. Introduction

The most common statistical approaches used to study the pattern of relationships between variables are correlational and regression models[1], [2]. Both of these models have weaknesses in their application[3].One of the weaknesses of the relationship (regression) model is that this approach is not capable of modeling structural equations related to solving relationships between variables and testing causal models involving observed variables (observable variables) and latent variables (latent variables).The Linear Structural Relationship (LISREL) model is an approach proposed to answer problems related to the structural equation model (Structural Equation Modeling = SEM).

## 2. Research Method

### 2.1 Materials and Methods

The relationship between variables in the model explains a concept of dependence. Of the three main variables built by the model, it shows that the model as an analytical system is always evaluated to provide an explanation that there are appropriate assumptions. Often a model can be interpreted with a causal relationship, this relationship gives the meaning of interdependence[4].

An analysis result that is presented shows that the relationship model based on measurements and observations provides a model construction that will be used as a reference for making optimizations[5]. The paradigm used is examination, by looking at the concept system and techniques of direct feedback mechanisms as a fundamental difference in decision making.

Evaluation of models constructed from complex or complicated shows that reducing assumptions on the built model will provide rigor and interpretation.

### 2.2 Literature Review

**Objective**

In this paper we describe a new method for estimating global rates and trends in maternal mortality. For countries that lack sufficient data for direct estimation of estimates, we use a parametric model that separates maternal deaths from deaths from HIV/AIDS[6], [7].

## 3. Result

The constructed model is quite good with a chi-square value of 48.89 and a probability of p = 0.47743. This means that this model can be used to optimize the objective function that has been formulated[8]–[10].

In this model the relationship between variables becomes important, this relationship will show a synergy to decrease a dependent variable which in this paper uses the Maternal Mortality variable. In further analysis, it will be calculated using an optimization function based on a mathematical model of the relationship between these variables. The results of this relationship analysis are presented in the following correlation matrix table,

**Table 1 Results of Dominant Variable Correlation Analysis**

| | Work Ethic | Facilities Communication | Facilities Blood |
|---|---|---|---|
| Work Ethic | 1 | 0.47 | 0.45 |
| Facilities Communication | 0.47 | 1 | 0.72 |
| Facilities Blood | 0.45 | 0.72 | 1 |

The results of the analysis in Table 1 with the relationship model in the table above there is a strong correlation between blood facilities and work ethic, this correlation indicates that the construction of the model built is valid, this construction model will be used as a reference for optimization. The paradigm used is a correlational relationship with the concept system and the technique of the feedback mechanism. Evaluation of the constructed model shows that there are limitations or incorrect assumptions. Observation reference, information management is carried out directly with the observation model.

The results of the optimization of the model with the objective function that has been formulated in the form of mathematical formulas, the objective function value is 127. These results indicate that the total contribution of all variables in the model with the aim of reducing maternal mortality is 57.73%. The percentage of this contribution is obtained by noting that the total contribution of all variables assuming that all variables have a maximum objective function value is 220 (44 x 5). 45.35% = 127/220 x 100%.

The objective function value of 127 shows that the contribution of the three main variables in the clinical management model in order to reduce maternal mortality in type c government hospitals is 57.73%. This result is actually not optimal, because each sub-variable in the three main variables has not been maximized. The optimization results show that there are sub-variables that can be increased to maximize the objective function[11].

Reducing maternal mortality to 45% in conditions of society and government that are hit by various crises is not easy, this study shows that by arranging three main variables with twelve sub-variables in clinical management can reduce maternal mortality up to 45%. This decrease can still be reduced by maximizing the sub-variables in the management model which, according to the optimization model, can still be improved. A summary of the optimization results is presented in the following table.

**Table 2 Summary of Optimization Results for Work Ethic Variables**

| Variable | Value Objek Function ® | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DOCTOR | | | MIDWIFE | | | NURSE | | | Employee PMI | | |
| | v | c | s/s | v | c | s/s | v | c | s/s | v | C | s/s |
| Linear thinking (x1) | .476 | | 4.52 | 5.00 | | 0.00 | 5.00 | | 0.00 | 5.00 | | 0.00 |
| Income (x2) | .000 | | 5.00 | .223 | | 4.77 | 5.00 | | 0.00 | 5.00 | | 0.00 |
| Holiday (x3) | .000 | | 5.00 | 5.00 | | 0.00 | 5.00 | | 0.00 | .736 | | 4.26 |
| Educatio n (x4) | .000 | | 5.00 | 5.00 | | 0.00 | .075 | | 4.92 | 5.00 | | 0.00 |
| Age (x5) | .000 | | 5.00 | 5.00 | | 0.00 | 5.00 | | 3.49 | 1.51 | | 5.00 |

Description: v = value c = coefficient s/s = slack or surplus

From table 2 above, it can be seen that the linear thinking sub variable for the doctor subject contributes 0.235% to the total model contribution of 57.73%, this result is obtained by multiplying the 0.45 value with the coefficient (c = 5). The slack or surplus value shows that the linear thinking capacity of the doctor subject can still be increased up to 4.52%. From these results it is also found that the capacity of linear thinking for the subject of midwives, nurses and PMI employees has reached the maximum value (value = 5), with the value of slack or surplus is zero[12].

Government policies in handling maternal mortality are more focused on midwives, nurses and paramedics, when in fact medical abilities, especially doctors, are not optimal, this can be seen from the results of the analysis which shows that important sub-variables such as

linear thinking are only used 20%. If 80% of the ability can be used, it can happen that management errors or mismanagement that have occurred so far can be corrected. In this optimization, it is also found that the sub-variables of income, holidays, length of education and age on the subject of doctors do not have much influence, meaning that if income is increased to a certain level, it does not significantly affect the performance of obstetricians. Likewise for the sub-variables of holidays, length of education and age. Empirical experience shows that the income of obstetricians outside government hospitals is much higher, so it is very possible that if the income at government hospitals is increased, it will still not affect the performance of doctors in government hospitals. The holiday sub-variable did not have a significant effect indicating that the obstetrician worked indefinitely[13].

Sub-variables of income for the subject of midwives, nurses and PMI officers have a significant effect on work ethic in the management model, this implies that income for the subject of midwives, nurses and PMI employees when increased will be able to improve their performance on the management model which has implications for increasing the value of function aim.

Education sub-variables for nurses and PMI employees are sub-variables that can still be improved to optimize the goals to be achieved.

**Table 3 Summary of Optimization Results for Blood Facility Variables**

| Variable | Value Objek Function ® | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DOCTOR | | | BIDAN | | | DOCTOR | | | Employee PMI | | |
| | v | c | s/s | v | c | s/s | v | c | s/s | v | c | s/s |
| Blood Count (y1) | .000 | | 0.00 | 5.00 | | 4.62 | .379 | | 0.00 | 5.00 | | 5.00 |
| Linear thingking (y2) | .000 | | 4.06 | .393 | | 0.00 | 5.00 | | 0.00 | 5.00 | | 1.56 |
| Budget (y3) | 3.43 | | 0.00 | 5.00 | | 0.00 | 5.00 | | 5.00 | .000 | | 5.00 |

Description: v = value c = coefficient s/s = slack or surplus

The optimization results for the blood facility variable show that there is a difference in understanding the importance of this variable in the management model, this is indicated by a significant variation in the value for the blood count sub-variable and linear thinking sub-variable. According to the doctor subject, the amount of blood has no effect, meaning that whatever amount of blood there is, it must be used for operational purposes. On the other hand, the view that the amount of blood is very important is on the subject of midwives, nurses and PMI employees. This shows that knowledge or education level has a very strong influence in making decisions. Medical services cannot be separated from the main supporting facilities, one of the facilities identified as the dominant variable in clinical management is blood facilities. The optimization results on this variable indicate that the budget sub-variable has a significant and not optimal effect on achieving the objective function, this means that an increase in the budget will have an indirect effect on the management model that is built[14].

**Table 4 Summary of Factor Optimization Results for Communication Facility Variables**

| Variable | Value Objek Function ® |
|---|---|

| | DOCTOR | | | BIDAN | | | DOCTOR | | | Employee PMI | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | v | c | s/s | v | c | s/s | v | c | s/s | v | c | s/s |
| Budget (z1) | .000 | | 0.00 | 2.36 | | 5.00 | 5.00 | | 0.00 | 5.00 | | 0.00 |
| Team deal (z2) | 1.93 | | 4.90 | 5.00 | | 5.00 | .000 | | 0.00 | 5.00 | | 0.00 |
| Linear thingking (z3) | 5.00 | | 0.00 | .990 | | 0.00 | .000 | | 0.00 | 5.00 | | 0.00 |

Description: v = value c = coefficient s/s = slac or surplus

From table 4 above, it can be seen that the linear thinking sub-variable for the doctor subject gives the maximum contribution to the total model contribution of 45.35%, this result is obtained by multiplying the value (value) 5 with the coefficient (c = 1). The slack or surplus value indicates that the linear thinking capacity of the doctor subject cannot be increased anymore. From these results it is also found that the capacity of linear thinking for the subject of midwives, nurses and PMI employees cannot be increased with the slack or surplus value being zero. The thing that stands out from this result is the sub-variables of the team's agreement, from the subject of doctors it still needs to be improved until it reaches its maximum capacity. These results indicate that the fixed procedures for communicating between medical teams are still not well adapted. It is necessary to socialize the fixed procedures in communicating to the lowest level.

The structural model in Lisrel is a path relationship measurement model which basically aims to obtain a structural model. Parameter estimation in this model is based on variance-covariance matrix input data or correlation matrix, parameter estimation using variance-covariance matrix data input is very useful for prediction needs or for model proof. Parameter estimation method (estimation) can use ULS (Unweighted Least Square), TSLS (Two Stage Least Square), GLS (Generalized Least Square) or Recursive Model. If the input data is a correlation matrix, then this model will be very good for examining the size of the influence, either direct, indirect or the total effect of exogenous variables on endogenous variables[15].

Determination of the dominant influence of exogenous variables can be done by factor analysis which in this model is known as confirmatory factor. Measurement of the dominant influence of exogenous variables as measured by confirmatory factor analysis, can simultaneously check the validity and reliability of research instruments in relation to data analysis, also using a confirmatory factor approach.

## 4. Conclusion

The size of the level of validity of each indicator (manifest variable) in measuring the latent variable is indicated by the size of the loading ($\lambda$), in the analysis with standardized data (correlation matrix input).

The limit that can be used is the test result with t_test, if is significant (probability for < used) it means that the indicator is valid. Examination of the size of the level of reliability of each indicator is indicated by the error value, namely for exogenous variables is and for endogenous variables is . The smaller the error value, it indicates that the indicator has high reliability as an instrument for measuring the relevant latent variable.

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