An Analysis of Variables Affecting the Implementation of Patient Safety in Budi Sehat Hospital Purworejo using Partial Least Square

R I Buwono¹, B Suhardi¹ and E Pujiyanto¹
¹Department of Industrial Engineering, Sebelas Maret University, Surakarta, Indonesia
ringgois1409@gmail.com

Abstract
Budi Sehat Hospital Purworejo is a healthcare facility whose status recently changed from general inpatient clinic. During the process of this status change, the hospital faced several obstacles related to patient safety. Near-miss cases include wrong diet for a patient, a near case of injection mix-up, wrong drug administration, wrong drug dose, a prescription error and one adverse event case of phlebitis. This study aims to minimize patient safety incidents by identifying variables that affect the implementation of patient safety in Budi Sehat Hospital Purworejo. Variables used in this study include teamwork climate (X₁), safety climate (X₂), job satisfaction (X₃), stress recognition (X₄), perceptions of management (X₅), working conditions (X₆), motivation (X₇), supervision (X₈), leadership style (X₉), communication (X₁₀), turnover intention (X₁₁) and frequency of patient safety events reported (Y₁). The method used in this study was the Partial Least Square (PLS). Results showed that the most influential variable was working conditions (X₆) with p-value of 0.01 and R-squared of 0.393.

1. Introduction
Budi Sehat Hospital Purworejo is one of the twelve hospitals in Purworejo Regency. This healthcare institution had recently upgraded its status from a general inpatient clinic in September 2015. During this status change, the hospital faced several obstacles related to patient safety. Near-miss cases include wrong diet for a patient, a near case of injection mix-up, wrong drug administration, wrong drug dose, a prescription error and one adverse event case of phlebitis.

Patient safety is a system where hospitals create a safer care for patients and implement solutions to minimize risks and injury arising from errors that resulted from carrying out a commission or omission of an action that should have been taken [1]. The implementation of patient safety is an obligation for healthcare institutions regulated by The Hospital Law of The Republic of Indonesia [2] and Ministry of Health Regulation [1]. The implementation of this system is also one of the hospital work programs written in the Hospital Strategic Plan [3] and the National Standard of Hospital Accreditation [4].

To solve the aforementioned issues and fulfill the demands of said regulations, an analysis of variables affecting the implementation of patient safety system is needed. The result of a search of 1.797 journals (published January 2011-August 2016) showed that there are 13 influential factors, i.e. economic aspect, leadership, culture, health care systems, knowledge, attitude and professionals interventions, workplace situation and condition analyses, the risk management system, the duration of nurses working, mentoring programs, nursing supervision, and evaluations of the implementation of patient safety [5]. Conversely, an interview with the head of a patient safety team revealed that the reason behind the slow implementation of patient safety was the high rate of turnover.
In regards to the explanation above, this study used twelve variables, i.e. teamwork climate, workplace safety climate, job satisfaction, stress recognition, perceptions of management, working conditions, motivation, supervision, leadership style, communication, turnover intention and frequency of patient safety events reported. This study aimed to determine the most influential variable, therefore Partial Least Square (PLS) was used as a method for analysis. Those method chosen because of small sample size, applications have little available theory and correct model specification cannot be ensured [6]. The results of the analysis would become a basis for recommendations for improvement so that a good patient safety system could be implemented in Budi Sehat Hospital Purworejo.

2. Method
The method used in this study was divided into seven steps: (1) designing questionnaire, (2) testing questionnaire validity, (3) testing questionnaire reliability, (4) description of respondents’ characteristics, (5) evaluation of measurement models, (6) evaluation of structural models, and (7) recommendations for improvement.

2.1. Designing Questionnaire
The questionnaire was designed to include the order of question codes, source of each variable and scale of measurement.

2.2. Testing Questionnaire Validity
A questionnaire validity test was conducted to determine the validity of a question item used to measure the variables under investigation.

2.3. Testing Questionnaire Reliability
A questionnaire reliability test was conducted to determine the scale of consistency of a measuring instrument used to measure the same phenomenon at a different time. This study used the Cronbach’s Alpha method to test questionnaire reliability.

2.4. Description of Respondents’ Characteristics
This part of the paper provided a description of the characteristics of the respondents, which included sex, age group, education level and length of employment.

2.5. Evaluation of Measurement Model (Outer Model)
An evaluation of measurement model was conducted to measure the validity and reliability of the model using convergent validity, discriminant validity and composite reliability.

2.6. Evaluation of Structural Model
A structural model evaluation is used to determine whether or not there are inter-construct correlations. This study evaluated the structural model using p value and R squared.

2.7. Recommendations for Improvement
Recommendations for improvement were designed based on the most influential variable determined using the evaluation of the structural models.

3. Result and Discussion

3.1. Designing Questionnaire
The design for the questionnaire on the implementation of patient safety is as shown on table 1.
Table 1. Design of Questionnaire on the Implementation of Patient Safety

| Variables                              | Question Codes | Sources | Scale |
|----------------------------------------|----------------|---------|-------|
| Teamwork Climate (X₁)                  | IKT_1 to IKT_6 |         |       |
| Safety Climate (X₂)                    | IK_7 to IK_13  |         |       |
| Job Satisfaction (X₃)                  | KK1_14 to KK1_18|        |       |
| Stress Recognition (X₄)                | SK1_19 to SK1_22|       | [7]   |
| Perceptions of Management (X₅)        | PTM_23 to PTM_27|       |       |
| Working Conditions (X₆)                | Kk_28 to Kk_31 |         |       |
| Motivation (X₇)                        | M_1 to M_10    |         | Likert|
| Supervision (X₈)                      | S_11 to S_20   |         | [2]   |
| Leadership Style (X₉)                 | GK1_1 to GK1_35|        | [8]   |
| Communication (X₁₀)                   | Kom_1 to Kom_6 |         | [9]   |
| Turnover Intention (X₁₁)              | KuK_1 to KuK_9 |         | [10]  |
| Frequency of Patient Safety Events     | FPKP_7 to FPKP_9|       | [9]   |

3.2. Questionnaire Validity Test
A validity test was carried out using a statistics application, SPSS. The validity test in this study used r table value of 0.235 because the total number of respondents were 70 people, all of whom were the employees of Budi Sehat Purworejo Hospital.

An item was considered valid if the value of the correlation coefficient (r value) was > 0.235 and was considered invalid if r < 0.235 [9]. The questionnaire validity test obtained four invalid items, IKT_2, M_5, M_6 and GK1_24. The invalid items were deleted and thus dropped from further analysis.

3.3. Questionnaire Reliability Test
A questionnaire reliability test was carried out using SPSS. A variable was considered reliable if Cronbach’s alpha > r table, which meant that all items were considered reliable if Cronbach’s alpha > 0.235 and considered unreliable if Cronbach’s alpha < 0.235 [12]. The results of the questionnaire reliability test showed that all variables in the questionnaire were reliable.

3.4. Description of Respondents’ Characteristics
The characteristics of the respondents in this study were:

- Sex: a total of 70 respondents involved in this study was made up of 30% male respondents and 70% female.
- Age group: respondents’ age group with the highest frequency was 32 people aged 25-34 (46%), followed by 31 people aged 17-24 (44%), 6 people aged 35-49 (6%), and 1 person aged 50-64 (1%). It could be concluded that most employees were of productive age.
- Education level: respondents’ education level with the highest frequency was 36 people with Diploma (51%) then followed by 18 high school graduates (26%), 15 undergraduates (21%), and 1 grade school graduate (1%). Diploma graduates made up more than half of the respondents because the degree was a requirement for a majority of the employees.
- Length of employment: 37 respondents (53%) had worked for less than a year, 25 respondents (36%) had worked for 1-5 years, and 8 respondents (11%) had worked for 6-10 years. These numbers showed the high frequency of turnovers.

3.5. Evaluation of Measurement Model (Outer Model)
The evaluation of measurement models (outer model) was carried out using a software, SmartPLS 3. This evaluation was carried out to measure the validity and reliability of the models by applying convergent validity, discriminant validity and composite reliability.
3.5.1. Convergent Validity. Convergent validity is the extent to which measure relates to other measures of the same phenomenon[13]. This test was conducted in two steps; by looking at the outer loadings and Average Variance Extracted (AVE).

- Outer Loadings

Outer loadings or loading factor show the value of correlation between an item and a latent variable. In this study, the limit of the loading factor was 0.5 [13]. The initial path diagram and the loading factors of each item is shown in figure 1.

Figure 1. Initial path diagram

Figure 1 shows that 41 items were considered invalid for having loading factor < 0.5. These items were deleted and dropped from the next step, which was model re-estimation. Model re-estimation was conducted to reevaluate the validity of the loading factors of each item to ensure that the value of the loading factor of each item was > 0.5. The final result of the re-estimation can be seen in the path diagram in figure 2. This figure showed that all of the indicators had a valid loading factor value since they were >0.5.
- Average Variance Extracted (AVE)

Average Variance Extracted (AVE) is used to measure the amount of variance of a construct component collected from its indicators by adjusting measurement error\[15\]. In this study, the minimum AVE value was 0.5 \[15\]. The AVE results from PLS Algorithm Report from Smart PLS is shown in table 2.

**Table 2. Average Variance Extracted (AVE)**

| Variable                          | AVE  |
|-----------------------------------|------|
| Teamwork Climate (X₁)             | 1    |
| Safety Climate (X₂)               | 0.434|
| Job Satisfaction(X₃)              | 0.566|
| Stress Recognition(X₄)            | 0.378|
| Perceptions of Management(X₅)     | 0.632|
| Working Conditions(X₆)            | 0.744|
| Motivation (X₇)                  | 0.467|
| Supervision (X₈)                 | 0.718|
| Leadership Style(X₉)              | 0.416|
| Communication(X₁₀)               | 0.487|
| Turnover Intention(X₁₁)           | 0.396|
| Frequency of Patient Safety Events Reported(Y₁) | 0.726|
Table 2 shows that there were six variables with AVE values < 0.5, namely safety climate (X_2), stress recognition (X_4), motivation (X_7), leadership style (X_9), communication (X_{10}) and turnover intention (X_{11}). These six variables were dropped from further analysis.

### 3.5.2. Discriminant Validity

A discriminant validity test was conducted using the Fornell-Larcker-Criterion. This test compares the correlation of inter-variable and \(\sqrt{AVE}\). A measurement model is said to have a good discriminant validity if the \(\sqrt{AVE}\) of each variable is higher than the inter-variable correlation. The output of the Fornell-Larcker-Criterion assessment can be seen in table 3.

#### Table 3. Fornell-Larcker-Criterion

| Variable                  | X_1 | X_3 | X_5 | X_6 | X_8 | Y_1 |
|---------------------------|-----|-----|-----|-----|-----|-----|
| X_1                       | 1*  |     |     |     |     |     |
| X_3                       | 0.158 | 0.795* |     |     |     |     |
| X_5                       | 0.094 | 0.430 | 0.684* |     |     |     |
| X_6                       | -0.035 | 0.311 | 0.386 | 0.848* |     |     |
| X_8                       | 0.111 | 0.494 | 0.541 | 0.338 | 0.698* |     |
| Y_1                       | 0.266 | 0.154 | 0.268 | -0.189 | 0.211 | 0.852* |

Description: * = \(\sqrt{AVE}\)

### 3.5.3. Composite Reliability

Composite reliability assessment is used to measure the reliability of each variable. A variable is considered reliable if the value of composite reliability > 0.70 [15]. The results of the assessment can be seen in table 4. This table shows that all of the variables in this study were reliable because they had Composite Reliability value of > 0.70.

#### Table 4. Composite Reliability

| Variable                                | Composite Reliability |
|-----------------------------------------|-----------------------|
| Teamwork Climate (X_1)                  | 1                     |
| Job Satisfaction(X_3)                   | 0.837                 |
| Perceptions of Management(X_5)         | 0.773                 |
| Working Conditions(X_6)                 | 0.835                 |
| Supervision (X_8)                      | 0.882                 |
| Frequency of Patient Safety Events Reported (Y_1) | 0.888 |

Table 4 shows that all of the variables in this study were reliable because they had Composite Reliability value of > 0.70.

### 3.6. Evaluation of Structural Model

The structural model was evaluated using p-value and R-squared. P-value is used to determine the significance of a structural path parameter coefficient, while R-squared is used to determine whether an independent latent variable has a substantive influence towards a dependent latent variable.

#### 3.6.1. Evaluation of Path Coefficients’ Significance on Research Hypothesis

To be able to arrive at a conclusion of whether or not the research hypothesis was accepted or rejected, the p-value significance was set at \(\alpha = 5\%\). If p-value < 0.05, then \(H_0\) was rejected, which meant that there was an influence, and vice versa. The results of the evaluation of the structural models assessed using Bootstrapping Report of SmartPLS can be seen in table 5.
Table 5. Path Coefficients

| Path Diagram | Original Sample | P Values | Description |
|--------------|-----------------|---------|-------------|
| X₁ → Y₁      | 0.093           | 0.570   | H₀ accepted |
| X₃ → Y₁      | -0.070          | 0.697   | H₀ accepted |
| X₅ → Y₁      | 0.319           | 0.099   | H₀ accepted |
| X₈ → Y₁      | -0.462          | 0.010   | H₀ rejected |
| X₆ → Y₁      | 0.095           | 0.560   | H₀ accepted |

Table 5 shows that the variable with the most significant influence towards frequency of patient safety events reported (Y₁) was working conditions (X₆) because their p-values were < 0.05 while other variables were > 0.05.

3.6.2. R-squared Value Analysis

The value of R-squared is used to explain the influence of an independent variable towards a dependent variable. The R-squared value of the variable frequency of patient safety events reported (Y₁) was 0.393. This meant that the climate of all independent variables had an influence value of 39.3%, while the remaining 60.7% was from other variables outside of the models examined in the study.

3.7. Recommendations for Improvement

Working Conditions (X₆) was identified as the most influential variable affecting the implementation of patient safety. In said variable, there are two valid statements, namely the number of staff and training for new employees. These statements are therefore used as the basis of recommendations for improvement proposed:

- It is suggested that the management of Budi Sehat Purworejo Hospital adapts the appropriate number of employees according to the legislation.
- Patient safety should become a main topic during the orientation program for new employees.
- All employees should be given a mandatory training in patient safety.

4. Conclusion

Based on the results of data processing and discussion of findings, the conclusions of this study are as follows:

- Working Conditions (X₆) is the most influential variable affecting the implementation of patient safety.
- All independent variables have an influence value of 39.3% towards the implementation of patient safety, represented by the variable frequency of patient safety events reported (Y₁). The remaining 60.7% influence rate is explained by other variables outside of the models examined in the study.

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