

Relationship Model for Occupational Safety and Health Climate to Prevent Needlestick Injuries for Nurses

Model Hubungan Iklim Kesehatan dan Keselamatan Kerja untuk Mencegah *Needlestick Injury* bagi Perawat

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Abstract

The risk of accidents and disease transmission when working at hospitals is quite high, especially in Indonesia. This study aimed to analyze the relationship model between the Occupational Safety and Health (OSH) climate and behavior intention in OSH performance to prevent needlestick injuries (NSI) based on a theory of planned behavior. A mixed approach using qualitative and quantitative methods was applied. Data were obtained from Structural Equation Model questionnaires, observation, and documentation, and interviews were analyzed qualitatively. The population was 1,042 nurses at Dr. Sardjito General Hospital in Yogyakarta. The sample consisted of 289 respondents determined by purposive random sampling with an accuracy level of 5%. The OSH climate consisted of attitude, norm, and perceived behavioral control effect on safety intention. An indirect OSH climate can influence safety performance, but it must be followed by intention. Intention directly affects safety performance in the form of behavior to implement NSI prevention procedures. Attitudes toward risk, attitudes toward leader commitment as role models, group norms, and beliefs in the ability to perform safety and health procedures determine the safety climate that leads to the intention for safe and healthy behavior in OSH performance.

Keywords: Needlestick injury, nurse, occupational safety and health, safety climate, safety performance

Abstrak

Tingginya risiko kecelakaan dan penularan penyakit saat bekerja di rumah sakit di Indonesia harus diantisipasi. Oleh karena itu, penelitian ini bertujuan mengetahui model hubungan antara iklim Kesehatan dan Keselamatan Kerja (K3), intensi perilaku terhadap kinerja K3 untuk mencegah cedera karena tertusuk oleh jarum suntik (*needlestick injury*) berdasarkan *theory of planned behaviour*. Penelitian menggunakan pendekatan campuran kualitatif dan kuantitatif. Data diperoleh dari kuesioner menggunakan *structural equation model*, observasi, dokumentasi, dan wawancara dianalisis secara kualitatif. Populasi adalah semua perawat di RSUP Dr. Sardjito Yogyakarta sejumlah 1.042 orang, sampel terdiri dari 289 responden ditentukan secara *purposive random sampling*, dengan taraf ketelitian 5%. Iklim K3 yang terdiri atas sikap, norma, dan persepsi kontrol perilaku berpengaruh terhadap intensi (*safety intention*). Iklim K3 secara tidak langsung mempengaruhi kinerja K3, tetapi harus didahului dengan intensi. Intensi berpengaruh secara langsung terhadap kinerja K3 (*safety performance*) yang berupa perilaku untuk melaksanakan prosedur pencegahan *needlestick injury*. Sikap terhadap risiko, sikap terhadap komitmen pimpinan sebagai teladan, dan norma kelompok, serta keyakinan terhadap kemampuan untuk melakukan prosedur K3 merupakan penentu adanya iklim K3 (*safety climate*) yang selanjutnya akan menimbulkan intensi untuk berperilaku selamat dan sehat (*safety intention*) sebagai kinerja K3.

Kata kunci: Needlestick injury, perawat, kesehatan dan keselamatan kerja, iklim K3, kinerja K3

How to Cite: Ismara KI, Husodo A, Prabandari YS, Hariyono W. Relationship model for occupational safety and health climate to prevent needlestick injuries for nurses. *Kesmas: National Public Health Journal*. 2019; 13(3): 144-149 (doi:10.21109/kesmas.v13i3.1989)

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Received: January 4th 2018

Revised: February 13th 2018

Accepted: February 15th 2018

Introduction

The risk of accidents and disease transmission when working at hospitals is quite high, especially in Indonesia. The dangers that threaten the hospital workers, especially nurses, include radiation, chemical and biological exposure, nosocomial infections, allergies, electricity, and physical threats such as sprains, slips, falls, scratches, punctures, and bumps. The situations and conditions at hospitals can also cause errors or omissions (near misses, human errors) resulting in accidents or the emergence of occupational diseases.¹⁻⁷

One common accident is needlestick injury (NSI); that is, a wound from skin penetration by a needle. This can transmit infectious diseases, especially blood pathogenic viruses like HIV and hepatitis B and C. The risk of contracting the hepatitis B virus infection is the highest among these three viruses. The risk rate for HBV is 5–40%; HCV 3–10%; and HIV 0.2–0.5%.⁸

Unhygienic or unsafe needles can cause needle stitching accidents. The Minister of Health No.1087/Menkes/Sk/VIII/2010 decree lists the study results from 2005 to 2007 showing that the proportion of NSI reached 38–73% out of all incidents. NSI can occur during injections (72.8%), taking blood (13.6%), and recapping (13.6%).⁹ The results indicated that 45–50% of immunization injecting practices and disposal of used syringes became potential sources of danger from NSI.⁹ This phenomenon is like an iceberg, where the number of cases appear lower than the actual number of cases that have not been reported, which are many.

Observations at the safety unit at Dr. Sardjito General Hospital showed that there were 22 NSI cases in 2015, of which occurred with nurses. Based on further observational data, 68% of 100 respondents were injured due to needle injection, but only 38% of the incidents were reported.¹³ The low reporting percentage was due to the belief that NSI was commonly experienced by every hospital worker. This condition raises a question about how to achieve a safe and healthy unit by urging safety intention in order to prevent NSI. It is very interesting to examine and understand how to implement the obtained model as a material improvement on the management of Occupational Safety and Health (OSH) in hospitals.

This study aimed to analyze the relationship model between the OSH climate and behavior intention in OSH performance to prevent needlestick injuries (NSI) based on a theory of planned behavior. Theoretically, the results of this study will contribute to a model for health and safety performance established by a healthy and safe climate that is influenced by nurses' intention. High risk hazard controls at hospitals, including prevention and treatment of NSI, are expected to be implemented.

Method

This study applied a Theory of Planned Behavior (TPB) model using a mixed qualitative and quantitative method. Initial conditions included beliefs, behaviors, and health and safety management systems at Dr. Sardjito General Hospital of Yogyakarta that were obtained through interviews, in-depth observation, and documentation. The results of this qualitative analysis were used as the basis for preparing the measurement tools and assessing the feasibility of the study model application. The data were collected by questionnaire and analyzed using a Structural Equations Model (SEM) to determine the relationship, contribution, and model among variables.

Dr. Sardjito General Hospital of Yogyakarta was chosen as the research setting. Within the hospital, this study was conducted in all wards and sections considered as having a high risk of puncture injury due to sharp or pointed objects (NSI).

The study population was 1,042 nurses at RSUP Dr. Sardjito. The sample of 289 respondents ($\alpha = 5\%$) worked in the units or sections with a high incidence of injury due to sharp or pointed objects. The total number of respondents was 330 people, with a mortality possibility of 10%. This study applied random and purposive sampling techniques in these areas, respectively: Operation Room 40, IGD 30, Lab. 40, Hd. 20, adult VIP 45, VIP child 30, ICU 20, ICCU 15, Cath Lab. 10, Inpatient Children 40, and Adult Adults 40.

This study consisted of the dependent variable or endogenous variable (Y), independent variable or exogenous variable (X), and intervening variables. Exogenous variables in this case were attitudes, group norms, and perceived behavior control (PBC) representing a latent safety and health climate. The climate was measured through easily observable factors; namely, risk perception, leadership commitment and attitude toward safety and health, subjective or group norms, and normal work pressures. The competence was measured for the safety management system and the perception of behavior control.¹²

Latent endogenous variables included the behavior of using standardized safety procedures or so-called safety and health performance. This performance was formed by measured variables including behavior in alignment with the main task and contextual behavior that supported the successful implementation of the safety and health program for NSI prevention. Intention was the intervening variable, and it was interpreted as purpose, or the bond between the climate of safety and health with performance.

Qualitative data were obtained through elicitation study questionnaires, in-depth observations, and interviews related to behavioral beliefs. The data obtained from the open questionnaire were used as the basis for the initial guideline preparation and the questionnaire statement items.

The questionnaire was developed using a creative ad-

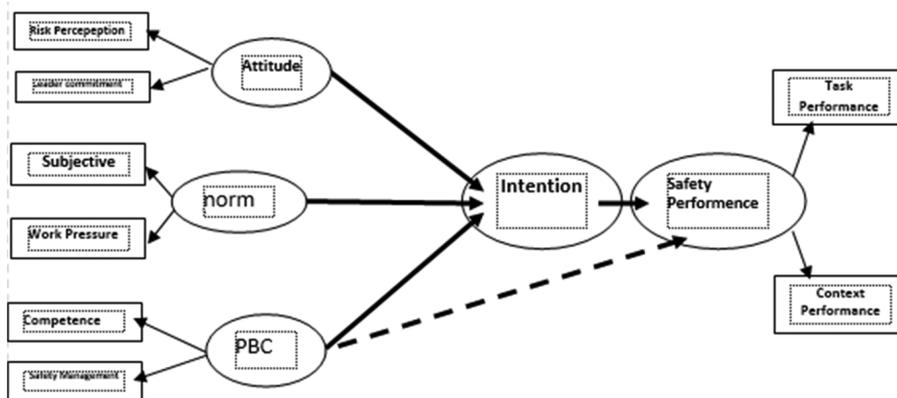


Figure 1. Study Variable

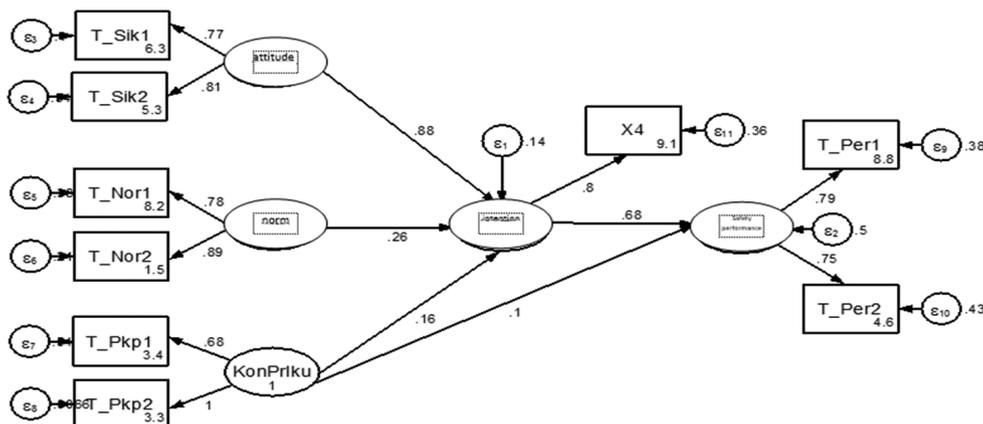


Figure 2. Line Chart of TPB Structural Model

adaptation approach from the studied and used instruments.¹¹⁻¹³ The study results were based on the use of term or statement to support the questionnaire as related to safety and health climate, intention, and safety and health performance.^{12,14}

This study used content and qualitative analysis for interview data, focus group discussion, observation, and documentation. The SEM analysis was used to test the model based on TPB¹³ as the main theory by adopting the study results of safety and health climate¹¹ and safety and health performance.¹²

Results

The TPB had the match coefficient score of $\chi^2 = 193.765$ (p-value 0.000), CFI = 0.875, and RMSEA = 0.147. The prerequisite analysis test was not necessary for the structural model since it had been done on the measurement model. The p-value < 0.05 indicates that the relationship between the latent variables in the model is statistically acceptable.

The first null hypothesis (Ho1) attitude had no significant and positive effect on the intention. Tests based on table 4:40 mentioned that the null hypothesis was rejected because $z_{count} 19.08$ was bigger than $z_{table} 1.96$, and the p score (significance level) showed a value of 0.000

which was much lower than 0.05. This indicates an alternative hypothesis (HA1) that can be accepted, stating that attitude has a significant and positive influence on intentions. As part of safety and health climate determinants, attitudes can directly affect the incidence of safety intentions to behave based on safe procedures for NSI prevention.

That the statement of norm did not have a significant and positive effect on the intention was the second null hypothesis. This hypothesis was rejected based on the score of $z_{count} 4.23$ being bigger than $z_{table} 1.96$, and the value of p (significance level) 0.000 not being significant at the margin error of 5%. Based on these tests, the alternative hypothesis (HA2) was accepted, stating that the norm significantly and positively affected the intention. The safety intention to behave in order to prevent the occurrence of intention is directly affected by the existence of norms in the work environment such as work pressure, peers, and norms.

The third null hypothesis (Ho3) stated that the behavior control perception had no significant and positive effect on the safety intention. The null hypothesis was rejected based on the z score of 2.93, which is larger than the z_{table} of 1.96, and the p-value (significance level) showed a value of 0.003, which was much smaller than 0.05.

Table 1. Hypothesis Testing on Direct Influence Variables of the TPB Model

Hypothesis	Relation	Unstandardized	Estimate (Standardized)	z	p-Value	Explanation
H ₁	Attitude intention	0.629	0.877	19.08	0.000	H _{A1} accepted
H ₂	Norm intention	0.342	0.264	4.23	0.000	H _{A2} accepted
H ₃	PCB intention	0.088	0.154	2.93	0.003	H _{A3} accepted
H ₄	PCB performance	0.103	0.105	1.35	0.176	H _{A4} rejected
H ₅	Intention performance	1.189	0.682	14.07	0.000	H _{A5} accepted

Table 2. Influence of Independent Variables of Health and Safety Performance on NSI Prevention

Variable	Direct Influence	Indirect Influence	Total Effect	p-Value
Attitude	-	0.749	0.749	0.000
Norm	-	0.407	0.407	0.000
PBC	0.103	0.104	0.207	0.009

Table 3. Effect of PBC Indicators on Safety and Health Performance

Indicator	Regression Coefficient	T	p-Value	R ²
PBC 1 (Management system of safety and health)	0.073	0.880	0.382	12.64%
PBC 2 (self-ability)	0.450	4.640	0.000	

This indicates the alternative hypothesis (HA3) can be accepted, stating that the perceived behavioral control significantly and positively affected the safety intention. The perception was that safe behavior was easy and it is understood that the importance of the OSH hospital management system will cause the intention to follow NSI prevention procedures.

The fourth null hypothesis (Ho4) was that perceived behavioral control had no significant and positive effect on safety and health performance related to NSI prevention. The value of z_{count} of 1.35 is lower than z_{table} of 1.96, and the significant p-value (significance level) of 0.176 at the test level of 5% (p-value is greater than 0.05) became the basis for accepting the null hypothesis. An alternative hypothesis (HA4) was rejected, stating that the perception of behavioral control significantly and positively affects safety and health performance associated with NSI prevention. These results showed that self-efficacy for NSI prevention and acceptance of the hospital's safety management system did not directly affect the performance of safety work.

The null hypothesis (Ho5) stated that the intention did not have a significant and positive effect on performance. The Ho5 test showed the null hypothesis as rejected because the z_{count} 14.07 is bigger than z_{table} , and the p-value (significance level) showed a score of 0.000, which is smaller than 0.05. This means that the alternative hypothesis (HA5) stating that intention had a significant and positive effect on performance was accepted. Safety performance related to NSI preventive behavior through task performance and contextual performance indicators will increase due to the intention's influence. This underscores the important role of intention in hospital safety management systems for NSI prevention.

Based on the information in Table 2, only PBC had

direct and indirect effects on safety and health performance related to NSI prevention, while attitude and norm only show indirect effects. This means that attitudes and norms can only affect safety and health performance as related to NSI prevention through intention. This can also be seen from the p-value for the indirect effect of each variable, which was lower than 0.05; this indicates that these variables were proven significant.

The results of regression analysis showed that the PBC indicators for the Health and Safety Management System had no significant effect (p-value > 0.05) on safety and health performance related to NSI prevention. On the contrary, perceived behavioral control in the form of self-efficacy showed a significant influence (p-value < 0.05) on safety and health performance related to NSI prevention. It showed that the variable of safety and health performance related to NSI prevention was only influenced by perceived behavioral control in the form of self-ability to prevent NSI. This means that improved self-ability was supported by knowledge and training; in other words, the better a nurse's perception of ease of control of self-behavior related to NSI prevention, the more safely the nurse will perform. Nurses with the intention to perform safely tend to take care to avoid NSI in every step of their work. This underscores the urgency of strengthening the role of the hospital's safety management system to improve nurses' performance in preventing NSI.

As seen in Table 3, the R² score was 12.64%, showing that both indicators of perceived behavioral control on performance was 12.64%, while the rest (87.36%) were influenced by anything else suspected to participate in determining PBC. This aligns with Fogarty and Shaw's opinion (2004), which states that perceived behavioral control strengthens the relationship between intention and performance. Intentions influenced by the

competence and the safety of the health management system could influence performance in carrying out the main tasks and supporting safety procedures for the prevention of injury from punctures, slashes, and scratches by sharp and pointed objects, especially syringes.

Discussion

Intention variables were needed to supplement the output of structured behavioral theories related to safety and health climate. For example, one needs to go through the intention stage in order to behave in a safe and healthy way.¹⁵ The result of the first hypothesis testing stated that attitude significantly and positively affects intention. The attitudes formed from perceptions of leadership commitments and perceptions of risk from potentially hazardous sources affects the incidence of intent to conduct behavior based on safety and health procedures. Displaying attitudes of concern, anxiety, and role modeling by direct leadership stimulated the staff to imitate them. Attitudes toward risk from potentially hazardous injuries such as punctures, slashes, and scratches also cause an increase in a person's intention to behave safely. This aligns with the opinion that awareness of potentially hazardous sources in the workplace can lead to rejection of risky, unsafe, and unhealthy behaviors.¹¹

The testing results of the second hypothesis showed that norms had a significant and positive influence on intention. Indicators of norm measurement; namely, perceptions of subjective norms and perceptions of work pressure, directly influence one's intentions. The results of this test indicated that one's intention to perform safety and health procedures to avoid puncture and scratch injuries came mostly from external factors; that is, the work environment. This aligns with the opinion that a person's norm is influenced by colleagues and leaders in the work environment.¹⁵

The results of the third hypothesis testing stated that perceived behavioral control significantly and positively affected intention. Indicators of ability or self-competence and using the safety management system as a measure of behavior control perception directly influence the formation of one's intention. Ability, experience, and preparation for carrying out safety and health procedures related to the prevention of injuries is one form of displaying one's intentions. Like the availability of personal protective equipment, the ease of disposing of medical waste such as needles also affects the formation of one's intentions.

The first to the third hypothesis had a partial direct influence on the climatic substructure (attitude, norm, and perception of behavioral control) of intention. Based on the results of the first to the third hypothesis test, it can be concluded that all subconstructions of climate (attitude, norm, and perceived behavioral control) can affect one's intention. The safety and health climate construct

had a contribution of 69.5% in explaining the intention construct. The remaining 30.5% of intention constructs was caused by other factors, such as work experience, sex, age, and other factors that were not discussed in this study. The big effect of the construct of a safety and health oriented climate indicated that it was strong enough to affect nurses' intentions, because the percentage obtained was higher than 50%. Therefore, to increase the nurses' intentions, hospital management needed to pay more attention to the safety and health climate construct. This in turn encourages nurses to maintain their intention to behave according to implemented NSI prevention procedures.

The fourth hypothesis test showed that there was no direct effect of behavior control perception on safety and health performance. Perceived behavioral control describes the perception of respondents who believe they are able or unable to prevent NSI (target behavior). Perceived behavioral control which was measured by indicators of competence or self-efficacy and the OSH management system had little effect on performance to relate the main or supporting activities to prevention of injury procedures with regard to sharp or pointed medical equipment. The OSH hospital management system includes standard procedures and devices, the availability of personal protective equipment, the ease of container reach, waste management, and socialization or warnings via posters. Experience and capability alone did not facilitate a person carrying out main or supporting activities related to the prevention of injuries from sharp or pointed medical equipment. Careless nurses can make the safety and health procedures ineffective at preventing injuries. These results contradicted the idea that high performance was closely related to the management's strong commitment to OSH, individual attention to their own safety and health, and organized and planned workplaces.¹⁶

Based on the structure model, the influence of one variable to other variables can be either direct or indirect (according to the analysis line). For example, the influence of attitudes on performance can be direct or indirect. Table 2 illustrates the total effects, both direct and indirect, of the independent and intervening variables of safety and health performance related to NSI prevention.

The results of the fourth hypothesis testing stating that perceived behavioral control did not significantly affect safety and health performance can be explained using the table results of these influences. PBC did not directly affect the performance of safety and health, except through intention variables. In other words, intention was an intervening variable on the influence of perceived behavioral control, attitudes and norms on safety and health performance.

The result of the fourth hypothesis testing can be clarified by examining the influence of each PBC indicator;

that is, the hospital management system and the self-ability of preventing NSI on the performance of safety and health through regression analysis.

Conclusion

In conclusion, as a part of a safe environment, attitude has a significant effect on safety intention to implement NSI prevention procedures. As an OSH climate component, norms also influence one's intention to behave based on NSI prevention practices. The perceived behavioral control from an OSH climate has a significant effect on the safety intention of nurses to implement NSI prevention procedures. The intention to behave based on NSI prevention procedures has been shown to have a significant effect on nurses' safety performance and behavior to prevent NSI. As part of a safety climate, attitudes have a significant effect on safety performance for NSI prevention procedures. As part of a safe climate, safety intention is also proven to have significant effect. Also as part of a safety climate, perceived behavioral control proved to have a significant influence on safety intention performance. Moreover, self-efficacy directly influences safety performance in the form of NSI prevention procedures, while safety management has no direct effect.

The fifth hypothesis concluded that intention had a significant and positive effect on safety performance. A person's intention was the starting point for all behaviors. A person behaves in a certain way based on his own intention. Intention was the reason or purpose for behaving in a certain way; in this case, applying standard safety procedures related to NSI prevention. A person will automatically perform safe actions in both the main task and supporting activities in order to avoid medical injuries.

The sixth hypothesis concluded that a significant indirect and positive influence of attitudes existed as part of the climate on safety performance. This hypothesis was a combination of the first hypothesis (influence of attitudes on intention) and the fourth hypothesis (influence of intention on safety performance). Both hypotheses had a significant and positive effect. The results of this hypothesis are aligned with the opinion that intention strengthens the relationship between attitude and safety performance. Intention influenced by attitude with perception indicators of leader commitment and perception of risk of hazard source potency was very high; therefore, it can influence performance in carrying out main and supporting safety and health procedures for prevention of NSI.¹⁶

The indirect effect of norm on safety performance, which is positive and significant, is the conclusion of the seventh hypothesis. The seventh hypothesis is a combination of the second hypothesis (the effect of norms on safety intentions) and the fifth hypothesis (influence of safety intentions on performance). The significance of the second and fifth hypotheses is one of the reasons for the

significance of the seventh hypothesis. The strong influence of indicators of subjective perceptions of the norm and the perception of work pressure on safety intention can affect the way nurses perform their main tasks and supporting activities to prevent puncture, slash, and scratch injuries from medical equipment.

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