

Research Article



Variables Influencing Nurses' Adherence to Personal Protective Equipment (PPE) Utilization at PKU Muhammadiyah Hospital Bantul

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ABSTRACT

Background: A hospital is a health service facility that provides outpatient and inpatient patient services. Hospitals can also be a source of infection for officers, patients, and other visitors. To prevent nosocomial infections in officers, hospitals must protect all health workers, for example, by wearing gloves, masks, gowns, face shields, shoes, and aprons. Compliance with PPE on health workers is supported by a positive attitude from officers and supervision carried out by management. This study aims to determine factors related to compliance with use among nurses.

Method: This was quantitative research using correlation with the cross-sectional approach. The population in this study was 130 permanent nurses. The sample was calculated using the Slovin formula, resulting in 100 samples. The respondent was selected via proportional random sampling among the care units. Chi-Square was used to analyze the data.

Results: There was a relationship between PPE compliance and age ($p=0.005$), attitude ($p=0.000$), and supervision ($p=0.016$). Meanwhile, factors that were not related to PPE compliance were gender ($p=1.000$), education ($p=0.054$), knowledge ($p=0.170$), facilities ($p=0.505$), and training ($p=0.811$).

Conclusion: There was a significant relationship between age, attitude supervision, and compliance with PPE in nurses when performing their duties.

Keywords: Compliance; Nurse; PPE

INTRODUCTION

The hospital is one of the health service facilities that provide services for the community in the form of treatment and care, both outpatient and inpatient; besides that, the hospital can be a source of infection for officers, patients, and other visitors.¹ Infections in health facilities

are often called nosocomial infections or *healthcare-associated infections* (HAIS). These infections occur during the patient's treatment. Infections can also occur in health workers due to work done or actions given to patients.² Based on WHO data (2016), the incidence of nosocomial infections / HAIs as much as 9% or 4.1 million patients treated in all hospitals in the world, and the prevalence of infection in the United States every year is 1.7 patients per year while in Europe the incidence of nosocomial infections is 4-4.5 million annually.³ The Ministry of Health surveillance data (2015) shows the rate of nosocomial infection in patients, with an average of 9.8% in hospitalized patients.⁴ The risk of infection can also occur in staff when treating patients and in the hospital environment, so actions are needed to prevent the risk of infection.⁵

Hospitals must protect health workers when providing services to prevent nosocomial infections in health workers. One protection measure requires all health workers to use Personal Protective Equipment (PPE) when carrying out risky actions.⁶ Personal protective equipment used by nurses functions to protect themselves and patients from the risk of exposure to dangerous materials such as chemical, physical, biological, and other infectious materials.⁷ PPE does not eliminate the risk of exposure to infectious materials but functions as a protector, barrier and reduces the risk of exposure to infectious sources.⁸ The Personal Protection Equipment often used by health workers are masks, gloves, dresses, eye or face protection, boots, and aprons.⁹ To protect health workers and patients from nosocomial infections, it is necessary to adhere to the use of PPE to get maximum benefit.¹⁰

Based on *Lawrence Green's* theory, several factors affect PPE compliance, including *presdisposing* (knowledge, age, attitude, length of service, motivation), *enabling* (facilities), and *reinforcing* (training and supervision).¹¹ Obedience is an officer's discipline or positive behavior to obey all established rules¹². To maintain an officer's positive attitude, management support is needed through policies on PPE and routine supervision.¹³ With a positive attitude from officers and supervision carried out regularly to increase officer compliance in using PPE and reduce infection rates in health workers.¹⁴ From the research results, there were 57.7% who did not comply with the use of PPE, which was caused by a lack of supervision carried out by the head of the room where the head of the room still assumed that the knowledge possessed by the head of the room was the same as other officers.¹⁵

From the results of a preliminary study conducted by researchers in August 2022, data was obtained from April to June 2022 regarding the incidence of nosocomial infections that occurred in patients, namely phlebitis 2.09 ‰, UTI 0 ‰, VAP 0 ‰ and SSI 1.03% and the incidence of injury 0% risk of nosocomial infections such as needle sticks. Meanwhile, compliance with using PPE among nurses resulted in 67% compliance and 23% non-compliance among 105 officers. Compliance when using masks is 100%, gloves 67%, boots 100%, gowns 73%, face shields 25%, hats 45% and aprons 65%. Of the 70 officers who complied, 69% were female, and 31% were male. PPE is available in each unit at 95% and in the pharmacy at 100%; PPI training is carried out annually for all employees, while supervision has not been done optimally by the head of the room and IPCN (Infection Prevention Control Nurses). This research contributes to determining the determinants of compliance with the use of PPE among nurses in preventing and controlling infections.

METHOD

This was quantitative research with correlation using a *cross-sectional* design. The population was represented by permanent nurses hospitalized at PKU Muhammadiyah Bantul Hospital (130 people). The number of samples used was 100 nurses using the *Slovin* formula, and the number of proportional random samplings was determined in 8 inpatient units. The research was conducted in October 2023 at PKU Muhammadiyah Bantul Hospital. The instruments used in this study were attitude questionnaires using the Likert scale that had been tested for validity and reliability testing with *Cronbach's Alpha* and observation sheets on the use of PPE in nurses at Universitas Islam Indonesia Hospital Bantul, Yogyakarta. Analysis was performed using univariate and bivariate with *Chi-Square* test.

RESULTS

Univariate analysis

Table 1 shows that the characteristics of respondents based on gender are primarily women, with a total of 69 people (69%). The characteristics of respondents based on age are early adulthood (<40 years) with a total of 62 people (62%). The attributes of respondents based on the length of work were in the old category (> six years), as many as 63 people (63%). While the characteristics of respondents based on the most education are Diploma 3 with 75 people (75%).

Table 1. Distribution of Respondent Characteristics

Characteristics of respondents	Frequency	Percentage (%)
Gender		
Male	31	31%
Woman	69	69%
Age		
Early Adulthood (< 40 years)	62	62%
Advanced Adults (> 40 years)	38	38%
Length of work		
< 6 years	37	37%
> 6 years	63	63%
Education		
Diploma	75	75%
Bachelor	1	1%
Profession	24	24%

Table 2 shows the level of knowledge of nurses with good categories, as many as 64 people (64%), nurses who have a positive attitude, as many as 68 people (68%), nurses who state complete PPE facilities, as many as 58 people (58%), nurses who state that training is carried out regularly as many as 55 people (55%), nurses who state the implementation of routine supervision as many as 58 people (58%).

Based on the results of direct observations of nurses when carrying out actions, it was found that 69 nurses (69%) were compliant with using PPE, and 31 nurses (31%) were non-compliant out of 100 respondents (Table 3).

Table 2. Frequency Distribution of Respondent Determinants

Characteristics of respondents	Frequency	Percentage (%)
Knowledge		
Good	64	64
Enough	36	36
Attitude		
Positive	68	68
Negative	32	32
Facilities		
Complete	52	52
Incomplete	48	48
Training		
Routine	55	55
Not routine	45	45
Supervision		
Routine	58	58
Not routine	42	42

Table 3. Distribution of PPE Usage Observations

Compliance	Frequency	Percentage (%)
Obedient	69	69
Disobedient	31	31
Total	100	100

Bivariate analysis

According to the cross-tabulation results in Table 4, there is a relationship between age and compliance with PPE use with a p-value of 0.005 ($\alpha < 0.05$) and a coefficient value of 0.289, which can be interpreted that the relationship between age and compliance with PPE use is low. In the category of working period, there is a relationship with compliance with the use of PPE with a p-value of 0.024 ($\alpha < 0.05$) and a coefficient of 0.240, which can be interpreted that the relationship between working period and compliance with the use of PPE is low. Meanwhile, in the gender ($\alpha > 0.05$) and education ($\alpha > 0.05$) categories, there was no relationship with compliance with the use of PPE. Meanwhile, the gender and education categories did not show any relationship with the level of PPE compliance ($\alpha > 0.05$).

Table 5 shows is known that there is a relationship between attitude and compliance with the use of PPE with a p - p-value of 0.000 ($\alpha < 0.05$) and a coefficient value of 0.351, which can be interpreted as meaning that the relationship between age and compliance with the use of PPE is low. In the supervision variable, there is a relationship between compliance with the use of PPE with a p - p-value of 0.016 ($\alpha < 0.05$) and a coefficient of 0.253, which can be interpreted as meaning that there is a relationship between work life and compliance with the use of PPE is low. Meanwhile, in the categories of knowledge ($\alpha > 0.05$), facilities ($\alpha > 0.05$), and training ($\alpha > 0.05$), there was no significant relationship with compliance with the use of PPE. Meanwhile, the facilities and training categories did not show any relationship with the level of PPE compliance ($\alpha > 0.05$).

Table 4. Cross-tabulation between respondent characteristics and PPE compliance

Characteristic	Compliance		Total n (%)	P-Value
	Disobedient n (%)	Obedient n (%)		
Gender				
Male	10 (10)	21 (21)	31 (31)	1,000
Woman	21 (21)	48 (48)	69 (69)	
Age				
Early adult (<40 years)	26 (26)	36 (36)	62 (62)	0,005
Older adult (>40 years)	5 (5)	33 (33)	38 (38)	
Length of work				
< 6 years	17 (17)	20 (20)	37	0,024
>6 years old	14 (14)	49 (49)	63	
Education				
Diploma	19 (19)	56 (56)	75	0,054
Bachelor	1 (1)	0 (0)	1 (1)	
Profession	11 (11)	13 (13)	24 (24)	

Table 5. Cross-tabulation between determinants and compliance with PPE use

Determinant	Compliance Status		Total n (%)	P-Value
	Disobedient n (%)	Obedient n (%)		
Knowledge				
Good	16 (16)	48 (48)	64 (64)	0,170
Enough	15 (15)	21 (21)	36 (36)	
Attitude				
Positive	13 (13)	55 (55)	68 (68)	0,000
Negative	18 (18)	14 (14)	32 (32)	
Facilities				
Complete	20 (20)	38 (38)	58 (58)	0,505
Incomplete	11 (11)	31 (31)	42 (42)	
Training				
Routine	16 (16)	39 (39)	55 (55)	0,811
Not routine	15 (15)	30 (30)	45 (45)	
Supervision				
Routine	12 (12)	46 (46)	58 (58)	0,016
Not routine	19 (19)	23 (23)	42 (42)	

Multivariate analysis

Multivariate analysis was carried out to determine how much the independent variable affects the dependent variable. Based on the Chi-Square test results, four variables deserve to be included in the logistic regression test: age, length of service, attitude, and supervision (p-value < 0.25) (Table 6).

Table 6. Degree of influence on PPE compliance

Variable	Significance	OR (Odd Ratio)
Age	0,037	3,582
Attitude	0,000	8,809
Supervision	0,005	5,006

Based on Table 6, age affects compliance with PPE use in nurses with a p-value of 0.037 ($\alpha < 0.05$) with an odd ratio of 3.582, which means that age can increase nurse compliance in using PPE by 3.582. The attitude variable affects the compliance of PPE use with a p – p-value of 0.000 ($\alpha < 0.05$) with an odd ratio of 8.809, so it can be concluded that attitude has the

opportunity to increase nurse compliance by 8.809. At the same time, supervision has compliance with the use of PPE with a p-value of 0.005 and an odd ratio of 5.006, so it can be concluded that supervision has the opportunity to increase nurse compliance by 5.006.

DISCUSSION

The frequency distribution of respondents' characteristics shows that most respondents are women, which is almost the case in all hospitals; this happens in nearly all hospitals due to the perception of a woman's feminine attitudes, such as nurturing or caring.^{16,17} Based on age, the most significant number in the early adulthood category is 25-40 years, which is the age with a high productivity level.¹⁸ At the same time, older adults will be more trusted because of their maturity in thinking and acting.¹⁹ While the length of the work period of respondents in the long category is the longer the work period, the higher the experience and ability to complete the work and the more excellent the opportunity to improve knowledge and skills through training held at the hospital.^{20,21} Based on the respondents' education, the highest level of education was at the Diploma level. The level of education will influence the extent of knowledge and ability to accept new things and the education that can be obtained through formal and non-formal education.²² The results of observations of compliance with the use of PPE show that the most compliant nurses were, with the number of respondents being 69 people (69%). Compliance in the health sector can be interpreted as when a health worker complies with the rules or procedures that have been established, especially in implementing standard precautions to prevent nosocomial infections.²³

About the Determinants of Compliance

Nurse compliance is a positive behavior possessed by a nurse to comply with a rule or policy to maintain safety when providing health services to patients. A nurse's compliance in wearing PPE can begin with a compulsion to obey the rules when wearing PPE voluntarily and interpret the importance of using PPE rationally and according to indications to prevent nosocomial infections.²⁴

1) The relationship of knowledge to PPE compliance

In this study, the level of knowledge was not related to PPE compliance among nurses (p-value 0,132). This research aligns with previous research, which states no relationship exists between knowledge and officer compliance using PPE (p-value 0.30).²⁴ Previous research states a relationship exists between knowledge and nurse practice in preventing nosocomial infections (p-value 0.002).²⁵ Knowledge is the result of knowing something that is manifested into reality so that there is no hesitation on the part of a health worker to comply with prevention and infection control measures.²⁶ A person's level of knowledge is influenced by the officer's high exposure to information about preventing nosocomial infections with the use of PPE both formally and informally; information that is not full can create wrong perceptions in a nurse. Nurses who have good knowledge and data about infection prevention and control will influence behavior in using PPE.^{27,28,29} Factors that influence nurses' knowledge about the use of PPE are increasing age, the length of work of nurses so that they are increasingly exposed to information about the importance of using PPE to prevent nosocomial infections when performing actions. To increase nurses'

knowledge, the hospital conducts socialization about infection prevention and control during the orientation of new employees and once a year as one of the routine activities.

2) The relationship of attitude to PPE compliance

The study results show a significant relationship between attitudes and compliance with using PPE in nurses (p-value 0,000). This study's results align with research on nurses at Dr. RM Pratomo Bagansiapiapi Hospital, which found that an officer's attitude is related to using PPE (p-value 0.004).³⁰ In contrast, research conducted at Tuban Regency Hospital found no relationship between attitude and compliance in using PPE (p-value 0.156).⁶ Attitude is a mental response of an individual who will bring oneself in a good and honest direction or a potentially negative one.⁸ A health worker's attitude is a person's view of an object and the tendency to act according to the object.³¹ It can be concluded that a positive attitude from a nurse arises from a sense of confidence in the function of PPE to prevent nosocomial infections. On the other hand, nurses who have a negative attitude are based on distrust and discomfort when using PPE. Lack of knowledge and negative attitudes of nurses will affect compliance in the use of PPE so that it will increase the incidence of nosocomial infections and decrease the quality of hospitals; this is due to a lack of awareness that they work in an environment where there is a risk of disease transmission due to their work. According to *Sigmund Freud*, consciousness is the part of a person's soul that contains known things based on their knowledge.^{32,33} So, it can be concluded that awareness of using PPE is an awareness that arises from within to implement the use of PPE following regulations.

3) Facility relationship to PPE compliance

The research showed no relationship between facilities and PPE compliance (p-value 0.505). This research is in line with previous research, which states that the availability of PPE (p-value 0.611) has nothing to do with officer compliance in wearing PPE.³⁴ While another research states that the availability of facilities has a significant relationship with officer compliance in using PPE (p-value 0.000).³⁵ The availability of complete PPE, which is easy to reach and comfortable, will encourage the good behavior of officers to comply with the use of PPE so that the procurement of PPE needs to be adjusted to needs.^{34,36} The researcher's observations showed that each treatment room had complete PPE facilities, was easy to access PPE, and was comfortable to use, which was a supporting factor in increasing nurses' compliance with PPE.

4) Training relationship to PPE compliance

The results of the analysis showed no relationship between training and compliance with PPE use (p-value 0.811). This research was in line with previous research that stated no significant relationship exists between PPE training and compliance with PPE use (p-value 0.559).³⁴ However, our result differed from another research study stating that there was a relationship between training and PPE compliance among nurses (p-value 0.003).³⁵ Training is an activity used to promote health, increase knowledge and skills, and determine attitudes toward using PPE to prevent nosocomial infections and as one of the guidelines given to an officer.^{5,34} Lack of training provided to officers can increase the risk of infection in the workplace and serve as a reminder of previously acquired knowledge.^{37,38} From the results of infection prevention and control training, interviews were given by all new employees and repeated regularly once a year. However, compliance with using PPE to prevent nosocomial infections still needs to improve.

5) Supervision relationship with PPE compliance

The research results state a relationship between supervision and compliance with PPE (p-value of 0.016). This research is in line with previous research reported that there is a relationship between supervision and compliance with PPE use with a p-value - value of 0.049,³⁹ While an earlier study stated that there was no relationship between supervision and compliance with PPE use in health workers with a p-value of 0.148.⁴⁰ Supervision is a continuous process of a job that begins with planning and ends with completing a job, which is initially authoritarian. Still, as time passes, supervisory activities are dynamic and function as motivators, supporters, and guidance in implementing regulations.^{41,42,43} Supervision carried out is expected to increase officer compliance in wearing PPE⁴⁴, and supervision carried out regularly will positively impact officer compliance compared to supervision not carried out routinely.⁴⁵ From the results of interviews and observations, the implementation of supervision was carried out by the head of the room and the IPCN, where the implementation of supervision was not optimal because it was constrained by the number of IPCNs and the number of activities carried out by the head of the room.

Level of relationship based on Multivariate analysis

Based on the results of multivariate tests conducted by researchers, the results of p - p-value age of 0.037 with an OR value of 3.582 so that it can be concluded that age can affect compliance with PPE use by 3.582 times, while in the attitude variable with p - value 0.000 with an OR value of 8.809 which can be concluded the attitude of a nurse can affect the level of compliance with PPE use by 8.809 times. While the supervision variable p-value of 0.005 with OR 5.006, it can be concluded that routine supervision activities can affect the compliance of PPE use in nurses by 4,615 times. The age of a nurse greatly influences the level of compliance with the use of PPE; this is because as age increases, the knowledge, insight, and experience in using PPE will increase so that it can prevent nosocomial infections.^{18,46} Age level will affect a nurse's attitude and behavior to obey the hospital's policies.²⁵

Meanwhile, the attitude variable has a powerful influence on the level of PPE compliance; this is caused by a nurse's positive attitude about the importance of wearing PPE, which will be reflected in behavior to prevent nosocomial infections. A nurse who has a positive nature is more likely to comply with existing policies and vice versa.⁴⁷ This result follows the attribution theory from Haider (1958), which states that each individual knows his attitude by inferring the situation, time, and method used.⁴⁸ The implication is that a nurse will be obedient in wearing PPE because of a positive attitude in her. To maintain a positive attitude in a nurse, supervision is needed to improve nurse compliance with wearing PPE.

Regular supervision will impact increasing compliance with PPE use for nurses.³⁰ Supervision will provide external encouragement for nurses to comply with PPE use⁷, which can increase work effectiveness and efficiency when using PPE.⁴⁹ In addition, compliance in using PPE by an officer is also influenced by colleagues, so fellow nurses need supervision, and supervision carried out by a superior will affect attitudes and norms in practicing PPE according to regulations.⁵⁰ In this study, researchers stated that a

positive attitude influences compliance with the use of PPE in nurses, which will impact behavior to comply with hospital policy. In addition, the factor that encourages compliance with PPE is the supervision carried out regularly by superiors or colleagues. With supervision, actions carried out regularly can maintain a positive attitude in a nurse in carrying out infection prevention and control while in the hospital.

CONCLUSION

Based on the research results conducted at PKU Muhammadiyah Bantul Hospital, the level of compliance with PPE is influenced by several factors, including age, attitude, and supervision. There is a significant relationship between age, attitude supervision, and compliance with using PPE on nurses when performing actions.

Authors' contribution

ASN was responsible for research design, data collection, analysis, and manuscript writing; DS and WH reviewed the analysis. All authors contributed to reviewing and evaluating this manuscript for publication.

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Conflict of interest

There is no conflict of interest in this research.

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