

## **THE DETERMINANT FACTORS OF NURSE COMPLIANCE IN THE USE OF PERSONAL PROTECTIVE EQUIPMENT (PPE)**

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### **ABSTRACT**

This study aims to see the determinants associated with compliance with the use of PPE. The research design used is a cross-sectional study. The results showed differences in the average value of knowledge, attitudes, motivation, supervision, and PPE standards/guidelines between nurses who obeyed using PPE and those who did not comply with using PPE. In conclusion, multiple logistic regression analysis shows that knowledge is the most influential variable in nurses' compliance with the use of PPE.

**Keywords:** Personal Protective Equipment, Compliance, Nursing Services, Nurse

### **INTRODUCTION**

According to WHO, among 35 million health workers, 3 million were exposed to blood pathogens (2 million were exposed to the HBV virus, 0.9 million were exposed to the HBC virus, and 170,000 were exposed to the HIV/AIDS virus. Frequency of Occupational Accidents (KAK) in hospitals in SC- In 1998, Americans were 41% higher than other workers, with the largest number of KAK being Needle Stick Injuries (NSI). In the United States, it is estimated that there are 600,000 to 800,000 injuries due to needle stick injuries to health workers every year. The Central for Disease Control (CDC) is estimated that every year 385,000 needlestick injuries occur involving nurses (Istih, et al 2017).

Occupational Diseases (PAK) and Occupational Accidents (KAK) in Indonesia according to the Ministry of Health in 2007, indicate that the risk of harm in hospitals experienced by workers is the risk of exposure to mucous membranes (1%), the risk of skin exposure (<1%), HIV (0.3%) and the rest had needle sticks, injuries, low back pain, dermatitis, hepatitis and respiratory disorders. According to the Health Ministry of the Republic of Indonesia 2010 regarding K3 standards in hospitals, hospital workers have a higher risk than other industrial workers for the occurrence of PAK and KAK. Accidents that often occur in hospitals are needle sticks, back pain, sprains, burns, scratches/cuts, and other infectious diseases, so hospital workers need to apply the use of Personal Protective Equipment (PPE) to minimize the risk of PAK and KAK (Nahrisah & Ardila, 2021).

PPE is a tool used to protect oneself or the body against the dangers of work accidents, which can technically reduce the severity of work accidents that occur. Personal protective equipment does not eliminate or reduce existing hazards, this equipment only reduces the number of contacts with hazards by placing barriers between workers and hazards. PPE is an alternative preventive measure for nurses in protecting themselves from the risk of disease transmission while interacting with patients. PPE must be used when performing actions that are at risk of contact with blood, body fluids, secretions, mucus, non-intact skin, and contaminated objects (Riyanto, 2016).

The use of Personal Protective Equipment (PPE) for nurses is still categorized as lacking in its implementation and application. This shows that the attitude of nurses in the use of Personal Protective Equipment (PPE) is still lacking, indicated by a negative attitude of 53.30%. Showing the behavior of using Personal Protective Equipment (PPE) nurses is not significant as indicated by the majority of respondents who have a behavior of using Personal Protective Equipment (PPE) that are less compliant amounting to 44 nurses (52.4%) (Zaki et al., 2018; Zubaidah, 2015).

This is in accordance with the results of Ningsih's research (2018) that nurses who have less knowledge about PPE as many as 23 respondents (76.7%) with less knowledge do not use PPE. While the respondents who have good knowledge about PPE and use PPE are 22 respondents (64.7%). The results of research conducted by Astuti et al., (2018) found different or contradictory results from the results of Ningsih's (2018) research. The results of Astuti's research (2018) stated that there was no significant relationship between knowledge and the level of compliance of nurses using personal protective equipment with the results of the statistical test  $p\text{-value} < (0.05)$ .

Astuti et al., (2018) argues that compliance behavior using PPE by nurses can not only be influenced by knowledge but there are also several other factors that can affect nurse compliance, such as the availability of adequate PPE, length of work, workload, and much more. Even though nurses have good knowledge but are not supported by adequate infrastructure, it can make the nurse's performance not optimal. Several units in the hospital are vulnerable to the spread of infection, such as the ICU, obstetrics department, internal medicine room, and surgical treatment room.

Based on this, researchers are interested in researching because there are still nurses who do not comply with the use of PPE in carrying out their duties. Therefore, researchers are interested in researching what determinant factors are related to nursing compliance in the use of PPE in hospital inpatient services.

## RESEARCH METHODS

This study is an analytical descriptive study, cross-sectional on intrinsic and extrinsic factors with compliance in the use of Personal Protective Equipment (PPE), independent variables include intrinsic factors (age, gender, education, years of service, knowledge, attitudes, and motivation) and extrinsic factors (supervision, availability of PPE, Guidelines/Standards for the Use of PPE), while the dependent variable is nurse compliance in using Personal Protective Equipment (PPE). Research respondents were nurses in the treatment room of Muhammadiyah Hospital in Palembang with the technique of accidental sampling.

Data collection for the dependent variable Compliance with the use of PPE by nurses was obtained through observation by the enumerator (head of the RSMP treatment room) to nurses in the nursing room. which is conducted. While Variable independent data was obtained by filling out a Google Form with the link <https://forms.gle/tGaXoYsP5nXspyaS9> which consists of age, gender, education variables in the form of numerical data, and knowledge variable with 7 statements, attitude 7 statements, motivation 7 statements, supervision 7 statements, Availability of PPE 5 statements and PPE standards/guidelines 5 statements with a Likert scale of 1 strongly disagree (STS), 2 disagree (TS), 3 disagree (KS), 4, agree (S) and 5 strongly agree (SS) which is an alternative score of instrument response. The research instrument has been tested previously, namely the validity and reliability test with the results of the calculated  $r\text{-value} > r\text{-table} = 0.355$  then it is declared valid and the alpha value  $> r\text{ table} = 0.355$ , then it is declared reliable. Before data analysis,

a data normality test was carried out followed by a univariate test analysis for variables of age, years of service, knowledge, attitudes, motivation, supervision, availability of PPE, and PPE standards/guidelines for numerical data and variables of gender, education and nurses' compliance with the use of variables. PPE categorical data.

For bivariate analysis, an independent t-test analysis was conducted between the variables of age, years of service, knowledge, attitudes, motivation, supervision, availability of PPE, and PPE standards/guidelines with the nurse's compliance variable on the use of PPE, while the variable gender and education with the nurse's compliance variable on the use of PPE. APD was analyzed by the Chi-Square test.

For the multivariate test, multiple logistic regression tests were carried out with the stages of bivariate testing for all independent variables, with the conclusion that if the test results obtained a p-value  $< 0.05$ , then the variable was declared to have passed the selection to the multiple logistic regression test stage (variable selection stage) with connecting the dependent variable (nurse compliance with the use of PPE) with the main independent variable (knowledge) along with the confounding variables of attitude, motivation, supervision and PPE standards/guidelines) and their interactions. The following are the results obtained from the early-stage multivariate modeling. The interaction test is carried out by removing the interaction variables from the model one by one starting from the variable with the largest p-value, if a p-value  $< 0.05$  means that there is an interaction. The confounding test is carried out by removing the confounding/confounding variables one by one starting from the one with the largest P-Value value, namely the attitude variable, if after removing the main variable OR difference between before and after

If the confounding variable is greater than 10%, then the variable is declared as a confounding variable and must remain in the model until the final modeling. This research has obtained ethical clearance from the KEPK Health Polytechnic of Palembang with "Ethical Approval" number: 1175/KEPK/Adm2/IX/2021 and a certificate of conducting research from the Director of Muhammadiyah Hospital Palembang number: 563/KET/H-5/RSMP /XI/2021 dated November 11, 2021. In its implementation, researchers still pay attention to aspects of anonymity (maintaining confidentiality) of respondents and provide protection (protection against inconvenience) and beneficiary

## RESULTS

Table. 1  
Kolmogorov Smirnov Test Results

N	Unstandardized Residual
	35
Normal Parameters <sup>a</sup>	
- Mean	,0000000
- Std. Deviation	,22311063
Most Extreme Differences	
- Absolute	.129
- Positive	.107
- Negative	-.129
Kolmogorov-Smirnov Z	.762
Asymp. Sig. (2-tailed)	.607

Based on the results of the normality test, it is known that the significance value is  $0.607 > 0.05$ , it can be concluded that the residual value is normally distributed. Univariate and bivariate analyses were then tested with variables using the Chi-Square test for gender and education variables with PPE compliance while the independent test was carried out on the variables of age, tenure, knowledge, attitudes, motivation, supervision, PPE availability, and PPE standards/guidelines with Compliance Variables.

### Univariate

From the data analysis conducted on all independent and dependent variables with the analysis of categorical data and numerical data, the following results were obtained:

Table. 2  
Distribution of Nurse's Frequency by Compliance  
with Using PPE

Compliance using PPE	Frequency	Percentage %
Compliance	21	60
Not Compliance	14	40

Based on table 2 of the 35 nurses who obeyed using PPE as many as 21 people (60%) while those who did not obey used PPE as many as 14 people (40%).

Table. 3  
Distribution of Age, Working Period, Knowledge, Attitude,  
and Motivation of Nurses

Variable	Mean	Minimum	Maximum	Deviation std
Age	39,46	30	55	5,918
Working period	13,54	8	24	3,988
Knowledge	22,57	19	26	1,420
Attitude	22,97	20	25	1,124
Motivation	19,69	16	22	1,409

Based on table 3, 35 nurses have an average age of 39.46 years with a minimum age of 30 years and a maximum age of 55 years, the average working period of nurses is 13.54 years with a minimum working period of 8 years and a maximum working period of 24 years. The average value of knowledge of nurses is 22.57 with a minimum value of knowledge of 19 and a maximum value of knowledge of 26 years. The average value of the attitude of nurses is 22.97 with a minimum value of 20 and a maximum value of 25. The average value of nurses' motivation is 19.69 with a minimum motivation value of 16 and a maximum value of 22.

Table. 4  
Distribution of Nurses by Gender and Education

Variable	Frequency	Percentage %
Gender		
Man	4	11,4
Woman	31	88,6
Knowledge		
Professional	20	57,1
Vocational	15	42,9

Based on table 4 of the 35 nurses who are male, 4 (11.4%) are female, 31 are female (88.6%) and 20 have professional education (57.1%) while those with vocational education are 15 people (42.9%)

Table. 5  
Distribution of Supervision, Availability of PPE,  
and PPE Standards/Guidelines

Variable	Mean	Minimum	Maximum	Deviation std
Supervision	22,51	19	26	2.133
PPE availability	13,09	11	16	1,040
Standard/guideline PPE	15,31	14	16	0,631

Based on table 5 obtained 35 nurses on average with a supervision value of 22.51 with a minimum value of 19 and a maximum value of 26 and an average PPE availability with a value of 13.54 with a minimum value of 11 and a maximum value of 16 and an average standard/guideline value PPE 15.31 with a minimum value of 14 and a maximum value of 16.

### Bivariate Analysis

Table. 6  
Distribution of Average Age, Years of Service, Knowledge, Attitudes, Motivation,  
Supervision, Availability of PPE, PPE Standards/Guidelines According  
to Compliance with Using PPE

Variable	Obey	n	Mean	SD	SE	P Value
Age	Obey	21	40,14	5,480	1,196	0,409
	Not Obey	14	38,43	6,595	1,763	
Working Period	Obey	21	13,19	1,662	0,363	0,530
	Not Obey	14	14,07	6,070	1,622	
Knowledge	Obey	21	22,00	1,414	0,309	0,002
	Not Obey	14	23,43	0,938	0,251	
Attitude	Obey	21	22,57	1,028	0,224	0,008
	Not Obey	14	23,57	1,016	0,272	
Motivation	Obey	21	19,14	1,195	0,261	0,04
	Not Obey	14	20,50	1,345	0,359	
Supervision	Obey	21	21,52	1,401	0,306	0,001
	Not Obey	14	24,00	2,219	0,593	
PPE Availability	Obey	21	12,90	0,944	0,206	0,212
	Not Obey	14	13,36	1,151	0,308	
Standard/Guideline PPE	Obey	21	15,00	0,548	0,120	0,001
	Not Obey	14	15,79	0,426	0,114	

The average age of obedient nurses was 40.14 years with a standard deviation of 5.480 years, while the average age of non-compliant nurses was 38.43 years with a standard deviation of 6.595 years. Statistical test results obtained p value = 0.409, meaning that at alpha 5% there is no significant difference in the average age of nurses between obedient nurses using PPE and non-adherent using PPE.

The average tenure of obedient nurses is 13.19 years with a standard deviation of 1.662 years, while the average tenure of non-compliant nurses is 14.07 years with a standard deviation of 6.070 years. Statistical test results obtained p value = 0.530 means at

alpha 5% there is no significant difference in the average working period of nurses between obedient nurses using PPE and non-adherent using PPE.

The average score for knowledge of obedient nurses is 22.00 with a standard deviation of 1.414, while the average score for knowledge of non-compliant nurses is 23.43 with a standard deviation of 0.938. Statistical test results obtained p value = 0.002 means that at 5% alpha there is a significant difference in the average score of knowledge of nurses between obedient nurses using PPE and non-adherent using PPE.

The average score for the attitude of obedient nurses is 22.57 with a standard deviation of 1.028, while the average score for the attitude of disobedient nurses is 23.57 with a standard deviation of 1.016. Statistical test results obtained p value = 0.008 means that at 5% alpha there is a significant difference in the average score of nurses' attitudes between nurses who obey using PPE and non-compliant using PPE.

The average score of the motivation value of obedient nurses is 19.14 with a standard deviation of 1.195 while the average score of the motivation of non-compliant nurses is 20.50 with a standard deviation of 1.345. Statistical test results obtained p value = 0.04 means that at 5% alpha there is a significant difference in the average score of nurses' motivation scores between obedient nurses using PPE and non-adherent using PPE.

The average score for the supervision value of obedient nurses is 21.52 with a standard deviation of 1.401, while the average score for the supervision of non-compliant nurses is 24.00 with a standard deviation of 2.219. Statistical test results obtained p value = 0.001 means at alpha 5% there is a significant difference in the average score of nurse supervision between obedient nurses using PPE and non-adherent using PPE.

The average score for the availability of PPE for obedient nurses is 12.90 with a standard deviation of 0.944, while the average score for the availability of PPE for non-compliant nurses is 13.36 with a standard deviation of 1.151. Statistical test results obtained p value = 0.212, which means that at alpha 5%, there is no significant difference in the average score of the value of the availability of PPE for nurses between obedient nurses using PPE and non-adherent using PPE.

The average score of PPE standards/guidelines for obedient nurses is 15.00 with a standard deviation of 0.548 while the average score for PPE standards/guidelines for non-compliant nurses is 15.79 with a standard deviation of 0.426. Statistical test results obtained p value = 0.001 means at alpha 5% there is a significant difference in the average score of the value of the availability of PPE for nurses between obedient nurses using PPE and non-adherent using PPE.

Table. 7  
Relationship between Sex, Education, and Nurses' Adherence  
to Use of PPE

Variable	Compliance of using PPE				Total	OR (95%CI)	P-Value
	Not Obey		Obey				
	n	%	n	%			
<b>Gender</b>							
- Man	2	50	2	50	4	100	1,583 1,2 – 12,8
- Woman	12	38,7	19	61,3	31	100	
<b>Knowledge</b>							
- Professional	9	45	11	55	20	100	1,636 0,4 – 6,6
- Vocational	5	33,3	10	66,7	15	100	
<b>Total</b>	14	40	21	60	35	100	

The results of the chi-square test analysis on the relationship between nurses' gender and compliance with the use of PPE showed that there were 2 (50%) male nurses who were obedient in using PPE, while among female nurses, 19 (61.3%) were obedient. in the use of PPE. The results of the statistical test obtained a p-value = 1,000, so it can be concluded that there is no difference in the proportion of compliance with the use of PPE between male and female nurses. From the results of the analysis, the OR value = 1.583, meaning that female nurses have a 1.58 times chance to obey using PPE compared to male nurses.

The results of the Chi-square test analysis on the relationship between nurse education and compliance with the use of PPE showed that there were 11 (55%) nurses with professional education obediently using PPE, while among nurses with vocational education, there were 10 (66.7%) who were obedient in the use of PPE. The results of statistical tests obtained a p-value = 0.727, so it can be concluded that there is no difference in the proportion of compliance with the use of PPE between nurses with professional education and vocational education. From the results of the analysis, the value of OR = 1.636, means that nurses with vocational education have a 1.64 times chance to obey using PPE compared to nurses with professional education.

### Multivariate Analysis

Table. 8  
Candidate Selection Test Results

Variable	P-value	Multivariate Candidate
Age	0,339	Not Included
Gender	0,666	Not Included
Knowledge	0,487	Not Included
Working Period	0,519	Not Included
Knowledge	0,008	Included
Attitude	0,024	Included
Motivation	0,010	Included
Supervision	0,003	Masuk
PPE Availability	0,217	Not Included
Standard/Guideline PPE	0,001	Included

From the selection results, it is known that the variables of knowledge, attitude, motivation, supervision, and PPE standards/guidelines have a P-Value < 0.25 so these variables will be included in multivariate analysis to be tested for interaction and confounding tests.

### Multivariate Modeling

Table. 9  
Results of Multivariate Analysis after Interaction Test

Variable	P Value	OR (95% CI)
Knowledge	0,007	0,192 (0,58 – 0,630)
Attitude	0,065	0,330 (0,102 – 1,071)
Motivation	0,016	0,212 (0,060 – 0,750)

From table 9 it is known that the OR value of the Knowledge Variable is 0.192, with the confounding variable the attitude variable p-Value = 0.065, then we remove the attitude variable

Table. 10  
Results of Multivariate Analysis without Attitude Variable

Variable	P Value	OR (95% CI)
Knowledge	0,008	0,211 (0,066 – 0,668)
Motivation	0,015	0,216 (0,063 – 0,738)

From table 11, it is known that the OR value of the knowledge variable is 0.211, with changes in the OR value as follows:

Table. 11  
Changes in OR Values Before and After  
Attitude Variables are Excluded

Variable	OR before	OR after	Conversion (%)
Knowledge	0,192	0,211	< 10%

From table 12 it is obtained that the difference in the OR value of the main variable between before and after the attitude variable is removed is smaller than 10%, namely Changes in OR Knowledge =  $(0.192 - 0.211) * 100\% / 0.192 = 9.89\%$ , meaning below 10% the conclusion is attitude is not as Confider variable and must be family from modeling.

### Final Model of Multivariate Analysis

Table. 12  
Results of Final Stage Multivariate Analysis

Variable	P Value	OR (95% CI)
Knowledge	0,008	0,211 (0,066 – 0,668)
Motivation	0,015	0,216 (0,063 – 0,738)

It can be concluded that in the group of nurses who know, the chance of being obedient to the use of PPE is 0.2 times greater than that of nurses who lack knowledge after being controlled by motivational variables.

### DISCUSSION

Supported by research Putri et al., (2018) states that non-compliant respondents are often found in respondents in the 20–27 years old group (50%) compared to respondents with an age group above 27 years (46.4%). The same condition also occurs in the variable of the working period, where the conclusion from the analysis is that there is no relationship with nurses' compliance with the use of PPE, the above is due to the increasing safety (safety) which is supported by both the hospital management and by individuals who in this case are nurses in maintaining security or safety in providing nursing services in hospitals. Supported by research on the relationship between knowledge and behavior in the use of PPE in health workers at RSUD Banjarbaru the results of the Chi-square statistical test obtained a value (p-value = 0.0001) (Apriluana et al., 2016).



Fridalni & Rahmayanti (2020) with the results that there is an influence of knowledge on the behavior of nurses in the use of PPE. The results of this study with research conducted by Zaki et al., (2018) there is a relationship between knowledge and the use of PPE. The knowledge variable was also studied by Fitriani et al., (2019) but in Fitriani's research, she tried to find out the effect of knowledge on attitudes in the use of PPE on nurses in taking action. The results of the research by Fitriani et al., (2019) are that there is an influence of knowledge on nurses' attitudes, where there are 87 respondents who have high knowledge (58.4%) while those with low knowledge are 62 respondents (41.6%).

Research conducted by Maramis et al., (2019) related to the relationship between knowledge and the use of PPE. Research conducted by Iriani (2019) regarding the relationship between knowledge and the level of nurse compliance in using PPE is significantly related. However, the results of this study are not in line with the research conducted by Mariana et al., (2018); Putri et al., (2018); Astuti et al., (2018). The three articles stated that there was no influence of knowledge on the behavior and compliance of nurses in using PPE. If the nurse has good knowledge but still has a sense of laziness, then the nurse does not use PPE and someone who has good knowledge tends to underestimate and ignore certain rules (Iskandar & Samauna, 2022).

Supported by research on the relationship between nurses' attitudes and adherence to using Personal Protective Equipment according to Standard Operating Procedures (SOP) in injection procedures in the inpatient room at Brendan Hospital, Pekalongan City with  $p$ -value = 0.019 ( $p < 0.05$ ) (Maliangkay et al., 2021). In line with the research on Factors Affecting Nurse Compliance in Applying Standard Precautions in Government Hospitals in Yogyakarta with the results of  $P$  value = 0.0001  $< 0.05$  (Sagita, 2019).

Good motivation for nurses' compliance with the use of PPE is driven by the intrinsic and extrinsic motivation of nurses where nurses must comply with the use of PPE every time they carry out their nursing care to avoid disease transmission, especially in the Covid-19 pandemic era.

This shows the important role of hospital involvement in providing and maintaining the availability of tools in every nursing room to support workplace safety and security for nurses. Guaranteeing the availability of intensive equipment is the responsibility of the hospital in allocating funds and also managing hospital operations, including the role of controlling the availability of personal protective equipment for nurses against the use of personal protective equipment when taking action.

The Standard Operating Procedure (SOP) is a written document that contains detailed, step-by-step, and systematic work procedures, so that it will have an impact on nurse compliance in providing nursing services, in addition to the socialization of SOPs that are carried out on an ongoing basis.

### **Multivariate Analysis**

The results of the multivariate analysis conducted with multiple logistic regression showed that the most influential variable on nurses' adherence to the use of PPE is knowledge with a  $p$ -value of 0.008 with an OR (exp B) of 0.211 (0.066 – 0.0668).

The results of this study are alignment with Septiani (2018) which states that 76.9% have a level of knowledge about safe behavior in the good category. Supported by research Maliangkay et al., (2021) with the chi-square statistical test design, the probability value of  $p$ -value = 0.001 is smaller than the value of = 0.05 ( $p < 0.05$ ), and it can be concluded that there is a relationship between nurses' knowledge and compliance with using Personal

Protective Equipment according to Standard Operating Procedures (SOP) at Noonan Hospital.

With so much information from various media as well as various seminars, workshops, and training in the era of the COVID-19 pandemic, this has led to an increase in nurses' knowledge of situations and conditions related to disease transmission, especially COVID-19, including fear or concern about being infected, encouraging nurses to be more obedient in using PPE in every provision of nursing care in hospital health service facilities.

## CONCLUSION

Multiple logistic regression analysis showed that the most influential variable on nurses' adherence to the use of APD was knowledge.

## SUGGESTIONS

Improving the competence of nurses through training, seminars, and workshops must be carried out following the improvement of science and technology in the health sector, including various diseases that develop with various mutations. Hospital management must provide various medical devices, especially Personal Protective Equipment (PPE) following what is needed in the provision of health services, especially nursing care.

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