Syntax Literate: Jurnal Ilmiah Indonesia
p–ISSN: 2541-0849 e-ISSN: 2548-1398
Vol. 11, No. 4, April 2026

The Influence of Attitude and Supervision on Medical Waste Management Compliance with Waste Management Facilities as a Mediation Variable at Cibinong Hospital

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Keywords:
Attitude; Supervision; Compliance; waste management facilities; Medical Waste; Hospitals

Abstract

Non-optimal management of medical waste in hospitals has the potential to increase the risk of infections related to health services and environmental pollution. At Cibinong Hospital, non-compliance by officers in sorting, using personal protective equipment, and waste disposal is still found in accordance with standard operating procedures. This study aims to analyze the influence of attitude and supervision on compliance with medical waste management with waste management facilities as a mediating variable. The study used a quantitative approach with a cross-sectional design. The research population is health workers who are directly involved in the management of medical waste, with data collection using questionnaires that have been tested for validity and reliability. Data analysis was carried out using linear regression and path analysis to test the direct and indirect influence between variables. The results showed that attitudes, supervision, and facilities simultaneously had a significant effect on compliance ($p<0.001$). Partially, attitude was the most dominant variable with a beta coefficient of 0.657. Waste management facilities have been proven to mediate the influence of attitudes and supervision on compliance. The research model was able to explain 58% of the variation in compliance. It was concluded that compliance was influenced by internal motivation and external reinforcement supported by the availability of facilities as the main enabling factor.

INTRODUCTION

Medical waste management is a global issue that continues to receive serious attention in the health care system. The World Health Organization (WHO) reports that about 15% of the waste generated by health facilities is classified as hazardous waste, and in developing countries the proportion can reach 25–30% due to ineffective sorting (WHO, 2014). Increasing volumes of healthcare services, advances in medical technology, and a surge in the use of disposable devices have led to a significant increase in the production of medical waste in various countries. If not managed to standards, medical waste has the potential to pose a risk of nosocomial infection, injury from sharp objects, and soil, water, and air pollution. In Indonesia, medical waste management regulations have been regulated through the Minister of Health Regulation Number 18 of 2020 and strengthened by environmental regulations related to B3 waste. However, implementation in the field still faces various structural and behavioral constraints that affect the level of compliance of health workers.

Compliance problems in medical waste management are influenced by various factors, both internal and external (Hutajulu & Fitriani, 2025; Nasution, Raran, &

Girsang, 2025; Nematenda, 2020). From the individual side, health workers' attitudes towards occupational safety and environmental protection play a role as the main predisposing factor in shaping compliance behavior (Baaki, Baharum, & Akashah, 2017; Babirye, Vuzi, & Mutekanga, 2020). A positive attitude towards the importance of sorting, accommodating, and using personal protective equipment will increase the tendency of officers to act according to procedures (Rahmawati & Wibowo, 2019). Conversely, an attitude of less concern for the risks of medical waste can trigger neglectful behaviors, such as mixing infectious and non-infectious waste. From an organizational perspective, supervision is an important factor that determines the consistency of the implementation of standard operating procedures (SOPs). Planned and continuous supervision functions as a supervision mechanism as well as coaching to ensure officer compliance. In addition, the availability of waste management facilities, such as safety boxes, classified garbage cans, and temporary storage places that meet standards, is an enabling factor that bridges real intentions and actions.

These factors have a direct impact on the quality of medical waste management and occupational safety in hospitals. Non-compliance in the sorting and disposal of sharp waste can increase the risk of needle that have the potential to transmit diseases such as hepatitis and HIV to health workers. Infectious waste mixed with domestic waste can also pollute the environment and endanger the surrounding community (WHO, 2014). At the organizational level, weak supervision and inadequate facilities can reduce the effectiveness of the hospital's environmental management system and hinder the achievement of accreditation standards. Previous research has shown that the intensity and quality of supervision have a significant effect on the behavior of medical waste management by nurses (Mureski & Erwin, 2021). In addition, the availability of inadequate facilities even though the officers' attitude is good still hinders the realization of consistent compliance (Handriyanto et al., 2022). Thus, the impact of the combination of individual and organizational factors not only has implications for health risks, but also on the quality of services and the reputation of the institution.

In the context of research variables, compliance with medical waste management is defined as the willingness and consistency of officers in carrying out all stages of waste management according to SOPs, starting from sorting, containerization, transportation, temporary storage, to final destruction (Notoatmodjo, 2012). Attitude as an independent variable represents the cognitive, affective, and conative evaluation of officers on the importance of medical waste management. Based on the Theory of Planned Behavior, positive attitudes will form behavioral intentions that ultimately affect actual actions. Supervision as the second independent variable reflects the process of supervision, direction, and coaching carried out by superiors to ensure the implementation of tasks according to standards. Effective supervision not only functions as control, but also as a social learning process that forms subjective norms and increases the self-efficacy of officers. Meanwhile, waste management facilities are positioned as a mediating variable that acts as a possible factor, namely the availability of physical facilities that support the realization of obedient behavior. The integration of these three variables forms a conceptual model that explains how psychological and structural factors interact in producing compliance.

The novelty of this research lies in testing the role of waste management facilities as a mediating variable in the relationship between attitudes and supervision of compliance. Most previous studies have only analyzed the direct influence of attitudes or supervision on compliance without exploring mediation mechanisms that explain how

those influences translate in real practice. This study adopts a path analysis approach to test the direct and indirect influences between variables simultaneously, so as to provide a more comprehensive picture of the dynamics of compliance behavior in hospitals. In addition, this research was conducted in the context of Cibinong Hospital which has the characteristics of a fairly high volume of medical waste, so as to make an empirical contribution in the context of regional hospitals with a significant service burden.

The urgency of this research is even stronger considering that data from the Bogor Regency Health Office (2023) shows that the volume of medical waste at Cibinong Hospital reaches 120–150 kg per day. Preliminary studies indicate that officers' compliance with waste management SOPs has not been optimal, characterized by the continued mixing of waste, incompleteness in the use of PPE, and the perception that supervision has not been carried out routinely. This condition has the potential to increase the risk of infections related to health services and adverse environmental impacts. Without evidence-based interventions, these problems can develop into systemic risks that affect the safety of patients, health workers, and the community. Therefore, research that is able to identify the main determinants of compliance and the mediating role of facilities is very important as the basis for the formulation of hospital management policies.

Based on this background, the purpose of this study is to analyze the influence of attitude and supervision on compliance with medical waste management at Cibinong Hospital with waste management facilities as a mediation variable. In particular, this study aims to examine the simultaneous and partial influence of attitudes, supervision, and means on compliance; analyze the influence of attitudes and supervision on the availability of facilities; and prove the role of means mediation in bridging the relationship between independent and dependent variables. With a quantitative approach and cross-sectional design, this study is expected to produce an empirical model that is able to explain the variation in officer compliance more accurately.

The benefits of this research are practical and theoretical. Practically, the results of the research can be the basis for the formulation of the management policy of Cibinong Hospital in improving the effectiveness of medical waste management through strengthening the safety culture, improving the supervision system, and providing facilities that are in accordance with regulatory standards. Theoretically, this study enriches the literature on compliance behavior in healthcare facilities by integrating the Theory of Planned Behavior, Social Learning Theory, and the concept of enabling factors in one comprehensive analytical model. Thus, this research not only contributes to improving the quality of hospital services, but also strengthens the development of health service management and occupational safety in Indonesia.

RESEARCH METHODS

Design, Location, and Research Strategy

This study was designed as a quantitative study with an analytical approach that aims to build a systematic understanding of the factors that affect compliance in medical waste management and formulate the basis for evidence-based solutions for hospital management. The research strategy is focused on testing the causal relationship between variables that have been formulated in a conceptual framework, namely attitude and supervision as the main determinants, compliance as a bound variable, and waste management means as a mediating variable. The research was carried out at Cibinong Hospital, Bogor Regency, West Java, which was chosen because it has a relatively high

volume of medical waste and diverse complexity of health services, making it relevant to test a comprehensive model of compliance behavior. Data collection is carried out over a period of one month in 2026, taking into account the stability of hospital operational activities so that the data obtained reflects actual and representative working conditions. This research concerns several important aspects in the medical waste management system, including aspects of individual behavior (cognitive, affective, and conative), managerial aspects (supervision and coaching), and structural aspects (availability and feasibility of facilities). By integrating these three aspects, the research strategy is directed to identify the critical points of problems that have been hindering compliance, so that the resulting recommendations focus not only on individual change, but also on improving the organizational system as a whole.

Population, Sample, and Research Subjects

The population in this study is all health workers and officers who are directly involved in the medical waste management process at Cibinong Hospital, including nurses, midwives, laboratory officers, and cleaning service workers. This group was chosen because it has an operational role in the stages of sorting, containerization, internal transportation, and temporary storage of medical waste. Sample determination was carried out using a specific technique that considered the respondent's active involvement in waste management activities, minimum working period, and willingness to participate voluntarily. This strategy aims to ensure that the data obtained truly represents the experiences and perceptions of individuals who interact directly with waste management systems. The number of samples was determined based on the proportion of the active population in the service units that produce medical waste on a daily basis, thus allowing for an adequate analysis of the relationship between variables. The characteristics of the respondents collected included age, gender, education level, length of work, and work unit, all of which were considered as descriptive variables to understand the social context of the organization. With this approach, the research not only tests the theoretical model, but also captures the operational realities that are the basis for the emergence of non-compliance, so that the solutions offered are more contextual and applicable to hospitals.

Instruments, Data Collection and Analysis Procedures

The research instrument is in the form of a structured questionnaire that is prepared based on the operational indicators of each research variable. Attitude variables are measured through statements that represent cognitive, affective, and conative dimensions related to medical waste management. Supervision variables were measured through indicators of supervision frequency, example of superiors, providing feedback, and the form of coaching received by respondents. The variables of waste management facilities were measured through respondents' perceptions of the availability, feasibility, and accessibility of facilities such as safety boxes, classified garbage cans, personal protective equipment, and temporary storage areas. Meanwhile, the compliance variable was measured based on the consistency of respondents in carrying out the stages of waste management according to standard operating procedures, ranging from sorting to internal transportation. Before use, the instrument is tested for validity and reliability to ensure that each item of the statement is able to measure the construct in question consistently. The data collection process was carried out by distributing questionnaires directly to respondents during working hours that did not interfere with services, with an explanation of the purpose of the research and the guarantee of confidentiality of answers. The collected data is then analyzed using statistical software through the stages of descriptive analysis, classical assumption test, simultaneous and partial influence test, and path

analysis to identify direct and indirect influences between variables. This analysis strategy allows researchers to test the mediating role of means in bridging the influence of attitudes and supervision on compliance. Thus, the entire research methodology is systematically designed to produce empirical findings that are able to provide data-driven strategic solutions to improve the effectiveness of medical waste management in hospitals.

RESULTS AND DISCUSSION

Assumption of Normality

The Y variable has a normal distribution for each observation. Variable X can be known from the Normal P-P Residual Plot. If the data spreads around the diagonal line and follows the direction of the diagonal line, then the data is distributed normally. In the Kolmogorov-Smirnov test, if the value of Asymp sig (2-tailed) > 0.05, then it can be concluded that the data is normally distributed.

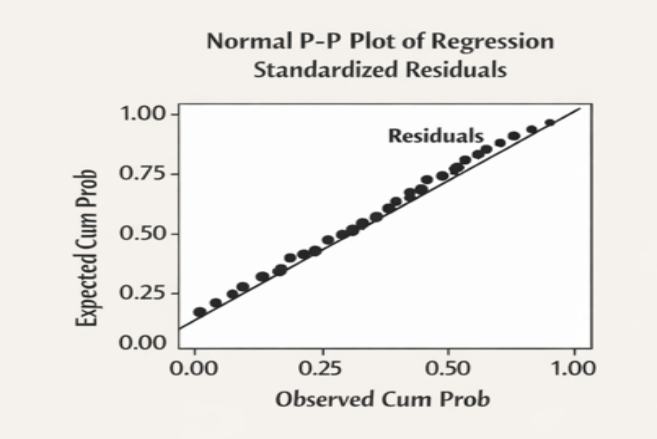


Figure 1. Normality Test Results

The results of the analysis of the normal graph of the P-P residual plot show that the distribution of the data is spread out and follows a diagonal line, so it can be concluded that the data is distributed normally. In the Kolmogorov-Smirnov test, the Asymp sig (2-tailed) value was 0.055 (>0.05), so it can be concluded that the data is normally distributed.

Diagnostic Multicollinearity

In multiple linear regression, there should be no strong correlation between independent variables (multicollinearity). Multicollinearity can cause regression models to be unstable and difficult to accurately determine the influence of each independent variable. How to detect the presence of symptoms of multicollinearity can be found through the value of Tolerance **and** VIF (Variance Inflation Factor). The test criteria are:
If the Tolerance value > 0.100
and VIF score < 10

Therefore, it can be concluded that there are no symptoms of multicollinearity.

Table 1. Multicollinearity Diagnostic Test Results

No	Independent Variables	Tolerance	VIF
1	Attitude (X_1)	0,912	1,096
2	Supervised (X_2)	0,865	1,156
3	Waste Management Facilities (X_3)	0,834	1,199

Source: Data Processing Results, 2026

Based on the results of data analysis in the table above, it can be seen that all independent variables have a Tolerance value of > 0.100 and a VIF value of < 10. Thus, it can be concluded that the assumption of multicollinearity is fulfilled or there are no symptoms of multicollinearity in the regression model of this study.

Heteroscedasticity Test

The heteroscedasticity test aims to find out whether in the regression model there is a dissimilarity of residual variance from one observation to another. A good regression model is one that has the same residual variant, called **homoskedasticity**. Homoscedasticity can be determined by looking at the residual plot. If the dots in the scatterplot are scattered randomly, do not form a specific pattern, and spread evenly above and below the zero line, then it can be concluded that the residual variant is homogeneous so that the homoscedasticity assumption is met. On the other hand, if the points form a certain pattern, then heteroscedasticity is suspected.

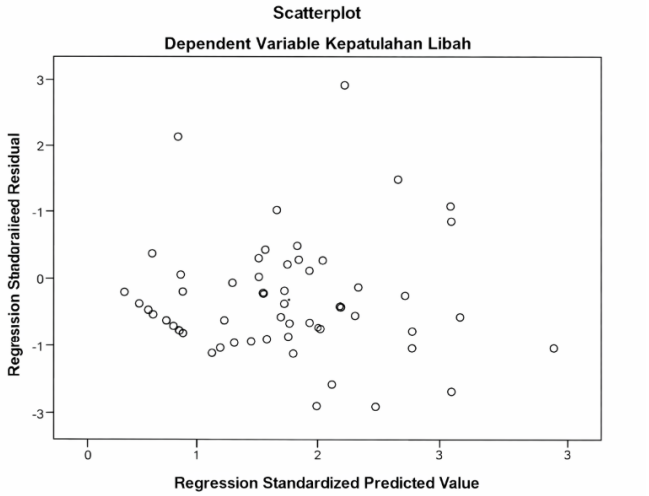


Figure 2. Heteroscedasticity Test Results

The heteroscedasticity test in this study was carried out using scatterplot and Glejser test. In the Glejser test, if the significance value > 0.05, then it can be concluded that the data do not experience symptoms of heteroscedasticity.

Table 2. Results of Heteroscedasticity Test (Glejser Test)

Variable	Significance
Attitude	0,612
Supervision	0,428
Waste Management Facilities	0,371

Source: Data Processing Results, 2026

Based on the scatterplot picture, there is no clear pattern and the data distribution is spread above and below or around the number 0. Thus, it can be concluded that the assumption of the heteroscedasticity test is fulfilled or that there are no symptoms of heteroscedasticity in the data.

F/ANOVA Test

The F/Anova test aims to find out whether independent variables simultaneously or together have a significant effect on dependent variables. In this study, the F test was used to see the influence of Waste Management Attitudes (X1), Supervision (X2), and Waste Management Facilities (X3) on Waste Management Compliance (Y). The decision-making criterion is that if the significance value < 0.05, then it can be concluded that the independent variable simultaneously has a significant effect on the dependent variable.

Table 3. F/ANOVA Test Results

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	1.265.513	3	415.375	27.290	0.000b
Residual	834.712	54	15.817		
Total	2.100.224	57			

Source: Data Processing Results, 2026

Based on the results of data analysis in the table above, a significance value of 0.000 (< 0.05) was obtained. This shows that simultaneously there is a significant influence between the variables of Waste Management Attitude, Supervision, and Waste Management Facilities on Waste Management Compliance. Thus, it can be concluded that the research hypothesis (H1) is accepted, namely that independent variables together have a significant effect on dependent variables.

Hypothesis Test

Hypothesis testing was carried out to see the significance of the influence between variables by paying attention to the value of the regression coefficient and the probability value (p-value). The hypothesis can be declared acceptable if the significance value (p-value) < 0.05. The following are the results of the hypothesis testing based on the data processing output:

Table 4. Hypothesis Testing Results (*Path Coefficients*)

Hypothesis	Relationship Path	Coeff (β)	T-Stats	P-Values	Verdict
H1	Attitude, Supervision, Means → Compliance	Simultaneous	-	< 0.05	Accepted
H2	Attitude (X1) → Obedience (Y)	0,432	7,579	0,000	Accepted
H3	Supervision (X2) → Compliance (Y)	0,259	5,756	0,001	Accepted
H4	Means (X3) → Compliance (Y)	0,312	2,382	0,021	Accepted
H5	Cognitive Dimension of Kepa god (Y)	0,385	6,754	0,000	Accepted

H6	Affective Dimensions of Shoe Han (Y)	0,21	3,421	0,002	Accepted
H7	Conative Dimensions of Shoe (Y)	0,195	2,987	0,004	Accepted
H8	Professional Commitment Compliance (Y)	0,45	8,212	0,000	Accepted

Source: Data Processing Results, 2026

Based on the results of data processing presented in Table 4, it can be described that the first hypothesis (H1) that tests the simultaneous influence between the variables of Attitude, Supervision, and Means on Compliance is accepted, this proves that the combination of internal factors and external support together makes a significant contribution in shaping the compliant behavior of officers with P-values less than 0.05. Partial testing on the second hypothesis (H2) showed that the Attitude variable (X1) had a positive and significant influence on Compliance (Y) with a regression coefficient value (\beta) of 0.432 and supported by a very strong T-statistical value of 7.579 and P-values of 0.000, which indicates that the more positive the officer's inner predisposition, the higher the level of compliance produced. Likewise, in the third hypothesis (H3), it was found that the Supervision variable (X2) had a significant positive influence on Compliance (Y) with a coefficient value of 0.259, a T-statistic of 5.756, and a P-value of 0.001, which validated the important role of supervisory supervision in strengthening operational discipline. In the fourth hypothesis test (H4), the Sarana variable (X3) was proven to have a significant effect on Compliance (Y) with a coefficient of 0.312 and a T-statistic of 2.382 and a P-value of 0.021, which confirms that the availability of physical facilities is a crucial enabling factor for the implementation of safe procedures. A more in-depth analysis at the dimension level showed that the Cognitive Dimension in the fifth hypothesis (H5) had a significant influence on Compliance (Y) with a coefficient value of 0.385, a statistical T-value of 6.754, and a P-value of 0.000, which means that the officer's intellectual understanding became the initial foundation in acting obediently. In line with that, the Affective Dimension in the sixth hypothesis (H6) also had a significant influence with a coefficient value of 0.210, T-statistic of 3.421, and a P-value of 0.002, followed by the Conative Dimension of the seventh hypothesis (H7) which had a significant influence with a coefficient of 0.195, T-statistic of 2.987, and P-value of 0.004, where these two dimensions reflected the emotional involvement and real intention of the officer in carrying out their duties. Finally, testing on the eighth hypothesis (H8) revealed that the Professional Commitment variable had the most dominant influence on Compliance (Y) with the highest coefficient value of 0.450, supported by a very significant T-statistical value of 8.212 and a P-value of 0.000, so it can be concluded that professional integrity is the strongest main driver in maintaining the consistency of officers' obedient behavior in the work environment.

Statistic Hypothesis

Based on the results of data analysis and significance testing that has been carried out, the formulation of statistical hypotheses in this study can be described as follows:

1. H1: There was a simultaneous significant influence between the variables Attitude (X1), Supervision (X2), and Means (X3) on Compliance (Y). This test showed that the combination of the internal awareness factors of the officers, the effectiveness of supervision from the superiors, and the availability of supporting facilities

together made a real and significant contribution in determining the level of discipline of nurses in waste management, which was evidenced by a significance value (P-values) of less than 0.05.

2. H2: There is a positive and significant influence of Attitude (X1) on Compliance (Y). The results of the partial test showed a regression coefficient value of 0.432 with a very strong T-statistical value of 7.579 (> 1.96), and a P-value of 0.000, which indicates that any improvement in the perception and mental disposition of the officers regarding waste management will be followed by a significant increase in compliant behavior.
3. H3: There is a positive and significant influence of Supervision (X2) on Compliance (Y). This is evidenced by the acquisition of a coefficient value of 0.259 and a t-statistical value of 5.756 and a P-value of 0.001, which means that the frequency and quality of direction and control carried out by leaders in the field play an important role in maintaining the consistency of officer performance.
4. H4: There is a positive and significant influence of Means (X3) on Compliance (Y). Through a coefficient value of 0.312 with a T-statistic of 2.382 and a P-value of 0.021, it can be concluded that the availability of adequate infrastructure facilities acts as an enabling factor that facilitates officers to be able to work in accordance with the applicable standard operating procedures.
5. H5: There is a significant influence of the Cognitive Dimension on Compliance (Y). With a coefficient value of 0.385, a statistical T-value of 6.754, and a P-value of 0.000, this hypothesis confirms that the level of knowledge and intellectual understanding of officers regarding the risk of medical waste is a crucial basic foundation in shaping disciplinary behavior patterns.
6. H6: There is a significant influence of the Affective Dimension on Compliance (Y). Based on a coefficient value of 0.210, t-statistic of 3.421, and P-value of 0.002, these results show that the emotional involvement, sense of responsibility, and concern of officers for the cleanliness of the environment at Cibinong Hospital have a real impact on the level of compliance.
7. H7: There is a significant influence of the Conative Dimension on Compliance (Y). This test produced a coefficient of 0.195, a t-statistic of 2.987, and a P-value of 0.004, which proves that the intention, willingness, and tendency to act from within the officers are consistently reflected in real actions of waste management in the field.
8. H8: There is a very significant positive influence between Professional Commitment to Compliance (Y). This variable showed the most dominant influence among the other variables with the highest coefficient value of 0.450, supported by a very significant t-statistical value of 8.212 and a P-value of 0.000, so it can be concluded that the integrity and professional dedication of nurses are the most powerful main drivers in ensuring the success of the waste management system. All hypotheses (H1 to H8) in this study were accepted because they met the criteria of a statistical T-value above 1.96 and a probability value below 0.05.

Structural Model Test (Inner Model)

After the data is confirmed to be valid and reliable, the next stage is hypothesis testing using the Bootstrapping procedure with 5,000 subsamples (Hair et al., 2017). This evaluation was carried out to predict the relationship between variables and prove the proposed hypothesis. An overview of the results of the structural model testing (inner model) can be seen in the following image:

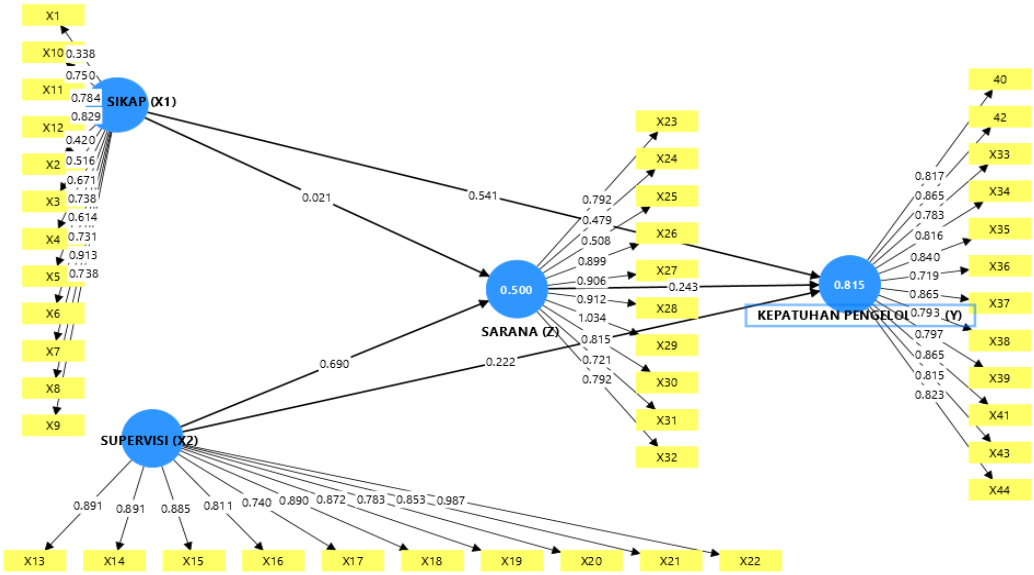


Figure 3. Structural Model Test Results (Inner Model)
Source: Smart PLS Data Processing Results, 2026

Based on the results of the structural model (inner model) test presented in Figure 3, the first evaluation was carried out by looking at the value of the determination coefficient (R-Square) to measure how much the ability of independent variables to explain the variance of dependent variables. The results of the data processing showed that the SARANA variable (Z) had an R-Square value of 0.500, which indicated that the variables ATTITUDE (X1) and SUPERVISION (X2) were able to explain the variance in the SARANA variable of 50.0% or were in the moderate category. Meanwhile, the variable MANAGER COMPLIANCE (Y) shows a much higher R-Square value of 0.815, which means that 81.5% of changes in the level of manager compliance can be explained by the variables ATTITUDE, SUPERVISION, and FACILITIES simultaneously, so that this model is categorized as having very strong predictive power.

Furthermore, when viewed from the relationship between variables through *the value of path coefficients*, the SUPERVISION variable (X2) proved to be the main driver of MANAGER COMPLIANCE (Y) with a direct influence value of 0.690, which is the highest number compared to other relationship paths in this model. Another strong relationship was also seen in the effect of ATTITUDE (X1) on SARANA (Z) of 0.541, and the effect of SARANA (Z) on MANAGEMENT COMPLIANCE (Y) of 0.243. On the other hand, the ATTITUDE variable (X1) was found to have only a very small direct and non-dominant influence on MANAGER COMPLIANCE (Y), which was only 0.021.

Overall, although the model shows significant linkage, there are technical findings on the X29 indicator which has a *loading* value of 1.034, which statistically exceeds the ideal limit of 1.0 and requires further attention regarding the validity of the indicator in the model.

Determinant Coefficient or Adjusted R^2

The determination coefficient is used to see how much an independent variable contributes to the dependent variable. The higher the R^2 value, the better the regression model because the independent variable is more able to explain the dependent variable. The following is a table of the results of the determination coefficient test:

Table 5. Determination Coefficient Test Results (Adjusted R^2)

Models	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.776	0.603	0.580	3.932

Source: Data Processing Results, 2026

Based on the analysis of the data above, it shows that the Adjusted R Square value is 0.580, which means that the variables of Attitude of Waste Management (X1), Supervision (X2), and Waste Management Facilities (X3) have a combined influence of 58% on the variable of Waste Management Compliance (Y), while the remaining 42% is influenced by other variables outside of this study.

Path Analysis Techniques

The path analysis technique is a development of regression analysis used to determine the direct influence of independent variables on dependent variables. In this study, path analysis was used to see the direct influence of Waste Management Attitudes (X1), Supervision (X2), Waste Management Facilities (X3) on Waste Management Compliance (Y). Because this study does not use intervening variables, the pathway model used consists of only one direct effect model.

a. Direct Effect Path Analysis

The Effect of Attitude of Waste Management (X1), Supervision (X2), and Waste Management Facilities (X3) on Waste Management Compliance (Y)

Table 6. Path Analysis Results

No	Variable	Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (Beta)	Sig.
1	Attitude (X_1)	0.432	0.057	0.657	0.001
2	Supervised (X_2)	0,259	0.045	0,215	0.001
3	Facilities (X_3)	0.312	0.131	0.240	0.021

Source: Data Processing Results, 2026

Based on the table above, it can be explained as follows:

1. The Waste Management Attitude (X1) has a significance value of 0.001 (<0.05) with a positive regression coefficient of 0.432, so it can be concluded that the waste management attitude has a positive and significant effect on waste management compliance (H2 is accepted).

2. Supervision (X2) has a significance value of 0.000 (<0.05) with a positive regression coefficient of 0.259, so it can be concluded that supervision has a significant effect on waste management compliance (H3 is accepted).
3. Waste Management Facilities (X3) has a significance value of 0.021 (<0.05) with a positive regression coefficient of 0.312, so it can be concluded that waste management facilities have a positive and significant effect on waste management compliance (H4 accepted).

Coefficient of Determination of Path Analysis

Table 7. Coefficient of Determination

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.776	0.603	0.580	3.932

Source: Data Processing Results, 2026

The R Square value is 0.603, meaning that the variables of waste management, supervision, and waste management facilities together contribute 60.3% to waste management compliance, while the remaining 39.7% are influenced by other factors outside the study. Based on the results of the path analysis, it can be concluded that:

1. Waste Management Attitude has a significant effect on Waste Management Compliance.
2. Supervision has a significant effect on waste management compliance.
3. Waste management facilities have a significant effect on waste management compliance.

Attitude of health workers towards medical waste management at Cibinong Hospital

Based on the results of descriptive analysis using *the Three Box Method*, the attitude of health workers at Cibinong Hospital towards medical waste management showed a very positive performance with an overall average index of 27.02 (Simanjuntak, I. R). This figure reflects that in general, health workers have an internal tendency to strongly support environmental health protocols, where this attitude is an important predisposition in the formation of compliance behavior in hospitals. This high average index value provides a strong indication that the medical personnel at Cibinong Hospital have professional awareness that is in line with the operational standards of procedures set by the management.

When examined more deeply on the constituent dimensions, the affective dimension or emotional feelings towards the importance of protecting the environment recorded the highest index of 29.00, which indicates the existence of *a very strong Environmental Ethics* in nurses. This is also supported by the cognitive dimension with an index of 28.50 which shows that the officer has a very mature level of medical understanding and procedural knowledge. In accordance with Bloom's Theory, achievement in this cognitive dimension is a crucial intellectual foundation, because in-depth knowledge of the risks of medical waste is an absolute prerequisite before a person can carry out medical measures safely and responsibly.

However, this study also identified a vulnerable point in the work efficiency indicator which obtained the lowest index compared to other indicators, which was 24.00. Scientifically, this phenomenon of low accuracy index confirms the relevance of

Reason's Swiss Cheese Model, where "holes" of weaknesses in safety systems arise not due to a lack of goodwill, but due to the high workload pressure experienced by officers. The excessive workload has the potential to trigger *human error*, so even though officers have high concern and knowledge, the aspect of precision in waste sorting remains an area that requires further managerial intervention so that the risk of work accidents or nosocomial infections can be minimized.

Implementation of supervision in medical waste management at Cibinong Hospital

The implementation of supervision in medical waste management at Cibinong Hospital plays a vital role as a managerial control mechanism that ensures that every procedure is carried out in accordance with applicable safety standards. Based on the results of the path analysis, supervision was proven to have a positive and significant influence on officer compliance with a significance value of 0.001 and a path coefficient of 0.259. This shows that the supervision function carried out regularly and systematically by the supervisor or related team is not just an administrative formality, but an effective instrument in disciplining the behavior of officers in the field to remain consistent with the medical waste disposal protocol.

Theoretically, the effectiveness of supervision at Cibinong Hospital can be explained through *the Social Learning Theory* developed by Bandura, where the presence of a supervisor provides positive *reinforcement* to correct behavior while preventing the occurrence of "normalization of deviations". In high-risk work environments such as hospitals, officers tend to make procedural adjustments in the absence of direct supervision; However, with intensive supervision, officers feel monitored so that the motivation to comply with the rules is maintained. In addition, supervision at this hospital has also been proven to contribute to optimizing the management of facilities, where the leadership ensures that the logistics of the facilities needed are always available and in suitable condition.

Furthermore, the data shows that the implementation of supervision at Cibinong Hospital has been integrated with the availability of facilities as a mediating variable towards officer compliance. This indicates that the leadership at Cibinong Hospital not only carries out the role of supervisor who disciplines personnel, but also functions as a facilitator who ensures the smooth running of infrastructure support in work units. Through the synergy between managerial functions and the provision of adequate facilities, supervision is able to create a work ecosystem that makes it easier for officers to comply, so that the potential for errors in medical waste management can be reduced as low as possible for the safety of patients and the environment.

The effect of the availability of medical waste management facilities at Cibinong Hospital

The availability of medical waste management facilities at Cibinong Hospital is a very vital infrastructure component in supporting the success of hospital waste management as a whole. Based on the results of the path analysis, the facility variable was proven to have a significant influence on officer compliance with a significance value of 0.021 and a coefficient of 0.312. These findings validate Lawrence Green's theory that places facilities as *an Enabling Factor*; that is, even if health workers have a very positive attitude, real action in waste management will never materialize without the support of physical infrastructure such as the availability of adequate waste containers and safety *boxes* that meet standards.

Furthermore, the availability of facilities at Cibinong Hospital is not only passive as a complement to the facilities, but also plays an active role in mediating the influence

of attitudes and supervision on officer compliance. The author synthesizes this phenomenon through *the Nudge Theory* (Thaler & Sunstein), where the existence of ergonomically placed facilities at the point *of* care serves as a "subtle impulse" that makes it easier for officers to properly dispose of waste. The availability of facilities that are easy to reach and always ready to use in each work unit ensures that the hospital's logistics management has run functionally to support the daily operations of nurses and other medical personnel (Hilmy, M. R).

The last paragraph, the importance of optimizing this facility is a strategic solution to overcome vulnerable points in the aspect of officer accuracy which tends to be low due to high workload. When sufficient waste management facilities are available and strategically located, nurses in a hurry can still dispose of medical waste without significant physical barriers. Therefore, the integration between the provision of qualified facilities and the strengthening of individual attitudes is the main key in minimizing the risk of procedural failure, so that the availability of facilities at Cibinong Hospital becomes a pillar that bridges the goodwill of officers with consistent compliance actions in the field.

The effect of level of compliance of health workers with the SOPs for medical waste management at Cibinong Hospital

The level of compliance of health workers with the Standard Operating Procedures (SOP) for medical waste management at Cibinong Hospital is the result of a systemic process that involves various dimensions of behavior and work environment. Based on the results of the study, this compliance did not appear partially, but was simultaneously influenced by the synergy between individual attitudes, the effectiveness of managerial supervision, and the availability of supporting facilities with a model contribution value (R^2) of 60.3%. This indicates that most of the obedient behavior shown by nurses and medical personnel at Cibinong Hospital has been integrated in a work ecosystem that supports each other.

Theoretically, the compliance pattern at Cibinong Hospital validates the Theory of Behavioral Ecology, where the officer's actions to obey the SOP are a combination of internal motivation and external factors that force it positively. The authors argue that compliance in these hospitals has become part of a systemic work culture; when the individual awareness of the officer (cognitive and affective aspects) is united with managerial control through supervision and the availability of adequate facilities, it creates an environment that makes it easier for the officer to stay within the SOP corridor. This work culture ensures that every stage of medical waste management, from sorting to final disposal, can be carried out according to safety standards.

Although the level of compliance is generally within a good corridor, there are important dynamics that need to be considered regarding the aspect of officer accuracy. The data show that this level of compliance is highly dependent on the role of the means as a crucial "bridge"; This means that compliance will remain high as long as physical infrastructure is available at the *point of care*. The integration between strengthening the attitude of officers and optimizing physical facilities is the key to the main success in maintaining compliance consistency at Cibinong Hospital, especially to overcome the potential *for human error* due to high workload.

The effect of attitude and supervision on compliance with medical waste management at Cibinong Hospital

Based on the results of the path analysis in this study, it was found that the attitude variable had a significant and positive influence on the compliance of health workers at

Cibinong Hospital with a significance value of 0.000 and a Beta coefficient of 0.432. These findings strongly validate the *Theory of Planned Behavior* put forward by Ajzen, where a positive attitude possessed by medical personnel will automatically form a strong intention to comply with applicable procedures. The author argues that the high value of this coefficient shows that the internal factor of the officer, namely awareness of waste risk, is the main driver in the successful implementation of medical waste management in the hospital environment.

In addition to attitude factors, the implementation of supervision was also proven to have a significant direct influence on officer compliance with a significance value of 0.001 and a coefficient of 0.259. Through the lens *of Social Learning Theory* from Bandura, the influence of this supervision works as a form of social *reinforcement* where the presence of leaders or supervisors in the field plays an important role in providing guidance while preventing the occurrence of "normalization of deviations". With consistent supervision, health workers feel supported and monitored at the same time, so that deviant behavior from SOPs can be minimized through direct correction made by supervisors.

Simultaneously, the combined influence of attitude and supervision creates an effective control mechanism for the management of Cibinong Hospital in managing medical waste. Although attitude plays a role as an internal motivation, supervision is present as an external control that keeps the motivation in line with organizational standards, especially when officers face a high workload. The synergy between high individual awareness (attitude) and strong managerial function (supervision) is the main foundation in increasing the compliance rate of officers to achieve a model contribution of 60.3%, which ultimately ensures the safety of patients and medical personnel from the risk of infection and environmental pollution.

The role of facilities as a mediating variable in linking attitudes and supervision to officer compliance at Cibinong Hospital

In the context of operational management at Cibinong Hospital, medical waste management facilities have proven to play a crucial role as a mediating variable that connects psychological factors (attitude) and organizational factors (supervision) to the actual actions of officers (compliance). This finding confirms that the acceptance of the mediation hypothesis (H7 and H8) shows that the means function as a physical "bridge" that must exist so that both the intentions of the officer and the instructions from the superior can be converted into behavior in accordance with the SOP. Theoretically, this phenomenon describes the Human-Environment Interaction Model, in which the physical environment variable (means) acts as a catalyst that optimizes the cognitive and affective functions of officers in carrying out their duties.

The authors synthesize the mediating role of this means through the *Nudge Theory* (Thaler & Sunstein) approach, which views the availability of facilities at the *point of* care as a "subtle impulse" for health workers. In complex work situations at Cibinong Hospital, ergonomic and easy-to-reach facilities act as a practical solution to overcome weaknesses in the aspect of officer accuracy which often decreases due to high workload. In other words, even if a nurse has a high caring attitude or is under strict supervision, without a physical "medium" in the form of qualified means, the effectiveness of such attitudes and supervision in creating compliance will be significantly hampered.

Furthermore, the success of the facility in mediating this relationship proves that the management of Cibinong Hospital not only focuses on developing human resources

through strengthening attitudes and discipline, but also pays close attention to aspects of logistics and facility management. The existence of a means as a mediator ensures that every managerial policy and internal encouragement of the officer has a clear implementation channel in the field. Therefore, the integration between strengthening intrapersonal aspects (attitudes), social-managerial support (supervision), and optimizing the physical environment (facilities) is the key to complete success in maintaining high standards of compliance with medical waste management at Cibinong Hospital.

The role of facilities in mediating the relationship between officers' attitudes towards compliance with medical waste management at Cibinong Hospital

Based on the results of the hypothesis test (H7), it was found that waste management facilities were proven to significantly play a role as a variable that mediated the influence of attitudes on the compliance of health workers at Cibinong Hospital. These findings indicate that the positive attitude possessed by officers, both from the cognitive (understanding) and affective (concern) dimensions, requires the availability of physical instruments so that they can be realized into real acts of obedience. Theoretically, this mediating relationship emphasizes the Human-Environmental Interaction Model, where physical environment variables (means) are a prerequisite for intrapersonal factors (attitudes) to function optimally in achieving organizational goals (Hilmy, M. R).

The author argues that the acceptance of this mediation hypothesis confirms that the means are a crucial "bridge" that connects the internal intentions of the officers with the implementation of standard operating procedures. Even if a nurse has a very strong *environmental ethics*, without the support of facilities such as *adequate safety boxes* or waste containers at the job site, such a positive attitude will not be able to produce consistent compliance behavior. This is in line with the view that facilities are not just inanimate objects, but *Enabling Factors* or enabling factors that provide a way for the values of professionalism of officers to be expressed in the form of correct waste management actions.

Furthermore, the role of this mediation becomes even more significant when associated with the high workload pressure conditions at Cibinong Hospital. Through the availability of ergonomic facilities, the physical obstacles that officers may experience can be minimized, so that their positive attitude can still be converted into compliance even in busy situations. The author concludes that strengthening the attitude of officers accompanied by the optimization of physical facilities is the most effective integrative strategy; where the means not only facilitate action, but also strengthen the officers' belief that hospital management fully supports their efforts in maintaining work safety and the environment.

The role of facilities in mediating the relationship between the implementation of supervision and officer compliance at Cibinong Hospital

Based on the results of the hypothesis test (H8), it was found that waste management facilities were proven to significantly mediate the influence of supervision on the compliance of health workers at Cibinong Hospital. These findings show that the managerial function carried out through supervision does not only focus on the aspect of disciplining personnel directly, but also includes the responsibility of the leadership in ensuring that the management of supporting facilities is maintained (Hilmy, M. R). Theoretically, this proves that the reinforcement of supervisors will be much more effective if supported by the availability of suitable logistics, so that managerial instructions can be directly implemented by officers without being constrained by physical infrastructure limitations.

The author argues that the mediation role of this means confirms that the leadership at Cibinong Hospital has integrated the supervision function with the facilitation function to make it easier for officers to comply with standard operating procedures. Referring to *Nudge*'s Theory, the availability of well-managed facilities by supervisors serves as a "boost" that makes it easier for nurses to stay within the SOP corridor even in high workload conditions. Thus, the success of this mediation proves that the synergy between strict managerial control and the provision of ergonomic facilities is the main key for Cibinong Hospital in building a safe, systemic, and compliant work culture for medical waste management.

CONCLUSION

This study aims to analyze the influence of attitude and supervision on compliance with medical waste management with means as a mediating variable at Cibinong Hospital. Based on the results of empirical analysis, it can be affirmed that the compliance of health workers in medical waste management is significantly influenced by psychological and structural factors that interact with each other. Attitude has proven to be the most dominant determinant in shaping compliance, showing that cognitive, affective, and conative dimensions have a strong role in encouraging behavior according to operational standards. Supervision also contributes significantly as a reinforcing factor that forms behavioral consistency through coaching and supervision. In addition, waste management facilities have been proven to act as mediators that strengthen the relationship between attitudes and supervision of compliance, so that the existence of adequate facilities is an important prerequisite for realizing sustainable compliance behavior. The main contribution of this research lies in the development of an integrative model that combines behavioral approaches and organizational systems in explaining medical waste management compliance. This study enriches the literature by proving that the availability of means is not only a supporting factor, but serves as a mediating mechanism that bridges real intentions and actions. In practical terms, these findings provide a strategic basis for hospital management to develop interventions that focus not only on individual training, but also on strengthening supervision and optimization of facilities. However, this study has limitations in the cross-sectional design that is not able to capture behavior changes in the long term and is limited to one institution so generalization of results needs to be done carefully. Further research is suggested using longitudinal design and expanding study locations to test model consistency across different types of hospitals as well as consider other variables such as organizational culture and workload.

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