

The Influence of Human Resources and Medical Equipment on the Implementation of Preeclampsia Protocols in the Perspective of Total Quality Management (TQM)

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ABSTRACT: The high incidence of preeclampsia in Indonesia, including cases reported at a Mother and Child Hospital in Tasikmalaya City, highlights the need to improve the quality of maternal and child health services. Although hospitals have implemented various efforts to prevent complications in the form of eclampsia and maternal death, the increasing number of preeclampsia cases demands an evaluation of the factors that support the successful implementation of preeclampsia treatment protocols. From the perspective of Total Quality Management (TQM), improving the quality of service is carried out through strengthening the competence of human resources and providing adequate medical equipment. This study aims to analyze the influence of human resources and medical equipment on the implementation of preeclampsia protocols with a Total Quality Management (TQM) approach. The study employed a quantitative approach with an explanatory research design. Data were collected through a questionnaire administered to 47 medical personnel at a Mother and Child Hospital in Tasikmalaya City and were analyzed using multiple linear regression with SPSS. The results of the study show that human resources and medical equipment have a positive and significant effect on the implementation of preeclampsia protocols, both partially and simultaneously. The determination coefficient value of 81.1% indicates that the variation in the implementation of preeclampsia protocols can be largely explained by human resources and medical equipment, while the rest is influenced by other factors outside the research model. The findings of this study show that improving the competence of medical personnel and optimizing medical equipment according to the standards of the Minister of Health Regulation Number 3 of 2020 supports the implementation of preeclampsia protocols as part of efforts to improve service quality through the Total Quality Management (TQM) approach.

KEYWORDS: Preeclampsia Protocol, Human Resources, Medical Equipment, Total Quality Management

I. INTRODUCTION

Preeclampsia is a hypertensive condition that occurs after pregnancy enters the age of 20 weeks, accompanied by the presence of protein in the urine or symptoms of damage to other organs, without any other cause that can explain it. Preeclampsia is a typical disorder of pregnancy related to impaired placental function and systemic inflammatory responses of the mother's body, which can trigger endothelial activation and blood clotting system (POGI, 2016). Preeclampsia is often the leading cause of obstetric complications that require intensive care, including the use of antihypertensive drugs, magnesium sulfate therapy, and strict monitoring of the mother's and fetal conditions. Maternal mortality due to preeclampsia and eclampsia is caused by a combination of medical and non-medical factors. A study by Khusen et al. (2012) showed that clinical factors such as gestational age <32 weeks, history of hypertension, low platelets, as well as complications such as bleeding, pulmonary edema, HELLP syndrome, and sepsis are the main causes of death. Meanwhile, research by Manuk et al. (2021) highlights that delays in decision-making to seek medical help due to low knowledge, lack of health insurance, and socio-economic conditions also exacerbate the risk of death. In conclusion, prompt medical treatment and education and equitable access to health services are essential in preventing maternal deaths due to preeclampsia and eclampsia.

If not treated properly, preeclampsia can develop into eclampsia. According to POGI, (2016), eclampsia is defined as a condition of preeclampsia that is accompanied by tonic-clonic seizures and can be followed by coma. Eclampsia is one of the serious complications of preeclampsia that can occur during pregnancy, childbirth, or after childbirth (postpartum). This condition requires immediate medical treatment to prevent morbidity and mortality in the mother and fetus. Complications from eclampsia include

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acute kidney failure, pulmonary edema, liver disorders, HELLP (Hemolysis, Elevated Liver enzymes, and Low Platelets) syndrome, placental abruption, and maternal and fetal death. Eclampsia seizures can also cause trauma, lung aspiration, and encephalopathy.

Data from several Mother and Child Hospitals in Tasikmalaya City indicate that the incidence of preeclampsia remained relatively high and increased between 2023 and 2024. In 2023, a total of 1,035 preeclampsia cases were recorded across the hospitals, increasing to 1,166 cases in 2024. This represents an increase of approximately 12.7% over the one-year period. Among the hospitals included in the comparison, the hospital under study recorded the highest number of preeclampsia cases in both years. The increasing incidence of preeclampsia across Mother and Child Hospitals in Tasikmalaya City highlights the need to strengthen maternal health services, particularly through early detection, appropriate clinical management, and health education for pregnant women. Effective management is important because untreated or inadequately managed preeclampsia may progress to eclampsia, increasing the risk of adverse outcomes for both mothers and fetuses.

Internal data from the hospital under study shows that throughout 2023 the number of preeclampsia cases has fluctuated with a tendency to increase since March and reach a peak in October of 34 cases. However, during that year there were no cases of eclampsia or deaths due to preeclampsia complications. This condition indicates that the management of preeclampsia in hospitals has gone well, although the evaluation of the system of recording and case reporting still needs to be carried out on an ongoing basis. In 2024, the number of preeclampsia cases at the hospital under study will again show a high number with peak incidence in March and June, as many as 38 cases each. Overall, the number of cases increased from 285 cases in 2023 to 311 cases in 2024 or around 9.1%. During this period, only one case of eclampsia was recorded, namely in January, and no maternal deaths due to preeclampsia or eclampsia were found.

Although the number of preeclampsia cases at the hospital under study has increased, the hospital has made various efforts to improve the quality of patient handling and prevent more severe complications, such as eclampsia and maternal death. These efforts include improving the competence of medical personnel through Comprehensive Neonatal Emergency Obstetrics (PONEK) training for general practitioners, the implementation of in-house training for nurses and midwives regarding the handling of obstetric emergencies, the provision of supporting medical equipment according to the needs of preeclampsia services, and the implementation of standardized preeclampsia management protocols. These various efforts reflect the application of the principles of Total Quality Management (TQM), namely continuous quality improvement, improving the competence of human resources through training, standardizing service processes through the implementation of preeclampsia management protocols, and providing supporting facilities to ensure service quality. Although the number of preeclampsia cases is still high, these efforts contribute to reducing the incidence of more severe complications such as eclampsia and maternal death.

Based on Law Number 17 of 2023 concerning Health, a hospital is a healthcare facility that provides comprehensive individual health services through promotive, preventive, curative, rehabilitative, and/or palliative care, including inpatient, outpatient, and emergency services. According to the Indonesian hospital classification system, one type of hospital is the Specialized Hospital, which provides specific healthcare services. Mother and Child Hospitals are classified as specialized hospitals that provide maternal and child healthcare services. These hospitals deliver comprehensive services focusing on obstetrics, gynecology, perinatal care, and child healthcare from infancy through adolescence. Along with the increasing number of preeclampsia cases, competent human resources, particularly medical personnel who understand preeclampsia management protocols, as well as adequate hospital facilities, are essential to ensure optimal patient care.

Along with the increasing number of preeclampsia cases, competent human resources are needed to ensure the implementation of appropriate and consistent handling protocols. Based on the Regulation of the Minister of Health of the Republic of Indonesia Number 3 of 2020, Class C Special Maternal and Child Hospitals must be supported by adequate health workers, including obstetricians and gynecologists, pediatricians, nurses, midwives, pharmaceutical personnel, laboratory personnel, hospital management personnel, and other supporting health workers. In addition, several personnel such as subspecialist doctors, dentists, radiographers, physiotherapists, clinical psychologists, and blood service technicians are provided according to the needs of hospital services. The availability of health workers is one of the important factors in ensuring the quality of obstetric services, especially in the handling of preeclampsia cases that require multidisciplinary coordination and rapid clinical response. Based on data from the hospital under study, the hospital has a total of 170 workers consisting of three obstetricians and gynecologists, three pediatricians, six general practitioners, two other specialists (surgery and anesthesia), 55 nurses, 24 midwives, and various health and other support personnel. Although the needs of the main specialists have been met, there are still several types of health workers that are not available, such as obstetrics and gynecology subspecialists, pediatric subspecialist doctors, dentists, radiographers, physiotherapists, clinical psychologists, and blood service technicians. In addition, several health workers are still in the process or expiration of their Practice Permits (SIP), including eight nurses, two midwives, and three pharmaceutical technical personnel. This condition shows that even though hospitals have sufficient human resources to support services, there are still limitations in the aspects of the completeness of health workers and administrative readiness that have the potential to affect service optimization, especially in handling preeclampsia cases that require competence, coordination, and preparedness of medical personnel on an ongoing basis.

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In addition to human resources, the success of the implementation of preeclampsia protocols can also be influenced by the availability of medical equipment in accordance with hospital service standards. Based on the Regulation of the Minister of Health of the Republic of Indonesia Number 3 of 2020, Class C Special Maternal and Child Hospital must have service support equipment, including outpatient facilities, inpatient facilities, emergency rooms, operating rooms, laboratories, pharmacy rooms, Central Sterile Supply Department (CSSD), radiology rooms, and intensive care facilities according to service needs. Based on data from the hospital under study, most of the equipment is available, including outpatient rooms, inpatient rooms, emergency rooms, operating rooms, laboratories, and Neonatal Intensive Care Unit (NICU) facilities. However, there are still several facilities that are not yet available, including the Pediatric Intensive Care Unit (PICU), High Care Unit (HCU), pharmacy room, CSSD, radiology room, and medical rehabilitation room. However, to support the implementation of preeclampsia protocols, the hospital has provided various special medical equipment, such as digital sphygmomanometers, Doppler ultrasound, cardiotocography (CTG), electrocardiogram (ECG), ventilators, infusion pumps, urine protein tests, hematology analyzers, as well as NICU facilities equipped with neonatal incubators and neonatal ventilators.

The implementation of preeclampsia protocols includes clinical measures that are carried out systematically to prevent complications in the mother and fetus. The management includes blood pressure control, prevention of eclampsia through the administration of magnesium sulfate, monitoring of maternal and fetal conditions, and determining the timing of delivery according to the patient's clinical conditions to reduce the risk of maternal and perinatal morbidity and mortality (Ramos et al., 2017). In addition to the clinical aspect, the successful implementation of the preeclampsia protocol also requires support from organizational aspects, such as the implementation of standard operating procedures (SOPs), compliance with health workers with established procedures, the availability of supporting facilities, and supervision in the implementation of services so that patient handling can be carried out consistently according to standards (Islami, 2019). Therefore, medical personnel who treat preeclampsia patients need to understand and apply the protocol appropriately so that the services provided are in accordance with applicable procedures and are able to improve the safety of mothers and babies.

A relevant approach to be able to handle the condition of preeclampsia patients quickly and accurately is through the Total Quality Management (TQM) approach. Total Quality Management is a way to continuously improve performance at every process or level of operation, in every functional area of an organization, by using all available resources (Rifai & Yulianto, 2022). This approach aims to achieve long-term success through patient satisfaction and benefits for all medical personnel, hospital staff, and the community. TQM allows hospital management and medical personnel to collaborate in improving the quality of health services on an ongoing basis, ensuring operational efficiency, patient safety, and compliance with health standards (Widjanarko et al., 2024).

Based on the results of previous research, it is known that research on preeclampsia generally still focuses on clinical aspects, such as early treatment of patients, the effectiveness of therapy, and risk factors that affect the incidence of preeclampsia. Research by Imelda and Putriana (2018) and Hasibuan et al. (2024) focuses on the implementation of early treatment and clinical management of preeclampsia patients without examining the organizational factors that support the successful implementation of the protocol. On the other hand, research by Yusrawati et al. (2024) identified that the quality of emergency obstetric services is influenced by the performance of health workers, but has not yet linked it to the readiness of human resources in the implementation of preeclampsia protocols. Meanwhile, research by Masinambow and Karuntu (2019) shows that the implementation of Total Quality Management (TQM) plays a role in improving the quality of hospital services, but it is still studied in general and has not been applied to obstetric services, especially the implementation of preeclampsia protocols. Therefore, the novelty of this research lies in the integration of human resources and medical equipment as factors that affect the implementation of preeclampsia protocols using the Total Quality Management (TQM) approach at a Mother and Child Hospital in Tasikmalaya City. This research is expected to contribute to the development of hospital service quality management, especially in an effort to improve the quality of the implementation of preeclampsia protocols in a sustainable manner.

Based on the description of the background, the problems that occurred, and the research gaps that have been described, this study was conducted to analyze the influence of human resources and medical equipment on the implementation of preeclampsia protocols with a Total Quality Management (TQM) approach among medical personnel at a Mother and Child Hospital in Tasikmalaya City. The results of the research are expected to be an input for hospital management in improving the quality of obstetric services through the optimization of human resources, the provision of adequate medical equipment, and the implementation of sustainable preeclampsia protocols according to the principles of Total Quality Management (TQM).

II. FORMULATION OF THE PROBLEM

1. How do human resources and medical equipment affect the simultaneous implementation of preeclampsia protocols?
2. How does human resources affect the implementation of the partial preeclampsia protocol?
3. How does medical equipment affect the implementation of the partial preeclampsia protocol?

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4. How are the results of the implementation of the Preeclampsia Protocol based on the influence of Human Resources and Medical Equipment reviewed in the framework of Total Quality Management (TQM)?

III. RESEARCH METHODS

A. Research Design

This research uses a quantitative approach with verifiable methods. A verifiable approach was used to test the influence of human resources and medical equipment on the implementation of preeclampsia protocols through statistical hypothesis testing. In this study, Total Quality Management (TQM) is used as a quality improvement framework to interpret the results of the research and formulate efforts to improve the quality of human resources, optimize medical equipment, and implement preeclampsia protocols in a sustainable manner.

B. Population and Sample

The population in this study consists of all employees of the hospital under study, totaling 170 people, consisting of medical personnel, nursing and midwifery personnel, pharmaceutical personnel, other health workers, hospital management personnel, and non-health personnel. However, not all members of the population were made respondents because this study focused on the implementation of preeclampsia protocols. Therefore, respondents were selected based on certain characteristics that were in accordance with the purpose of the study, namely health workers who had direct involvement in the service of preeclampsia patients.

The sampling technique uses purposive sampling. The selection of respondents began with the Preeclampsia Handling Competency Test to identify health workers who have an understanding of the preeclampsia protocol. The inclusion criteria in this study include health workers who are involved in the service of preeclampsia patients, have participated in Comprehensive Emergency Neonatal Obstetrics (PONEK) and Neonatal Resuscitation training, are willing to be respondents, and obtain the category of sufficiently or very well understood based on the results of the competency test. The exclusion criteria include employees who are not involved in the service of preeclampsia patients, are on leave or are sick at the time of the study, are not willing to be respondents, or obtain a category of lack of understanding based on the results of the competency test. Based on the selection process, a final sample of 47 respondents consisting of obstetrics and gynecologists, general practitioners, nurses, and midwives was obtained.

C. Technical Data Collection

The research data was collected using a questionnaire distributed online through Google Form to health workers who had met the inclusion criteria as research respondents. The questionnaire was used to obtain data on human resources, medical equipment, and the implementation of preeclampsia protocols at the hospital under study. The assessment of each statement uses a five-point Likert scale, namely strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5).

D. Validity and Reliability Tests

The validity test aims to determine the ability of each statement item in measuring the variables being studied, namely human resources, medical equipment, and the implementation of preeclampsia protocols. Validity testing is carried out using Pearson's Product Moment correlation, with the criterion that each statement item is declared valid if it has a correlation coefficient (r) greater than 0.287.

Furthermore, a reliability test is carried out to measure the level of consistency of the instrument in producing stable and reliable data. Reliability testing uses the Cronbach's Alpha method, with the criterion that a variable is declared reliable if it has a Cronbach's Alpha value of more than 0.60. The results of the validity and reliability test showed that all statements on each variable had met the valid and reliable criteria, so that the instrument was declared suitable for use in the research data collection process.

E. Data Analysis Techniques

1) Classic Assumption Test

Classical assumption tests are carried out to ensure that the regression model meets statistical assumptions so that the results of the analysis can be interpreted appropriately. The tests include normality tests, autocorrelation tests, heteroscedasticity tests, and multicollinearity tests so that the results of regression analysis can provide unbiased and reliable estimates.

a) Normality Test

The normality test aims to find out whether the residual in the regression model is normally distributed. The test was carried out through two approaches, namely graph analysis using the Normal Probability Plot (Normal P-P Plot) and statistical analysis using the Kolmogorov-Smirnov test. In graph analysis, residual is declared to be normally distributed when the points are spread around the diagonal line and follow the direction of the line. Meanwhile, based on the Kolmogorov-Smirnov test, the data is declared to be normally distributed if the Asymp value. Sig. (2-tailed) > 0.05 .

b) Autocorrelation Test

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The autocorrelation test aims to find out whether or not there is a correlation between the residual in one observation and the residual in the other observation in the regression model. The test was performed using Durbin-Watson (DW). The regression model is stated to be autocorrelated when the Durbin-Watson value is in the autocorrelation-free region

c) Heteroscedasticity Test

The heteroscedasticity test aims to find out whether there is residual variance inequality in the regression model. The test was carried out through graph analysis using a scatterplot. The regression model is declared free of heteroscedasticity if the points in the scatterplot are randomly spread above and below the zero axis and do not form a specific pattern.

d) Multicollinearity Test

The multicollinearity test aims to find out whether or not there is a high correlation between independent variables in the regression model. The test was carried out by looking at the value of Tolerance and Variance Inflation Factor (VIF). The regression model is declared free of multicollinearity if the Tolerance value is > 0.10 and the VIF value is < 10 .

2) Hypothesis Testing

The hypothesis test was carried out to find out whether human resources and medical equipment had an effect on the implementation of preeclampsia protocols at the hospital under study. Hypothesis testing in this study was carried out using simultaneous tests (F test) and partial tests (t tests) with a significance level of 5% ($\alpha = 0.05$).

a) Simultaneous Test (F Test)

The simultaneous test (F test) was used to determine whether human resources and medical equipment together had an effect on the implementation of preeclampsia protocols. Decision-making is based on the significance value (Sig.), that is, if the Sig. value < 0.05 , then the two independent variables simultaneously have a significant effect on the implementation of the preeclampsia protocol. On the other hand, if the Sig. value > 0.05 , then the two independent variables simultaneously do not have a significant effect on the implementation of the preeclampsia protocol.

b) Partial Test (t-test)

The partial test (t-test) was used to determine the influence of each independent variable, namely human resources and medical equipment, on the implementation of preeclampsia protocols. Decision-making is based on significance value (Sig.), where the value of Sig. < 0.05 indicates that each independent variable has a significant effect on the implementation of the preeclampsia protocol, while the value of Sig. > 0.05 indicates that each independent variable does not have a significant effect on the implementation of the preeclampsia protocol.

IV. RESULT AND DISCUSSIONS

A. Validity and Reliability Tests

Table 1. Validity Test Results

Research Variables	Number of Items	Number of Valid Items	r Table	Description
Human Resources (X1)	9	9	0.287	All items are valid
Medical Equipment (X2)	9	9	0.287	All items are valid
Preeclampsia Protocol (Y)	15	15	0.287	All items are valid

Source: Primary data processed, 2025

Based on the results of the validity test in Table 1, all statement items on the variables of human resources, medical equipment, and the implementation of preeclampsia protocols had a greater r value than the r of the table (0.287). Thus, all statement items are declared valid and suitable for use as research instruments.

Table 2. Reliability Test Results

Research Variables	Cronbach's Alpha	Alpha Coefficient	Description
Human Resources (X1)	0.863	0.60	Reliable
Medical Equipment (X2)	0.805	0.60	Reliable
Preeclampsia Protocol (Y)	0.793	0.60	Reliable

Source: Primary data processed, 2025

Based on the results of the reliability test in Table 2, all research variables have a Cronbach's Alpha value above the minimum limit of 0.60. The Human Resources variable obtained a Cronbach's Alpha value of 0.863, Medical Equipment of 0.805, and Implementation of Preeclampsia Protocol of 0.793. These results show that all research instruments have a good level of internal consistency so that they are declared reliable and suitable for use as research instruments.

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B. Classic Assumption Test

1) Residual Normality Test

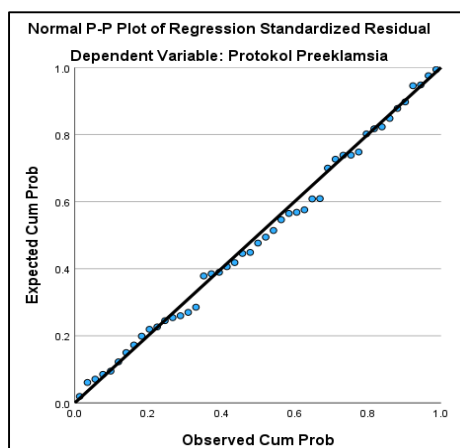


Figure 1. Residual Normality Test Results P-P Plot

Based on Figure 1, the results of the normality test using the Normal Probability Plot (P–P Plot) graph show that the residual points are spread around the diagonal line and follow the direction of the line. This condition indicates that the residual in the regression model is normally distributed so that the assumption of normality has been met. To support the results of the analysis visually, normality testing was also carried out using the Kolmogorov–Smirnov statistical test. The test results are presented in Table 3.

Table 3. Kolmogorov-Smirnov Normality Test Results

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		47
Red	.0000000	Red
Std. Deviation	2.05900570	Std. Deviation
Absolute	.069	Absolute
Positive	.069	Positive
Negative	-.035	Negative
Test Statistic		.069
Asymp. Sig. (2-tailed) ^c		.200d

Source: Primary data processed, 2025

Based on Table 3, the results of the normality test using Kolmogorov-Smirnov show an Asymp value. Sig. (2-tailed) is 0.200, which is greater than 0.05. These results show that the residual is distributed normally, so the normality assumption in the regression model has been fulfilled and the data is suitable for further regression analysis.

2) Autocorrelation Test

Table 4. Autocorrelation Test Results

Model Summary ^b					
Models	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.901a	.811	.803	2.10528	2.363
a. Predictors: (Constant), Medical Equipment, Human Resources					
b. Dependent Variable: Preeclampsia Protocol					

Source: Primary data processed, 2025

Based on table 4 above, the DW value obtained from the regression model is 2,363. Based on the DW table with a significance of 0.05 (5%), the number of samples (n) = 47, and the number of independent variables (k) = 2, the dL value of 1,443 and the dU of 1,620 were obtained. Therefore, the value of $dU < d < 4 - dU$ or $1,620 < 2,363 < 2,380$ was obtained. These results show that the Durbin-Watson value is in the area where there is no autocorrelation. Thus, it can be concluded that the regression model does not

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undergo autocorrelation, either positive or negative autocorrelations, because the DW value is between the upper limit (dU) and 4 – dU according to the decision-making criteria of the Durbin-Watson test.

3) Heteroscedasticity Test

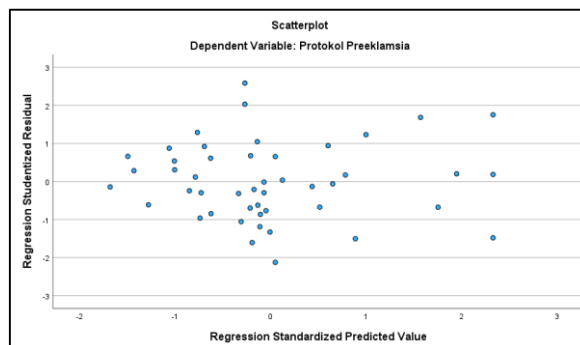


Figure 2. Heteroscedasticity Test Results

Based on Figure 2, the results of the heteroscedasticity test using scatterplots show that the residual points are randomly spread above and below the zero axis and do not form a specific pattern. Thus, it can be concluded that the regression model does not experience symptoms of heteroscedasticity so that the assumption of heteroscedasticity has been fulfilled.

4) Multicollinearity Test

Table 5. Multicollinearity Test Results

Coefficient			
Models		Collinearity Statistics	
		Tolerance	VIVID
1	Human Resources	.655	1.526
	Medical Equipment	.655	1.526
a. Dependent Variable: Preeclampsia Protocol			

Source: Primary data processed, 2025

Based on Table 5, the results of the multicollinearity test showed that the Human Resources and Medical Equipment variables had a Tolerance value of 0.655 (> 0.10) and a Variance Inflation Factor (VIF) value of 1.526 (< 10 , respectively). These results show that there are no symptoms of multicollinearity between independent variables, so the regression model meets the assumption of multicollinearity. Thus, the two independent variables do not have a high correlation with each other and are suitable for use in multiple regression analysis.

C. Multiple Linear Regression Analysis Results

Multiple linear regression analysis was performed to model the relationship between Human Resources and Medical Equipment to the Preeclampsia Protocol. The results of multiple linear regression analysis are presented in Table 6.

Table 6. Multiple Linear Regression Analysis Results

Coefficient				
Models		Unstandardized Coefficients		Standardized Coefficients
		B	Std. Error	Beta
1	(Constant)	20.107	1.533	
	HUMAN RESOURCES	0.254	0.064	0.321
	Medical Equipment	0.569	0.068	0.674
a. Dependent Variable: Preeclampsia Protocol				

Source: Primary data processed, 2025

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Based on Table 6, the multiple linear regression equation is obtained as follows:

$$Y = 20.107 + 0.254X_1 + 0.569X_2$$

The equation shows that the constant value of 20,107 is the value of the implementation of the preeclampsia protocol if the variables of Human Resources and Medical Equipment are considered constant. The Human Resources regression coefficient of 0.254 indicates that every one unit increase in human resources will increase the implementation of preeclampsia protocols by 0.254 units, assuming other variables are fixed. Meanwhile, the Medical Equipment regression coefficient of 0.569 indicates that every one unit increase in medical equipment will increase the implementation of the preeclampsia protocol by 0.569 units, assuming the other variables are fixed.

Based on the Standardized Beta value, the Medical Equipment variable has a value of 0.674, higher than the Human Resources variable which has a value of 0.321. These results show that Medical Equipment is the variable that has the most dominant influence on the implementation of preeclampsia protocols.

D. Hypothesis Test

1) The Influence of Human Resources and Medical Equipment on Preeclampsia Protocols

To find out the Human Resources and Medical Equipment together against the Preeclampsia Protocol, a simultaneous test (F test) was carried out. In addition, the magnitude of the contribution of the two independent variables to the quality of service was analyzed using the simultaneous determination coefficient (R Square).

Table 7. Test F Results (Simultaneous)

NEW ERA						
Models		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	838.990	2	419.495	94.647	<0.001b
	Residual	195.017	44	4.432		
	Total	1034.008	46			
a. Dependent Variable: Preeclampsia Protocol						
b. Predictors: (Constant), Medical Equipment, HUMAN RESOURCES						

Source: Primary data processed, 2025

Based on Table 7, the results of the simultaneous test (F-test) show that Human Resources and Medical Equipment simultaneously have a significant effect on the implementation of the Preeclampsia Protocol. This is indicated by the calculated F value of 94.647, which is greater than the critical F value of 3.209, so the regression model is considered significant. This result is further supported by a significance value of < 0.001, which is lower than 0.05. Thus, it can be concluded that Human Resources and Medical Equipment simultaneously have a significant effect on the implementation of the Preeclampsia Protocol.

The amount of contribution of Human Resources and Medical Equipment to the implementation of the Preeclampsia Protocol was then analyzed using the determination coefficient (R Square). The results of these tests are presented in Table 8.

Table 8. Simultaneous Determination Coefficient

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.901	0.811	0.803	2.10528

Source: Primary data processed, 2025

Based on Table 8, the R Square value is 0.811. The results showed that Human Resources and Medical Equipment together were able to explain 81.1% of the variation in preeclampsia protocols, while the remaining 18.9% were influenced by other factors outside the study model.

2) The Influence of Human Resources on Preeclampsia Protocols

To determine the influence of Human Resources on the Preeclampsia Protocol, a partial test (t-test) was carried out. In addition, the amount of Human Resources' contribution to the Preeclampsia Protocol was analyzed using the partial determination coefficient through the calculation of effective contributions.

Table 9. Results of the t-test (Human Resources)

Variable	B	Beta	t count	t table	Zero Order	Sig.	Remarks
Human Resources (X1)	0.254	0.321	3.967	1.680	0.717	<0.001	Significant

Source: Primary data processed, 2025

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Based on Table 9, the results of the partial test show that Human Resources have a positive and significant influence on the implementation of the Preeclampsia Protocol. A regression coefficient value (B) of 0.254 indicates that every one unit increase in the Human Resources variable will increase the Implementation of the Preeclampsia Protocol by 0.254 units, assuming the other independent variables are fixed. In addition, a beta coefficient value of 0.321 indicates that Human Resources make a positive contribution to changes in the implementation of the Preeclampsia Protocol in the regression model. The test results also showed a calculated t-value of 3.967, which is larger than the t-table of 1.680, and a significance value of <0.001 or less than 0.05. These findings prove that Human Resources have a significant effect on the implementation of the Preeclampsia Protocol, so that the proposed hypothesis can be accepted. Meanwhile, a zero-order correlation value of 0.717 indicates a strong positive relationship between the two variables. (β)

The amount of Human Resources' contribution to the implementation of the Preeclampsia Protocol is calculated through effective contribution by multiplying the value of the beta coefficient (0.321) and the zero-order correlation (0.717), then multiplying by 100%. The calculation results show an effective contribution value of 23.02%. Thus, it can be interpreted that about 23% of the variation in the implementation of the Preeclampsia Protocol is influenced by Human Resources factors, while the remaining 77% is influenced by other factors that were not analyzed in this study.

3) The Effect of Medical Equipment on Preeclampsia Protocols

To determine the effect of Medical Equipment on the Preeclampsia Protocol, a partial test (t-test) was performed. In addition, the amount of Medical Equipment's contribution to the Preeclampsia Protocol was analyzed using a partial determination coefficient through the calculation of effective donation.

Table 10. T Test Results (Medical Equipment)

Variable	B	Beta	t count	t table	Zero Order	Sig.	Remarks
Medical Equipment (X2)	0.569	0.674	8.337	1.680	0.863	<0.001	Significant

Source: Primary data processed, 2025

Based on Table 10, the results of the partial test show that Medical Equipment has a positive and significant effect on the Preeclampsia Protocol. This is shown by the value of the regression coefficient (B) of 0.569, which indicates that every one unit increase in the Medical Equipment variable will increase the Preeclampsia Protocol value by 0.569 units, assuming the other variables are fixed. A beta coefficient value (β) of 0.674 indicates that Medical Equipment has a relatively strong positive influence in explaining the variation in the application of the Preeclampsia Protocol. In addition, the calculated t value of 8.337 is greater than the table t of 1.680, so the hypothesis that there is an influence of Medical Equipment on the Preeclampsia Protocol is acceptable. The results were also strengthened by a significance value of <0.001 , which is smaller than 0.05, so that statistically the influence of Medical Equipment on the Preeclampsia Protocol was declared significant. A zero-order value of 0.863 indicates a very strong positive relationship between Medical Equipment and Preeclampsia Protocols, which is further used as a basis for calculating the partial contribution of these variables. (β)

The amount of partial contribution of Medical Equipment to the Preeclampsia Protocol was calculated using the effective donation method, namely by multiplying the value of the beta coefficient (0.674) by the zero-order correlation value (0.863), then multiplied by 100%. Based on this calculation, an effective contribution value of 58.1% was obtained. These findings show that Medical Equipment contributes 58.2% to the variation in the implementation of the Preeclampsia Protocol, while the remaining 41.9% is influenced by factors other than the Medical Equipment variables that were not studied in this study.

E. Discussion

1) Human Resources and Medical Equipment to Preeclampsia Protocols

Based on the results of the first hypothesis test, it was found that the variables of Human Resources (X1) and Medical Equipment (X2) simultaneously had a positive and significant effect on the implementation of the Preeclampsia Protocol (Y). This is reinforced by a determination coefficient value (R^2) of 0.811 indicating that 81.1% of the variation in protocol implementation can be explained by the combination of Human Resources and Medical Equipment, while the rest is influenced by other factors outside the model. These findings indicate that the success of protocol implementation is more influenced by the readiness of the service system as a whole than by a single factor separately. This means that improving the quality of HUMAN RESOURCES without being followed by the provision of adequate facilities does not necessarily result in an increase in optimal service quality, and vice versa. Synergy between the competence of health workers and the readiness of facilities is the main prerequisite in ensuring that all stages of the protocol can be implemented consistently.

When associated with the Total Quality Management (TQM) approach, these results reflect the importance of holistic and integrated quality management. TQM emphasizes that the achievement of quality does not depend only on one aspect, but requires continuous

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collaboration between organizational elements including HUMAN RESOURCES and medical equipment. Therefore, the implementation of TQM in this context requires hospitals to continue to develop the competencies of medical personnel through continuous training and ensure that the medical equipment used is always in a suitable condition and according to standards. This approach will improve the effectiveness of the overall preeclampsia protocol in the long run.

Previous research supports the finding that the effectiveness of implementing preeclampsia protocols is highly dependent on the synergy between HUMAN RESOURCES and medical equipment. One of them is an audit study in Zanzibar by Seif and Rashid (2022) which revealed that the readiness of facilities both in terms of knowledge and skills of medical personnel (X1) and the availability and function of medical equipment (X2) has a strong correlation with the quality of simultaneous preeclampsia management. The audit showed that facilities with high scores in both aspects were able to ensure routine blood pressure and proteinuria checks, as well as timely intervention (Seif & Rashid, 2022). These findings support the results, where a combination of competent HUMAN RESOURCES and adequate tools (although there is still a need for increased technical readiness) explains about 81.1% variation in protocol implementation ($R^2 = 0.8111$). Within the framework of Total Quality Management (TQM), this emphasizes the importance of a holistic approach that integrates HUMAN RESOURCES training and maintenance of medical facilities through continuous improvement so that preeclampsia services run effectively and consistently.

2) The Influence of Human Resources on Preeclampsia Protocols

Based on the results of the second hypothesis test, it was found that the Human Resources variable (X1) partially had a positive and significant influence on the variable of the Implementation of the Preeclampsia Protocol (Y). This shows that medical personnel at the hospital have a fairly important role in supporting the implementation of preeclampsia protocols in accordance with standards. The dimensions tested in this variable include the availability of medical personnel who understand the protocol, the competence of medical personnel, and the training and development of HUMAN RESOURCES. The results of the partial determination coefficient show that the HUMAN RESOURCES variable provides a partial determination coefficient of 23%, which means that the contribution of HUMAN RESOURCES to the variation in the implementation of preeclampsia protocols is quite real even though it is not completely dominant. These findings show that improving the competence of health workers alone is not necessarily able to improve the quality of protocol implementation optimally if it is not supported by an adequate service system. In the practice of treating preeclampsia, medical personnel can have good knowledge about management, but these abilities can only be implemented optimally if diagnostic facilities, access to laboratory examinations, medications, and a supportive referral system are available.

These findings are also relevant to the principle of Total Quality Management (TQM), especially the concept of continuous improvement which requires systematic and sustainable quality improvement in all aspects of the organization, including human resource management. In the context of health services, quality HUMAN RESOURCES are not only available in sufficient quantities, but must also be fostered and developed continuously in order to be able to keep up with the development of clinical service standards. Therefore, even though the HUMAN RESOURCES training and development score is relatively good, hospitals still need to conduct periodic evaluations of the effectiveness of training, ensure that all medical personnel have equal access to capacity building, and update training materials according to the latest medical science developments. This is important so that the quality of the implementation of the preeclampsia protocol can be maintained consistently in the long term.

In line with the results of research, a study by Seif and Rashid (2022) at an antenatal clinic in Zanzibar showed that the presence of medical personnel who participated in direct training in the handling of preeclampsia increased the likelihood of having adequate knowledge by up to 7.8 times. In addition, research by Raney et al. (2019) in Bihar, India, found that clinical simulation-based training successfully increased the number of evidence-based actions in cases of preeclampsia-eclampsia, for example an increase from an average of 2 to 3 important management steps. The two findings support the results of this study that Human Resources (X1), especially through training and competency development, have a positive influence on the implementation of the Preeclampsia Protocol (Y). This approach is consistent with the principle of Total Quality Management (TQM), which is the need for continuous improvement of HUMAN RESOURCES so that protocols can be applied consistently and according to standards.

3) The Effect of Medical Equipment on Preeclampsia Protocols

The results of the third hypothesis test showed that the Medical Equipment (X2) variable partially had a positive and significant effect on the implementation of the Preeclampsia Protocol (Y). These findings confirm that the existence and utilization of adequate medical equipment is an important factor in supporting the optimal implementation of preeclampsia protocols. The results of the analysis of the partial determination coefficient of the medical equipment variable were 58.1%. This indicates that the availability and quality of medical equipment are the most dominant factors in explaining the variation in the implementation of preeclampsia protocols.

These results are in line with the basic principle of TQM, which is continuous improvement. In this case, health facilities are not only required to have adequate medical equipment, but also to consistently improve the quality and readiness of these tools in order to support safer and more effective services. Therefore, the findings that the feasibility and standardization dimensions are still in the Sufficient category indicate that there is still a gap for hospitals to conduct continuous evaluation and development of

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systems, particularly in the aspects of maintenance, periodic calibration, and equipment updates. This process is an important part of the TQM cycle which aims to ensure that all components of services, including medical facilities, are able to keep up with evolving clinical standards and patient needs. Therefore, the relevance between the results of this study and the TQM approach lies in the need for institutional commitment to continuous improvement to ensure the quality of consistent and quality implementation of preeclampsia protocols.

The findings of this study are reinforced by the results of a study by McLaren et al. (2017), which examined the effectiveness of the use of simple medical equipment such as semi-automated blood pressure monitors and urine protein tests in detecting preeclampsia in health care facilities with limited resources. The results of their study show that the existence of diagnostic medical equipment, although simple, is able to significantly improve the early detection of preeclampsia. This confirms that the fulfillment of appropriate and standard medical devices, even in non-sophisticated forms, can contribute greatly to the success of clinical protocols. In line with that, research by Meazaw et al. (2022) in Ethiopia also found that the completeness and readiness of diagnostic tools such as sphygmomanometers and proteinuria tests is still a major challenge, even though most facilities already have basic equipment. The results of the national survey showed that there was a gap between the availability and readiness of tools, especially in the aspects of maintenance and calibration, which had an impact on the delay in intervention in preeclampsia cases.

4) Analysis of Preeclampsia Clinical Outcomes in the Framework of Total Quality Management (TQM)

The clinical results of preeclampsia treatment during 2024 show that of the 311 cases of preeclampsia treated, only one case developed into eclampsia (0.32%) and no maternal deaths due to preeclampsia or eclampsia were found. These achievements show that patient management has provided good clinical outcomes. However, from a quality management perspective, the success of the outcome is not only influenced by the final result, but also by the readiness of resources and the consistency of the service process that supports the optimal implementation of the protocol.

In this study, the interpretation of the results was carried out using the input-process-output framework in Total Quality Management (TQM). Inputs are represented by human resources and medical equipment as the main resources that support services. The process is represented by the application of preeclampsia protocols which serve as guidelines in clinical decision-making and service delivery to patients. Meanwhile, the output was represented by the clinical outcomes of preeclampsia treatment, which was reflected in the low rate of case progression to eclampsia and the absence of maternal mortality. The relationship between the three components shows that the quality of service is the result of the integration between the readiness of resources, consistency of protocol implementation, and the achievement of clinical outputs.

According to Mahmudah et al. (2025), Total Quality Management (TQM) has five main principles, namely customer focus, total employee involvement, process-based approach, continuous improvement, and fact-based decision making. Based on the results of the study, the Human Resources variable contributed 23.0% to the implementation of the preeclampsia protocol. From the perspective of TQM, human resources are an input component that determines the readiness of the service system. The competence of health workers, understanding of protocols, and the involvement of obstetricians and gynecologists, general practitioners, nurses, and midwives in services reflect the application of the principle of total employee involvement. In addition, improving competencies through training, evaluation, and knowledge renewal is the implementation of the principle of continuous improvement to improve service quality in a sustainable manner.

In the Medical Equipment variable, the regression results showed that this variable contributed the most to the implementation of the preeclampsia protocol, which was 58.1%. Within the framework of TQM, medical equipment is also part of the input that supports the continuity of the service process. The availability, feasibility, calibration, and maintenance of equipment are important factors so that services can be provided appropriately and safely. This condition reflects the application of the principle of fact-based decision making, because the provision and use of medical equipment is based on service standards, clinical needs, and objective facility evaluation results. In addition, periodic evaluation and maintenance of equipment is also an implementation of the principle of continuous improvement in improving service quality.

In the concept of TQM, the implementation of the preeclampsia protocol is part of a process-based approach, namely the implementation of services through a standardized and integrated process. The application of protocols that refer to clinical guidelines, such as POGI recommendations, shows that each stage of service is carried out systematically and consistently according to applicable standards. On the other hand, clinical results that show a low rate of complications and no maternal mortality reflect the application of the customer focus principle, because the success of service is measured by the hospital's ability to provide safe, precise, and safety-oriented services and the needs of the mother and fetus.

Based on the interpretation of the research results from the perspective of Total Quality Management (TQM), it can be concluded that the quality of preeclampsia services is formed through the relationship between the readiness of human resources, the availability of medical equipment, and the consistency of the implementation of service protocols. The results show that the input component, especially human resources and medical equipment, has an important role in supporting the service process, which further contributes to the achievement of good clinical outcomes.

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CONCLUSIONS

- 1) Human resources have a positive and significant effect on the implementation of preeclampsia protocols with a Total Quality Management (TQM) approach. The results of the study show that increasing the competence, involvement, and readiness of health workers contributes to the consistency of the implementation of preeclampsia protocols according to service standards.
- 2) Medical equipment has a positive and significant effect on the implementation of preeclampsia protocols with a Total Quality Management (TQM) approach. The availability, feasibility, and utilization of adequate medical equipment support the optimal implementation of the protocol, and is the variable that contributes the most to this study.
- 3) Human resources and medical equipment simultaneously have a positive and significant effect on the implementation of preeclampsia protocols with a Total Quality Management (TQM) approach. A coefficient of determination value (R^2) of 0.811 indicates that 81.1% of variations in the implementation of preeclampsia protocols can be explained by the two variables together, while 18.9% are influenced by other factors outside the study.
- 4) The interpretation of the results of the study in the perspective of Total Quality Management (TQM) shows that the quality of preeclampsia services is formed through the relationship between input, process, and output components. Human Resources and Medical Equipment play a role as input components that support the readiness of the service system, while the Implementation of the Preeclampsia Protocol is a component of the process that is carried out systematically according to clinical guidelines. The clinical results in the form of a low number of cases that develop into eclampsia and no maternal deaths due to preeclampsia or eclampsia are output components that reflect the quality of service. The results of this study also reflect the application of the principle of total employee involvement through the involvement of health workers in services, continuous improvement through the development of human resource competencies and the evaluation and maintenance of medical equipment on an ongoing basis, a process-based approach through the implementation of preeclampsia protocols according to clinical guidelines, fact-based decision making through the implementation of services that refer to clinical standards and guidelines, and customer focus through service orientation to the safety of the mother and fetus.

REFERENCES

- 1) Hasibuan, W. N., Cahya, L., Ardian, M., & Budiono, B. (2024). Early management of severe pre-eclamptic and eclamptic referral patient at Kotabaru Regency. *Indonesian Midwifery and Health Sciences Journal*, 4(2), 98–108.
- 2) Imelda, A. D., & Putriana, Y. (2018). Initial treatment of severe preeclampsia and eclampsia at one of the hospitals in Lampung Province. *Scientific Journal of Nursing Science*, 13(2), 203–208.
- 3) Islami, D. (2019). Midwives' compliance to the standard operating procedure on the early identification of preeclampsia. *Journal of Indonesian Health Administration*, 7(1), 50–59. <https://doi.org/10.20473/jaki.v7i1.2019.50-59>
- 4) Ministry of Health of the Republic of Indonesia. (2020). *Regulation of the Minister of Health of the Republic of Indonesia Number 3 of 2020 concerning hospital classification and licensing*. Ministry of Health of the Republic of Indonesia.
- 5) Ministry of Health of the Republic of Indonesia. (2023). *Law Number 17 of 2023 concerning Health*.
- 6) Khusen, D. (2012). Factors influencing maternal mortality from severe preeclampsia and eclampsia. *Indonesian Journal of Obstetrics and Gynecology*.
- 7) Mahmudah, Jasiah, & Dakir. (2025). Integrated quality management in the perspective of the Qur'an and Total Quality Management. *Journal of Educational Management*, 10(2), 528–536. <https://doi.org/10.34125/jmp.v10i2.535>
- 8) ManuK, M., Akbar, M., & Wittiarika, I. (2021). Factors affecting the delay of decision making to receive health services in preeclampsia pregnant mothers at RSUD Mgr Gabriel Manek SVD Atambua. *Indonesian Midwifery and Health Sciences Journal*. <https://doi.org/10.20473/imhsj.v5i2.2021.160-173>
- 9) Masinambow, R. G., & Karuntu, M. M. (2019). Analysis of the implementation of Total Quality Management at Siloam GMIM Sonder Hospital. *EMBA Journal: Journal of Economics, Management, Business and Accounting Research*, 7(1).
- 10) McLaren, Z. M., Sharp, A., Hessburg, J. P., Sabet Sarvestani, A., Parker, E., Akazili, J., Johnson, T. R. B., & Sienko, K. H. (2017). Cost effectiveness of medical devices to diagnose pre-eclampsia in low-resource settings. *Development Engineering*, 2, 99–106. <https://doi.org/10.1016/j.deveng.2017.06.002>
- 11) Meazaw, M. W., Chojenta, C., Forder, P., Taddele, T., & Loxton, D. (2022). Health care readiness in management of preeclampsia/eclampsia in Ethiopia: Evidence from national facility-based survey. *Risk Management and Healthcare Policy*, 15, 1225–1241. <https://doi.org/10.2147/RMHP.S366055>
- 12) Indonesian Obstetrics and Gynecology Association. (2016). *National guidelines for medical services: Diagnosis and management of pre-eclampsia*. NIGHT.
- 13) Raney, J. H., Morgan, M. C., Christmas, A., Singh, M. K., Nanda, P., Das, A., Saggurti, N., & Thomas, A. (2019). Simulation-enhanced nurse mentoring to improve preeclampsia and eclampsia care: An education intervention study in Bihar, India. *BMC Pregnancy and Childbirth*, 19(1), 41. <https://doi.org/10.1186/s12884-019-2186-x>

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- 14) Ramos, J., Sass, N., & Costa, S. (2017). Preeclampsia. *RBGO Gynecology & Obstetrics*, 39, 496–512. <https://doi.org/10.1055/s-0037-1604471>
- 15) Rifai, M., & Yulianto, A. E. (2022). Comparison of production cost efficiency before and after the implementation of Total Quality Management (TQM) at PT. Pacific Indo Packing Lamongan. *Bisman (Business and Management): The Journal of Business and Management*, 5(1), 59–71.
- 16) Seif, S. A., & Rashid, S. A. (2022). Knowledge and skills of preeclampsia management among healthcare providers working in antenatal clinics in Zanzibar. *BMC Health Services Research*, 22(1), 1512. <https://doi.org/10.1186/s12913-022-08892-5>
- 17) Widjanarko, H., Tajuddin, M., Cahayani, N. B., Desiree, F., Rahayuningrum, D. P., Alexangela, J. S., ... & Veranita, M. (2024). Total Quality Management in hospitals: A literature review of related methodologies and approaches. *Health Care Management*, 1(2), 11–11.
- 18) Yusrawati, Respati, T., Suwarsi, S., Muhandi, Dasman, H., & Yanis, A. (2024). Factors that affect the performance of health workers in providing comprehensive emergency obstetric and newborn care. *The Open Public Health Journal*, 17, e187494453052782. <https://doi.org/10.2174/0118749445305278240506063742>