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Original Research

THE EFFECT OF CLINICAL PATHWAY COMPLIANCE ON THE QUALITY AND COST OF CABG PROCEDURES

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Abstract

Background

Coronary Artery Bypass Graft (CABG) is a surgical procedure with a fairly high number of cases and risks. To handle the procedure, the implementation of Clinical Pathway is required. The purpose of this study was to analyze the effect of Clinical Pathway compliance on the quality and cost of CABG procedures at Dr. Soetomo Hospital, Surabaya.

Methods

Quantitative with an observational analytical approach, cross-sectional design. The population size was 99 medical records, with a total sampling technique of 95 medical records obtained according to the inclusion criteria, descriptive data analysis. Secondary data were obtained from medical records, incident data from the PPI Committee and the hospital's financial report in 2023.

Results

The average age of patients was 53 years with male gender of 80%. Compliance of officers in implementing the Clinical Pathway for CABG procedures with a compliant category 14 (14.7%), a less compliant category 75 (78.9%) and a non-compliant category of 6 (6.3%). Quality in this study was measured by the SSI and LOS variables. There were no incidents of SSI for CABG procedures 0 (0%). LOS of CABG procedures with length of stay ≤ 10 days were 67 (70.5%) and > 10 days were 28 (29.5%). Cost disparity is a significant difference or gap between the cost conditions recorded in a tariff system and the actual conditions of actual service tariffs. Costs for CABG procedures with large Disparity (+) were 1 (1.1%), small Disparity (+) were 52 (54.7%), large Disparity (-) were 13 (13.7%) and small Disparity (-) were 29 (30.5%).

Conclusion

There is an inverse effect between Clinical Pathway compliance and Length Of Stay (LOS), there is no effect of Clinical Pathway compliance on Surgical Site Infection rates and there is an effect of Clinical Pathway compliance on cost disparities.

Keywords: Clinical Pathway; Coronary Artery Bypass Graft (CABG); Surgical Site Infection (SSI); INACBG; Length of Stay (LOS)

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INTRODUCTION

Coronary Artery Bypass Graft (CABG) is a surgical procedure by taking blood vessels from other parts of the body (usually the chest, legs or arms) and attaching them to the coronary arteries above and below the narrowed or blocked area to improve blood circulation and oxygen supply to the heart.

Coronary Artery Bypass Graft (CABG) is an interventional procedure for Coronary Heart-Disease (CHD), in which a new channel is created through the narrowed or blocked coronary artery. There are several conditions that are indications for undergoing CABG, such as asymptomatic angina/mild angina with findings of blockage in the left main, triple vessel disease, stable angina, non-ST elevation/unstable myocardial infarction, ST elevation myocardial infarction, decreased left ventricular function, life-threatening ventricular arrhythmias, failure of Percutaneous Coronary Intervention (PCI), and a history of previous CABG (Melly et al., 2018).

CABG has a fairly high number of cases (high volume) and requires long-term care because it can cause complications and even death (high risk). In order to overcome cases that are high volume, high risk and high cost, a policy can be implemented in the form of implementing a Clinical Pathway. One of the most appropriate policies to overcome over budget is quality control of cost control with Clinical Pathway instruments, so hospitals can carry out service functions well and with quality without experiencing financial losses.

Clinical Pathway is a tool or method that can be used as a guideline for medical services based on professional procedure standards that are by the hospital structure, for quality and costs to improve services and control service costs. The term Clinical pathway was originally a term with several names, namely case management plans or commonly called care pathway, critical pathway, integrated pathway, coordinated care pathway, care map, and anticipated recovery pathway which are several forms of terms with definitions that are still in the formation stage (Szelagowki et al., 2019).

Implementing Clinical Pathway can reduce the incidence of treatment-related infections and reduce patient length of stay (Length Of Stay). Reduced length of hospitalization can affect hospital costs so they are more efficient. In reality, compliance with Clinical Pathway is still lacking. This has an impact on the Length Of Stay which is longer and the hospital costs incurred are greater.

The implementation of Clinical Pathway can affect the shortening of LOS, which can affect the cost of patient care (Haninditya et al., 2019). This is in line with the research of Fitria

et al (2021), which states that the implementation of Clinical Pathway can lead to a decrease in the cost of inpatient care. In addition, according to Safi et al., (2023) the implementation of Clinical Pathway can also increase the effectiveness and efficiency of health services.

The number of CABG cases at Dr. Soetomo Hospital in 2022 was 160 cases. One of the indicators of Clinical Pathway compliance is Length Of Stay (LOS). The standard Length Of Stay (LOS) for the Coronary Artery Bypass Graft procedure at Dr. Soetomo Hospital is 7 days. Evaluation of compliance with the implementation of the Clinical Pathway based on LOS in CABG cases from January to December 2022 showed an average result of 18%. The results of this evaluation are very low from the target set by the Indonesian Ministry of Health.

The compliance target for the implementation of the Clinical Pathway is set at a minimum of 80% according to the 2022 Ministerial Regulation. However, the compliance achievement for the implementation of the Clinical Pathway for Coronary Artery Bypass Graft in 2022 did not meet the specified target. In January 2022, compliance was at 38%, but it continued to decline in the following months. By December 2022, it had increased slightly to 36%, while the overall average for 2022 was 18%.

Previous research can serve as a source of new inspiration for further studies and can be used as a reference to enrich the theoretical framework of the research. In a study titled *The Effect of Clinical Pathway Compliance in Reducing Length of Hospitalization* by Michael Siswanto and Djazuly Chalidyanto (2020), it was stated that many factors can influence the length of hospitalization, particularly the patient's own condition. In that study, Clinical Pathway compliance was found to have no impact on reducing the length of hospitalization. Meanwhile, in another study titled *Clinical Pathway Compliance in Clinical Supervision in Reducing Length of Hospitalization for Mastectomy Patients in Teaching Hospitals* by Ahmad Amin Mahmudin, Djazuly Chalidyanto, et al. (2020), it was stated that there was a significant difference between high and low Clinical Pathway compliance in clinical supervision in terms of reducing the length of hospitalization for mastectomy patients in teaching hospitals.

The purpose of this study was to analyze the effect of Clinical Pathway compliance on the quality and cost of Coronary Artery Bypass Graft procedures at Dr. Soetomo Hospital, Surabaya.

RESEARCH METHOD

Research design

This research is a quantitative study with an observational analytical approach, aimed at measuring the variables being studied. The design of this research is cross-sectional, as it was conducted at a specific point in time to provide a snapshot of the situation during that period. This study has a limitation in the type of analysis used, namely descriptive analysis.

Setting and samples

The population of this study consisted of all medical records of coronary heart disease patients who underwent Coronary Artery Bypass Graft (CABG) procedures at Dr. Soetomo General Hospital, Surabaya, from January to December 2023. The total population size in this study was 99 medical records. The sample used in this study was selected from the population based on the following inclusion criteria: (1) patients diagnosed with coronary heart disease, (2) patients who underwent CABG procedures at Dr. Soetomo General Hospital, Surabaya, (3) patients treated between January 2023 and December 2023, (4) BPJS patients who utilized hospital facilities according to their entitled class, and (5) patients with complete medical records. The exclusion criteria were: (1) general (non-BPJS) patients, and (2) BPJS patients who upgraded their class of care. The sampling technique employed in this study was total sampling, which is a method where all members of the population who meet the criteria are included as the sample. (Salsabillah et al., 2022). Based on the inclusion criteria, the sample size used in this study was 95 medical records.

Measurement and data collection

The data used in this study were collected from secondary sources, including medical records, SSI CABG incident report data from the Infection Prevention and Control (PPI) Committee, and hospital financial report data. Additional data were obtained from the fourth-quarter 2023 evaluation report on compliance with the implementation of the Clinical Pathway, provided by the Quality Committee of Dr. Soetomo General Hospital, Surabaya, as well as from interviews with the Chairperson of the PPI Committee, IPCN, and IPCD regarding the validation of SSI data.

The instruments used in this study included a Clinical Pathway checklist sheet and a data collection sheet. The data collection sheet consisted of a table with several columns designed to record the required data according to the research variables.

The stages of data processing in this study began with the compilation of authentic data, followed by classification into specific criteria to facilitate hypothesis testing. Data processing

was then conducted to test the hypothesis, and the process concluded with the presentation of the data in the form of tables or narratives, depending on the results.

Data analysis

The analysis used in this study is descriptive analysis. Descriptive analysis is a statistical method employed to analyze data with the aim of providing a comprehensive overview or description of the collected data, without attempting to draw general conclusions or make generalizations.

There are three variables in this study: compliance with the implementation of the CABG procedure clinical pathway, quality of health services, and cost disparities. Compliance with the clinical pathway was measured by reviewing the medical records of the care history, using 6 compliance indicators: medical care, nursing care, supporting examinations, therapy compliance, pharmaceutical care, and nutritional care. The data were classified into three categories: compliant (> 4 indicators declared compliant), less compliant (4 indicators declared compliant), and non-compliant (≤ 4 indicators declared compliant).

The variable of health service quality includes Length of Stay (LOS) and Surgical Site Infection (SSI). LOS is defined as the length of hospitalization from the time the patient is first admitted until discharged administratively. This variable is measured using the patient's medical records and categorized into two groups: ≤ 10 days and > 10 days. SSI refers to an infection occurring in a surgical wound within 30-90 days after surgery. SSI is measured using the PPI committee incident report, and the data is categorized into two groups: infected and no infection.

The third variable is cost disparity, which compares the cost of the CABG procedure health services with the INA-CBG rate, expressed as a percentage. The measurement method involves reviewing the hospital's financial data. The disparity is calculated as: $\text{Disparity} = [(\text{INA-CBG rate} - \text{hospital billing}) / \text{INA-CBG rate}] \times 100\%$. The data is categorized based on the comparison between the INA-CBG rate and the hospital billing rate, and is grouped into the following categories: Small Disparity (+) if $< 50\%$, Large Disparity (+) if $> 50\%$, Small Disparity (-) if $< 50\%$, and Large Disparity (-) if $> 50\%$.

In statistical analysis, the researchers applied the Pareto principle, without hypothesis testing methods such as chi-square or ANOVA. According to the Pareto principle, a small portion of causes has a disproportionately large effect, with around 80% of the effects stemming from 20% of the causes. If the difference in value is $> 20\%$, it indicates an influence between the two variables.

ETHICAL CONSIDERATIONS

This research has passed the ethical test by the Health Research Ethics Committee of Dr. Soetomo Hospital with the number 1638/LOE/301.4.2/IV/2024 valid from April 24, 2024 to April 2025.

RESULT

Dr. Soetomo General Hospital, Surabaya, is a type A hospital owned by the East Java Provincial Government. It serves as one of the tertiary referral hospitals in the East Java region, with a total of 1,299 beds. The hospital has collaborated with BPJS and received full accreditation from the Hospital Accreditation Commission (KARS) in 2022.

Analysis of the Influence of Clinical Pathway Compliance on Quality Based on the Number of Surgical Site Infections in Coronary Artery Bypass Graft Procedures at Dr. Soetomo Hospital, Surabaya

This test was conducted to determine the effect of Clinical Pathway compliance on quality, as measured by the Surgical Site Infection (SSI) rate in the Coronary Artery Bypass Graft (CABG) procedure at Dr. Soetomo General Hospital, Surabaya.

SSI is an infection that occurs in a surgical wound within 30-90 days after surgery. The method for measuring SSI is through the PPI committee incident report. The data will be categorized into two groups: infected and no infection.

Table 1. Surgical Site Infection (SSI) of Coronary Artery Bypass Graft procedures at Dr. Soetomo Hospital, Surabaya

Compliance	Surgical Site Infection (SSI)		
	Yes	No	Total
Obedient	0 (0%)	14 (100%)	14 (100%)
less obedient	0 (0%)	75 (100%)	75 (100%)
not obey	0 (0%)	6 (100%)	6 (100%)
Total	0 (0%)	95 (100%)	95 (100%)

Based on the results of the descriptive analysis, the data obtained were homogeneous, which made them unsuitable for further analysis. This occurred because the Surgical Site Infection (SSI) data showed no variation, with 100% of the data indicating no Surgical Site Infection (SSI). Therefore, it can be concluded that there is no influence of Clinical Pathway compliance on the incidence of Surgical Site Infections.

Analysis of the Influence of Clinical Pathway Compliance on Quality Based on Length of Stay (LOS) in Coronary Artery Bypass Graft Procedures at Dr. Soetomo Hospital, Surabaya

This test was conducted to determine the effect of Clinical Pathway compliance on quality, as measured by Length of Stay (LOS) in the Coronary Artery Bypass Graft (CABG) procedure at Dr. Soetomo General Hospital, Surabaya.

LOS is measured using the patient's medical records and is categorized into two groups: ≤ 10 days and > 10 days.

Table 2. Compliance of Clinical Pathway to Quality Based on Length of Stay (LOS) in Coronary Artery Bypass Graft procedures at Dr. Soetomo Hospital, Surabaya

Clinical Pathway Compliance	Length of Stay (LOS)		Total
	≤ 10 days	> 10 days	
	N	N	
Obedient	7 (50,0%)	7 (50,0%)	14 (100,0%)
Less Obedient	56 (74,6%)	19 (25,4%)	75 (100,0%)
Not Obey	4 (66,7%)	2 (33,3%)	6 (100,0%)
Total	67 (70,5%)	28 (29,5%)	95 (100,0%)

Using the Pareto principle, which states that a small portion of causes accounts for a large effect—approximately 80% of the effects come from 20% of the causes—it can be observed from Table 2 that a difference greater than 20% indicates an influence between the two variables. However, the influence observed is inverse, meaning there is an opposite relationship between Clinical Pathway compliance and Length of Stay (LOS). Specifically, the data show that the less compliant the Clinical Pathway is, the more likely the LOS is ≤ 10 days (74.6%). These results are counterintuitive and warrant further investigation.

Analysis of the Influence of Clinical Pathway Compliance on Cost Disparities in Coronary Artery Bypass Graft Procedures at Dr. Soetomo Hospital, Surabaya

This test was conducted to determine the effect of Clinical Pathway compliance on cost disparities in Coronary Artery Bypass Graft (CABG) procedures at Dr. Soetomo General Hospital, Surabaya. The data is categorized based on the comparison between INA-CBG rates and hospital billing rates, and is grouped into the following categories: Small Disparity (+) if $< 50\%$, Large Disparity (+) if $> 50\%$, Small Disparity (-) if $< 50\%$, and Large Disparity (-) if $> 50\%$.

Table 3. Clinical Pathway Compliance with Cost Disparities in Coronary Artery Bypass Graft Procedures at Dr. Soetomo Hospital, Surabaya.

Clinical Pathway Compliance	Cost				Total
	Disparity (-) Large	Disparity (-) Small	Disparity (+) Large	Disparity (+) Small	
	N	N	N	N	
Obedient	1 (7,1%)	4 (28,6%)	0 (0,0%)	9 (64,3%)	14 (100,0%)
Less Obedient	9 (12,0%)	25 (33,3%)	1 (1,3%)	40 (53,4%)	75 (100,0%)
Not Obey	3 (50,0%)	0 (0,0%)	0 (0,0%)	3 (50,0%)	6 (100,0%)
Total	13 (13,7%)	29 (30,5%)	1 (1,1%)	52 (54,7%)	95 (100,0%)

Using the Pareto principle, which states that a small portion of causes has a large effect—around 80% of the effect comes from 20% of the causes—it can be observed from Table 3 that a difference greater than 20% indicates an influence between the two variables. Therefore, it can be concluded that Clinical Pathway compliance affects cost disparities. Specifically, the more non-compliant the Clinical Pathway, the greater the negative cost disparity (50.0%). Conversely, in the analysis of positive cost disparities, the more compliant the Clinical Pathway, the greater the positive cost disparity. If the negative cost disparities are addressed and managed effectively, better results in cost control can be achieved.

DISCUSSION

Compliance of healthcare officers in implementing the Clinical Pathway (CP) is a crucial aspect of improving patient quality and safety in hospitals. In this study, it was found that most officers were less compliant in implementing the Clinical Pathway for the Coronary Artery Bypass Graft (CABG) procedure at Dr. Soetomo Hospital, Surabaya. The compliance rate for the CABG procedure was categorized as follows: 14 medical records (14.8%) in the compliant category, 75 medical records (78.9%) in the less compliant category, and 6 medical records (6.3%) in the non-compliant category. Non-compliance was mainly observed in the aspects of therapy compliance, with 14 medical records (14.8%) showing compliance, and pharmaceutical care, with 19 medical records (20.0%) showing compliance. These figures still did not meet the target set by the Minister of Health Regulation, which requires 80% compliance.

Based on research by Junaidi et al. (2022), compliance with the Clinical Pathway among healthcare workers at Jemursari Islamic Hospital (RSI) Surabaya was also significantly below the established standards. This was attributed to RSI Surabaya not fully integrating the Clinical Pathway into the Hospital Management Information System (SIM RS), suggesting that the integration of the Clinical Pathway with SIM RS could help improve healthcare worker compliance and enhance the quality of hospital services.

Another supporting study is a study conducted by Nuryadin & Rahmawati (2021), which showed that the compliance of health workers related to the implementation of the Clinical Pathway at the Labuang Bajo Makassar Regional Hospital was lacking due to standards that had not been implemented, lack of human resources, lack of audit implementation, lack of socialization and facilities and infrastructure that had not been met. According to research by penelitian Putri H et al., (2022), there was a significant influence

between compliance with the implementation of the Clinical Pathway at the Royal Prima Medan Hospital where good compliance with the implementation of the Clinical Pathway was 45 people (54.2%), good compliance with the implementation of the Clinical Pathway in the bad category was 7 people (8.5%), poor compliance with the implementation of the Clinical Pathway was 13 people (15.6%), and poor compliance with the implementation of the Clinical Pathway in the good category was 7 people (8.5%).

According to Fitria et al., (2021), The Clinical Pathway is an important component in achieving good clinical governance in hospitals. Its implementation requires compliance from every healthcare worker involved. Without compliance, the Clinical Pathway cannot be effectively implemented, which may hinder efforts to reduce Length of Stay (LOS) and inpatient costs. Additionally, the proper implementation of the Clinical Pathway offers several benefits, including increased patient satisfaction and improved quality of service management. (Putri H et al., 2022).

Based on the various references mentioned above, it can be concluded that healthcare worker compliance with the Clinical Pathway is a crucial aspect of good clinical governance in hospitals. Furthermore, the integration of the Clinical Pathway with the Hospital Management Information System (SIMRS) can serve as a key factor in improving the assessment and monitoring of compliance.

The Influence of Clinical Pathway Compliance on Quality Based on Surgical Wound Infection Rates

Infection control is a key component in improving the quality of hospital services. The results of this study indicated that there was no effect of Clinical Pathway compliance on quality, as measured by the Surgical Site Infection (SSI) rate in the Coronary Artery Bypass Graft (CABG) procedure at Dr. Soetomo Hospital, Surabaya. The data obtained were homogeneous and could not be further analyzed. This occurred because the SSI data showed no variation—100% of the cases recorded no incidence of Surgical Site Infection.

In a study entitled Risk Factors for Post-Cardiac Surgery Infection, out of a total of 2,366 patients, 151 patients (6.4%) were identified as having post-surgical infections. (Alghamdi et al., 2022). Meanwhile, according to Oley et al., (2022), The better the quality of nursing services in a hospital, the more effective the control of nosocomial infections. Quality control can be enhanced through the implementation of a Clinical Pathway. One of the key benefits of implementing a Clinical Pathway is the reduction in the incidence of infections.

The results of the study indicated that there was no significant influence of Clinical Pathway compliance on quality, as measured by the incidence of Surgical Site Infections (SSI) in Coronary Artery Bypass Graft (CABG) procedures. However, these findings warrant further investigation, considering the limitations in data collection, which relied solely on incident reports.

The Influence of Clinical Pathway Compliance on Quality Based on Length of Stay (LOS)

In this study, the length of stay (LOS) for Coronary Artery Bypass Graft (CABG) procedures at Dr. Soetomo Hospital, Surabaya showed that 67 medical records (70.5%) had a LOS of ≤ 10 days, while 28 medical records (29.5%) had a LOS of > 10 days. The average length of stay was 10 days.

According to Liu et al., (2001) Several factors influence the length of stay (LOS), including the patient's diagnosis, presence of complications, age, payment classification, referral source, physician's specialty, and ethnic group. A previous study reported that the average LOS for patients undergoing coronary artery bypass was 9.33 days. According to the Indonesian Ministry of Health, an efficient LOS for such procedures ranges from 6 to 9 days.

The results of the study showed an inverse relationship between Clinical Pathway compliance and quality based on the Length of Stay (LOS) in Coronary Artery Bypass Graft (CABG) procedures at Dr. Soetomo Hospital, Surabaya. This indicates that the outcomes observed were contrary to the expected or planned results. Patients who were less compliant or non-compliant with the Clinical Pathway had a higher proportion of LOS ≤ 10 days (74.6%). According to Rochayati et al., (2023) Post-operative factors that affect the LOS of the CABG procedure include the duration of mechanical ventilator use, post-operative events such as atrial fibrillation, the risk of pneumonia infection, and the occurrence of Acute Kidney Injury (AKI), all of which influence the length of stay, especially during treatment in the ICCU. According to Trimarchi et al., (2021), the development and implementation of Clinical Pathways require strong organizational commitment, including the involvement of all medical staff.

The results of the study showed an inverse relationship between Clinical Pathway compliance and quality, as measured by length of stay (LOS), which was contrary to expectations. This was influenced by various confounding factors. For instance, 11 data points indicated compliance with the Clinical Pathway evaluation, yet the patients were not treated within the hospital's LOS standard of ≤ 7 days. Upon evaluation, the prolonged LOS was attributed to several factors, including complications following the CABG procedure and comorbidities such as diabetes mellitus, which required time for blood sugar regulation and

extended postoperative wound care. Additional contributing factors included the presence of atrial fibrillation risk, kidney dysfunction, pneumonia, and the need for prolonged ventilator support, all of which necessitated extended care in the ICCU. These factors were largely unavoidable, leading to longer hospital stays.

The Impact of Clinical Pathway Adherence on Cost Disparities

The implementation of Clinical Pathway can be one of the cost control efforts in the JKN era. According to Waluyo & Indrastuti (2023), the costs incurred by service providers for patient care can be calculated based on the Clinical Pathway and compared with the established INA-CBG rates. In this study, descriptive analysis revealed an effect of Clinical Pathway compliance on cost disparities. Specifically, greater non-compliance was associated with larger negative cost disparities.

Similarly, in the analysis of positive cost disparities, higher compliance was associated with greater positive cost disparities. According to Waluyo & Indrastuti (2023), the implementation of the INA-CBG tariff requires hospitals to save costs, maximize hospital financial management, and implement quality control, cost control and access through calculating service costs (cost of care) based on the calculation of hospital unit costs. A literature review conducted by Hijrah et al., (2022), showed a significant effect of the implementation of the integrated Clinical Pathway on reducing hospital costs for postoperative patients. Cost savings themselves can be achieved if there is a decrease in the length of stay (LOS). According to Rotter et al., (2012), reduced LOS can have an impact on more efficient hospital costs.

IMPLICATION

The results of this study can serve as a reference for improving the quality of hospital services, particularly for the quality control and cost control teams. For the quality control team, improvements can be made to the incident reporting system, which is evaluated every three months. Meanwhile, for the cost control team, a dedicated menu related to cost control can be created in the EMR

STRENGTH AND LIMITATIONS

The results of this study can have an impact on health workers in complying with the Clinical Pathway because it is related to the quality of the Coronary Artery Bypass Graft

procedure. However, further research is needed regarding other factors that cause prolonged LOS in CABG cases and the causes of negative disparities.

In this study, compliance data were obtained from medical records because they cover various aspects. Compliance with CABG procedure therapy includes several aspects reviewed according to CABG PPK, namely procedure indications, pre-operative therapy, post-operative therapy, antibiotic therapy and anesthesia therapy.

There are several limitations in this study. Some of them are the single-center study design, the data taken is retrospective, multivariate analysis was not performed, and there are confounding factors that produce an inverse relationship. Therefore, this can be further explored for further researchers.

CONCLUSION

The conclusion of this study is that there is no influence of Clinical Pathway compliance on quality based on the Surgical Site Infection (SSI) rate in the Coronary Artery Bypass Graft procedure, there is an inverse influence between Clinical Pathway compliance on quality based on Length Of Stay (LOS) in the Coronary Artery Bypass Graft procedure, and there is an influence of Clinical Pathway compliance on cost disparities in the Coronary Artery Bypass Graft procedure at Dr. Soetomo Hospital, Surabaya.

The unexpected inverse relationship between adherence and LOS warrants further investigation to explore confounding variables.

Suggestions for further researchers include analyzing the causes of non-compliance with the implementation of the Clinical Pathway, other factors that cause prolonged LOS in CABG cases, cases of SSI in outpatients after CABG and the possibility of readmission, as well as the causes of negative disparities in cases that are high volume, high risk, and high cost. In addition, it is recommended for further researchers to deepen the stronger multivariable model with prospective data collection.

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CONFLICT OF INTEREST

There were no conflicts of interest in this publication.

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