


RESEARCH

The Relationship Between the Quality of Health Services and Total Costs in Patients with Open Appendectomy in a Type C Hospital with Indonesia Health Insurance (BPJS Kesehatan) Coverage

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ABSTRACT

Introduction: Under BPJS Health, both open and laparoscopic appendectomies, are reimbursed at the same rate despite differences in consumable use. This study aimed to investigate whether open appendectomy provides favorable clinical outcomes at a lower cost and to analyze healthcare costs and service quality in class C private hospitals. **Methods:** This quantitative study was conducted at a type C hospital in South Jakarta from January 2022 to August 2023. The sample size was calculated using G*Power, the minimum required sample was 70 patients, based on linear multiple regression analysis. Patients included were those with appendicitis undergoing appendectomy under BPJS Kesehatan coverage, selected through purposive sampling. Patients with upgraded insurance or laparoscopic surgery were excluded. Data from medical records were analyzed using logistic regression with a significance level of $p < 0.05$. **Results:** Postoperative infection after appendectomy does not significantly influence cost and quality of care, possibly due to other factors. However, length of stay does, as longer patients require more resources. Cost significantly influences quality of care ($p < 0.05$). **Conclusion:** Postoperative infections do not significantly impact care costs, suggesting case-mix and illness severity are more influential. Longer stays result in higher costs, especially in advanced services. Hospital management should prioritize controlling complications and infections to improve service and meet accreditation standards.

Keywords: Costs, Indonesia health insurance (BPJS Kesehatan) coverage, length of stay, health services, open appendectomy.

ABSTRAK

Pendahuluan: Dalam program BPJS Kesehatan, baik apendektomi terbuka maupun laparoskopi, memiliki tarif penggantian yang sama, meskipun terdapat perbedaan dalam penggunaan bahan habis pakai. Penelitian ini bertujuan untuk menilai apakah tindakan apendektomi terbuka memiliki luaran klinis yang lebih baik dengan biaya yang lebih ekonomis, serta menganalisis biaya dan mutu pelayanan di rumah sakit swasta tipe C. **Metode:** Penelitian kuantitatif dilakukan di sebuah rumah sakit tipe C di Jakarta Selatan dari Januari 2022 hingga Agustus 2023. Besar sampel dihitung menggunakan G*Power dengan sampel minimal 70 pasien, berdasarkan uji regresi linear multipel. Pasien yang diikutsertakan adalah mereka yang menderita apendisitis dan menjalani apendektomi terbuka dengan jaminan BPJS Kesehatan, yang dipilih melalui teknik *purposive sampling*. Pasien dengan jaminan asuransi yang ditingkatkan atau yang menjalani laparoskopi dikecualikan. Data diperoleh dari rekam medis dan dianalisis menggunakan regresi logistik dengan tingkat signifikansi $p < 0,05$. **Hasil:** Kejadian infeksi pascaoperasi apendektomi tidak berpengaruh signifikan terhadap biaya dan mutu pelayanan, mungkin disebabkan oleh faktor-faktor lain. Sebaliknya, lama rawat inap yang lebih panjang berpengaruh signifikan, akibat peningkatan penggunaan sumber daya. Biaya juga terbukti berhubungan signifikan dengan mutu pelayanan ($p < 0,05$). **Simpulan:** Infeksi pascaoperasi tidak berdampak signifikan terhadap biaya perawatan, yang mengindikasikan bahwa komposisi pasien dan tingkat keparahan penyakit memiliki pengaruh yang lebih besar. Lama rawat inap yang lebih lama mengakibatkan biaya yang lebih tinggi, terutama pada layanan tingkat lanjut. Pihak manajemen rumah sakit sebaiknya memprioritaskan pengendalian komplikasi dan infeksi guna meningkatkan kualitas layanan serta memenuhi standar akreditasi. **Ayesha Melissa Rahmania Siahaan, Gracia Shinta S. Ugut. Hubungan Kualitas Pelayanan Kesehatan dengan Biaya Total Pasien Apendektomi Terbuka di Rumah Sakit Tipe C dengan Cakupan Asuransi Kesehatan di Indonesia (BPJS Kesehatan).**

Kata Kunci: Biaya, cakupan asuransi kesehatan di Indonesia (BPJS), lama rawat inap, pelayanan kesehatan, apendektomi terbuka.

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INTRODUCTION

Universal health coverage (UHC) is essential to the Sustainable Development Goals (SDGs), which encompass a broader array of economic, social, and environmental objectives than the Millennium Development Goals (MDGs) and establish a new health objective: 'ensuring healthy lifestyles and fostering well-being for everyone at all ages.' UHC is a global development framework designed to guarantee that all individuals and communities can access essential and comprehensive health services—promotion, preventive, curative, rehabilitative, and palliative—of high quality, while ensuring that such access does not impose financial burdens on users or specific populations.[1,2]

Improving healthcare outcomes and the growing demand for healthcare services have increased the focus on minimizing costs and improving efficiency in delivering healthcare services. However, the pressure to minimize costs by increasing efficiency can lead to poorer quality, hence the need to control the quality of care.[3] It is argued that poor quality can also be related to unnecessary costs incurred. Measures of interest are those that reflect medical quality by showing improvements in health, but from an economic point of view, quality-of-care measures are relevant if they reflect value to the patient.[4]

Appendicitis is an inflammation of the vermiform appendix, typically acute within 24 hours after onset, though it can also present chronically, resulting in around 300,000 hospital admissions annually.[5] The definitive therapy for acute appendicitis is appendectomy, which can be performed either conventionally or laparoscopically; laparoscopic treatments are currently preferred over traditional methods.[5] For patients with chronic appendicitis, laparoscopic appendectomy is typically conducted. Numerous studies have evaluated the outcomes of laparoscopic versus open appendectomy, revealing that laparoscopic appendectomy is associated with a reduced incidence of wound infection, diminished requirement for postoperative analgesics, and a shorter duration of hospitalization.[5,6]

Acute appendicitis necessitates prompt intervention and carries a substantial risk of infection or sepsis. Under the BPJS Health guarantee, the fees for both open and laparoscopic appendectomy are identical,[7] despite differing consumable costs: open appendectomy uses less expensive materials than laparoscopic appendectomy, which requires items such as trocars. The efficacy of laparoscopy in appendectomy treatment is established; however, the associated consumables are costly. This study will investigate whether open appendectomy yields favorable outcomes at a lower cost.[1,8] Several studies in Indonesia indicate that clinical pathway implementation has not resulted in significant improvements in outcomes such as length of stay, surgical wound infection at discharge, or hospitalization costs, but has shown benefits in improving antibiotic therapy.[7,9] This study will specifically analyze post-operative infection, readmission, mortality, and length of stay related to the cost of appendectomy in private class C hospitals.

METHODS

This quantitative study employed logistic regression analysis and was conducted at a type C hospital in South Jakarta from January 2022 to August 2023. The minimum required sample size was calculated using G*Power v 3.1.9.3 using multiple linear regression and assuming a small effect size ($f^2 = 0.2$), $\alpha = 0.05$, power = 0.80, and six predictors, resulting in 70 patients. The study population included patients diagnosed with appendicitis who underwent appendectomy and were covered under the standard BPJS Kesehatan health insurance. Purposive sampling was applied to select 70 patients; those with upgraded BPJS Kesehatan coverage or laparoscopic appendectomy were excluded. Data were collected from hospital medical records, covering demographic characteristics, clinical profiles, and treatment outcomes. Logistic regression was performed to examine the association between the clinical pathway implementation and surgical outcomes, with statistical significance set at $p < 0.05$.

RESULTS

This study involved patients who underwent open appendectomy surgery with BPJS Health coverage at a Type C hospital in South Jakarta. Inclusion criteria included patients who used BPJS Health services from class 1 to class 3. **Table 1** describes the profile of participants in this study.

Table 1. Characteristics of participants.

Profile	f	%
Age (year)		
< 13	3	4
13–18	13	19
19–30	24	34
31–45	17	24
> 45	13	19
Gender		
Male	27	39
Female	43	61
Class of BPJS		
Class 1	23	33
Class 2	11	16
Class 3	36	51
Total	70	100

The overall model (overall model fit) was indicated by the log likelihood value (-2LL value) by comparing the -2LL value at the beginning (block number = 0) with the -2LL value at the end (block number = 1). The test was carried out by comparing the initial -2 log-likelihood value (block number = 0) with the final -2 log-likelihood value (block number = 1). If the initial -2 log likelihood value was greater than the final -2 log likelihood value, then there was a decrease in results. A decrease in log likelihood indicated a better regression model. The regression analysis results (**Table 2**) show that the initial -2 log likelihood (block number = 0) is 97.041, which is greater than the final -2 log likelihood (block number = 1), which is 70.667. This indicated that the hypothesized model fit the data, so that the addition of independent variables improved the regression model.

Table 2. Overall model fit.

-2 Log likelihood in first model (block number = 0)	97,041
-2 Log likelihood in last model (block number = 1)	70,667

The feasibility of the regression model was assessed using Hosmer and Lemeshow's Goodness-of-Fit Test, as indicated by the chi-square value. Hosmer and Lemeshow's Goodness-of-Fit Test tested the null hypothesis that the empirical data fit the model (i.e., that there was no significant difference between the model and the data, so the model can be said to fit). The analysis yielded a chi-square of 5.089 with a significance of 0.748. Since the *p*-value (0.748) was ≥ 0.05, there was no significant difference between the model and the data. This indicated that the regression model used was feasible and acceptable, and it predicted the observed values well.

The variability of the independent variables in explaining the dependent variable was measured by the coefficient of determination, reflected in the Nagelkerke R Square value. The Nagelkerke R-Square value was expressed as a decimal and could be converted to a percentage for easier understanding and interpretation. The coefficient of determination seen from the Nagelkerke R Square value was 0.419. This indicated that the ability of the independent variables, namely age, sex, postoperative infections, readmissions, mortality, and length of stay in explaining the dependent variable, namely cost was 41.9%. The remaining 58% was explained by other variables outside of this research model.

Based on logistic regression analysis, postoperative infection did not influence the cost and quality of care, with a *p*-value of 0.613 ($p > 0.05$), indicating no significant influence on the cost of care. This could be due to other more dominant factors, such as case mix or disease severity. In this study, no patients had readmissions within 30 days or complications that increased mortality rates. Thus, the regression correlation data cannot be analyzed, and its effect on total costs could not be sought. The influence of length of stay (LOS) on cost and quality of care was accepted, with a *p*-value of < 0.001, indicating a significant influence. LOS affected costs because the longer the admission, the more resources are used, including beds, medications, medical personnel and ancillary services. Based on the results of logistic regression analysis, the cost variable had a *p*-value (Sig.) of < 0.001; because the *p*-value < 0.05, cost had a significant influence on quality of care.

DISCUSSION

The results indicated that postoperative infection did not significantly affect the cost of care . This may result from several additional factors that influence the cost of care, such as patient condition heterogeneity (case-mix). In the study by Kruse and Christensen (2013),[10] the correlation between postoperative complications and costs was frequently negative, potentially attributable to insufficient case-mix correction. Patients predisposed to complications and readmissions incur higher expenses, complicating the correlation between complications and expenditures and making comparisons across medical specialties difficult.[10,11]

Birkmeyer, *et al*., (2012) found that 30-day complication rates after acute and elective treatments were positively correlated with Medicare funding, while also indicating an inverse link between cost and quality of care. Hospitals exhibiting elevated complication rates generally incur higher treatment costs, particularly with Medicare insurers. While postoperative infections did not significantly influence care costs in the logistic regression analysis, findings from other studies indicate that complications are a crucial metric for assessing healthcare quality, with varying impacts on costs based on risk adjustment and case-mix.[12] This analysis also has relevance to the SDGs, specifically SDG 3: Good Health and Well-being. One of the targets in SDG 3 is to improve the quality of health services and ensure access to safe and effective care. Although postoperative infections, in logistic regression, did not have a significant effect on the cost of care, efforts to prevent complications remain important for improving health system efficiency and reducing the economic burden on patients and providers.

The analysis indicates that length of stay (LOS) significantly affects the cost of care. Prolonged treatment of a patient increases the likelihood that care costs will exceed the average, thereby impacting the quality of care. Augmented resources, including financial expenditures, can enhance quality through technology implementation. Specific technologies can expedite processes, reduce length of stay, and reduce hospitalizations, thereby enhancing healthcare efficiency and outcomes. These technologies have the potential to reduce personnel burden and labor duration, thereby reducing care costs.[13,14]

Some hospitals reported that INA-CBGs reimbursement for emergency surgical procedures often does not reflect the real costs, especially if the patient has complications that require longer treatment. If the rates are insufficient to cover operational costs, hospitals may incur financial losses that, in the long run, could undermine service sustainability and the quality of care. Therefore, further evaluation of the BPJS tariff structure, especially for emergency services such as appendectomy, is needed to ensure that the JKN system remains sustainable without compromising service quality. In line with SDG 3, improving health system efficiency must be accompanied by efforts to maintain optimal standards of care for all patients.[15]

Moreover, Diagnosis-Related Group (DRG)-based reimbursement methods have demonstrated an impact on expenses. Research conducted in hospitals across Australia, Denmark, Norway, and Sweden indicates that increasing DRG rates enhances hospital efficiency by reducing length of stay and increasing the volume of cases treated. A shorter LOS typically generates cost efficiencies, whereas a longer LOS, particularly in patients with acute problems stemming from chronic disorders, tends to extend the duration of stay and elevate expenses. This indicates that LOS management, aided by advancing technology, can be a crucial element in controlling healthcare costs.[15,16]

CONCLUSION

Postoperative infections did not significantly influence the cost of care. This result indicates that other factors, such as case mix and severity of illness, may be more influential in determining costs. Length of stay has a significant influence on costs. The longer a patient is hospitalized, the greater the costs incurred, both in resource utilization and in additional services. Higher costs are often

associated with improved quality, especially in services that require advanced technology or high levels of specialization. Although the postoperative infection factor was not significant for costs in this study, hospital management should still prioritize controlling complications and infections to improve service image and meet accreditation standards. The Diagnosis-Related Group used in INA CBGs aims to improve efficiency by reducing LOS, but without proportional tariff adjustments, hospitals are at risk of financial pressure that could impact service quality. Therefore, the increase in INA CBGs tariffs must be adjusted to the complexity of cases and resource requirements, so that hospitals are still able to provide quality services while maintaining the cost efficiency of care.

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