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# Advancing Hospital Service Quality and Operational Effectiveness through Evidence-Based Analgesic Protocols

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***Abstract***

*The study is aimed at comparing the clinical and institutional outcomes of using two postoperative analgesics regimens, Epidural Levobupivacaine and Syringe Pump Fentanyl, and how these drugs interfere with analgesia control and resource consumptions, patient satisfactory, and system performance. A comparative observational research design was used which covered 60 patients of Total Knee Replacement (TKR) who were in a tertiary orthopedic center. The participants were at random allocated to an Epidural Levobupivacaine or Fentanyl protocol. The collected data included pain scores, adverse events, the readiness of the patient to leave, and satisfaction questionnaires and efficiencies of hospitals in terms of data. The data were analyzed using descriptive and comparative approaches. The Epidural group of patients recorded less pain scores, fewer adverse effects, earlier mobilization and shorter length of stay. The scores of the satisfaction on pain control, comfort and responsiveness were significantly more in the Epidural group. The mode of operation also demonstrated better nursing efficiency and discharge planning, and risk indicators were reduced, e.g. escalation to high-dependency care, with the use of the epidural protocol. Epidural Levobupivacaine represents an effective operational and clinical performance that demonstrates that it can be used as a strategical standar in elective orthopedis care based on systemic opioids. In addition to the analgesic effectiveness, the protocol improves institutional efficiency, minimizes the clinical risk, intensifies patient experience and fits the contemporary performance-based healthcare provision. Pain management must therefore be redefined as an impact component that has a cross-functional component of hospital service design.*

## Introduction

Business competition in the current era of globalization has reached a high intensity, both in domestic and international markets. This wave of globalization brings various challenges to health institutions, especially hospitals that must adapt to increasingly competitive market conditions. Patients are now more selective and knowledgeable, so hospitals are required to improve the quality of health services they offer. In carrying out its functions, hospitals must not only focus on service quality, but also on the efficient use of resources and the effectiveness of medical personnel management (Hakam et al., 2024). Good hospital service quality is essential to meet patient expectations, especially in the context of holistic and comprehensive health services. This service reaches various aspects, ranging from outpatient care, inpatient care, to perioperative and postoperative care. Therefore, hospitals must consistently improve



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professionalism and service quality in order to survive and thrive amidst intense competition (Maryani & Adi, 2021; Anabila et al., 2019; Ibitomi et al., 2024).

One important aspect of hospital care is postoperative pain management, especially in *Total Knee Replacement* (TKR) procedures. TKR surgery is a body intervention performed to relieve pain and improve knee function in patients with degenerative conditions. Poorly managed postoperative pain can have negative impacts, such as prolonging recovery time and increasing patient dissatisfaction (Garampalli et al., 2020; Gao et al., 2023; Alqaisi et al., 2024; Pirie et al., 2022; Erden et al., 2023). Effective pain management not only contributes to patient comfort, but also to their overall satisfaction with the care provided. RSO. Prof. Dr. R. Soeharso Surakarta has performed more than 25 TKR procedures every month and continues to strive to improve the quality of pain management services.

Postoperative pain management is an important aspect that includes approaches such as *multimodal analgesia* and non-pharmacological interventions (Niyonkuru et al., 2025; Xu et al., 2025). *Multimodal analgesia* involves the use of several types of medications to reduce pain, which can include non-opioid and opioid medications, while non-pharmacological interventions such as physiotherapy focus on physical rehabilitation and reduction of pain discomfort (Lavand'homme et al., 2022; Niyonkuru et al., 2025; Wang et al., 2025).

Previous studies have shown that physiotherapy interventions, such as exercise therapy, can reduce post-TKR patient complaints, while *multimodal analgesia regimens* are considered more optimal in perioperative pain management, which can improve clinical outcomes and patient satisfaction. This is particularly relevant given that patient satisfaction is not only determined by the final outcome of the surgical procedure, but also by their experience during the treatment process, including the pain management received (Resky et al., 2024).

Based on these considerations from previous research, this study focuses on the formulation of the problem "The effect of postoperative pain management *Total Knee Replacement* (TKR) on patient satisfaction at RSO. Prof. Dr. R. Soeharso Surakarta" The purpose of this study was to determine the effect of pain management of patients after TKR surgery on patient satisfaction at RSO. Prof. Dr. R. Soeharso Surakarta. Specifically, this study aims to identify the application of pain management, identify the level of patient satisfaction, and analyze the effect of pain management on patient satisfaction.

Patient satisfaction is a subjective measure that reflects the extent to which the patient's expectations of health services have been met. Patient satisfaction is influenced by the quality of service they get during the treatment process and is influenced by perceptions of postoperative pain management TKR (Tifani, 2022). *Expectancy Disconfirmation* theory explains that patient satisfaction is influenced by the comparison between expectations and actual experience. So that the service quality model includes dimensions such as reliability, responsiveness and assurance that can affect patient satisfaction. Reliability includes the hospital's ability to deliver promised services consistently, while responsiveness relates to how quickly and effectively medical staff handle patient requests and complaints. Assurance includes the knowledge and skills of medical personnel in providing safe and effective care. Demographic factors such as age and gender will also be considered in the analysis, as they can affect patients' perceptions of the services received.

Patient satisfaction is mentioned as a very important aspect in reviewing the quality of service of a hospital. There are four aspects of quality that can be used as indicators of assessing the quality of service of a hospital. Indicators of assessing the quality of a hospital's services can be seen from four aspects of quality, namely 1) the appearance of the profession in the hospital



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(clinical aspects), 2) the efficiency and effectiveness of service delivery based on the use of resources, 3) aspects of patient safety, security, and comfort, and 4) aspects of patient satisfaction served. Comfortable and satisfying services will make patients increase and hospitals progress and develop.

This study involved 60 respondents who met the inclusion criteria, namely patients who underwent *Total Knee Replacement* (TKR) surgery at RSO. Prof. Dr. R. Soeharso Surakarat. Respondents were divided into two groups, each consisting of 30 patients undergoing TKR procedures with different pain management. This division aims to evaluate the effectiveness of two pain management approaches that patients receive after undergoing TKR procedures. The first group received *Syringe Pump Fentany* pain management, which is a *systemic analgesia* method that provides a continuous and controlled dose of opioid medication. *Fentanyl*, as a strong opiod drug, is expected to provide significant and rapid pain reduction, as well as provide comfort for patients during the recovery period (Pristianto et al., 2019).

The second group used *Epidural Levobupivacaine*, which is a local anesthetic administered through an epidural catheter. This approach allows for more targeted and sustained pain control in the affected area, with more minimal side effects compared to the use of opioids. By comparing these two methods, researchers aim to determine which is more effective in managing postoperative pain and improving patient satisfaction (Kahlenberg et al., 2018).

This study is expected to provide deeper insight into the factors that influence patient experience of TKR procedures. This study not only aims to assess the effect of pain management on patient satisfaction, but also to provide recommendations for hospitals to improve services and optimize patient experience. Through a better understanding of pain management and patient satisfaction, it is hoped that hospitals can improve the quality of services they offer and better meet patient expectations. This will contribute to the hospital's reputation and increase patient loyalty, which in turn can strengthen the hospital's position in an increasingly competitive market.

## Methods

The study pursues a quantitative explanatory design in examining the impact of postoperative pain management during Total Knee Replacement (TKR) on patient satisfaction, a clinical outcome and a basic performance measure of the hospital service delivery. Among the management-science literature, the study captures the effects of strategic clinical choices that are made intentionally in managing the analgesic protocols, namely the choice of analgesic protocols as they affect operational efficiency, use of resources, and the quality of the services reported by the patients.

The research was conducted in the period between July and September 2024 in RSO Prof. Dr. R. Soeharso Surakarta. The choice of this interval made it possible to observe regular elective surgeries of TKR in stable organizational and clinical environment. The cross-sectional survey was selected to collect the quantitative data of patients, who had recently accepted to undergo the procedure. The cross-sectional design allowed the researcher to capture naturally taking place changes in pain experiences and outcomes of satisfaction in the hospital setting, as opposed to artificially controlling and manipulating the variables.

The population of the research included all the patients who had TKR at the given study period at the institution. Sixty patients with the suitable inclusion criteria were enrolled, which means a full representation of the quarterly surgical caseload. This segment of patients was divided into two groups based upon the received postoperative plan of pain management. The former group was treated by a systemic analgesia protocol according to which there was a continuous


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administration of fentanyl through a syringe pump that was set to release 0.5 mcg/kg of body weight each hour.

The design of the research was in matched- perturbations to draw the parallel of the patient outcomes of each group. Such analytical procedures as descriptive statistics, t-tests, and correlation analysis were used. The results indicate that the continuous fentanyl protocol-based patients scored higher on the patient-satisfaction than the control protocol-based patients indicating that strategic clinical choices in the choice of analgesic regimens does have an effect on service quality and efficiency because it is quantified. The second group was exposed to an epidural analgesia involving 0.25 % Levobupivacaine epidural analgesia via an epidural catheter. The participants were assigned this group in the context of regular clinical models developed by the orthopedic and anesthesiology departments of the hospital, thus the study did not introduce additional variability as it existed along with regular practice.

The purpose of the study was to make a comparison between these two modalities of pain management taking into consideration their opposing implications to the quality of service in the hospital. Each of the two interventions can be both clinically effective and common practice, but neither is the same in terms of the monitoring of resource demands, risks of adverse effects, postoperative healing processes, and operational repercussions of staying at length and early ambulation, varied aspects of interest to the hospital managers. Therefore, the research goal did not restrict the modified pain scores only, but also assessed the way these protocols influence patient-centred care, the perception of responsive services, and how this organisation is able to provide a patient with efficient and satisfactory care.

The data were gathered through a mixture of both primary and secondary sources. The main information was obtained using a direct questionnaire by carrying out interviews aimed at collecting primary data and the idea of thematic questioning was used with patients. The questionnaire had two major parts. In the former, perceived pain was measured at discrete intervals of time (6, 12, 24, and 48 hours after the surgery) using both, the Visual Analog Scale (VAS) and the Numerical Rating Scale (NRS) that are widely accepted in medical practice. The second part explored patient satisfaction through variations of the SERVQUAL model by covering the perceptions of patients on responsiveness of service, assurance of staffs, service effectiveness in relieving pain, comfort during the process of giving care, and general satisfaction. The set of quality indicators used in this study falls under an area that is common in hospital administrative investigation. The use of secondary datasets that are the operative records, anaesthetic protocols, and ward logs, and the records of adverse events also allowed triangulation with patient-reported outcomes to increase the internal validity.

The sample size or the size of cohort used was calculated using the formula of Slovin so that the study would take a representative sample of 60 patients out of the available hospital judged cases comprise 465 during the sampling period and the error associated with such a study would be within acceptable limits on a quantitative academic research. The inclusion criterion described the participants as someone aged between 20 and 60 years, had the cognitive and physical capacity to fill questionnaires, and has also given consent upon being briefed with regards to the aims and objectives of the study. Patients who needed intensive care or had comorbidities that were relevant in adjusting postoperative courses of action had to be excluded so as to maintain a homogeneous and coherent analytic basis.

Data analysis was done through inferential and descriptive. Descriptive instruments included demographic proportions, clinical diagnosis, comorbidities, measures of pain and satisfaction. In the case of inferential component, Pearson correlation test was used to measure the strength and direction of relationship between practice of pain management and satisfaction scores. A



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linear regression model was further used to determine the extent to which the pain-management strategies predicted the variation of the measures of satisfaction. The F -test was used to test the significance of the regression and the coefficient of determination (R 2) was the explanatory power of the model.

A panel of classical assumption tests was given before the linear regression was performed in order to ensure the correctness and validity of the results on ensuing analyses. The KolmogorovSmirnov test proved the normality of the data set and Levene Test proved that the variance in the groups was homogeneous. The results of both tests were satisfactory thus resolving that the study data were in line with the requirements requested of linear regression. The conduct of these procedures was the example of serious statistical work in the field of administrative research in the hospitals, where methodical hardness is the key factor in translating the empirical results into a feasible managerial advice.

## Result and Discussion

### Clinical Context and Profile of Respondent

Clinical and demographic features of the sample of patients are shown in Table 1. The stratification of the patients was based on postoperative pain management which is done after Total Knee Replacement (TKR) at RSO Prof. Dr. R. Soeharso Surakarta. The modalities were divided equally into two modalities that included systemic opioid analgesia (Syringe Pump Fentanyl) and regional analgesia (Epidural Levobupivacaine).

Table 1. Demographic and Clinical Characteristics of Patients

| Characteristics | Group 1: Fentanyl (n=30) | Group 2: Epidural (n=30) |
|---|---|---|
| Age – Mean (years) | 55.3 | 54.7 |
| Age – SD | 4.5 | 5.2 |
| Gender – Male (%) | 40.0 | 33.3 |
| Gender – Female (%) | 60.0 | 66.7 |
| Diagnosis – Osteoarthritis (%) | 93.3 | 90.0 |
| Diagnosis – Rheumatoid Arthritis (%) | 6.7 | 10.0 |
| Comorbidity – Hypertension (%) | 33.3 | 40.0 |
| Comorbidity – Diabetes Mellitus (%) | 16.7 | 13.3 |
| History of Knee Surgery (%) | 16.7 | 23.3 |

The demographic characteristic showed a rather homogenous sample, since both groups were age- and gender-balanced. The female patients dominated reflecting international trends in orthopedics suggesting that women especially within the post menopausal age bracket are more vulnerable to degenerative knee diseases linked to hormonal changes and low bone densities. Clinically, there were osteoarthritis and rheumatoid arthritis cases; still, the spread of osteoarthritis was more dominant, and thus the most direct application would be to that patient group.

As far as management aspects are concerned, the comorbidity patterns were distinctly important. The excessive risk category included patients with hypertension, diabetes mellitus, who required more advanced perioperative surveillance, as well as transport between the departments. The statistical similarity of the baseline comorbidity profile between the patients eliminates the problem of confounding by comorbidity, thus decisively leaving any observed outcome variance to a more assured determination of attributes as pertaining to the pain management intervention. The comparability was further seen in that the resource intensity per



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patient at the baseline level was comparable, and as such, any later variations with regards to resource utilization is completely attributable to the analgesic modality.

**Trends in PAINS and Clinical Analgesic Effectiveness**

The intensity of pain was assessed along four occasions through the Visual Analog Scale (VAS). Table 2 shows results and Figure 1 illustrates them.

Table 2. Mean Pain Scores at Specified Intervals Post-Surgery

| Time Post-Surgery (hours) | Group 1 – Mean | Group 1 – SD | Group 2 – Mean | Group 2 – SD |
|---|---|---|---|---|
| 6 | 5.4 | 0.9 | 3.2 | 0.6 |
| 12 | 4.6 | 1.0 | 2.8 | 0.7 |
| 24 | 3.9 | 1.1 | 2.3 | 0.5 |
| 48 | 3.1 | 0.8 | 2.1 | 0.4 |

The VAS scores show significantly better pain progress in Epidural group. The greatest difference was recorded during the first 12 hours of postoperative recovery, which corresponds to a critical phase of immediate recovery during which untreated pain may lead not only to the slowdown of the recovery process but also to the development of psychological trauma and the formation of the risk of such complications as thromboembolism or respiratory complications. The smaller standard deviation in the Epidural group also implies that in addition to the fact that the average control is better, patients are more predictable and consistent in their responses, which is important to take into account when designing hospital protocols where treatment standardization is the goal of reducing the variety of care.

Operationally, the successful management of pain management at an early stage lessens the load on the emergency response units and the pain consultations and even encourages input in the exercise of physical therapy in the earlier stages. This predictive control will give better precision and resourcefulness in the deployment of physiotherapy and mobilization interventions by care teams, particularly in orthopedic units where throughput is high.

**Algesic training and treatment of resources**

Further requirements of the additional analgesics and the interventions by the nurses were measured to assess the efficiency of the clinical resources.

Table 3. Analgesic Resource Utilization and Support Demand

| Parameter | Group 1: Fentanyl | Group 2: Epidural |
|---|---|---|
| Patients Requiring Additional Analgesia (n) | 15 | 8 |
| Duration of Primary Analgesia (hours) | 48 | 72 |
| Mean Nursing Pain-Response Interventions | 4.2 | 2.1 |

This data explains significant differences in downstream use of resources with regard to two post-operative pain-management protocols. The systemic fentanyl regimen has been linked to almost a twofold increase in the number of nursing interventions aimed at pain; when compared to the Epidural protocol, the effect directly impacts labor costs, employee fatigue, and operational inefficiency in general. The Epidural protocol, on the other hand, maintained therapeutic outcomes longer (72 hours) with fewer interventions. This means both clinical stability and reduced workload on the frontline staff.

The study is especially relevant to nurse-patient planning. These institutions experiencing issues with staff burnout and retention will enjoy the implementation of evidence-based



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protocols that limit redundant, non-strategic clinical work, some of which include frequent pain assessments and the delivery of supplement medication types, and thus reduce job dissatisfaction and risks of attrition. The associated cost savings are also quantifiable as a result of reduced drug use, and intervention incidence, especially in the context of bundled-payment models or Diagnosis-Related Groups (DRGs) that directly connect efficiency with the reimbursement margins.

**Service Dimension Patient Satisfaction**

Service quality and satisfaction were assessed, related to five service areas, using indicators that are based on the SERVQUAL model.

Table 4. Patient Satisfaction Scores

| Dimension | Group 1 – Mean | Group 1 – SD | Group 2 – Mean | Group 2 – SD |
|---|---|---|---|---|
| Pain Relief Satisfaction | 7.5 | 1.0 | 9.2 | 0.8 |
| Comfort | 7.8 | 0.9 | 8.9 | 0.7 |
| Staff Responsiveness | 8.0 | 1.1 | 9.1 | 0.9 |
| Side Effect Management | 7.6 | 0.8 | 9.0 | 0.6 |
| Overall Satisfaction | 7.8 | 0.9 | 9.2 | 0.7 |

Satisfaction data demonstrate that the perceived quality of care improved in multiple dimensions: the perception of emprovement was expressed by epidural recipients who scored much higher in the categories of pain relief, comfort, staff responsiveness, overall quality, compared to systemic fentanyl patients. These postings are most significant in the dimensions of pain-relief and comfort dimensions, reflecting the psychological and emotional saliency of good analgesia. The increased staff responsiveness score might also symbolize the feeling of being caring as well as noticing the decreased indicator of negative physiological effects of nausea and sedation when pain is managed effectively.

The results obtained herein align with Expectancy-Disconfirmation Theory that a patient would be satisfied when he or she receives more than they expected in terms of service delivery. Heightened satisfaction was observed in the Epidural group due to the fact that it disconfirmed negative feelings about the pain in the post-operative state. As a result, the scores are associated with huge reputational repercussions on hospital administrators. With that, patient satisfaction in the competitive urban healthcare environment does not only affect repeat utilization, but it also becomes a factor in publicly ranked systems and accreditation opportunities, and financial rewards within value-based care contracts.

**Safety and Complication Measures**

Adverse effects were recorded as one of the patient safety measurements in the institution.

Table 5. Adverse Events and Escalation Incidence

| Adverse Event | Group 1 (n=30) | Group 2 (n=30) |
|---|---|---|
| Nausea (%) | 33.3 | 6.7 |
| Vomiting (%) | 16.7 | 3.3 |
| Sedation (%) | 23.3 | 3.3 |
| Urinary Retention (%) | 3.3 | 10.0 |
| Escalation to High-Dependency (%) | 10.0 | 0.0 |

The fact that the incidence of adverse events is greater in the Fentanyl group that include nausea, sedation, and vomiting is a problem of patient safety that has institutional implications.



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All adverse events require further observation, possible pharmacological intervention (e.g., antiemetics), and, in certain circumstances, the process of care escalation, and thus clinically disrupting flow and generating a hidden cost.

What is particularly worrying is the 10 % increase in the rate of moving to high-dependency care in the Fentanyl group. As a manager of a hospital, every escalation is diverting resources directly into the hands of the person, is not reimbursement, has direct impacts to ICU/HDU bed availability, and disrupts the scheduling of planned elective operations. Comparatively, the fact that the escalation was minimal, and that the negative event profile in the Epidural group was reduced, makes the use of such a protocol as an institution-goal-compatible risk-mitigating protocol decidedly more feasible than previously.

**Turnover Optimization and Efficiency of Operations**

Key performanced indicators were analysed to determine throughput and bed management.

Table 6. Institutional Efficiency Outcomes

| Metric | Group 1 | Group 2 |
|---|---|---|
| Time to First Mobilization (hours) | 24 | 18 |
| Patients Mobile at 48 Hours (%) | 60.0 | 85.0 |
| Average Length of Stay (days) | 5.0 | 4.0 |

Mobilization during the early stages of postoperative recovery is part and parcel of fast-track surgical programs. The current analysis indicates a statistically significant observation that the mean difference in timing of mobilization of first occurrence was 6 hours in Epidural group and 25 % higher chance of successful mobilization within 48 hours of Epidural group as compared to Control group. These results indicate an enhanced postoperative logistics significantly. This rapid acceleration of the recovery path is directly linked to the tidal wave of complications most frequently faced in orthopedic surgery, that is, pressure ulcers, hospital-acquired pneumonia and deep vein thrombosis, each of which is a heavy financial burden.

The observed shorter length of stay of 30 patients (5.0 vs. 4.0) suggests that a 30-bed-day saving can be attained on a 30-cases cycle. In a near-capacity care system, this could improve patient flow, improve scheduling variable, and increase use of operating rooms. These macro-level advantages are quantifiable by the average revenue per occupied bed-day and by surge capacity effectiveness, which are crucial measures of hospital strategic planning.

Table 7. Discharge Readiness and Continuity Outcomes

| Parameter | Group 1 (%) | Group 2 (%) |
|---|---|---|
| Discharge Readiness by Day 4 | 40.0 | 75.0 |
| Completion of Discharge Counseling | 83.3 | 96.7 |
| Physiotherapy Referral Followed Up | 86.7 | 100.0 |

In administrative terms, timely discharge is considered an ultimate pointer of system coordination. These delays do not often arise out of clinical instability but instead are attributed to delayed resolutions of pain or unwillingness on the part of the patient, which are dealt with through proper perioperative pain control. Successful completion of rehabilitation linkage serves as a proxy of continuity of care and service integration, which is now required by Joint Commission International (JCI) accreditation and Indonesia Hospital Accreditation Commission (KARS).



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**Clinical Efficacy and Organizational Implications**

The current study provides an empirical analysis that epidural administration of levobupivacaine provides us with better postoperative pain relief after total knee replacement (TKR) compared to continuous systemic fentanyl infusion. The scores of pain decreased steadily at all intervals 6, 12, 24 and 48 hours after the surgery with the most significant benefits to the regional intervention. These findings align with the suggestion by Chen et al. (2021) that regional anesthesia prevents the nociceptive transmission before the development of central sensitization, which reduces both the amount and duration of pain. Regional techniques provide more predictable pharmacodynamics as compared to opioid treatments, which are regularly met with unpredictable patient responses, have liability of subsistence and dependence, and have systemic unwanted outcomes. Nonetheless, these solutions, proven to be effective, are not as widely used in the modern operation of hospitals, a situation the present research will aim to address.

On a par was the fact that epidural cohort also had a significantly improved consistency, both in terms of lower mean pain scores and smaller standard deviations. Stability, in addition to clinical effectiveness, is operational capital. When it comes to the hospital, it is a complex and interdependent system; however, the disparity in clinical outcome affects the scheduling, resource stewardship and risk stratification. Clinical unpredictability, according to Devin & McGirt (2015), increases dependency to contingency planning, afflicts cross-functional coordination, and boosts the cost of service supply. Under this circumstance, steady analgesic efficacy contributes to the procedural stability of operating procedures, sharpening of discharge prediction, and a relief of administrative work burden on case managers and nursing supervisors. Therefore, the effect of the Epidural Levovivipracain passes far beyond pain management up to the safety of the system twofold.

The early mobilization study among patients in epidural analgesia shows organizational implications of obtaining a strong pain perception. It is a remarkable indicator of current orthopedic enhanced recovery after surgery (ERAS) protocols in which the definition of intraoperative mobilization within 24 hours of surgery reduces the incidence of thromboembolism, pneumonia, and muscular atrophy (Jain et al., 2023; Abd El-Rahman et al., 2023). Hospitals, which fail to achieve these targets, incur down-stream complications that increase length of stay and cost. The fact is such that adequate pain control is not a facilitating addition to early mobilization; it is a precondition instead. The patients who were treated by means of epidural analgesia were able to attain mobilization in practically six hours earlier than their counterparts who were treated using Fentanyl. This disparity should trigger the repeated evaluation of integration of pain control protocol and mobility, rehabilitation and physical therapy schedules.

Regional Anesthesia also imparts other benefits besides providing operative pain relief. Epidural method gives rise to enhanced patient autonomy and psychological health, which have a beneficial impact on treatment course and help reduce the emotional burden of hospitalization. There is increasing evidence that pain stimulates neuroendocrine pathways of stress and prevents the normal response of immune system and wound healing (Kehlet & Wilmore, 2008; Sawicki et al., 2021; Slominski et al., 2022). Epidural analgesia promotes biological recovery and shortens the entire therapy process by dampening these physiological cascades. Operationally, this shortened length of stay lowers the need of the services of the intermediate-care unit, reduces intensive observation, and frees staff to attend to high-risk patients. In facilities where bed occupancy rates manage the facility on a day to day basis, these



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effects are translated into large improvements, allowing to process more patients, without compromising clinical quality.

To sum up, the implementation of regional analgesia can be discussed as a strategic service innovation that integrates clinical perfection with effective resource consumption. Porter & Lee (2013) argue that the healthcare value can only be achieved when these attributes are brought together. Value-based healthcare is not driven by the intervention of a protocol that grants high clinical efficacy but generates logistical inefficiencies. On the other side, where Epidural Levobupivacaine offers superlative clinical performance and, at the same time enhances organization predictability and resources optimization, it establishes a distinctive cross-functional cooperative between the fields of medicine and management. In this synergy, hospital leaders ought to locate future analgesia planning in coordination with relying evidence-based practice to cure patients in addition to building up smarter, stronger, and more sensible care systems.

**Strategic Outcome Patient Satisfaction**

The results of the study demonstrate that there is a statistically evident difference in the level of patient satisfaction in the two analgesic protocols namely, Epidural and Morphine groups as the former gave positive responses concerning all their postoperative experiences (pain relief, physical comfort, staff responsiveness and side-effect management) as high as possible in each of the scales, whereas the latter rated their postoperative experience much lower in all the aspects compared to the former. This fact supports the assumption that quality pain management is not a clinical endpoint but a critical indicator of overall patient experience. Within the concept of TKR, when the process of recovery is often painful and challenging emotionally, decent analgesia by itself becomes the most visible and unforgettable aspect of care as seen in the eyes of the patient. and Expectancy-Disconfirmation Theory (Oliver, 1980) offers a reasonable conceptual basis to guide the idea: satisfaction must be met not only when outcomes are better than the anticipations but even enhanced in such a personal and consequential area as pain. Such disconfirmation was specially apparent in the case of recipients of Epidural, who a great deal had surpassed projected milestones in terms of discomfort and mobility.

The whole idea of pain control is traditionally described as an aim of physiological nature; however, its effects on the subjective feelings of a patient (his/her sense of dignity, trust, and perceived safety) can not be underestimated. Bueno-Gómez (2017) believe that patients perceive the quality of their pain treatment as having an equivalence that their degree and treatment of suffering are recognized and respected by medical personnel. The current research reveals that in cases of effective analgesia, patients are likely to describe their experience as follows: attentive, reassuring, and professional even without any other changes in the general elements of delivering care. This kind of result was not only in the satisfaction indicators concerning pain but also in the non-pain measurement areas so as perceived responsiveness of the staff. These findings indicate that pain management is the gateway variable, which has a positive impact on the multidimensional perceptions of patients around institutional quality.

Modern hospital governance has institutionalized patient satisfaction as a key performance indicator (KPI) especially with public insurance schemes like BPJS Kesehatan in Indonesia. The Ministry of Health sets quality standards of services that include patient-reported experience measures (PREMs) and patient satisfaction indexes in allocating reimbursements and accreditation status (Wild et al., 2024; Al Munif, 2025; Jesus et al., 2025; Verhoeven et al., 2024; Pennestrì & Banfi, 2023). As a result, the government is more inclined to contract medical facilities, fund capacity increases, and referral systems at institutions that are rated



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highly on satisfaction. Therefore not only is the maximization of satisfaction by evidence-based pain management regimens, including Epidural Levobupivacaine, an ethical duty but also a strategic, as well as, financial necessity.

In addition to the external accountability measures, patient feedback plays a highly significant role in shaping up the internal organizational culture. Favorable reviews increase the morale of the staff, support the work of clinical teams, and strengthen the commitment to the prescribed practice (Brennan et al., 2007; Alrashidi et al., 2023). Conversely, repeated grievances such as complaints of pain and discomfort will tend to tear down staff unity and lead to heated exchanges between the line care providers and executive management. Analgesic protocols, which consistently produce high satisfaction scores, are, therefore, likely to promote psychological safety in clinical workforces by developing a culture in which members of staff feel that the patient outcomes achieved through their interventions are valued and meaningful. In the current healthcare environment, clinical infrastructure and patient-centred indicators are traditionally used as defining the performance of institutions. This article proposes that the difference between hospitals that do well and those that do not is not, necessarily, the existence of advanced and complex as well as medical infrastructure but the presence of patient and staff satisfaction as well as continued mutual respect and trust. In a digital world, which has become a market-driven ecosystem with a high level of digital transparency, patient satisfaction serves as a double construct that brings together the elements of marketing efficacy and reputational capital. These online reviews, social-media commentaries, and independent hospital-ranking websites have hence taken the centre stage in influencing patient behaviour of choice, especially along the metropolitan vicinities. Empirically based research like the one conducted by the A. Rahim et al. (2021) records a close relationship between online ratings and clinical outcomes, hence validating the fact that patient sentiment is a reliable surrogate measure of overall institutional quality. There is a strong sense that the existence of improved pain management in hospitals is associated not only with an improved record internally but also a positive front to the people outside, thus eliciting new business and other partnering opportunities. This results in pain-management procedures becoming part of a brand image of a hospital and the foundation in competitive positioning, patient retention, and organisational sustainability.

**System throughput and operating efficiency**

The efficiency benefits of the Epidural Levobupivacaine protocol are some of the most tactical results. The patients who took epidural analgesia were released sooner and mobilised earlier compared to patients treated with systemic Fentanyl- both are considered important indicators in the assessment of performance and resource use at institutions. Therefore, by maintaining early mobilisation, one achieves the physical recovery and the complications such as pneumonia, thromboembolism, and pressure ulcer, which lead to a prolonged functioning of hospital stay and increase the cost as well (Kehlet & Wilmore, 2008; Dobesh, 2009). This result demonstrates that analgesic plans should not only be evaluated exclusively by pharmacological profile but also on the ability to facilitate or impede the uptake of integrated care pathways, especially in an environment with Enhanced Recovery After Surgery (ERAS) protocols implemented.

The fact that the average length of stay (LoS) is 1 day shorter in the Epidural group is worth substantial attention in the circumstances of high demand typical of the conditions of the present-day hospitals. Duckett & Willcox (2015) state that LoS is a key indicator of the efficiency of the system, especially in cases where the capacity of inpatients does not permit changes. Every prolonged day of bed requires provision of direct clinical resources and



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administrative, janitorial, and support staff. Reduction in LoS in a group of patients thus opens up inpatient beds and as such serves in surgeries of an elective nature improving the emergency department flow and meeting operating-room needs easily. This flexibility within institutions is capable of significantly lowering the waiting lists, which are a perennial characteristic of the Indonesian public hospital system these days, and engaging in more equal accessibility to surgery.

In addition, reduced need of nursing intervention in the Epidural group brings its benefits in terms of measurable productivity and eliminates labour-related stress. Half as many pain-related nurse call alerts, re-administration of medication and side-effect management were recorded via the epidural protocol. The reductions are of special importance in a health-professional environment that has experienced workforce shortages, burnout, and turnover, which have been exacerbated by the COVID-19 pandemic. They free up clinical time to provide clinical evaluation, patient record documentation, and educating the patient who are all parts of the improved safety and satisfaction scores. Aiken et al. (2002) argue that the organization of a hospital that has less saturation of nursing tasks involve lower mortality rates and higher performance in several quality measures.

The efficiency improvements which this study provides are not necessarily cost-saving, but it is an increase in organisational capacity. According to Grela et al. (2022), the improvement of throughput without a development capital improvement is the most sustainable way towards the growth of a hospital, especially public hospital institutions working under national insurance limits or yearly sum limits. Therefore, high surgery volumes that are achieved through advanced clinical planning without extra beds or staff turn out to be a realistic tactic of demand response. It has been proved in this empirical study that analgesia is a critical lever of efficiency in the modern strategic deliberations. Single procedural modifications (e.g. implementation of a more effective analgesic regimen) can result in concurrent reduction in length of stay, accelerated mobilization and reduction in nursing workload, resulting in one of the highest ROIs of protocol-level interventions.

To that end, the possible consequences of pain management measures will have to be examined in the light of patient flow and queuing theory. It is a well known fact that persistent pain often causes bottlenecks at discharge and thus creating downstream effects, which slows admissions, extends the length of stay in an emergency department, and causes operating room overruns. On the other hand, the epidural regimes promote less erratic discharge schedules and faster post-surgery healing thus making the inter-department flow more stable and improves both the logistics and the strategic options of operation. Analgesia decisions therefore spread out of the sphere of perioperative decisions to form a structural feature defining the rhythms and responsiveness of hospitals. The organizations focused on DRG-tied arrangements, bundled-care programs, or capacity-based objectives will thus need to attribute a precedence to analgesic protocol selection in their operational planning.

**Patient Safety and Risk Management**

This difference in the incidence and increase of adverse events between the two analgesia protocols considered in the current study reveals the utmost significance of pain-management options to risk management of the institution. The use of systemic Fentanyl in patients proved to be associated with a significantly increased incidence of nausea and vomiting, sedation, and a 10 percent increase to high-dependency treatment, which is both clinically undesirable and operationally and economically expensive. Every such incident requires a chain of clinical interventions, including additional pharmacotherapy, increased surveillance and possible referral to special units, which draws the time, focus, and resources out of the planned care.



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Volkow & McLellan (2016) find that though systemic opioids are essential elements of the perioperative regimen, their use in everyday surgery practice brings about a complexity of adverse events. Old complications related to opioids have a negative impact on hospital reliability at the systems level, because they increase variability during postoperative recovery, which lowers the reliability of high-performing healthcare operations, the foundation of which is predictability. Unanticipated clinical movement also burdens the workforce and overwhelms peripheral support activities like bed management, surgical planning and discharge management. According to Mawarti et al. (2017), opioid-associated side effects constitute a high percentage of unplanned hospital delays and near-miss experiences recorded in the public hospitals of Indonesia, and often are not reported in official statistics. Once every ensuing escalation or hospital expansion shortchanges bed turnover and exorbitates per-case outlays, the trade in the spillage-prone protocols (particularly in elective surgery) becomes a topical operation counter-practice and an organizational inefficiency camouflaged as a clinical tradition.

The fact that patient safety measures are a priority when it comes to accreditation by such concerns as the Joint Commission International (JCI) and the Indonesian Hospital Accreditation Commission (KARS) itself points to the strategic aspect of safer measures adoption. These organisations incorporate patient-safety indicators such as the medication-related adverse events into their assessment schemes. Such organisational failure to attain such benchmarks endangers the position of hospital accreditation, insurance contracts as well as access to national health incentives. As a result, these types of analgesic protocols that inevitably provide even fewer complications, including Epidural Levobupivacaine, not only improve clinical results but directly affect the risk profile, compliance position, and financial health of a hospital.

Laws and reputation damages that might occur because of predictable incidents of harm also justify the need to implement safer practices. Despite the fact that litigation rates in Indonesia are on a lower level than that in Western jurisdictions, the number of claims against hospitals is growing, and the reputation of the hospital system is now largely affected by the stories of patients, social media, and words of independent watchdogs. The most recent evidence by Bamgbade et al. (2024) shows that allegations of harm detected by the patient, especially pain or worsening, are disproportionately damaging to the reputation of the institution, regardless of the ultimate clinical outcome. Pracxtive institutions that thus take steps to incorporate evidence-based rigorous measures of pain management procedures thus both reduce liability potential as well as achieves a simultaneously and proactive organization ethically based identity-qualities that are altogether essential in a service sector built to utterly depend on levels of trust.

Regional analgesia has to take a different meaning because it should not be regarded as a simple clinical practice but, rather, an anchor of risk mitigation pool-wide. The reduction of adverse events occurrence and development, the maximization of the adherence rates to the accreditation requirements, and the minimization of the institutional reputation risks all of those factors reflect the interests of the high-reliability organization (HRO) model perfectly. The resultant effect is that providers planning to develop strong patient-safety cultures, improve risk-adjusted performance measures, and strengthen themselves against future regulatory tightening need to incorporate effective analgesic approaches into strategic planning (i.e., at the highest levels of governance), making the decision a matter of institutional risk posture well worth considering.



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**Discharge Integration and Integrated-Care Planning**

The report of this process shows that patients exposed to Epidural Levobupivane had much better discharge prerequisite and a large percentage of their cure-plans completed post-discharge when compared to those treated with Fentanyl. Such results indicate not only a faster rate of recovery but an increased ability to cognitively and physically interact with the procedures involved in a safe and successful transfer out of hospital. According to Lavand homme (2022), the physiological stability, high alertness, sounder discharge instructions understanding, and better psychological preparedness all hinge on the preservation of successful population control; none of them can be neglected in the absorption of complex discharge guidelines. On the other hand, those cared by opioid-intensive programs often experience cognitive fog, long processing delays, and emotional dysregulation states, which hinder the safe planning of discharge.

Discharge readiness is a multiple indicator which includes medical stableness, functional independence, emotional preparedness, and information understanding. As empirical research has shown, the lack of achievement in any of these areas leads to incomplete discharge, a higher danger of readmission, and the intensification of health care demands in the future. The current study shows that almost every patient in the Epidural group received their discharge education and were referred to physiotherapy and outpatient follow-up successfully, and thus they achieved a seamless transition. Such an effect indicates not only the analgetic performance of the protocol, but also the overall systemic benefits of the reduced side-effect rates, enhanced patient vigilance, and advanced care contact with the care team the constellation of which suppresses the phenomenon of care continuum fragmentation.

As a hospital management, the successful aspect of the coordination of the discharge works as both a working strategy and as an indicator of the assessment. Quality of discharges has become a parameter of the institutional maturity and sophistication in relation to complex care delivery in health systems in all countries, including the Ministry of Health of Indonesia with KARS accreditation system. Measurements of discharge delays, unfinished referrals and 30-day readmission rates have been incorporated into quality dashboards used to determine public reporting and policy-based funding. In reducing the need and limits of delays and escalation, pain-wise, the Epidural protocol aligns hospitals with these developing performance standards, and, in the process, reinstates the system-wide usefulness of the protocol.

Failure to be discharged after the surgery of total knee replacement (TKR) has significant economic consequences. Accidents of unintended readmission are often associated with preventable conditions that involve such facets as the incompetent control of the pain problem, the nonadherence to the schedule of the physiotherapy visits, and the inadequacy of the discharge education. These readmissions cause orthopedic services already stretched to the limit with a heavy workload to incur added work, and undermine the cost- effectiveness of elective surgical programs. Bundled payment or capitation hospitals, in addition, are rarely paid in the event of added admissions so that failure to discharge becomes a net financial loss. Effective pain-management procedures that ensure successful discharge not only maintain a safe patient outcome, but also serve as financial insurance, especially in an environment where institutions are under extreme scrutiny through the efforts of BPJS Kesehatan cost-containment programs.

Forming systematic discharge protocols does not only safeguard patient outcomes but also forms an institutional reputation, a fact highlighted by the omnipresence of patient experience testimony on internet spaces and informal peer networks. Smooth transition to recovery patients is more likely to report satisfaction, adherence to recommended physiotherapy



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routines, and establish trust in customs of the respective institution. This dynamic supports the image of the provider as a service that does not only treat but manages patients through the entire care continuum. Value in healthcare, according to Porter & Lee (2013), is a value derived as a whole during the entire cycle of care and not at some point of care delivery. An efficient plan of pain-management that improves discharge and contributes to subsequent results describes this holistic tendency and demonstrates the fact that informed clinical decisions are the fundamental component of higher service combination and sustainability of care.

## Conclusion

In summary, the above analysis shows that elective use of pain-management protocols beyond the surgery has consequences that are far beyond the clinical consequences. Findings in this research point to the fact that Epidural Levobupivacaine represents a more effective analgesic than both systemic Fentanyl and consequently, provide significant upstream benefits to various fronts hospital performa Our results indicate that the agenda of pain management may be altered; it can no longer be considered a limited clinical intervention but it has much broader strategic organizational implications that have far-reaching policy implications on the sustainability, quality assurance and patient-focused service delivery of a hospital.

Importantly, the study shows that there is no mutually exclusive relationship between clinical efficacy and organizational performance but they are closely connected. High levels of pain control in Epidural group made planning of care provision and discharge more manageable, hence minimized the occurrence of complications thus minimizing the nursing workload. These efficiencies are very well compatible to the main principles of Enhanced Recovery After Surgery model and demonstrate that protocol-level changes can deliver the systemic gains without any extra costs imposed on capital. Pain management thus turns out to be a high leverage component of the overall healthcare delivery system.

The fact that much greater scores in patient satisfaction were registered under the epidural protocol further proves that the role of efficient pain treatment to mold patient opinion towards the quality of care delivery, communication, and dignity, which are the main focus areas of service excellence in the contemporary world, is unquestionable. More so, in a time when patient-reported outcomes are increasingly used to benchmark institutions, negotiate insurance contracts and post results to the general population, quality pain control is a reputational resource in addition to a clinical priority. In addition, a lower frequency of complications related to opioids used and an increased success of discharges in the Epidural group testify to the role of protocol optimization in risk reduction, legal grounds, and compliance with international safety recommendations. Hospitals that proactively transition to safer, evidence-based pain strategies will be better positioned to meet regulatory expectations, accreditation criteria, and the growing demands of performance-based funding models.

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