

Factors Causing Delays Between Surgeries in a Government Medical Center: A Cross-Sectional Study

Philner P. Salindo^{1*}, Philmed P. Salindo²

¹Negros Oriental State University-Guihulngan Campus, Guihulngan City, Philippines

²Vicente Sotto Memorial Medical Center, Cebu City, Philippines

*Corresponding Author Email: philnersalindo@gmail.com

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Abstract. Efficient OR management is crucial for delivering high-quality healthcare. This study investigated the root causes of turnover time delays in the Operating Room (OR) during elective surgeries. This research aimed to identify factors contributing to unwarranted delays in OR turnover time and proposes targeted solutions to enhance operational efficiency. The study used a cross-sectional design to focus on elective general surgery cases over six months. Data is derived from narrative reports by operating room staff, documenting turnover times and factors causing delays. Analysis of this six-month data highlights anesthesia and hospital-related factors as primary contributors to turnover time delays. Anesthesia-related factors account for delays ranging from 130 to 1,302 minutes, while hospital-related factors contribute between 145 and 1,860 minutes of delay. The findings underscore the multifaceted nature of elective surgery delays, driven by various factors. The study recommends a holistic approach, including optimizing staffing, streamlining processes, enhancing communication, improving emergency readiness, and embracing continuous improvement to address these delays effectively. Implementing these strategies can increase efficiency, ensure timely surgeries, and optimize resource allocation in the OR.

Keywords: Anesthesia-related factors; Cross-sectional study; Elective surgeries; Hospital-related factors; Operating room.

1.0 Introduction

The Operating Room (OR) comprises a collaborative effort in which two or more people identify common goals and work together to achieve them (Halverson et al., 2011). One component of the Operating Room is the health care team, broadly defined, encompassing all professionals involved with the patient, those who have direct patient contact, and those who work in other departments and contribute indirectly to patient care (Wong et al., 2010; Palter et al., 2020). Additionally, the most critical resources of the Operating team or health care team are the knowledge and experience of the constituent clinicians – the surgeons, anesthesiologists, nurses, and others (Donham et al., 1999; Mazzei, 1994).

The productivity in the Operating Room depends on the efficiency and organization of related functions within the Operating Room (Gupta et al., 2011). To complete defined tasks as a unified entity, team members should communicate and have a shared distribution of roles (Halverson et al., 2011; Kimbrough et al., 2015). The team approach to patient care should be a well-coordinated effort involving the participation of all caregivers (Panni et al., 2013). To work as a team, each member must try to achieve common goals competently and safely. Each team

member's actions are critical. With the help of other teams and individuals, every person can achieve the goal (Santos-Jaén et al., 2022; Palter et al., 2020).

The Operating Room is the most efficient area of any medical facility (Panni et al., 2013). Although every time spent in the Operating Room is valuable, turnover time is notably significant because of the time lost due to inactivity (Cima et al., 2011; Does et al., 2009). Multidisciplinary teamwork is essential for its effective application, particularly in providing ancillary services that shorten the time spent waiting between surgeries (Porta et al., 2013; Head et al., 2011).

Excellent and efficient OR management is evidenced by rapid surgical turnover between surgeries. It measures how well a group works together to do its job in the OR. The study's goals are to assess what causes Operating Room turnover times to be longer than necessary and to provide solutions that will allow for the most efficient use of the OR resources with the support of the participation of all relevant parties. Through this framework, practitioners can identify specific measures to enhance, counteract, or eliminate these aspects to facilitate more efficient OR administration.

This research was instigated by our medical center's data that the times to turnover in the OR were way above the national average, hence decreasing overall surgical capacity and increasing patient wait time. The objectives of this study are to identify what factors are causing these delays and propose solutions for the optimization of the use of OR resources. Precisely, the current study aims at increasing the efficiency of OR management and better outcomes for patients by understanding and addressing these issues.

2.0 Methodology

2.1 Research Design

This study utilized a cross-sectional research design, considering Elective General Surgery cases from January to June 2023. Data were extracted from the existing narrative reports of Operating room staff. The researcher personally noted and measured turn-over times, and the factors causing their delay were recorded as variables.

2.2 Data Source

This study occurred in a government medical center's general surgery operating room. This operating room had the resources and personnel to accommodate all General Surgery Department elective patients. All elective cases of General Surgery from the period of January – June 2023 were included in the data gathering, during which the duration of each could vary significantly due to factors such as the surgeon's skill level, the complexity of the case, and the availability of materials required for the surgery. Each elective case in the mentioned duration of the study was noted, as well as the TOT. It encompassed all Elective General Surgery Department operations. General surgery procedures commonly involve the use of general anesthesia. However, the turnover time was typically calculated from the time ended (first case) to the time of anesthesia induction in the succeeding case. It is important to note that the induction time, which referred to the period from the start of anesthesia administration to the patient's readiness for surgery, did not vary based on the type of anesthesia employed. All emergency and direct-to-operating-room operations performed by the General Surgery Department were not considered. Hence, a non-general surgery case was not a priority in observing the TOT. The current study also emphasized that procedures done by other cutting specialties were excluded. No sampling technique was used in this investigation, and no reference group was chosen.

2.3 Data Gathering

Data were gathered from the narrative reports the Duty Team leaders of nurses made every after their shift. These data were stored in the Operating Room Nurse's office and could be accessed through properly asked and endorsed permission. These data were also printed, and hard copies were available for data verification at the OR Chief Nurses' Office. The narrative report contained information regarding the process flow of the operating room, which included the time of the patient's arrival at the Operating Room, the time of the arrival of the surgeon and anesthesia staff, and, most importantly, it contained the time when the surgery started and when it ended. It was also recorded in the narrative report every time there was an undue delay in the turn-over time, of which the cause was highlighted and reported. The turn-over time and the reasons for Turnover time delays were recorded. The data were then placed in Microsoft Excel 2016 for data processing.

2.4 Data Analysis

The frequency and causes of delay in the Department of General Surgery's Turnover time between two elective surgeries were determined through data analysis. The causes for each surgeon, anesthetic, patient, and hospital-related delay were noted, tabulated, and calculated using Microsoft Excel 2016. Recording did not require any coding manual because data were assigned absolute numbers. Data collected were gathered and encoded in the Researcher's personal laptop computer with a secure password to protect its integrity and privacy.

Analysis processing was performed by counting the frequency of the factors mentioned above, highlighting the most frequent or the most common cause of TOT delay. This was then plotted in a table and presented in a pie graph to represent the proportional data or relative data in a single chart showing the percentage of the most common or frequent cause of TOT delay as data from the whole pie. The whole pie was comprised of the factors causing the delay in TOT.

The TOT between procedures was also noted and recorded in a separate Microsoft Excel 2016 sheet. TOT's mean and standard deviation (measured in minutes) were then determined. The result served as a benchmark TOT for this institution or at least an accepted TOT by the accepted mean TOT of 45 minutes (Dexter et al., 2005; Porta et al., 2013). The analysis was done using Microsoft Excel 2016.

2.5 Ethical Considerations

Because this research was integral to the quality enhancement initiative and services, obtaining necessary approvals and observing all relevant ethical guidelines was essential. Furthermore, the issue of waiver/consent not being necessary in this study was supported by the fact that Turnover time was currently recorded by Supervisory nurses who were on duty. These nurses were tasked to facilitate the Operating Room procedures and traffic the flow of transition between 2 surgeries, during which the causes of delays were also recorded. Hence, this study was within the working norm of the operating room where surgeons, anesthesia specialists, nurses, and staff were all aware of their tasks and duties and had knowledge of the existing operating policy, including recorded Turnover time. The main emphasis of this study was to identify the most frequent cause of these delays. This increased value and added more precise and unbiased information to an existing operating room policy.

The researcher guaranteed that the collected data would be securely stored and protected according to data privacy regulations to establish a reliable data management and disposal strategy. The information was solely utilized for this research. Once the analysis and results were obtained, they were presented in their original form. It was then at the administration's discretion to take action if significant findings emerged that necessitated interventions to enhance the flow and productivity of the operating room.

3.0 Results and Discussion

3.1 Factors Prolonging Turnover Time

Data Gathered from January 2023 – June 2023

Table 1. Factors prolonging turnover time based on the data gathered from January 2023

Factors	Frequency	Percentage	Mean	SD
Surgeon related	0	0		
Anesthesia-related	2	50	68.75	1.1545
Patient-related	0	0	minutes	
Hospital related	2	50		

Data in Table 1 offer valuable insights into the factors affecting the prolongation of turnover time in January 2023. Anesthesia-related and hospital-related factors each accounted for 50% of the total time. Additionally, the means indicate the average additional time attributed to these factors, with anesthesia-related factors contributing an average of 130 minutes and hospital-related factors contributing an average of 145 minutes.

In February 2023, an examination was conducted to identify and analyze the factors contributing to prolonging turnover during medical procedures. Table 2 provides detailed information on each factor's frequency, percentage, mean, and minute standard deviation.

Table 2. Factors prolonging turnover time based on the data gathered from February 2023

Factors	Frequency	Percentage	Mean	SD
Surgeon related	0	0		
Anesthesia-related	4	40	207.7	3.000
Patient-related	0	0	minutes	
Hospital related	6	60		

These data offer significant insights into the factors influencing the prolongation of turnover time in February 2023. Notably, hospital-related factors had the most substantial impact, accounting for 60% of the total time, with an average additional time of 1,682 minutes. Anesthesia-related factors also significantly contributed 40% to the total time, with an average of 395 additional minutes. The means suggest variations in the extent of time prolongation within these categories during the specified period.

Table 3. Factors prolonging turnover time based on the data gathered from March 2023

Factors	Frequency	Percentage	Mean	SD
Surgeon related	1	12.5		
Anesthesia-related	3	37.5	281.25	1.8256
Patient-related	0	0	minutes	
Hospital related	4	50		

In March 2023, a comprehensive analysis was conducted to identify and assess various factors contributing to prolonging turnover time during medical procedures. Table 3 shows the frequency, percentage, mean, and standard deviation for each factor measured in minutes. These data offer valuable insights into the factors influencing the prolongation of turnover time in March 2023. Hospital-related factors had the most significant impact, accounting for 50% of the total time, with an average additional time of 1,860 minutes. Anesthesia-related factors also played a substantial role, contributing 37.5% to the total time, with an average of 270 additional minutes. Surgeon-related factors accounted for 12.5% of the total time, with an average of 120 additional minutes. Patient-related factors did not contribute to the prolongation of turnover time during this period.

Table 4. Factors prolonging turnover time based on the data gathered from April 2023

Factors	Frequency	Percentage	Mean	SD
Surgeon related	3	23.1		
Anesthesia-related	7	53.8	100	2.6299
Patient-related	2	15.4	minutes	
Hospital related	1	7.7		

In April 2023, a comprehensive examination was conducted to analyze and identify the factors contributing to prolonging turnover time during medical procedures. Table 4 presents a detailed breakdown of each factor's frequency, percentage, mean, and standard deviation, measured in minutes. These data offer valuable insights into the factors influencing the prolongation of turnover time in April 2023. The data indicates that anesthesia-related factors had the most significant impact, contributing 53.8% to the total time, with an average additional 670 minutes. Surgeon-related factors accounted for 23.1% of the total time, with an average of 190 additional minutes, while patient-related factors contributed 15.4% to the total time, with an average of 90 additional minutes. Hospital-related factors had the least impact, accounting for 7.7% of the total time, with an average additional time of 350 minutes.

Table 5. Factors prolonging turnover time based on the data gathered from May 2023

Factors	Frequency	Percentage	Mean	SD
Surgeon related	1	6.3		
Anesthesia-related	11	68.8	120.75	4.6904
Patient-related	2	12.5	minutes	
Hospital related	2	12.5		

In May 2023, an in-depth analysis was conducted to identify and assess the factors contributing to prolonging Turnover time during medical procedures. Table 5 provides a detailed breakdown of each factor's frequency,

percentage, mean, and standard deviation, measured in minutes. These data offer valuable insights into the factors affecting the prolongation of turnover time in May 2023. Notably, anesthesia-related factors had the most substantial impact, accounting for 68.8% of the total time, with an average additional time of 1,302 minutes. Surgeon-related factors contributed to 6.3% of the total time, with an average of 90 additional minutes. Patient-related factors accounted for 12.5% of the total time, with an average of 80 additional minutes, while hospital-related factors also contributed 12.5% to the total time, 460 minutes.

Table 6. Factors prolonging turnover time based on the data gathered from June 2023

Factors	Frequency	Percentage	Mean	SD
Surgeon related	0	0		
Anesthesia-related	7	63.6	91.27	2.9860
Patient-related	2	18.2	minutes	
Hospital related	2	18.2		

In June 2023, a comprehensive analysis was conducted to identify and evaluate the factors contributing to prolonging turnover during medical procedures. Table 6 provides detailed information on each factor's frequency, percentage, mean, and minute standard deviation. These data points offer valuable insights into the factors influencing the prolongation of Turnover time in June 2023. Among the factors examined, anesthesia-related factors had the most substantial impact, accounting for 63.6% of the total time, with an average additional time of 562 minutes. Patient-related factors contributed to 18.2% of the total time, with an average of 172 additional minutes, while hospital-related factors also accounted for 18.2% of the total time, with an average additional time of 270 minutes. Surgeon-related factors did not contribute to the prolongation of TOT during this particular period.

A trend over six months of data, from January to June 2023, shows that factors contributing to prolonged turnover periods between operating room cases remain highly variable on a month-to-month basis. These variance attributes to seasonal fluctuations of type and volume of surgeries performed. Staffing levels and experience, as well as the allocation of resources in general and equipment in particular, have shifted. For example, months when the more junior anesthesiologists are on duty or when there is a higher influx of complex surgeries that prolong set-up time can ultimately increase anesthesia-related percent delays.

External variables, such as public holidays, training periods, and changes in hospital policy, have also influenced these shifts, as the existence of inconsistencies in the gathering of information. It then becomes possible for hospital management to plan and hence avoid the issues responsible for increasing turnover times, in return facilitating more consistent and less wasteful operating room operations and hence better results on patient care.

Summary of Causes of Delay

Figure 1 provides a visual breakdown of the various causes of delays in the healthcare setting. Anesthesia-related issues are the most prominent cause, followed by hospital-related delays, patient-related factors, and surgeon-related delays, which contribute the least to delays in elective procedures.

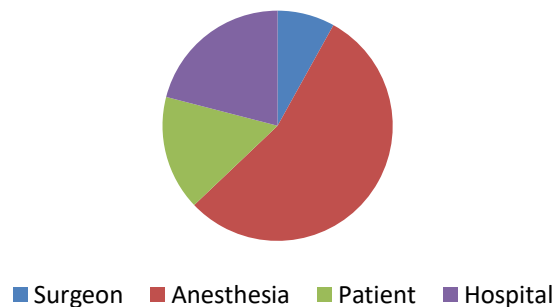


Figure 1. Distribution of the causes of delay

Anesthesia-related factors constitute the largest segment of the pie, representing approximately 52.7% of all delays attributed to anesthesia-related issues. These delays may arise from factors such as the unavailability of anesthesia providers or the time taken for patient induction. Hospital-related factors are the second-largest segment, comprising around 18.2% of all delays, representing hospital-related factors. These delays can stem from staffing shortages or resource constraints within the hospital setting. Patient-related factors account for roughly 13.1% of all delays and represent patient-related factors. These delays may be linked to specific patient conditions or circumstances that require additional attention or preparation before surgery. Finally, surgeon-related factors comprised about 15.9% of all delays, corresponding to surgeon-related factors. Surgeon-related delays may result from the surgeon's availability, preparation time, or other factors specific to the surgical team.

3.2 Insights

The data covering six months highlights the occurrence of delays in a significant proportion of elective surgeries (about 25%) (Fu et al., 2020). These delays stem from various factors, including anesthesia-related issues, surgeon-related factors, patient conditions, and constraints within the hospital. This information underscores elective procedure delays' complex and multifaceted nature in healthcare settings. It is not a single problem but a combination of factors contributing to these delays, making it crucial to take a comprehensive approach to address them.

To enhance the efficiency and timeliness of elective surgeries, healthcare institutions must adopt a multifaceted approach encompassing various strategies. First and foremost, ensuring optimal staffing levels is paramount. Adequate staffing in critical areas such as anesthesia, surgery, and nursing departments is essential to meet the demands of both elective and emergency cases. Anesthesia providers, surgeons, and nursing staff are pivotal in ensuring surgeries proceed smoothly. When these departments are adequately staffed, the risk of delays due to staff shortages is significantly reduced (Vitez & Macario, 1998).

Process optimization is another key pillar of improvement. Streamlining preoperative processes, particularly patient induction and preparation, can substantially decrease anesthesia and patient conditions delays. This involves efficient scheduling, standardized procedures, and clear protocols to ensure patients are adequately prepared for surgery (Hommel et al., 2017). Healthcare institutions can improve overall efficiency and enhance patient care by minimizing unnecessary delays in the preoperative phase.

Effective communication and coordination are fundamental to the success of any surgical team (Chalya et al., 2011). Enhancing collaboration among surgical teams, anesthesiologists, and hospital staff is essential. This includes better scheduling practices, improved information sharing, and more transparent communication channels. When surgical teams are well-coordinated and have access to timely information, surgeries can be scheduled and executed with greater efficiency, reducing delays caused by miscommunication or logistical issues (Jung et al., 2019).

Emergency preparedness is crucial to ensuring that elective surgeries proceed as planned. Healthcare institutions must develop robust contingency plans and surge capacity protocols to address emergency cases without disrupting elective procedures (Mesic et al., 2022). These plans should involve allocating dedicated resources and teams to handle emergencies separately, allowing elective surgeries to continue as scheduled. Hospitals can maintain a balance between elective and emergency cases by having clear and well-rehearsed emergency procedures in place.

Continuous improvement is the final but ongoing element of the strategy. Regularly analyzing data on delayed procedures is vital for identifying trends and implementing measures for improvement (Huda, 2014). This data-driven approach allows healthcare institutions to pinpoint recurring issues, assess the effectiveness of implemented strategies, and make necessary adjustments. Continuous improvement fosters a culture of learning and adaptation, ultimately leading to more efficient and timely elective surgeries (Koushan et al., 2021).

Addressing delays in elective surgeries requires a comprehensive approach encompassing staffing levels, process optimization, communication and coordination, emergency preparedness, and a commitment to continuous

improvement. By implementing these strategies, healthcare institutions can enhance the quality of patient care, optimize resource utilization, and reduce delays in elective surgical procedures (Briggs et al., 2011).

4.0 Conclusion

The analysis of the data offers a comprehensive strategy for improving the efficiency and timeliness of elective surgeries within an operating room setting. Firstly, determining the average turn-over time between elective cases is crucial in gauging operational efficiency. This measure provides insights into how long it takes to prepare the operating room between procedures and serves as a baseline for improvement. Secondly, identifying the major factors affecting turnover time, including Surgeon-related, Anesthesia-related, Patient-related, and Hospital-related delays, allows healthcare institutions to pinpoint areas requiring intervention. By calculating the total time attributed to each factor and assessing their relative impact, it becomes evident that Anesthesia-related issues are the most prevalent contributors to delays. Lastly, focusing on targeted solutions, such as increasing anesthesia staffing, streamlining preoperative processes, enhancing communication and coordination, and developing robust emergency preparedness plans, offers a practical roadmap for addressing the most common factor causing undue delay—anesthesia-related issues. Implementing these solutions can lead to more efficient operating room management, smoother case transitions, and improved resource allocation. Continuous data analysis and ongoing efforts for improvement are essential components of this strategy, enabling healthcare institutions to adapt to evolving circumstances and consistently enhance their elective surgery processes.

5.0 Contributions of Authors

Philmed P. Salindo –conception of research, conduct of research, writing the research report, Philner P. Salindo -data analysis, interpretation of data, proof reading, manuscript writing.

6.0 Funding

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7.0 Conflict of Interests

The authors declare no conflicts of interest about the publication of this paper.

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