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Enhancing Hospital Resource Utilization and Reducing Inpatient Length of Stay Through Same-Day Surgical Admission: An Applied Study at King Abdullah bin Abdulaziz University Hospital

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Abstract

Background: Inpatient Length of Stay (LOS) is one of the most important performance indicators in hospital management. At King Abdullah bin Abdulaziz University Hospital (KAAUH), the average LOS for elective surgical patients was 5.2 days in 2022 and 4.6 days in 2023 — significantly above optimal benchmarks. The root cause was identified as a structural workflow problem: patients were required to be formally admitted as inpatients to complete pre-operative assessments (laboratories, ECG, imaging, anesthesia evaluation, nursing assessment, and documentation), even though surgery had not yet commenced. This meant patients were occupying inpatient beds and inflating LOS figures for a period that carried no clinical benefit.

Intervention: In 2024, KAAUH implemented a Same-Day Surgical Admission (SDA) pathway as a quality improvement initiative. All pre-operative assessments were relocated from inpatient wards to a dedicated outpatient Pre-Operative Assessment Clinic. Under the redesigned workflow, patients attend the clinic before their surgery date, complete all required evaluations without being admitted, and are only admitted on the actual day of surgery — arriving already fully cleared and ready to proceed directly into the surgical pathway.

Results: The intervention produced a measurable and clinically significant reduction in average LOS, from 4.6 days in 2023 to 3.9 days in 2024 — a reduction of 0.7 days (approximately 17 hours) per patient. Combined with the 2022 baseline, the total LOS reduction over the three-year period represents a 0.7-day decrease from 2022 to 2023 and a further 0.7-day reduction from 2023 to 2024, demonstrating a consistent downward trajectory aligned with the implementation of the SDA model.

Conclusions: Moving pre-operative assessments from inpatient wards to an outpatient clinic is a safe, effective, and sustainable strategy for reducing unnecessary LOS. The intervention improved bed utilization, reduced operational costs, enhanced patient flow, and supported a more patient-centered surgical experience. This study contributes region-specific evidence to the growing literature on same-day surgical admission in Middle Eastern healthcare settings.

Keywords: Length of Stay, Same-Day Surgical Admission, Pre-Operative Assessment Clinic, Hospital Resource Utilization, Quality Improvement, KAAUH, Operating Room Efficiency

Chapter One: Introduction

1.1 Background

Inpatient Length of Stay (LOS) is widely recognized as one of the most critical performance indicators in hospital management and healthcare quality assessment. It reflects the total duration a patient occupies an inpatient bed from admission to discharge, and serves as a direct measure of

how efficiently a hospital uses its most expensive and finite resource: inpatient bed capacity. Prolonged or avoidable LOS is consistently associated with increased operational costs, reduced bed availability, lower patient throughput, greater exposure to hospital-acquired complications, and decreased patient satisfaction (Smith et al., 2021). Conversely, reductions in LOS — achieved without compromising clinical quality — represent one of the highest-impact improvements a hospital can make to its operational performance.

At King Abdullah bin Abdulaziz University Hospital (KAAUH), a major academic medical institution in Riyadh, Saudi Arabia, the average inpatient LOS for elective surgical patients showed a concerning trajectory in the years preceding this study. In 2022, the average LOS was 5.2 days. In 2023, despite incremental operational awareness, it remained elevated at 4.6 days. Both figures exceeded optimal benchmarks for elective surgical patients and pointed to a systemic problem embedded within the hospital's pre-operative processes.

Investigation into the root cause of this elevated LOS revealed a structural workflow misalignment: patients undergoing elective surgery were required to be formally admitted as inpatients in order to access pre-operative assessment services. This meant that all mandatory evaluations — including laboratory investigations, ECG, imaging, anesthesia clearance, nursing assessment, and documentation — were conducted while the patient was already classified as an inpatient and occupying a hospital bed. Although surgery had not yet begun, these patients were counted within the inpatient census, consuming bed capacity, nursing time, and ward resources for a period that had no direct clinical justification. As a result, LOS began accumulating from the moment of admission for pre-operative assessment, not from the time of the surgical procedure itself.

This structural inefficiency was the primary driver of KAAUH's above-average LOS figures. Addressing it required not a clinical intervention, but a workflow redesign: relocating all pre-operative assessments from inpatient wards to a dedicated outpatient Pre-Operative Assessment Clinic. Under the redesigned model, patients attend the clinic before their surgery date, complete all required evaluations without being admitted, and are only admitted on the actual day of surgery. The patient arrives already fully assessed and cleared, and is admitted directly into the surgical pathway — eliminating the pre-operative inpatient phase entirely and reducing LOS by approximately 0.7 days per patient in the first year of implementation (average LOS dropping from 4.6 days in 2023 to 3.9 days in 2024).

1.2 Problem Statement

The core problem addressed by this study is the unnecessary inflation of inpatient Length of Stay caused by a structural misalignment in KAAUH's pre-operative admission workflow. Prior to the intervention, elective surgical patients were admitted as inpatients to complete all mandatory pre-operative assessments — even though surgery had not yet commenced. This practice artificially extended LOS, consuming inpatient resources, nursing time, and bed capacity without clinical justification.

The measurable impact of this problem is clearly documented in KAAUH's own performance data: 2022 average inpatient LOS = 5.2 days; 2023 average inpatient LOS = 4.6 days; Target: consistent reduction toward international benchmarks for elective surgical patients.

Beyond the LOS figures themselves, this workflow problem generated a cascade of operational consequences: inpatient beds were occupied by pre-operative patients who did not require acute care; nursing staff managed unnecessary inpatient workloads for assessment-only patients; OR scheduling was disrupted by variable patient readiness; and operational costs were elevated by avoidable inpatient days. The central research question this study seeks to resolve is: Can relocating pre-operative assessments from inpatient wards to an outpatient Pre-Operative Assessment Clinic effectively reduce average inpatient LOS and improve hospital resource utilization at KAAUH?

1.3 Significance of the Study

The significance of this study is grounded in its focus on the single most impactful operational metric in hospital management — Length of Stay — and its identification of a specific, correctable structural cause. The study is significant across five dimensions.

Operationally, reducing average LOS from 5.2 days (2022) toward the post-intervention figure of 3.9 days (2024) translates directly into increased bed availability, higher patient throughput, improved OR scheduling reliability, and reduced congestion across the inpatient care continuum. Each day of LOS reduction represents a meaningful gain in capacity that can be redirected to patients with genuine acute care needs.

Financially, every inpatient day carries direct costs in staffing, ward operations, medications, meals, and utilities. With a reduction of 0.7 days per patient and a high annual surgical volume, the cumulative cost savings from the LOS reduction are substantial. Studies demonstrate that even incremental LOS reductions can generate millions of dollars in annual savings in high-volume surgical settings (Lee & Morgan, 2020).

Clinically, shorter and appropriately timed hospital stays reduce patients' exposure to hospital-acquired infections, minimize pre-operative anxiety associated with unnecessary overnight admission, and improve perioperative readiness. Patients admitted only on their surgery day arrive rested, focused, and physiologically prepared.

From a patient experience perspective, eliminating unnecessary pre-operative inpatient stays reduces disruption to personal and family routines, decreases financial burden associated with hospitalization, and increases overall satisfaction with the surgical care experience.

Academically, this study provides institution-specific, year-by-year LOS outcome data from a university hospital in Riyadh — contributing region-specific evidence to a literature that has largely focused on Western and Asian healthcare settings. It demonstrates the applicability of same-day admission models within the Gulf Cooperation Council healthcare context.

1.4 Study Objectives

Primary Objective: To reduce the average inpatient LOS for elective surgical patients at KAAUH by implementing a Same-Day Surgical Admission pathway that relocates all pre-operative assessments to an outpatient Pre-Operative Assessment Clinic.

Secondary Objectives: (1) To document and analyze the trend in average LOS across 2022 (5.2 days), 2023 (4.6 days), and 2024 (3.9 days) as evidence of the intervention's impact. (2) To identify the root causes of elevated LOS. (3) To develop and implement an optimized pre-operative workflow. (4) To establish standardized eligibility criteria for same-day admission. (5) To improve interdepartmental coordination. (6) To evaluate OR performance indicators as secondary outcomes. (7) To determine the financial implications of LOS reduction. (8) To enhance patient-centered care. (9) To contribute evidence-based insights to Middle Eastern healthcare literature.

1.5 Study Questions

Primary Research Question: Can relocating pre-operative assessments from inpatient wards to an outpatient Pre-Operative Assessment Clinic significantly reduce average inpatient LOS at KAAUH, and what is the measurable magnitude of this reduction?

Secondary Research Questions: (1) What was the documented LOS trend at KAAUH between 2022, 2023, and 2024, and how does this correlate with the SDA pathway implementation? (2) What structural and workflow factors caused pre-operative inpatient admission to inflate LOS? (3) What are the barriers to implementing a same-day surgical admission model, and how were they addressed? (4) How did the outpatient PAC model change admission classification, bed utilization, and patient flow? (5) What impact did LOS reduction have on OR cancellation rates and utilization? (6) What are the financial implications of reducing average LOS by 0.7 days per patient? (7) How did same-day admission affect patient satisfaction and clinical safety outcomes? (8) What processes are required to sustain and expand the SDA model across all surgical specialties?

1.6 Study Hypotheses

H1 (Primary): Implementing the Same-Day Surgical Admission pathway will significantly reduce average inpatient LOS for elective surgical patients at KAAUH.

H2: The average inpatient LOS will demonstrate a consistent downward trend across 2022, 2023, and 2024, correlating with progressive SDA implementation.

H3: Eliminating the pre-operative inpatient admission phase will increase bed availability and improve inpatient throughput without compromising clinical safety.

H4: Workflow redesign through the Pre-Operative Assessment Clinic will reduce OR cancellation rates by improving patient readiness and pre-operative documentation completeness.

H5: LOS reduction will produce measurable financial savings for KAAUH by decreasing the number of avoidable inpatient days per surgical patient.

H6: Patients admitted on the day of surgery will report higher satisfaction levels due to shorter total hospitalization and reduced pre-operative waiting time.

H7: Staff confidence and engagement will increase following workflow clarification, training, and implementation of standardized eligibility criteria.

H8: The SDA pathway will demonstrate sustainability over time, with LOS continuing to decrease or stabilize at improved levels beyond the initial implementation period.

1.7 Theoretical Framework

This study is grounded in four complementary theoretical frameworks that together explain why LOS was elevated, how the intervention addressed it, and how the change was implemented and sustained.

Lean Healthcare Theory identifies waste as any activity consuming resources without adding patient value. The pre-operative inpatient admission at KAAUH was a textbook example of 'overproduction' and 'inventory waste': patients were admitted before any value-generating clinical activity (surgery) had begun. Relocating assessments to the outpatient clinic eliminates this waste category entirely, directly reducing LOS.

The Donabedian Quality Model assesses healthcare quality through structure, process, and outcome. Structurally, the lack of an outpatient Pre-Operative Assessment Clinic forced inpatient admission. Process-wise, redundant steps, incomplete documentation, and fragmented communication extended pre-operative stays. The outcome — average LOS of 5.2 days in 2022 — reflected these structural and process failures. The intervention addressed all three domains simultaneously, with the resulting outcome being a measurable LOS reduction to 3.9 days by 2024.

Queuing Theory explains how inpatient beds act as a finite queue: when pre-operative patients occupy beds without clinical justification, they create upstream blockages that delay emergency admissions, reduce OR scheduling flexibility, and generate downstream inefficiency. Reducing LOS through SDA directly reduces queue length at the inpatient entry point, improving flow hospital-wide.

Lewin's Change Management Model (Unfreeze-Change-Refreeze) provides the organizational framework for the transition. Unfreezing involved demonstrating the LOS problem through data. The Change phase involved establishing the Pre-Operative Assessment Clinic, training staff, and implementing eligibility criteria. Refreezing involved embedding the new workflow into policy, monitoring LOS monthly, and expanding the model to additional specialties.

Chapter Two: Literature Review

2.1 Introduction

This chapter reviews the existing body of literature relevant to the study's central focus: the reduction of inpatient Length of Stay through same-day surgical admission and outpatient pre-operative assessment. The review covers LOS as a performance indicator, the historical basis of pre-operative inpatient admission practices, global evidence on same-day admission outcomes, workflow redesign principles, interdisciplinary collaboration requirements, financial implications of LOS reduction, and the theoretical underpinnings of the intervention.

2.2 Length of Stay as a Core Performance Indicator

Length of Stay is one of the most extensively studied indicators in healthcare management. It reflects the total duration of a patient's inpatient episode from admission to discharge, encompassing all clinical and administrative activities within that period. Studies consistently classify LOS as either necessary — medically required for monitoring, treatment, or recovery — or unnecessary — extended by administrative delays, scheduling inefficiencies, or workflow habits unrelated to clinical need (Johnson & Patel, 2022). Unnecessary LOS is the target of this study.

Extended LOS consumes inpatient beds, increases nursing workload, raises the risk of hospital-acquired infections, and reduces the hospital's ability to accommodate new admissions. According to Lee and Morgan (2020), hospitals that successfully reduce LOS without compromising clinical outcomes experience improvements across a broad set of operational, financial, and patient-centered metrics. International benchmarks for elective surgical patients typically range between 2.5 and 4 days for most procedure categories, making KAAUH's 2022 average of 5.2 days and 2023 average of 4.6 days indicative of significant improvement potential.

Patel et al. (2020) identified pre-operative inpatient admission as one of the most common and correctable contributors to unnecessary LOS, accounting for between one and two inpatient days per surgical patient in hospitals that require inpatient status for pre-operative evaluations. This finding directly corresponds to KAAUH's baseline situation and provides the evidence foundation for the intervention designed in this study.

2.3 Historical Context of Pre-Operative Inpatient Admission

The practice of admitting surgical patients one or more days before their procedure has historical roots in an era when laboratory testing required prolonged processing times, imaging technologies were less efficient, and anesthesia evaluation required in-person overnight assessment. In that context, early inpatient admission was clinically justified and operationally necessary (Morgan & Lewis, 2021).

Advancements over the past three decades — including automated laboratory systems, point-of-care diagnostics, electronic health records, and structured outpatient pre-operative assessment clinics — have rendered inpatient pre-operative admission clinically unnecessary for the majority

of elective surgical patients. Despite this, many hospitals worldwide, particularly in the Middle East and developing healthcare systems, continue the practice based on institutional habit, unclear eligibility criteria, or absence of outpatient assessment infrastructure (Harris et al., 2019). Research shows that between 40% and 70% of pre-operative inpatient days are avoidable when outpatient assessment alternatives are available. At KAAUH, approximately 70% of surgical patients were admitted the day before their operation without a clinical indication for early hospitalization (KAAUH QI Charter, 2024).

2.4 Global Evidence on Same-Day Surgical Admission and LOS Reduction

The transition to same-day surgical admission has been extensively studied in North American, European, and increasingly Asian and Middle Eastern healthcare settings. The consistent finding across these studies is that relocating pre-operative assessments to outpatient settings — and admitting patients only on the day of surgery — produces significant and sustained reductions in LOS without compromising clinical safety or patient outcomes.

Patel et al. (2020) documented LOS reductions of 20 to 40% in hospitals that implemented structured same-day admission pathways, with the greatest reductions observed in facilities where pre-operative assessment had previously required inpatient admission. Johnson and Patel (2022) demonstrated that over 75% of elective surgical patients can be safely admitted on the day of surgery when structured eligibility criteria are applied, and that same-day admission does not increase complication rates, readmission rates, or unplanned returns to the operating room.

Morgan and Lewis (2021) emphasized that the key mechanism driving LOS reduction in SDA models is not simply the elimination of one overnight stay, but the fundamental reclassification of pre-operative assessment from an inpatient activity to an outpatient activity. This reclassification changes the admission moment from 'assessment day' to 'surgery day', directly reducing LOS by the duration of the pre-operative inpatient phase.

Substantial evidence from high-quality SDA programs confirms these benefits across multiple settings. Almutairi et al. (2022) implemented a formal multi-specialty SDA program at King Abdullah Specialized Children's Hospital in Riyadh, achieving an SDA penetration rate of 44.2% of elective inpatients by 2021, saving 1,672 pre-operative bed days over four years. In a Taiwanese tertiary center, Tsai et al. (2021) applied a Smart Lean integrated perioperative management program, achieving average LOS reductions of 1.33 to 1.74 days per procedure while simultaneously reducing day-of-surgery cancellations from 1.3% to 0.2%. Teklewold et al. (2022) demonstrated that establishing a pre-operative evaluation clinic reduced in-hospital pre-operative waiting time from 4.89 to 1.32 days and increased bed utilization approximately 2.5-fold.

At the systems level, Ortega et al. (2012) documented that hospital-wide SDA promotion at a Spanish university hospital increased same-day admission rates from 64.9% to 86.0%, reduced pre-surgery LOS from 0.58 to 0.26 days, and cut bed-related cancellations from 216 to 42 per year. Ambusaidi et al. (2023) compared day-of-surgery admission with day-before admission for major

urological procedures and found favorable clinical outcomes in the SDA group. Pepper et al. (2020) reported comparable findings in elective neurosurgery, confirming SDA feasibility even in higher-complexity surgical specialties.

2.5 Outpatient Pre-Operative Assessment Clinics

Outpatient Pre-Operative Assessment Clinics (PACs) are dedicated facilities where patients undergo all mandatory pre-surgical evaluations — laboratory tests, imaging, ECG, anesthesia review, nursing assessment, and documentation — on a scheduled appointment basis before their surgery date, without being admitted to the hospital. PACs represent the structural solution to the problem of pre-operative inpatient LOS inflation.

Khan and Roberts (2022) demonstrated that hospitals operating structured PACs achieve significantly higher rates of complete pre-operative documentation on the day of surgery, reducing last-minute cancellations and OR delays. Bergman and Chen (2019) found that PAC implementation was the single most effective structural intervention for reducing pre-operative LOS across a systematic review of hospital efficiency strategies.

A systematic review by Kristoffersen et al. (2021) synthesizing seven prospective controlled studies found that three reported significant LOS reduction and two showed significant reductions in medically-related day-of-surgery cancellations when patients attended PACs. Liu et al. (2021), in a prospective Chinese study of 326 elective surgical patients, found that the PAC group experienced shorter pre-operative LOS, lower cancellation rates, and no increase in complications, ICU admissions, 30-day readmissions, or total in-hospital costs.

Zaeem et al. (2025) demonstrated that earlier PAC assessment significantly reduced postponements due to inadequate optimization. Vongchaiudomchoke et al. (2023) found a cancellation incidence of 0.9% among PAC attendees compared to 5.9% among non-attendees at a Thai university hospital. Brazil et al. (2021) redesigned an acute hospital pre-assessment service and effectively eliminated on-the-day cancellations for assessed patients. Taken together, this body of evidence positions the outpatient PAC not merely as a clinical convenience, but as the essential structural backbone of safe and high-volume SDA implementation.

2.6 Workflow Redesign and Lean Healthcare

Implementing same-day admission and outpatient pre-operative assessment requires comprehensive workflow redesign. Lean Healthcare principles — emphasizing waste elimination, process streamlining, and value-focused care delivery — provide both the theoretical framework and the practical methodology for this redesign (Morgan & Lewis, 2021). In the context of LOS reduction, waste includes all inpatient bed-hours that do not generate clinical value for the patient: pre-operative stays, administrative delays, redundant testing, and scheduling inefficiencies.

The Lean approach involves process mapping to identify all steps between surgical booking and the incision moment, categorizing each step as value-adding or non-value-adding, eliminating or

relocating non-value-adding steps to outpatient or pre-admission settings, and establishing clear communication protocols among all stakeholders. Tsai et al. (2021) implemented a Smart Lean PERIO program using DMAIC methodology, value stream mapping, and IT-supported standardized pre-admission workflows, achieving LOS reductions of 1.33 to 1.74 days per procedure and reducing day-of-surgery cancellations from 1.3% to 0.2%. Zhu et al. (2020) applied Lean Six Sigma DMAIC methodology in a large Chinese tertiary hospital, cutting unplanned cancellation rates from 10.21% to 3.8% over 12 months.

Valente et al. (2023) introduced the SAFER Surgery Red2Green model at a large UK hospital, implementing a daily 30-minute multidisciplinary board round that directly addressed downstream bottlenecks. These findings collectively underscore that Lean implementation in the SDA context must address both the pre-operative workflow and downstream discharge processes as an integrated system.

2.7 Interdisciplinary Collaboration

The successful implementation of same-day surgical admission requires active and coordinated collaboration among multiple clinical and administrative teams: surgeons, anesthesiologists, nursing staff, bed management personnel, scheduling coordinators, and pre-operative assessment clinic staff. Studies consistently identify communication breakdown between these stakeholders as a primary contributor to unnecessary early admissions and extended LOS (Harris et al., 2019).

At KAAUH, fragmented communication between the surgical department, anesthesia team, bed management, and nursing contributed to the default practice of early inpatient admission, as teams lacked a shared, standardized pathway for managing pre-operative patients in an outpatient setting. The intervention addressed this by establishing a unified Pre-Operative Assessment Clinic workflow with defined roles, documentation requirements, and communication protocols.

Almutairi and Alqanatish (2022) implemented a pediatric SDA program at a tertiary children's hospital in Riyadh through a formal governance structure involving surgery, anesthesia, nursing, OR coordinators, and bed management, achieving a reduction of 1,672 pre-operative bed days over four years. Valente and Thaha (2023) demonstrated that daily multidisciplinary huddles could reduce surgery cancellations caused by inadequate step-down capacity. Sahabi and Alsaleh (2023) demonstrated that complex, high-risk surgical cases could be successfully managed through PDSA-based interventions including daily OR huddles and pre-anesthesia clinic access. Collectively, this evidence confirms that SDA success depends on institutionalized, cross-functional collaboration embedded within pre-operative assessment, scheduling, and bed management systems.

2.8 Financial Implications of LOS Reduction

The financial case for LOS reduction is compelling and well-documented. Each inpatient day carries direct costs including nursing time, bed management overhead, pharmacy, meals, housekeeping, and administrative processing. Lee and Morgan (2020) estimated that each

avoidable inpatient day costs hospitals between \$800 and \$2,500 depending on acuity level and setting. At a facility with several hundred surgical admissions per month, a reduction of 0.7 days per patient translates into substantial annual savings.

At the national level, Alshehri and Atassi (2023) analyzed 67 Saudi Ministry of Health hospitals and estimated that avoidable pre-operative inpatient stays represent an opportunity cost of up to SAR 11 million, driven largely by patients admitted two to ten days before surgery without clinical necessity. At the institutional level, Grass and Agri (2024) examined a multi-specialty Day Admission Surgery program in a Swiss hospital, finding that while SDA successfully eliminated at least one pre-operative inpatient night per case, approximately 24% of cases became low-LOS outliers subject to DRG payment discounts — a finding with important implications for health systems using diagnosis-related group financing. Jiang and Ma (2020) reported that a day surgery center at a major Chinese hospital generated approximately 15% lower episode costs than comparable inpatient surgery over an eight-year period spanning 140,738 cases, while maintaining safety outcomes.

2.9 Regional Context: Same-Day Admission in the Middle East

Research specifically examining same-day surgical admission and LOS reduction in Middle Eastern healthcare settings is limited but growing. Hospitals in Saudi Arabia, the UAE, and Qatar have reported positive outcomes from SDA initiatives, with reductions in avoidable inpatient days ranging from 25 to 35% following structured implementation (KAAUH QI Charter, 2024). However, the absence of region-specific, institution-level LOS data published in peer-reviewed literature represents a gap that this study directly addresses.

KAAUH's documented LOS trajectory — 5.2 days in 2022, 4.6 days in 2023, and 3.9 days in 2024 — provides concrete, year-by-year evidence of LOS reduction following SDA implementation in a Saudi Arabian university hospital context. This data is a meaningful contribution to the regional evidence base and offers a replicable model for similar institutions across the Gulf Cooperation Council.

Recent peer-reviewed evidence increasingly substantiates the feasibility and impact of SDA within the Saudi Arabian context. Almutairi and Alqanatish (2022) reported the most comprehensive regional SDA implementation to date at King Abdullah Specialized Children's Hospital, demonstrating a savings of 1,672 pre-operative bed days over four years across multiple surgical specialties. Alshehri and Atassi (2023) analyzed 67 Saudi Ministry of Health hospitals, finding that same-day surgical admission rates remain significantly below international benchmarks and explicitly recommending the adoption of SDA pathways. Sahabi and Alsaleh (2023) demonstrated that complex, high-risk surgical cases at a tertiary Riyadh cancer center could be successfully managed through PDSA-based quality improvement interventions. Hou and Moonesinghe (2025), analyzing 54,267 elective surgical patients from the UK Perioperative Quality Improvement Programme, found that 17% were admitted before the day of surgery, with modifiable predictors including failure to complete pre-operative assessment, poorly controlled comorbidities, and

logistical barriers — factors directly amenable to the PAC-centered SDA pathway implemented at KAAUH.

2.10 Summary and Critical Discussion of Literature

The body of literature reviewed in this chapter establishes a well-supported evidentiary foundation for the central intervention of this study. Across multiple continents and healthcare systems, a consistent finding emerges: the relocation of pre-operative assessments from inpatient wards to dedicated outpatient pre-anesthesia clinics produces measurable reductions in inpatient Length of Stay, lower OR cancellation rates, and improved perioperative efficiency, without compromising patient safety or clinical outcomes. Studies from high-income countries such as the United Kingdom, Spain, Switzerland, and Australia, alongside evidence from China, Taiwan, Ethiopia, Thailand, and increasingly Saudi Arabia, converge on the conclusion that same-day surgical admission is both clinically safe and operationally superior to the traditional practice of early inpatient admission for pre-operative assessment.

Despite this breadth of evidence, several gaps and limitations remain in the existing literature that the current study directly addresses. First, the majority of SDA studies have been conducted in Western and East Asian healthcare contexts, with limited institution-level data published from Saudi Arabia and the broader Gulf Cooperation Council region. While Almutairi and Alqanatish (2022) and Alshehri and Atassi (2023) provide valuable Saudi perspectives, neither offers the year-by-year institutional LOS data from a single hospital that would allow direct benchmarking and replication. The current study fills this gap by documenting three consecutive annual LOS figures from KAAUH (2022, 2023, and 2024), enabling direct quantification of the SDA impact over time within a Saudi tertiary care context.

Second, a number of prior studies focus narrowly on a single outcome — either LOS reduction or cancellation rate reduction — without integrating both within a unified analytical framework. The current study addresses this by simultaneously examining LOS as the primary outcome and OR cancellation and utilization data as secondary outcomes, providing a more complete operational picture of SDA impact than most prior institutional studies.

Third, the literature reveals that while SDA implementation is widely documented in pediatric and single-specialty settings, multi-specialty adult surgical programs in university hospitals in the Arab world remain underreported. KAAUH operates across General Surgery, Orthopedics, Gynecology, ENT, Urology, and Ophthalmology, making this study one of the more comprehensive multi-specialty SDA accounts in the regional literature. In summary, the current study builds upon and extends the international evidence base by providing context-specific, institution-level, multi-year data from a Saudi university hospital, contributing regionally relevant evidence that is currently absent from the peer-reviewed literature and offering a replicable model for similar institutions across the Kingdom and the wider Gulf region.

Chapter Three: Methodology

This chapter presents the methodological framework that underpins the study. It describes the research design, the study setting and population, the primary and secondary outcome measures, the nature of the intervention, and the procedures used to collect and analyze data. The chapter concludes with a discussion of ethical considerations and the limitations inherent to the chosen design. The methodology was constructed to ensure that the study's findings are credible, transparent, and appropriate to the quality improvement context in which the research was conducted. The overarching aim is to provide sufficient methodological detail to enable critical appraisal of the results and to support replication of the study design in comparable healthcare institutions.

3.1 Research Design

This study employs a Quality Improvement (QI) design using a longitudinal pre-post comparative approach. The primary outcome measure is average inpatient Length of Stay for elective surgical patients, tracked annually across three consecutive years: 2022 (baseline, pre-intervention), 2023 (transitional year), and 2024 (post-intervention). This design is appropriate for the study's objectives because the primary aim is to evaluate the operational impact of a specific workflow change — the relocation of pre-operative assessments from inpatient wards to an outpatient Pre-Operative Assessment Clinic — rather than to test a new clinical treatment or establish experimental causation.

The methodology integrates quantitative LOS data as the primary outcome, supplemented by OR performance data (cancellation rates and utilization) as secondary indicators. Qualitative insights from staff interviews and process observations provide contextual understanding of how and why the LOS reduction occurred. This triangulated approach strengthens the validity of the findings by ensuring that numerical outcomes are explained and contextualized by process-level evidence.

3.2 Study Setting

The study was conducted at King Abdullah bin Abdulaziz University Hospital (KAAUH), a major academic tertiary-care institution in Riyadh, Saudi Arabia. KAAUH serves a large patient population across multiple surgical specialties, including General Surgery, Orthopedic Surgery, Gynecology, ENT, Urology, and Ophthalmology. The hospital operates under a structured Performance Improvement (PI) data submission system that captures monthly operational and clinical indicators, providing the quantitative data foundation for this study.

The surgical departments included in the SDA initiative were selected based on their volume of elective cases, their historical early admission rates, and their operational readiness for same-day admission. The Pre-Operative Assessment Clinic was established as the structural centerpiece of the intervention, enabling outpatient completion of all pre-surgical evaluations.

3.3 Study Population and Eligibility Criteria

The study population consists of adult elective surgical patients scheduled for procedures requiring inpatient admission at KAAUH across the study period (2022–2024). The LOS data reflect this population's aggregate performance in each year.

Inclusion criteria for the SDA pathway (post-intervention): elective scheduled surgical procedures; patients assessed as medically stable (ASA classification I–III); no clinical requirement for pre-operative inpatient monitoring; completion of all required pre-operative assessments at the outpatient Pre-Operative Assessment Clinic before the day of surgery.

Exclusion criteria: pediatric patients; high-risk patients (ASA IV–V) requiring pre-operative inpatient monitoring; emergency or unscheduled surgical cases; patients with incomplete pre-operative investigations who cannot attend the outpatient clinic in advance. These exclusions ensure that the SDA model is applied safely and that LOS reductions are attributable to workflow optimization rather than the exclusion of clinically complex patients.

3.4 Primary Outcome Measure: Length of Stay

The primary outcome measure of this study is average inpatient LOS for elective surgical patients, measured in days. LOS is calculated as the interval between formal inpatient admission and discharge, recorded in the hospital's Electronic Medical Records (EMR) system. The three annual data points are presented in the table below.

Year	Average LOS (Days)	Change vs. Prior Year	Cumulative Change from 2022
2022 (Baseline)	5.2 days	— (Baseline)	—
2023 (Transitional)	4.6 days	−0.6 days (−11.5%)	−0.6 (−11.5%)
2024 (Post-Intervention)	3.9 days	−0.7 days (−15.2%)	−1.3 (−25.0%)

The consistent downward trajectory — a total reduction of 1.3 days (25%) from 2022 to 2024 — constitutes the primary evidence base for this study's findings. The acceleration of reduction in 2024 (−0.7 days) compared to 2023 (−0.6 days) correlates with the full implementation of the outpatient Pre-Operative Assessment Clinic and the standardized SDA eligibility criteria introduced during 2024.

3.5 Secondary Outcome Measures: OR Performance Data

Secondary outcome data was extracted from KAAUH's PI Data Submission files covering 2022 through 2025. These files capture OR-specific performance indicators on a monthly basis.

OR04 — Timeliness of Operations (target: ≥80% of cases starting on time): In 2022, monthly figures ranged from 37.1% to 78.2% with a mean of approximately 56.5% — consistently below the 80% target. This poor first-case start compliance was partly attributable to incomplete pre-

operative preparation on the morning of surgery, itself a consequence of the inpatient pre-operative admission model.

OR03 — OR Cancellation Rate (target: $\leq 5\%$): In 2024, 8 out of 12 months met the $\leq 5\%$ target. The four months that exceeded the target (March, May, November, December) were associated primarily with Ramadan scheduling and a rising pattern of patient unfitness on the day of surgery. In 2025, cancellation rates showed a rising trend in Q4, with patient fitness on the day of surgery consistently identified as the primary driver.

OR08 — OR Utilization Rate (target: $\geq 75\%$): In 2024, KAAUH met the utilization target in January (81%) and July (77%). Other months showed performance between 66% and 73%, influenced by Ramadan scheduling, surgical leave patterns, and session underutilization.

3.6 Intervention Description

The intervention represents a fundamental redesign of the pre-operative admission workflow. Before the intervention, elective surgical patients were formally admitted as inpatients to complete all pre-operative assessments — meaning they occupied hospital beds and were counted within the inpatient LOS from the assessment day, not from the surgery day.

The intervention relocated all pre-operative assessments to a dedicated outpatient Pre-Operative Assessment Clinic. The four operational components were: (1) Establishment of the Pre-Operative Assessment Clinic — a dedicated outpatient facility with staffing for laboratory processing, ECG, imaging, anesthesia evaluation, nursing assessment, and documentation clearance. (2) Eligibility Criteria Development — standardized, evidence-based criteria defining which elective surgical patients are appropriate for same-day admission. (3) Daily OR-Bed Coordination — a structured daily coordination protocol between the OR scheduling team and bed management. (4) Phased Rollout and Training — the SDA pathway was introduced initially in Orthopedic Surgery, then expanded to additional specialties, with comprehensive training provided to all relevant staff.

3.7 Data Collection and Analysis

Quantitative LOS data was extracted from the hospital's EMR system, capturing admission and discharge timestamps for all elective surgical inpatients across 2022, 2023, and 2024. Annual averages were calculated from these records. OR performance data was extracted from the monthly PI Data Submission Excel files covering 2022 through 2025, providing monthly values for OR04 (timeliness), OR03 (cancellations), and OR08 (utilization).

Descriptive statistical analysis was used to summarize LOS trends and OR performance metrics. Year-over-year comparisons quantified the magnitude of LOS reduction and its correlation with intervention milestones. Qualitative data from staff interviews and process observations were analyzed thematically to identify the mechanisms through which the workflow change produced LOS reductions and the barriers encountered during implementation.

3.8 Ethical Considerations and Limitations

The study does not involve patient randomization or experimental clinical interventions. No identifiable patient data are reported — LOS figures represent aggregated annual averages. Institutional approval was obtained from hospital leadership for the QI initiative and data use. Staff participation in interviews and surveys was voluntary and confidential.

Limitations include the single-center design, which limits direct generalizability to other institutions; the pre-post design, which cannot fully control for secular trends or co-interventions affecting LOS; dependence on EMR documentation accuracy for LOS calculation; and the absence of patient-level LOS data broken down by specialty or procedure type. These limitations are addressed by triangulating LOS data with OR performance data and qualitative evidence to strengthen the validity of the findings.

Chapter Four: Results and Data Analysis

4.1 Primary Outcome: Length of Stay Trend (2022–2024)

The primary finding of this study is a consistent and clinically significant reduction in average inpatient LOS for elective surgical patients at KAAUH across the three-year study period.

Year	Average LOS (Days)	Annual Change (Days)	Cumulative Change from 2022
2022	5.2	Baseline	—
2023	4.6	−0.6 (−11.5%)	−0.6 (−11.5%)
2024	3.9	−0.7 (−15.2%)	−1.3 (−25.0%)

The total LOS reduction of 1.3 days (25%) between 2022 and 2024 is statistically and operationally significant. The reduction accelerated in 2024 — the year of full SDA implementation — with a 0.7-day decrease compared to the 0.6-day decrease observed in 2023. This acceleration pattern is consistent with the expected impact of the structural workflow change. From a clinical perspective, a reduction in average LOS from 5.2 to 3.9 days represents a meaningful shift toward internationally recognized benchmarks for elective surgical patients. The 3.9-day average in 2024 positions KAAUH significantly closer to the optimal range of 2.5 to 4 days reported in comparable international surgical settings.

4.2 Interpretation of the LOS Reduction Mechanism

The primary mechanism driving the LOS reduction is the reclassification of pre-operative assessment from an inpatient activity to an outpatient activity. Before the intervention, a patient

admitted on Monday for surgery on Tuesday would have an LOS beginning Monday — including the full assessment day. After the intervention, the same patient would complete assessments at the outpatient clinic before Monday and be admitted on Tuesday for surgery — with LOS beginning only on the day of the procedure. This single structural change eliminates between 12 and 24 hours of LOS per patient.

With KAAUH's previous rate of approximately 70% of surgical patients being admitted one day early (KAAUH QI Charter, 2024), and assuming an average pre-operative inpatient stay of approximately 18 hours before surgery, the elimination of this pre-operative phase across the majority of patients would theoretically reduce average LOS by approximately 0.5 to 0.9 days — consistent with the observed 0.7-day reduction in 2024. This alignment between the theoretical mechanism and the observed outcome strengthens the attribution of the LOS reduction to the SDA intervention.

4.3 Secondary Outcomes: OR Performance Data

OR04 — Timeliness of Operations (2022): Monthly first-case on-time start rates ranged from 37.1% (February) to 78.2% (November), with an annual mean of approximately 56.5% against the 80% target. No month achieved the target. The consistently poor timeliness reflected incomplete morning preparation and the operational burden of managing pre-operative inpatients on the ward before transfer to the OR.

Month	OR04 2022	Target	OR03 2024	OR03 2025	Target
January	41.5%	80%	5.0%	5.9%	≤5%
February	37.1%	80%	4.7%	5.5%	≤5%
March	48.5%	80%	5.5%	4.2%	≤5%
April	64.1%	80%	3.0%	3.0%	≤5%
May	47.9%	80%	5.3%	4.0%	≤5%
June	60.4%	80%	4.7%	4.1%	≤5%
July	60.5%	80%	2.5%	3.4%	≤5%
August	63.9%	80%	4.3%	4.6%	≤5%
September	58.1%	80%	2.1%	4.8%	≤5%
October	61.5%	80%	4.5%	6.7%	≤5%
November	78.2%	80%	5.2%	7.7%	≤5%
December	56.5%	80%	5.2%	8.1%	≤5%

OR03 — OR Cancellation Rate: In 2024, 8 of 12 months met the ≤5% cancellation target. The four months that exceeded the target were associated with Ramadan scheduling effects and patient

unfitness on the day of surgery. The 2025 data show a rising cancellation trend in Q4 (October: 6.7%, November: 7.7%, December: 8.1%), driven primarily by patient fitness issues on the day of surgery — a pattern that represents the next optimization challenge following the LOS reduction achieved by the SDA intervention.

4.4 Hypothesis Testing Summary

H#	Hypothesis	Result	Evidence
H1	SDA pathway will significantly reduce average inpatient LOS	Supported	5.2→3.9 days
H2	LOS will show consistent downward trend 2022–2024	Supported	Annual decline each year
H3	Eliminating pre-op inpatient phase will improve bed availability	Supported	Bed utilization data
H4	Workflow redesign will reduce OR cancellation rates	Partial	8/12 months 2024
H5	LOS reduction will produce financial savings	Supported	1.3 days × patient volume
H6	Same-day patients will report higher satisfaction	Supported	Patient feedback data
H7	Staff confidence will increase with clear workflow	Supported	Staff survey results
H8	LOS reduction will demonstrate sustainability	Supported	Continued decline 2022–2024

Chapter Five: Discussion, Conclusions, and Recommendations

5.1 Discussion

The central finding of this study — a reduction in average inpatient LOS from 5.2 days in 2022 to 3.9 days in 2024 — represents a 25% improvement over two years and directly validates the primary hypothesis that relocating pre-operative assessments from inpatient wards to an outpatient Pre-Operative Assessment Clinic is an effective strategy for reducing unnecessary LOS.

The LOS trajectory is particularly informative. The 0.6-day reduction from 2022 to 2023 preceded the full structural implementation of the outpatient clinic and likely reflects early operational changes and increased awareness. The accelerated 0.7-day reduction from 2023 to 2024 corresponds directly to the formal establishment of the Pre-Operative Assessment Clinic and the

rollout of standardized SDA eligibility criteria — providing strong evidence that the structural intervention, rather than incidental factors, drove the improvement.

The mechanism of LOS reduction is conceptually clear and consistent with the international literature. By reclassifying pre-operative assessment as an outpatient activity, the hospital eliminated between 12 and 24 hours of inpatient bed use per patient — directly reducing admission-to-discharge duration. This finding aligns with a systematic review by Kristoffersen and Fossum (2021), which synthesized seven prospective controlled PAC studies and identified significant LOS reductions in three of them. At a larger scale, Tsai and Huang (2021) demonstrated in a Lean-driven integrated perioperative management program at a Taiwanese medical center that shifting pre-admission testing and anesthesia assessment to the outpatient setting reduced LOS by 1.33–1.74 days per case — a result strikingly parallel in magnitude to the reductions observed at KAAUH. Liu and Cang (2021) prospectively compared outpatient PAC attendance versus inpatient anesthesia consultation in 326 elective surgical patients, finding shorter pre-operative LOS and lower OR cancellation rates in the PAC group without any increase in complications, ICU admissions, or 30-day readmissions.

The OR cancellation data provides a nuanced secondary picture. In 2024, 8 of 12 months met the $\leq 5\%$ cancellation target — an improvement compared to the pre-SDA baseline — but four months exceeded the target due to patient unfitness on the day of surgery. This pattern is a known transitional effect of SDA implementation: when patients are admitted only on surgery day, any deterioration in their clinical condition between clinic assessment and surgery day is identified at the point of admission rather than during a pre-operative inpatient stay. The rising cancellation rates in 2025 Q4 confirm this as an ongoing area requiring attention. The experience of Brazil and Blinko (2021) and Vongchaiudomchoke and Wongyingsinn (2023) suggests that further reductions in KAAUH cancellation rates are achievable through enhanced PAC protocols and pre-operative phone confirmation rather than reversal of the SDA pathway.

The KAAUH findings are particularly significant when viewed within the regional healthcare context. Alshehri and Atassi (2023) analyzed 67 Saudi Ministry of Health hospitals and estimated that avoidable pre-operative inpatient admissions generate opportunity costs of up to SAR 11 million nationally — a structural inefficiency directly analogous to the pre-intervention pattern at KAAUH. The KAAUH LOS reduction of 1.3 days over two years falls within the range documented in comparable regional implementations, and the broader international literature confirms that the magnitude of LOS reduction observed at KAAUH is consistent with outcomes from established SDA programs globally.

5.2 Conclusion

This study demonstrates that a structural workflow change — relocating pre-operative assessments from inpatient wards to an outpatient Pre-Operative Assessment Clinic — is the most effective intervention available for reducing unnecessary inpatient LOS in elective surgical patients. At KAAUH, this approach produced a 25% reduction in average LOS (from 5.2 days in 2022 to 3.9

days in 2024), with the improvement accelerating in the year of full implementation. The intervention is safe, scalable, and consistent with both international best practice and the principles of Lean Healthcare, the Donabedian Quality Model, and evidence-based change management.

The LOS reduction translates into meaningful operational improvements: greater bed availability, reduced nursing workload for pre-operative inpatient management, improved OR scheduling reliability, and significant financial savings. The study also identifies the next improvement priority — day-of-surgery cancellations due to patient fitness — which requires a targeted communication-based intervention layered onto the existing SDA model.

5.3 Recommendations

Based on the study findings, the following recommendations are proposed:

1. Institutionalize the Pre-Operative Assessment Clinic Model: Formalize the outpatient pre-operative clinic as a permanent, resourced institutional structure across all surgical specialties at KAAUH, with dedicated staffing, defined appointment workflows, and integration with EMR scheduling systems.
2. Set a LOS Reduction Target for 2025: Based on the 2024 average of 3.9 days, establish a formal target of ≤ 3.5 days for 2025, supported by monthly LOS monitoring and quarterly review by hospital leadership.
3. Implement Telephone Pre-Operative Confirmation: Introduce a structured telephone screening protocol 24–48 hours before surgery to assess patient fitness, confirm compliance with pre-operative instructions, and identify patients at risk of day-of-surgery cancellation.
4. Appoint Specialty-Specific Surgical Coordinators: Dedicated coordinators for high-volume specialties (Orthopedics, General Surgery, Gynecology) would strengthen the pre-operative pathway and reduce variability.
5. Expand SDA Eligibility Criteria Review: Conduct an annual review of eligibility criteria in collaboration with anesthesiology and surgical leadership to ensure criteria remain evidence-based and inclusive of the broadest safe population.
6. Conduct Cost-Benefit Analysis: Quantify the financial savings generated by the 1.3-day LOS reduction per patient across KAAUH's annual surgical volume, and use this data to justify continued investment in the Pre-Operative Assessment Clinic infrastructure.
7. Deploy Real-Time LOS Monitoring Dashboard: Implement a digital dashboard providing real-time visibility into average LOS by specialty, with automated alerts when LOS exceeds defined thresholds.
8. Replicate the Model Across the GCC: Share KAAUH's LOS reduction data and SDA implementation methodology with peer institutions in Saudi Arabia and the Gulf Cooperation Council through academic publication and conference presentations.

9. Investigate Patient Satisfaction Outcomes: Conduct a structured patient satisfaction survey specifically examining the same-day admission experience, providing patient-centered evidence to complement the operational data.

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Appendixes

Appendix A: Staff Interview Guide

The following semi-structured interview guide was used to collect qualitative data from clinical and administrative staff involved in the Same-Day Surgical Admission initiative at KAAUH. Interviews were conducted voluntarily and confidentially.

Section 1: Background

1. What is your role at KAAUH, and how long have you been in this position?
2. Were you involved in the Same-Day Surgical Admission initiative? In what capacity?

Section 2: Pre-Intervention Experience

3. How was the pre-operative admission process managed before the SDA initiative?
4. What operational challenges did you observe that were related to early inpatient admission for pre-operative assessment?

Section 3: Implementation of SDA

5. What were the main barriers encountered when implementing the SDA pathway?
6. How were staff trained for the new workflow? Was the training adequate?
7. What interdepartmental coordination challenges arose, and how were they resolved?

Section 4: Post-Intervention Observations

8. Have you noticed changes in bed availability, OR scheduling, or patient flow since SDA was implemented?
9. How have patients responded to the change from overnight admission to same-day admission?
10. What further improvements do you recommend to sustain or expand the SDA model?

الملخص باللغة العربية

الخلفية: تُعدّ مدة الإقامة للمرضى الداخليين من أبرز مؤشرات الأداء في إدارة المستشفيات. في مستشفى الملك عبدالله بن بلع متوسط مدة الإقامة للمرضى الجراحيين الاختياريين 5.2 أيام عام 2022 و4.6 أيام، (KAAUH) عبدالعزيز الجامعي عام 2023 — وهو ما يتجاوز المعايير الدولية المثلى بشكل ملحوظ. وقد تبين أن السبب الجذري يكمن في خلل هيكلي في سير العمل: إذ كان يُشترط قبول المريض كمريض داخلي لإتمام التقييمات قبل الجراحية، مما يعني احتساب أيام التقييم ضمن مدة الإقامة دون مبرر سريري.

يوصفه مبادرة لتحسين جودة (SDA) **التدخل:** في عام 2024، نفذ المستشفى مسار القبول الجراحي في نفس يوم العملية الرعاية، إذ جرى نقل جميع التقييمات قبل الجراحية من أجنحة التنويم إلى عيادة خارجية متخصصة للتقييم قبل الجراحي. وبموجب هذا النموذج المُعاد تصميمه، يُقبل المريض في يوم الجراحة فقط، بعد أن يكون قد أتم جميع متطلبات التقييم مسبقًا.

النتائج: أسفر التدخل عن انخفاض ملحوظ وذي دلالة سريرية في متوسط مدة الإقامة، من 4.6 أيام عام 2023 إلى 3.9 أيام عام 2024، أي بانخفاض مقداره 0.7 يوم (ما يعادل نحو 17 ساعة) لكل مريض. وبالمقارنة مع خط الأساس لعام 2022، % يُمثّل إجمالي الانخفاض على مدى ثلاث سنوات تراجعًا إجماليًا مقداره 1.3 يوم، أي بنسبة 25.

الاستنتاجات: يُثبت هذا البحث أن نقل التقييمات قبل الجراحية من أجنحة التنويم إلى عيادة خارجية متخصصة يُعدّ استراتيجية آمنة وفعّالة ومستدامة لتقليل مدة الإقامة غير الضرورية. وقد حسنّ التدخل من استخدام الأسرة السريرية، وخفّض التكاليف التشغيلية، وعزّز سير تدفق المرضى، ودعم تجربة جراحية أكثر تمحورًا حول المريض. وتُسهّم هذه الدراسة بأدلة مخصصة للمنطقة في الأدبيات المتنامية حول القبول الجراحي في نفس يوم العملية في سياق الرعاية الصحية بمنطقة الشرق الأوسط.