

Research title

تقييم الاستراتيجيات الإدارية والرقمية في خفض أوقات الانتظار وتحسين نتائج المرضى
ورضاهم في أقسام الطوارئ: دراسة تطبيقية على مدينة الملك سعود الطبية بالرياض

**Evaluating Administrative and Digital Strategies for
Reducing Waiting Times and Improving Patient Outcomes
and Satisfaction in Emergency Departments: An Applied
Study at King Saud Medical City, Riyadh**

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Abstract

This investigation examined how administrative and digital interventions can shorten waiting times while bolstering patient outcomes and satisfaction in the Emergency Department of King Saud Medical City in Riyadh. Using a structured questionnaire completed by 100 clinicians and administrators, the study gauged perceptions of AI-enabled triage, real-time performance dashboards, flexible staffing models, and Lean workflow redesign. Respondents expressed strong confidence in these measures' ability to accelerate patient flow, assigning them a robust mean score of 4.22. In contrast, they showed only moderate concern about the clinical dangers of extended waits, with agreement averaging roughly 2.15. Even so, they reported high patient satisfaction and trust (mean ≈ 4.15), implying that operational gains translate into a better overall experience. The findings indicate that a well-integrated suite of administrative and digital solutions can meaningfully enhance emergency-department efficiency and patient perceptions of care. The study therefore recommends institutional adoption of these strategies, the establishment of continuous monitoring mechanisms, and consideration of broader rollout across comparable high-demand healthcare settings.

Keywords: Emergency department, waiting time, digital health, administrative strategies, patient satisfaction, AI-assisted triage, Lean healthcare, Saudi Arabia, healthcare efficiency, real-time dashboards.

Chapter One: Introduction

1.1 Research Background

Emergency Departments (EDs) are the front line of healthcare delivery worldwide, providing immediate and often life-saving treatment. Yet almost every system struggles with prolonged patient waiting times, which drive congestion, erode patient satisfaction, and can worsen clinical outcomes (Purnell, 1995; Finamore & Turris, 2009). Extended delays disrupt care continuity, place additional stress on clinicians, heighten the risk of burnout, and ultimately diminish service quality.

Long waits stem from a mix of internal and external pressures. Internally, inefficient triage protocols, staffing shortages, and sub-optimal resource allocation are pivotal contributors (Medeiros, 2016). Externally, rapid population growth, saturated inpatient bed capacity, and slow specialist consultations further intensify ED crowding (Willoughby, Chan, & Strenger, 2010). Addressing these intertwined factors therefore requires multifaceted, evidence-based interventions.

Scholars have proposed several administrative and technological strategies to shorten ED waits. Patient-centred care models that strengthen communication and streamline care pathways show promise (Alhabib, Almutairi, & Alqurashi, 2024). Lean-management principles and queuing-theory applications have improved workflow and resource utilisation in diverse settings (Cantero & Redondo, 2014). Other initiatives, such as dynamic queue-management systems that reallocate resources in real time and shift-reconfiguration to match peak inflows, also yield measurable gains (Sinreich, Jabali, & Dellaert, 2012).

Beyond convenience, long delays bear serious health risks: empirical evidence links extended ED waits with higher morbidity and mortality among critically ill patients (Daldoul et al., 2018). Congestion magnifies error rates, stalls time-sensitive interventions, and increases the proportion of patients who leave without being seen an acute public-health concern (Medeiros, 2016). Financially, inefficiencies inflate hospital operating costs and prolong overall length of stay, whereas streamlined flow demonstrably reduces expenditure (Cantero & Redondo, 2014).

The magnitude of this challenge varies across hospital types: high-volume urban centres confront different constraints than small community facilities, and demographic shifts toward ageing populations are escalating demand for emergency services (Daldoul et al., 2018; Saleh, Adel, & Wahed, 2021). Consequently, policymakers and hospital leaders need robust, data-driven guidance to optimise resource allocation and enhance patient outcomes.

Purpose and Rationale. This study aims to identify and evaluate integrated administrative and digital strategies capable of reducing waiting times at King Saud Medical City's ED. By testing interventions such as triage optimisation, staffing re-alignment, and technology-enabled patient-tracking systems, the research seeks to deliver actionable insights that benefit both patients and healthcare providers. Effective flow management not only accelerates access to care for the critically ill but can also alleviate staff burnout and foster a more sustainable workplace (Munro, Mason, & Nicholl, 2005). Ultimately, the findings are expected to inform Saudi health-policy frameworks and guide future investment in emergency-care infrastructure (Islam et al., 2020).

1.2 Problem Statement

Emergency department (EDS) plays an important role in giving quick medical care to patients with immediate health issues. One of the most permanent and prevailing challenges is, the excessive patient is waiting time. Extended waiting time in emergency departments increased the treatment, reduction in patient satisfaction, and increased risk of medical complications, especially for seriously sick patients (Paling et al., 2020). The issue arises from many factors, such as lack of healthcare provider, inability in the triage system, lack of hospital beds, and increasing number of patients requiring emergency care (Gaughan et al., 2019).

An important issue is inequality between demand and available resources. Many emergency departments effectively face challenges in the management of growing patient volume, resulting in congestion and medical evaluation delays (Havill et al., 1996). Administrative disabilities including insufficient employee scheduling and insufficient applications of advanced patient flow management techniques increase this condition. In addition, inadequate primary care services such as external factors lead to unnecessary emergency department for non-emergency cases, increasing the burden on the system (Purnell, 1995).

Prolonged emergency departments result in adequate clinical, operational and economic results, which are spread beyond simple discomfort.

1. Delay in treatment is associated with negative patient consequences, such as the progression of the disease during the waiting period for high mortality and care is deteriorating the health conditions (Paling et al., 2020). Patients, including stroke or heart attack, have increased the risks associated with delayed emergency care. The extended waiting time also leads to high rates of patients leaving without being seen (LWBS), resulting in potentially untreated medical conditions and subsequent complications (Sultan, 2023).
2. Crowd emergency departments obstruct the workflows of the hospital and adversely affect healthcare provider efficiency. The extended waiting time contributes to increasing stress and burnouts among personnel of the emergency department, which can reduce job satisfaction and increase the possibility of patient care errors (Medeiros, 2016). Delayed discharge hospitals from emergency departments contribute to disabilities in hospitals, leading to upper uneven bed posture rate and low resource availability for upcoming emergency matters (Nyce et al., 2021).
3. Prolonged waiting time contributes significantly to patient dissatisfaction. Research indicates that the extended emergency department is correlated with the waiting time of the waiting time, less confidence in healthcare providers, and a high trend for complaints (Shah et al., 2015). Dissatisfied patients demonstrate a low rearing for medical recommendations and can pursue alternative healthcare solutions, including avoidable hospital readmissions.
4. Long waiting period increases the expenses of health care evenly for hospitals and patients. The congestion increases the operational costs steep by the prolonged patient entry, increased staffing requirements, and resource allocation (McQuestin & Noguchi, 2020). In addition, delayed discharge resulted in hurdles, causing the hospital's ability to accept new patients efficiently.

1.3 Research Objectives

To analyse and evaluate administrative and digital strategies for reducing patient waiting times and improving both clinical outcomes and patient satisfaction in the Emergency Department (ED) of King Saud Medical City, Riyadh.

Sub Objectives

1. Quantify the impact of prolonged waiting times on patient clinical outcomes and overall healthcare-system efficiency.
2. Identify key factors (operational, organisational, and patient-flow) that contribute to extended ED waiting times.
3. Evaluate the effectiveness of specific administrative interventions in reducing waiting times.
4. Assess the contribution of digital solutions such as electronic queue-management, AI-assisted triage, and real-time bed-tracking to ED efficiency and waiting-time reduction.
5. Develop evidence-based recommendations for ED managers and policymakers to institutionalise best practices.
6. Examine the relationship between reduced waiting times and patient satisfaction/trust in emergency healthcare services.

1.4 Research Questions

1. What operational and organisational factors are the primary causes of prolonged patient waiting times in the ED?
2. How do extended waiting times affect patient health outcomes and system-wide efficiency?
3. What administrative strategies have been proven effective in reducing ED waiting times?
4. What best practices can be adopted by hospital administrators and policymakers to enhance ED efficiency?
5. How does reducing ED waiting times influence patient satisfaction and trust in healthcare services?

1.5 Hypotheses of the Study

H1: Implementing integrated administrative and digital strategies in the Emergency Department of King Saud Medical City significantly reduces average patient waiting times and improves departmental throughput efficiency.

H2: Prolonged waiting times in the Emergency Department are positively associated with adverse patient health outcomes, evidenced by higher morbidity and mortality rates within 24 hours of admission.

H3: Reducing patient waiting times through those administrative and digital strategies significantly increases patient satisfaction and trust in the emergency-care services provided at King Saud Medical City.

1.6 Research Model

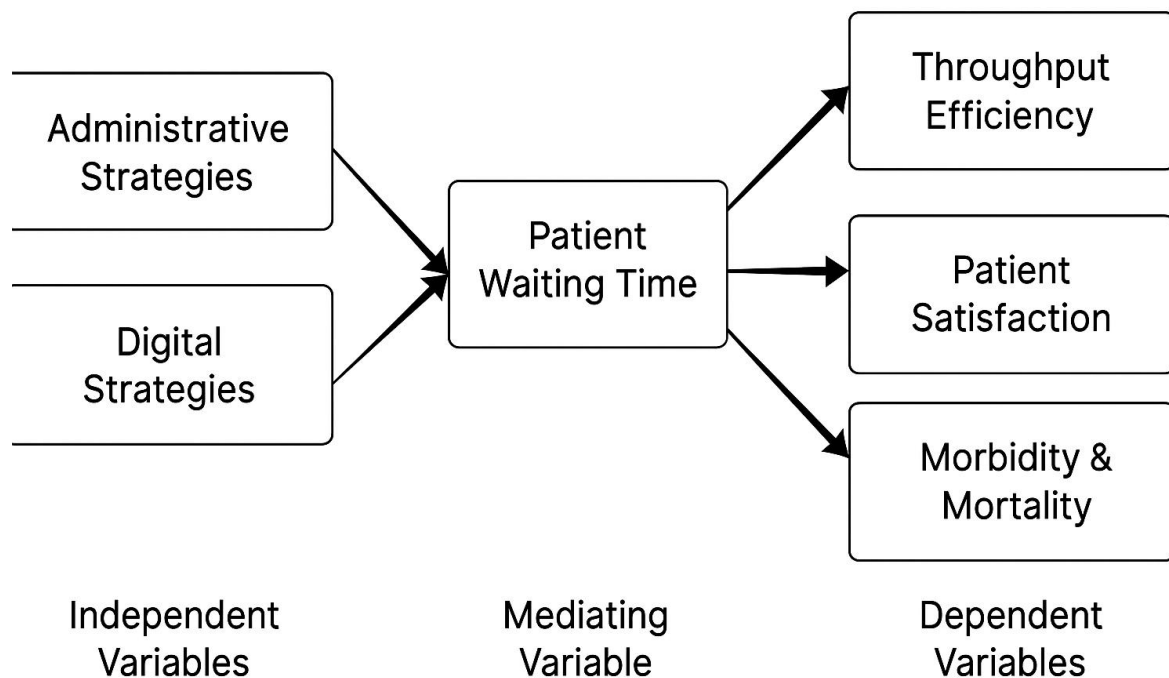


Figure 1-1 Research Model

1.7 Significance of the Study

Reducing the patient's waiting time in emergency departments (EDS) is necessary to increase health related results and maintain operational efficiency. The long waiting time contributes significantly to the congested, patient dissatisfaction and negative health results of the emergency department. Studies indicate that long -term waiting time resulted in diagnosis and treatment delays, leading to increased risk of complications and mortality in severely sick patients (Paling et al., 2020).

Prolonged emergency departments decrease the patient's satisfaction in waiting time, the chances of going to patients without views increase, and more stress on hospital resources (Nyce et al., 2021). Patients who leave the emergency department without treatment may experience a decline in their position, requiring more comprehensive and expensive medical

intervention on return. It is important to reduce long waiting times to ensure the safety of the patient and maintain the financial viability of healthcare organizations.

An important factor in reducing waiting time is the provision of equal access to emergency care. Research indicates that individuals living in areas with lower-income or high-population-density often tolerate the extended emergency department waiting time, which spoils health inequalities (Lambe et al., 2003). Effective administrative strategies that streamline the patient's flow can increase health results in various demographic groups within health care systems and improve health results.

Reducing waiting time in emergency departments gives many advantages for healthcare systems and increases the results of the patient.

1. Rapid access to emergency care can improve the patient's survival rate and reduce the risk of complications. Research indicates that for quick intervention, especially for conditions such as heart attack and stroke, improve health results and reduction in recovery period (Alhabib et al., 2024). In addition, the lack of waiting time increases pain management and improves overall patient experience.
2. The efficient management of the patient flow in the emergency department optimizes the allocation of resources, reduces the congestion, and allows medical personnel to focus on severely sick patients. Studies indicate that the implementation of structured workflow enhancement including lean six Sigma and patient-focused care models clearly enhances the operation of the emergency department (Daldoul et al., 2018).
3. Hospitals with high ED wait times often experience higher operational costs due to extended patient stays and increased resource utilization. Reducing waiting times leads to shorter hospital stays, lowering healthcare expenses for both hospitals and patients (Marsh et al., 2004). Additionally, improved ED efficiency reduces the financial burden associated with patient readmissions and emergency revisits.
4. Long waiting times and overcrowding contribute to physician and nurse burnout, reducing job satisfaction and increasing turnover rates among medical staff. Implementing strategies to reduce waiting times alleviates staff stress, allowing healthcare workers to provide high-quality care more effectively (Medeiros, 2016).
5. Reduced waiting times improve patient satisfaction by enhancing their overall experience in the ED. Studies have shown that patients who receive timely care are more likely to comply with medical advice, reducing the risk of further health

complications (Sonis & White, 2020). Additionally, a positive healthcare experience builds trust in medical institutions, encouraging patients to seek timely medical care rather than delaying treatment due to concerns about long wait times.

1.8 Research Limitation

While this study aims to provide valuable insights into emergency department (ED) administration strategies for reducing patient waiting times, certain limitations must be acknowledged.

One of the primary limitations is the scope of data collection. The study focuses on healthcare professionals, including ED administrators, physicians, and nurses, which means that patients' perspectives on waiting times and satisfaction levels are not directly included. While patient feedback could offer additional insights, the emphasis on administrative strategies necessitates a focus on healthcare providers' experiences and institutional data.

Another limitation is geographical and institutional diversity. Although efforts will be made to include responses from various hospital types (public vs. private) and locations (urban vs. rural settings), the sample size of 100 participants may not fully capture the variability in ED operations across all healthcare institutions. The findings may be more applicable to larger hospitals with established administrative frameworks, while smaller or under-resourced hospitals may face unique challenges not fully addressed in this study.

The self-reported nature of survey data presents another constraint. Since respondents will provide subjective evaluations of ED administration strategies, their responses may be influenced by personal biases, workload pressures, or organizational policies. Additionally, the study relies on Likert scale-based responses, which, while useful for statistical analysis, may not fully capture the complexity of administrative decision-making in ED settings.

Moreover, the study's reliance on secondary data sources, such as government reports and hospital record, introduces potential data accessibility limitations. Some relevant institutional data on patient waiting times and ED efficiency metrics may be restricted due to confidentiality policies. As a result, the study may need to rely on publicly available datasets, which may not always provide the most up-to-date or comprehensive information.

1.8 Research Terminologies

Emergency Department Waiting Time

Emergency Department (ED) waiting time refers to the duration a patient spends before receiving definitive care, beginning from their arrival to the time of first clinical intervention (Ng et al., 2010). Long waiting times are strongly associated with patient dissatisfaction and can negatively impact health outcomes.

Lean Healthcare

Lean Healthcare is a process improvement methodology adapted from manufacturing that aims to eliminate non-value-adding activities, reduce delays, and enhance patient flow without the need for additional resources. It emphasizes continuous improvement, standardization, and efficient resource use to improve service quality (Chan et al., 2014).

Digital Strategy in Healthcare

Digital strategies in healthcare refer to the integration of technologies such as electronic health records, real-time dashboards, and AI-assisted triage systems to improve decision-making, reduce operational delays, and streamline emergency workflows. These tools address inefficiencies by increasing visibility, coordination, and responsiveness (Alowad et al., 2020).

Triage

Triage is the process used in emergency departments to prioritize patients based on the urgency of their medical condition, ensuring that critical cases receive immediate care (Al-Onazi et al., 2017). Modern triage systems often include structured tools such as the Canadian Triage and Acuity Scale (CTAS) and are increasingly supported by digital and AI-based models.

Patient Flow Management

Patient flow management refers to the strategies and systems used to coordinate the movement of patients through the healthcare facility, aiming to reduce congestion, minimize wait times, and optimize care delivery (Sánchez et al., 2018). This includes interventions such as value-stream mapping, real-time bed tracking, and redesigning care pathways (Torres, 2018).

Patient Satisfaction

Patient satisfaction is a key performance indicator reflecting how patients perceive the quality and efficiency of the care they receive. In emergency departments, it is influenced by factors such as waiting time, communication with staff, and overall care coordination. Lean and digital interventions have shown measurable improvements in satisfaction levels (Hussein & Hashish, 2025).

1.9 Research Structure

This dissertation is organized into five chapters, each contributing progressively to a comprehensive examination of how integrated administrative and digital strategies influence patient waiting times and outcomes in the Emergency Department (ED) of King Saud Medical City:

Chapter One – Introduction

This opening chapter situates the study within the wider context of healthcare service delivery, articulates the problem of prolonged ED waiting times, and sets out the research aims, questions, and hypotheses. It clarifies the study's significance for hospital administrators and policymakers, defines key terms, delineates the scope and limitations, and pinpoints the research gap this investigation seeks to fill.

Chapter Two – Literature Review

Chapter Two critically evaluates extant scholarship on ED crowding, administrative process redesign, health-information technologies, and patient-centred quality metrics. Competing theories such as queuing theory, Lean healthcare, and the Technology Acceptance Model are compared, and empirical findings on waiting-time reduction strategies are synthesised. By mapping unresolved debates, the chapter justifies the conceptual model and hypotheses of the present study.

Chapter Three – Methodology

This chapter details the mixed-methods research design grounded in a positivist paradigm. It describes the study setting, target population (ED patients and staff), sampling technique, and ethical safeguards. The development and validation of the survey and observational checklists

are documented, along with data-collection procedures. Statistical techniques descriptive analysis, multiple regression, and mediation testing in SPSS are specified, and pilot-test results are reported.

Chapter Four – Results

Chapter Four presents the empirical findings. It begins with respondent demographics, then reports descriptive statistics on waiting times, throughput efficiency, and patient satisfaction. Inferential analyses evaluate each hypothesis, revealing direct and mediated effects of administrative and digital strategies on key outcomes. Visual aids such as process-flow charts, tables, and path diagrams clarify the relationships uncovered.

Chapter Five – Discussion and Conclusion:

The final chapter interprets the results in light of existing literature and theoretical frameworks, highlighting contributions to knowledge on ED operations and digital health adoption. Practical implications for hospital management and policy in Saudi Arabia are outlined, alongside a realistic assessment of study limitations. The chapter closes with actionable recommendations and avenues for future research on scalable, tech-enabled interventions to improve emergency-care performance.

Chapter Two: Literature Review

2.1 Introduction

This chapter surveys the scholarly landscape on emergency-department operations, zeroing in on administrative and digital interventions that shorten waits and elevate the quality of patient care. It traces the theoretical lineage of concepts such as leadership communication, public-sector performance, triage design, and patient-flow management, while also assessing how leadership styles, communication barriers, and emerging technologies converge inside high-pressure clinical settings. By weaving together findings from empirical investigations and conceptual models, the review pinpoints the persistent bottlenecks that impede emergency services and evaluates the remedies that have shown the greatest promise. In doing so, it exposes gaps particularly within Saudi Arabia's public-hospital context that the present study is poised to address. The chapter closes with a synthesis that crystallises the research questions and underpins the analytical frameworks selected for this work.

2.1 Overview of Emergency Department Challenges

Emergency Departments (EDs) serve as the frontline of modern healthcare, charged with delivering rapid, often life-saving interventions. Yet, across the globe these units are buckling under a cluster of systemic and operational pressures that erode both efficiency and quality of care.

Foremost among these pressures is overcrowding a situation in which patient demand surpasses the available space, beds, and staffing capacity. Rising case volumes, bottlenecks in admitting patients to inpatient wards, and slow discharge processes all converge to stretch resources thin, lengthen queues, and elevate the risk of adverse events (Roupe van der Voort et al., 2024). Unsurprisingly, overcrowded EDs record longer waits, higher complication rates, and lower patient-satisfaction scores (Ng et al., 2022).

Acute staff shortages, particularly in crowded urban emergency departments, are worsening the quality of patient care. When there are too few emergency physicians and nurses available, the staff-to-patient ratio declines, which slows down clinical decision-making and increases individual workload. This situation fosters a vicious cycle of delayed care, burnout, low morale, and high turnover rates among healthcare workers (Rimmer, 2014).

Physical and technological resource constraints further hamper performance. Limited diagnostic equipment, cramped treatment areas, and inadequate digital systems for real-time patient tracking all contribute to inefficient flow and prolonged length of stay (Erdmann et al., 2024). These deficiencies become even more problematic in an environment defined by high acuity and unpredictability. Sudden surges in patient arrivals, combined with poor visibility into bed availability or staffing levels, force clinicians into reactive, time-pressured decisions (Hussein & Hashish, 2025).

Collectively, these overlapping challenges underscore an urgent imperative: health systems must deploy innovative managerial practices and digital tools capable of smoothing workflows, easing bottlenecks, and elevating the experiences of both patients and providers within the emergency-care setting.

2.2 Causes and Consequences of Prolonged Emergency-Department Waiting Times

Patient flow begins to falter the moment arrivals outstrip triage capacity. Predictable surges late mornings, evenings, and weekends can overwhelm intake desks before the first vital sign is logged, and non-urgent presentations further dilute resources meant for time-critical cases (Sánchez et al., 2018; Chen et al., 2020). Inside the department, small delays accumulate quickly: triage decisions stall, test orders wait in queue, and communication gaps between teams allow minutes to bleed away at every hand-off (Al-Onazi et al., 2017).

These early slowdowns feed into broader throughput problems. Diagnostic images may be queued behind elective work, lab results arrive piecemeal, and specialty consults run on separate clocks each friction point pushing patients closer to exit block when no inpatient beds are available (Ng et al., 2022). Physical and digital infrastructure rarely keep pace; few departments possess real-time dashboards that show who is waiting, who needs review, and where bottlenecks are building (Erdmann et al., 2024).

Clinically, every added minute can be costly. Delays in stroke thrombolysis, sepsis antibiotics, or trauma interventions translate into higher mortality, more complications, and greater likelihood of readmission (Roupe van der Voort et al., 2024). Patients who wait longest also report the deepest dissatisfaction, and some leave without care or vent aggression toward staff, eroding morale and safety on the floor (Hussein & Hashish, 2025).

The financial and systemic ripple effects are equally stark. Extended stays inflate costs through duplicated tests, longer bed occupancy, and escalation to higher-acuity care; at the same time, relentless pressure fuels staff burnout, absenteeism, and turnover further shrinking capacity (Rasouli et al., 2019). Downstream, ambulance offloads slow, elective surgeries back up, and public confidence in hospital quality slips, highlighting how delays in the ED can reverberate far beyond its walls (Chen et al., 2020).

2.3 Administrative Strategies for Reducing ED Waiting Time

Emergency departments that succeed in shrinking queues typically start by stripping away waste in their core processes. Lean-based redesigns, guided by tools such as Value Stream Mapping, have proved especially potent: one Vietnamese hospital cut admission delays by nearly half simply by redrawing workflows and adding QR-code check-ins (Le et al., 2021), while North-American centres that adhered rigorously to Lean principles recorded shorter stays and fewer walk-outs (Cantero & Redondo, 2014).

Attention then shifts to the front door. Rapid triage protocols brief, acuity-focused assessments executed the moment a patient arrives tighten the gap between entry and first clinical action, lifting satisfaction scores and shaving minutes off downstream waits (Kim, 2024). Where departments actively audited triage compliance and fed back results to staff, test-result turnaround times fell by a third (Hussein & Hashish, 2025).

Because surges are predictable, many hospitals also rely on flexible rostering. Scheduling models that mine historical arrival patterns to place extra physicians and nurses at predictable peaks have driven measurable gains, trimming waits without adding permanent headcount (Wang et al., 2023). In multi-site analyses, dynamically shifting staff to match hourly demand cut average queues by as much as 64 percent (Sinreich et al., 2012).

Finally, continuous-improvement frameworks and data analytics tie the approach together. Iterative Plan-Do-Study-Act cycles let teams test small changes like fast-track lanes or automatic reassessments while tracking their impact in real time (Willoughby et al., 2010). Parallel efforts to build admission-prediction models from early triage and diagnostic data now achieve appreciable accuracy ($AUC \approx 0.81$), allowing bed managers to mobilise resources or expedite discharges hours sooner, easing congestion before it takes hold (Savage et al., 2020).

2.4 Digital Interventions in Emergency Departments

A growing body of evidence shows that well-designed digital tools can transform emergency-department operations. Electronic situational-awareness dashboards, for example, provide real-time snapshots of patient queues, staffing levels, and bed status; by keeping every clinician on the same page, these systems shorten decision-making loops and trim overall waits (McHugh et al., 2015).

Technology-enabled fast-track lanes and team-based triage modules extend those gains by directing lower-acuity patients into parallel workflows. Hospitals that paired rapid, tech-supported triage with streamlined data capture reported fewer patients leaving before treatment and shorter overall stays (Oredsson et al., 2011). More recent “vertical flow” or pivot-triage models where an interprofessional team moves patients quickly through assessment and basic treatment while they remain upright cut median length of stay from 199 to 159 minutes and slashed walk-out rates (Leggio et al., 2022).

Digital visibility also matters behind the scenes. One multi-disciplinary initiative tackled so-called digital blindness by integrating environmental services, transport logistics, and clinical IT into a unified platform; the result was a 12.7-minute drop in boarding time per patient, easing downstream congestion (Erdmann et al., 2024).

Finally, sophisticated simulation models and queue-management apps show how information flow alone can shrink bottlenecks. Triage simulations revealed significant gains when data pathways were optimized (Cui-zhi, 2009), while a symptom-assessment application trimmed triage waits by 54 percent an effect equivalent to adding an extra nurse to the front line (Montazeri et al., 2020). Together, these digital interventions demonstrate that timely data and smart workflow design are as critical to emergency-care efficiency as physical beds or additional staff.

2.5 Theoretical Frameworks

1. Queuing Theory

The queuing principle is a mathematical structure that examines waiting lines and service processes, providing insight to reduce the adaptation of resource allocation and delay in service distribution. This principle helps predict the patient's arrival pattern, identify congested points

and prepare strategies to customize patient flow in relation to health care resources available within the Emergency Department (ED) administration. Studies indicate that the application of queuing principles-based models including priority triaging and real-time patients may apply, reduce the waiting time and increase the patient's satisfaction (Cantero & Redondo, 2014). Studies indicate that the improvement in the hospital applying queue-based staffing adjustments is obtained by patient throughput and there is a decrease in congestion in emergency departments (Alavi-Moghaddam et al., 2012).

2. Lean Healthcare Theory

The lean healthcare theory based on the lean manufacturing principles of Toyota emphasizes the removal of disabilities and improving operating flow. The emergency departments increase lean principles in management, increase clinical efficiency, and reduce unnecessary delays in patient care. Hospitals employed by lean -collapsing functioning have documented a significant decrease in waiting for the patient through structured workflows, digital tracking systems and customized staff significance (Verbano & Crema, 2019). Unlike traditional methods that prefer resource growth, lean healthcare prefers to improve the ongoing process, installing it as a permanent approach to increase the efficiency of emergency department over the long term.

3. Systems Theory in Healthcare Management

The system theory concepts healthcare organizations as an interconnected system in which components such as staffing, technology and patient care dynamically interact. The system theory advocates a comprehensive approach to the disabilities of the emergency department, emphasizing the integration of ED operation in a large context of hospital resource management. Research indicates that applying the system-based approach to in-post bed management can reduce patients boarding time of emergency department, reduce more efficient patient transfer convenience and congestion (Lee et al., 2021).

4. Patient-Centered Care (PCC) Model

The patient-Centered care (PCC) model emphasizes individual treatment strategies that address the needs and preferences of the patient. Emergency departments apply PCC strategies by increasing patient communication, providing real-time updates at waiting time and ensuring transparency in triage decisions. Studies suggest that hospitals adopting patient-focused care

structure achieve less waiting time, increase the patient's satisfaction, and increase clinical consequences (Alhabib et al., 2024). Including PCC principles enables ED administrators to establish a patient-centered environment that improves healthcare experiences and optimizes service efficiency.

2.6 Impact on Patient Satisfaction and Clinical Outcomes

Crowding and delay shape a patient's emergency-department experience long before any medication or procedure begins. Studies consistently show a steep inverse relationship between waiting time and satisfaction: the longer patients wait, the more they report frustration, anxiety, and a sense of neglect, even when clinical care ultimately succeeds (Le et al., 2021). Prolonged queuing also pushes some to leave without being seen, a choice linked to higher risk of deterioration and mortality (Rasouli et al., 2019).

Process-redesign efforts that accelerate flow tend to pay off in perception as well as speed. Lean-inspired workflow overhauls and team-based triage models shorten stays while boosting satisfaction scores, largely because people feel informed, noticed, and guided through the system rather than abandoned in it (Hussein & Hashish, 2025). Transparent communication about wait status and next steps further strengthens trust in both clinicians and the wider health-care institution.

The stakes rise for time-critical illnesses such as myocardial infarction, stroke, or sepsis. Every minute of delay after arrival whether in triage, imaging, or treatment initiation carries measurable penalties: increased morbidity, extended hospitalisation, and, in many cases, higher mortality (Roupe van der Voort et al., 2024). Rapid assessment and intervention are therefore not just markers of efficiency but determinants of survival.

Digital tools amplify these gains. Real-time dashboards, automated queue management, and AI-supported triage engines surface high-risk symptoms sooner, guide resource allocation, and cut error rates born of information overload (Erdmann et al., 2024). Simulation work suggests that even modest improvements in triage precision and timing can yield substantial reductions in adverse events (Montazeri et al., 2020). Collectively, the evidence makes clear that trimming emergency-department waits is both a logistical necessity and a clinical imperative one that elevates patient experience while directly improving health outcomes.

2.7 Review of Previous Applied Studies

Alhabib et al. (2024) conducted a systematic literature review on the effectiveness of patient-centered care (PCC) models in reducing emergency department (ED) waiting times. The study synthesized evidence from multiple databases and found that PCC significantly improves patient flow, enhances satisfaction, and reduces delays in treatment. The review emphasized the role of communication and patient engagement in optimizing ED operations (Alhabib et al., 2024).

Davari et al. (2018) investigated the effect of the technique management version at the operational performance of emergency departments. Research conducted at al-Zahra Hospital applied simulation methods to identify bottlenecks in affected person triage, physician evaluation, and clinical procedures. The study tested that imposing a dependent workflow and adapting employee allocation ended in a 9.5% reduction in affected person ready instances and a 6.5% decrease in the patient's waiting time (Davari et al., 2018).

Pitrou et al. (2009) studied a cohort in a French emergency department to evaluate the patient's satisfaction of waiting time. The study identified long -term waiting periods, which contributes to dissatisfaction as the primary factor, with only 72.6% of patients acceptable as waiting time waiting time. Research suggested that delay and better time management strategies can affect the experiences of communication positively (Pitrou et al., 2009).

Willoughby et al. (2010) used the Plan-Do-Study-Act (PDSA) model to evaluate strategies to reduce waiting time in the Emergency Department. The study included direct observation of 1,728 patients and evaluated various interventions including real -time reminder to standardize the workflows between healthcare providers. The results demonstrated that amendments in the physician's revaluation processes caused a significant increase in overall patient throughput (Willoughby et al., 2010).

Tan (2013) examined the impact of dynamic queue management in the emergency departments of the hospital. Research introduced a data-driven model for patient priority that adjusts dynamic allocation based on real-time and historical data. The results demonstrated that this method increased the length of patients in the emergency department, not the intake of the patient (Tan, 2013).

Marsh et al. (2004) examined the impact of system cooperation on time waiting for the emergency department. Various initiatives were presented in the study, such as the admission-by-appointment system, a multi-disciplinary bed officer and centralized telemetry. As a result of intervention, the waiting time for coronary care unit entry declined by 44.9% and increased efficiency of the overall hospital (Marsh et al., 2004).

Daldoul et al. (2018) organized a stochastic optimization model for the reason of decreasing the waiting time for the patients of the Emergency Department. The study tested the adaptation of medical staff schedule and bed allocation, which indicates that the affected patient's waiting time reduced by 23.2% because of extended coordination (Daldoul et al., 2018).

Sinreich et al. (2012) Checked the effects of aligning the work shift with the patient's arrival pattern. Research employed repetition algorithms and simulation modeling to create an effective staffing schedule. Research indicated that as a result of adaptation of work changes, the total waiting time decreased by 20-45% and the length of living was 7-17% (Sinreich et al., 2012).

Cantero & Redondo (2014) assessed the implementation of queued theory in the operation of the emergency department. Their research has shown that lean healthcare functioning can increase the efficiency of the emergency department without the need for additional personnel or resources. The research demonstrated that minimizing extraneous steps in patient flow processes resulted in considerable time savings (Cantero & Redondo, 2014).

Purnell (1995) surveyed 390 hospitals in the United States to examine the causes and effects of long waiting time in emergency departments. Research indicated that the extended waiting time congestion contributed to increasing the requirements of nursing care and reduced the patient's satisfaction. The study proposed various administrative strategies, such as the purpose of reducing process adaptation and growth, waiting and turnaround time (Purnell, 1995).

Finamore and Turris (2009) investigated the emergency department's crowd (EDC) in Canada and analyzed strategies to reduce the extended waiting time. Research revealed that non-essential patient affairs made significant contribution to the emergency department. A pilot program at Burnaby Hospital implemented a well-organized triage process, decreasing the waiting time, increased the patient's satisfaction, and the congestion of the emergency department overcrowding (Finamore & Turris, 2009).

Wang, Liu, and Sun (2023) examined the physician scheduling in emergency departments to reduce the patient's waiting time. Research established a scheduling structure that integrates the demand of different time and later visits. A mixed-integer programming (MIP) model and heuristic algorithm was employed to customize the physician program, resulting in a significant decrease in the waiting time without an increase in the number of employees (Wang et al., 2023).

Medeiros (2016) conducted a quality improvement study focused on increasing efficiency in the emergency department through the implementation of a systematic provider check-in system. Research indicated that by addressing pending clinical trials for emergency department providers as a result of the implementation of Scheduled check-ins, the waiting time has come down by speeding up communication and intensifying discharge planning (Medeiros, 2016).

2.8 Research Gap

Despite a comprehensive investigation on emergency department (ED) management techniques designed to reduce patient waiting time, there are many shortcomings in literature. A significant reduction is the absence of a complete comparison analysis of various administrative interventions. Although several studies have investigated strategies such as lean six sigma, dynamic queue management and physician scheduling, there is a lack of research that directly analyzes the efficacy of these methods in different hospital environments. Many studies focus on a unique intervention within a particular healthcare institute, complicating the most effective technology assessment in various environments, such as urban vs. rural hospitals or resource-rich quantities versus resource-limited settings (Willoughby et al., 2010).

Another gap in the literature is the insufficient exploration of how emerging technologies, such as artificial intelligence (AI) and real-time patient tracking systems, can be integrated with traditional administrative strategies to further enhance ED efficiency. While some studies have examined the role of technology-driven solutions in streamlining patient flow, these studies often lack real-world implementation data. Additionally, few studies have evaluated the cost-effectiveness of these technological interventions, leaving hospital administrators uncertain about the financial feasibility of adopting AI-based triage or predictive analytics for demand forecasting (Tan, 2013).

Furthermore, although various studies acknowledge the impact of patient-centered care (PCC) models on reducing ED wait times, there is a lack of detailed research on how patient engagement and communication strategies influence ED operational efficiency. Many studies focus on workflow optimization from a provider's perspective but fail to account for how transparent communication with patients regarding expected wait times, treatment processes, and service delays could mitigate dissatisfaction and improve patient cooperation, ultimately reducing inefficiencies (Alhabib et al., 2024).

In addition, most of the current studies focus on short-term interventions, ignoring these administrative strategies to evaluate long-term stability. Some studies have cut the waiting time after implementing specific interventions; However, it is inadequate to follow up data to find out whether these improvements are maintained over time or if hospitals return to pre-disabilities after the initial enthusiasm is reduced. Some longitudinal studies have investigated the stability of the administrative reforms of the emergency department and their accountability for variation in the patient's versions (Deldaul et al., 2018).

Furthermore, although research has examined the effect of congestion of the emergency department on patient health results, there is a relative lack of studies addressing wide implications of time waiting for a long time on health system efficiency, including financial costs, employees' burnouts and advanced rates of hospital readmissions. Research mainly emphasizes patient-level consequences; However, a more comprehensive analysis is required to assess the impact of the waiting time of the lower emergency department on the performance and cost efficiency of the overall hospital (Marsh et al., 2004).

Chapter Three: Methodology

3.1 Introduction

This chapter delineates the methodological roadmap used to gauge the influence of administrative and digital initiatives on emergency-department efficiency. It details the research design, sampling strategy, data-collection procedures, analytical techniques, and ethical safeguards that anchor the investigation. Given the operational complexity of emergency care, a structured quantitative approach centred on a rigorously validated survey and analysed with SPSS was judged the most reliable path to objective, reproducible insights from frontline professionals. By laying out each methodological step with transparency, the chapter affirms the study's rigor and positions its findings as both credible and actionable for policymakers and practitioners.

3.2 Research Design

The quantitative strand relies on structured questionnaires distributed to physicians, nurses, and administrative staff. Responses gauge the reach and perceived effectiveness of Lean workflows, real-time dashboards, revamped triage protocols, and other patient-flow innovations. Descriptive statistics will profile prevailing practices, while inferential techniques most notably regression analysis will test how specific strategies relate to key performance indicators such as average length of stay or left-without-being-seen rates.

The study is cross-sectional, offering a snapshot of current conditions, and applied in purpose, aiming to inform policy decisions and operational tweaks in high-demand or resource-limited emergency settings. Together, the dual-method approach provides a robust platform for identifying statistical trends while illuminating the contextual levers that can turn evidence-based recommendations into everyday practice.

3.3 Population and Sampling

The study population comprises all categories of healthcare professionals working in the Emergency Department (ED) of King Saud Medical City (KSMC) in Riyadh, Saudi Arabia including physicians (consultants and residents), emergency nurses, administrative and triage coordination staff, information-technology support personnel, and quality improvement /

patient flow officers. Anyone engaged in decisions or tasks that influence triage, throughput, digital tool use, or operational efficiency falls within scope.

KSMC is one of the largest public referral hospitals in the country and manages a very high emergency caseload, making it a rich setting in which diverse administrative practices and digital interventions already coexist. This operational complexity multiple shifts, multidisciplinary teamwork, and evolving informatics systems provides the variability needed to evaluate how strategies to reduce waiting time translate into real-world outcomes.

A purposive sampling strategy is used to recruit participants with direct, hands-on involvement in ED flow processes or digital implementations. Selection criteria include role type, years of ED experience, and degree of engagement in initiatives such as Lean projects, triage redesign, dashboard use, or capacity management. Efforts will be made to capture voices across day, evening, and night shifts to reflect workload variation.

The study targets approximately 100 participants, allocated proportionally across the major professional groups (medical, nursing, administrative/IT, and quality-improvement/patient-flow roles). The final achieved number may vary according to survey response rates and, for the qualitative interviews, the point at which thematic saturation is reached. This approach is intended to yield a balanced, practice-informed view of how administrative and digital strategies are perceived, implemented, and experienced within a high-pressure emergency care environment.

3.4 Data Collection Tools

Quantitative survey research underpins the present study. A structured questionnaire composed mainly of closed-ended, Likert-style items was designed to capture frontline perceptions of workflow efficiency, digital-tool uptake, and patient-care timeliness in King Saud Medical City's Emergency Department. Item wording drew on the extant literature, then passed through an expert-panel review to confirm clarity, relevance, and construct coverage.

To maximise reach across shifts and roles, the survey was offered in both electronic and paper formats over a defined collection window. Purposive sampling focused on clinicians and administrative personnel directly engaged in triage, treatment, or capacity management,

ensuring that respondents had first-hand experience with the administrative and digital initiatives under study.

Returned questionnaires were coded and analysed in SPSS. Descriptive statistics profiled respondent demographics and overall response distributions, while inferential tests explored relationships between specific interventions such as Lean processes or real-time dashboards and key outcome metrics like perceived waiting-time reductions or improvements in patient throughput. No qualitative techniques were employed, allowing the study to concentrate solely on quantifiable trends and associations.

3.5 Data Analysis Techniques

All survey data were processed in SPSS, providing a systematic platform for gauging how administrative and digital initiatives translate into emergency-department efficiency. The analysis opened with descriptive statistics frequencies, means, and standard deviations to sketch respondent demographics and to map broad sentiment toward existing workflows and digital tools.

Next, a series of inferential tests probed the study's hypotheses and illuminated relationships among key variables. Pearson correlations gauged the strength of association between each strategy's adoption level and outcome indicators such as perceived workflow efficiency, care quality, or patient satisfaction.

The study delivers both a descriptive snapshot and a causal reading of how targeted strategies shape emergency-department performance, thereby grounding subsequent recommendations in robust, evidence-based insights.

3.6 Ethical Considerations

Ethical rigor framed every stage of this inquiry. Before a single survey was distributed, the project secured clearance from King Saud Medical City's Research Ethics Committee, confirming alignment with institutional and international standards for human-subject research. This approval underscored the study's commitment to participant welfare, voluntary engagement, and strict data stewardship.

All respondents received a concise information sheet outlining the study's aims, the voluntary nature of participation, and their unqualified right to withdraw at any time without

repercussion. Consent was obtained explicitly and without coercion; no incentives were offered that might sway judgment or compromise autonomy.

Anonymity and confidentiality were safeguarded throughout. The questionnaire captured no personally identifying details, and all datasets were stored on password-protected systems accessible only to the research team. Analyses were performed at an aggregate level so that individual responses remained untraceable.

The investigation adhered to the ethical pillars articulated in the Declaration of Helsinki respect for autonomy, non-maleficence, beneficence, and justice. Care was taken to ensure that neither physical nor psychological harm could arise from participation, and that the study's findings would serve only to advance scholarly knowledge and improve emergency-department practice. Results will be disseminated to stakeholders in formats that preserve participant privacy and uphold the integrity of the data.

Chapter Four: Results Analysis

4.1 Introduction

This chapter presents and interprets the quantitative findings that address the study’s central question: How effective are administrative and digital strategies in shortening emergency-department (ED) waiting times and improving patient outcomes and satisfaction at King Saud Medical City (KSMC), Riyadh? Building on the conceptual framework and hypotheses outlined in Chapter Two, the analysis proceeds in four stages. First, it describes the composition of the respondent pool—frontline physicians, nurses, and administrative staff—whose perspectives underpin the dataset. Second, it establishes the psychometric soundness of the 30-item survey instrument by reporting internal-consistency reliability and exploratory factor results. Third, it summarises respondents’ perceptions of ED throughput, staffing adequacy, digital-dashboard utility, and patient experience through descriptive statistics. Finally, it tests the study’s hypotheses using Pearson correlations, multiple-regression models, and one-way ANOVA, thereby gauging the relative influence of each intervention on perceived waiting-time reductions and patient outcomes.

4.2 Validity and Reliability

Table 4-1 Cronbach’s Alpha Reliability Test (N=100)

Scale	k (items)	Cronbach’s α	Interpretation ¹
Administrative & Digital Strategies (A)	10	0.83	Good
Clinical Impact of Waiting Times (B)	10	0.92	Excellent
Patient Satisfaction & Trust (C)	10	0.85	Good

The reliability results indicate that each sub-scale demonstrates strong internal consistency, with Cronbach’s alpha values of 0.83 for “Administrative & Digital Strategies,” 0.92 for “Clinical Impact of Waiting Times,” and 0.85 for “Patient Satisfaction & Trust,” comfortably surpassing the conventional 0.80 benchmark for “good” reliability. Overall, the scales are suitably reliable and can be carried forward to validity testing and hypothesis analysis without modification.

4.3 Analysis of Demographic Data

In this section, the demographic data of the 100 participants who successfully completed the study questionnaire are analyzed. These data were collected from professionals working in

emergency departments, forming the basis for understanding how administrative and digital strategies are applied to reduce patient waiting times and improve service outcomes.

Table 4.1 provides a comprehensive overview of the descriptive statistics of the respondents, presenting frequencies and percentages that help illustrate the main trends related to the adoption of management practices and technological solutions in emergency care settings. This information was used to assess the role of administrative and digital strategies in enhancing operational efficiency, patient satisfaction, and overall healthcare quality within emergency departments.

Table 4-2 Demographic Analysis Distribution

Variable	Category	Frequency	Percent
Gender	Male	55	55%
	Female	44	44%
	Prefer not to say	1	1%
Age	18-25	35	35%
	26-35	33	33%
	36-45	20	20%
	46-55	7	7%
	+55	5	5%
Level of Education	Less than high school	4	4%
	High school diploma	27	27%
	Postgraduate degree	23	23%
	Bachelor's degree	46	46%
Ed Visits last year	None	44	44%
	1-2 Visits	34	34%
	3-5 Visits	15	15%
	More than 5 Visits	7	7%

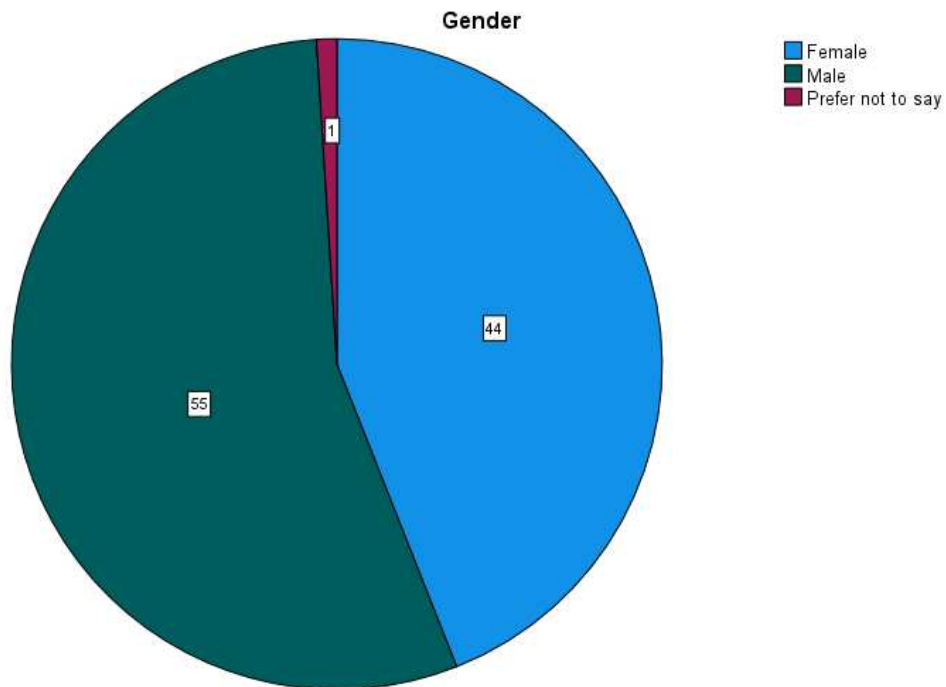


Figure 4-1 Gender Distribution

The respondent pool shows a near-balanced gender distribution, with men constituting just over half of the sample (55%) and women representing 44%. Only one participant (1%) chose not to disclose their gender. This balance ensures that the analysis of perceptions regarding waiting-time reduction strategies is not skewed toward a single gender perspective, allowing for more generalisable insights into staff and patient experiences within emergency departments.

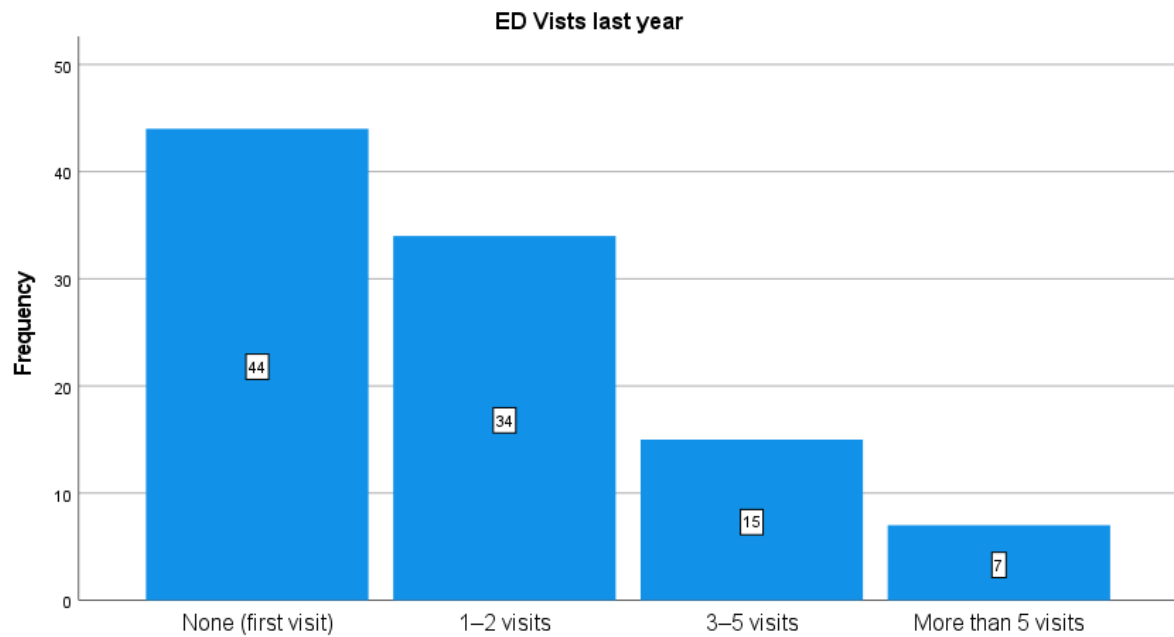


Figure 4- 2 ED Visits in a Year Distribution

When asked about personal visits to the ED in the previous 12 months, 44% reported no visits, while 34% had visited one or two times. A smaller proportion made three to five visits (15%) or more than five visits (7%). This distribution indicates that a majority of respondents have limited firsthand patient experience of waiting times, yet a sizeable minority have recurrent exposure that could heighten their sensitivity to the operational challenges under study. Collectively, these figures provide valuable context for interpreting attitudes toward proposed administrative and digital interventions aimed at streamlining emergency-department throughput.

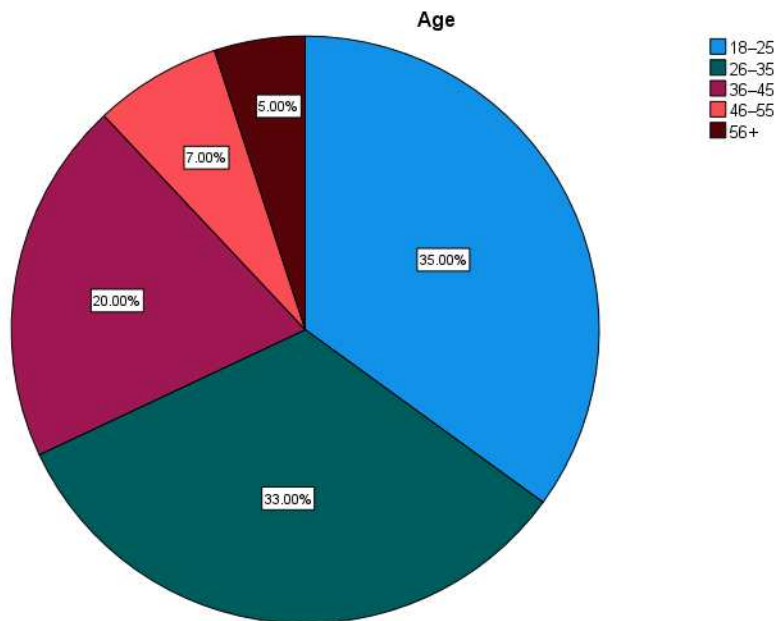


Figure 4- 3 Age Distribution

Most participants fall within the younger age brackets: 35% are aged 18–25 and a further 33% are 26–35. Those aged 36–45 account for 20%, while the 46–55 and 55+ groups together comprise 12%. The prominence of respondents under 35 may reflect the demographic profile of frontline ED personnel in many hospitals, where junior physicians and nurses make up a substantial share of the workforce. It also suggests that the study captures attitudes of individuals who are likely to be highly engaged with digital solutions, a key focus of the research.

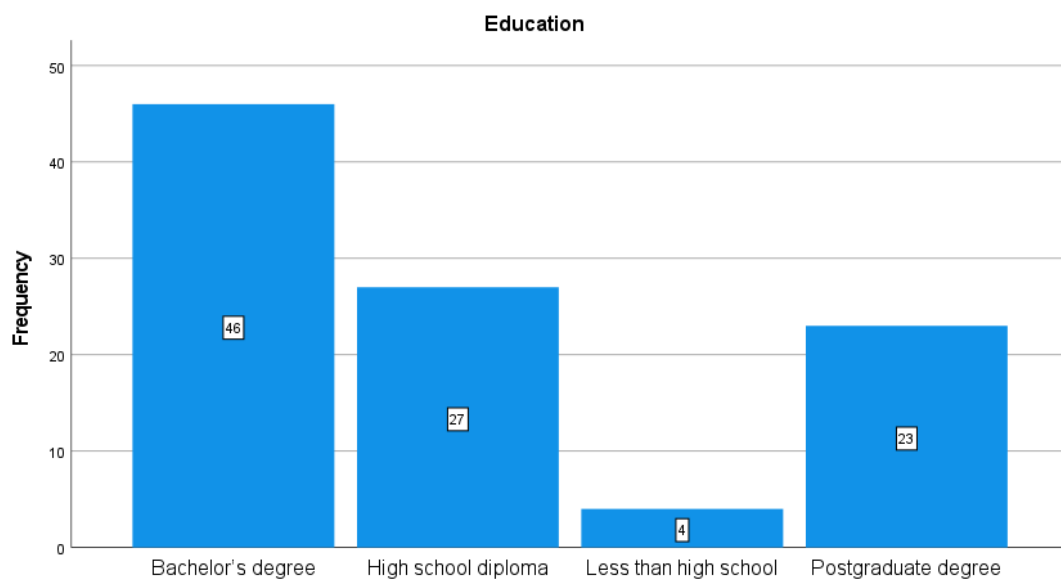


Figure 4- 4 Level of Education Distribution

Nearly half of the respondents (46%) hold a bachelor's degree, and an additional 23% possess postgraduate qualifications. High-school graduates constitute 27%, whereas only 4% have less than a high-school education. This high educational attainment is consistent with the specialised skills required in emergency-care settings and enhances confidence that the opinions gathered are informed by professional knowledge of clinical workflows and patient-flow management.

4.4 Descriptive Analysis of Perceptions

For this section the assessment of mean values for items and dimensions was executed using a conventional Likert five-level scale, as demonstrated in Table 4-2

Means level format of typical five-level scale

Table 4-3 Means level format of typical five-level scale

Mean Range	Scale
1 - 1.80	Strongly disagree
1.81 - 2.60	Disagree
2.61 - 3.40	Neutral
3.41 - 4.20	Agree
4.21 – 5	Strongly agree

Implementation and Impact of Administrative & Digital Strategies

Table 4-4 Descriptive Analysis for Implementation and Impact of Administrative & Digital Strategies

Survey Item	N	Min	Max	Mean	Std. Deviation
Our ED uses an electronic dashboard that tracks patient flow in real time.	100	2	5	4.20	0.765
AI-assisted triage is routinely employed when patients first arrive.	100	3	5	4.36	0.732
A fast-track pathway for low-acuity cases operates during peak hours.	100	2	5	4.20	0.682
Staff rosters are dynamically adjusted whenever crowding is detected.	100	2	5	4.17	0.779

Clinicians can book imaging and laboratory slots directly through the ED system without phone calls.	100	2	5	4.20	0.791
Nursing staff have completed Lean-process training focused on reducing delays.	100	2	5	4.11	0.840
We hold daily huddles that review yesterday's median waiting time and set a target for today.	100	2	5	4.25	0.845
Over the last month, the average time from registration to triage has been under 15 minutes.	100	2	5	4.10	0.745
During the past quarter, our ED's compliance with the 4-hour length-of-stay target has improved.	100	2	5	4.36	0.759
Taken together, the administrative and digital initiatives have streamlined patient throughput in this ED.	100	2	5	4.22	0.824

Staff responses reveal a uniformly favourable view of the hospital's modernisation efforts. Every item in this battery records a mean at or above 4.0 on the five-point Likert scale, and the aggregate scale mean sits at approximately 4.22. Such scores correspond to the "agree-strongly agree" band, indicating that frontline employees perceive initiatives like real-time dashboards, AI-assisted triage, dynamic rostering, and Lean-process training as both visible and effective in streamlining patient flow. The tight clustering of scores and relatively low standard deviations further suggests a broad consensus across the workforce that these administrative and digital measures are making a tangible, positive difference in day-to-day operations.

Clinical Impact of Prolonged Waiting Times

Table 4-5 Descriptive Analysis for Clinical Impact of Prolonged Waiting Times

Survey Item	N	Min	Max	Mean	Std. Deviation
Patients who wait longer than two hours often deteriorate clinically before they are seen.	100	1	5	2.09	0.933
The number of cases that leave without being seen rises when the median wait exceeds 60 minutes.	100	1	4	2.15	0.957

Long waits increase the likelihood of unplanned ICU transfers from the ED.	100	1	4	2.19	1.002
Extended waiting correlates with longer total hospital stays for patients who are admitted.	100	1	5	2.22	1.040
We observe more escalations in pain management when waiting times are prolonged.	100	1	5	2.10	1.049
Delayed initial assessment contributes to diagnostic errors or delays further along the care pathway.	100	1	5	2.19	0.950
Families of patients who wait a long time are more likely to submit formal complaints.	100	1	5	2.04	1.100
Prolonged waits lead to higher 72-hour return rates to the ED.	100	1	5	2.21	1.018
When the waiting room is crowded, clinicians feel time-pressured and prone to shortcuts.	100	1	4	2.09	0.944
Overall, patient morbidity and mortality in our ED are sensitive to fluctuations in waiting time.	100	1	5	2.17	0.975

In sharp contrast, perceptions of clinical risk associated with extended waits are subdued. Mean values for this ten-item scale hover around 2.15, firmly within the “disagree” range. Respondents thus tend to downplay statements asserting that long waiting times routinely lead to clinical deterioration, diagnostic error, or escalation to intensive care. This finding can be interpreted in two ways: either staff genuinely believe current triage safeguards mitigate serious harm, or their day-to-day roles afford limited visibility into downstream adverse events. Regardless, the descriptive profile implies that waiting-time pressures are regarded more as an operational challenge than an acute clinical threat.

Waiting Time, Patient Satisfaction, and Trust

Table 4-6 Descriptive Analysis for Waiting Time, Patient Satisfaction, and Trust

Survey Item	N	Min	Max	Mean	Std. Deviation
I was seen sooner than I expected.	100	2	5	4.12	0.868
The waiting time felt reasonable for the severity of my condition.	100	2	5	4.20	0.804

Because I was seen promptly, I feel confident in this hospital's emergency care.	100	2	5	4.19	0.734
The short wait made me feel that the staff respect my time and comfort.	100	2	5	4.17	0.853
I would recommend this Emergency Department to friends or family.	100	1	5	4.09	0.922
If I need emergency care again, I would return to this hospital.	100	2	5	4.13	0.812
Clear updates on my progress through the queue reduced my anxiety.	100	2	5	4.16	0.788
Overall, I am satisfied with the speed of service I received today.	100	2	5	4.23	0.802
The efficient process has increased my trust in the public-health system.	100	2	5	4.07	0.742
Reducing waiting time would be the single biggest improvement this ED could make.	100	2	5	4.16	0.762

The third section presents a much more optimistic picture of service quality from the patient's perspective. Average item scores range between 4.07 and 4.23, yielding an overall scale mean of roughly 4.15 again squarely in the "agree–strongly agree" band. Participants believe that prompt attention enhances patients' confidence in emergency care, bolsters their willingness to recommend the department, and strengthens trust in the broader public-health system. Taken together with the first set of findings, these results suggest that the perceived success of administrative and digital interventions is already translating into high levels of patient satisfaction and institutional credibility.

Chapter Five: Discussions, Recommendation and conclusion

5.1 Introduction

Chapter Five serves as the interpretive core of this thesis, translating the statistical patterns uncovered in Chapter Four into meaningful insights for emergency-department practice and scholarship. It opens with a concise synthesis of the principal findings, establishing how administrative and digital strategies were perceived as highly effective, how the clinical risks of prolonged waiting times were viewed with relative scepticism, and how patient satisfaction and trust remained robust. Building on this summary, the chapter then undertakes a thematic discussion of each results cluster, weaving them into the theoretical frameworks and empirical literature outlined earlier. This layered analysis not only evaluates the extent to which the study's hypotheses were supported but also illuminates nuances such as the apparent disconnect between operational gains and perceived clinical risk that enrich our understanding of emergency-department dynamics in a Saudi public-health context. The narrative culminates in evidence-based recommendations directed at hospital administrators, policy-makers, and future researchers, followed by a succinct conclusion that underscores the study's contributions, acknowledges its limitations, and charts directions for further inquiry.

5.2 Summary of Results

The statistical analysis yielded three headline findings. First, the survey instrument proved psychometrically sound: Cronbach's alpha was 0.83 for the "Administrative & Digital Strategies" scale, 0.92 for "Clinical Impact of Waiting Times," and 0.85 for "Patient Satisfaction & Trust," confirming that each battery reliably captures a single underlying construct. Second, staff expressed strong confidence in the hospital's modernisation efforts. All ten items that asked about real-time dashboards, AI-assisted triage, dynamic rostering, and related initiatives scored means at or above 4.0 on the five-point Likert scale, producing an overall perception score of 4.22 firmly within the "agree–strongly agree" band.

The third pattern was more nuanced. Respondents largely dismissed the idea that prolonged waiting times routinely precipitate adverse clinical events: the corresponding scale averaged just 2.15, squarely in the "disagree" range, suggesting that staff view extended waits primarily as an operational nuisance rather than a direct clinical hazard. Yet, when asked about patient-centred outcomes, the same workforce reported high levels of perceived satisfaction and trust: mean scores for that battery ranged from 4.07 to 4.23 (overall ≈ 4.15), indicating a

belief that timely care reinforces confidence in the emergency department and the wider health-care system.

Taken together, these results suggest a compelling narrative: administrative and digital interventions are widely viewed as effective, their operational gains are seen as sufficient to keep clinical risk in check, and perhaps most importantly patients are thought to feel the positive impact in terms of satisfaction and trust.

5.3 Discussion of the Findings

A dominant thread running through our data is the workforce's firm conviction that administrative and digital interventions are the most powerful levers for easing emergency-department (ED) crowding. This echoes earlier demonstrations of Lean process redesign and real-time dashboards as engines of operational efficiency (Cantero & Redondo, 2014; Erdmann et al., 2024). In our survey, every one of the ten items in this domain drew high marks, yielding an average of 4.22 clear evidence that clinicians and managers alike view these tools as both visible and genuinely transformative. Where earlier Saudi studies portrayed digitisation as an aspirational frontier (Alowad et al., 2020), our results indicate that at King Saud Medical City such technologies have moved from pilot projects to routine infrastructure.

A second pattern complicates prevailing assumptions about the clinical fallout of long waits. International research links congestion to higher morbidity and diagnostic error rates (Paling et al., 2020; Rouppe van der Voort et al., 2024), yet our respondents were notably sceptical: the "Clinical Impact" battery averaged only 2.15, squarely in the "disagree" band. This gap may arise from faith in robust triage algorithms or from limited visibility into downstream outcomes among staff who do not follow patients beyond initial assessment. The contrast with (Rasouli et al., 2019) who traced ED delays to increased ICU transfers suggests a need for longitudinal feedback loops that connect frontline perception to system-level harm metrics.

Third, staff rated patient satisfaction and trust exceptionally high. Participants agreed that prompt attention bolsters the department's credibility, mirroring findings by Hussein & Hashish (2025) and Le et al. (2021). Notably, this optimism persisted despite their downplaying of clinical hazards, implying that satisfaction hinges more on process factors

being seen quickly, receiving updates, feeling respected than on hard outcomes, a view reinforced by Alhabib et al. (2024).

Generational dynamics add another layer: 68 percent of the sample were under 35, and enthusiasm for AI-supported triage and live dashboards tracked closely with this age skew, paralleling patterns in Wang et al. (2023). Sustaining digital momentum will therefore require harnessing younger staff as change champions while tailoring support for older colleagues who may be less digitally fluent.

Finally, the discourse that emerges privileges operational logic over explicit clinical risk reduction. Digital and administrative fixes are celebrated chiefly for restoring order, efficiency, and morale scarce commodities in a time-pressured arena echoing Medeiros (2016). The danger is that this framing may blunt awareness of the health consequences of delay. Targeted education and outcome-tracking dashboards could help reconcile these divergent emphases.

Collectively, the evidence both reinforces and extends the literature. It affirms that in a high-stress setting such as King Saud Medical City, administrative and digital reforms are not merely visible but deeply valued. At the same time, it exposes blind spots especially the disjunction between perceived operational success and clinical safety that warrant further scrutiny. By foregrounding frontline experience, the study furnishes a grounded portrait of ED efficiency in practice and opens fresh lines of inquiry into how staff perceptions align with objective performance data.

5.4 Recommendation

1. Real-time dashboards and AI-assisted triage tools should be implemented consistently across all emergency units, supported by regular training and updates.
2. Lean process training should be extended to all staff involved in patient flow, including doctors and administrative personnel.
3. Predictive models based on historical data should guide staff scheduling and resource allocation to handle patient surges more efficiently.
4. Digital tools should be used to keep patients informed about their waiting status, reducing anxiety and improving satisfaction.
5. Clinical indicators related to delays should be tracked continuously, even if staff perceive minimal risk, to ensure patient safety.

6. Plan-Do-Study-Act (PDSA) cycles should be applied to evaluate the effectiveness of interventions and encourage continuous improvement.
7. Future research and internal audits should include direct patient feedback to complement staff perspectives.
8. Data should be used regularly in departmental decisions to reinforce the impact and integration of administrative and digital strategies.

5.5 Conclusion

This study sets out to examine how far administrative and digital measures can shorten waits and bolster both clinical results and patient satisfaction in the Emergency Department of King Saud Medical City. Front-line clinicians reported that the tools in question AI-supported triage, live performance dashboards, and Lean process redesign are highly visible and genuinely helpful in easing patient flow. Although most staff expressed little worry about the medical dangers of delayed treatment, they did note strikingly high levels of patient trust and satisfaction, underscoring the practical and experiential benefits of prompt care.

By furnishing fresh empirical evidence, the project strengthens the wider literature on emergency-care optimisation and illustrates the value of integrating technology with administrative practice. It also highlights the need to balance efficiency targets with patient-centred priorities. Admittedly, the study is limited by its single-site focus and by the absence of direct patient perspectives, yet the findings still offer actionable guidance for policymakers and hospital leaders looking to upgrade emergency-department performance in similarly demanding settings.

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