Arab American University
Faculty of Graduate Studies
Department of Health Sciences
Master Program in Quality Management in Healthcare Institutions

Using Lean Six Sigma to Improve Patient Flow at the Emergency Department of Palestine Medical Complex in Ramallah

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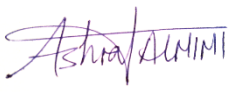
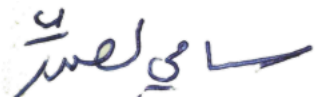
1. Dr. Ashraf Almimi	Main Supervisor	
2. Dr. Sami Sameer Sader	Members of Supervision Committee	
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Declaration

I declare that, except where explicit reference is made to the contribution of others, this thesis is substantially my own work and has not been submitted for any other degree at the Arab American University or any other institution.

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Dedication

I dedicate this thesis to my beloved family, whose unwavering support has been instrumental in my academic journey. I am eternally grateful to my parents for their boundless love and encouragement. Their faith in my abilities has been a constant source of motivation. I would also like to express my sincere gratitude to my siblings for their constant support and belief in me.

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Abstract

Palestine Medical Complex's emergency department struggles with issues like excessive wait times, patient and staff dissatisfaction, and congestion. Through the integration of Lean Six Sigma methodologies—a methodical approach that centers on the elimination of non-value-added operations—this study seeks to improve the performance of the emergency department. The study used a mixed-methods approach to collect data on staff and patient experiences, including observations and surveys. Waste in the procedures utilized by the emergency department was found using value stream mapping. To identify the underlying causes of congestion, the study also identified the Voice of the Customer and Voice of the Process. The study revealed a number of important concerns, such as the requirement for sufficient manpower, improved IT systems, and increased departmental collaboration and communication. Waiting periods were found to have a considerable impact on patient satisfaction, with a high link established between longer wait times and poorer satisfaction. Training and development opportunities, bed availability, maintenance of medical equipment, and IT system updates were all associated with higher levels of staff satisfaction. The study makes strategic recommendations for the Palestine Medical Complex emergency department based on its findings. These include expanding the number of employees and available beds, enhancing IT infrastructure, maximizing patient flow, and resolving communication breakdowns. There are additional recommendations for resource allocation, policy implementation, and public education campaigns aimed at decreasing non-emergency visits. The study concludes that a multifaceted approach, supported by Lean Six Sigma principles, is essential for improving the emergency department's performance and patient satisfaction.

Keywords: lean six sigma, patient flow, emergency department, voice of process, voice of customer

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List of Definitions of Abbreviations

Abbreviations	Title
ED	Emergency Department
LOS	Length of Stay
LSS	Lean Six Sigma
MOH	Ministry of Health
PHC	Primary Health Care
PMC	Palestine Medical Complex
PT	Patient Flow
VOC	Voice of Customer
VOP	Voice of Process
VSM	Value Stream Mapping
WHO	World Health Organisation

Chapter One: Introduction

1.1 Overview

This chapter sets the scene. It gives a summary of the entire topic, the research problem, the primary objectives, and the research questions. We give reasons for choosing Palestine and the Palestine Medical Complex (PMC) Hospital for the case study. We then go over the anticipated knowledge gains that this research should bring. An outline of the thesis structure is provided in this chapter.

1.2 Background

Organizations are under increasing pressure to provide high-quality care, reduce costs, meet community expectations, and maintain continuous improvement initiatives in the highly competitive healthcare market of today (Al Owad et al., 2013). It is now critical for healthcare businesses to improve care quality, efficiency, and cost effectiveness due to increased rivalry among healthcare providers, rising customer expectations, and stronger regulatory requirements (Al Owad et al., 2013). Research has demonstrated the negative effects of inadequate care given to patients who are admitted from the Emergency Department (ED) and has connected it to increased mortality rates (Schuur et al., 2013).

Global health systems, like those in Palestine, face difficulties from limited resources to restrictions on public policy, which means that careful management and decision-making are essential to preserving high-quality care (Souza et al., 2021). In addition to the United States, healthcare systems in fifteen other countries—Australia, Canada, Denmark, Finland, France, Germany, Hong Kong, India, Iran, Italy, The Netherlands, Saudi Arabia, Catalonia (Spain), Sweden, and the United Kingdom—are also impacted by the worldwide problem of ED overcrowding (Pines et al., 2011). Despite diverse healthcare models, ED congestion persists, posing clinical and organizational challenges (He et al., 2011).

The skyrocketing cost of healthcare in the US, exceedingly even the direst predictions (e.g., 15.9% of GDP by 2010) (Saghafian et al., 2015), needs a focus on efficient resource use. Long wait times in EDs, caused by the growing gap between patient volume and available facilities (Saghafian et al., 2015), highlight the urgency for healthcare organizations to address patient

flow (PF). Streamlining processes is crucial to ensure both quality care and financial stability in the face of this economic strain.

Lean Thinking techniques, which minimize waste and streamline operations, show promise for enhancing EDs (Al Owad et al., 2013). Complex systems with no standard strategy for improvement, EDs gain from an integrated method that combines Six Sigma and Lean concepts (Souza et al., 2021). This approach has enhanced healthcare performance and holds promise for a broad improvement in ED operations by combining lean for process effectiveness and Six Sigma for efficiency (Souza et al., 2021).

In this situation, optimizing PF seems to be a vital tactic for reducing ED crowding and enhancing medical care. Healthcare businesses may effectively deliver high-quality care while navigating the difficulties of emergency department operations by utilizing innovative approaches such as Lean Six Sigma (LSS) in conjunction with operations management methodologies.

1.3 Problem Statement

The ED at the PMC is confronted with a complex challenge that is not isolated to the Palestinian healthcare system but is a widespread issue in emergency healthcare globally. The central issue is the struggle to manage PF effectively, leading to delays in treatment and overcrowding within the ED. This challenge is intensified by the absence of organizational policies for staff scheduling and an inadequate number of registration workers, which results in patients enduring registration delays that can vary from five to twenty minutes.

The Head of the ED at the PMC has emphasized the gravity of the overcrowding problem, stating that it can lead to patient dissatisfaction and, in severe cases, patients leaving without receiving essential treatment (personal communication, December 15, 2023). Additionally, he noted that overcrowding can contribute to a decline in healthcare service quality and an increase in violence. His deputy further highlighted the lack of research on patient flow times as a contributing factor to the escalating congestion (personal communication, December 16, 2023).

The PMC ED is particularly challenged by the high volume of patients it serves daily, approximately 415 patients, which places a substantial strain on the department's resources and staff. The absence of studies to accurately measure patient flow times and the variability in wait

times due to staffing shortages exacerbate the problem, impacting the quality of service provided to patients and increasing the pressure on the ED.

The research conducted by the General Directorate of Performance Control (2020) pinpoints the specific challenges faced by the PMC ED, underscoring the necessity for strategic interventions to enhance patient flow and mitigate overcrowding. The integration of Lean and Six Sigma methodologies is posited as a promising approach to address these challenges, with the aim of minimizing waste, optimizing ED workflows, and enhancing the consistency and quality of service delivery. This approach aligns with the findings that suggest a multifaceted strategy, supported by LSS principles, is essential for improving the performance of the ED and enhancing patient satisfaction.

In addition, there are few studies conducted in Palestine, including a study conducted in Gaza at Al-Aqsa Hospital, which emphasized the need to improve patient flow and reduce waiting times. The study also highlighted that Lean and Six Sigma are promising approaches for improvement (Abu Olwan, 2021).

1.4 Justification of the Study

For a number of strong reasons, the selection of Palestine as the research problem's case study has global significance. First off, Palestine is not the only place where the PMC faces difficulties with PF and ED service quality. These problems are a global concern that EDs face (Jarvis, 2016). As a result, looking into the situation and coming up with solutions in the Palestinian context may produce ideas and approaches that improve healthcare systems everywhere.

Second, it is impossible to exaggerate the significance of patient satisfaction. Patients may leave the ED without getting the care they require as a result of treatment delays and overcrowding, which frequently cause patient discontent (van der Linden, & van der Linden, 2016). Enhancing patient happiness and guaranteeing prompt access to vital healthcare requires lowering waiting times and improving PF (Love et al., 2012). The findings also fill in a significant research void. The scarcity of comprehensive studies on PF in the context of Palestine underscores the need for this research initiative. By conducting a thorough examination of PF challenges, this study aims to contribute to the existing literature, providing evidence-based recommendations and it can present it as a possible example for areas around the world dealing with comparable healthcare problems.

1.5 Research Objectives

In pursuit of addressing the research questions outlined, this study seeks to develop a systematic approach rooted in the integration of Lean and Six Sigma methodologies. To improve PF inside EDs, the main objective is to identify and eliminate non-value-added operations. The specific objectives are as follows:

1. Integration of Lean and Six Sigma: To integrate Lean principles with Six Sigma methodology, tailored to the context of PMC, for the continuous enhancement of PF within EDs.
2. Voice of Customer (VOC) and Voice of Process (VOP) Integration: To devise an innovative approach that combines the VOC and the VOP, thus enabling a comprehensive investigation into the primary causes of overcrowding that disrupt PF in EDs.
3. Value Stream Mapping (VSM): To construct a VSM process to meticulously identify instances of waste within EDs, thereby facilitating informed improvement initiatives.

1.6 Research Questions

To answer the main research question, the following sub-questions are addressed:

1. How can Lean thinking and Six Sigma methodology be used for improving PF in EDs?
2. How can a Lean strategy and Six Sigma techniques identify wastes that affect PF and quality of service in EDs?
3. How can an integrated LSS model determine the performance measurements to evaluate any improvement in PF?
4. What are the root causes of overcrowding in EDs, and how can these causes, which impact PF, be identified and addressed by integrating the VOC and the VOP?
5. What types of waste, affecting both PF and the quality of service in EDs, can be identified and eliminated through the application of Lean strategies and Six Sigma techniques?

1.7 Research Hypotheses

Hypothesis 1: The integration of Lean principles with Six Sigma methodologies will significantly improve PF in the ED of the PMC by reducing non-value-added operations and enhancing overall service quality.

Hypothesis 2: Identifying and addressing the root causes of overcrowding in the ED through the integration of the VOC and VOP will lead to measurable improvements in patient satisfaction and operational efficiency.

Hypothesis 3: The application of VSM will effectively identify wasteful practices within the ED, resulting in targeted improvement initiatives that enhance both patient flow and the quality of care provided

1.8 Thesis Structure

This thesis is structured as follows:

Chapter One: Introduction

This chapter provides an overview of the study's background, defines the problem statement, discusses the study's importance, identifies the objectives, and poses research questions.

Chapter Two: Literature Review

Previous empirical investigations are reviewed in this chapter. Following that, comments on these studies are made.

Chapter Three: Methodology

This chapter covers a number of topics, including the research design, population and sample specifications, data collection methods, research instruments, unit of analysis determination, data analysis techniques, statistical analysis software, the application of LSS principles, and specific ethical considerations.

Chapter Four: Data Analysis and Discussion

This chapter brings both descriptive and inferential statistics to the analysis of primary data.

Chapter Five: Conclusions and Recommendations

This chapter presents the findings, offers suggestions, outlines some paths for further research, and addresses the study's shortcomings.

Chapter Two: Literature Review

2.1 Overview

This chapter delves into the critical issue of patient flow management within EDs, focusing on the challenges, strategies, and potential solutions. The review examines the global context of ED overcrowding, its impact on patient care quality, and the factors contributing to this phenomenon. It explores the application of operations management techniques, such as Lean and Six Sigma, as promising approaches to enhance ED efficiency and patient outcomes.

2.2 Healthcare Systems

2.2.1 Healthcare Challenges

In addressing the imperative to meet heightened expectations, approximately 75% of organizations have implemented strategies to enhance their processes (Al Owad et al., 2013). Despite efforts toward quality improvement within hospitals, the lack of significant changes may stem from a failure to address the root cause of frequent emergency room visits. It is crucial to target specific issues such as emergency room overuse, setting clear objectives aimed at enhancing safety for both patients and staff (Al Owad et al., 2013). Long waiting times for care and treatment pose life-threatening risks and undermine healthcare service quality (Al Owad et al., 2013). ED overcrowding remains a critical concern, driven by both high patient arrival rates and internal inefficiencies slowing down PF (Micró et al., 2003).

ED crowding has been associated with adverse clinical outcomes, including elevated complication rates and mortality (Pines et al., 2011). The Institute of Medicine identified ED crowding as a significant issue in 2006 (Pines et al., 2011). The healthcare system of the UK's National Health Service (NHS) is under immense strain, evidenced by nursing shortages exceeding 43,000 vacancies and over 4.4 million patients (about twice the population of New Mexico) experiencing prolonged wait times. Performance targets have dropped from 95% to 86.5%, while medication errors incur a staggering £2.5 billion annually, contributing to preventable deaths (Antony et al., 2023).

Palestinian emergency services face extraordinary pressure due to insufficient human resources and inadequate medical equipment and supplies. The need for medical care is growing as Israeli aggression against Palestinians becomes more intense. The unique political and social

circumstances in Palestine, including the ongoing Israeli occupation and its impact on healthcare infrastructure, necessitate a tailored approach to improving patient flow in EDs (Amro et al., 2018).

The Palestinian healthcare system operates under significant constraints, including limited financial resources, restricted mobility due to checkpoints, and a reliance on international aid, all of which influence PF dynamics, the Palestinian Ministry of Health's (MOH) efforts to improve healthcare quality and accessibility are commendable , yet the implementation of these policies is often hindered by practical challenges on the ground (Palestinian MOH, Health Annual Report, Palestine 2021, June 2022), underscoring the need for innovative solutions like LSS (Al Owad et al., 2013).

2.2.2 Patient Flow Conceptualization in EDs

EDs are vital to the healthcare system because they are the first port of entry for a diverse group of patients with different requirements. To guarantee high-quality treatment, patient satisfaction, and effective resource use, the ED must optimize PF (Tlapa et al., 2020).

PF is the term used to describe how patients travel through the ED, including everything from admission to release (Tlapa et al., 2020). According to Tlapa et al. (2020), it entails a complicated interaction between internal systems, physical resources, and medical care. Effective PF has a direct impact on the ED's overall performance, affecting variables like wait times, crowding, and, in the end, the standard and cost of care provided (Al Owad et al., 2013). It is essential to comprehend the difficulties related to patient flow in order to put improvement methods into practice. Staffing shortages often result in registration bottlenecks, which is a common concern for EDs (General Directorate of Performance Control, 2020). Furthermore, insufficient data documentation and worries about long waiting times can impede efficient PF even more (General Directorate of Performance Control, 2020). These difficulties eventually affect patient satisfaction, which is a crucial sign of the caliber of care received in EDs (Amro et al., 2018). Improvement strategies are built upon the conception of PF in EDs. Healthcare practitioners can work toward achieving a seamless and effective PF through the ED by locating and fixing systemic inefficiencies. Thus, there is an increase in patient satisfaction, higher quality of service, and increased safety for patients (Amro et al., 2018).

2.2.3 Patient Flow Challenges in EDs

Across the globe, one of the biggest challenges faced by EDs is PF. As acknowledged by Al Owad et al. (2013), this congestion is a global issue that has a number of detrimental effects, including increased adverse events and patient mortality, longer hospital stays and higher costs, and ultimately, poorer quality of care (Al Owad et al., 2013; Alsufi Thesis, n.d.).

There are numerous causes of ED overpopulation. Patients seeking care in the ED for non-emergency conditions are one of the culprits, thereby depleting resources for those in dire need (Souza et al., 2021). Additionally, inefficiencies within the ED itself, such as prolonged waiting times and treatment delays, can exacerbate the problem (Alsufi Thesis, n.d.). Finally, issues in other parts of the hospital, such as bed availability, can create bottlenecks that impede PF through the ED (Souza et al., 2021).

2.2.4 The Palestine Medical Complex: A Case Study

The PMC emergency department exemplifies the challenges faced by EDs worldwide (General Directorate of Performance Control, 2020). The ED experiences fluctuations in patient registration wait times due to staffing shortages. These wait times can reach 20 minutes, exceeding the typical range of 5-10 minutes (General Directorate of Performance Control, 2020). Furthermore, documentation weaknesses pose a significant hurdle, with only 36% of patient discharges adequately documented, impacting data accuracy and patient safety (General Directorate of Performance Control, 2020).

These challenges underscore the need for effective strategies to improve PF in EDs. LSS, a methodology that has been successfully implemented in healthcare settings, offers a promising solution (Souza et al., 2021). This strategy integrates two potent philosophies:

- Lean emphasizes reducing waste and optimizing ED workflows (Beck et al., 2016; Cirrone et al., 2016). Excessive wait periods, pointless testing, or ineffective staff time management are a few instances of waste in an ED setting.
- The other part of this system, called Six Sigma, measures and lowers variation inside a process using statistical methods. This enables the application of sustainable solutions to enhance process consistency and quality, as well as evidence-based decision making and root cause analysis (Cirrone et al., 2016).

EDs like the PMC may be able to increase PF, decrease wait times, and ultimately improve the standard of patient care by implementing LSS techniques.

2.2.5 International Perspectives on ED Issues

The demand for services from EDs is rising globally. A startling 27.8% increase in yearly ED visits occurred between 2005 and 2015, according to a ten-year research conducted in California (Hsia et al., 2018). This may be the result of difficulties getting primary care elsewhere, leading to an increasing dependency on EDs (Hsia et al., 2018). Studies have shown a 32% countrywide rise in ED utilization, indicating similar trends are seen globally (Carter et al., 2014). In order to increase productivity, efficiency, and overall quality of treatment, healthcare organizations must find creative management solutions to meet this growing demand (Souza et al., 2021).

This worldwide tendency is reflected in the situation in Palestine. The number of ED visits is still high even after there has been a considerable expansion in the healthcare infrastructure, with 89 hospitals and a network of 765 primary healthcare (PHC) facilities (MOH, Health Annual Report, Palestine 2021, June 2022). Over 2.2 million visits were recorded in 2021, with over 850,000 occurring in MOH hospitals in the West Bank alone (MOH, Health Annual Report, Palestine 2021, June 2022). The Palestinian MOH is committed to providing high-quality comprehensive healthcare services to all citizens (MOH, Health Annual Report, Palestine 2021, June 2022). However, challenges persist.

A report by the General Directorate of Performance Control (2020) highlights some of the specific issues faced by the PMC ED. These include:

- A lack of organizational policies for employee working hours, potentially contributing to inefficiencies (General Directorate of Performance Control, 2020).
- The lack of studies to determine PF times are reasons for the increase in congestion. This problem affects the quality of service provided to patients and increases the pressure on the ED as approximately 415 patients are received daily at the PMC (General Directorate of Performance Control, 2020).
- Variations in wait times for patient registration because of a lack of staff (General Directorate of Performance Control, 2020).

These difficulties highlight the necessity of efficient management strategies in EDs. Thankfully, improvements in performance indicators have been demonstrated by Operations

Research/Management Science (OR/OM) methodologies in a variety of healthcare settings, including EDs (Saghafian et al., 2015). One such promising strategy is LSS, a methodology that blends Six Sigma's emphasis on data-driven process optimization with Lean's focus on waste elimination (Souza et al., 2021). Healthcare organizations like the PMC may be able to increase productivity, lessen traffic, and ultimately improve the standard of care given to patients by putting LSS ideas into practice.

2.3 Definitions and Tools for Lean and Six Sigma

This study uses a variety of methods and approaches to address the problems of PF and overcrowding in EDs. These instruments are essential for methodically locating and removing non-value-added processes, which improves PF and shortens wait times. The essential tools consist of:

- **VSM:** This method creates a graphic depiction of the patient journey from point of arrival to point of discharge. It plots important events such patient arrival, triage, initial evaluation, diagnosis, planning of care, and discharge. By giving a comprehensive picture of the existing process and highlighting possibilities for improvement, VSM assists in locating possible bottlenecks and waste (Rother & Shook, 2003).
- **Cause and Effect Diagram (Fishbone Diagram):** This is a technique for classifying and examining the underlying causes of delays and overcrowding. It facilitates the visual organization of the elements that contribute to a problem, which makes it simpler to pinpoint the root causes and create focused solutions (Ishikawa, 1986).
- **VOC and VOP:** These perspectives are crucial for understanding the needs and expectations of both staff and patients. VOC data helps in understanding the external customer's perspective, while VOP data helps in identifying the inefficiencies within the ED processes (Griffin & Hauser, 1993).

2.4 Lean Six Sigma: Transforming Emergency Department Operations for Improved Patient Care

2.4.1 Overview

EDs worldwide are under increasing pressure due to a growing patient volume and the constant need to deliver timely and effective care (Al Owad et al., 2013). Traditional healthcare processes can struggle under this strain, leading to inefficiencies and potentially compromising patient outcomes. LSS, a potent blend of approaches taken from the manufacturing industry, provides an appealing way to boost PF in EDs and optimize operations.

2.4.2 Lean Thinking: Eliminating Waste for Improved Throughput

The basis of LSS in the healthcare industry is lean thinking. It places a strong emphasis on locating and getting rid of waste—that is, actions that don't bring value—from ED operations (Al-Zuheri et al., 2021). This waste can include ineffective staff time utilization, or delays in patient handoffs. Lean thinking seeks to increase productivity and patient throughput by optimizing processes and concentrating on tasks that bring value (Souza et al., 2021). Research has indicated that the adoption of Lean concepts in emergency departments (EDs) can result in notable enhancements, such as a 50% decrease in patient waiting times and a 30% increase in treatment capacity (Souza et al., 2021).

2.4.3 Six Sigma: Data-Driven Approach to Quality Improvement

The other half of LSS, Six Sigma, approaches healthcare process improvement using a data-driven methodology (Cirrone et al., 2016). It makes use of statistical tools to measure issues, locate sources of variance in the provision of care, and locate the core reasons of inefficiency. Healthcare professionals can save waste and provide consistent, high-quality care by making evidence-based decisions based on their awareness of these differences. With patient satisfaction as the ultimate goal, Six Sigma also encourages a culture of continuous improvement (Al-Zuheri et al., 2021).

2.4.4 The Potential Benefits of LSS in Healthcare

Beyond streamlined PF and shorter wait times, LSS has other potential advantages in the healthcare industry. Research indicates that LSS can have a major influence on total healthcare costs by streamlining ED processes (Saghafian et al., 2015). Improving ED efficiency can benefit the overall healthcare system, since admitted patients from EDs account for a large portion of healthcare expenses.

2.4.5 A Case for LSS in Developing Countries

Overcrowding is a problem in emergency rooms everywhere, and developing nations like Palestine are not an exception (Amro et al., 2018). Longer patient wait times are a result of this overcrowding, which is a serious public health concern that may have a detrimental effect on the standard of care provided (Al-Zuheri et al., 2021). Research has indicated that individuals brought to the hospital may have greater death rates as a result of receiving subpar care in the emergency department (Al Owad et al., 2013).

2.4.6 The Promise of LSS for the PMC

In light of these difficulties, LSS presents a viable remedy. According to Al Owad et al. (2013), LSS blends the ideas of Lean manufacturing with Six Sigma's emphasis on minimizing variance and faults. According to Souza et al. (2021) this integrated strategy provides a methodical means of enhancing healthcare quality, efficiency, and ultimately patient happiness. The PMC can become a part of the worldwide trend towards better patient outcomes and healthcare delivery by putting LSS into practice. Potential advantages include significant cost reductions as well as better PF and shorter wait times—a critical component for healthcare systems in developing nations.

2.5 Operations Management Techniques and Patient Flow Improvement in ED

Serving the right patient in the right place at the right time, especially in the face of unforeseen circumstances, presents a special challenge for EDs (Al Owad et al., 2013). This frequently results in crowding, protracted wait times, and treatment delays, all of which have a detrimental effect on patient care and results (Souza et al., 2021).

To solve these challenges, healthcare practitioners have been using operations management strategies more and more in the last few decades. Inspired by lean manufacturing (LM) and the Toyota Production System (TPS), lean healthcare (LH) is a service strategy that provides a

strong framework for streamlining ED processes and improving PF (Tlapa et al., 2020; Womack et al., 1990).

Eliminating processes that don't improve patient care is at the heart of lean healthcare. This may entail lowering wait times, enhancing communication, and optimizing procedures. Lean concepts can improve the capacity and quality of ED services by emphasizing efficiency (Souza et al., 2021).

LSS is a potent instrument for putting lean healthcare into practice. This methodology finds and eliminates waste, delays, and defects by combining statistical analysis tools from Six Sigma with lean concepts (Cirrone et al., 2016). To continuously improve processes and guarantee quality, LSS makes use of the DMAIC cycle, which stands for Define, Measure, Analyze, Improve, and Control (Cirrone et al., 2016).

The necessity for increased ED efficiency is underscored by the growing expense of healthcare. As healthcare costs accounted for 17.6% of the world's GDP in 2010 (Saghafian et al., 2015), improving PF becomes an issue of both financial necessity and high-quality healthcare.

But unlike conventional for-profit companies, EDs are not able to simply turn away patients because of capacity issues. EDs are required to treat all patients who enter, regardless of insurance coverage or financial situation, under the Emergency Medical Treatment and Labor Act (EMTALA), which was passed in 1986 (Saghafian et al., 2015). This emphasizes how crucial it is to maximize PF while staying within the current parameters.

EDs can better satisfy patient requirements in an economical, effective, and efficient manner by implementing lean healthcare principles and tools like LSS. This guarantees that everyone continues to have access to high-quality emergency treatment while simultaneously improving the patient's experience.

2.6 Factors Affecting ED Patient Flow

In a thorough investigation carried out at Al-Aqsa Hospital in Gaza (Abu Olwan, 2021) examined a variety of factors that impact the flow of ED patients. The study found a number of important factors that affect how well patients move through the system. These factors were divided into two categories: staff characteristics (such as age, gender, specialization, and experience) and patient characteristics (such as age, gender, education level, and intensity of disease). It was discovered that these factors significantly impacted the patient care delivery process, output, and input. The study also emphasized how crucial it is to manage patient flow

and lessen overcrowding by implementing triage systems, maintaining staffing ratios, and having security personnel on duty. The study also emphasized how important facility capacity is in determining ED crowding, including bed occupancy and turnover interval. Chronic inpatients and non-urgent visits were found to be factors in overcrowding, indicating the need for improved management techniques to reroute patients to suitable care environments. The study confirmed (Abu Olwan's, 2021), in order to improve emergency treatment quality, lower medical expenses, and minimize patient harm, a more efficient patient flow method is essential.

Yoon et al. (2003) used time studies to look into the variables influencing the LOS in EDs. They carefully monitored the patients' progress, noting important milestones with dates. Researchers were able to identify bottlenecks affecting LOS by examining this data in conjunction with variables such as triage level and ordered investigations. Targeted changes were made possible by the time studies that exposed delays in triage, test results, or specialist consultations. Simplifying triage, improving test processing, and improving expert communication may all help cut down on wait times and lower overall LOS in the ED.

According to Alyasin and Douglas (2014), non-urgent patients are the cause of the overcrowding in Saudi Arabia's EDs. Many people rely on the ED for basic healthcare since they do not have a regular physician. In addition, the ED is more enticing than primary care physician appointments due to its 24/7 accessibility and same-day service. It's interesting to note that a sizable percentage of patients think their symptoms are more serious than doctors evaluate, which may indicate a lack of awareness regarding the ED's role.

Access block, a concern in Australian EDs where admitted patients wait more than eight hours for a bed, was examined by Richardson et al. (2009). According to their nationwide survey, wait times for both admission and medical consultations were increasing, and one-third of patients reported experiencing access block.
It's interesting to note that hospitals in New South Wales had a drop in access blocks, indicating the possibility of solutions. The study's overall findings emphasize how urgently Australian EDs must increase bed availability and efficiency. Additional investigation into the practices employed by hospitals in New South Wales may provide insightful information.

Pines et al.'s (2007) study examined the detrimental effects that overcrowded emergency rooms can have on patient treatment. Patients with community-acquired pneumonia, a dangerous lung infection, were the main focus of their attention. The main conclusion was that, within 4 hours of arrival, there was a substantial correlation between increasing ED crowding and either a delay in antibiotic treatment or none at all. This is concerning because treating pneumonia effectively requires the prompt use of medicines. The study emphasizes the necessity of reducing ED overcrowding in order to provide care that may be faster and more efficient.

2.7 Application of Manufacturing Principles in Healthcare:

Rutledge et al. (2010) looked into how a pediatric hospital dealing with more demand and workload may enhance core laboratory operations using the Toyota Production System (TPS). The laboratory aimed to improve turnaround time, quality, and decrease costs. They implemented TPS lean manufacturing principles to achieve these goals. The researchers believed this system would eliminate waste, improve workflow, and standardize processes. These principles included techniques like 5S (sort, straighten, shine, standardize, and sustain) and the creation of a work cell for random access analyzers. The results showed significant improvement in turnaround time for various tests, reduced variation in turnaround time, and increased efficiency. Staff eliminated the need for STAT testing (medical emergency test) because routine tests met the previously set STAT turnaround time goals. The authors recommend further research to explore the impact of these techniques on error reduction. Overall, this study suggests TPS can be a successful method for improving core laboratory operations.

Modeling approaches for ED flow optimization: Emergency departments (EDs) worldwide grapple with crowding issues that impact patient care. To address this, researchers have developed various modeling approaches. These models offer valuable tools to understand and potentially improve patient flow within the ED, ultimately aiming to reduce crowding and enhance patient care (Wiler et al., 2011).

Using the concepts of manufacturing to increase ED efficiency, Walley's (2003) study, examined the application of design ideas from manufacturing processes to the healthcare industry. It discovered inefficiencies in EDs, such as protracted wait times brought on by shoddy process design and improper capacity distribution. The solutions put forth by the researchers were

influenced by cellular manufacturing. In order to cut down on needless waiting and enable staff specialization, this method proposes segmenting patients according to their treatment needs and establishing specialized units for each segment. To enhance coordination throughout the healthcare system, the report also suggests decentralizing support functions and encouraging multi-agency collaboration. Overall, it indicates that ED efficiency and patient care can be greatly enhanced by implementing manufacturing principles.

2.8 Lean and Six Sigma Methodologies in Healthcare

Lean and Six Sigma for better healthcare delivery: According to a research conducted in NHS Scotland, these techniques have the potential to greatly enhance the provision of healthcare (Antony, Jiju, & Maneesh Kumar, 2012). Processes can be streamlined with Lean and Six Sigma to improve patient care quality and safety while cutting waste and waiting times. Benefits include reduced healthcare expenses, better equipment use, and more productivity result from this. Examples of effective implementation were found in the study, including decreasing medication mistakes and patient wait times. But in order for these approaches to succeed, the NHS requires a more accommodating atmosphere. The study emphasizes the significance of initiatives for cultural change, leadership commitment, and appropriate training programs. The NHS can fully realize the benefits of Lean and Six Sigma for a more effective and efficient healthcare system by tackling these issues.

Aligning Lean approaches with evidence-based healthcare: Waring & Bishop's (2010) examine how Lean approaches might change the way that healthcare is provided in an NHS hospital operating room in the United Kingdom. The connection of Lean's data-driven methodology with the growing application of evidence-based standards in healthcare has been noted as one possible advantage. Lean could improve the way these recommendations are implemented by drawing attention to the places where present procedures stray from accepted best practices. Lean data analysis, for instance, may highlight treatment route inefficiencies, triggering a review and possible alignment with the most recent evidence-based practices.

Combining Lean and Six Sigma to create a more effective strategy: By comparing the two, this study demonstrates how LSS, as developed by Edward D. Arnheiter and John Maleyeff in 2005, is a more effective approach. The merits and disadvantages of each methodology were determined by the writers through an analysis of both their personal experience and previous

research. They discovered that by combining Six Sigma's emphasis on defect minimization with Lean's emphasis on waste reduction, LSS solves these drawbacks.

2.9 Patient Flow Management in ED

Asplin et al. (2006) examined the difficulties EDs have as a result of patient demand fluctuations and overcrowding. In order to enhance patient care, the researchers sought to pinpoint areas of overlap between daily surge capacity and PF study and to suggest new models. They admitted that most of the research that had already been done had concentrated on large-scale catastrophes, ignoring the daily challenges that EDs face in dealing with sudden spikes in patient volume.

Two models were suggested by the study to close this gap. The first model took into account variables like predictable arrival patterns and unpredictable surges and mathematically explained the dynamic variations in the ED census. Using this model, researchers were able to evaluate how well an ED recovers from surges and how well its design and operations work. The second model examined the connection between the LOS in the ED and the caliber of care received. In order to take system-level influences on patient flow into account, it stressed the significance of examining median LOS for patient cohorts within particular time intervals as opposed to individual patient LOS. According to this approach, absolute LOS may not be the most important measure of healthcare quality; rather, departures from predicted LOS may be. The study's overall conclusions emphasize how crucial effective ED planning and management are to controlling daily spikes and enhancing patient care.

2.10 Lean and Six Sigma Implementation

NHS: Lean and Six Sigma implementation: This study looked at how the NHS in Scotland is currently using these approaches. The investigators sought to ascertain the degree of utilization, perceived advantages, and obstacles faced (Antony, Jiju, and Maneesh Kumar, 2012). They believed that Lean and Six Sigma could enhance the NHS's financial performance, patient care, and efficiency. Semi-structured interviews were paired with a survey in this study. A variety of NHS employees were the target audience for the study, including nurses, clinical governance leaders, medical directors, and consultants participated in the interviews. The findings demonstrated a lack of broad acceptance of these approaches and a gulf between personnel and

leadership. Some hospitals claimed to have used Lean for projects like cutting waste and wait times, but others lacked adequate training or strategic coherence.

Six Sigma and UK SMEs: According to the study, a large number of SMEs either do not know about Six Sigma or do not have the funding to put it into practice (Antony, Jiju, Maneesh Kumar, and Madu, 2005). Lean Sigma was an unpopular blend of lean manufacturing and Six Sigma. However, it was found that the key to a successful Six Sigma deployment in SMEs was strong management engagement, customer focus, and alignment with corporate strategy. This is the first study to look at Six Sigma implementation in UK SMEs, and it offers practitioners and researchers useful information.

2.11 Case Studies on Improving ED Efficiency

Berwald et al. (2010) looked at the Six Sigma methodology, a data-driven approach to process improvement that is frequently employed in industries, to address lengthy wait times in EDs. In order to enhance PF, this study concentrated on ED procedure simplification. Targeted interventions such as staff training and updated guidelines were put into place once patient paths were mapped out and bottlenecks were identified. With these modifications, wait times were significantly reduced, indicating the potential use of Six Sigma as an effective instrument for ED efficiency.

The efficiency of lean management in enhancing PF in the ED was investigated by Chan et al. (2014). Concerns about long wait times, access blocks, and overcrowding in EDs were addressed. These problems have an adverse effect not just on patients but also on hospital employees and overall productivity.

The researchers used lean management principles to build a multifaceted approach. This involved redesigning the process and visualizing it with a logistic flow chart to find inefficiencies and bottlenecks. VSM was utilized to examine the complete patient journey and pinpoint areas in need of enhancement. Among the specific treatments were the implementation of a new high-sensitivity blood test, improved communication with medical departments, and a triage mechanism to prioritize admissions. Subsequently, the investigators assessed the influence of these interventions on multiple time intervals, encompassing the waiting periods for triage, consultation, blood test turnaround, admission, and overall length of stay in the ED. The

outcomes were encouraging. Wait times for consultations and triage were significantly reduced as a result of lean practices.

2.12 The Application of LSS in Healthcare in Palestine

Patient satisfaction and service quality have increased significantly in Palestine as a result of the adoption of LSS principles in the healthcare industry. The influence of LSS on physiotherapy services at UNRWA healthcare centers in the Gaza Strip was investigated in a noteworthy study by Sharikh et al., (2019), which found that 81% of LSS practices were adopted and 89% of patients were satisfied. This study highlights how LSS can improve the quality of healthcare services and recommends that LSS concepts be further integrated, backed by staff incentive and training programs, to ensure successful implementation.

The study conducted at Al-Aqsa Hospital in Gaza by Abu Olwan, (2021) highlights the application of Lean manufacturing techniques to improve patient flow within the Emergency Department (ED). This approach led to reduced waiting times and enhanced patient satisfaction. The study emphasizes the significance of Lean and Six Sigma methodologies in boosting the efficiency and quality of healthcare services, particularly in the ED setting, by focusing on process improvement and waste elimination. It recommends utilizing the DMAIC (Define-Measure-Analyze-Improve-Control) methodology as part of Lean Six Sigma to improve the quality of waiting times in health services. This methodology assists medical professionals in converting practical problems into statistical data, thereby addressing process weaknesses effectively.

Chapter Three: Methodology

3.1 Overview

In order to explore and address the issues of PF and overcrowding in the ED of the PMC in Ramallah, a thorough strategy and methods are outlined in the research methodology chapter. This chapter goes over the research design, data collection strategies, analysis methods, and LSS principles applied to improve ED PF and quality of care.

3.2 Research Design

The problems with PF and overcrowding in the ED of the PMC in Ramallah was be examined in this study using a mixed-methods approach. In order to obtain a thorough grasp of the variables influencing patient experiences and the caliber of care in the ED, this strategy integrates quantitative and qualitative data gathering techniques (Sekaran & Bougie, 2016).

3.3 Population and Sample

I. Target Population

Every patient who presented to the PMC's ED in Ramallah during the study period of October 5, 2024 to December 8, 2024, and was triaged as Canadian Triage and Acuity Scale (CTAS) Levels 3 or 4, was included in the study. It is important to note that the population may experience seasonal variations in disease patterns and potential surges in emergency cases.

The CTAS classifies patients into five urgency levels: Resuscitation (Red), Emergent (Orange), Urgent (Yellow), Less Urgent (Green), and Non-Urgent (Blue). The study focused on Levels 3 and 4, which constitute a substantial portion of the ED caseload and are more likely to encounter delays in treatment (Gravel, 2014).

II. Sample

Obtaining data from every patient who visits the ED wasn’t possible due to practical and resource limitations. Consequently, a sample that is representative of the target population was selected. The PMC's ED sees about 415 cases a day, according to the General Directorate of Performance Control (2020).

The sampling strategy employed the following considerations:

Inclusion Criteria:

- Patients visiting the ED at the PMC in Ramallah during the study period.
- Patients who are triaged into Levels 3 and 4 based on the CTAS triage system during the study period.
- Patients with the capacity to understand and respond to the questionnaire in Arabic (or have a designated caregiver who can provide responses on their behalf).
- Patients who are able to provide informed consent to participate in the study.

Exclusion Criteria:

- Patients who are triaged into Levels 1, 2, or 5 based on the CTAS triage system.
- Patients who are under 18 years of age.
- Patients who are critically ill or incapacitated, rendering them unable to participate in the study.
- Patients who are not fluent enough in Arabic to understand and respond to the questionnaires.

3.4 Data Collection

The study involved collecting data from three primary sources:

3.4.1 Voice of the External Customer (Patients):

A structured questionnaire was administered to patients attending the ED as shown in Appendix B. To gather patient perspectives on five key areas: demographic characteristics, reasons for attending the ED, their understanding of quality in ED services, their experience with the time taken for ED processes, and their overall satisfaction with healthcare services.

The required sample size is calculated using the formula of Yamani (1967):

$$\mathbf{n}=\frac{\boldsymbol{N}}{\mathbf{1}+\boldsymbol{N}*(\boldsymbol{e})^{\mathbf{2}}}$$

where:

n: Represents the required sample size.

N: Represents the total population size.

e: Represents the margin of error (expressed as a decimal, for example, 0.05 for a 5% margin of error).

This formula assumes a 95% confidence level and a population proportion (p) of 0.5.

Let's anticipate a similar number of patients triaged into Levels 3 and 4. With a desired confidence level of 95% and a medium effect size, a sample size calculator might recommend approximately 100 participants per group (Level 3 & Level 4) for a total sample size of 200.

- **Pilot Study**

- A descriptive cross-sectional study was conducted to evaluate patient flow and overcrowding at the PMC in Ramallah. The study focused on patients in Levels 3 and 4. A convenience sample of 50 participants was selected for the pilot study, which aimed to refine the research instruments and methodology.
- The primary objective of the pilot study was to assess the validity and reliability of the questionnaire. Secondary objectives included identifying issues with the questionnaire's format, wording, and overall structure. The pilot study was conducted to prepare for the main research project, refining the research design and methodology.
- The questionnaire was evaluated the quality of ED services based on six dimensions: responsiveness, tangibles, assurance, empathy, professionalism, and reliability. These dimensions were adapted to the Palestinian healthcare system and the PMC's ED context. That based on primary sources by Al Owad et al. (2013), which applied Lean Six Sigma principles to improve patient flow in hospital EDs.
- Patient satisfaction with ED services was measured using an 18-item scale, ranging from "Very Unsatisfied" to "Very Satisfied." The questionnaire was reviewed by experts, including Dr. Hamdallah Khaled from Ibn Sina University, Dr. Rebhi Bsharat and Dr. Adam Marawaa from Modern University College, Dr. Ahmad Hanani from Alnajah University, and Dr. Mustafa Shuli from Ibn Sina University, to ensure content validity.
- The study utilized various instruments to measure patient satisfaction and experiences in the ED. The validity and reliability of these instruments were rigorously assessed. The EMPATH Study by Ragin et al. (2005) provided insights into why patients use ED services. Additionally, the study referenced the Emergency Department (ED) CAHPS 1.0 2-Column Survey from the Centers for Medicare & Medicaid Services (CMS) and the A&E 2012 Questionnaire from the National Health Service Surveys (NHSS) to develop the survey tool.

- **Ethical Considerations**

  Ethical approval was obtained, and informed consent was secured from all participants. Data collection was conducted through a self-administered questionnaire designed to be comprehensive and reflective of the patient experience.

- **Validity and Reliability of Instruments**

- Five reviews (see appendix B) by experts were used to qualitatively evaluate the content validity. Testing whether the instrument accurately measures the theoretical construct it is designed to measure is known as construct validity. This is frequently required for a number of the statistical methods that SPSS offers. An exploratory factor analysis (EFA) was performed to determine if the test load items corresponded to the anticipated number of components.
- The internal consistency of the items meant to measure the same construct was examined using Cronbach's Alpha. Evaluating the instrument's correlation with a pertinent criteria measure is part of criterion validity. Therefore, correlation analysis was performed to examine the link between the criterion measure and the instrument scores.
- **Results**

  Factor analysis was performed with (the Eigen value = 1) to assess the strength of the factors. A rotated component matrix from a principal component analysis (PCA) using Varimax rotation is displayed in (Table 3.1). It was applied to evaluate the validity of a questionnaire concerning satisfaction with the ED services. The Principal Component Analysis of the satisfaction scale identified seven distinct components representing various aspects of the ED experience: Medical Services, Care of ED Staff, Arrival Triage, Facility Environment, Patient Care, Treatment Education, and Overall Experience. Each component highlighted specific areas of patient satisfaction or dissatisfaction, with high factor loadings indicating strong associations. Values nearer ±1 suggest a stronger correlation. For more details see (Table 3.1).

Table 3.1: Rotated Component Matrix

Item	Components of satisfaction scale						
	Medical services	Care of ED staff	Arrival Triage	Facility Environment	Patient Care	Treatment Education	Overall experience
The medical devices some times did not function.	0.996						
The bed capacity at emergency department is not enough.	0.994						
Some medical examination were not available in the ED.	0.984						
The nurse did not take enough time for primary examination.		0.78					
The doctor did not give comprehensive consultation and diagnosis		0.8					
Sometime necessary staffs were not available.		0.72					
How satisfied were you with the assistance provided by the registration staff?			0.6				
How satisfied were you with the priority given to emergency situations based on the actual need?			0.8				
How satisfied were you with the speed and efficiency of the service when you were received in the emergency department?			0.71				
Facility and Environment: How easy was it to find your way inside the emergency department?				0.74			
Facility and Environment: How would you rate the comfort and cleanliness of the waiting area?				0.74			
Patient Care: How satisfied were you with how the staff treated you, considering their attention to you and how much they made you feel respected and valued?					0.853		
Patient Care: How well did the medical staff listen to your complaints and questions?					0.853		
Treatment and Education: How satisfied were you with the explanations provided about medical tests and procedures?						0.907	
Treatment and Education: Were medical terms used by the staff explained in a clear and understandable way?						0.897	
Treatment and Education: How clearly were post-discharge follow-up and home care instructions explained to you?						0.732	
Overall Experience: Considering your experience, how likely are you to return to this department for emergency medical care in the future?							0.872
Overall Experience: Based on your experience, how likely are you to recommend this emergency department to friends and family in need of medical care?							0.872
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.							

- **Concept of quality in ED services**

  (Table 3.2) shows the correlation of each items of quality concepts. 11 items had a positive correlation with sum score of quality concepts with p-values less than 0.05.

Table 3.2: Items correlation for Concept of quality in E D services

Quality Concept	Correlation	
Accurate diagnosis and proper treatment.	R	0.540
	P-value	0.000
Respect for Patients.	R	0.652
	P-value	0.000
The optimal utilization of available resources.	R	0.689
	P-value	0.000
Minimizing the proportion of diseases, mortality and disability within the society.	R	0.567
	P-value	0.000
Serve the maximum number of patients possible.	R	0.580
	P-value	0.000
Expertise and efficiency of Emergency Department staff.	R	0.564
	P-value	0.000
Use of modern technology in providing health services in Emergency Department.	R	0.641
	P-value	0.000
Availability of adequate test facilities	R	0.502
	P-value	0.000
Short waiting times throughout the process of treatment in Emergency Department.	R	0.304
	P-value	0.032
Minimize unnecessary tests and diagnosis.	R	0.537
	P-value	0.000
Errors free in treatment and diagnosis.	R	0.655
	P-value	0.000

- **Reliability Statistics**

  As shown in (Table 3.3), both instruments was reliable evidenced by Cronbach's Alpha were more than 0.7 (Taber, 2018).

Table 3.3: Reliability Statistics

Instrument	Cronbach's Alpha	N of Items
Concept of quality in Emergency Department services	0.784	11
Satisfaction with ED services	0.70	18

3.4.2 Voice of the Internal Customer (Staff)

To complement the patient perspective, a separate interview was administered to ED staff, including physicians, nurses, and others (who related to ED experience).

According to the General Directorate of Performance Control (2020), the numbers of physicians and nurses in the ED in PMC in Ramallah are 28 and 29, respectively.

These interviews explored, as shown in Appendix C:

- Staff experience and satisfaction with resources and facilities
- Staff perceptions of the factors contributing to long wait times and overcrowding
- Challenges faced by staff in providing optimal care due to overcrowding
- Suggestions for improvement in PF and staff well-being

3.4.3 Voice of the Process (Patient Flow Observation)

To gain insights into patient flow within the ED, a systematic random sampling approach was used to observe patient journeys from arrival to discharge (Cochran,1977).

A representative sample of days and shifts was selected across a two-day period. Observations were conducted in key areas of the ED: reception, triage, and discharge over a 24-hour period, were closely monitored to identify potential bottlenecks and areas for process improvement. A standardized data collection sheet was used to record timestamps for each patient at these critical stages, as shown in Appendix D and Appendix E:

a) Time for Reception
b) Time for Triage
c) Time Seen by ED Physician
d) Discharge Time

3.5 Data Analysis Techniques

A multifaceted approach to analyze data that is collected from various sources, including patient questionnaires, staff interviews, and PF observations. This combined quantitative and qualitative analysis allows for a comprehensive understanding of the VOC and VOP in the ED.

Quantitative Analysis:

1. **Descriptive Statistics**: Descriptive statistics like frequency analysis, measures of central tendency (mean, median), and dispersion (standard deviation, range) were used to summarize demographic data (patient age, gender, education) and staff satisfaction ratings with resources in the ED.

2. **Inferential Statistics**:

- Factor Analysis: Factor analysis was used to identify underlying factors or dimensions within specific sections of the patient questionnaire (reasons for attending the ED, concept of quality in ED services).

- **ANOVA (Analysis of Variance):** ANOVA was used to examine if there are significant differences in VOC scores (concept of quality, satisfaction and waiting time) based on demographic variables (e.g., age, gender).

- **Chi-square analysis**: Used to determine if there is a significant association between two categorical variables for looking at the relationship between participant characteristics (gender, education, age, residency, and number of visits) and two categorical variables:
    - Importance of reasons related to symptoms (low, moderate, high)
    - Importance of reasons related to services (low, moderate, high)

- **Correlation Analysis**: Correlation analysis was used to identify potential relationships between different variables within the questionnaire sections. It can be used to explore associations between reasons for attending the ED, concept of quality in ED services, and satisfaction with healthcare services.

Qualitative Analysis:

Open ended responses in staff interviews (Sections 3 & 4) were analyzed thematically to identify recurring issues, staff perceptions on causes of overcrowding, and potential solutions. Techniques like content analysis and development of a cause-and-effect diagram (fishbone diagram) were used to visually represent the relationships between factors contributing to overcrowding and their impact on patient flow and service quality.

3.6 Statistical Analysis Software

Quantitative Analysis: Statistical software like SPSS (Statistical Package for the Social Sciences) was used for descriptive statistics, factor analysis, ANOVA, Chi-square, and correlation analysis. Spreadsheets: Spreadsheets Microsoft Excel used for data entry, cleaning, and basic descriptive analysis of patient flow data.

3.7 Application of Lean Six Sigma

The application of the DMAIC (Define, Measure, Analyze, Improve, Control) methodology to collect the voice of staff in the ED and identify the root causes of overcrowding presents an opportunity to provide improvement suggestions. This entails setting specific goals to comprehend employee viewpoints and concentrate on areas that need improvement, gauging employee experiences and perceptions to obtain insightful knowledge, examining data to spot trends and potential improvement areas, and proposing efforts for change.

3.8 Ethical Considerations

It is crucial to emphasize a few ethical issues. The study places a high priority on informed consent, making sure that patients and ED personnel alike are fully informed about the goals, methods, potential hazards, and benefits of the study. Additionally, all acquired data is securely saved and only authorized study workers have access to it, ensuring that confidentiality and anonymity are properly preserved to protect the privacy of the participants. In addition, the study is carried out with integrity, honesty, and transparency while abiding by all applicable institutional rules, ethical guidelines, and legal obligations pertaining to research involving human subjects. Finally, in order to guarantee that the study complies with ethical guidelines and protects the participants' rights and welfare, Institutional Review Board (IRB) permission is acquired.

Chapter Four: Data Analysis and Discussion

4.1 Overview

This chapter is an essential part of the in-depth analysis of the operational difficulties facing the ED. It combines the voices of the internal customer (staff) and the external customer (patients) to determine the main causes of lengthy wait times and crowding. In order to inform strategic improvements, the chapter methodically breaks down the problems and provides a data-driven discussion using tools like the Current Process Map, Cause and Effect Diagram, and VSM.

4.2 Voice of the External Customer (Patients)

This chapter commences by articulating the expectations and dissatisfactions of patients, the external customers of the ED, which aligns with Hypothesis 2 that underscores the crucial role of the external customer (patients) in understanding and satisfying patient needs. The significance of this lies in the fact that the VOC is one of the most important techniques related to the Integrated LSS Model (Define/Specify/Identify the value) (Tenera & Pinto, 2014). Quantitative data highlights patients' desire for timely care, clean facilities, respectful treatment, and clear communication, affirming the importance of these factors in achieving patient satisfaction and overall quality of care delivery.

4.2.1 Patient Experience Evaluation survey in the ED at PMC

Demographic data (n=200)

The study involved two hundred participants. About 52.5% of these were females, and 47.5% were males. About 3.0% of the population was under 18, 13.0% was between the ages of 18 and 30, 25.5% was between the ages of 31 and 50, and 58.5% was over 50. Of the participants, 6.5% lived in camps, 25.5% in cities, and the majority (68.0%) in villages. In terms of education, 23.0% lacked a formal education, 32.0% had completed elementary school, 28.0% had completed secondary school, 3.0% had a diploma, 12.5% had completed a bachelor's degree, and 1.5% had furthered their education. Among those who visited the ED in the previous 12 months, 32.5% were first-time visitors, 29.0% went twice, 13.0% went four times, and 24.5% went six times or more. Of those who visited, 1.0% were unable to recollect how many times they had gone. See (Table 4.1) for more details.

Table 4.1: Demographic data

Variable		F	%
Gender	Male	95	47.5
	Female	105	52.5
Age	Below 18 years	6	3.0
	From18 - 30 years	26	13.0
	From 31 - 50 years	51	25.5
	Above 50 years	117	58.5
Residency place	City	51	25.5
	Village	136	68.0
	Camp	13	6.5
Education level	No Formal Education	46	23.0
	Primary	64	32.0
	Secondary	56	28.0
	Diploma	6	3.0
	Bachelor	25	12.5
	Higher Education	3	1.5
How many times (including this one) have you visited an ED department as a patient in the last 12 months?	This was the only time	65	32.5
	2 – 3 times	58	29.0
	4 – 5 times	26	13.0
	6 or more times	49	24.5
	Don't know / can't remember	2	1.0

The importance pathological reasons for attending ED

(Figure 4.1) presents a bar chart illustrating the reasons why individuals sought care at the ED. The data is categorized into three levels of severity: low, moderate, and high, based on a scoring system ranging from 1 to 5. The chart compares the frequency of reasons related to symptoms and those related to services.

The ranges for Low, Moderate, and High importance were determined as follows:

- Low (L): 1-2.33
- Moderate (M): 2.34-3.67
- High (H): 3.68-5

These ranges were set to help interpret the data more easily. For instance, a mean score of 3.68 or higher indicates that the majority of respondents rated the reason as 4 or 5 on the Likert scale, signifying high importance. Conversely, a mean score of 2.33 or lower suggests that most respondents rated the reason as 1 or 2, indicating low importance. The moderate range captures the middle ground where the reasons are considered somewhat important but not critically so.

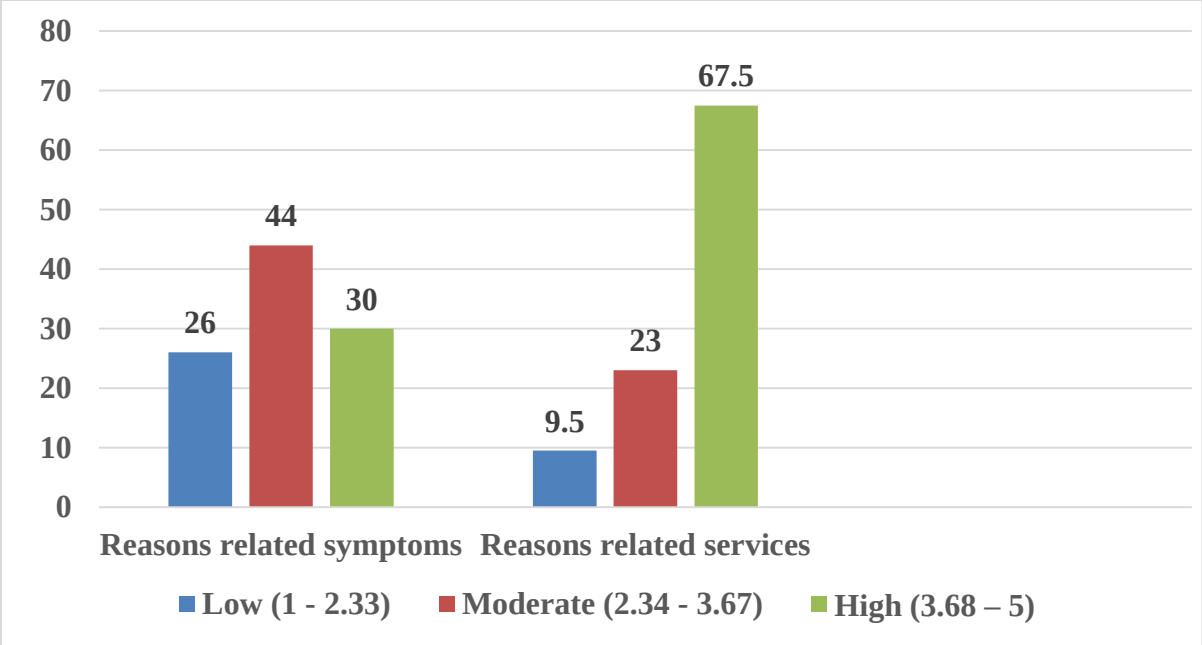

Figure 4.1: Reasons for attending ED

As shown in (Table 4.2), reasons for attending ED were categorized into reasons related symptoms and reasons related to services. Participants claimed that reasons related services were more important than symptoms. Accident-related injury (4.14 ± 1.60), short of breathing (4.14 ± 1.60) and fracture or dislocation (3.98 ± 1.57) were the highest important reasons for attending ED. Dental problems (1.50 ± 1.21), lacerations, or cuts that might require stitches (2.13 ± 1.61) and sore throats (2.14 ± 1.63). Other reasons were categorized as a moderate importance. Regarding to reasons related to services, “Cannot afford other places” had the highest mean scores (4.46 ± 1.06) followed by “Primary medical canter transferred me to here” (4.34 ± 1.23), “The primary medical center was closed” (4.03 ± 1.54), “My health problem was too serious or complex to see a primary medical center” (4.02 ± 1.45) and then “Better medical treatment here” (3.86 ± 1.49).

Table (4.2): Reasons for attending ED

Variables		M	SD	Scoring
Reasons related symptoms	Minor injury: A simple injury, such as "stubbing your toe"	2.40	1.79	M
	Laceration: A cut or tear that may require stitches	2.13	1.61	L
	Musculoskeletal pain	2.68	1.75	M
	Accident-related injury	4.14	1.60	H
	General symptoms: Feeling unwell or fatigued	3.62	1.67	M
	Gastrointestinal symptoms	3.33	1.71	M
	Fracture or dislocation	3.98	1.57	H
	Sprain or strain	2.93	1.76	M
	Shortness of breath	4.14	1.60	H
	Sore throat	2.14	1.63	L
	Toothache or dental problem	1.50	1.21	L
	Urinary tract infection (UTI)	2.91	1.72	M
	Women's health or obstetric issue	3.49	1.84	M
Reasons related services	Emergency Department is closest/easiest place	3.29	1.36	M
	The primary medical center was closed	4.03	1.54	H
	Better medical treatment here	3.86	1.49	H
	Primary medical canter transferred me to here	4.34	1.23	H
	My health problem was too serious or complex to see a primary medical center	4.02	1.45	H
	I wanted a second opinion	2.84	1.83	M
	Cannot afford other places	4.46	1.06	H

M = Mean, SD= Standard Deviation, L= Low, M= Moderate, H= High

4.2.2 Concept of quality in ED services

The overall quality score mean was (2.31 ± 0.74), which suggests disagreement with ED care. High levels of disagreement were found with minimizing diseases, mortality, and disability (71.5% strongly disagree) and servicing the greatest number of patients possible (82.5% strongly

disagree). Aspects such as respect for patients (53%), short wait times (51.5%), accurate diagnosis and treatment (51%), utilization of modern technology (47%), and reduction of pointless tests (45.5 %%) were also challenged. With respect to the error-free treatment, 37.5% of respondents disagreed, while 46% agreed. See (Table 4.3).

Table 4.3: Concept of quality in ED services

Variable	Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree			
	F	%	F	%	F	%	F	%	F	%	**M**	**SD**
Accurate diagnosis and proper treatment	78	39	24	12	19	9.5	73	36.5	6	3	**2.52**	**1.40**
Respect for Patients	78	39	28	14	21	10.5	57	28.5	16	8	**2.52**	**1.45**
The optimal utilization of available resources	91	45.5	12	6	14	7	76	38	7	3.5	**2.48**	**1.46**
Minimizing the proportion of diseases, mortality and disability within the society	143	71.5	-	-	16	8	34	17	7	3.5	**1.81**	**1.33**
Serve the maximum number of patients possible.	165	82.5	-	-	8	4	23	11.5	4	2	**1.51**	**1.13**
Expertise and efficiency of	120	60	6	3	18	9	54	27	2	1	**2.06**	**1.37**

ED staff												
Use of modern technology in providing health services in ED	83	41.5	11	5.5	32	16	66	33	8	4	**2.52**	**1.41**
Availability of adequate test facilities	142	71	6	3	15	7.5	35	17.5	2	1	**1.74**	**1.23**
Short waiting times throughout the process of treatment in ED	32	16	71	35.5	29	14.5	27	13.5	41	20.5	**2.87**	**1.39**
Minimize unnecessary tests and diagnosis	81	40.5	10	5	36	18	65	32.5	8	4	**2.55**	**1.40**
Errors free in treatment and diagnosis	71	35.5	4	2	33	16.5	88	44	4	2	**2.75**	**1.38**
Mean of total quality											**2.31**	**0.74**

4.2.3 Waiting Time in ED

As shown in (Table 4.4), the overall mean of waiting time in ED was (3.46 ± 0.79), which suggests agreement with long time of ED services. A 44.5 % of participants were agree with long waiting time at reception department. A 50 % of participants were agree with long time before examination by nurse. A 52 % of participants were agree with long time before diagnosing by doctor. A 62.5 % of participants were agree with long time during laboratory procedures. A 62 % of participants were agree with long time during radiology procedures.

Table 4.4: Waiting time in ED

Waiting time	Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree			
	F	%	F	%	F	%	F	%	F	%	**M**	**SD**
At reception was long	43	21.5	40	20	20	10	29	14.5	68	34	**3.20**	**1.60**
Before examination by nurse was long	42	21	27	13.5	31	15.5	26	13	74	37	**3.32**	**1.58**
Before diagnosing by doctor was long	38	19	26	13	32	16	44	22	60	30	**3.31**	**1.49**
During laboratory procedures was long	22	11	32	16	21	10.5	34	17	91	45.5	**3.70**	**1.45**
During radiology procedures was long	27	13.5	25	12.5	24	12	13	6.5	111	55.5	**3.78**	**1.53**
Mean of total waiting time											**3.46**	**0.79**

4.2.4 Satisfaction with Healthcare Services in ED

The overall satisfaction with medical services (M ± SD = 2.31 ± 0.82) was relatively low. About 56 % of participants were dissatisfied with the functioning of medical devices, 80% with bed capacity at ED and 48 % with availability of some medical examinations. The satisfaction with care of ED staff's (M ± SD = 2.34 ± 0.85) was also relatively low. About 71 % of participants were dissatisfied with the time of nursing primary examination, 44.5 % with comprehensive consultation and diagnosis by doctor and 52% with availability of necessary staffs. Arrival and

triage was another healthcare services in ED that had low mean score of satisfaction (2.62 ± 0.86). Participants were not satisfied with services provided by registration staff (50.5%), emergency situations were not Prioritized (44%) and services were not quick and efficient (55%). The facility and environment mean score was found to be low, at 2.22 ± 0.89. Because a significant percentage of respondents (69.5%) expressed extreme dissatisfaction with the ED's accessibility. Although respondents' satisfaction with the waiting area's comfort and cleanliness was more fairly distributed, the majority of them remained extremely dissatisfied or unsatisfied. The mean score for satisfaction with patient care services was 2.30 ± 1.28. There was a great deal of dissatisfaction with respect and consideration as well as listening to complaints and questions. Regarding care and instruction (2.49 ± 1.16), there was a great deal of discontent with the explanations of medical tests and procedures, medical terminology, post-discharge follow-up, and home care guidelines. Participants expressed dissatisfaction with the whole experience as well. Many of the respondents expressed extreme dissatisfaction with their whole experience, including their propensity to return to the ED and refer others to it. For more details see (Table 4.5).

Table 4.5: Satisfaction with healthcare services in ED

Variables		Very Unsatisfied		Unsatisfied		Neutral		Satisfied		Very Satisfied	
		F	%	F	%	F	%	F	%	F	%
Medical services	Functioning of medical devices	80	40	32	16	20	10	49	24.5	19	9.5
M ± SD	Bed capacity at ED	154	77	6	3	5	2.5	26	13	9	4.5
2.31 ± 0.82	Availability of some medical examination	67	33.5	29	14.5	24	12	39	19.5	41	20.5
Care of ED staff's	Time of nursing primary examination	127	63.5	15	7.5	30	15.0	18	9	10	5
M ± SD	Comprehensive consultation and diagnosis by	74	37	35	17.5	34	17	32	16	25	12.5
2.34 ±											

0.85	doctor										
	Availability of necessary staffs	78	39	26	13	14	7	49	24.5	33	16.5
Arrival and Triage M ± SD 2.62 ± 0.86	Registration staff	73	36.5	48	24	16	8	49	24.5	14	7
	Priority given to emergency situations	46	23	42	21	31	15.5	45	22.5	36	18
	Speed and efficiency of the service	59	29.5	51	25.5	36	18	33	16.5	21	10.5
Facility & Environment M ± SD 2.22 ± 0.89	Easy way inside ED	139	69.5	10	5	17	8.5	17	8.5	17	8.5
	Comfort and cleanliness of the waiting area	48	24	49	24.5	42	21	51	25.5	10	5
Patient Care M ± SD 2.30 ± 1.28	Attention and respect	99	49.5	17	8.5	16	8	52	26.0	16	8
	Listening to complaints and questions	113	56.5	11	5.5	10	5	45	22.5	21	10.5
Treatment and Education M ± SD 2.49 ± 1.16	Explanations about medical tests and procedures	84	42	11	5.5	15	7.5	71	35.5	19	9.5
	Medical terms used by the staff explained in a clear and	88	44	16	8	25	12.5	63	31.5	8	4

	understandable										
	Post-discharge follow-up and home care instructions	81	40.5	47	23.5	12	6	36	18	24	12
Overall Experience	Returning to this department for emergency medical care in the future	100	50	9	4.5	15	7.5	59	29.5	17	8.5
M ± SD											
2.46 ± 1.35	Recommend this ED to friends and family	86	43	12	6	35	17.5	44	22	23	11.5
Mean of total satisfaction = 2.39 ± 0.603											

4.2.5 Relationship Between Concept of Quality and Satisfaction with Healthcare Services in ED

The overall quality score means as shown previously in (Table 4.3) suggested disagreement with ED care. Satisfaction with healthcare services in ED also was low as shown in (Table 4.4). (Table 4.6) shows the relationship between concept of quality and satisfaction with healthcare services in ED across various domains. There was a weak positive correlation between the mean quality and satisfaction with medical services, care of ED staff, patient care, treatment and education and overall experience. The correlation was statistically significant (p = 0.029, 0.001, 0.000, 0.000, 0.000 respectively), suggesting that lower quality care was associated with lower satisfaction in those domains. Additionally there was a positive correlation between the mean quality and total satisfaction (r=0.464, p= 0.000). No meaningful correlations of quality across arrival triage satisfaction and facility environment satisfaction. The satisfaction with medical treatments and waiting times had a modest negative connection that was not statistically significant. A statistically significant (P=0.000) somewhat unfavorable relationship was seen between waiting time and care of ED staff satisfaction. This suggests that waiting durations increased dissatisfaction. Although there was a slight positive correlation between arrival triage

satisfaction and waiting time, it was not statistically significant. Waiting time and facility environment satisfaction showed a statistically significant (P=0.000) somewhat unfavorable relationship. Furthermore, there was a statistically significant moderately negative association (P= 0.002) between waiting time and patient care satisfaction and a moderately negative correlation (P= 0.000) between waiting time and treatment education satisfaction. There was a statistically significant (P=0.000) substantial negative association found between waiting time and overall experience satisfaction. In the same way, waiting time and overall satisfaction showed a significant negative relationship (P= 0.000). Lastly, there was a statistically significant and severe negative association between the mean quality of services and waiting times. In summary, the data shows that longer waiting times in the ED were generally associated with lower satisfaction across multiple dimensions, with several of these correlations being statistically significant. The strongest negative correlations were seen with overall experience satisfaction and total satisfaction.

Table 4.6: Relationship between concept of quality and Satisfaction with healthcare services in ED

Mean of quality and satisfaction		Pearson Correlation	P
Mean of quality	Medical services satisfaction	0.155	0.029
	Care of ED staff satisfaction	0.234	0.001
	Arrival Triage Satisfaction	0.083	0.242
	Facility Environment Satisfaction	-0.033	0.643
	Patient Care Satisfaction	0.349	0.000
	Treatment Education Satisfaction	0.464	0.000
	Overall experience Satisfaction	0.448	0.000
	Total satisfaction	**0.464**	**0.000**
Waiting time	Medical services satisfaction	-0.116	0.101
	Care of ED staff satisfaction	-0.246	0.000
	Arrival Triage Satisfaction	0.104	0.143
	Facility Environment Satisfaction	-0.304	0.000
	Patient Care Satisfaction	-0.215	0.002
	Treatment Education Satisfaction	-0.267	0.000
	Overall experience Satisfaction	-0.381	0.000
	Total satisfaction	**-0.376**	**0.000**
Mean of quality	**Waiting time**	**-0.327**	**0.000**

4.2.6 Feedback of Participants about Issues for Improvement

(Table 4.7) provides actionable insights for hospital administration to enhance patient satisfaction and care. Respondents consistently highlighted the need for improved cleanliness, particularly in public areas, cited by 30% of participants. Staffing shortages were another significant concern, with 20-25% of respondents advocating for increased medical and support personnel. Facility expansion, including additional beds and waiting areas, and upgrades to hospital systems like Avicina were also identified as crucial areas for improvement.

Table 4.7: Feedback of participants about Issues for improvement

Issue	F	%
Attention to cleanliness	6	30%
Attention to public facilities and their cleanliness	5	25%
Increase and organize staff	4	20%
Expansion of beds, improvement of health facilities, and increasing waiting chairs	3	15%
Increase the number of nurses	3	15%
Increase employees	3	15%
Better attention to patients	3	15%
Increase medical staff in emergencies	3	15%
Equipment maintenance	3	15%
Expand emergency, increase beds, employees, and cleanliness	3	15%
Reduce overcrowding	2	10%
Increase staff, especially in the caravan	2	10%
Expansion of rooms and increase seats	2	10%
Problem with the system (Avicina)	2	10%
Commitment in emergencies and quick response	2	10%
Increase waiting chairs for patients and companions, and wheelchairs	2	10%
Consider patient priority	2	10%
Faster service	2	10%
Follow-up with specialist doctors	1	5%
Attention to the radiology department, elevators, and public facilities	1	5%
Increase care and organization	1	5%
Reduce waiting time	1	5%
Total	56	

A Pareto chart (Figure 4.2) visually reinforces these priorities. Applying the 80/20 rule, the chart reveals that cleanliness, staffing, and facility improvements are the top three contributors to overall performance issues. Addressing these areas can significantly enhance patient experience and outcomes.

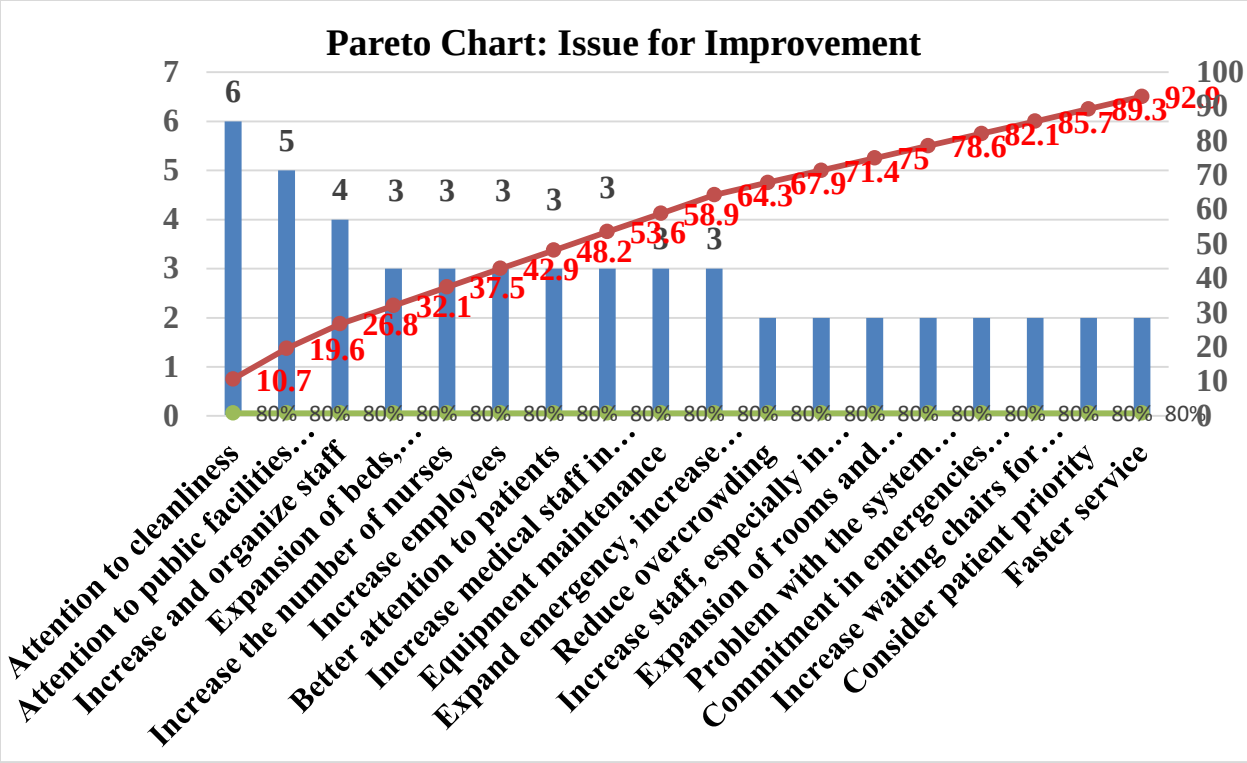

Figure 4.2: Pareto Chart: Issue for Improvement

4.2.7 Importance of Reasons, Concept of Quality, Satisfaction and Waiting Time Based on Participants Characteristics

(Table 4.8a) and (Table 4.8b), present data on the importance of reasons related to symptoms and services, respectively, based on participants' characteristics. Symptoms refer to physical or psychological indicators of a possible medical condition that prompted participants to seek medical attention, while services pertain to reasons related to the healthcare services provided by the ED. By analyzing the content focus, participant characteristics, statistical significance, and mean scores, we can differentiate between the data for symptoms and services.

There were a statistically significant differences in mean scores of importance of reasons related symptoms in favor females ($p = 0.047$) and no differences related to services ($p = 0.176$). Regarding to education, there were a statistically significant differences in mean scores of importance of reasons related symptoms in favor to primary education ($p = 0.000$) and also related to services ($p = 0.011$). Regarding to age, there were a statistically significant differences in mean scores of importance of reasons related symptoms in favor to whom above 50 years ($p = 0.022$) and also related to services ($p = 0.000$). In case of residency place, there were a statistically significant differences in mean scores of importance of reasons related symptoms in

favor to who lived in villages (p = 0.022) and also related to services (p = 0.000). Finally, according to number of visits there were a statistically significant differences in mean scores of importance of reasons related symptoms in favor to first visits and 2 to 3 visits (p = 0.002) and no difference related to services (p = 0.16).

Table 4.8a: Importance of reasons related symptoms based on participants characteristics

Variable		Low	Moderate	High	P
Gender	Male	23	50	22	0.047
	Female	29	38	38	
Education	No formal education	14	7	25	0.000
	Primary	14	30	20	
	Secondary	13	37	6	
	Diploma	0	5	1	
	Bachelor	10	7	8	
	Higher education	1	2	0	
Age	Below 18 years	3	2	1	0.024
	From18 - 30 years	7	9	10	
	From 31 - 50 years	14	31	6	
	Above 50 years	28	46	43	
Residency place	City	19	23	9	0.020
	Village	29	63	44	
	Camp	4	2	7	
Number of visits	First time	23	26	16	0.002
	2 – 3 times	16	32	10	
	4 – 5 times	9	5	12	
	6 or more times	4	24	21	
	Don’t know	0	1	1	

P values based on Pearson Chi-Square

Table 4.8b: Importance of reasons related services based on participants characteristics

Variable		Low	Moderate	High	P
Gender	Male	6	26	63	0.176
	Female	13	20	72	
Education	No formal education	3	7	36	0.011
	Primary	6	8	50	
	Secondary	6	21	29	
	Diploma	0	0	6	
	Bachelor	4	8	13	
	Higher education	0	2	1	
Age	Below 18 years	0	3	3	0.000
	From18 - 30 years	8	7	11	
	From 31 - 50 years	6	18	27	
	Above 50 years	5	18	94	
Residency place	City	15	10	26	0.000
	Village	4	31	101	
	Camp	0	5	8	
Number of visits	First time	10	16	39	0.16
	2 – 3 times	3	17	38	
	4 – 5 times	2	5	19	
	6 or more times	3	8	38	
	Don’t know	1	0	1	

P values based on Pearson Chi-Square

As shown in (Table 4.8c), male and female differences in quality mean (P=0.648), satisfaction mean (P=0.986), and waiting time mean (P=0.450) were not statistically significant. Among education levels, differences in quality mean (P=0.000) and satisfaction mean (P=0.000) were statistically significant favoring who had education more than secondary, but waiting time mean (P=0.151) was not. Regarding to age, there was a significant differences in mean scores of quality (P=0.000) favoring whom from 18 - 30 years, satisfaction (P=0.000) favoring whom were from groups below 18 years and from 18 - 30 years, and waiting time (P=0.001), favoring whom were from groups from 18 - 30 years and who were above 50 years. The quality mean

(P=0.009) differed statistically significantly between the residence places but not the satisfaction (P=0.342) or waiting time (P=0.174) means. Based on the number of visits, statistically significant differences were found in the quality mean (P=0.003) and satisfaction mean (P=0.000) among who had First time visits. There was not a significant variation in the waiting time mean (P=0.739).

Table 4.8c: Concept of quality, satisfaction and waiting time based on participants characteristics

Variable		Quality		Satisfaction		Waiting time	
		mean	P	mean	P	mean	P
Gender	Male	2.279	0.648	2.361	0.986	3.459	0.450
	Female	2.326		2.420		3.461	
Education	No formal education	2.075	0.000	2.310	0.000	3.561	0.151
	Primary	2.041		2.093		3.572	
	Secondary	2.464		2.592		3.236	
	Diploma	3.030		2.917		3.633	
	Bachelor	2.778		2.658		3.392	
	Higher Education	3.000		3.000		3.933	
Age	Below 18 years	1.697	0.000	2.750	0.000	2.967	0.001
	From18 - 30 years	2.972		2.760		3.477	
	From 31 - 50 years	2.414		2.555		3.126	
	Above 50 years	2.138		2.220		3.627	
Residency place	City	2.510	0.009	2.491	0.342	3.282	0.174
	Village	2.271		2.349		3.516	
	Camp	1.839		2.447		3.569	
Number of visits	First time	2.456	0.003	2.533	0.000	3.446	0.739
	2 – 3 times	2.412		2.476		3.372	
	4 – 5 times	2.346		2.528		3.462	
	6 or more times	1.944		2.022		3.567	
	Don’t know	2.455		2.631		3.800	

P values based on Independent t test and ANOVA test

4.3 Voice of the Internal Customer (Staff)

The perspective of the ED staff is equally crucial. It presents staff feedback on the challenges they face, including inadequate resources, inefficient processes, and a lack of a supportive work environment. It quantifies the staff's dissatisfaction with various aspects of their work, such as staffing levels, training opportunities, and the overall work environment.

4.3.1 Descriptive Statistics of Participants' Characteristics

Their years of experience, 10.0% of respondents were relatively recent arrivals at the ED. A 20 % of participants had an experience of (1–3) and (4–7) years. A considerable portion of the responders (50.0%) had over seven years ED experience.

4.3.2 Satisfaction with Resources and Facilities

(Table 4.9) presents the level of staff satisfaction with resources and facilities. More than half of the respondents (56.7%) expressed dissatisfaction with the availability of beds for patients, making it a serious worry. (36.6 %) were dissatisfied with adequacy of medical equipment while just 20 % were satisfied. A 50 % were satisfied with overall functionality and layout of the ED workspace. An 80 % were satisfied with availability of essential medications. 56.7 % satisfied with availability of diagnostic services and 30 % were satisfied with staffing levels and support. Cleanliness and hygiene of the ED had a satisfaction of 20 % of participants while 23 % were not satisfied.

Table 4.9: Level of staff satisfaction with resources and facilities

Variable	Very Dissatisfied		Somewhat dissatisfied		Neutral		Somewhat satisfied		Very Satisfied			
	F	%	F	%	F	%	F	%	F	%	M	SD
Availability of beds for patients	5	16.7	12	40	12	40	1	3.3	-	-	**2.30**	**0.79**
Adequacy of medical equipment	2	6.6	9	30	13	43.3	6	20	-	-	**2.73**	**1.16**
Overall functionality and layout of the ED workspace	2	6.6	3	10	10	33.3	11	36.7	4	13.3	**3.37**	**1.16**
Availability of essential medications	1	3.3	2	6.7	9	30	12	40	6	20.0	**3.67**	**0.99**
Availability of diagnostic services (e.g., lab, imaging)	1	3.3	3	10	9	30	12	40	5	16.7	**3,57**	**1.0**
Staffing levels and support	-	-	7	23.3	14	46.7	8	26.7	1	3.3	**3.10**	**0.80**
Cleanliness and hygiene of the ED	-	-	7	23.3	17	56.7	6	20.0	-	-	**2.97**	**0.67**

4.3.3 Causes of long Waiting Times and Overcrowding

According to (Table 4.10), none who answered "Never" said they had ever experienced delays because of administrative processes. This implies that there had been some degree of delay encountered by each respondent. Twenty percent of those surveyed said they "Rarely" encounter delays. This suggests that a tiny percentage of people experience delays on a rare basis. Regarding delays, 36.7% of the respondents said they happened "Sometimes." This was the largest category, indicating that delays were not always a problem for many individuals, but rather a quite common occurrence. 23.3% of those surveyed said they encounter delays "Often." This demonstrates that a sizable section of the populace frequently experiences delays, which may have an effect on their productivity or workflow. Twenty percent of those surveyed said they "Always" experienced delays. This suggests a serious problem for 5% of the population, who consistently experience delays in the administrative process. According to the data, most respondents (80%) report experiencing delays as a result of administrative procedures on a variable basis. This implies that a considerable percentage of respondents experience administrative delays as a regular issue that reduces their productivity and efficiency.

There were several factors contributing to long wait times and ED overcrowding, including both systemic problems (such a high patient amount, a lack of beds, and a shortage of medical staff) and particular case categories (like chronic illnesses and RTAs). Increasing bed capacity, adding additional medical personnel, enhancing management procedures, and making sure non-emergency cases were sent to the right care settings are only a few of the comprehensive measures needed to address these problems. The pressure on EDs might also be greatly reduced by improving hospital infrastructure generally and modernizing IT systems to minimize delays caused by faults. The number of patients/overload of patients was the most commonly cited issue (41%) that contributes to lengthy wait times in the ED. This suggests that there were more patients in the ED than it could effectively manage, which was causing serious delays. A significant proportion of participants identified the insufficient number of beds (33%) as a primary concern. This implied that there might be delays in patient flow even after patients were seen and treated because they might not immediately be able to get into a bed. Another important concern was the lack of medical personnel, particularly nurses (30%). Patients might probably have to wait longer due to this shortage because there was not enough staff to properly handle the volume of patients. Delays were also caused by issues with the computerized system (26%), like frequent hang-ups. Facilitating procedures and handling patient data in the ED required dependable and efficient IT systems. One significant influence was the presence of the patient's friends and family (16%). They might interfere with medical personnel workflow and add to the problem of overpopulation. Longer wait times were a result of systemic inefficiencies and organizational issues, as evidenced by the 15% of respondents who mentioned issues with administration and management methods. Congestion in the ED is further exacerbated by the 11% increase in patients with non-emergency diseases who might receive treatment in primary care settings. Long wait times were caused by another factor (4–7%), which were less commonly discussed but yet contributed to them. These factors included security incidents, long consultation durations, far-off imaging facilities, and delays in diagnostic results. Regarding to types of cases contributing to ED overcrowding, the majority of the reasons for ED overcrowding were chronic diseases (33%) such as heart failure, chronic obstructive pulmonary disease (COPD), and cerebrovascular accidents (CVA). Overcrowding was mostly caused by road traffic accidents (RTAs), which accounted for 30% of the total. Usually, these cases demand for urgent, comprehensive medical care. The ED was becoming overcrowded as a result of a significant percentage of non-emergency cases (16%) that might be managed in primary care

settings instead of the ED. The high ED occupancy was partly caused by cardiac difficulties (15%), such as myocardial infarction (MI) and chest pain, which were common and necessitated immediate care. Overcrowding was also significantly influenced by injuries sustained in military engagements and assaults (15%), particularly in areas where there is ongoing war. Asthma and respiratory distress syndrome (RDS), which account for 15% of respiratory disorders, were prevalent in the ED and required prompt, often lengthy, care. A number of other reasons (4–11%) contributed to the overall congestion, albeit to varying degrees. These included gunshot wounds, death cases, and medical cases without ED criteria, dialysis, neurological problems, fractures, and gastroenteritis.

Table 4.10: Causes of Long Waiting Times and Overcrowding

Variable	Never		Rarely		Sometimes		Often		Always			
How often do you experience delays due to administrative procedures?	F	%	F	%	F	%	F	%	F	%	**M**	**SD**
	-	-	6	20	11	36.7	7	23.3	6	20	**3.43**	**1.04**
	Factors								F	%		
In your opinion, what are the top 3 factors that contribute to long wait times for patients in the ED?	Number of Patients / Overload of Patients								11	41		
	Lack of Beds								9	33		
	Lack of Medical Staff / Nurses								8	30		
	System Issues (including computerized system hanging)								7	26		
	Patient Relatives / Companions								5	16		
	Poor Management / Administration Problems								4	15		
	Presence of Non-Emergency Cases								3	11		
	Delay in Diagnostic Results								2	7		
	Security Issues								1	4		
	Consultation Time								1	4		
	Faraway Imaging								1	4		
	Limited Resources								1	4		
What are your observations on the types	Chronic Conditions								9	33		
	Road Traffic Accidents (RTA)								8	30		

of cases (e.g., minor injuries, chronic conditions) that contribute most to ED overcrowding?	Minor Conditions / Non-Emergency Cases	5	16
	Cardiac Issues (including MI, chest pain)	4	15
	Military Injuries / Assaults	4	15
	Lack of Places for Admission	1	4
	Gunshot Wounds	1	4
	Respiratory Conditions (Asthma, COPD, DESAT, RDS)	4	15
	Death Cases	1	4
	Medical Cases with No Indications for ED Presentation	2	7
	Dialysis	1	4
	Neurological Conditions (CVA, Neurosis)	3	11
	Fractures	2	7
	Gastroenteritis	1	4

The Pareto chart (Figure 4.3) provides valuable insights for hospital administrators to address the root causes of long ED wait times. By focusing on the top three factors—number of patients, lack of beds, and lack of medical staff—hospitals can implement strategies to significantly reduce wait times and improve patient satisfaction.

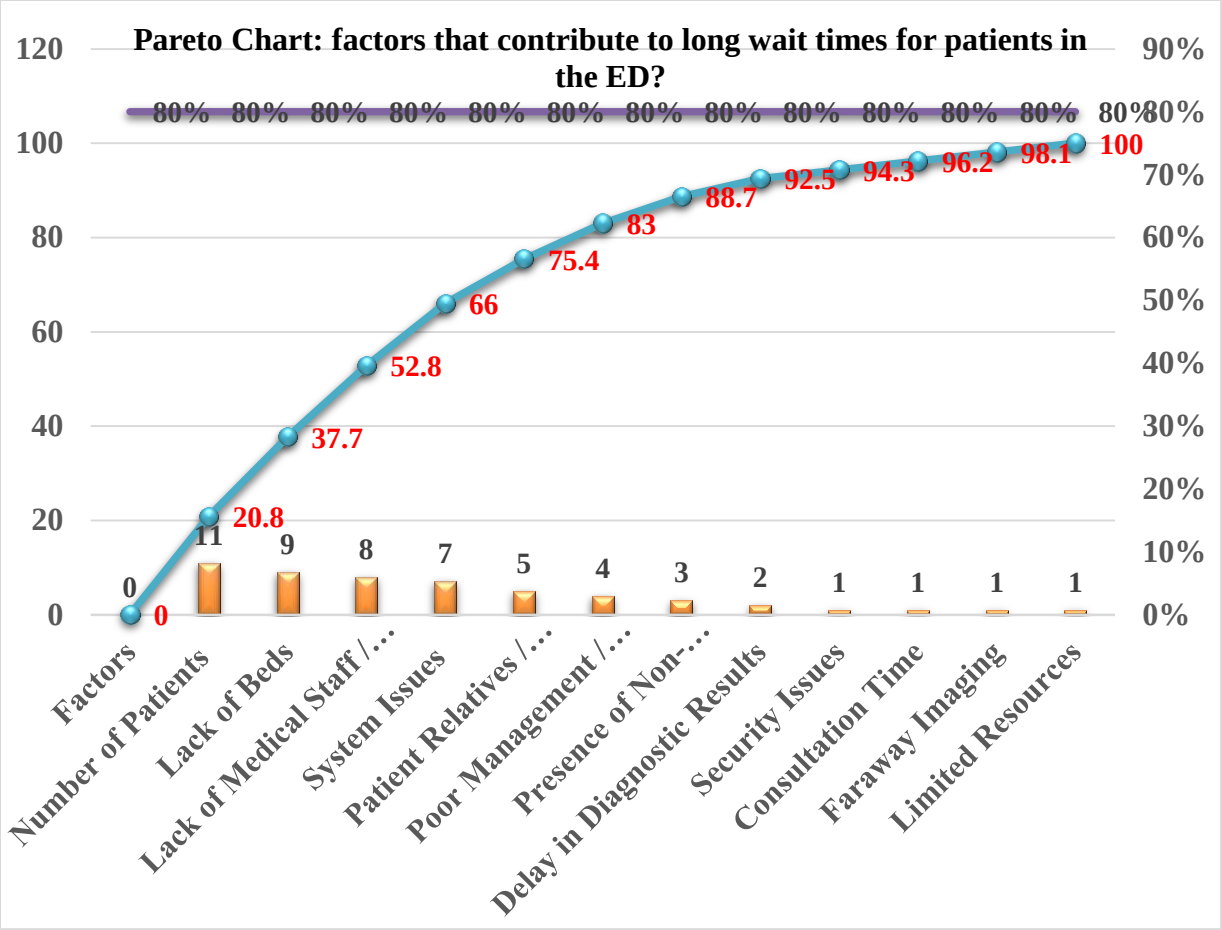

Figure 4.3: Pareto Chart factors that contribute to long wait times for patients in the ED?

The Pareto chart (Figure 4.4) provides valuable insights for healthcare administrators to address the most common and impactful types of cases. By focusing on the top three factors—chronic conditions, road traffic accidents, and minor conditions—hospitals can implement strategies to optimize resource allocation and improve patient care.

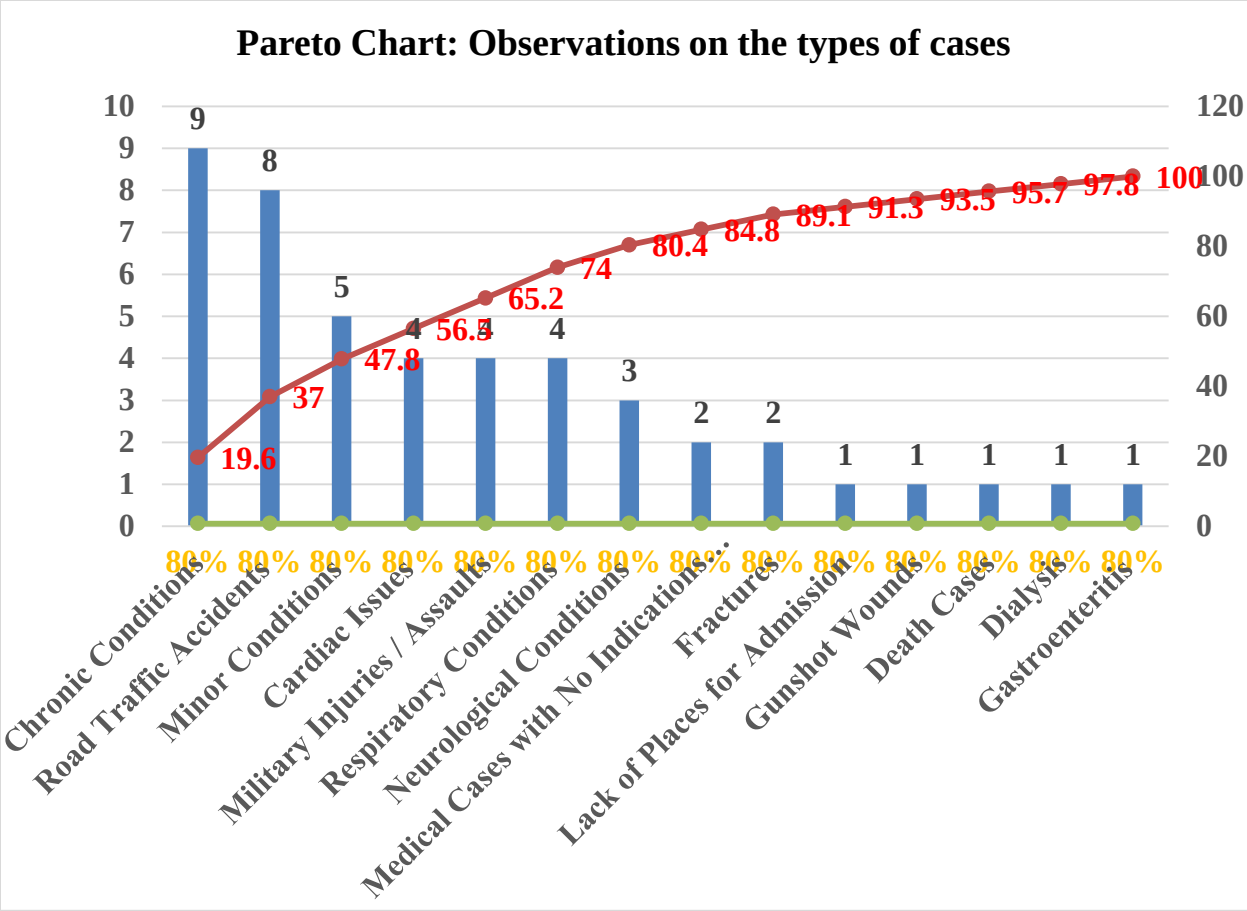

Figure 4.4: Pareto Chart observations on the types of cases

4.3.4 Challenges in Providing Optimal Care Due To Overcrowding

As shown in (Table 4.11), a majority of respondents (76.7%) felt they had enough options for professional growth and training. A quarter of those surveyed (23.3%) believed they did not get enough opportunity for professional growth and training. Most respondents (53.3%) had a positive opinion of communication and collaboration with other departments. Nonetheless, a significant percentage of the general population (13.4%) held a negative perception of it, while 23.3% expressed neutrality. Thirty percent of participants said that having patient relatives' present and frequent intervention caused serious problems. They can interfere with medical care and added to the overpopulation. A quarter (26%) thought that a serious problem was the lack of nurses and medical personnel. A further 26% of respondents stated that an excess of patients in comparison to the amount of beds and resources available was the reason for congestion impeding timely and effective service. Another obstacle, accounting for 16% of the total, was inadequate internet access and issues with the IT system, particularly with the outdated

technologies. 15% of respondents said that it was harder to control patient flow because of the overcrowding issue, which was made worse by a bed shortage. Eleven percent of participants stated that general resource and equipment shortages, together with a lack of incentives for medical staff, were the main causes of staff unhappiness and overall inefficiency. An additional 11% reported that staff burnout results from a demanding workload and a stressful work environment, which lowers the standard of care even more. Systemic problems and general social ignorance also contribute to the challenges encountered in the ED (7%). A few further variables were the existence of non-emergency situations, problems with communication, and difficulty in transferring patients.

4.3.5 Suggestions for Improvement

A third of the participants suggested hiring more physicians and nurses in order to manage the patient load more effectively and prevent staff burnout. A further 33% suggested increasing the number of beds available to take in more patients and reduce crowding. 16 % to modernize and strengthen internet connectivity and operation systems in order to boost productivity and cut down on delays. 15% to increase security in order to control patient flow and uphold ED order. A further 15% of respondents stated that they had successfully implemented triage protocols, which rank patients according to the severity of their ailments and guarantee that those in urgent need of care get it quickly. 15% will go toward enlarging the emergency room's physical area so that it can accommodate more patients. 11% for staff training and education and 11% for each suggestion. Just 7% went into public education, 7% went toward allocating resources, and 7% went toward implementing policies. Lastly, 4% for separation of critical care areas.

Table 4.11: Challenges and Suggestions for Improvement

Variable												
							Yes		No			
Do you feel you receive adequate training and professional development opportunities to perform your job effectively?							F	%	F	%		
							23	76.7	7	23.3		
How would you rate the communication and collaboration with other departments?	Very poor		Poor		Neutral		Good					
	F	%	F	%	F	%	F	%			**M**	**SD**
	2	6.7	2	6.7	7	23.3	16	53.3			**3.23**	**0.97**

	Factors	F	%
Please describe the biggest challenges you face in providing optimal care to patients in the ED due to overcrowding.	Relatives of Patients	8	30
	Lack of Medical Staff	7	26
	Large Number of Patients	7	26
	System Issues	5	16
	Lack of Beds	4	15
	Lack of Resources	3	11
	Burnout and Exhaustion	3	11
	Uneducated Society / Bad System	2	7
	Presence of non-emergency cases	1	4
	Communication issues	1	4
	Difficulty in patient transfer	1	4
What are some suggestions you have for improving the overall quality of service and staff well-being in the ED?	Increase Staffing	9	33
	Increase Bed Capacity	9	33
	System Improvements	5	16
	Security Enhancements	4	15
	Good Triage	4	15
	Expansion of ED Facilities	4	15
	Training and Education	3	11
	Incentives for Staff	3	11
	Public Education	2	7

Resource Allocation	2	7
Policy Implementation	2	7
Separate Areas for Critical Care	1	4

The Pareto chart (Figure 4.5) provides valuable insights for healthcare administrators to address the most critical challenges associated with overcrowding. By focusing on the top three factors—relatives of patients, lack of medical staff, and large number of patients—hospitals can implement strategies to improve patient care and reduce the negative impacts of overcrowding.

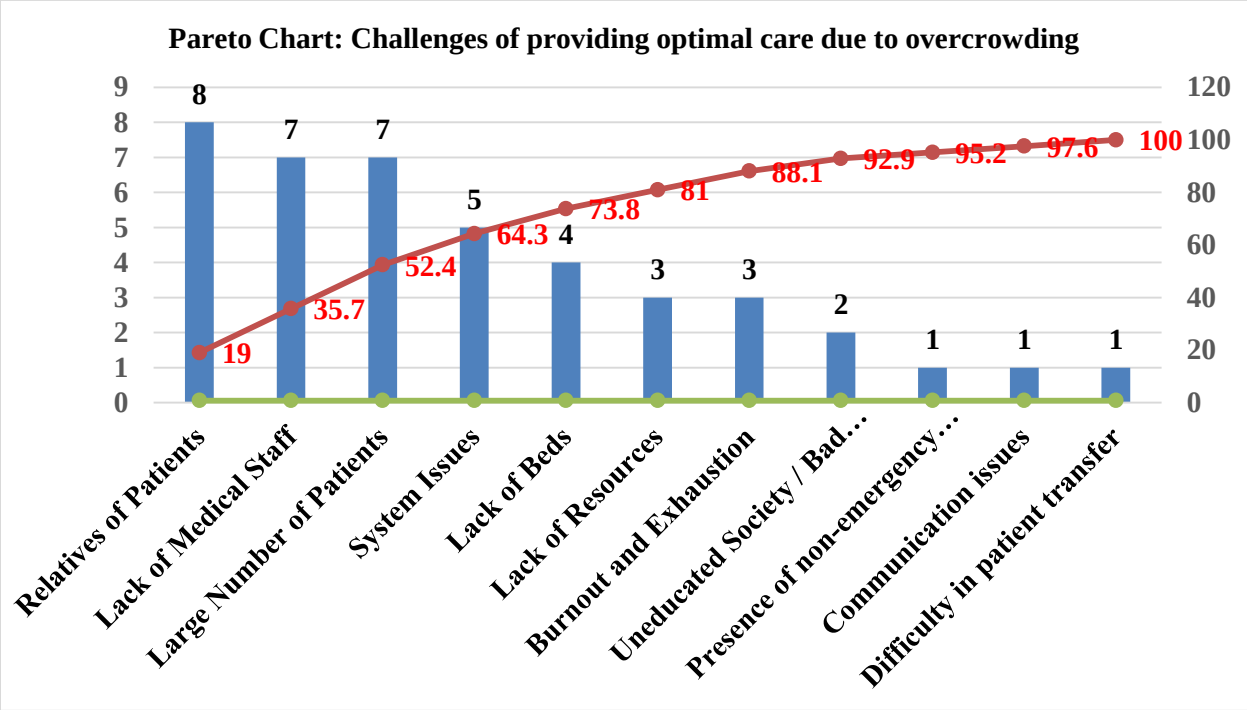

Figure 4.5: Pareto Chart challenges of providing optimal care due to overcrowding

The Pareto chart (Figure 4.6) provides valuable insights for healthcare administrators to address the most pressing issues affecting ED quality and staff well-being. By focusing on the top three factors—increase staffing, increase bed capacity, and system improvements—hospitals can implement strategies to enhance patient care and improve the working conditions for their staff.

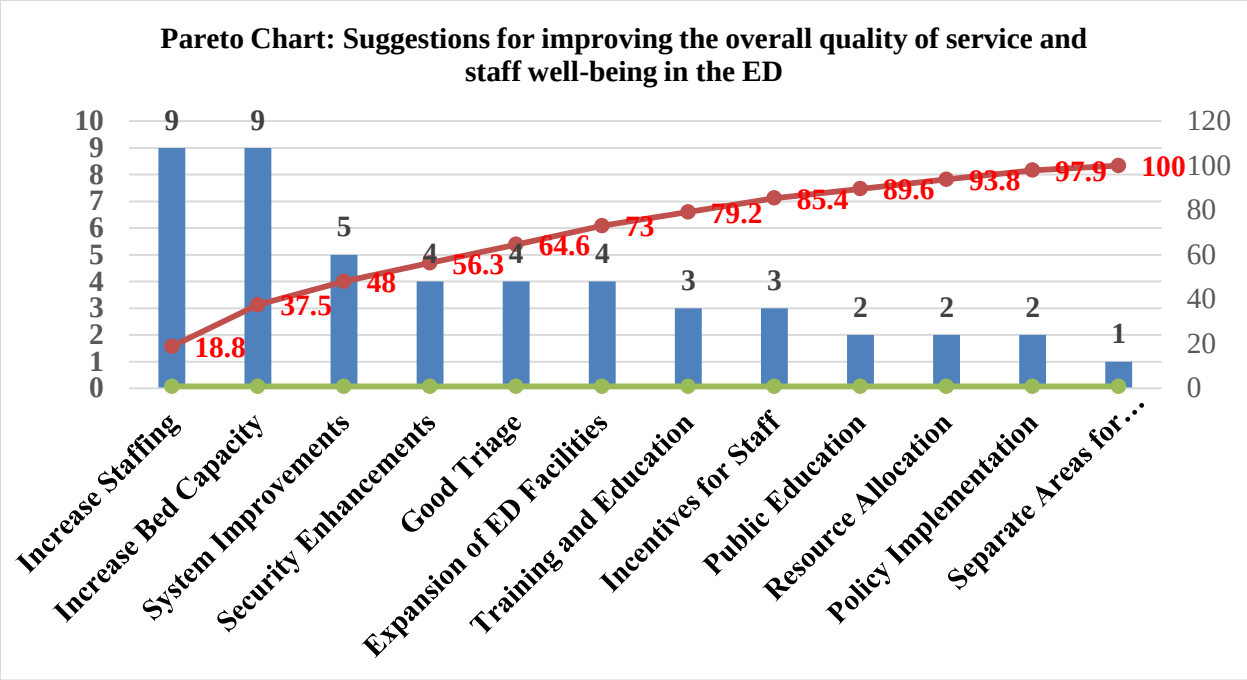

Figure 4.6: Pareto Chart: Suggestions for improving the overall quality of service and staff well-being in the ED

4.4 Voice of the Process

It delves into the operational aspects of the ED, analyzing the processes that contribute to the identified problems. It examines the efficiency of triage processes, diagnostic services, administrative procedures, and the adequacy of IT systems and medical equipment. The analysis extends to the physical environment, including space constraints and cleanliness.

4.4.1 Waiting Time in ED

The ED at the PMC is a dynamic environment where patient wait times can vary significantly due to factors such as patient volume, staffing levels, and case complexity. Understanding these wait times is crucial for improving operational efficiency, patient satisfaction, and perceived quality of care.

To assess the current state of ED wait times and identify areas for improvement, a patient flow observation was conducted over a two-day period. A sample of 43 patients was observed across different days and shifts to ensure representativeness. Key areas of the ED, including reception, triage, and discharge, were closely monitored to identify potential bottlenecks. Timestamps were recorded for each patient at these critical stages using a standardized data collection sheet,

providing detailed information on the duration of their wait times and the time spent receiving treatment, as shown in Appendix D and Appendix E.

(Table 4.12) presents the empirical data collected during the observation period. This data offers valuable insights into the current state of ED wait times and can inform targeted interventions to enhance patient experience and improve overall ED performance. The data is categorized into four distinct phases: reception, triage, consultation with a doctor, and the overall duration from arrival to discharge. Patients typically experienced a wait before being greeted by reception staff. Following registration, they spent time awaiting assessment by a triage nurse. The most significant delay occurred in the waiting room, with patients enduring a wait before being seen by a physician. The consultation with the doctor, which involved discussing symptoms, medical history, and treatment plans, averaged time. The total time from arrival to discharge (LOS) encompasses all these stages, providing a holistic view of the patient's experience.

Table 4.12: Waiting time at ED

	WT for Reception	Waiting Time for Triage (minutes)	Waiting Time to See Doctor (minutes)	Time with Doctor (minutes)	Total Time (minutes) From arrival to discharge
Mean	9.0930	7.2093	23.3256	162.9070	188.5349
SD	8.266	7.514	24.720	214.694	192.772
Median	4.0000	5.0000	17.0000	90.0000	119.0000
Mode	3.00[a]	2.00	6.00	12.00[a]	49.00[a]
Minimum	1.00	1.00	1.00	8.00	14.00
Maximum	30.00	40.00	131.00	1180.00	884.00

a. Multiple modes exist. The smallest value is shown

The waiting times at various ED stages are shown in this (Table 4.12). The median wait time was much lower at 4.00 minutes than the mean of 9.09 minutes, suggesting that most patients wait relatively short while few outliers have longer wait times. This indicates that, according to the data, most patients in the ED have modest reception wait times, whereas a small percentage of patients had considerably prolonged wait times. The fact that the mean was greater than the median indicates that certain larger numbers, or outliers, may have skewed the data. Put another

way, the mean wait time was 9.09 minutes, but some patients experienced wait times that were noticeably longer than the average, with the majority of patients waiting about 4 minutes (the median). These lengthier wait times were taken from 11:05 am to 12:26 pm were system failures in these time. The minimum value was 1 minute while maximum was 30 minutes. As shown in (Figure 4.7).

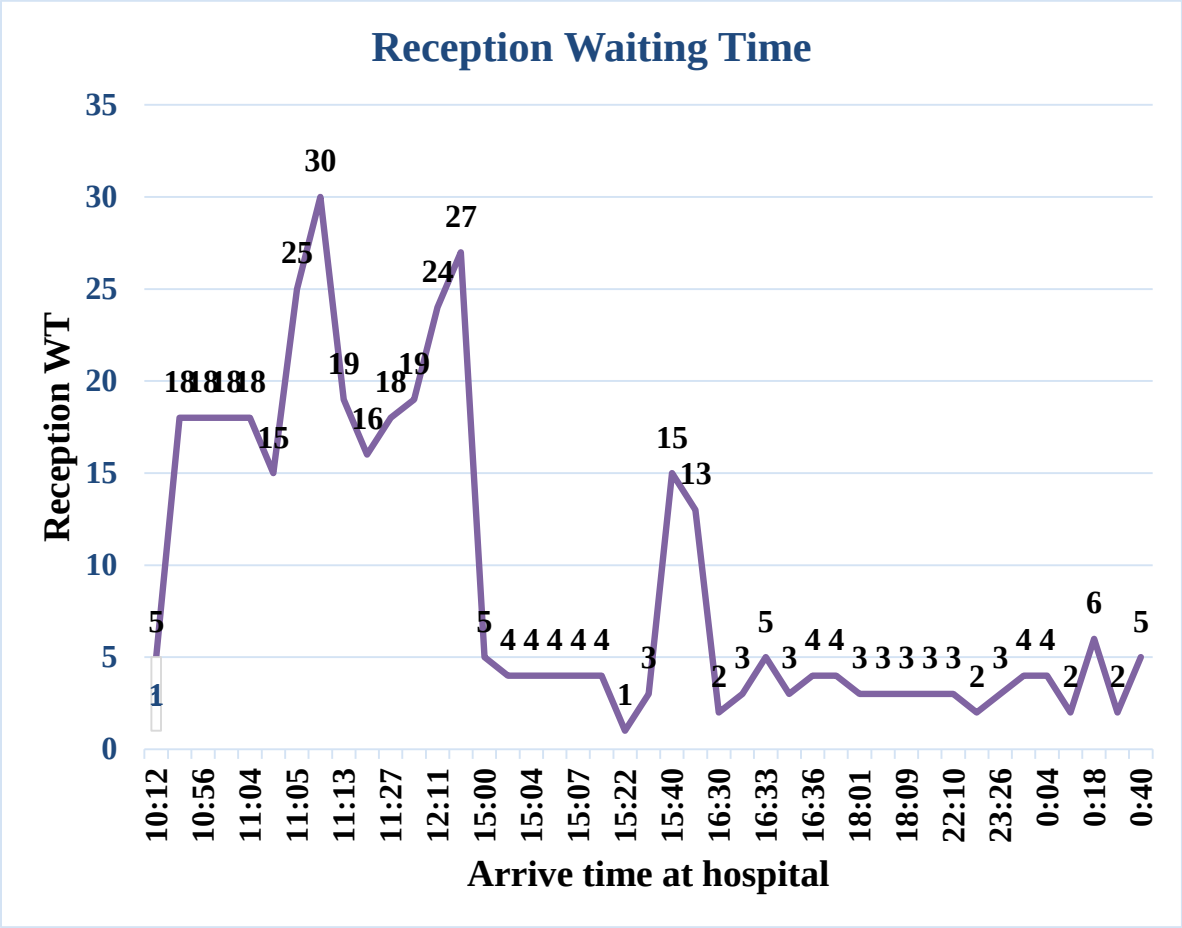

Figure 4.7: Reception Waiting Time

There may be a greater consistency in wait time for triage because the mean and median timeframes for the task were almost equal. The 2 minute mode suggests that this was the most typical wait time. 40 minutes was the maximum value, and 1 minute was the minimum. The median wait time for patients was 17.00 minutes, meaning that half of them wait less than 17 minutes, while the other half wait longer, with some notable outliers. The mean wait time for patients was 23.33 minutes. One minute was the minimum value and 131 minutes was the maximum. The length of time spent with the doctor varied greatly; the median was 90.00

minutes, and the average was 162.91 minutes. The average duration of 12 minutes implies that brief visits were typical, while certain patients need far more time. Eight minutes was the minimum value and 1180 minutes was the maximum.

As shown in (Figures 4.8) and in (Figure 4.9), respectively.

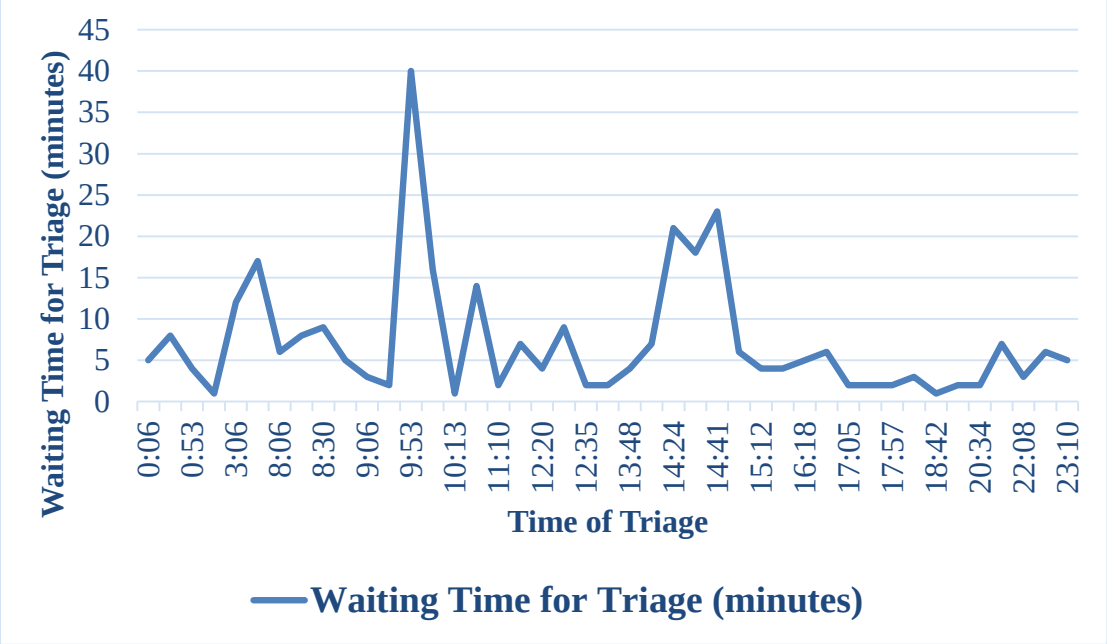

Figure 4.8: Waiting Time for Triage

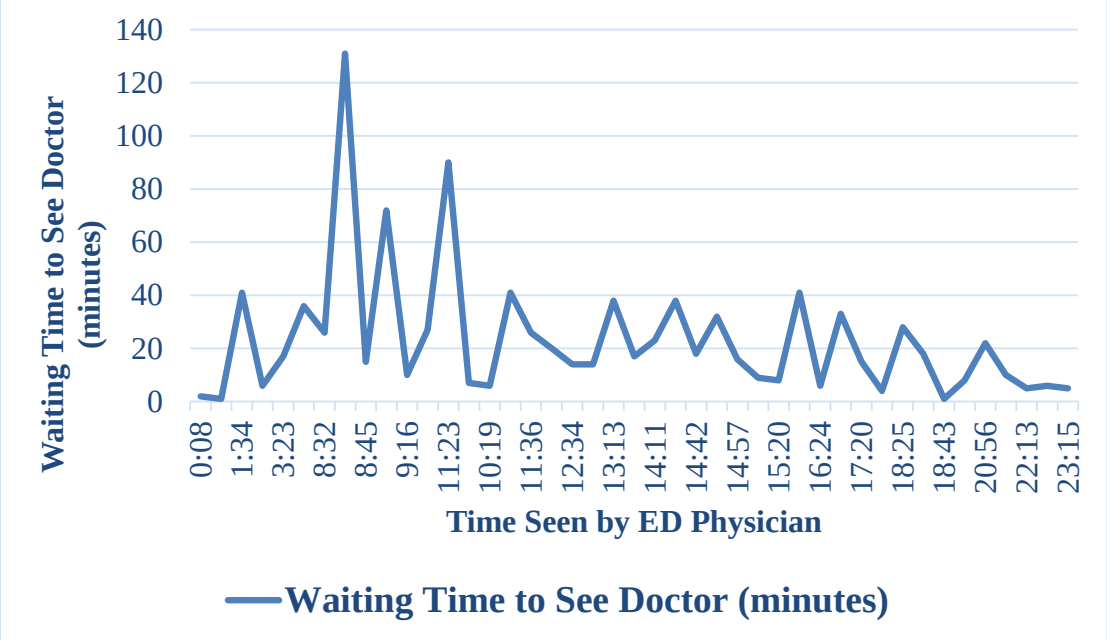

Figure 4.9: Waiting Time to See Doctor

The overall time shows in (Figure 4.10) a wide range in the data, with a mean of 188.53 minutes and a median of 119.00 minutes. There are a lot of shorter visits and a few really lengthy ones, as evidenced by the mode of 49 minutes, which is very low when compared to the mean. Fourteen was the minimum value and 884 minutes was the maximum.

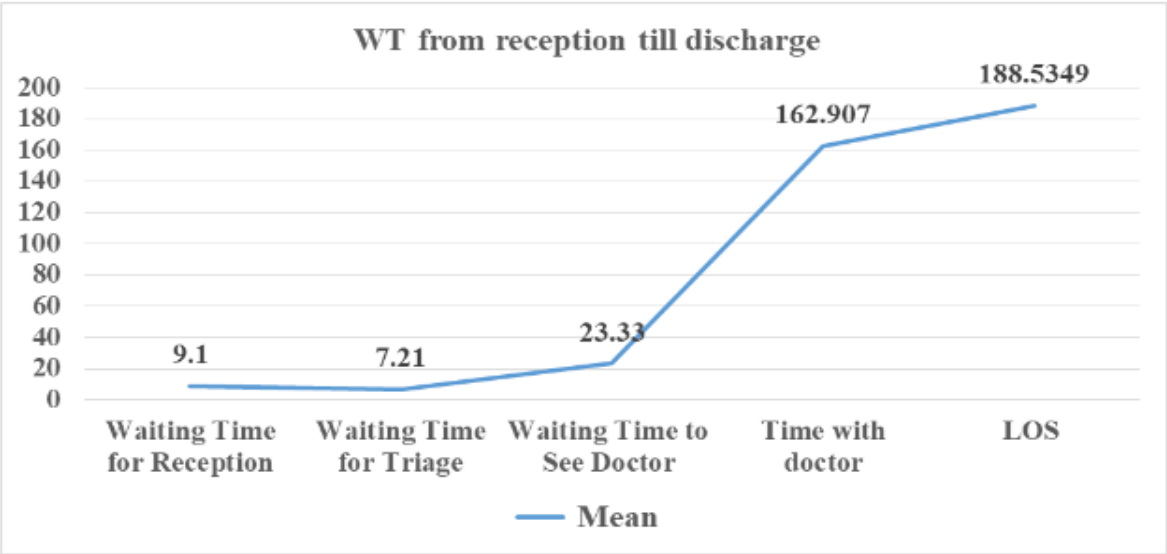

Figure 4.10: Waiting from Reception till Discharge

The daily number of patients in ED is approximately 415 cases per day, as this result represents 10% of the number of visitors (N=43).

4.5 Current Process Map

A visual representation of the current ED processes is provided, mapping out the patient journey from arrival to discharge. This map helps to identify bottlenecks and areas for improvement. As presented in (Figure 4.11).

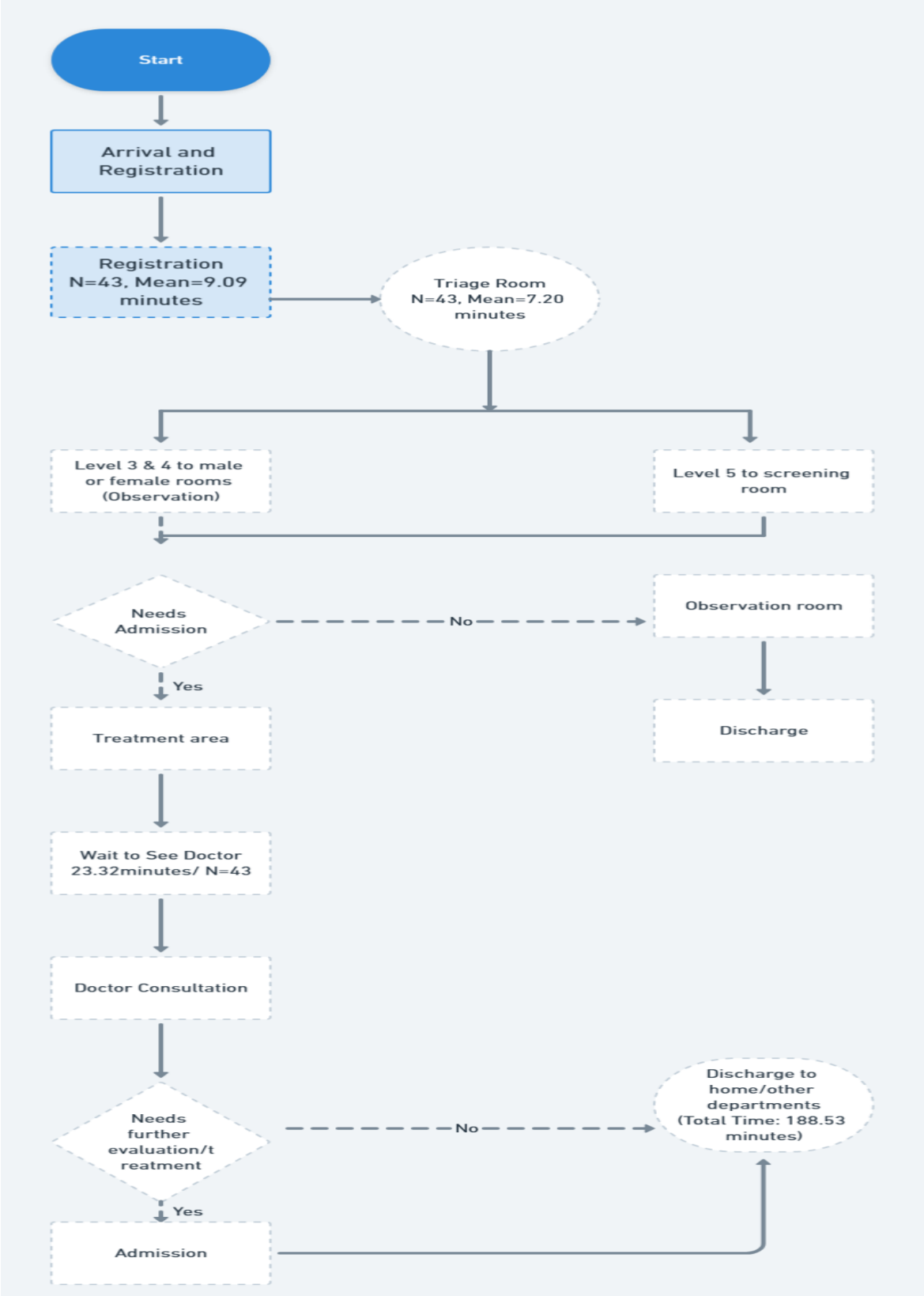

Figure 4.11: A current analysis of the flow of patients through the ED of PMC Hospital

4.5.1 Principal Issues Noted

The following important problems were noted by ED personnel:

- Staffing Shortages: There's a need for increased staffing levels to manage the high volume of patients effectively.
- Bed Availability: Insufficient bed capacity leads to overcrowding and longer wait times.
- IT System Issues: Technical problems with the computerized system contribute to administrative delays and inefficiencies.
- Triage and Patient Flow: Inefficiencies in triage protocols and patient flow.
- Security Concerns: Inadequate security measures in the ED.
- Facility Expansion: Limited space and outdated facilities.
- Professional Growth Opportunities: Staff face difficulties in professional growth due to overcrowding and systemic issues.
- Non-Emergency Case Management: The presence of non-emergency cases further exacerbates overcrowding and long wait times.
- Furthermore, there is a lack of a patient-centered primary health center (PHC) that is dependable, efficient, and effective.

4.5.2 Metrics to Quantify the Severity of the Issues

The analysis of waiting times at different ED stages in PMC hospital reveals a skewed distribution with a few outliers, as evidenced by the significant difference between the median and mean wait times. This suggests that most patients experience relatively short waits, while a small percentage face considerably longer delays. For example, the mean wait time for patient

reception was 9.09 minutes, but some patients waited much longer, likely due to system failures during specific time periods.

The waiting times for triage show greater consistency, with similar mean and median times. However, the median wait time for patients to see doctor was 17 minutes, and the mean was 23.33 minutes, suggesting the presence of outliers. The duration of time with doctor varied widely, with a median of 90 minutes and a mean of 162.91 minutes. The overall time spent in the ED also shows a wide range, with a mean of 188.53 minutes and a median of 119.00 minutes. These findings align with previous research conducted in other settings. For instance, a study in Saudi Arabia found that the average patient waiting time between registration and triage varied significantly across different shifts, ranging from 4.17 minutes to 23.85 minutes (Al Owad et al., 2018). Additionally, research by Huang et al. (2015) demonstrated that efficient registration systems can significantly reduce wait times, with electronic registration systems leading to a decrease in average reception wait times from 15 minutes to under 5 minutes. Weiss et al. (2014) further emphasized the importance of triage efficiency, finding that the median wait time for triage in well-functioning EDs was typically around 10 to 15 minutes. Finally, a comprehensive review by McHugh et al. (2013) highlighted the influence of patient volume and case complexity on the total length of stay in EDs, with average LOS ranging from 120 to 180 minutes in many facilities.

The standard estimated times for the ED process are; registration (30 min), waiting time to get vital signs by nurses (1 hour), investigation and treatment (4 hours), and waiting time to see a physician (3 hours) (Abu Olwan, 2021).

The absence of a short stay department within the ED at PMC may result in a distinct patient experience. This suggests that the findings from PMC do not align with those from other countries, as ED waiting times at PMC appear to be shorter. Specifically, the lack of a short stay department seems to streamline patient flow through the ED, reducing wait times. Additionally, PMC's ED waiting times compare favorably with international benchmarks, possibly due to local adaptations and strategies. These points were also discussed in a study conducted at Al-Aqsa hospital in Gaza by Abu Olwan, (2021) which documented shorter ED waiting times and highlighted the efficiency of patient flow and the favorable comparison with international standards.

Furthermore, a study conducted in Gaza, focusing on patient behavior at Al-Aqsa hospital, provides insights into the factors that can influence waiting times. Patients at Al-Aqsa

demonstrated a strong aversion to waiting, especially those with non-urgent complaints. This behavior was likely influenced by several factors, including the lack of a comfortable waiting area, insufficient security personnel, inconsistent triage protocols, unclear expected wait times, and a perceived lack of staff commitment. These factors highlight the importance of creating a welcoming and efficient environment to mitigate patient anxiety and improve the overall ED experience (Abu Olwan, 2021).

4.5.3 Root Cause Analysis: Factors Causing ED Overcrowding (based on ED staff perspectives)

1. **Staffing Shortages and Overcrowding:**

- Issue: Insufficient staffing levels to manage the high volume of patients effectively.
- Root Causes:
    - High Patient Volume: The ED experiences a high number of daily patient visits, which exceeds the capacity of the current staffing levels.
    - Non-Emergency Cases: A significant portion of the patient load includes non-emergency cases that could be managed in other settings, contributing to overcrowding.
    - Lack of Staff: There is a shortage of medical staff, including doctors, nurses, and support personnel, which hampers the ability to handle the patient load efficiently.

2. **Bed Availability:**

- Issue: Insufficient bed capacity, resulting in overcrowding and longer wait times.
- Root Causes:
    - Limited Space: The ED's physical space is constrained, and the quantity of patients in need of care cannot be met by the number of beds available.
    - Inefficient Use: When beds are not used effectively, they are occupied needlessly and PF is delayed.
    - Admissions and Transfers: One of the main causes of ED bed obstructions is late admissions of patients to inpatient units and transfers of patients to other hospitals.

3. **IT System Issues:**

- Issue: Administrative delays and inefficiencies are caused by technical issues with the computerized system.
- Root Causes:
    - System Failures: The timely processing of patient data and documentation is hampered by frequent system crashes and sluggish response times.
    - Outdated Technology: Delays and errors result from the IT infrastructure's age and incapacity to manage the present workload.

4. **Security Concerns:**

- Issue: Staff and patient safety in the ED is impacted by inadequate security measures.
- Root Causes:
    - Inadequate Security Staff: The ED environment is not adequately managed and controlled due to a shortage of security personnel.
    - Patient Behavior: Since disruptive patient conduct necessitates more staff time and resources, it can exacerbate security concerns and crowding.

5. **Ineffective Triage Protocols:**

- Issue: Ineffective patient flow management is caused by inefficient triage methods.
- Root Causes:
    - Insufficient Training: Employees might not receive sufficient training on efficient triage procedures, which could result in incorrect categorization and ordering of patient requirements.
    - Overcrowding: An excessive number of patients overloads the triage system, resulting in inefficiencies and delays.

6. **Facility Conditions:**

- Issue: Current facilities and a lack of space have an impact on staff satisfaction and patient treatment.
- Root Causes:
    - Outdated Infrastructure: The physical facilities are outdated and not designed to handle the current patient load, leading to overcrowding and inefficiencies.

- Lack of Maintenance: Insufficient maintenance and upkeep of facilities contribute to a deteriorated environment, affecting both patient care and staff morale.
- Space Utilization: Ineffective use of available space further exacerbates overcrowding and hinders efficient patient flow.

7. **Training and Education:**

- Issue: Employee education and training must be ongoing in order to increase competency and care quality.

Root Causes:

- Lack of Training Programs: To keep personnel abreast of the newest medical procedures and technological advancements, there might not be enough thorough training programs in place.
- Resource constraints: The creation and execution of successful training programs are hampered by a lack of resources for education and training.
- Time Restraints: Because of heavy workloads and crowding, staff members might not have enough time to attend training.

8. **Incentives and Recognition:**

- Issue: Employee motivation and retention are impacted by a lack of rewards and recognition.
- Root Causes:

- Inadequate Remuneration: When employees receive inadequate pay for their efforts, they may feel devalued, which lowers morale and increases turnover.
- A dearth of acknowledgment programs for staff accomplishments can lead to a decrease in job satisfaction and demotivation among employees.
- Workload: Stress from crowded spaces and heavy workloads can further sap motivation and job satisfaction.

9. **Public Education:**

- Issue: In order to decrease non-emergency visits, there is a need for public education regarding the proper use of ED services.
- Root Causes:

- Lack of Awareness: It is possible that the public is not sufficiently educated about the suitable usage of ED services, resulting in pointless trips.
- Access to Healthcare: Patients may seek care in the ED for non-emergency conditions if they have limited access to primary care providers.
- Communication: The hospital's inability to effectively communicate with the community prevents information on ED use from being shared.

10. **Resource Allocation:**

- Issue: Poor resource allocation, including medical supplies and equipment, has an impact on patient satisfaction and care quality.
- Root Causes:
    - Budget Constraints: Insufficient funds can limit the acquisition and upkeep of necessary medical supplies and equipment.
    - Supply Chain Issues: Issues with the supply chain may result in shortages of vital supplies required for patient care.
    - Resource Management: Poor handling of the resources at hand can result in waste and insufficient supply of essential goods.

11. **Policy Implementation:**

- Issue: To govern ED activities, clear and efficient policies are required.
- Root Causes:
    - Inadequate Standardized Protocols: Lack of established protocols and guidelines can result in ED operations that are inconsistent and inefficient.
    - Enforcement: In the event that policies are established but ineffectively carried out, noncompliance and operational problems may arise.
    - Stakeholder Engagement: When important stakeholders are not included in the creation and execution of policies, resistance and inefficiency may result.

12. **Separation of Critical Care Areas:**

- Issue: To enhance PF and shorten wait times, distinct spaces are required for critical and non-emergency cases.

- Root Causes:

- Restricted Space: Devoted spaces for various patient categories cannot be created due to space constraints.
- Patient Mix: Inefficient PF is caused by a high percentage of non-emergency cases combined with essential situations.
- Resource Allocation: Insufficient resources to establish and maintain separate critical care areas.

4.5.4 Staff Perspectives and Suggestions for Improvement

Staff demographics show a range of experience levels, with half the staff having over seven years of experience. Staff satisfaction varies, with dissatisfaction in areas such as bed availability and cleanliness. Overcrowding and long waiting times are attributed to high patient volumes, lack of beds, insufficient staff, and IT system issues. Staff suggest various improvements, with the top recommendations being increasing staffing levels and bed capacity, as well as system improvements and security enhancements.

4.6 Cause and Effect Diagram (Fishbone Diagram)

By investigating the most significant problems that impact on patient flow at an ED, a cause and effect diagram was developed based on taking the voice of the customer and the voice of the process into consideration together. As shown in (Figure 4.12), employs the Cause and Effect Diagram to categorize the root causes of ED overcrowding and long waiting times into six main areas: People (Staff), Methods (Processes), Machines (Equipment), Materials (Supplies), Measurement (Data), and Environment (Facilities).

Figure 4.12: Root causes of overcrowding: Cause and effect diagram

4.7 Strategic Improvements and Target Conditions

The ED at PMC can operate more efficiently, improve patient satisfaction, and enhance staff performance, by addressing the key gaps identified in the current process, including long waiting times, low patient satisfaction, and variable staff satisfaction. Here are the specific goals for each area:

1. Patient Satisfaction

- Goal: Raise the overall 5-point patient satisfaction score to 4.0 or above.
    - Medical Services: Guarantee prompt and efficient medical car.
    - ED Staff Care: Boost staff empathy and responsiveness.

- Facilities and Environment: Improve the surroundings' general comfort, cleanliness, and atmosphere.
- Patient Care: Offer thorough and considerate treatment.
- Treatment and Education: Provide health education as well as precise, efficient treatment strategies.

2. Staff Performance

- Goal: Attain a minimum 5-point rating of 4.0 for staff satisfaction.
  - Bed Availability: Make sure there is enough room for beds and effective bed management.
  - Medical Equipment: Make sure the equipment is current and kept in good condition.
  - Hygiene and Cleanliness: Keep your hygiene and cleanliness up to par.
  - Availability of Essential Medication: Make sure that necessary medications are readily available.
  - Diagnostic Services: Provide accurate and quick diagnostic assistance.

3. Operational Efficiency

- Goal: Simplify procedures to enhance PF and cut down on administrative delays.
  - Staffing Levels: To properly manage patient volume, make sure there is a sufficient number of employees.
  - IT System: Implement a reliable and efficient IT system to support operations.
  - Triage Protocols: Establish and enforce effective triage protocols to prioritize patient needs.
  - Security Measures: Enhance security measures to ensure a safe environment for staff and patients.

4.7.1 Measurable Targets (Quantity and Time)

- Arrival: Patient registers and is immediately assessed by a triage nurse (Target: 5 minutes)

- Triage: Nurse assesses patient and assigns a priority level (Target: 3 minutes)
- Immediate Care: High-priority patients are seen by a doctor within 10 minutes
- Non-Emergency Care: Low-priority patients are directed to a separate area for assessment and care (Target: 15 minutes)
- Laboratory and Radiology: Patients undergo necessary tests efficiently (Target: 30 minutes)
- Doctor Consultation: Patients are seen by a doctor for consultation and treatment (Target: 1 hour)
- Discharge: Patients are discharged or admitted to inpatient care within 2 hours of arrival

4.7.2 Target Condition

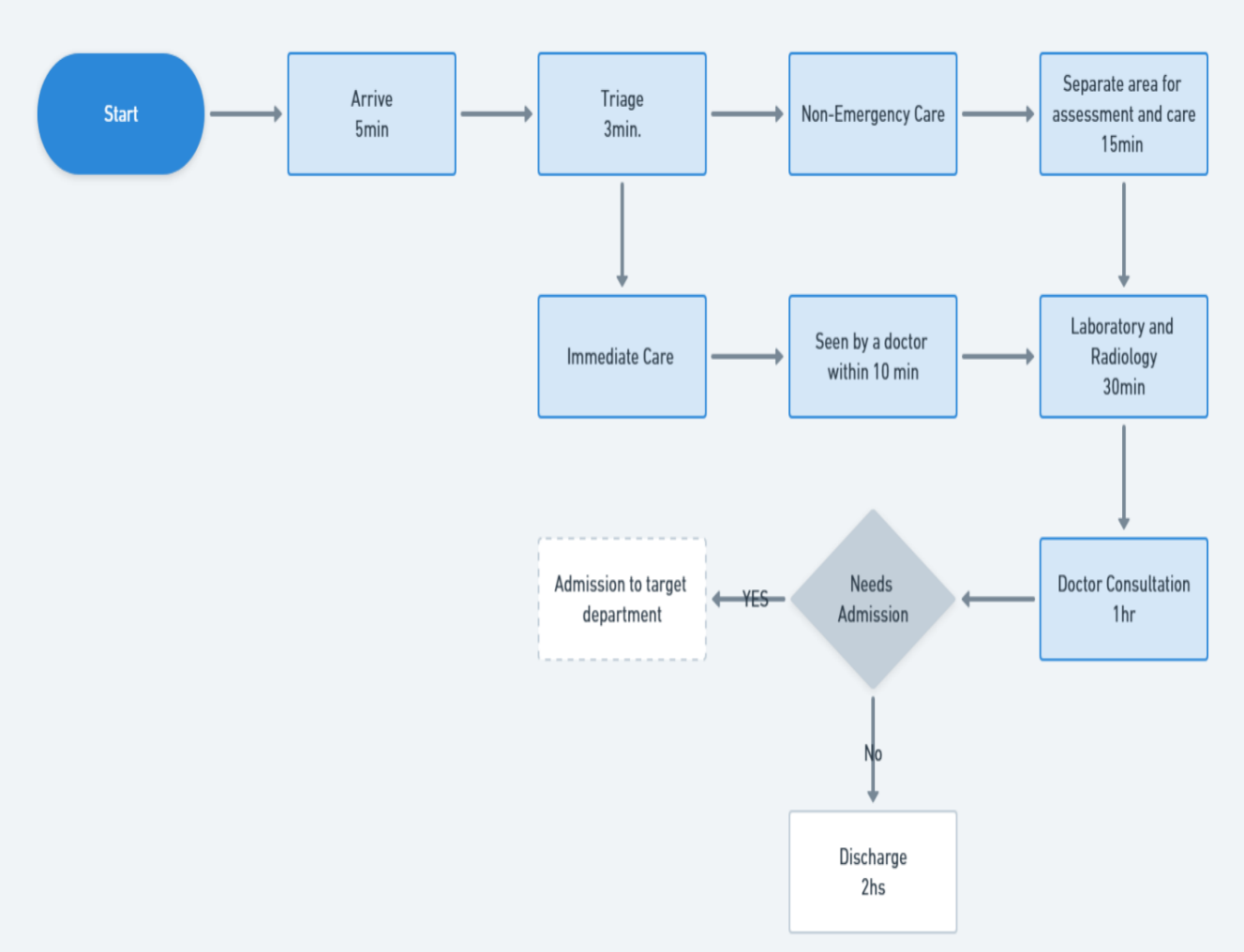

Figure 4.13: Diagram for proposed improved PF in PMC Hospital ED

4.8 Voice of Patients as Lean Strategy

Incorporating the Voice of Patients is a powerful approach within Lean healthcare. Lean principles emphasize eliminating waste and maximizing value. In healthcare, true value can only be defined by the customer, which in this case is the patient. After all, the main mission of healthcare is to treat and cure patients – they are the end-consumers in the care process (Greenhalgh, Jones, & Armstrong, 2017). Therefore, by collecting and analyzing patient feedback through VoP methods, we gain a crucial understanding of what aspects of care truly matter to them (Nelson, Batal, Jha, Kossovsky, & Epstein, 2002). The quality of a service can then be measured not just by clinical outcomes, but also by the level of satisfaction of the recipients of that service (Donabedian, 1980). By prioritizing patient needs and experiences, VoP

empowers Lean initiatives to target waste that directly impacts patient satisfaction, leading to a more efficient and effective healthcare system.

4.8.1 Reasons for Visiting ED and Relevant Waste

Similar to a global trend, EDs in Palestine face a challenge – patients utilizing them for non-urgent medical needs. This overuse strains the healthcare system, leading to overcrowded EDs, longer wait times for true emergencies, and stress on staff (Bani Odeh et al., 2024).

Several factors contribute to this situation in the Palestinian context. One major reason might be limited access to primary care is a major contributing factor. A shortage of primary care physicians in Palestine can lead to long wait times for appointments. Faced with discomfort or a perceived need for immediate attention, patients might choose the ED despite its purpose for true emergencies. Furthermore, inconvenient clinic hours can be a barrier. If primary care clinics have limited operating hours, patients who work or have busy schedules might find the ED's 24/7 availability more convenient. Financial barriers can also play a role. The lack of health insurance or high co-pays for primary care might make the ED seem like a more affordable option, despite the generally higher cost of ED care.

Patient perceptions also influence ED use for non-urgent needs. Misunderstandings about the urgency of their condition can lead patients to believe the ED is necessary. Additionally, a lack of familiarity with the healthcare system can cause them to bypass primary care altogether, unaware of its role in addressing their concerns. The perceived faster service of the ED can be particularly appealing compared to waiting for a primary care appointment, especially for patients experiencing discomfort or anxiety. Finally, negative experiences with primary care providers in the past might lead to a lack of trust, causing patients to seek care directly from the ED.

Although the Palestinian MOH manages a network of 765 primary healthcare centers (606 in the West Bank) serving a population of over 1.9 million with an average of 6,435 people per center (Ministry of Health, Health Annual Report, Palestine 2021, June 2022). This network has grown significantly since 1994 (The number of primary health care centers increased from 203 at the end of 1994 to 491 in 2021, with an increase of 142%). Palestine also boasts 89 hospitals with a total bed capacity of 7,769, with the West Bank accounting for 54 hospitals and 4,182 beds [59].

Despite this infrastructure, emergency room visits remain high, with over 2.2 million recorded in 2021 of which 853,806 visits in the MOH hospitals in the West Bank.
a lack of awareness or education can contribute to non-value-added visits. Patients might visit the ED for conditions better suited for urgent care or primary care due to a lack of understanding about appropriate healthcare options. This misuse of resources results in waste from unnecessary testing and treatment in the ED, diverting resources from true emergencies.
It is obvious that any attendance at EDs for reasons that cannot be shown to be related to their main duties will contribute to a waste that affects patient flow.
Consequently, these will be categorized as waste-based, or non-value-added, activities according to lean thinking.

4.8.2 Trends in the Use of the ED at Ramallah PMC

“Cannot afford other places” had the highest mean scores (4.46 ± 1.06), suggesting a possible trend of using the ED for non-emergency needs due to limited access to affordable primary or specialty care. Reasons like "referred by primary care" and "closest location" suggest a potential lack of awareness about alternative care options for non-urgent needs.
24.5% of patients were frequent visitors, which might indicate chronic health conditions that could be better managed with primary care, potentially contributing to ED overcrowding.
a lack of standardized work schedules for staff can disrupt operational flow and hinder efficient patient care. Inconsistent staffing patterns make it difficult to ensure adequate personnel are available at all times, leading to delays and bottlenecks, in addition, the absence of defined metrics for patient flow creates a knowledge gap (General Directorate of Performance Control, 2020). Without established benchmarks for wait times and processing steps, it becomes challenging to identify areas for improvement. This lack of data makes it difficult to pinpoint exactly where congestion is occurring and hinders efforts to streamline the patient experience. These issues directly impact the quality of service patients receive. Long wait times and inefficient care processes can create frustration and dissatisfaction. Additionally, increased pressure on staff can lead to burnout and potentially compromise care quality.
Looking ahead, this research proposes a patient-centered approach to improve PF in EDs. The core principle is the VOC derived from Lean Thinking. Lean strategy and Six Sigma are emphasizes understanding customer needs and experiences to drive process improvement. In the

context of EDs, this translates to gathering insights directly from patients who visit the ED provides valuable information about their experience. By involving patients in the process, researchers and healthcare providers can gain valuable insights and develop solutions that truly improve the patient journey through the ED.

Improved access to primary care: Ensuring affordable and accessible primary care services can help steer patients away from the ED for non-urgent needs.

In addition, educating the public about appropriate healthcare utilization can help them understand when the ED is the right option and when to seek primary care and developing urgent care centers or implementing extended hours for primary care clinics can provide better options for non-urgent needs, reducing strain on the ED.

4.8.3 Concept of Quality in ED Services through the Lens of Lean Thinking

Thinking emphasizes two core concepts: value and flow. In the context of ED services, value can be defined as anything that contributes to a positive patient outcome, while minimizing waste. This includes:

1. Accurate and timely diagnosis and treatment: This is the core value proposition of an ED visit.
2. Respectful and compassionate care: Patients like being understood, heard, and given respect.
3. Minimizing wait times: Prolonged wait times can aggravate a patient's condition and cause discomfort and anxiety.
4. Resource efficiency: This guarantees the best possible care for patients without wasting staff time, supplies, or equipment.

There is a worrying discrepancy between what patients value and their actual experiences, according to the survey results from PMC's ED. Patients emphasize the ED's usability and accessibility, as shown by their attention to service-related reasons for visiting. They also place a high value on efficiency and clear communication, as evidenced by how much emphasis they put on prompt wait times and procedure descriptions.

According to research by Amro et al. (2018), patient satisfaction in emergency rooms is a crucial sign of the caliber of treatment and service provided. Nonetheless, the study also indicates a lack

of satisfaction with PMC's general level of care quality. This implies that patients believe essential services like diagnosis, treatment, and respect are being provided at a low value. Long wait times can point to an issue with the ED's PF, suggesting that patients are not moving through the system quickly enough.

It is critical to take into account the larger background of Palestinian emergency services. Amro et al. (2018) note that these services are provided under extreme time constraints, with a shortage of medical supplies and equipment as well as a shortage of human resources. The severity of Israeli aggression against Palestinians has probably escalated, making this problem worse and placing more burden on the hospital system.

The Palestinian MOH (Ministry of Health, Health Annual Report, Palestine 2021, June 2022) emphasizes its commitment to maintaining a continuous and high-quality healthcare system for all citizens. However, the survey results suggest that PMC's ED may be falling short of these goals.

The healthcare system can often lose its way, prioritizing the wrong aspects and creating inefficiencies that harm patients. Instead of focusing on what truly matters – the patient's well-being and experience – the system can become fixated on amenities, hospital profits, or even cost-cutting measures that ultimately compromise care. While these issues are important, they must be addressed with the patient at the center. Otherwise, these approaches lead to wasted resources and increased pain for the very people the system is designed to help.

4.8.4 Patient Satisfaction and Healthcare Service Quality

In the pursuit of understanding the true voice of the patient, healthcare providers are encouraged to walk in their shoes, accompanying them throughout their entire hospital stay. As Garrubbo (2013) insightfully suggests, "If you want to see what your patients experience, accompany them during their entire stay. What a great way to get the true voice of the customer" (p. 12). This approach is fundamental to grasping the essence of patient-centered care and the direct observation of patient experiences, which are critical components in evaluating the quality of healthcare services provided.

Our survey, which delved into the patient experience at PMC Hospital's ED, shed light on the satisfaction levels with various elements of the ED. The results were eye-opening, pinpointing critical quality elements that profoundly affect patient flow and satisfaction levels.

Waiting periods were the main source of concern for patients. According to the poll, patients waited an average of 3.46 hours, and lengthy waits were recorded at every point of the process, including reception, a nurse's assessment, a doctor's diagnosis, and laboratory and radiology procedures. A significant amount of discontent stemmed from this protracted waiting period. Additionally, the ED staff's treatment did not live up to the patients' expectations. Patients said there was a perceived lack of necessary staff, that the time allotted for nursing examinations was insufficient, and that consultations and diagnoses were not thorough enough. A perception of neglect and a decreased degree of confidence in the treatment received were exacerbated by these circumstances.

In addition, the ED's physical surroundings and amenities were deemed inadequate. Improvements were determined to be necessary in the areas of ED accessibility as well as the waiting area's comfort and cleanliness. Despite being frequently disregarded, these elements are crucial in determining the whole patient experience.

The poll also revealed that patient care services—which include regard, respect, and effective communication—scored poorly. Patients said that their opinions were ignored and that timely and clear explanations of medical tests and treatments were not always given. A weakened sense of wellbeing and a lack of trust may result from this communication breakdown.

Finally, there was a general feeling of discontent with the ED experience. Patients were not likely to refer friends and family or return to the ED in the future for medical care. This sentiment emphasizes how urgently all ED components must be improved in order to guarantee a better patient experience.

However, our study also showed that several quality indicators were more positively perceived by the patients. While not perfect, some patients found the availability of some medical examinations to be acceptable, suggesting that this is not a major worry for all respondents. Although the registration staff's services were a source of disagreement for many, some people felt that they were adequate, suggesting that the hospital can still improve in certain areas while also meeting minimum standards.

Last but not least, despite the concerns of many, other patients viewed the prioritizing of emergency cases as appropriate, which reflects the wide range of experiences that patients have in the ED.

EDs place a high premium on providing exceptional patient care. According to Amro et al. (2018), patient satisfaction is a crucial metric for assessing the caliber of treatment and services

provided by these departments. The Palestinian MOH, as highlighted in their 2021 Annual Report (Palestinian Ministry of Health, Health Annual Report, Palestine 2021, June 2022), is firmly committed to maintaining a strong Palestinian healthcare system and providing its citizens with high-quality, comprehensive health services.

These worries were confirmed by a 2024 study on Quality Standards for EDs in Palestine. The study used a number of techniques to assess both patient satisfaction and the general standard of service in EDs. It underlined how crucial it is to address the crucial areas that have been found to require improvement in order to improve patient satisfaction as well as the general standard of care provided in these departments. According to research by Amro et al. (2018), patient satisfaction is greatly impacted by a number of factors, including waiting times, staff responsiveness, contact with healthcare providers, and the ED's general atmosphere. According to the study's findings, raising these variables may significantly raise patient satisfaction.

And the PMC Hospital is where these elements show up. Uneven times of congestion were noted by the General Directorate of Performance Control (2020) when patients were being registered in the emergency room. Patient care delays are caused by this congestion, which is linked to a lack of registration personnel. Although waiting periods normally last five to ten minutes, they may last up to twenty minutes.

Moreover, data documentation poses an additional difficulty. According to statistics (General Directorate of Performance Control, 2020), just 36% of patients had documented discharge summaries when they left the department. This suggests that the system is inefficient.

Additionally, there are a number of difficulties that EDs in the US encounter that may have a detrimental effect on patient satisfaction. These difficulties put stress on the healthcare system in addition to affecting patient satisfaction.

One major concern is overcrowding. EDs often struggle to manage the influx of patients, leading to long wait times and a feeling of being rushed for both patients and staff. This overcrowding directly impacts patient satisfaction. A study by Lin et al. in 2019 found a significant correlation between overcrowding and negative patient experiences. Patients waiting in overcrowded EDs reported being 32% less satisfied with their overall experience compared to those in less crowded departments.

In light of these challenges, it's crucial for US EDs to prioritize the voice of the patient and actively seek ways to enhance their satisfaction, especially, Patient satisfaction is no longer just a subjective measure. The Joint Commission International (JCI) accreditation process, a globally

recognized standard for healthcare quality, now places significant emphasis on patient satisfaction. Hospitals strive to achieve JCI accreditation to demonstrate their commitment to providing high-quality care.

The current ED PF can be evaluated based on patient perspectives regarding the quality of services in six dimensions: responsiveness, tangibles, assurance, empathy, professionalism, and reliability. Its right that questionnaire does not provide specific mean scores for each of these dimensions or a breakdown of the 33 elements (variables) of patient perspectives of quality of services. However, it does offer a general overview of patient satisfaction and quality perceptions across various aspects of the ED experience.

To provide a comprehensive view, I will synthesize the relevant information from the questionnaire to create a summary that aligns with the six dimensions of service quality.

1. Responsiveness

- Waiting Times: The overall mean of waiting time in the ED was (3.46 ± 0.79), indicating long waiting times. Patients reported significant agreement with long waiting times at various stages, including reception, examination by nurses, diagnosing by doctors, laboratory procedures, and radiology procedures.
- Speed and Efficiency: There was dissatisfaction with the speed and efficiency of services, with 29.5% of participants agreeing that the service was not quick and efficient.

2. Tangibles

- Facility and Environment: The mean score for satisfaction with the facility and environment was low (2.22 ± 0.89). Respondents were extremely dissatisfied with the ED's accessibility (69.5%), and there was a significant dissatisfaction with the comfort and cleanliness of the waiting area.
- Equipment and Facilities: There was dissatisfaction with the functioning of medical devices (56%) and the availability of some medical examinations (48%).

3. Assurance

- Accurate Diagnosis and Treatment: A significant portion of respondents (39%) strongly disagreed with the accuracy of diagnosis and proper treatment.

- Expertise and Efficiency of ED Staff: 60% of respondents strongly disagreed with the expertise and efficiency of ED staff.

4. **Empathy**

- Respect and Consideration: Many respondents (49.5%) were dissatisfied with the respect and consideration shown by the ED staff.
- Listening to Complaints and Questions: A large percentage of respondents (56.5%) were dissatisfied with how their complaints and questions were handled.

5. **Professionalism**

- Care of ED Staff: The overall satisfaction with the care of ED staff was low ($M \pm SD = 2.34 \pm 0.85$), with significant dissatisfaction in areas such as the time of nursing primary examination (63.5%), comprehensive consultation and diagnosis by doctors (37%), and the availability of necessary staff (39%).

6. **Reliability**

- Minimizing Diseases, Mortality, and Disability: There was strong disagreement (71.5%) with the ED's ability to minimize diseases, mortality, and disability.
- Serving the Maximum Number of Patients: There was also strong disagreement (82.5%) with the ED's capability to serve the maximum number of patients possible.

Overall Quality and Satisfaction

- Total Satisfaction: The mean score for total satisfaction was low (2.39 ± 0.603), indicating a generally unsatisfactory experience.
- Correlation with Waiting Times: Longer waiting times were associated with lower satisfaction across multiple dimensions, with significant negative correlations observed for overall experience satisfaction and total satisfaction.

While the research on the ED at PMC provides valuable insights into patient satisfaction and service quality, it is important to recognize that other studies in Palestine have identified additional factors influencing patient satisfaction

One study explored (Amro, et al. 2018) overall service quality across various Palestinian hospitals. Patients expressed appreciation for the availability of medical services, the competence of medical staff, and the cleanliness of facilities. However, long waiting times, inadequate communication with healthcare providers, and a lack of patient privacy emerged as significant concerns.

Another study by a Aljuneidi, (2023) focused on primary healthcare centers, assessing the quality of services and patient satisfaction. Here, accessibility of care and medication availability were positively noted. However, limitations in specialized services, insufficient medical equipment, and restricted operating hours were identified as areas requiring improvement.

These studies showcase the importance of looking beyond specific departments to understand the broader patient experience in Palestinian healthcare. While dedicated staff and clean facilities are commendable, addressing wait times, communication gaps, and privacy concerns remains crucial. Similarly, primary care can benefit from expanding specialized services, bolstering equipment, and extending operating hours to better serve the community's needs.

4.8.5 Major Problems from Patient Perspectives

The ED at PMC is grappling with several critical issues as reported by patients who participated in an evaluation survey. A significant concern is the prolonged waiting times, patients reported long waiting times at various stages of their ED journey, which was a source of dissatisfaction. The overall mean waiting time in the ED was 3.46 ± 0.79, indicating agreement with the perception of lengthy delays. Specifically, patients experienced long waits at reception, before examination by a nurse, before diagnosing by a doctor, and during laboratory and radiology procedures. These delays contribute to an extended LOS in the ED, as evidenced by the total time from arrival to discharge, which is 188.54 ± 192.772 minutes.

A major problem is the deficiency in admitting patient beds, with 77% of participants expressing dissatisfaction with the bed capacity at the ED. This issue likely exacerbates the overcrowding and the increased waiting times, which are indicative of a rise in ED patients' volume that the department is struggling to manage.

The survey also suggests that there may be delays in disposition planning, as patients are dissatisfied with the speed and efficiency of the service. This implies that the processes for

determining the next steps for patients—admission, transfer, or discharge—could be more efficient.

4.9 Voice of Staff and Process as Lean Strategy

The 'Voice of Staff' and the 'VOP' are valuable sources of information for lean thinking in healthcare, such as enhancing patient flow in an ED. Staff experience helps detect waste and inconsistencies, while data analysis helps find bottlenecks and inefficiencies. This section highlights the importance of integrating the Voice of Staff (VOP) to identify waste and inefficiency, which is crucial for addressing congestion and improving operational efficiency, aligning with Hypothesis 2. Including both points of view guarantees a comprehensive understanding of the existing state of affairs, resulting in more efficient solutions for improved PF.

Research has indicated that better results occur when staff members are involved in initiatives for change. In the ED, for example, frontline staff involvement in change identification and implementation led to significant decreases in length of stay and percentages of patients leaving without being seen (Wolf et al., 2015). Lean promotes a collaborative atmosphere where employees can use their real-world expertise to identify issues and provide solutions by integrating voice of the staff with VOP.

Continuous improvement is emphasized by the Lean philosophy, and hearing what employees and VOP have to say is essential to achieving this. Research such as Shojania et al. (2008) showed that more long-lasting and beneficial changes result when quality improvement initiatives are guided by data from voice of the workers and VOP. Furthermore, by addressing staff concerns raised through voice of staff, like staffing shortages or inadequate training, improvements in morale and efficiency can be achieved. This, in turn, leads to better patient care. The important factors affecting PF in the ED based on the voice of the ED staff, shown as following points:

- Lack of medical staff, particularly nurses (30%).
- Thirty percent of participants said that having patient relatives' present and frequent intervention caused serious problems.
- A third of the participants suggested hiring more physicians and nurses in order to manage the patient load more effectively and prevent staff burnout (33%).
- Increase Staffing (33%).

- More than half of the respondents (56.7%) expressed dissatisfaction with the availability of beds for patients, making it a serious worry.
- The lack of beds (4%) in some cases also contributes to longer wait times.
- Increase Bed Capacity (33%).
- Delays were also caused by issues with the computerized system (26%), like frequent hang-ups.
- System Improvements (16%).
- The number of patients/overload of patients was the most commonly cited issue (41%) that contributes to lengthy wait times in the ED.
- A significant percentage of non-emergency cases (16%) that might be managed in primary care settings instead of the ED.
- Public Education (7%).

4.10 Model for Future Improvement in Patient Flow

In our research, we demonstrate that the integration of the voice of the customer (internal and external), the voice of the process, and the DMAIC methodology is an effective lean tool to identify and eliminate waste in EDs, which aligns with the hypothesis regarding service quality improvement. By understanding fundamental factors, engaging frontline workers, and it is essential to develop and implement effective strategies for continuous quality improvement. VSM is one such tactic that has shown to be effective in locating and getting rid of waste in healthcare procedures. Long wait times and pointless steps in the process can be found, along with other waste and inefficiencies, by charting the movement of patients through the emergency department. (Wolf et al., 2015) found that significant decreases in length of stay and left-without-being-seen rates occurred when frontline staff was involved in the identification and implementation of changes in the ED. This illustrates how VSM can successfully find and fix PF bottlenecks, improving both operational effectiveness and patient satisfaction. In order to prevent any abrupt changes in the number of ED visitors, VSM can also assist in the creation of short- and long-term backup plans, ensuring that the department is capable of managing variations in patient load. Enhancing PF is one of the EDs' top priorities. Modernizing IT systems to cut down on administrative delays, assuring proper workforce levels, and streamlining triage procedures

are all effective tactics. These variables can be addressed by EDs to shorten wait times and enhance the general patient experience.

4.10.1 Future Value Stream Mapping

The process of creating a VSM entails gathering a lot of information, seeing things firsthand, and getting advice from different ED staff members.

A great deal of information was obtained by closely observing the service delivery process in order to create an efficient VSM. This observation yielded average process times and helped illustrate how various service delivery processes interacted. Additionally, in order to obtain important insights into the theory and practice of ED operating processes, interviews with ED doctors, nurses, administrators, nursing staff, and unit porters were undertaken. In order to construct the VSM and comprehend the present ED service delivery procedures, data from various sources was gathered.

4.10.2 Enhancing Patient Flow

To enhance PF at PMC, the following evidence-based recommendations can be put into practice:

- **Fast-Track System for Non-Urgent Cases**

Implement a dedicated Fast-Track System to manage level 3, 4 patients, reducing overcrowding and length of stay by allowing for quick assessment and management (Abu Olwan, 2021). This system should be integrated before patient registration to streamline processes, with two experienced nurses staffing triage shifts for efficiency (Al Owad, 2013).

- **Physician-Led Team Triage**

Implement a Physician-Led Team Triage approach to expedite patient input and optimize ED processes, potentially leading to shorter lengths of stay and higher patient satisfaction (Abu Olwan, 2021).

- **Diagnostic Testing in the Waiting Room**

Initiate diagnostic testing for patients in the waiting room to decrease time spent occupying ED beds, potentially reducing length of stay and the number of patients leaving without being seen (Abu Olwan, 2021).

- **Nurse-Led Emergency Journey Coordinator**

Introduce a Nurse-Led Emergency Journey Coordinator role to enhance management of patient flow and reduce length of stay, ensuring the coordinator can focus on flow management without clinical distractions.

- **Creating Continuous Flow**

Establishing continuous flow systems from patient registration to discharge is essential for improving patient flow in the emergency department. This entails improving communication techniques, integrating systems, and getting rid of non-value-added tasks at every step of the procedure.

- **Enhanced Primary Care Access**

Improve access to primary healthcare services by extending hours of operation for PHCCs, thereby mitigating the number of non-urgent visits to the ED and alleviating overcrowding.

- **Addressing PHCC Closure Impact**

Provide ED staff with the necessary support to manage the influx of patients efficiently during times when PHCCs are closed, to address the exacerbated overcrowding.

- **Monitoring and Auditing**

Frequent audits and ongoing patient flow monitoring guarantee compliance with the mechanisms put in place and point up opportunities for improvement.

4.10.3 The VSM and Improvement Strategies

The VSM will act as a visual representation of the ED process, highlighting current wait times, bottlenecks, and opportunities for improvement. This section describes how VSM acts as a visual representation of the ED process, highlighting current wait times and bottlenecks, which supports the hypothesis regarding the identification of wasteful practices. By incorporating the recommended strategies within the VSM framework, we can create a future state map that optimizes patient flow and enhances patient care delivery at PMC.

4.10.4 Proposed Future Value Stream Map

A comprehensive data collection process was conducted to create the Current VSM for patient flow in the ED at PMC Hospital, as depicted in (Figure 4.14). This process involved direct observation of various service delivery processes to determine average process timeframes and understand their interactions. Additionally, interviews were conducted with ED physicians, nurses, administrators, and nursing staff to gain insights into the theoretical and practical aspects of ED operations.

Data was gathered from multiple sources, including patient wait times, staffing levels, bed availability, and IT system performance, to provide an accurate representation of the ED's current state. This meticulous data collection enabled the development of a VSM that that highlights areas where patients experience delays, such as at triage, reception, and during doctor's appointments in the ED. This section discusses the creation of a Current VSM for patient flow, emphasizing its role in identifying delays and optimizing patient flow, which aligns with Hypothesis 3.

The VSM serves as a foundation for future improvements by outlining the current process. This allows the hospital to strategically plan and implement changes that will optimize patient flow, reduce wait times, and enhance overall patient satisfaction.

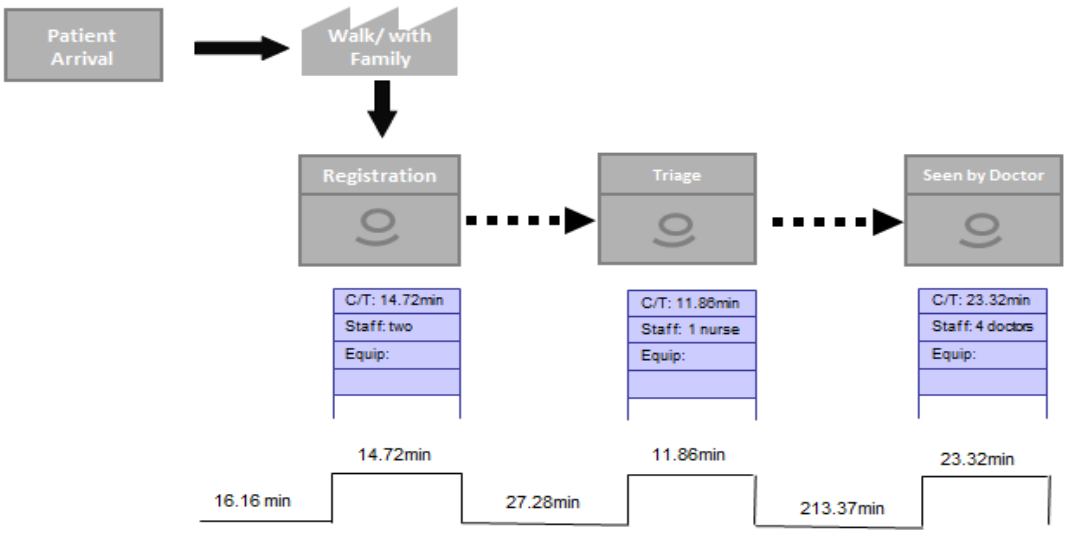

Figure 4.14: Current value stream map for patient flow in ED

The (Figure 4.14) shows a VSM of PMC Hospital's ED, revealing significant cycle and delay times, highlighting challenges in reception, triage, and doctor visits.

At the reception, the presence of two receptors suggests an attempt to expedite the initial patient intake process. However, the data indicating a cycle time of 14.72 minutes and a delay time of 16.16 minutes after reception implies that despite the dual staffing, there may still be inefficiencies in how patients are moved from registration to the next stage of care. This due to issues such as system delays, inadequate communication with downstream processes and the capacity to handle the flow.

In the triage area, the solitary nurse conducting assessments with a cycle time of 11.86 minutes reflects a focused effort to swiftly evaluate patients. The subsequent delay time of 27.28 minutes, however, indicates that the system struggles to promptly connect triaged patients with the appropriate care providers or areas. This bottleneck may stem from a lack of coordination between triage and the rest of the ED, understaffing in other areas, or an imbalance between the volume of patients and the capacity to accommodate them.

Within the ED itself, the presence of four doctors reflects a commitment to providing medical attention to patients. The cycle time of 23.32 minutes for seeing a doctor suggests that once patients are with a physician, the consultation process is relatively efficient. The staggering delay time of 213.37 minutes before this consultation, however, points to a critical gap between the need for medical evaluation and the availability of doctors to conduct these evaluations. This could be due to factors such as excessive patient volume overwhelming the available doctors, inefficiencies in patient routing, or delays in the diagnostic process that precede the consultation.

To further analyze the efficiency of the ED process at PMC Hospital, it would be beneficial to calculate the percentage of value-added time (%VA), which is determined by the formula: (Sum of Cycle Times / Lead Time) * 100. This calculation provides insight into the proportion of time spent on activities that directly contribute to patient care versus time spent waiting or on non-value-added tasks.

Using the data from the Value Stream Map (VSM) in Figure 9, we can calculate the %VA as follows:

%VA= (Sum of Cycle Times / Lead Time) * 100

%VA = (49.9 / 306.71) * 100

%VA = 16.26%

The calculated %VA is only 16.26%, which is quite low and confirms that there is a significant opportunity for improvement within the ED process. This low percentage indicates that the majority of the time patients spend in the ED is not directly contributing to their care but rather is consumed by delays and non-value-added activities.

Several tactics can be used to increase the ED's overall efficiency and the percentageVA activities. First, lead times can be greatly lowered by addressing the underlying causes of delay times, such as improving IT systems, staffing levels, and administrative procedures. Second, the percentageVA can be improved by raising the number of value-added activities and concentrating on those that have a direct bearing on patient care, such as triage evaluations and doctor consultations. Third, the ED process can continue to be improved by promoting a culture of continuous improvement and routinely analyzing the VSM to find and remove waste. By using these tactics, PMC Hospital can try to lower overall lead times, raise the percentageVA, and improve the efficiency and patient-centeredness of the ED.

4.11 Critical Success Factors for Lean Implementation

While implementing a lean program holds great promise for improving efficiency and reducing waste, significant challenges can arise during its introduction. Overcoming resistance to change from staff accustomed to existing processes can be a hurdle. Additionally, ensuring clear communication and buy-in from leadership is crucial for successful implementation. Fortunately, research has identified critical success factors that can help navigate these difficulties.

Firstly, the leadership commitment. Without strong buy-in from upper management, a lean initiative can quickly lose momentum. Leaders need to be champions for the program, allocating resources, removing roadblocks, and holding themselves accountable for its success (Laureani and Antony, 2012) so, strong leadership commitment is one of the most critical factors for success (Antony et al. 2006).

Secondly, employee engagement is another critical success factor (Wolf et al. 2015) Lean programs are most effective when employees are actively involved. This means providing comprehensive training on lean principles and tools, soliciting their ideas for improvement, and empowering them to make changes on the front lines. A successful lean program fosters a cultural shift towards continuous improvement (Shukri et al. 2018)

This requires an environment of open communication where employees feel comfortable raising concerns and suggesting new approaches. It's also important to celebrate successes and recognize employee contributions to keep motivation high (Shah and Ward, 2007).

Thirdly, a well-defined plan with clear goals and metrics is essential. Clearly defined goals provide a roadmap for the program (Antony et al. 2006), while metrics allow you to track progress and measure the impact of your efforts. It's critical to concentrate on value by identifying and removing non-value-added activities for success because this data may be utilized to highlight areas that require more attention and show stakeholders the program's worth (Laureani, A., & Antony, J. 2012).

Lastly, lean programs can successfully modify standardized work (Wong et al. 2010).

Chapter Five: Conclusions and Recommendations

5.1 Overview

The study's conclusions, key recommendations, a discussion of possible future research directions, and a description of the study's shortcomings are all included in this chapter.

5.2 Conclusion

This thorough analysis emphasizes the major problems that the ED at the PMC in Ramallah faces, with a particular emphasis on the pressing problems of patient discontent, lengthy wait times, and congestion. The research offers a methodical strategy to identifying and resolving these issues by utilizing the combination of Lean and Six Sigma approaches, improving the ED's overall effectiveness and standard of care. The reason this study is significant is that not much research has been done on using Lean concepts and the Six Sigma technique to analyze and improve PF in EDs.

Key Findings and Contributions

1. Multidimensional Challenges: The investigation shows that a variety of intricately intertwined elements, such as staffing numbers, bed capacity, IT infrastructure, security, and facility conditions, have an impact on ED performance.
2. Quantified Metrics: The study offers numerical data on wait times at different ED process steps, which may be used as a baseline to gauge the severity of the problems and monitor progress.
3. Root Cause Analysis: This paper pinpoints the precise sources of ED inefficiencies and overpopulation, which is essential for creating focused remedies.
4. Staff and Patient Perspectives : Including the opinions of both staff and patients in the analysis emphasizes how crucial it is to take a comprehensive approach to comprehending and resolving ED issues.
5. Strategic Goals: The study offers a framework for strategic changes by defining precise, quantifiable goals for enhancing staff performance, patient happiness, and wait times.

6. Implications for Public Health: The findings about the overuse of emergency departments (EDs) for non-urgent cases have an impact on public health policy and highlight the need for better access to primary care.
7. Useful Suggestions: The document provides useful suggestions that can be applied in comparable healthcare environments to improve patient flow, such as physician-led triage and fast-track systems.

5.3 Recommendations

In order to maximize PF, minimize wait times, and improve overall efficiency of the ED, the following suggestions are recommended:

1. Increase Staffing Levels: To efficiently manage the patient load and prevent staff fatigue, address the shortage of medical staff, especially nurses and doctors.

2. Increase Bed Capacity: To handle the large patient load and lessen overcrowding, increase the number of beds available.

3. System Improvements: To cut down on administrative lag time and boost data processing effectiveness, update and modernize the IT systems.

4. Public Education: Launch public education initiatives to educate the public about proper ED usage and motivate non-emergency cases to look for other forms of care.

5. Fast-Track System for Non-Urgent Cases: Establish a special fast-track system to handle patients who are not emergencies in order to lessen their effect on patient flow and duration of stay.

6. Physician-Led Team Triage: To speed up patient intake and enhance ED procedures, use a physician-led team triage strategy.

7. Diagnostic Testing in the Waiting Room: To reduce the amount of time patients spend in the ED bed unnecessarily, start diagnostic testing for patients in the waiting room.

8. Nurse-Led Emergency Journey Coordinator: Create a position that is led by a nurse to oversee patient flow and shorten hospital stays.

9. Improve Access to Primary Care: To reduce the amount of non-urgent ED visits, extend the hours of operation for primary healthcare facilities.

10. Address PHCC Closure Impact: To efficiently handle the higher patient load during periods when primary healthcare facilities are closed, give ED staff extra assistance.

11. Monitoring and Auditing: To guarantee adherence to new procedures and spot potential areas for improvement, conduct routine audits and continuous patient flow monitoring.

12. Improve Security Measures: To guarantee a secure atmosphere for both employees and patients, add more security personnel and put in place procedures to deal with unruly patient conduct.

13. Staff Training and Development: Provide staff members with continual training opportunities to stay current on medical techniques and technologies, which will improve their competency and quality of care.

14. Resource Allocation: Make sure that enough medical supplies, tools, and resources are available to enable efficient patient care.

15. Policy Implementation: Create and implement standard operating procedures and rules that clearly define ED operations and guarantee effective and consistent practices.

5.4 Future Research Directions

Subsequent studies might concentrate on the long-term effects of applying Six Sigma and Lean techniques at the PMC ED. It would be helpful to investigate the long-term effects of the suggested strategies—such as facility expansion, fast-track system for non-urgent cases,—on patient flow and satisfaction. Furthermore, studies could examine how sustainable these advancements are and pinpoint any unanticipated difficulties. It would also be beneficial to look

into the culture's shift toward continuous improvement and how staff empowerment and training contribute to the maintenance of these changes. Additionally, analyzing how facility modernization and growth affect staff performance and patient care may shed light on the recommendations' wider ramifications.

5.5 Limitations of Study

The following study limitations should be noted:

1. The study admits that resource restrictions resulted in limitations in data collecting. A reduced sample size or abbreviated observation duration may have an effect on the findings' strength and generalizability. More comprehensive data gathering and a bigger, more representative sample may be possible in future studies with greater funding.

2. The proposed strategic improvements, while supported by the study's findings, may face implementation challenges due to organizational inertia, resistance to change, and the need for additional resources.

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Appendices

Appendix A: Patient Questionnaire

As part of preparing a Master's thesis titled "Using Lean Six Sigma to Improve Patient Flow in the Emergency Department at Palestine Medical Complex in Ramallah," the researcher, Zahraa Mohammed Sarsour, from the Master's program in Quality Management in Healthcare Institutions at the Graduate School of the Arab American University, is conducting a field study to evaluate the quality of services in the Emergency Department at Palestine Medical Complex. This evaluation will utilize the Lean Six Sigma methodology through the attached survey.

Given the importance of your opinion in enriching this study, we kindly ask for your cooperation in answering the questions in the survey accurately and objectively. Please note that all data will be used solely for scientific research purposes, and the estimated time to complete this survey is approximately five minutes.

Thank you.

Researcher

Zahraa Sarsour

Questionnaire for Patients

1. General Information

A. Sex:

[ ] Male [ ] Female

B. Education Level:

[ ] No Formal Education [ ] Primary [ ] Secondary

[ ] Diploma [ ] Bachelor [ ] Higher Education

C. Age:

[ ] Below 18 years old [ ] From18 - 30 years old

[ ] From 31 - 50 years old [ ] Above 50 years old

D. Place of Residence: ……..

E. How many times (including this one) have you visited an ED department as a patient in the last 12 months?

a) This was the only time
b) 2 – 3 times
c) 4 – 5 times
d) 6 or more times
e) Don't know / can't remember

2. A- Pathological Reasons for Attending Emergency Department (ED): Please indicate the degree of importance for each of the following reasons by checking the appropriate number. You can choose more than one reason.

1 – Unimportant, 2 - Somewhat Important, 3 - Moderately Important, 4 – Important, 5 - Very Important.

Reasons	5	4	3	2	1
1. Minor injury: A simple injury, such as "stubbing your toe" or "aching hand."					
2. Laceration: A cut or tear that may require stitches, such as a "cut on the finger."					
3. Musculoskeletal pain: Pain in the bones, muscles, or joints, excluding fractures and sprains, such as "low back pain" or "stiff knee."					
4. Accident-related injury: Injuries resulting from accidents, such as a "car accident" or "falling down the stairs."					
5. General symptoms: Feeling unwell or fatigued, such as "poor health condition" or "fainting."					
6. Gastrointestinal symptoms: Pain in the stomach or intestines, such as "abdominal pain" or "nausea."					
7. Fracture or dislocation: A broken bone or dislocated joint, such as a "broken wrist" or "dislocated shoulder."					
8. Sprain or strain: A sudden movement that causes pain in the muscles or ligaments, such as a "sprained ankle" or "pulled muscle."					
9. Shortness of breath: Difficulty breathing.					
10. Sore throat: Pain or discomfort in the throat.					
11. Toothache or dental problem: Pain or discomfort in the teeth or gums, such as a cavity, chipped tooth, or abscess.					
12. Urinary tract infection (UTI): An infection in the urinary system, causing symptoms like burning urination, urgency, and cloudy urine.					
13. Women's health or obstetric issue: A problem related to the female reproductive system or pregnancy, such as menstrual cramps, irregular bleeding, or complications during pregnancy.					

2. B- Other Reasons for Attending Emergency Department (ED): Please indicate the degree of importance for each of the following reasons by checking the appropriate number. You can choose more than one reason.

1- Strongly Disagree. 2- Disagree. 3- Neutral. 4- Agree. 5- Strongly Agree.

Reasons	5	4	3	2	1
1- Emergency Department is closest/easiest place					
2- The primary medical centre was closed					
3- Better medical treatment here					
4- Primary medical centre transferred me to here					
5- My health problem was too serious or complex to see a primary medical centre					
6- I wanted a second opinion					
7- Cannot afford other places					

3. Your concept of quality in Emergency Department services is based on the following: (please determine degree of your agreement with each of the following statements by checking (✓) the appropriate number)

1- Strongly Disagree. 2- Disagree. 3- Neutral. 4- Agree. 5- Strongly Agree.

Statements	5	4	3	2	1
1. Accurate diagnosis and proper treatment.					
2. Respect for Patients.					
3. The optimal utilization of available resources.					
4. Minimising the proportion of diseases, mortality and disability within the society.					
5. Serve the maximum number of patients possible.					
6. Expertise and efficiency of Emergency Department staff.					
7. Use of modern technology in providing health services in Emergency Department.					
8. Availability of adequate test facilities.					
9. Short waiting times throughout the process of treatment in Emergency Department.					

10. Minimize unnecessary tests and diagnosis.					
11. Errors free in treatment and diagnosis.					

4. Based on Your experience with this Emergency Department, please express the degree of your agreement with each of the following observations by checking (✓) the appropriate number:

1- Strongly Disagree. 2- Disagree. 3- Neutral. 4- Agree. 5- Strongly Agree.

Problems	5	4	3	2	1
Waiting time:					
• At reception was long.					
• Before examination by nurse was long					
• Before diagnosing by doctor was long					
• During laboratory procedures was long					
• During radiology procedures was long					

5. Based on Your experience with healthcare services in Emergency Department: please determine the degree of your satisfaction with each of the following elements by checking (✓) the appropriate number: Notes: 1- Very Unsatisfied. 2- Unsatisfied. 3- Neutral. 4- Satisfied. 5- Very Satisfied.

Elements	5	4	3	2	1
Medical services:					
1. How satisfied were you with the functioning of the medical devices?					
2. How satisfied were you with the bed capacity in the emergency department?					
3. How satisfied were you with the availability of medical examinations in the emergency department?					
Care of ED staff's					
4. How satisfied were you with the amount of time the nurse spent conducting your primary examination?					
5. How satisfied were you with the comprehensiveness of the doctor's consultation and diagnosis?					
6. How satisfied were you with the availability of necessary staff members?					
Arrival and Triage					
7. How satisfied were you with the assistance provided by the					

registration staff?					
8. How satisfied were you with the priority given to emergency situations based on the actual need?					
9. How satisfied were you with the speed and efficiency of the service when you were received in the emergency department?					
Facility and Environment					
10. How easy was it to find your way inside the emergency department?					
11. How would you rate the comfort and cleanliness of the waiting area?					
Patient Care					
12. How satisfied were you with how the staff treated you, considering their attention to you and how much they made you feel respected and valued?					
13. How well did the medical staff listen to your complaints and questions?					
Treatment and Education					
14. How satisfied were you with the explanations provided about medical tests and procedures?					
15. Were medical terms used by the staff explained in a clear and understandable way?					
16. How clearly were post-discharge follow-up and home care instructions explained to you?					
Overall Experience:					
17. Considering your experience, how likely are you to return to this department for emergency medical care in the future?					
18. Based on your experience, how likely are you to recommend this emergency department to friends and family in need of medical care?					

Thank you for your kind participation

If you wish to make further comment on any of these issues described above, please do so here:

……

……

……

……

College of Postgraduate Studies

Quality Management in Health Institutions / Master Program

استبيان تقييم تجربة المرضى في قسم الطوارئ بمجمع فلسطين الطبي

عزيزي / عزيزتي:

في اطار اعداد رسالة بحث ماجستير بعنوان " استخدام اللين ستة سيجما لتحسين تدفق المرضى في قسم الطوارئ في مجمع فلسطين الطبي في رام الله" تقوم الباحثة زهراء محمد صرصور في برنامج ماجستير ادراة الجودة في المؤسسات الصحية في كلية الدراسات العليا في الجامعة العربية الامريكية. و كجزء من أطروحتها بإجراء بحث ميداني لتقييم جودة خدمات قسم الطوارئ بمجمع فلسطين الطبي من خلال استخدام منهجية لين ستة سيجما من خلال استخدام استبانة البحث المرفقة، ونظرا لاهمية رايكم في اثراء الدراسة نأمل تعاونكم بالاجابة على الاسئلة الواردة بالاستبيان بدقة وموضوعية، حيث سيتم استخدام كافة البيانات لأغراض البحث العلمي فقط علما ان الوقت المقدر لإكمال هذا الاستبيان حوالي خمسة دقائق.

لمزيد من الاستفسارات والايضاحات:

زهراء محمد صرصور

طالبة ماجستير – برنامج إدارة الجودة في المؤسسات الصحية

1. المعلومات العامة

أ. الجنس:

[ ]ذكر [ ]أنثى

ب. المستوى التعليمي:

[ ]لا يوجد تعليم رسمي [ ]أساسي [ ] ثانوي

[ ]شهادة دبلوم [ ] بكالوريوس [ ] دراسات عليا

ت. **العمر:**

[ ] أقل من 18 سنة [ ] بين 18 و 30 سنة [ ] بين 31 و 50 سنة
[ ] أكثر من 50 سنة

ث. مكان السكن: .....

ج. من خلال الاثني عشر شهرًا الماضية، كم مرة ذهبت إلى قسم الطوارئ كمريض؟

أ) مرة واحدة فقط

ب) مرتين إلى ثلاث مرات

ج) أربع إلى خمس مرات

د) ست مرات أو أكثر

هـ) لا أعرف / لا أتذكر

2. أ)- أسباب زيارة قسم الطوارئ (تقييم الاهمية من 1 الى 5):

يرجى تقييم اهمية كل سبب لزيارة قسم الطوارئ على مقياس 1 الى 5, حيث يعني 1 " ليس مهما على الاطلاق" و5 "مهم للغاية".

سبب الزيارة	5. مهم	4.مهم	3.مهم بدرجة	2.ليس	1.ليس مهما
أسباب مرضية					
1- إصابة بسيطة، مثل "اصطدام القدم" أو "ألم في اليد."					
2- جرح بسيط يحتاج الى غرز، مثل "جرح في الإصبع."					
3- آلام في العظام أو العضلات، باستثناء الكسور والإلتواءات، على سبيل المثال "آلام أسفل الظهر" أو "تصلب الركبة."					
4- إصابات نتيجة حوادث، مثل "حادث سيارة" أو "السقوط من الدرج."					
5- شعور بعدم الارتياح أو الإعياء، مثل "الحالة الصحية المتدهورة" أو "الإغماء."					
6- آلام في المعدة أو الأمعاء، على سبيل المثال "آلام البطن" أو "الغثيان."					
7- كسر في العظم أو خلع مفصل، على سبيل المثال "كسر في الرسغ" أو "خلع في الكتف."					
8- حركة مفاجئة تسبب ألماً في العضلات أو الأربطة، على سبيل المثال "التواء الكاحل" أو "شد في الركبة."					
9- صعوبة في التنفس.					
10- ألم في الحلق					
11- آلام الأسنان ومشاكل الأسنان					

12- التهابات المسالك البولية					
13- مشاكل النساء والتوليد					

2. ب)- أسباب زيارة قسم الطوارئ:

يرجى تقييم مدى اتفاقك لكل سبب لزيارة قسم الطوارئ: ضع اشارة (✓) حول الرقم الذي يعبر عن رأيك

1. لا أتفق تماما .2 لا أتفق .3 محايد .4 أتفق .5 أتفق تماما

سبب الزيارة	.5 أتفق تماما	.4 أتفق	.3محايد	.2لا أتفق	.1لا أتفق تماما
أسباب أخرى					
1- قسم الطوارئ هو الأقرب لمنزلك أو أسهل للوصول إليه بالمواصلات.					
2- المركز الصحي الرئيسي لبلدك مغلق.					
3- أتوقع تلقي علاج أفضل في قسم الطوارئ.					
4- المركز الصحي الأولي حوّلني إلى هنا.					
5- تشعرأن حالتك الصحية تحتاج إلى تدخل سريع وعلاج متخصص غير متوفر في العيادة.					
6- تريد استشارة طبيب آخر غير طبيب العيادة المعتاد.					
7- لا أستطيع تحمل تكلفة العلاج في أماكن أخرى.					

3. **تقييم مفهوم جودة خدمات قسم الطوارئ:**

مفهوم الجودة في أقسام الطوارئ يعتمد على التالي :ضع اشارة (✓) حول الرقم الذي يعبر عن رأيك

1. لا أتفق تماما .2 لا أتفق .3 محايد .4 أتفق .5 أتفق تماما

الرقم	البند	5. أتفق تماما	4. أتفق	3.محايد	2. لا أتفق	1.لا أتفق تماما
.1	تحديد المرض بشكل صحيح ووصف العلاج الفعال له.					
.2	معاملة المريض باهتمام وتعاطف خلال تواجده بالطوارئ.					
.3	استخدام كافة الإمكانيات المتوفرة في قسم الطوارئ بشكل جيد لتحسين تقديم الخدمة.					
.4	هدف قسم الطوارئ: تقليل نسبة الأمراض والوفيات والإعاقات في المجتمع.					
.5	من المهم تقديم الرعاية لجميع المرضى، لكن الأهم تقديم العلاج المناسب في الوقت المناسب.					
.6	وجود أطباء وممرضين ذوي خبرة عالية في التعامل مع الحالات الطارئة.					
.7	استعمال أحدث الأجهزة والمعدات الطبية لتشخيص وعلاج الحالات المرضية.					
.8	وجود أجهزة تحاليل وأشعة وغيرها لإجراء الفحوصات اللازمة لتشخيص المرض.					

.9	تقليل وقت انتظار المريض لتلقي العلاج قدر الإمكان.					
.10	إجراء الفحوصات الضرورية فقط لتشخيص المرض وتجنب الفحوصات التي لا تفيد.					
.11	تقديم العلاج الدقيق والتشخيص الصحيح للمرضى قدر الإمكان.					

4. **آراء حول زيارتك لقسم الطوارئ:**

بناءً على تجربتك في هذا القسم ضع اشارة (✓) حول الرقم الذي يعبر عن رأيك في كل من النقاط التالية:

1. لا أتفق تماما .2 لا أتفق .3 محايد .4 أتفق .5 أتفق تماما

المشاكل	**.5أتفق تماما**	**.4أتفق**	**.3 محايد**	**.2 لا أتفق**	**1 .لا أتفق تماما**
أوقات الانتظار					
• هل كان وقت الانتظار طويلا عند التسجيل؟					
• هل كان وقت الانتظار قبل الفحص من قبل الممرضة طويلا؟					
• هل كان وقت الانتظار قبل تشخيص الطبيب طويلا؟					
• هل كان وقت الانتظار أثناء إجراء التحاليل في المختبر طويلا؟					
• هل كان وقت الانتظار أثناء إجراء الفحوصات بالأشعة طويلا؟					

5. **يرجى تقييم مدى رضاك عن جودة خدمات قسم الطوارئ من خلال البنود التالية: ملاحظات: 1- غير راضٍ تماماً. 2- غير راضٍ. 3- محايدة. 4- راضي. 5- راضي جداً:**

البند	5. راضي جدا	4. راضي	3. محايدة	2. غير راضٍ	1. غير راضٍ تماماً
الخدمات الطبية					
• ما مدى رضاك عن أداء الأجهزة الطبية؟					
• ما مدى رضاك عن سعة الأسرة في قسم الطوارئ؟					
• ما مدى رضاك عن توفر الفحوصات الطبية في قسم الطوارئ؟					
رعاية موظفي قسم الطوارئ					
• ما مدى رضاك عن مقدار الوقت الذي قضاه الممرض/الممرضة في إجراء الفحص الأولي الخاص بك؟					
• ما مدى رضاك عن شمولية استشارة الطبيب وتشخيصه؟					
• ما مدى رضاك عن توفر أعضاء الفريق اللازمين؟					
الاستقبال والفرز					
• بأي مدى أنت راضٍ عن المساعدة التي قدمها لك موظفو التسجيل؟					

• بأي مدى أنت راضٍ عن العناية المقدمة لحالات الطوارئ حسب الحاجة الحقيقية؟					
• بأي مدى أنت راضٍ عن سرعة الخدمة وكفاءتها عند وصولك إلى قسم الطوارئ؟					
المرافق والبيئة					
• واجهت صعوبة في العثور على طريقك داخل قسم الطوارئ					
• وجدت منطقة الانتظار مريحة ونظيفة					
رعاية المرضى					
• اهتم بك الطاقم الطبي بشكل كافٍ وتعاملوا معك باحترام وتقدير					
• استمع الطاقم الطبي باهتمام لشكواك وأسئلتك					
العلاج والتوعية					
• بأي مدى كنت راضياً عن الشرح الذي قدم لك حول الفحوصات والإجراءات الطبية؟					
• هل شرح لك الأطباء والممرضين الكلمات الطبية التي استخدموها بطريقة واضحة ومفهومة؟					
• بأي مدى انت راض عن شرح تعليمات المتابعة بعد الخروج والرعاية المنزلية لك؟					

التجربة بشكل عام					
• بناءً على تجربتك، ما مدى احتمال عودتك إلى هذا القسم للحصول على رعاية طبية طارئة في المستقبل؟					
• بناءً على تجربتك، ما مدى احتمال توصيتك بقسم الطوارئ هذا للأصدقاء والعائلة الذين يحتاجون إلى رعاية طبية؟					

<u>نشكركم على مشاركتكم اللطيفة</u>

✓ **إذا كنت ترغب في تقديم تعليق إضافي على أي من القضايا الموضحة أعلاه، فيرجى القيام بذلك هنا:**

.....

.....

.....

.....

Appendix B: Reviewers for instruments

Name	Institution	Email	Response
Dr. Hamdallah Khaled	Ibn Sina University	Hamdallah@nu-vte.edu.ps	Valid
Dr. Rebhi Bsharat	Modern University College	Rebhi.bsharat@muc.edu.ps	Valid
Dr. Adam Marawaa	Modern University College	Adam.marawaa@muc.edu.ps	Valid
Dr. Ahmad Hanani	Alnajah University	a.hanani@najah.edu	Valid
Dr. Mustafa Shuli	Ibn Sina University	Mustafa.shouli@nu-vte.edu.ps	Valid

Appendix C: Staff Experience Interviews

I kindly invite you to participate in my research study on "Using Lean Six Sigma to Improve Patient Flow in the Emergency Department at Palestine Medical Complex in Ramallah," Your honest feedback is crucial in helping me understand the experiences of staff in the Emergency Department (ED) and identify areas for improvement.

(The estimated time to complete this survey is approximately ten minutes.)

Thank you

Researcher

Zahraa Sarsour

Section 1: Staff Experience in the ED

1. Years of experience in the ED: ( ) Less than 1 year ( ) 1-3 years ( ) 4-7 years ( ) More than 7 years

Section 2: Satisfaction with Resources and Facilities

Please rate your level of satisfaction with the following resources in the ED using a scale of 1 (Very Dissatisfied), 2 (Somewhat dissatisfied), 3 (Neutral), 4 (Somewhat Satisfied), 5 (Very Satisfied):

1. Availability of beds for patients: ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5
2. Adequacy of medical equipment: ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5
3. Overall functionality and layout of the ED workspace: ( ) 1 ( ) 2 ( ) 3 ( ) 4 ( ) 5

Section 3: Causes of Long Waiting Times and Overcrowding

- In your opinion, what are the top 3 factors that contribute to long wait times for patients in the ED? (Rank 1 as most significant, 3 as least significant)
    1. _____
    2. _____
    3. _____
- What are your observations on the types of cases that contribute most to ED overcrowding?

  _____

  _____

  _____
- Please describe the biggest challenges you face in providing optimal care to patients in the ED due to overcrowding.

  _____

  _____

  _____
- In your experience, what are some potential solutions to improve patient flow and reduce overcrowding in the ED?

  _____

  _____

  _____

- Is there anything else you would like to share about your experiences working in the ED?

  _____

  _____

  _____

Appendix D: Systematic Observation of Patient Flow

Patient No.	Arrival Time at Reception	Time of Triage	Time Seen by ED Physician	Discharge Time
1	00:01	00:06	00:08	01:00
2	00:07	00:15	00:16	01:03
3	00:49	00:53	01:34	02:03
4	01:21	01:22	01:28	02:10
5	02:54	03:06	03:23	04:05
6	07:45	08:02	08:38	10:28
7	08:00	08:06	08:32	09:00
8	08:19	08:27	10:38	12:44
9	08:21	08:30	08:45	09:58
10	08:33	08:38	09:50	16:41
11	09:03	09:06	09:16	01:22
12	09:04	09:06	09:33	13:35
13	09:13	09:53	11:23	15:38
14	09:38	09:54	10:01	12:51
15	10:12	10:13	10:19	13:02
16	10:22	10:36	11:17	15:21
17	11:08	11:10	11:36	16:29
18	11:30	11:37	11:57	18:57
19	12:16	12:20	12:34	13:50
20	12:17	12:26	12:40	16:04
21	12:33	12:35	13:13	13:25
22	13:19	13:21	13:38	15:09
23	13:44	13:48	14:11	17:30
24	13:55	14:02	14:40	16:10
25	14:03	14:24	14:42	18:10
26	14:10	14:28	15:00	16:10
27	14:18	14:41	14:57	16:00

28	14:19	14:25	14:34	14:42
29	15:08	15:12	15:20	15:51
30	16:10	16:14	16:55	20:15
31	16:13	16:18	16:24	17:01
32	16:51	16:57	17:30	19:56
33	17:03	17:05	17:20	18:39
34	17:16	17:18	17:22	18:20
35	17:55	17:57	18:25	14:39
36	17:59	18:02	18:20	19:00
37	18:41	18:42	18:43	18:55
38	19:47	19:49	19:57	20:36
39	20:32	20:34	20:56	17:16
40	21:18	21:25	21:35	23:00
41	22:05	22:08	22:13	01:00
42	22:28	22:34	22:40	00:27
43	23:05	23:10	23:15	23:30

Appendix E: Systematic Observation of Patient Flow

Patient No.	Waiting Time for Reception	Waiting Time for Triage	Waiting Time for Doctor	Time with Doctor	Total Time (minutes) from arrival to discharge
1	5	5	2	52	64
2	18	8	1	47	74
3	18	4	41	29	92
4	18	1	6	42	67
5	18	12	17	42	89
6	15	17	36	110	178
7	25	6	26	28	85
8	30	8	131	126	295
9	19	9	15	73	116
10	16	5	72	411	504
11	18	3	10	246	277
12	19	2	27	242	290
13	24	40	90	255	409
14	27	16	7	170	220
15	5	1	6	163	175
16	4	14	41	244	303
17	4	2	26	293	325
18	4	7	20	420	451
19	4	4	14	76	98
20	4	9	14	204	231
21	1	2	38	12	53
22	3	2	17	91	113
23	15	4	23	199	241
24	13	7	38	90	148
25	2	21	18	208	249

26	3	18	32	70	123
27	5	23	16	63	107
28	3	6	9	8	26
29	4	4	8	31	47
30	4	4	41	200	249
31	3	5	6	37	51
32	3	6	33	146	188
33	3	2	15	79	99
34	3	2	4	58	67
35	3	2	28	795	877
36	2	3	18	40	63
37	3	1	1	12	17
38	4	2	8	39	53
39	4	2	22	1,180	1208
40	2	7	10	85	104
41	6	3	5	167	241
42	2	6	6	107	121
43	5	5	5	15	30

Appendix F: تسهيل المهمة

State of Palestine Ministry of Health Education in Health and Scientific Research Unit		دولة فلسطين وزارة الصحة وحدة التعليم الصحي والبحث العلمي

Ref.: ....
Date:..................

الرقـــم: ٢٠٢٤/٥٦٤/١٦٥
التـــاريخ: ٢٠٢٤/٥/٢١

عطوفة الوكيل المساعد لمجمع فلسطين الطبي المحترم،،،

تحية واحترام،،،

الموضـــوع: تسهيل مهمة بحث

يرجى تسهيل مهمة الطالبة: **زهراء محمد صادق صرصور – ماجستير برنامج ادارة الجودة في المؤسسات الصحية** – الجامعة العربية الامريكية، بعنوان:

" استخدام اللين ستة سيجما لتحسين تدفق المرضى في قسم الطوارئ في مجمع فلسطين الطبي رام الله"

حيث ستقوم الطالبة بجمع معلومات عن حول موضوع البحث من خلال تعبئة استبانة الممرضين، وذلك في:

- **مجمع فلسطين الطبي**

بشرط موافقة مدير المجمع.

مع العلم ان مشرف الدراسة: د.أشرف الميمي .

على ان يتم الالتزام بالمحافظة على اخلاقيات البحث العلمي وسرية المعلومات، وعدم التعرض للمعلومات التعريفية للمشاركين.

على ان يتم تزويد الوزارة بنسخة PDF من نتائج البحث، التعهد بعدم النشر لحين الحصول على موافقة وزارة الصحة.

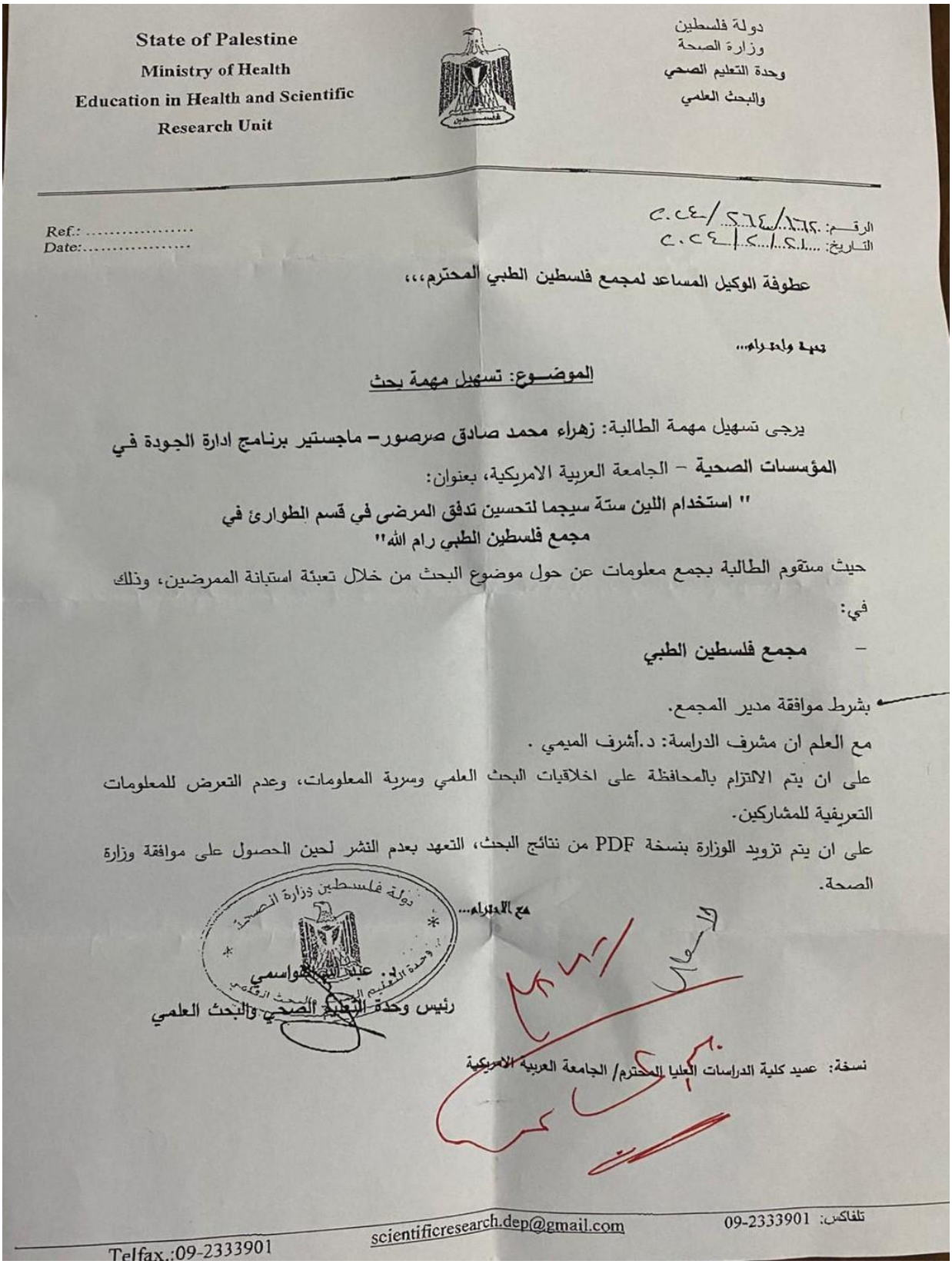
مع الاحترام،،،

د. عبد الله القواسمي
رئيس وحدة التعليم الصحي والبحث العلمي

نسخة: عميد كلية الدراسات العليا المحترم/ الجامعة العربية الامريكية

Telfax :09-2333901 scientificresearch.dep@gmail.com 09-2333901 :تلفاكس

Appendix G: Agreement from PMC director



State of Palestine
Ministry of Health
Education in Health and Scientific
Research Unit

دولة فلسطين
وزارة الصحة
وحدة التعليم الصحي
والبحث العلمي

Ref.: .....
Date:.....

الرقم: ٢٠٢٤/٥٦٤/١٦٨
التاريخ: ٢٠٢٤/٧/٢١

عطوفة الوكيل المساعد لمجمع فلسطين الطبي المحترم،،،

تحية واحترام...

الموضـــوع: تسهيل مهمة بحث

يرجى تسهيل مهمة الطالبة: **زهراء محمد صادق صرصور– ماجستير برنامج ادارة الجودة في المؤسسات الصحية** – الجامعة العربية الامريكية، بعنوان:

" استخدام اللين ستة سيجما لتحسين تدفق المرضى في قسم الطوارئ في مجمع فلسطين الطبي رام الله"

حيث ستقوم الطالبة بجمع معلومات عن حول موضوع البحث من خلال تعبئة استبانة الممرضين، وذلك في:

- **مجمع فلسطين الطبي**

بشرط موافقة مدير المجمع.

مع العلم ان مشرف الدراسة: د.أشرف الميمي .

على ان يتم الالتزام بالمحافظة على اخلاقيات البحث العلمي وسرية المعلومات، وعدم التعرض للمعلومات التعريفية للمشاركين.

على ان يتم تزويد الوزارة بنسخة PDF من نتائج البحث، التعهد بعدم النشر لحين الحصول على موافقة وزارة الصحة.

مع الاحترام...

دولة فلسطين وزارة الصحة وحدة التعليم الصحي والبحث العلمي

د. عبد الله الشواسمي
رئيس وحدة التعليم الصحي والبحث العلمي

نسخة: عميد كلية الدراسات العليا المحترم/ الجامعة العربية الامريكية

Telfax.:09-2333901 scientificresearch.dep@gmail.com تلفاكس: 09-2333901

Appendix H: Approval from Hospital

State of Palestine
Ministry of Health
Education in Health and Scientific Research Unit

دولة فلسطين
وزارة الصحة
وحدة التعليم الصحي
والبحث العلمي

Ref.: ………………
Date:………………

الرقم: ٢٢/٢٤٦٢/٢٠٢٤
التاريخ: ٢١/٢/٢٠٢٤

عطوفة الوكيل المساعد لمجمع فلسطين الطبي المحترم،،،

تحية واحترام...

<u>الموضــوع: تسهيل مهمة بحث</u>

يرجى تسهيل مهمة الطالبة: زهراء محمد صادق صرصور– ماجستير برنامج ادارة الجودة في المؤسسات الصحية – الجامعة العربية الامريكية، بعنوان:

" استخدام اللين ستة سيجما لتحسين تدفق المرضى في قسم الطوارئ في مجمع فلسطين الطبي رام الله"

حيث ستقوم الطالبة بجمع معلومات عن حول موضوع البحث من خلال تعبئة استبانة الممرضين، وذلك في:

- مجمع فلسطين الطبي

بشرط موافقة مدير المجمع.

مع العلم ان مشرف الدراسة: د.أشرف الميمي .

على ان يتم الالتزام بالمحافظة على اخلاقيات البحث العلمي وسرية المعلومات، وعدم التعرض للمعلومات التعريفية للمشاركين.

على ان يتم تزويد الوزارة بنسخة PDF من نتائج البحث، التعهد بعدم النشر لحين الحصول على موافقة وزارة الصحة.

مع الاحترام...

د. عبد الله القواسمي
رئيس وحدة التعليم الصحي والبحث العلمي

نسخة: عميد كلية الدراسات العليا المحترم/ الجامعة العربية الامريكية

Telfax.:09-2333901 scientificresearch.dep@gmail.com تلفاكس: 09-2333901

استخدام اللين ستة سيجما لتحسين تدفق المرضى في قسم الطوارئ في مجمع فلسطين الطبي في رام الله

زهراء محمد صادق صرصور

د. أشرف الميمي

د. سامي سمير صادر

د. يحيى أحمد صلاحات

ملخص

يعاني قسم الطوارئ في مجمع فلسطين الطبي من مشاكل مثل أوقات الانتظار المفرطة، وعدم رضا المرضى والموظفين، والازدحام. ومن خلال دمج منهجيات لين سيكس سيجما – وهو نهج منهجي يركز على القضاء على العمليات غير ذات القيمة المضافة – تسعى هذه الدراسة إلى تحسين أداء قسم الطوارئ.

استخدمت الدراسة نهجًا مختلطًا لجمع البيانات حول تجارب الموظفين والمرضى، بما في ذلك الملاحظات والمسوحات. تم العثور على هدر في الإجراءات التي يستخدمها قسم الطوارئ باستخدام رسم خرائط تدفق القيمة. لتحديد الأسباب الكامنة وراء الازدحام، نظرت الدراسة أيضًا في صوت العميل وصوت العملية. كشفت الدراسة عن عدد من المخاوف المهمة، مثل متطلبات القوى العاملة الكافية، وأنظمة تكنولوجيا المعلومات المحسنة، وزيادة التعاون والتواصل بين الأقسام. وجد أن فترات الانتظار لها تأثير كبير على رضا المرضى، مع وجود ارتباط كبير بين أوقات الانتظار الأطول والرضا الأقل. كانت فرص التدريب والتطوير، وتوافر الأسرة، وصيانة المعدات الطبية، وتحديثات نظام تكنولوجيا المعلومات مرتبطة جميعًا بمستويات أعلى من رضا الموظفين.

وتقدم الدراسة توصيات استراتيجية لقسم الطوارئ في مجمع فلسطين الطبي بناءً على النتائج التي توصلت إليها. وتشمل هذه التوصيات زيادة عدد الموظفين والأسرّة المتاحة، وتعزيز البنية التحتية لتكنولوجيا المعلومات، وتعظيم تدفق المرضى، وحل أعطال الاتصالات. وهناك توصيات إضافية لتخصيص الموارد، وتنفيذ السياسات، وحملات التوعية العامة التي تهدف إلى تقليل الزيارات غير الطارئة. وتخلص الدراسة إلى أن النهج المتعدد الأوجه، المدعوم بمبادئ لين سيكس سيجما، ضروري لتحسين أداء قسم الطوارئ ورضا المرضى.

الكلمات الرئيسية: لين سيكس سيجما، تدفق المرضى، قسم الطوارئ، صوت العملية، صوت العميل