Streamlining Patient Care: A Lean Healthcare Approach to Reducing Wait Times and Improving Efficiency in Primary and Urgent Care

Waleed Alhayaza 05/05/2023
SAE 506: Lean Operations

1.0 Abstract:

This paper investigates the challenges encountered in primary and urgent care facilities, with a focus on employing lean healthcare principles and tools to enhance patient wait times and overall operational efficiency. By leveraging data-driven approaches, such as flowchart analysis, cause and effect analysis, and histograms, the study pinpoints the underlying causes of prolonged wait times, staff burnout, and inefficiencies within primary and urgent care settings. A series of recommendations, encompassing the adoption of 5S, Heijunka, Jidoka, JIT, and ongoing training, is proposed to streamline processes, elevate patient satisfaction, and optimize healthcare operations. The paper also underscores the importance of engaging all stakeholders, including physicians, nurses, administrative management, and patients, in fostering a culture of continuous improvement to ensure the long-term success of the proposed changes, where all stakeholders feel a sense of ownership in the solutions due to their contributions. Lastly, a two-phase implementation plan details the necessary steps for integrating lean healthcare principles into daily operations, emphasizing the potential for substantial advancements in Saudi Arabia's healthcare system.

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2.0 Introduction & Background:

The healthcare system faces numerous challenges, including inefficient processes, staff burnout, long patient wait times, and the continuous increase in costs and demand. Primary and Urgent care are a critical component of healthcare services, often being the first point of contact for patients with urgent medical needs. However, they are also highly susceptible to these issues, which can lead to reduced patient satisfaction, compromised patient care, and increased stress on healthcare providers.

In recent years, there has been a growing interest in implementing lean operations methodologies in healthcare settings to address these challenges. Lean operations principles, such as Ohno's eight wastes, the 5Ss, and Cause & Effect Analysis, have been successfully applied in various industries to optimize processes, reduce waste, and improve overall efficiency. The potential benefits of applying these methodologies in Primary and Urgent care and the broader healthcare sector are significant, offering opportunities for improved patient care, reduced wait times, and increased staff satisfaction.

However, the implementation of lean operations in healthcare also presents several challenges. The resistance to change from stakeholders, including practitioners, staff, and patients, can hinder the adoption of new methodologies. Additionally, organizations may prioritize efficiency over patient care and staff satisfaction, creating an environment where healthcare providers feel overworked and undervalued. Furthermore, the frequent staff turnover in healthcare settings can lead to a knowledge disconnection, making it difficult to maintain continuity and consistency in the implementation of lean practices.

2. 1 Learning Objectives:

This research paper aims to address the following learning objectives:

- To understand the key principles and methodologies of lean operations in emergency rooms and the healthcare system in general, including the 7 wastes analysis, Cause & Effect Analysis, and the 5S Lean implementation.
- To study the challenges and inefficiencies faced by primary and urgent care facilities, including extended wait times, staff burnout, and increased costs.
- To explore the application of lean healthcare principles and tools in improving patient wait times and overall operational efficiency in primary and urgent care settings.

- To employ data-driven analysis techniques, such as flowchart analysis, cause and effect analysis, and histograms, to identify the root causes of the identified challenges in primary and urgent care facilities.
- To explore the potential barriers and resistance to change in implementing lean operations in healthcare settings.

By investigating these aspects, this paper seeks to provide a comprehensive understanding of the potential for lean operations in emergency rooms and healthcare settings, as well as the challenges and opportunities for successful implementation. Ultimately, this research aims to contribute to the ongoing improvement of patient care, staff satisfaction, and the overall efficiency of the healthcare system.

3.0 Current Value Stream Map (VSM):
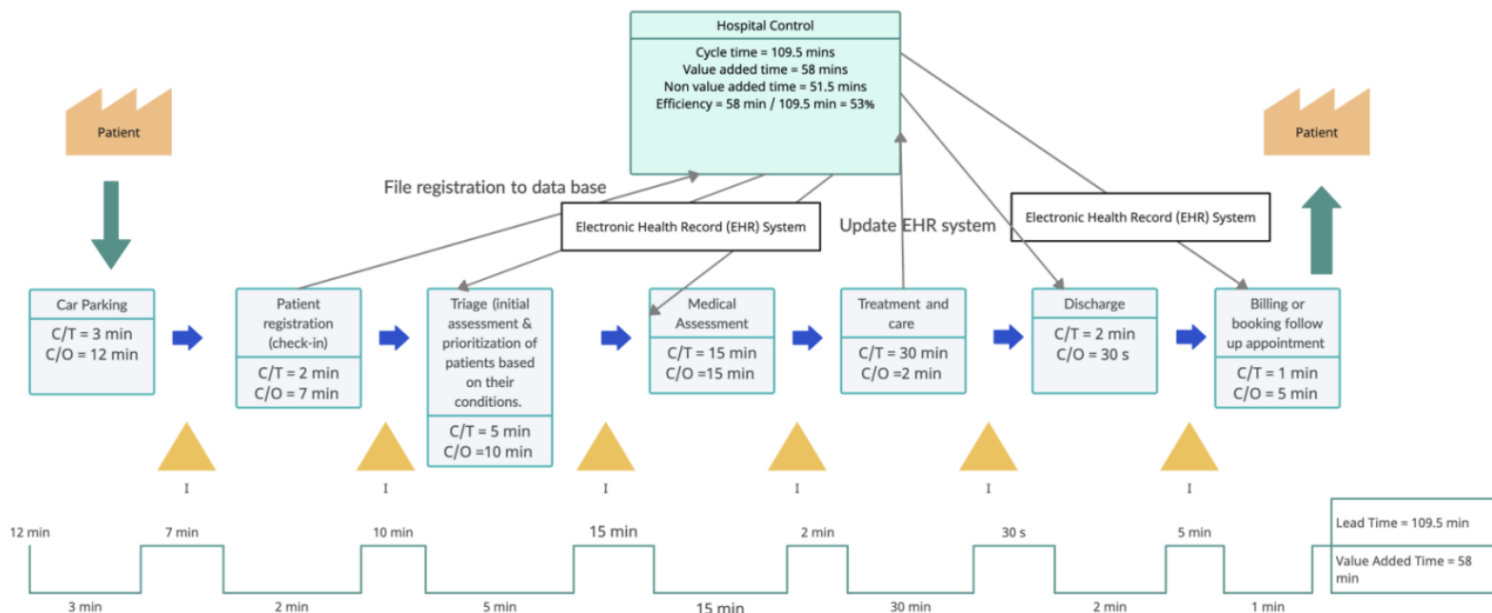

Figure1: Value Stream Map representing patients' visit to the hospital, Analysis: Waleed Alhayaza.

The Value Stream Map (VSM) illustrates the patient journey during a visit to the hospital, focusing on the emergency room process.

- The first stage upon arrival is parking the car, with a Cycle Time (C/T) of 3 minutes and a Connection Time (C/O) of 12 minutes. The hospital's location in a

high-traffic neighborhood in Riyadh, Saudi Arabia, poses challenges for patients finding parking.

- The next stage is Patient Registration, where patients check in at the registration desk. This stage has a C/T of 2 minutes, and a C/O of 7 minutes.

- Following registration is Triage, where patients undergo an initial assessment and prioritization based on the severity of their medical condition. This stage has a C/T of 5 minutes and a C/O of 10 minutes.

- The Medical Assessment stage comes next, with a C/T of 15 minutes and a C/O of 15 minutes.

- Subsequently, patients move to the Treatment and Care stage, with a C/T of 30 minutes and a C/O of 2 minutes.

- Following treatment, patients proceed to the Discharge phase, which has a C/T of 2 minutes and a C/O of 30 seconds.

- Finally, patients arrive at the Billing or Booking Follow-up Appointment stage, where they wait in line at the registration office to pay the bill and schedule their next appointment. The C/T for this stage is 1 minute and the C/O is 5 minutes. The **total lead time is 130 minutes, and the value-added time is 58 minutes. The takt time is estimated to be 8 minutes** following the calculations below.

Takt time = $\dfrac{Full\ shift-(breaks+meetings+etc)}{Demand\ for\ that\ production\ or\ service\ period}$

= 480 mins/ 60
= 8 min

4.0 Analysis:

4.1 Impediments to Flow:

4.1.1 List problems:

The objective of this section is to examine and address the elements that hinder the seamless flow of operations within primary and urgent care settings, resulting in inefficiencies and prolonged patient care. These obstacles may be linked to a variety of factors that were studied and analyzed through cause and effect analysis as well as data driven analysis The aim is to improve the overall efficiency and effectiveness of primary and urgent care facilities through the implementation of lean operations, ultimately leading to better patient outcomes and satisfaction. Through the use of quality tools and methodologies, the root causes will be identified and analyzed to develop targeted countermeasures to mitigate the identified impediments while ensuring their suitability to the organizational culture.

4.1.1.a People / transparency

In primary and urgent care settings, including emergency rooms, the role of people and transparency is vital for the efficient functioning of the healthcare system. These aspects significantly influence the overall patient experience, staff satisfaction, and the quality of care provided. To address People and Transparency challenges, a literature review was conducted, which was later complemented by the 7 wastes section.

1- Communication and Collaboration:

Effective communication and collaboration among all stakeholders are crucial for providing patient care and ensuring timely treatment. A lack of proper communication can lead to mismanagement, treatment delays, and increased patient dissatisfaction [1].

2- Involvement of All Stakeholders:

Improving the healthcare system's quality requires the engagement of all stakeholders, including physicians, nurses, administrative staff, practitioners, patients, and management.

> *2.1- Patient Involvement:*

> Involving patients in their care process can enhance their understanding of their medical condition and treatment options, leading to better adherence to treatment plans and improved patient satisfaction. A lack of transparency in patient care can result in diminished trust and reduced patient engagement [2].

In the current treatment procedure, after the medical assessment, the physician explains the patient's situation and suggests a medical treatment or referral to a specialist. To avoid conflicts of interest between the pharmacy and the patient, the patient can choose the pharmacy to purchase any needed medications.

However, incorporating decision analysis tools could help patients better understand their situation. These tools require a background in decision and risk analysis, which can provide patients and healthcare professionals, such as physicians and nurses, more informed decisions based on the results. This understanding would enable the patient to better comprehend their situation and the steps they need to take.

Training sessions for staff about game theory aspects related to patients' lab test results can provide them with a simplified understanding of what it means if the patient tests positive or not, as tests might not represent the full picture. Moreover, decision analysis tools such as decision trees can be used to help patients better understand their alternatives by incorporating all risks and associated costs.

3- Information Sharing:

Transparent sharing of information between departments and healthcare professionals can minimize errors, improve decision-making, and streamline patient care. Inadequate information sharing can lead to treatment delays, incorrect diagnoses, and increased patient anxiety [3].

To address the issues related to people and transparency in primary and urgent care settings, it is essential to establish effective communication channels, invest in staff training and development, and actively involve patients in their care.

However, examining the problem from a broader perspective can reveal a paradox that addresses communication and collaboration, staff training and development, and information sharing on one side, while considering staff burnout among healthcare professionals, especially experts, on the other.

To further explain the paradox, primary and urgent care providers have staff with varying levels of background and authority. This necessitates frequent consultations with doctors at any time during the day or night. Although this process contributes to staff training and development and information sharing, it also adds an additional burden on doctors.

4.1.1.b 7 Wastes

The evaluation of Primary and Urgent care operations must consider the eight primary wastes in lean operations, as outlined by Taiichi Ohno within the Toyota Production System. These wastes play a crucial role in affecting efficiency and overall effectiveness in healthcare environments:

- **Motion**: Unnecessary movements of patients, staff, or equipment in the Primary and Urgent care providers can create inefficiencies, increase costs, and inconvenience. For example, when the patient visits multiple rooms and locations, every room used has to be carefully cleaned and prepared, increasing not only burden on the patient and staff but also increases the costs.
- **Waiting**:

    a. Prolonged waiting periods for patients can stem from insufficient staff, inefficient processes, or inadequate resources, resulting in patient dissatisfaction and potential health risks.

    b. Lengthy waiting times for doctors to receive lab results or access patient records can cause delays in both diagnosis and treatment.
- **Overprocessing**: Excess procedures, such as repetitive documentation or unnecessary care, can cause inefficiencies and heighten expenses. Minimizing redundant paperwork and optimizing processes can conserve practitioners' time and enhance overall efficiency.
- **Correction**: Healthcare settings allow minimal room for errors, as patients anticipate top-quality service. Errors like misdiagnosis or improper medical treatment can jeopardize patient safety, lead to additional costs, or result in legal complications.
- **Excess Inventory:** Maintaining surplus medications or supplies can increase costs, generate waste due to expired items, and impede efficient space utilization.
- **Knowledge Disconnection**: Hospitals engage multiple stakeholders, including full-time doctors, part-time (contract) doctors, staff, patients, and suppliers. Constant staff changes can lead to knowledge loss, missed opportunities for improvement, and system inefficiencies.
- **Overproduction:** Conducting unnecessary tests or diagnostics on patients can waste time, effort, and resources. This practice may raise patient costs, consume additional resources, and potentially undermine patients' confidence in the healthcare system.

4.1.2 Why? (e.g., 7 quality tools)

1- Process Flowchart for Patient Journey:

      To better understand and analyze the current situation in primary and urgent care settings, a process flowchart was created to map the patient journey from arrival to departure in figure 2. This quality tool provides a visual representation of the various steps involved in the patient's visit, including registration, triage, medical assessment, treatment, and billing. The flowchart highlights decision points, such as verifying vaccinations and insurance status, as well as parallel processes, such as receipt issuance during the payment process. By mapping the patient journey, inefficiencies, bottlenecks, and areas for improvement can be identified, which will inform the development of targeted countermeasures to enhance the overall efficiency and effectiveness of the healthcare process.
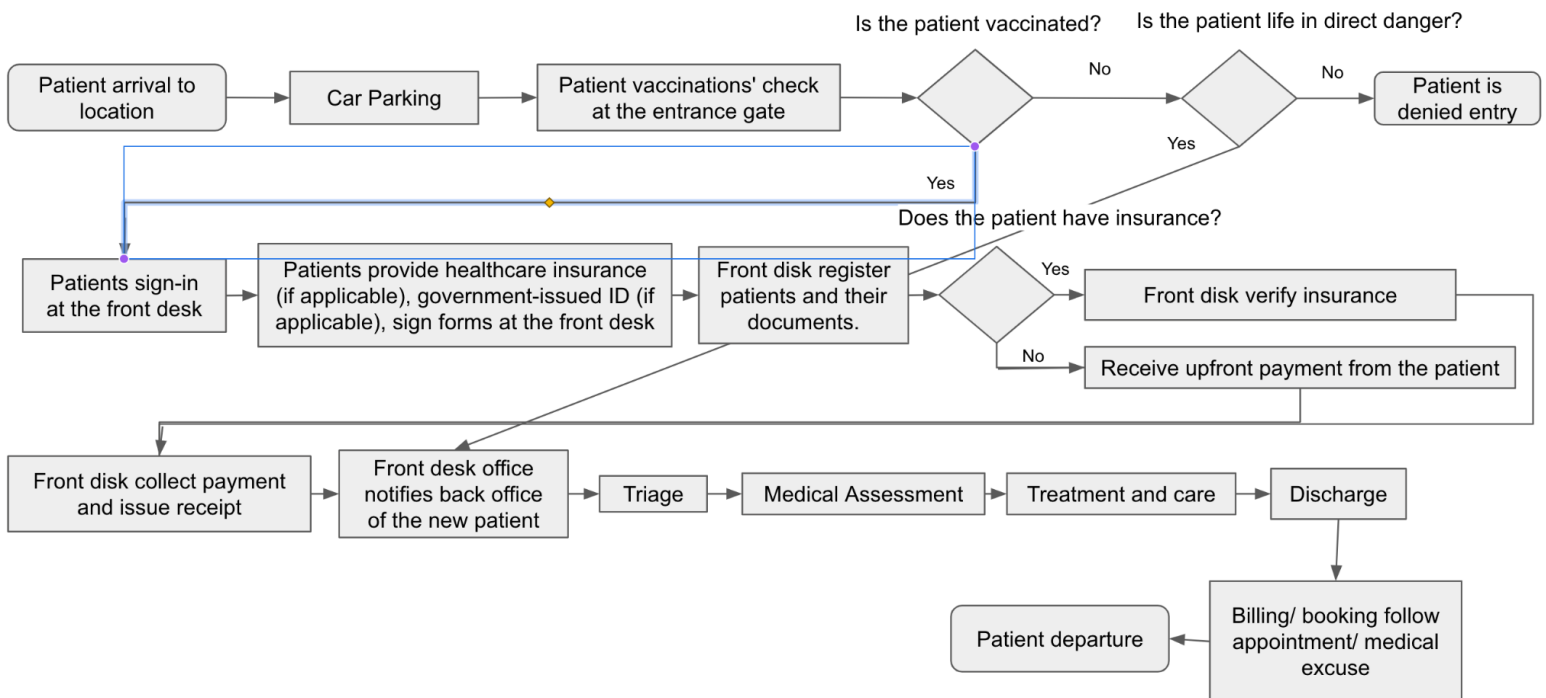
Figure 2: Process Flowchart for Patient Journey highlighting all steps from arrival to departure, Analysis: Waleed Alhayaza.

2- Cause and Effect Analysis

In this section a cause and effect analysis to identify the potential factors contributing to extended patient wait times and staff burnout in primary and urgent care settings. By understanding the underlying causes, healthcare providers can implement targeted interventions to reduce wait times and improve overall care quality.

2.1- Cause and Effect Analysis: Extended Patient Wait Times

To address the factors contributing to extended patient wait times, six main categories were developed, drawing from Professor Ted Mayeshiba's ISE 506: Lean Operations class. The six main areas are People, Machine, Method/Process, Environment, Materials, and Management. Each of these categories contains several sub-factors that can directly or indirectly impact patient wait times. The Cause and Effect diagram (Figure 3) illustrates these factors and their relationships, providing a comprehensive overview of the potential causes of extended wait times.
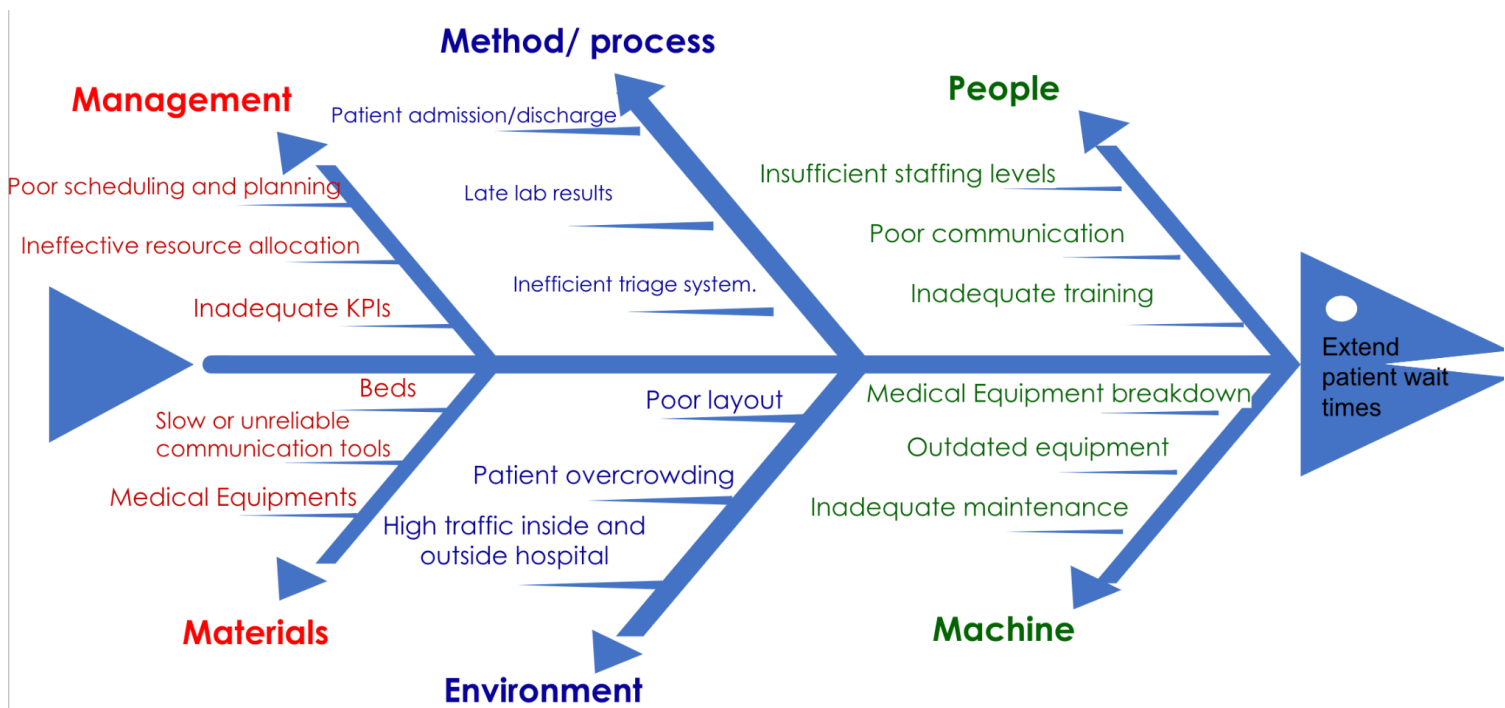
Figure 3: Cause and Effect Analysis: Extended Patient Wait Times, Analysis: Waleed Alhayaza.

2.2 Cause and Effect Analysis: Staff Burnout

Next the factors contributing to staff burnout were analyzed using the Cause and Effect analysis tool. To do so, six main categories were developed to help in identifying the root causes of staff burnout and develop targeted interventions to address them. These categories were People, Workload, Work Environment, Management, Personal Life, and Policies and Procedures. The Cause and Effect diagram (Figure 4) focus on the potential causes of staff burnout, examining factors such as inadequate training, overtime policy, lack of support, excessive workload, imbalanced workload distribution, high-stress work environment, poor work-life balance, inflexible scheduling, and inadequate support for professional development. By investigating these categories and

their sub-factors, the overall goal is to identify the root causes of staff burnout and develop targeted interventions to address them.
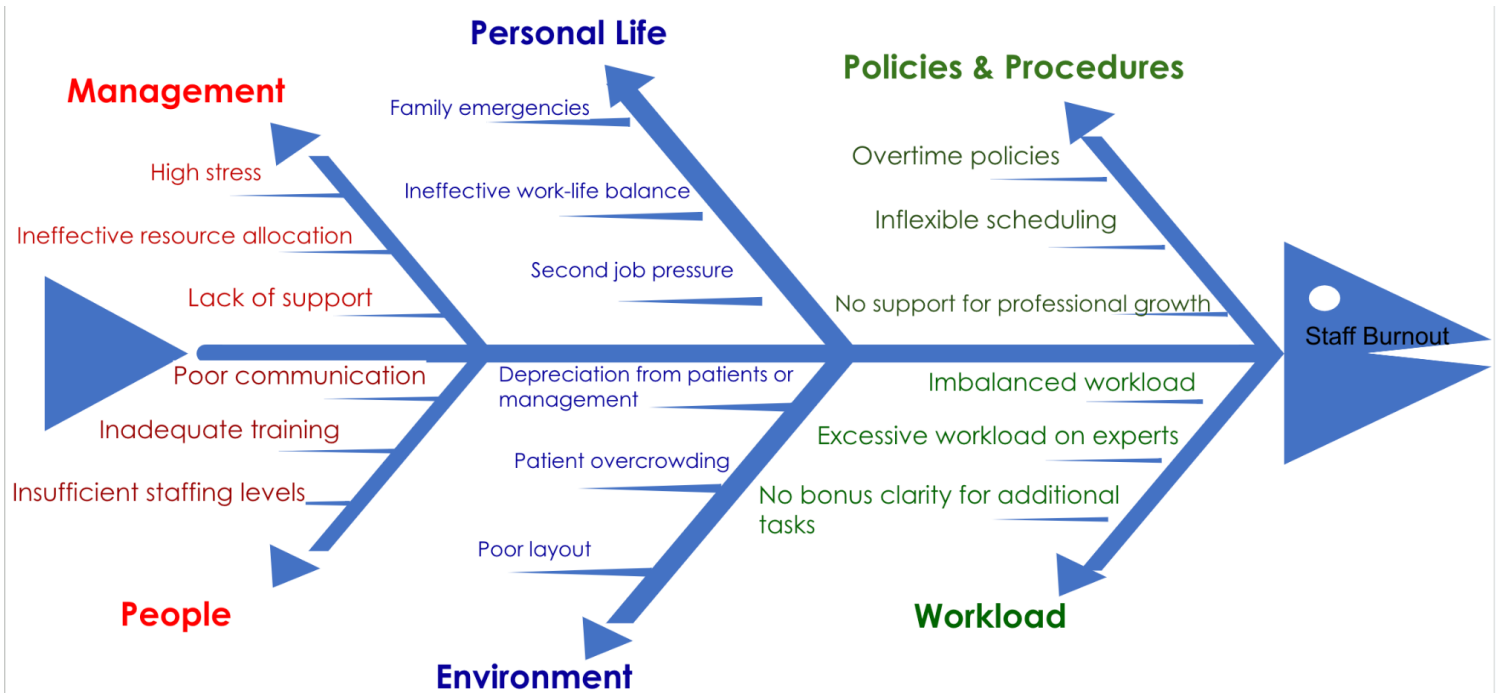
Figure 4: Cause and Effect Analysis: Staff Burnout, Analysis: Waleed Alhayaza.

3- Histograms: Analyzing Patient Waiting Times Across Shifts Using Histograms

Effective decision-making in healthcare systems is crucial to address the needs of various stakeholders, including management, healthcare professionals, and patients. Lean operations implementation offers several quality tools to enhance the decision-making process, such as histograms, scatter plots, and control charts.

To investigate patients' extended wait times, the average waiting times for each process step from arrival to departure were analyzed across three different shifts - morning, afternoon, and evening. Figure 5 presents a histogram illustrating this analysis. The results demonstrate that patients' waiting times during the evening shift are significantly higher than those in the morning shift. A considerable part of this increase can be attributed to parking and registration delays due to high traffic and increased number of patients. Although the number of staff is higher during the evening shift compared to the morning shift, the increase in patient volume is even greater.

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Staffing levels play a critical role in managing waiting times. The initial analysis reveals that staff shortages occur at two extremes - specialized consultants who need to move frequently within the primary and urgent care facility to address various patient needs, and staff responsible for managing patient arrivals, such as car parking and registration. Understanding these disparities can help healthcare providers develop targeted interventions to optimize staffing and reduce waiting times.

From the analysis, we can also infer that balancing patient volume and staffing levels across different shifts is essential for reducing overall waiting times and improving the patient experience. Implementing strategies such as flexible scheduling, process improvements, and resource allocation can help address these challenges.

In conclusion, data-driven decision-making can provide valuable insights into healthcare processes, allowing healthcare providers to identify areas for improvement and implement targeted interventions. By using quality tools such as histograms to analyze waiting times, healthcare facilities can enhance patient satisfaction and streamline operations.
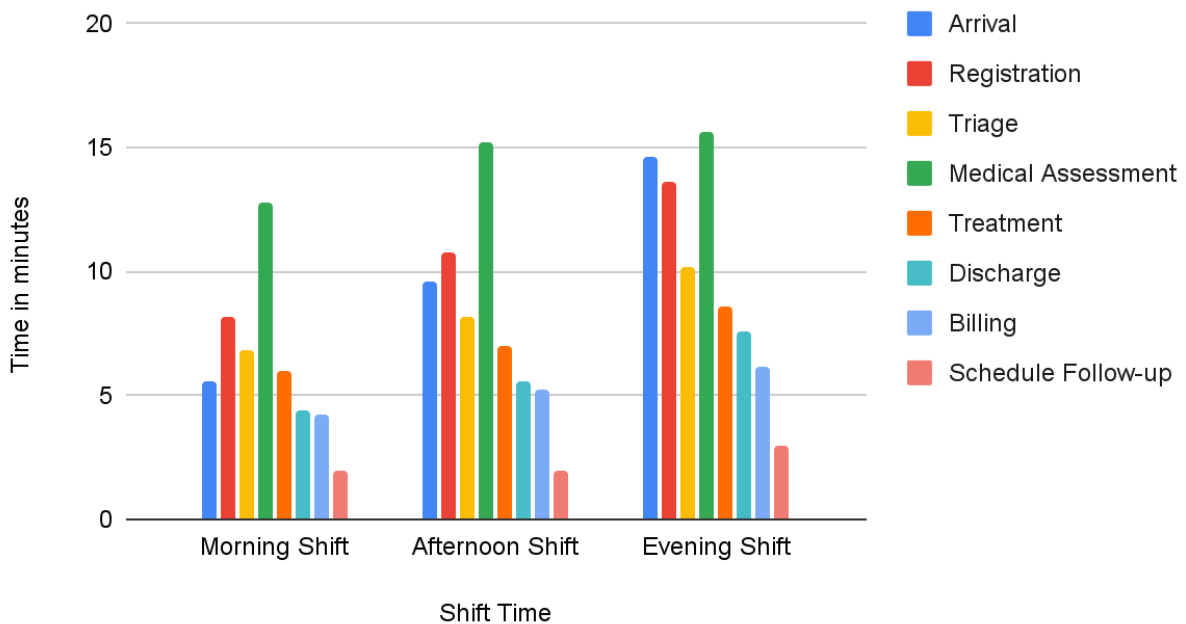

Figure 5: Data for Patients' average waiting times for each process step in morning, afternoon, and evening shifts. Analysis: Waleed Alhayaza.

4.2 Alternatives

4.2.1 Root cause(s)

Primary and urgent care facilities face numerous challenges that contribute to extended patient wait times and staff burnout. After analyzing the process through the implementation of lean quality tools such as histograms, flow charts, and root cause analysis, the 7 wastes were identified. These wastes contribute to increased costs, extended patient wait times, and staff burnout. To address these wastes the following root causes have been identified:

1- Communication Barriers:
Recent advancements in Saudi Arabia's healthcare system, including the primary and urgent care facilities under study, have led to the adoption of new technologies that enhance interdepartmental communication and improve patient care. However, the primary and urgent care provider analyzed in this study still faces a communication gap when it comes to integrating patients into the system. This gap contributes to extended patient wait times due to time-consuming tasks such as searching for parking spots, waiting in line at the front desk, completing repetitive forms, verifying insurance and government IDs, and processing payments. These redundant or inefficient processes ultimately result in longer wait times and diminished patient satisfaction.

2- Ineffective arrival processes:
Through utilization of the histogram analysis of the data for patients' average waiting times for each process step from their arrival to departure, as well as analyzing the VSM. The patients waste abundant time in the arrival process particularly in parking their car and registration in late shifts. This is due to challenges associated with finding a car parking, and long wait time at the registration due to higher number of patients and long processes.

3- Insufficient staffing levels:
The lack of certain staff levels, particularly during peak times, contributes to extended patient wait times and staff burnout. Better understanding of shortages in staff is essential. For example, sometimes consultants would be over exhausted as they need to visit multiple rooms to help. On the other hand, sometimes other tasks such as parking management or registration are the bottlenecks.

4- Poor Layout:

Primary and urgent care facilities face unique layout challenges, especially when renting a space that was not initially designed to accommodate their needs. In some cases, structural changes to the layout may be difficult to implement. Nevertheless, a poorly designed layout can contribute to staff burnout, as consultants may need to visit multiple patients in different rooms, or patients may have to navigate through various rooms to complete multiple steps, such as triage and medical assessment.

5- Insufficient Training:

Proper training is crucial for healthcare professionals, including physicians, nurses, and administrative staff. Staff members who have not received adequate training may struggle to perform tasks efficiently and effectively, which can result in extended wait times and increased workloads. In turn, this can exacerbate staffing shortages and put more pressure on expert staff members.

6- Ineffective Triage System:

An inefficient triage system can contribute to longer wait times for patients and increased workloads for staff members. A well-organized and streamlined triage process is crucial for accurately assessing patient needs, prioritizing cases, and ensuring patients receive timely and appropriate care.

It is important to recognize that it is still challenging to improve the triage system due to medical and morals complexity, yet increasing transparency would allow patients to understand expected waiting time upon their arrival.

4.2.2 Countermeasures

After identifying the root causes of extended patient wait times and staff burnout through cause and effect analysis, it is essential to propose countermeasures to address these issues effectively. The following are recommended countermeasures based on the analysis:

1- Implement Total Productive Maintenance (TPM) in Healthcare:

By adopting TPM, healthcare providers can optimize equipment and processes, reduce downtime, and enhance overall efficiency. This includes preventive maintenance of medical equipment, ensuring all devices are in proper working condition, and minimizing the likelihood of breakdowns and delays in patient care. To achieve this, an action plan was developed with the following steps:

      A- Formation of a TPM Implementation Team.
      B- Development of Baseline Assessment.
      C- Identification, clarification, and alignment of TPM Goals and Objectives
      D- Development of TPM Procedures and Standards

E- Implementation of Autonomous Maintenance System.
F- Establishment of a TPM Schedule.
G- Continuous Training and Development of TPM Skills.
H- Measurement and Analysis of TPM Performance.

2- Heijunka – Level out the workload:

By distributing the workload evenly among staff members help reduce bottlenecks, enhance efficiency, and prevent staff burnout. This can be achieved by implementing proper scheduling and adjusting staff levels according to patient demand. To accomplish this, the following three guidelines were recommended:

1- Standardize the patient care process and create a consistent flow of work.

2- Level the patient demand by optimizing appointment scheduling and balancing staff assignments.

3- Create a Level Patient Care Schedule to ensure a smooth, manageable workload for staff members

3- Training:

Provide comprehensive training for staff members and quality personnel to ensure they can perform their tasks efficiently and effectively. This includes regular training on updated protocols, procedures, and new technologies in the healthcare setting. Additionally, utilize training sessions to bridge the gap between employees' workloads, training those with reduced workloads on additional tasks to improve their added value.

4- Jidoka – Authority to stop a process when a problem is identified in Healthcare:

Implement an automated system that halts processes when issues are detected, preventing further delays and inefficiencies in patient care. For example, the usage of electronic health record systems with built-in alerts to notify staff of potential problems, such as drug interactions or critical lab results. Furthermore, the use of Visual Management Tools: Implementation of visual management tools like digital boards, color coding, and signs to help workers identify medications and treatment requirements, and streamline patient flow.

5- 5S Lean Implementation:

A- Implement 5S lean in car parking and patient registration:

Applying 5S lean methodology to car parking and patient registration can significantly enhance the patient arrival experience and streamline the admission process. However,

it's crucial to acknowledge the challenges in regulating car parking, such as poor layout and limited space.

1- Seiri (Sort):

Parking must consider multiple stakeholders' perspectives, allocating different types of parking spots for patients, staff, and disabled individuals.

2- Seiton (Set in order):

Enable patients to reserve parking with a scanning barcode, ensuring the parking spot is reserved for them upon arrival. Once discharged from the primary and urgent care facility, visitors should promptly remove their cars to make room for others. Clearly designate pathways with visible signage and color-coded markings in Arabic and English to guide patients entering the facility.

Allow patients to complete necessary documents before arriving at the facility, reducing wait times in registration lines and easing front desk pressure. Rearrange the reception space to include a forms section, enabling patients to fill out documents while waiting in line. This increases front desk efficiency and shortens patient wait times. Developing distinct registration sections for insurance verification and payment processing can further improve patient flow, particularly during evening shifts.

3- Seiso (Shine):

Primary and urgent care providers in Saudi Arabia must adhere to the highest cleanliness standards required by the Ministry of Health. Regular inspections ensure compliance, imposing high fines on facilities that don't meet cleanliness and healthcare standards.

Assign responsibility for maintaining cleanliness in the registration area, waiting areas, and patient rooms to specific employees. Supervisors should use check sheets, a quality tool, to monitor instances of quality problems and ensure cleanliness standards are maintained.

4- Seiketsu (Standardize):

Establish standardized procedures for patient registration, including electronic online registration systems to minimize paperwork and reduce wait times. Training staff on these standardized processes is essential for consistency and efficiency in the registration experience.

5- Shitsuke (Sustain):

Cultivating a culture of continuous improvement is vital for sustaining new processes and boosting employee morale. Encourage staff members to take responsibility for maintaining 5S standards in car parking and patient registration. Supervisors should review check sheets for compliance with regulations, conduct

regular audits, share feedback, and provide ongoing training to reinforce the importance of a welcoming and efficient arrival experience for patients in primary and urgent care settings

B- Implement 5S Lean in Primary and Urgent Care:

Incorporating the 5S Lean methodology in primary and urgent care is essential for creating a patient-centered and efficient environment. By integrating patients and their admission processes into the system, the overall experience can be improved.

1- Seiri (Sort):

Establish an effective patient triage system to categorize patients based on the severity of their conditions. This ensures that resources are allocated appropriately, and urgent cases receive timely attention.

2- Seiton (Set in order):

Create a smooth and efficient admission process, with clear pathways for patients to move from one area to another. Organize waiting areas, treatment rooms, and other spaces to minimize confusion and promote a positive patient experience.

3- Seiso (Shine):

Maintain a clean and germ-free environment by consistently cleaning and disinfecting all areas, including waiting rooms, treatment areas, and medical equipments. Ensure that each room is promptly cleaned and prepared after every patient visit. This practice not only helps prevent the spread of infections but also promotes a sense of professionalism and attentiveness. Moreover, adhering to the high cleanliness standards required by the Ministry of Health in Saudi Arabia is crucial. Failure to comply with these regulations and standards may result in fines or even the closure of the facility.

4- Seiketsu (Standardize):

Develop standardized procedures for patient care, registration, and other processes, ensuring consistency and efficiency. Regularly review and update these protocols to adapt to evolving best practices and maintain a high level of care.

5- Shitsuke (Sustain):

Foster a culture of continuous improvement and commitment to the 5S methodology. Encourage staff members to take ownership of their workspaces and maintain established standards. Conduct periodic audits and provide ongoing training to reinforce the importance of 5S principles in the healthcare setting.

C-Implement 5S Lean in Medical Supply and Equipment Management:

Incorporating the 5S Lean methodology in managing medical supplies and equipment within primary and urgent care settings can improve efficiency, reduce waste, and ensure that essential resources are readily available when needed.

1- Seiri (Sort):

Organization of medical supplies and equipment by type, frequency of use, and priority. It is important to recognize that certain medications could have severe side effects if given to wrong patients, which has to be carefully considered and to be clearly labled. Removal of any expired, damaged, or rarely used items to ensure easy access to necessary supplies.

2- Seiton (Set in order):

Designate specific storage locations for each category of medical supplies and equipment. Use clear labeling and signage to help staff members locate items quickly and minimize search time.

3- Seiso (Shine):

As explained in the previous section.

4- Seiketsu (Standardize):

Establish standardized procedures for ordering, receiving, and restocking medical supplies. Regularly review inventory levels and adjust as needed to avoid stockouts and overstocking.

5- Shitsuke (Sustain):

Similar to what has been previously addressed in previous 5S implementations. Creating a culture of continuous improvement by encouraging staff members to take responsibility for maintaining 5S standards in medical supply and equipment management is essential to sustain those changes.

6- Recommended Future Value Stream Mapping:

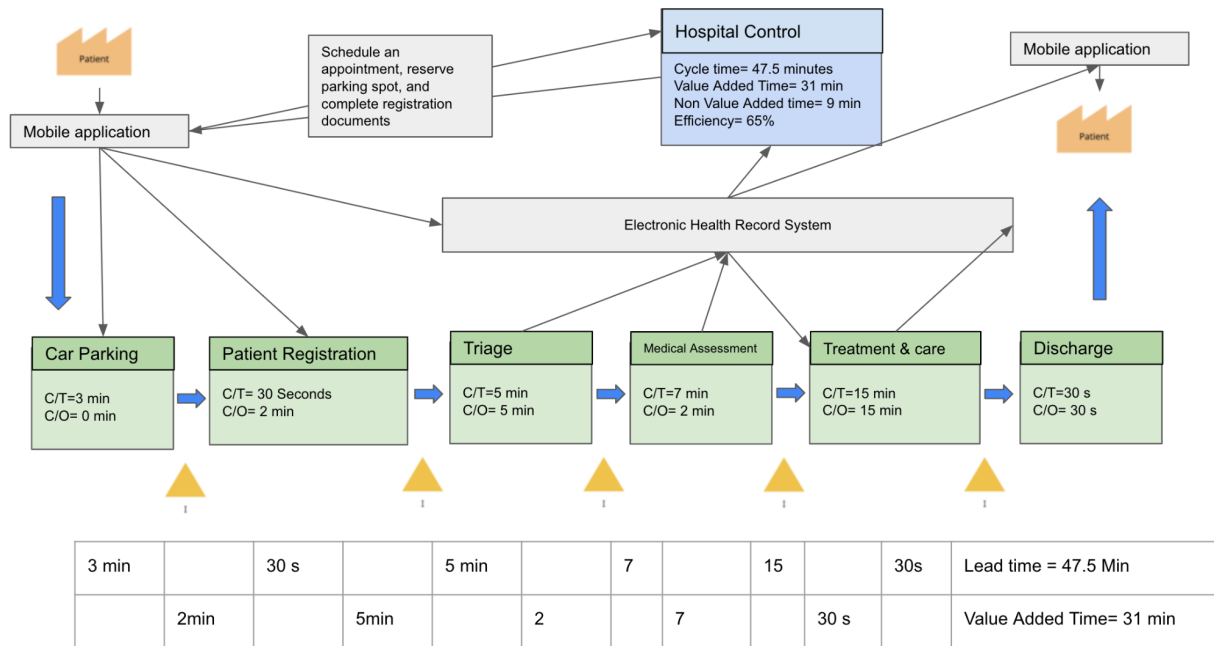| 3 min		30 s		5 min		7		15		30s	Lead time = 47.5 Min
	2min		5min		2		7		30 s		Value Added Time= 31 min

Figure 6: Recommended Future Value Stream Map representing patients' visit to the hospital, Analysis: Waleed Alhayaza.

To enhance the process flow within the primary and urgent care, and specifically address extended patient wait times, a new Value Stream Map (VSM) has been developed. This VSM leverages automation to advance the healthcare service delivery model, building on Saudi Arabia's strengths in employing advanced technology. Challenges such as traffic in the car park and patient registration are addressed by automating these processes through the utilization of a mobile application.

Upon examining the newly developed VSM, the cycle time (lead time) was reduced to 47.5 minutes, and the efficiency increased to 65% from the previous low efficiency. This demonstrates the potential of the proposed improvements to significantly streamline the healthcare experience for both patients and providers.

4.2.3 Suitability to Culture

While the proposed countermeasures and 5S Lean implementation aim to address the root causes of extended patient wait times and staff burnout, it is essential to consider potential risks related to these recommendations and their cultural suitability. Identifying

and addressing these risks can help ensure the success and sustainability of the proposed solutions.

4.2.3.1 Potential Risks: Recommendations & Suitability to Culture

1- Resistance to change:
Introducing new processes and methodologies may face resistance from healthcare professionals and staff members accustomed to traditional practices. Some healthcare professionals, including physicians, nurses, and administrative staff, may perceive that management is constantly trying to implement new processes solely for the sake of change or to increase profit margins.

To mitigate this risk, it is important to involve all stakeholders in the development and implementation of the recommendations, fostering a sense of ownership and commitment. Additionally, providing comprehensive training and support, as well as emphasizing the benefits of the proposed solutions, can help facilitate their acceptance.

2- Insufficient resources:
Implementing the recommendations may require additional resources, such as staff, equipment, and funding. For instance, addressing extended wait times during evening shifts might necessitate investment in patient arrival process automation, such as mobile applications for appointment scheduling, medical descriptions, doctor notes, insurance documents, and more. Although certain improvements offer long-term rewards, they might come with high initial investment costs.

To address this risk, it is essential to first identify the available alternatives and set clear objectives. Then, through the development of multi-attribute utility decision analysis, the facility can make informed decisions and develop a detailed implementation plan, outlining the required resources and exploring potential funding sources. One alternative to consider is to train administrative staff to manage the arrival of the patients.

3- Unintended consequences:
Implementing the proposed recommendations may inadvertently result in unintended consequences, such as increased workload for certain staff members or reduced patient satisfaction. Regularly monitoring the outcomes of the implemented recommendations and adjusting them accordingly can help identify and address any unintended consequences.

4- Lack of sustained commitment:
Maintaining the long-term commitment of healthcare professionals and staff members to the proposed countermeasures is essential for their success. The risk of losing momentum or interest over time can be mitigated by fostering a culture of continuous improvement, recognizing and rewarding staff members' efforts, and providing ongoing training and support.

5- Healthcare Supply Chain & JIT:
Implementing JIT supply chain systems in healthcare is inherently challenging. JIT systems rely heavily on precise delivery schedules, which can result in delays during unexpected events or disruptions. Such systems have low tolerances for errors, making them particularly risky in healthcare settings, where mistakes can potentially threaten patient lives.

4.3 Target Condition

4.3.1 Discussion of selection

To successfully develop and implement the recommendations, it is essential to create a structured plan that outlines responsibilities and target dates. While certain recommendations or initiation steps can be accomplished or initiated within one month, others require a longer time for planning, development, and execution.

Table 2 presents the recommendations, responsible parties, and action plans.

Recommendations	Responsible Party	Action Plan
Implement Total Productive Maintenance (TPM) in Healthcare	TPM Implementation Team	A- Formation of a TPM Implementation Team. B- Development of Baseline Assessment. C- Identification, clarification, and alignment of TPM Goals and Objectives D- Development of TPM Procedures and Standards E- Implementation of Autonomous Maintenance System. F- Establishment of a TPM Schedule. G- Continuous Training and Development of TPM Skills. H- Measurement and Analysis of TPM Performance.

Heijunka – Level out the workload	Healthcare Facility Management	A. Standardize the patient care process and create a consistent flow of work. B. Level patient demand by optimizing appointment scheduling and balancing staff assignments. C. Create a Level Patient Care Schedule to ensure a smooth, manageable workload for staff members.
Training	Training Department and Healthcare Facility Management	A. Develop a comprehensive training program for staff members and quality personnel. B. Schedule and conduct regular training sessions on updated protocols, procedures, and new technologies. C. Utilize training sessions to bridge the gap between employees' workloads and improve their added value.
Jidoka – Authority to stop a process when a problem is identified in Healthcare	Healthcare Facility Management and IT Department	A. Implement an automated system that halts processes when issues are detected. B. Use electronic health record systems with built-in alerts to notify staff of potential problems. C. Implement visual management tools like Andon boards, color coding, and signs.
5S Lean Implementation	Healthcare Facility Management, Department Supervisors, and 5S Implementation Team	A. Implement 5S lean in car parking, patient registration, primary and urgent care, and medical supply and equipment management B. Train staff members on the 5S methodology and conduct regular audits to ensure compliance. C. Foster a culture of continuous improvement and commitment to the 5S methodology.

Table 2: recommendations, responsible parties, and actions plan.

By following this plan, healthcare facilities can systematically develop and implement the recommended improvements, resulting in a more efficient and patient-centered healthcare experience.

Two phases of planning were developed: short-term and long-term. Phase 1 focuses on the formation of teams and committees, particularly the TPM and 5S implementation teams. This is the responsibility of healthcare facility management. Training, Heijunka, and 5S lean implementation can also be executed within one month according to the action plan listed in Table 3, which represents the recommendations, responsible parties, actions plans, and their durations. Figure 7 shows a suggested Gantt chart that was discussed with the team.

By initiating this one-month implementation plan, healthcare facilities can focus on quick wins and establish a foundation for longer-term improvements. The second phase will further refine and enhance the healthcare service delivery model.

Recommendation	Responsible Party	Action Plan	Duration
Formation of Teams and Committees	Healthcare Facility Management	A. Form TPM Implementation Team B. Form 5S Implementation Team	1 week in parallel
Training	Training Department and Healthcare Facility Management	A. Develop a comprehensive training program for staff members and quality personnel B. Conduct initial training sessions on updated protocols, procedures, and new technologies	2 weeks and ongoing
Heijunka	Healthcare Facility Management	A. Identify areas with the most significant staff workload imbalances B. Implement temporary measures to level out the workload in these areas	2 weeks
5S Lean Implementation	5S Implementation Team	A. Conduct initial 5S assessments in car parking, patient registration, primary and urgent care, and medical supply and equipment management B. Begin implementing the first two steps of 5S (Sort and Set in Order) in selected areas	2 weeks

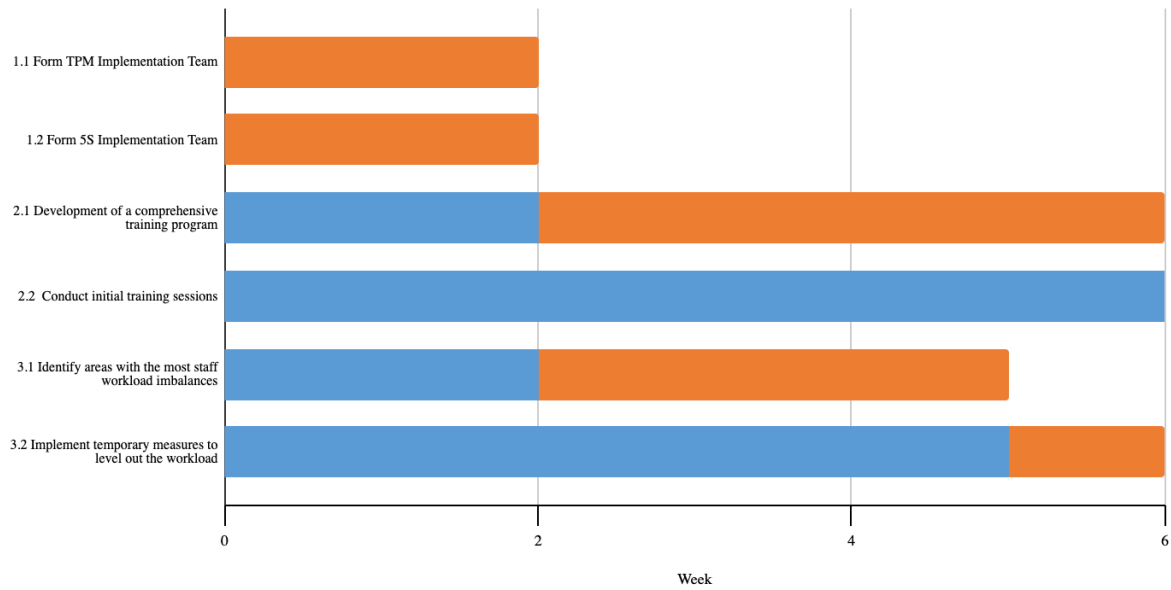Table 3: Phase1- Recommendations, responsible parties, and actions plan.

Figure 7: Gantt chart developed for phase 1, to be executed in six weeks.

Recommendation	Responsible Party	Action Plan	Duration
Total Productive Maintenance (TPM)	TPM Implementation Team	Refer to table 2 please	6 months
Training	Training Department and Healthcare Facility Management	A. Develop a comprehensive training program for staff members and quality personnel B. Conduct initial training sessions on updated protocols, procedures, and new technologies	Ongoing
Heijunka	Healthcare Facility Management	A. Identify areas with the most significant patient workload imbalances B. Implement temporary measures to level out the workload in these areas	3 months
5S Lean Implementation	Healthcare Facility Management, Department Supervisors, and 5S Implementation Team	Refer to table 2 please	6 months
Jidoka	Healthcare Facility Management.	Refer to table 2 please	4 months

Table 4: Phase2- Recommendations, responsible parties, and actions plan.

By following this two-phase plan, healthcare facilities can systematically develop and implement the recommended improvements, leading to a more efficient and patient-centered healthcare experience.

4.3.2 Follow up plan (audit, feedback)

To develop a follow-up plan two components have to be considered for audits and feedback. Doing so will help in effectively addressing, monitoring, and evaluating the recommendations.

A designated team shall focus on the key areas addressed in the recommendations, such as TPM, Heijunka, Jidoka, and 5S Lean implementation. The audit findings should be documented and shared with the relevant stakeholders for further analysis and corrective actions.

Gathering feedback from healthcare professionals, staff members, and patients is essential for understanding the impact of the implemented recommendations on the overall patient experience and identifying areas for further improvement. Feedback can be collected through various methods, such as surveys, mobile applications or texts. After that, this feedback has to be carefully analyzed and considered.

	Action Plan	Time
Stage 1: Initial Assessment	- Conduct an initial audit to evaluate the effectiveness of the implemented recommendations and identify any immediate issues that require attention. - Gather feedback from healthcare professionals, staff members, and patients to understand their experiences and perceptions of the changes.	After week six
Stage 2: Intermediate Assessment	- Perform a comprehensive audit to assess the progress towards achieving the target condition. - Collect feedback.	After 2 months
Stage 3: Long-term Assessment	- Perform final audit. - Collect feedback.	After6 months

Conclusions:

In conclusion, this paper demonstrates the potential of adopting lean healthcare principles and tools to address the challenges faced by primary and urgent care facilities in Saudi Arabia. By employing various lean methodologies, such as flowchart analysis, cause and effect analysis,

and histograms, a data-driven approach was used to identify the root causes of extended patient wait times and inefficiencies in the healthcare service delivery model.

The proposed recommendations draw on a range of lean concepts, including 5S, Heijunka, Jidoka, JIT, and continuous training for healthcare professionals. These strategies aim to streamline processes, improve patient satisfaction, and enhance the overall efficiency of primary and urgent care facilities. In addition, the paper emphasizes the importance of involving local stakeholders and fostering a culture of continuous improvement to ensure the long-term success of the proposed changes.

The implementation plan, divided into two phases, allows healthcare facilities to focus on quick wins and establish a solid foundation for longer-term improvements. By integrating lean healthcare principles and tools into the daily operations of primary and urgent care facilities, Primary and urgent care systems can achieve significant advancements in patient experience and healthcare service delivery, contributing to the overall improvement of the healthcare system.

A3 Summary Report

Context:
The paper examines primary and urgent care facilities, focusing on patient wait times, staff burnout, and inefficiencies. The study applies lean healthcare principles and tools to optimize operations and enhance patient satisfaction.

Current Condition:
- Extended patient wait times due to inefficient processes.
- Staff burnout.
- Inefficiencies in the system, including redundant processes and ineffective resource utilization.

Analysis:
- Flowchart analysis identified bottlenecks and inefficiencies in the patient care process.
- Cause and effect analysis highlighted communication barriers and staff burnout as root causes.
- Quality tools such as histograms and control charts were used to analyze data and support findings.

Target:
- Reduce patient wait times by streamlining processes and enhancing communication.
- Minimize staff burnout through workload optimization and continuous training.
- Improve overall efficiency in primary and urgent care facilities.

Recommendations:
- Implement lean principles such as 5S, Heijunka, Jidoka, and JIT.
- Enhance communication and collaboration among staff members and patients.
- Conduct regular training sessions to foster a culture of continuous improvement.

Plan:
Phase 1:
- Plan, do, study, and act.
- Conduct staff training on lean healthcare principles and tools.
- Initiate the implementation of 5S, Heijunka, Jidoka, and JIT.
- Establish effective communication channels among all stakeholders.

Phase 2:
- Monitor progress and evaluate the implemented changes.
- Refine and adjust strategies based on feedback and performance metrics.

Follow-up:
- Conduct regular audits to ensure the sustainability of implemented changes.
- Gather feedback from staff and patients to identify areas for further improvement.
- Continuously monitor performance metrics.

Appendix:

Shift	Arrival	Registration	Triage	Medical Assessment	Treatment	Discharge	Billing	Schedule Follow-up
Morning Shift	5	9	7	13	6	4	4	2
Morning Shift	4	8	6	12	7	4	4	2
Morning Shift	6	7	8	14	6	5	4	2
Morning Shift	7	8	7	13	5	5	5	2
Morning Shift	6	9	6	12	6	4	4	2
Afternoon Shift	10	10	8	15	7	5	5	2
Afternoon Shift	9	11	9	16	8	6	5	2
Afternoon Shift	8	12	9	15	6	5	5	2
Afternoon Shift	11	10	7	14	7	6	6	2
Afternoon Shift	10	11	8	16	7	6	5	2
Evening Shift	15	13	10	18	9	8	6	3
Evening Shift	14	14	11	15	8	7	6	3
Evening Shift	16	12	9	13	9	8	7	3
Evening Shift	13	15	10	15	8	7	6	3
Evening Shift	15	14	11	17	9	8	6	3

Table 1: Data for Patients waiting times for each process step in morning, afternoon, and evening shifts.

Acknowledgement:

I would like to extend my sincere gratitude to Professor Theodore Ken Mayeshiba and Teaching Assistant Samanyu Raju Kakarlapudi for their invaluable guidance, support, and expertise throughout my journey in SAE 506 Lean Operations at the University of Southern California. Their dedication to teaching and commitment to fostering a deep understanding of lean principles and practices have greatly enriched my academic experience and personal growth.

Thank you, Professor Mayeshiba and Mr. Kakarlapudi, for your unwavering encouragement, insightful feedback, and the inspiration you provided during our time together in this course. Your passion for lean operations and continuous improvement has left a lasting impact on me, and I am truly grateful for the opportunity to learn from such esteemed educators.

As I move forward in my academic and professional pursuits, I will carry with me the knowledge and skills gained in SAE 506, as well as the invaluable lessons on teamwork, problem-solving,

and critical thinking that you both have so generously shared. Thank you for making this learning experience truly exceptional.

References:

[1] McCarthy, D., Mueller, K., & Wrenn, J. (2013). Kaiser Permanente: Bridging the Quality Divide with Integrated Practice, Group Accountability, and Health Information Technology. The Commonwealth Fund.

[2] AHRQ. (2013). Guide to Patient and Family Engagement: Environmental Scan Report. Rockville, MD: Agency for Healthcare Research and Quality.

[3] Weaver, S. J., Dy, S. M., & Rosen, M. A. (2010). Team-training in healthcare: a narrative synthesis of the literature. BMJ Quality & Safety, 19(5), e27.

[4] Cover image :https://online.kettering.edu/news/2019/12/23/how-lean-principles-eliminate-waste-and-increase-productivity-healthcare