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Research Article

Lean Healthcare systematically applied to improve mobility accessibility in the medical clinic of a medium-sized hospital

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Abstract

Paper aims: The purpose of this paper is to applied systematically Lean Healthcare to improve mobility accessibility in the medical clinic ward of a medium-sized hospital.

Originality: The study focuses on the wheelchair's availability, as well as their provisions in the hospital, since this approach was not identified in the literature. In addition, this study is part of a branch of a project, based on the non-identification of applications in the medical clinic ward of hospitals, in order to formalize a systematic application of Lean Healthcare in the wing worked.

Research method: The study's methodology was divided into two phases, Survey and Lean Proposal, following a systematic approach established in prior papers, with a focus on addressing various hospital waste scenarios that affect patient mobility. The Survey phase aimed to identify the root cause of waste related to wheelchair use within the hospital, while the Lean Proposal phase sought to mitigate this waste using Lean tools, ultimately improving patient mobility in the medical clinic by reducing non-added value.

Main findings: The implementation of systematically Lean Healthcare led to a 72.2% reduction in the total activity time, dropping from 20 to 7 minutes, primarily by cutting non-value-added time from 18 to 5 minutes. This change increased the value-added time by 19%. Additionally, the unnecessary movement to retrieve wheelchairs decreased by 83%, with occurrences reducing by 100%. Furthermore, Lean Healthcare improved mobility and demonstrates how this effective approach not only enhanced the quality of medical services but also created a more favorable work environment and inspired a culture of continuous improvement within the hospital.

Implications for theory and practice: For the theory, this research highlights a hospital wing previously unexamined within the context of Lean Healthcare, thereby reinforcing a culture of systematic application and continuous improvement within the hospital. Furthermore, it delves into the hospital's accessibility, specifically focusing on mobility accessibility, addressing a gap in the literature. In practice, the research has significant implications, as it effectively reduces non-added value elements within an actual process in a medium-sized hospital, ultimately enhancing the quality of clinical healthcare delivery in the Brazilian public healthcare system.

Keywords

Lean Healthcare. Public health. Medical clinic wing. Mobility accessibility.

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1. Introduction

Ohno (2019) argued that Japan's reality was best suited for producing small quantities with a variety of products. In contrast to Mass Production, the Toyota Production System (TPS) aimed to improve efficiency by systematically and comprehensively eliminating waste.

Over time, the conspicuous success of Lean Production application became evident through various studies in diverse manufacturing domains, piquing the interest of other sectors, including services, and giving rise to the philosophy known as Lean Production (Liker, 2021).

Lean Healthcare, a derivative of the Lean philosophy, aims to eradicate waste within healthcare processes while maintaining consumer quality, as patients constitute the consumer base, making quality paramount due to the life-or-death nature of health concerns, leading managers and decision-makers to struggle with containing escalating costs while ensuring quality healthcare (Cóllden et al., 2017).

Furthermore, applying Lean in the healthcare sector offers a potential solution to the problems caused by the gap between Lean accessibility and implementation, as it helps change the organization's mindset toward providing the highest quality services with faster delivery at an optimal cost (Gupta et al., 2018).

Given that public healthcare can enhance cost-efficiency, effectiveness, and accessibility by modeling operations and introducing new management practices like Lean Healthcare (Castrén, 2016), the purpose of this paper is to applied systematically Lean Healthcare to improve mobility accessibility in the medical clinic ward of a medium-sized hospital.

The research problem of this study arises from the importance of accessibility for people with disabilities, particularly in healthcare settings such as hospitals. While Lean Healthcare is a philosophy that can assist in this matter through systematic application, there is currently a lack of literature addressing the use of Lean Healthcare to improve mobility within hospitals.

Although studies exist that discuss accessibility with Lean in healthcare, none specifically focus on the mobility impairment aspect (as it will be presented in the Lean Healthcare with accessibility subsection of this paper). Therefore, the identified research gap lies in the absence of papers utilizing Lean Healthcare to enhance mobility within hospitals. Furthermore, this study brings a second innovation by presenting a real-world application in the medical clinic wing, yielding tangible results.

For this, the study focuses on the wheelchair's availability, as well as their provisions in the hospital, since this approach was not identified in the literature. In addition, this study is part of a branch of a project, based on the non-identification of applications in the medical clinic ward of hospitals (Drei & Ignácio, 2019), in order to formalize a systematic application of Lean Healthcare in the ward worked (e.g., Drei et al., 2021; Drei & Ignácio, 2022).

2. Theoretical reference

2.1. Lean Healthcare

Lean Healthcare, rooted in Lean management principles, seeks to optimize healthcare processes by eliminating waste and emphasizing high-quality care, aiming to enhance efficiency, effectiveness, and value in healthcare delivery, similar to how Lean principles revolutionized manufacturing (Krijnen, 2007).

Fundamentally, Lean Healthcare is propelled by the principle of waste elimination, encompassing activities that fail to contribute value to patients or stakeholders, like overproduction, prolonged waiting times, unnecessary transportation, and redundant processes. This enables healthcare organizations to allocate resources more efficiently, prioritizing timely and effective care delivery (Gonçalves et al., 2022).

In healthcare settings like hospitals and clinics, various processes—from admission and diagnosis to treatment and post-treatment follow-up—are recognized by Lean Healthcare as interconnected value streams, and by mapping and analyzing each step, healthcare organizations can identify bottlenecks, redundancies, and improvement opportunities to enhance the flow of patients, information, and materials throughout the care journey (Aronsson et al., 2011).

A key aspect of Lean Healthcare is the emphasis on continuous improvement, fostering a culture of learning and innovation where healthcare professionals are encouraged to identify problems, experiment with solutions, and implement changes for better outcomes, engaging frontline staff in problem-solving and decision-making to leverage their invaluable insights into daily operations and challenges (Womack et al., 2007).

The application of Lean philosophy within healthcare is feasible, starting with incorporating time and comfort as evaluative factors, and Lean Healthcare involves empowering employees at all levels to drive change, with leaders providing crucial support, resources, and guidance to frontline staff, fostering a sense of ownership and accountability, thus promoting a more collaborative and efficient healthcare system (Oliveira et al., 2017).

This requires the obligatory incorporation of quality procedures in the healthcare sector, where a thorough analysis of the processes involved in a procedure becomes necessary, covering all aspects (Groenewegen et al., 2021).

Therefore, according to Toussaint et al. (2017), the successful implementation of Lean Healthcare can contribute to achieving various objectives, including:

- Empowering individuals through increased empowerment distribution;
- Enhancing flow;
- Eliminating unnecessary expenditures;
- Aligning resources with demand;
- Achieving first-time perfection;
- Embracing experiential learning;
- Facilitating problem identification;
- Enabling task anticipation.

Indeed, Lean Healthcare is a transformative approach aiming to revolutionize healthcare delivery by minimizing waste, enhancing patient experiences, and fostering continuous improvement, enabling healthcare organizations to create a more efficient, effective, and patient-centered system, benefiting both patients and professionals, in an evolving healthcare landscape where Lean Healthcare offers a promising framework for delivering value-driven care in a complex and dynamic environment (Toussaint et al., 2017).

Examining the practical integration of Lean methodologies within healthcare domains not only unveils strategies to identify and rectify inefficiencies, elevate patient outcomes, and cultivate a culture of continuous improvement but also underscores the significance of accessibility within the realm of healthcare, delving into real-world case studies and scrutinizing how Lean strategies adapt to various healthcare contexts, providing invaluable insights into the multifaceted challenges and successes that both Lean Healthcare and accessibility initiatives entail (Groenewegen et al., 2021).

This comprehensive inquiry equips healthcare practitioners and researchers with the knowledge required to adeptly navigate the complexities healthcare, while fostering an environment that prioritizes accessible and inclusive care for all (Clemente et al., 2022).

2.2. A panorama of Lean Healthcare applications in the literature

Similar to Lean Manufacturing, various adaptations of the Lean approach have been developed within healthcare environments, with the context of healthcare necessitating adaptations and integration of novel aspects into the framework of Lean Healthcare, prompting a specific emphasis on tools rather than comprehensive systemic implementation linked to strategic planning processes (Burgess & Radnor, 2013; Matthias & Brown, 2016).

For instance, Calero et al. (2020) introduced a model employing SMED, Kanban, and pull production methods to reduce waiting times within a healthcare service in Peru. Montella et al. (2017) sought to mitigate the incidence of bacterial infections among patients by leveraging interdisciplinary teams comprising medical professionals and scholars, achieving a 20% reduction in average hospitalization days.

Simultaneously, Kanamori et al. (2015) evaluated the influence of the 5S management methodology on workplace dynamics, process outcomes, and healthcare services within resource-limited settings. Their study derived insights from a pilot intervention of the 5S program in a Senegalese hospital. Notable improvements in patient experience included reduced waiting times and enhanced communication of guidelines. Additionally, safety measures, particularly in the context of sterilization processes, were positively impacted.

Vashi et al. (2019) conducted hospital visits, administered structured questionnaires to staff in relevant departments, and subsequently performed quantitative and qualitative analyses on the collected responses to inform implementation strategies.

Tortorella et al. (2019) proposed a methodology for assessing lean practices in healthcare organizations undergoing Lean implementation. Their findings indicated that, due to contextual diversity, understanding the critical success factors for Lean implementation in such conditions warrants attention. Thus, the proposed method facilitates a deeper comprehension of Lean implementation within healthcare organizations for both practitioners and academics.

Borges et al. (2020) evaluated the impact of Lean Production practices on the supply chain of a public hospital, enabling the verification of the effectiveness of proposed inventory policies to avoid negatively affecting the service level.

Furthermore, Gonçalves et al. (2022) developed a systematic approach for reducing medical appointment waiting lists. They proposed an optimization decision-making model followed by continuous engagement of personnel in a systematic approach to solving waiting list issues, contributing to both theory and practice by offering a way to manage various scenarios for waiting list reduction during and post-pandemic.

Drei & Ignácio (2022) conducted a three-stage study. The first stage aimed to map the process involving the focus activity using lean tools and integrating the collaborators involved in the application. The second stage proposed the application of the systematic approach with the collaborators, utilizing the A3 tool step by step. Finally, the third stage confirmed the systematic application by collecting and analyzing results in comparison to the initial situation.

Although these studies – which present only a few examples of the wide range of applications of Lean Healthcare, manage to propose several improvements in the areas of health studied, the Lean Healthcare literature dealing with improving accessibility in the health area is restricted.

To expound upon this aspect, a PRISMA survey was conducted (Figure 1), aimed at facilitating the reporting of systematic reviews for various research types (Page et al., 2021), and will be presented in the method section.

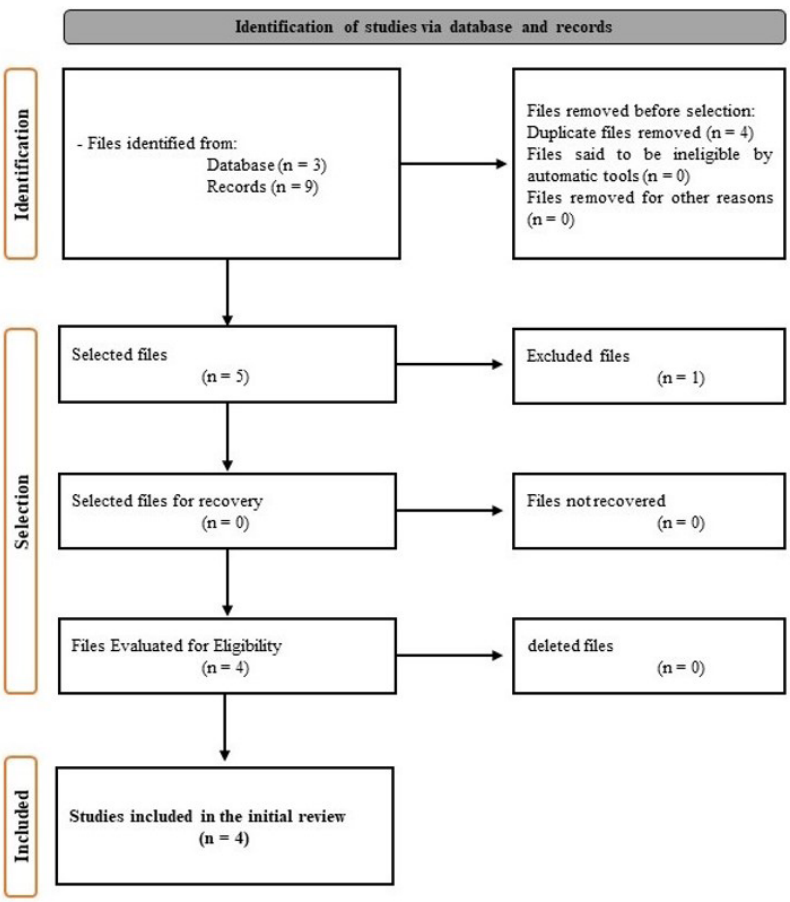

Figure 1. Survey of studies in Lean Healthcare with accessibility.
Source: Adapted from Page et al. (2021).

3. Method

3.1. Lean Healthcare with accessibility

Comprising three distinct phases, the initial stage involves delineating the databases and registries for the search of relevant articles. Following this, search terms and filters are selected to define the scope of the search (Page et al., 2021). For this investigation, the Scopus, Scielo, and Web of Science (WoS) databases were chosen due to their comprehensive coverage of high-impact journals across diverse domains. The selected search terms encompassed "Lean Healthcare" and its variations, as well as "Accessibility." No segmentation or date filters were imposed, ensuring that all resultant papers would be included in the analysis.

Moreover, the methodology facilitated the identification and exclusion of duplicate studies between databases, alongside the utilization of automated tools to filter out undesired articles (Page et al., 2021). While no automated tools were employed for selection in this study, an accessibility filter was used to ensure the inclusion of accessible papers, thereby eliminating unattainable and duplicate studies.

In the second phase, additional filters were introduced to exclude irrelevant papers and recover any previously excluded but relevant studies, culminating in the final selection of papers (Page et al., 2021). For this study, no papers were reinstated.

In the final phase, the total number of studies included in the review is presented (Page et al., 2021). This review focused on applications of Lean Healthcare involving accessibility. The study was conducted as of August 22, 2023, thus only studies published up to that date were considered.

As a result, only four papers were found that address Lean Healthcare and accessibility. Castrén (2016) demonstrates how public healthcare can improve cost-efficiency, effectiveness, and accessibility through operational modeling and the introduction of new management practices such as Lean Management. Gupta et al. (2018) discuss the implementation of Lean methodology to reduce turnaround time in a clinical laboratory in a super-specialty hospital. They highlight that applying Lean in the Indian healthcare sector provides potential solutions to issues arising from the gap between lean accessibility and implementation, ultimately enhancing service quality and delivery speed at optimal costs.

Additionally, Tiso & Verbano (2021) adopted Lean Healthcare in primary care, particularly for chronic conditions, with the aim of developing a model based on best practices to improve the efficiency, efficacy, safety, and continuity of care for frail patients. Their project helps identify guidelines to enhance coordination and integration, ensuring the sustainability, equity, and accessibility of health services.

Although these three papers apply Lean methodologies to health accessibility indirectly, Ramos et al. (2022) directly evaluate the application of Lean principles as assistive technology to optimize care for visually impaired individuals in Emergency Care Units. Their study focuses on reducing waiting times and making care units more accessible for visually impaired patients.

From these studies, it is evident that few papers focus on Lean Healthcare directed at accessibility. Therefore, this paper concentrates on patients with mobility impairments, specifically focusing on the use of wheelchairs in a medium-sized hospital, an approach not previously identified in the literature.

3.2. Study methodology

The methodology of this study was divided into two main phases: Survey and Lean Proposal. This structure builds upon the application framework proposed in previous studies (e.g., Drei et al., 2021; Drei & Ignácio, 2022) and presents a systematic approach applicable to various hospital waste scenarios, including those hindering patient mobility.

These two phases were formulated with distinct objectives. The Survey phase aimed to identify the root cause of waste related to wheelchair usage within the hospital. The Lean Proposal phase aimed to mitigate this waste by utilizing an appropriate Lean tool, thereby enhancing patient mobility within the medical clinic and reducing non-value-added elements. The Survey phase entailed the following steps:

- Process Mapping of X-ray Exam: The X-ray examination process was selected for analysis based on observations conducted over a three-month period. This process was chosen for its inherent complexity and its connections between the medical clinic and other hospital areas. Addressing waste in this process could yield holistic benefits for the entire institution. Additionally, this process involves wheelchair usage for many patients, highlighting mobility challenges. Time durations for each activity were obtained using Value Stream Mapping (VSM);

- Identification of Wastes in the Wheelchair Activity within the X-ray Exam Process: This step focused on activities directly involving wheelchair use and marked the commencement of patient transportation;
- Establishment of Causes of Identified Waste: The most frequent type of waste was selected for mitigation using a Pareto Chart;
- Identification of the Root Cause of the Targeted Waste: The 5 Whys tool was employed to determine the root cause of the most frequent waste type.

Upon identifying the root cause of the waste, the study transitioned to the Lean Proposal phase, which unfolded as follows:

- Presentation of a Lean Improvement Proposal: A suitable Lean Manufacturing tool was selected to address the root cause;
- Construction of an Action Plan: Guidelines from the Lean Institute Brasil (2023) were used to outline the implementation approach, involving medical clinic personnel;
- Execution of Scheduled Actions: The implementation spanned four months, with the first month under the guidance of implementers and the subsequent three months executed by medical clinic personnel.
- Computation of Time and Displacement Gains: The implementation's effectiveness was measured in terms of minutes saved and steps reduced;
- Elicitation of Perspectives: Feedback from medical clinic staff, patients requiring wheelchairs, and the authors was gathered to gauge perceived process improvements for the X-ray exam, beyond quantitative gains, thus validating the application.

In addition to the academic contribution, this study aims to be applicable and accessible to stakeholders, with the potential for future dissemination. This dissemination should extend beyond the wheelchair transfer activity to other identified waste scenarios involving patient movement within the medical clinic. Thus, a systematic application framework for Lean Healthcare is developed, intended for broad utilization.

4. Development

4.1. Study hospital

The focal hospital of this study features a three-story structure, accessible via ramps but lacking elevators. Additionally, there are stairs from the first to the second floor that are biometrically secured, granting access solely to authorized personnel.

Regarding the hospital's staff, it was crucial to establish the patient flow until they were effectively admitted to the medical clinic wing. This comprehensive approach considered the overall flow of processes within the medical clinic, from the moment the patient enters the hospital until their admission. This approach encompasses not only the clinic wing but also the hospital's reception and patient screening areas.

Primarily, the reception, like the hospital in general, operates in 12-hour shifts followed by 36 hours off-duty, resulting in four distinct shifts. Two of these are daytime shifts from 7 am to 7 pm, and the other two are nighttime shifts from 7 pm to 7 am.

The screening department also operates in four shifts, with one nurse on duty and two auxiliary technicians available during both daytime and nighttime shifts. The technicians assist with simpler procedures unrelated to the Medical Clinic, such as administering injections and aiding in observation rooms.

Furthermore, the Medical Clinic operates on the same shift schedule as the hospital, with four nurses on duty during the daytime and two during the nighttime shift. Located on the third floor of the hospital, the beds are distributed among rooms with 2 to 3 beds, totaling 25 beds, with an additional 3 beds in an emergency room on the second floor.

The 28 available beds for admission in the Medical Clinic are divided into two equal groups by gender, resulting in 14 beds for males and 14 for females, considering the patient's biological sex rather than their gender identity. Exceptions are made only in necessary circumstances, such as emergencies or isolation, when an entire room is vacant.

Lastly, the Medical Clinic features two rooms for the nurses responsible for the wing. One of these is the administrative room, where patient records are maintained, communication with other departments occurs, and scheduling is managed. The other room is the supply room, where material setup, sterilization, and other related functions take place.

4.2. Process study

The medical clinic is a complex wing with multiple distinct workflows. Therefore, these workflows have been categorized into three types for more in-depth study: (i) entry into the medical clinic, (ii) general processes encompassing procedures conducted on all or the majority of admitted patients, and (iii) specific processes addressing patient-specific procedures based on their individual needs.

This study focused on specific processes, exemplified by the X-ray Exam, from the request stage to the patient's final accommodation. A current Value Stream Mapping (VSM) was conducted for the X-ray Exam, as depicted in Figure 2. The VSM begins with the medical clinic receiving the X-ray order. Subsequently, the responsible nurse identifies the patient who will undergo the examination, locates the patient's bed, and summons the orderly for transportation. Upon arrival, the orderly reports to the responsible nurse, receives the orders, and is directed to the first patient's room for the examination.

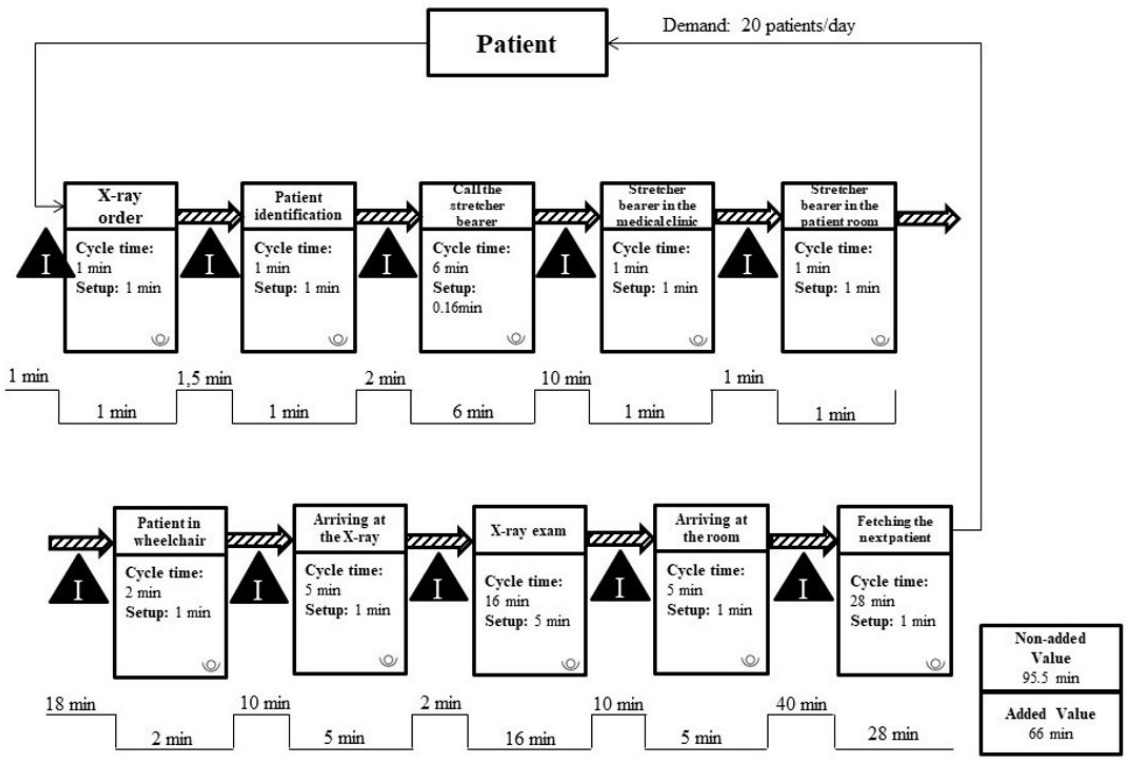

Figure 2. VSM for the X-ray Exam. I: Intercurrence.

The patient preparation activity then commences, involving the transfer of the patient from the bed to a wheelchair. This workflow is limited to patients requiring this service, which represents a significant portion of the medical clinic's occupants. Next, the orderly transports the patient to the X-ray room on the first floor, utilizing the hospital's access ramps.

Upon arrival in the X-ray room, the orderly hands over the order to the X-ray technician, who proceeds to configure the machine and prepare the patient for the examination. The orderly waits in the waiting room and, upon completion of the examination, accompanies the patient back to their room, commencing the process with the next patient in line, as examination requests are typically batched and sent to the medical clinic.

The analysis primarily focused on patient transportation activities, represented by "arrival at the room" and "arrival at X-ray", each with 10 minutes of non-value-added time and 5 minutes of value-added time due to waiting periods. Thus, non-value-added time exceeded value-added time by 5 minutes each.

4.3. Waste and Lean proposal

Based on the traced VSM and daily observations conducted over a three-month period at the hospital, with a daily demand of 20 patients in this process, it was possible to identify occurrences of non-value-added activities during the "patient in wheelchair" activity. As shown in Table 1, it was feasible to establish waiting occurrences for these activities.

Table 1. Occurrences of waiting to place the patient in the wheelchair.

Waiting Occurrences	Frequency	Percentage	Accumulated percentage
Fetching the wheelchair	182	84%	84%
Nurse did not specify which patient	32	15%	99%
Wait for the stretcher bearer	3	1%	100%
TOTAL	217	100%	100%

Firstly, the waiting time for the orderly (stretch bearer) can be attributed to their responsibilities extending beyond the medical clinic. The orderly is responsible for assisting with transportation needs across various wings of the hospital. Due to communication breakdowns and the considerable distances within the hospital, there are instances when the orderly is not immediately available to initiate the activity of placing the patient in the wheelchair and subsequently transporting them to the X-ray room. However, the medical clinic accounts for a significant portion of this need, and the orderly's absence only represents 1% of the waiting occurrences for this activity.

Secondly, there is the issue of not specifying which patient should go for the X-ray. This problem is linked to communication issues between the medical clinic and other wings and staff members of the hospital. The medical clinic is situated on the third floor, and the hospital lacks an integrated communication system, relying primarily on direct verbal communication or phone calls between wings. When the orderly is called, there are occasions where they do not receive a clear specification regarding which patient should undergo the X-ray examination, necessitating a reassessment upon their arrival at the medical clinic. This issue accounts for 15% of the waiting time in this activity.

Finally, the most significant cause of waiting is related to fetching the wheelchair. Despite the medical clinic having the highest demand for wheelchair use, these wheelchairs are also utilized in other wings, such as the surgical clinic and the emergency department. Consequently, since these wheelchairs are located on different floors within the hospital, the orderly must retrieve them after confirming their absence in the medical clinic. This issue is predominant, representing 84% of the patient's waiting time in this activity.

Given the frequencies of each occurrence, a Pareto chart for the waiting times in this activity was also constructed, as depicted in Figure 3.

Therefore, since fetching the wheelchair emerged as the most significant among the occurrences, the 5 Whys tool was applied to investigate this issue (Figure 4). The objective was to identify its root cause and subsequently address it with an appropriate Lean Healthcare tool.

Thus, it has been established that the need to retrieve wheelchairs arises due to the absence of a standardized location for their storage. Consequently, when these wheelchairs are used by other staff members, they are left where they were utilized and are not returned to a standardized location, as they are common-use items within the hospital. This results in waiting times for patients who must await the orderly to locate one for use.

This identified waste is detrimental to the hospital primarily because it hinders mobility within the facility. This challenge is particularly pronounced due to the considerable distance between the medical clinic and the X-ray, situated on the third and first floors, respectively. Moreover, it affects other specific processes occurring outside the medical clinic that require movement through the hospital's ramps.

In addition, this root cause generates Lean waste in the form of unnecessary movement for the stretch bearer. Therefore, the proposal (Table 2) involves the implementation of a standardized work procedure, specifically establishing designated wheelchair storage areas on all floors. This approach ensures a fixed location for wheelchairs on the third floor, and consequently, within the medical clinic.

Table 2. Action plan to place the patient in the wheelchair.

Action plan		Objective: Reduce waiting time to fetch a wheelchair															Department: Medical clinic
Task n	Task	Metric	Responsable	Date-Target	J	F	M	A	M	J	J	A	S	O	N	D	Review
1	Meeting with directors	Meeting held in a room with hospital directors	Aplicator 1	Oct-19										O/X			O
2	Establishment of wheelchair locations	Establish a standard place to place wheelchairs after use	Aplicator 1	Oct-19										O/X			O
3	Adaptation phase	Time to adapt to the new process	Aplicator 1	Nov-19											O/X		O
4	Use of the space for wheelchairs	Employees now use the proposed location for wheelchairs	Aplicator 1	From December/2019 to February/2020		X										O	O
5	Result recording	Measurement made through observations to compare with initial values	Aplicator 1	Mar-20			O/X										O
Prepared by: Applicator 1 and Applicator 2										**Caption**							
					O Start date									O On target			
					X Conclusion date									V Below the target			
					* Review									X Problem			

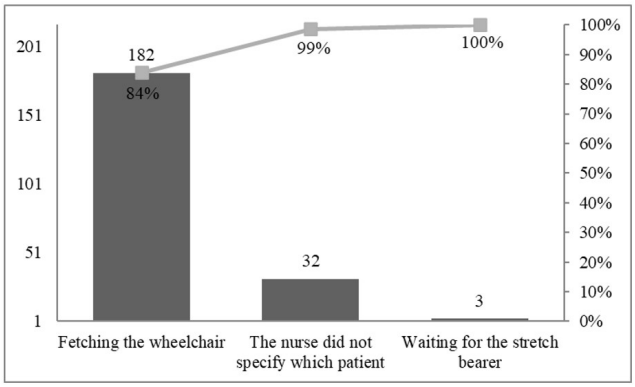

Figure 3. Pareto Graph for Waiting Occurrences in Placing the Patient in the Wheelchair.

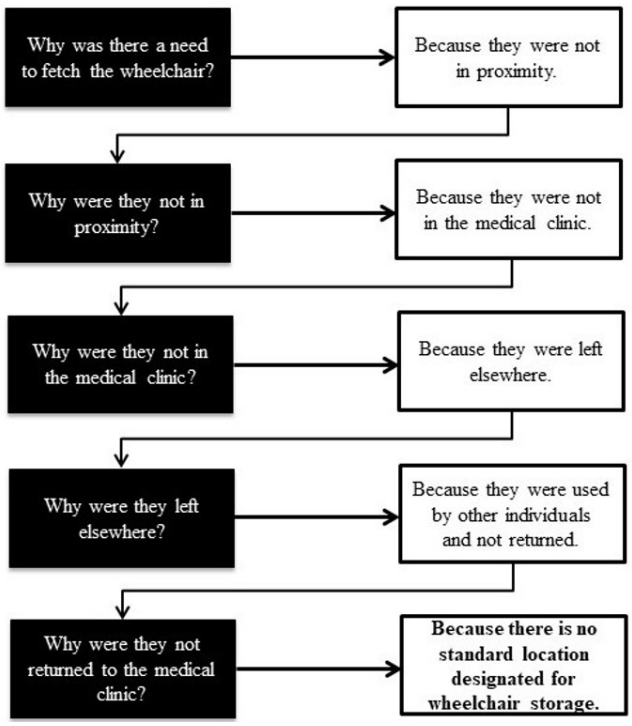

Figure 4. 5 Whys Analysis for Fetching the Wheelchair.

4.4. Quantitative results

These are the results related to the activity of placing the patient in the wheelchair. Table 3 shows the values obtained for these activities and the impact they had in relation to the time originally collected and post-application, as well as the number of occurrences of the root cause.

As a result, the total time for the activity reduced from 20 minutes to 7 minutes, with a decrease in non-value-added time from 18 minutes to 5 minutes, representing a reduction of 72.2%. The value-added time for the activity increased by 19% compared to the initial state due to this change. Furthermore, the unnecessary movement to retrieve the wheelchair decreased from 100 steps to 17 steps, resulting in a total reduction of 83% for this activity. Finally, the number of occurrences decreased by 100%.

Despite the indisputable quantitative gains demonstrated by the reduction in non-value-added time, leading to the elimination of the unnecessary movement of the stretch bearer and consequently a decrease in their

Table 3. Results obtained for the patient in the wheelchair.

PATIENT IN THE WHEELCHAIR									
INITIAL TIME					REACHED TIME				
Total time	Non-added value	Percentage of non-added value	Added value	Percentage of Added value	Total time	Non-added value	Percentage of non-added value	Added value	Percentage of Added value
20	18	90%	2	10%	7	5	71%	2	29%
INITIAL DISPLACEMENT					DISPLACEMENT REACHED				
100					17				
NUMBER OF INITIAL OCCURRENCES					NUMBER OF OCCURRENCES POST APPLICATION				
182					0				

overall movement - retaining only that which is necessary for the execution of the activity, it is essential to examine the qualitative benefits brought about by this Lean Healthcare application within the medical clinic.

To accomplish this, the impacts on accessibility were measured by the perspective of the results of the Lean Healthcare application was assessed from three viewpoints: those of the patients (through direct contact with patients who were admitted during this period), the staff (through interaction with the stretch bearer), and the applicators.

4.5. Discussions

The application of Lean Healthcare in the hospital's medical clinic represented a significant milestone in optimizing one of its specific procedures. The establishment of a Standard Work Procedure that standardized the location of wheelchairs in the hospital proved to be an effective strategy, resulting in tangible benefits for all stakeholders.

The main goal of this research was to improve accessibility in the study hospital, focusing primarily on mobility issues, through Lean Healthcare. Differently from what is presented in Castrén (2016), since the main goal was an improvement in efficiency, with accessibility as a background.

To highlight this difference, stakeholders were surveyed to characterize the paper in a more humanized way and closer to the advantages of Lean in the healthcare sector. Therefore, patients, as one of the most affected groups, experienced substantial improvements in their healthcare journey. The reduction in waiting time for X-ray examinations led to a more comfortable and efficient experience. Patients who were previously subjected to long waiting periods now have quicker access to diagnostic services, contributing to more effective and timely medical care.

For clinic staff, particularly the stretch bearer, the implementation of Lean Healthcare improved their work environment significantly. Standardizing the location of wheelchairs eliminated the need for extensive hospital-wide searches for these essential pieces of equipment. As a result, orderlies can now focus their energy and effort on more critical and meaningful tasks, enhancing both the quality and efficiency of their daily work.

Furthermore, the improvement in clinic mobility extended to Lean Healthcare implementers. The quantitative gains validated the Lean approach, underscoring the strategy's effectiveness in optimizing hospital processes. The reduction in waiting time and measurable improvements in operational efficiency clearly demonstrated the benefits of Lean implementation.

From the perspective of surveyed patients, faster access to examination services provides not only a more pleasant experience but also enhances trust in the hospital as a reliable healthcare provider. This mobility improvement also has the potential to expedite diagnoses, enabling more timely and effective treatments.

For surveyed staff, specifically the stretch bearers, the reduced need for unnecessary movements frees up time and energy that can now be redirected towards providing direct patient care. The improved quality of the work environment has the potential not only to increase staff satisfaction but also positively influence talent retention in the healthcare field.

Even though the research of Gupta et al. (2018) presents an innovation in bringing the application of the manufacturing area closer to health, in the Indian context, this paper explores the Brazilian public health sector, which stands out for the existence of the Unified Health System, which seeks to provide access, in a free medical and clinical care for the population.

Thus, it adds even greater importance (and difficulty) to this case, given that the demand in the country's health sector is high and, by law, it is necessary for the entire population to be served. Furthermore, the Brazilian

context, in terms of improving mobility in the healthcare sector through Lean Healthcare, is not identified in the literature, which shows a gap that this paper fills.

As for Lean Healthcare implementers, the quantitative gains not only validate their approach but also inspire a commitment to continuous process improvement and efficiency throughout the hospital.

Therefore, the implementation of Lean Healthcare in the medical clinic not only met expectations but also exceeded them by delivering concrete benefits to patients, staff, and implementers. The focus on improving mobility demonstrates how this effective approach not only enhanced the quality of medical services but also created a more favorable work environment and inspired a culture of continuous improvement within the hospital.

What this paper comes closest to is definitely the research of Ramos et al. (2022). In its results, it brings considerable improvements resulting from Lean Healthcare to the issue of accessibility in the healthcare sector.

However, it is noteworthy that, despite this approach, Ramos et al. (2022) focuses on accessibility of visually impaired people. The present research, on the other hand, seeks this accessibility in mobility issues, so it is worth highlighting the importance and innovation of this, since these are completely different accessibility problems, which require different developments and indicators.

5. Conclusions

Through this study, it is possible to recognize the positive outcomes that a systemic application can have in mitigating waste within the processes of a hospital's medical clinic, especially when adopting lean principles. The research successfully achieved its objective, as it effectively applied systematically Lean Healthcare to improve mobility accessibility in the medical clinic wing of a medium-sized hospital. Additionally, it involved mapping the flow of X-ray examinations, employing suitable tools, and implementing a viable solution to address the identified waste.

Identifying the root cause allowed for the proposal of an appropriate tool, the Standard Work Procedure, which improved the patient flow within the process. This led to a reduction in waiting times and minimized staff movements, particularly for the orderlies. Furthermore, the proposed application yielded positive results from a Lean perspective by reducing non-value-added time within the studied activity. Given these promising outcomes, a systematic expansion of this approach across additional activities is possible, utilizing a combination of suitable and structured Lean Healthcare tools.

The implementation of Lean Healthcare in the hospital's medical clinic yielded significant gains, particularly benefiting patients and staff. Patients experienced substantial improvements in their healthcare journey, notably through reduced waiting times for X-ray examinations. This enhancement not only increased patient comfort but also instilled greater trust in the hospital as a reliable healthcare provider. The expedited access to diagnostic services has the potential to accelerate diagnoses and lead to more timely and effective treatments, ultimately enhancing patient care and satisfaction.

For the clinic's staff, especially the stretch bearers, Lean Healthcare brought about transformative changes in their work environment. Standardizing the location of wheelchairs eliminated the need for extensive searches and allowed staff to redirect their energy and efforts toward more critical patient care activities. This not only improved the quality of their work but also contributed to a more favorable work atmosphere, increasing staff satisfaction and potentially aiding in talent retention within the healthcare sector. In summary, Lean Healthcare's implementation delivered tangible benefits by enhancing patient experiences and optimizing staff workflows, ultimately fostering a more efficient and patient-centered medical clinic.

Moreover, this study contributes to Lean Healthcare literature by focusing on the medical clinic area, which is not extensively explored, and by introducing a structured application methodology with practical and replicable results. For future research, it is recommended to replicate the application systematically, using specific metrics to address other areas of waste related to patient waiting and safety, in order to validate and enhance the obtained results.

5.1. Paper's limitations

The limitations of this paper are concentrated on two primary aspects. Firstly, in terms of application, the study addresses accessibility predominantly for wheelchair users, neglecting other mobility issues within the hospital, such as the use of crutches, access to stairs, ramps, and other relevant factors.

Moreover, from the perspective of the comparisons drawn in the discussions, the analysis is confined to the results, given the considerably restricted literature on Lean Healthcare and accessibility. The majority of papers do not

engage deeply with this specific topic, and when they do, they address different accessibility limitations than those considered in this study. Thus, it is essential to underscore the limitation in comparing this research with other studies, as comparing distinct types of accessibility limitations is not advisable due to their differential impacts on patients.

Therefore, for future research, it is recommended to investigate other forms of accessibility limitations within the Lean Healthcare framework to expand the existing body of literature. Equally critical is a deeper examination of mobility accessibility, which is highly significant in the hospital context.

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