LEAN HEALTHCARE CONTRIBUTIONS TO SUSTAINABLE DEVELOPMENT: A CASE STUDY IN A CENTRAL STERILE SUPPLY DEPARTMENT

Natália Tochetto (Universidade Federal do Rio Grande do Sul)
Bruna Borin (Universidade Federal do Rio Grande do Sul)
Priscila Wachs (Pontifícia Universidade Católica do Rio Grande do Sul)
Tarcísio Saurin (Universidade Federal do Rio Grande do Sul)

Lean Healthcare is a management philosophy focused on improving the quality of patient care and the quality of work life for healthcare professionals, as well as promoting sustainability. This article aims to identify the contributions of Lean Healthcare practices to the sustainable development of healthcare organizations. Through the analysis of secondary data from a study carried out at a Central Sterile Supply Department, this research associates the proposed improvement solutions, based on Lean Healthcare principles, with the Sustainable Development Goals (SDGs) defined by the 2030 Agenda. The results demonstrate that the analyzed Lean Healthcare solutions are directly or indirectly related to nine SDGs. The implementation of Lean Healthcare practices contributes to the preservation of natural resources, improvement of working conditions, and economic and financial progress, impacting all three dimensions of sustainability. Thus, this study can serve as a reference for other health institutions to align the implementation of Lean practices with the principles of the SDGs, thereby supporting the sustainable development of the organization.

Keywords: Lean Healthcare, Sustainable Development, Sustainable Development Goals, Central Sterile Supply Department.
1. Introduction

The Brazilian healthcare system presents many potential opportunities to be improved, to become more efficient, and contribute to greater cost-effectiveness and resource utilization (OECD, 2021). To effectively address the demand and meet the needs of society, it is essential to use tools that support process improvement within the system (ZANCHET et al., 2007). In light of this, research carried out in the last decade has demonstrated a significant impact of employing Lean tools in hospital environments, leading to substantial improvements in patient care (COSTA et al., 2017).

Lean, more than a set of tools, is a management system and a philosophy that enables a change in the way hospitals are managed (GRABAN, 2013). Lean principles include adding value to the customer (and reducing waste), organizing the value stream, not interrupting that flow, producing on demand (pull production), and continuous improvement (WOMACK; JONES, 2003). The focus on the value stream is noticeable, considering the value for the customer; which, in healthcare services, can be translated into the patient's journey (WORTH et al., 2013), the flow of materials in sterilization centers (SOLIMAN et al., 2020), the flow of medications (DIXIT et al., 2022).

Among the practices used in hospitals, visual management, value stream mapping, daily management routine, Kaizen Event, and the 5S Program stand out (ARAÚJO et al., 2017; TORTORELLA et al., 2016; VIDAL-CARRERAS et al., 2022). From this, significant benefits can be observed, such as the reduction of lead time, the time of hospitalization, and stay in the hospital environment (COSTA et al., 2017; VIDAL-CARRERAS et al., 2022), through the elimination of different types of waste associated with these processes (ZEPEDA-LUGO et al., 2020). For instance, the research carried out by Costa et al. (2017), adopted Lean philosophy practices in a hospital and resulted in increased patient satisfaction and reduced process costs by optimizing the use of sterilization machines and the sizing of material and medication inventories.

Furthermore, it is observed that Lean practices also contribute positively to improving organizational performance in the three dimensions of sustainability (environmental, social, and economic) (JUM'A et al., 2022; MESQUITA et al., 2021; LEON; CALVO-AMODIO, 2017). A concrete example of the benefits of implementing Lean practices in terms of sustainability is the significant reduction of environmental impacts, such as pollution and waste generation, and social impacts, such as improved ergonomics in the workplace (MATOS; MOTA, 2016).

Given this context, the research question of this study is stated as follows: how can initiatives based on Lean principles contribute to the sustainable development of a healthcare
organization? To address this question, the present study established a connection between sustainability factors and improvement proposals, arising from a value stream mapping previously carried out by the first author in a Central Sterile Supply Department (CSSD). The CSSD plays a pivotal role in the operation of a hospital, being responsible for providing materials to all units of all levels of complexity (SOLIMAN et al., 2020; ZANCHET et al., 2007). Therefore, due to its interactions with other areas and its critical role in the functioning of the care unit (TORTORELLA et al., 2016), the CSSD has great potential for carrying out this study. Thus, the obtained results can serve as a guideline for hospitals in the implementation of Lean-based improvements that increase process efficiency and reinforce aspects related to sustainable development.

2. Background

2.1. Sustainable development

Sustainable development involves meeting present needs without compromising the well-being of future generations, by combining economic growth, social inclusion, and environmental preservation (CMMAD, 1988). Therefore, sustainable development aims to improve society’s quality of life by considering factors such as income distribution, health, education, environment, freedom, and leisure (OLIVEIRA, 2002).

To realize this concept, in 2015, member countries of the United Nations signed a document called 'Transforming Our World: The 2030 Agenda for Sustainable Development' (or Agenda 2030), committing to reduce negative impacts on the planet and improve the quality of life of its inhabitants by the year 2030 (UN, 2015). To assist in the implementation of this plan, 17 Sustainable Development Goals (SDGs) were formulated based on the main challenges faced by humanity (UN, 2015), as shown in Figure 1.

The SDGs are ambitious and interconnected, aiming to eradicate poverty, protect the environment and climate and ensure peace and prosperity (UN, 2015). Each of these goals has sub-items that describe specific actions to guide signatory countries in building political, technological, and financial solutions in all dimensions of sustainability (ONU, 2022). Thus, institutions must guide their strategic planning to integrate the SDGs into their scope, seeking initiatives to improve social, economic, and environmental aspects as exposed by Oliveira (2002).
2.2. Lean Healthcare and sustainability

The implementation of Lean aims to achieve more efficient results, consuming fewer resources and adding value to the customer. To achieve these results, Lean principles are based on processes with continuous flow, initiated from customer demand, activities that add value, elimination of waste, and continuous improvement (LIKER, 2005; WOMACK; JONES, 2003). Therefore, many healthcare institutions are adopting Lean Healthcare (LH) practices, an adaptation of Lean for this sector, intending to improve their processes and make more assertive strategic decisions (ZEPEDA-LUGO et al., 2020).

The LH is a management philosophy that can improve the quality of care offered throughout the patient journey (from admission to discharge) and benefit both patients and healthcare staff, with a positive impact on the work environment (GRABAN, 2013). Thus, LH practices favor the reduction of employee stress, increasing motivation, as well as improving the relationship between areas present in the value stream. Therefore, the improvement of the quality of healthcare services is directly associated with the following positive effects: teamwork, value stream orientation, and everyone's involvement (DROTZ; POKSINSKA, 2014).

There is evidence that Lean practices contribute to achieving sustainability goals (MESQUITA et al., 2021). Specifically, in the social aspect, the implementation of Lean can promote active employee involvement in the adoption of sustainable measures (DROTZ; POKSINSKA, 2014; LEÓN; CALVO-AMODIO, 2017). To engage employees, it is essential to provide training to help them understand Lean practices and develop problem-solving skills (ZEPEDA-LUGO et al., 2020). This training can be provided through courses and specialized professionals (JUM'A et al., 2022).
Moreover, Lean implementation contributes to the environmentally appropriate use of material resources due to minimizing non-value-added activities in the flow (LEÓN; CALVO-AMODIO, 2017). In addition to providing efficient consumption, it is important that Lean-based initiatives also include actions involving waste management. Among these practices, responsible resource selection and the use of renewable resources are highlighted, contributing to the reduction of pollution (LEÓN; CALVO-AMODIO, 2017).

By aligning Lean and sustainability purposes, organizations can gain a better understanding of trade-offs and divergences within their systems, ultimately leading to improved economic development (LEÓN; CALVO-AMODIO, 2017). To achieve this, it is essential to establish and measure key performance indicators to reduce operating costs. Monitoring these indicators makes it possible to level the workload and adjust the takt time, which can eliminate unnecessary expenses and improve the well-being of employees (VIDAL-CARRERAS et al., 2022; ZEPEDA-LUGO et al., 2020).

3. Methodology

3.1. Study environment

This study was based on secondary data originally collected by previous research carried out by the main author, in a Central Sterile Supply Department (CSSD) of a public hospital located in the south of Brazil. The previous research is part of a main project in the same hospital, approved by the hospital's Research Ethics Committee (CAAE: 79424617.0.0000.5327). In recent years, this CSSD has undergone significant changes that have resulted in modifications to its internal processes, leading to changes in the flow. Faced with the difficulties reported throughout the process flow, another study was carried out by the author to diagnose the causes of the observed inefficiency and propose improvement solutions.

3.2. Research method

The present study was conducted in the following stages: (i) understanding the process flow analyzed; (ii) analysis of the improvement solutions proposed by the primary study; and (iii) analysis of the contributions of Lean practices to the sustainable development of the organization, by associating the solutions with the SDGs.

Data collected consisted of research reports resulting from the primary study. However, it is noteworthy that the first author of the present study is also the author of the primary study. Thus, the 80 hours of observation conducted for the primary study and the consulted documents also contributed to the development of the present study.
Data analysis mainly involved the content analysis of the research reports and resulting documents - with a focus on understanding how the flow works and the context in which it is inserted - and the analysis of improvement propositions based on Lean practices. Finally, the association of these propositions with the items and sub-items of the SDGs was analyzed to verify how the improvements can be related to the objectives and their sub-items and contribute to the organization's sustainable development.

4. Results

4.1. CSSD flow

The flow of the material cleaning and sterilization process in the CSSD involves the following stages: Receipt, Cleaning, Packaging, Sterilization, Storage, and finally, Distribution. After receiving dirty materials, in the Cleaning stage, the materials are checked and separated for washing. If necessary, a pre-wash is performed to remove any residues before placing them in the machines (washer-disinfectors). After going through the cleaning process, the materials are sent to the Packaging area, where their quality level will be evaluated, and the surgical kits will be assembled. For assembly, each instrument must be recorded on the system by scanning the QR code engraved on it.

Once ready, the kit goes to the Sterilization stage, where batches of loads are assembled to be inserted into steam sterilizers. After completing the steam sterilization cycle, in the Storage stage, the load is removed from the sterilizers, and each material is recorded on the system and then stored in the CSSD inventory. In the Distribution phase, supporting units' orders are checked on the system and items are separated for delivery. For this, the output of materials is registered in the system and the kits are assembled according to each request.

4.2. Improvement opportunities identified

In the analyzed case study, a diagnostic assessment of the CSSD processes was carried out to identify improvement opportunities. For each opportunity identified, a solution based on Lean concepts was proposed to enhance the respective process. Table 1 presents the number of verified opportunities classified into seven categories. As an opportunity may fall under multiple categories, each one has been classified according to the most suitable category.
The Quality category had the highest number of improvement opportunities, representing a quarter of all categories. Among these opportunities, the need for a tool to record and communicate non-conformities perceived by the CSSD’s customers (supporting units) stands out. Additionally, standard operating procedures (SOPs) are made available through an institutional computerized document management system and the difficulty of accessing SOPs can impact the kit assembly process.

Regarding People Management, encouraging the participation of employees in the collective construction of solutions to improve the work environment can prevent knowledge loss. In terms of Visual Management, there are opportunities to improve the identification of materials and spaces, focusing on the quantity and quality of materials used, to avoid wasting time due to rework and excessive use of materials. A significant portion of obstacles related to Pull Production reflects poor production planning and control. In addition, uneven workload distribution and inefficient use of cleaning machines (washer-disinfectors) were observed.

Towards Ergonomics, there is an opportunity to improve the handling of the steam sterilizer load during the Sterilization and Storage stages. As for Layout, the arrangement of workstations in the Storage and Distribution area leads to movement losses. In terms of Technology, the lack of standardization in the material register increases the possibility of errors in the generation of orders.

4.3. Lean Healthcare solutions and the SDGs

In this section, the improvement solutions proposed in the primary study will be presented, classified by category, and how they relate to the SDGs (Table 2).
Concerning the Quality category, it was proposed to develop an easily accessible form (Q1) to build a consistent data history (Q2). In terms of standard operating procedures (SOPs), it was suggested that tasks of greater complexity (such as assembling critical kits) have illustrative, easy-to-understand instructions located close to the workstations (Q3). For material separation, the use of tablets was recommended to access orders virtually (Q4).

For the People Management category, the implementation of Kaizen Event (PM1), supported by managers, was recommended, which can stimulate the team's creativity in resolving operational situations intrinsic to the sector, facilitating daily work. It was also proposed to build a consistent skills matrix (or multifunctionality) (PM2), enabling the creation of a more balanced service schedule, and distributing professionals with greater mastery in their respective functions.

Concerning Visual Management, the implementation of the 5S Program (VM1) can contribute to improving the quality of life in the work environment by making it cleaner and more organized. Additionally, it was recommended to invest in materials with greater durability for labeling areas (VM2). It was suggested the use of screens (televisions) (VM3) to display the schedule of activities, thus improving demand communication. For a better distribution of workload capacity, it was proposed to define the limit of Work In Process (WIP) stock limit (VM4). In terms of Ergonomics, it was suggested to improve the procedure regarding the use of steam sterilizers (E1) by creating a standard for handling the load.

Regarding the Pull Production category, it was proposed to level the production plan (Heijunka), the production scheduling point, and the standard information flow (PP4), as well as optimize the use of the washer-disinfectors (PP1). In addition to these solutions, a workload balancing study (PP2) and the extension of hours for receiving dirty materials (PP3) was recommended.

In terms of Layout, it was advised to position the storage workstation closer to the sterilization machines (steam sterilizers) (L1), which would speed up the unloading processes. The installation of a conveyor belt between the Packaging and Sterilization stages for transporting materials (L2) was also suggested to reduce movement and increase operational efficiency.

Relating to the Technology category, it was recommended to establish a standardized naming convention for the materials, assigning a unique name to each object (T1), to mitigate the risk of errors.
## Table 2 - Lean Healthcare solutions and associated SDGs

<table>
<thead>
<tr>
<th>Category</th>
<th>Lean Healthcare solutions</th>
<th>SDG*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality</td>
<td>Q1. Develop a form for recording non-conformities</td>
<td>12, 16</td>
</tr>
<tr>
<td></td>
<td>Q2. Monitor key performance indicators</td>
<td>8, 12, 16</td>
</tr>
<tr>
<td></td>
<td>Q3. Provide work instructions at workstations</td>
<td>3, 8, 12, 16</td>
</tr>
<tr>
<td></td>
<td>Q4. Use a cart and tablet for material separation</td>
<td>8, 9, 12</td>
</tr>
<tr>
<td>People Management</td>
<td>PM1. Implement Kaizen Event</td>
<td>3, 8, 9, 10, 12, 16, 17</td>
</tr>
<tr>
<td></td>
<td>PM2. Create a multifunctionality matrix for skills management</td>
<td>3, 8, 10, 12, 16</td>
</tr>
<tr>
<td>Visual Management</td>
<td>VM1. Implement the 5S Program</td>
<td>3, 8, 9, 12, 13, 16, 17</td>
</tr>
<tr>
<td></td>
<td>VM2. Use materials with greater durability for marking and identification</td>
<td>8, 9, 12, 16, 17</td>
</tr>
<tr>
<td></td>
<td>VM3. Include televisions displaying the demand sequence in each work area</td>
<td>8, 9, 12, 16</td>
</tr>
<tr>
<td></td>
<td>VM4. Define the Work In Process (WIP) limit</td>
<td>8, 9, 16</td>
</tr>
<tr>
<td>Pull Production</td>
<td>PP1. Optimize the use of washer-disinfectors</td>
<td>6, 8, 9, 12, 16, 17</td>
</tr>
<tr>
<td></td>
<td>PP2. Balance workload</td>
<td>8, 10, 16, 17</td>
</tr>
<tr>
<td></td>
<td>PP3. Extend hours for the delivery of soiled materials</td>
<td>8, 9, 10, 12, 16, 17</td>
</tr>
<tr>
<td></td>
<td>PP4. Improve production planning and control practices</td>
<td>6, 8, 9, 10, 12, 16, 17</td>
</tr>
<tr>
<td>Ergonomics</td>
<td>E1. Standardize the handling of steam sterilizers loads</td>
<td>3, 8, 9, 10, 16, 17</td>
</tr>
<tr>
<td>Layout</td>
<td>L1. Modify the layout of the storage area</td>
<td>8, 9,10, 16, 17</td>
</tr>
<tr>
<td></td>
<td>L2. Install a conveyor belt between the Packaging and Sterilization stages</td>
<td>8, 9, 16, 17</td>
</tr>
<tr>
<td>Technology</td>
<td>T1. Establish a standard naming convention for materials and record it in the system</td>
<td>8, 9, 12, 16</td>
</tr>
</tbody>
</table>

*The sub-items of these SDGs can be consulted at [https://www.un.org/sustainabledevelopment].

Source: Adapted from the primary study conducted by the first author.
Goal 3: good health and well-being - ensure healthy lives and promote well-being for all at all ages. Some of the proposed solutions (Q3, PM1, PM2, VM1, and E1) are related to this objective, specifically sub-item 3.c, which emphasizes care for health professionals in developing countries. Thus, these suggestions contribute to the empowerment of employees, motivating them and creating a more pleasant work environment. The implementation of the Q3 solution, for example, helps in performing the work correctly, thereby improving the quality of the process (COSTA et al., 2015). Initiatives such as Kaizen Event (PM1) improve productivity, strengthen collaboration between individuals and provide opportunities for engagement in problem-solving (GRABAN, 2013; LEÓN; CALVO-AMODIO, 2017).

Goal 6: clean water and sanitation - ensure access to water and sanitation for all. Regarding SDG 6, sub-items 6.3 and 6.4 are mentioned, which address the improvement of water quality and the efficient use of water, respectively. In line with these goals, there is a proposal to optimize the use of material cleaning machines (PP1). Maximizing the capacity of washer disinfectors helps minimize water consumption in this stage of the process (COSTA et al., 2015).

Goal 8: decent work and economic growth - promote inclusive and sustainable economic growth, employment, and decent work for all. Except for Q1, all solutions are associated with this SDG. Notably, sub-items 8.2, 8.3, 8.4, 8.5, and 8.8 stand out, which involve increased productivity supported by innovation and technologies, as well as the promotion of decent work policies and safe environments. In this sense, for example, workload balancing (PP2) helps to distribute the demand among employees, reducing overload (VIDAL-CARRERAS; GARCIA-SABATER; MARIN-GARCIA, 2022). Standardizing the handling of steam sterilizer loads (E1) and modifying the layout (L1) also contribute to a safer environment (GRABAN, 2013; COSTA et al., 2015).

Goal 9: industries, innovation and infrastructure - build resilient infrastructure, promote sustainable industrialization and foster innovation. This SDG focuses on modernizing facilities and strengthening scientific research, along with advancing technology to make processes more efficient. Therefore, the solutions linked (Q4, PM1, VM1, VM2, VM3, VM4, PP1, PP3, PP4, E1, L1, L2, T1, and T2) to this SDG propose the use of cost-effective resources to support the execution of activities. Measures such as the use of televisions (VM3) and the implementation of a conveyor belt for transporting materials (L2) reduce process lead time and
increase production capacity, while also providing ergonomic benefits to employees (GRABAN, 2013). Furthermore, standardizing the naming of materials in the system (T1) also promotes the efficient use of technology (LIKER, 2005).

**Goal 10: reduce inequalities - Reduce inequality within and among countries.** The improvements related to this SDG (PM1, PM2, PP2, PP3, PP4, E1, L1) are linked to the inclusion of all employees in different spheres (social, economic, political), as well as the promotion of appreciation and equal opportunities and results (subitems 10.2, 10.3 and 10.4). As part of the contribution to the sustainable development of the organization, the multifunctionality matrix (PM2) involves mapping the skills and abilities of each employee, enabling planning and equalization of training for all (DROTZ; POKSINSKA, 2014).

**Goal 12: responsible consumption and production - ensure sustainable consumption and production patterns.** The suggested propositions are directly related to six sub-items (12.2, 12.4, 12.5, 12.6, 12.7, and 12.8), making it the SDG with the most discussed assumptions. Among them, the efficient management and use of resources, handling of chemical products, reduction of waste generation, sustainable procurement, and dissemination of relevant information stand out. Thus, it is necessary to review current production and consumption models and align improvement initiatives conducted by organizations with the environmental sphere. In this sense, the use of materials with greater durability (VM2) leads to long-term consumption reduction. Meanwhile, the implementation of the 5S Program (VM1) is an example that promotes internal culture and, beyond the organization, supports education by raising employee awareness of the adoption of a sustainable lifestyle (J'UMA, 2022; CHOTCHOUNGCHATCHEAI et al., 2020; ZEPEDA-LUGO et al., 2020).

**Goal 13: climate action - take urgent action to combat climate change and its impacts.** Regarding SDG 13, sub-item 13.3 stands out, which emphasizes the importance of awareness and education for climate adaptation and impact reduction. Thus, this objective is in line with the benefits conferred by the implementation of the 5S Program, as discussed in SDG 12.

**Goal 16: peace, justice and strong institutions - promote just, peaceful and inclusive societies.** Sub-items 16.6 (Develop effective, accountable, and transparent institutions at all levels) and 16.7 (Ensure responsive, inclusive, participatory, and representative decision-making at all levels) are the ones most related to the proposed solutions. The establishment of
a work-in-process (WIP) limit (VM4) and the improvement of production planning and control practices (PP4) are ways to make the institution effective (GRABAN, 2013; LIKER, 2005). Furthermore, the formulation of a non-conformity registration form (Q1) encourages collective participation and the corresponding monitoring of key indicators (Q2) guides managers’ actions to promote continuous improvement of the system (GRABAN, 2013; LIM et al., 2022).

**Goal 17: partnerships for the goals - revitalize the global partnership for sustainable development.** Actions Q2, VM3, PP1, and PP4 are associated with this SDG through sub-item 17.7, which is about promoting the advancement, transfer, dissemination, and widespread adoption of environmentally-friendly technologies to developing countries in favorable conditions. Sub-item 17.14 proposes to enhance the coherence of sustainable development policies and is in line with the proposal to extend the delivery time for dirty materials (PP3) (LIKER, 2005), for example. This would distribute the workload, also enabling PP1 and PP2 solutions (LIKER, 2005). The encouragement of public-private partnerships (PPP) for combined efforts is explained in sub-item 17.17 and can be implemented to achieve PM1, PP1, PP4, and E1 solutions (ARAÚJO et al., 2017; CHOTCHOUNGCHATCHAI et al., 2020; JUM'A et al., 2022).

5. **Discussions and conclusions**

The main objective of this study was to identify the contribution of Lean-based solutions to the sustainable development of healthcare organizations. For this purpose, 18 improvement proposals for a Central Sterile Supply Department (CSSD) were analyzed, originating from a study carried out by the first author as part of a larger research project carried out at the hospital under investigation. Improvement propositions are divided into seven categories: Quality; People Management; Visual Management; Pull Production; Ergonomics; Layout; and Technology. These propositions are based on Lean principles to enhance the institution's performance and bring benefits to all stakeholders involved in the system.

The solutions were directly or indirectly associated with nine out of the 17 Sustainable Development Goals (SDGs) outlined in the 2030 Agenda. Thus, it was observed that the proposed measures can contribute to reducing inequalities (SDG 3), by promoting decent work (SDG 8) and well-being for employees (SDG 10). In addition, infrastructure improvements and employee training, for instance, can contribute to resource optimization (SDG 12) and institution effectiveness (SDG 16). The proposed improvements can also drive the reduction of environmental impacts by mitigating anthropic actions, helping to combat climate change (SDG 13).
13), and promoting conscious water consumption (SDG 6). Furthermore, the use of technologies and the adoption of standardized procedures can increase the organization’s efficiency (SDG 9), while partnering with employees can facilitate the innovation processes and the implementation of new techniques (SDG 17).

The alignment of LH solutions with the underlying SDG principles demonstrated that implementing Lean practices in the CSSD can contribute to the overall sustainable development of the hospital. In the social aspect, Lean practices aimed at improving the working conditions of employees, such as workload balancing, layout reorganization, and the 5S Program, stand out. In the environmental dimension, the efficient use of cleaning machines (thermal disinfectors) and the use of more durable materials prevail. In the economic sphere, solutions related to visual management and production capacity (process automation, workload optimization) are highlighted.

Based on the analysis of the solutions presented in light of sustainability concepts, it was found that there is a potentially positive impact on the three dimensions of sustainability (environmental, social, and economic). Therefore, it can be considered that Lean Healthcare practices can contribute to the sustainable development of healthcare organizations.

The research had some limitations, such as the exclusive analysis carried out in a public hospital located in a developing country, without considering countries in different stages of development and other health institutions such as private hospitals and primary supporting units. Additionally, the research focused on a specific area of the organization, without involving other departments, such as the supporting units of the hospital. Furthermore, only isolated Lean practices were considered, without addressing the impacts of implementing Lean culture throughout the institution.

For future studies, it is recommended to expand the analysis to other areas of a hospital, aiming to identify additional improvement opportunities that have a positive impact on all three dimensions of sustainability. It is also suggested to consider the processes involving other stakeholders, such as hospital service and materials suppliers, as well as including countries with different levels of development.

REFERENCES
CHOTCHOUNGCHATTAI, Somtanuek et al. Primary health care and sustainable development goals. 
http://dx.doi.org/10.2471/blt.19.245613.


http://dx.doi.org/10.1002/hpm.2331.


http://dx.doi.org/10.1080/14783363.2022.2048952


