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REVIEW ARTICLE

Repercussions obtained in health services with the implementation of Lean Healthcare: integrative review

Repercusiones obtenidas en los servicios de salud con la implementación de Lean Healthcare: revisión integradora

Repercussões obtidas nos serviços de saúde com a implantação do Lean Healthcare: revisão integrativa

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Abstract

The aim was to identify which types of health services/sectors implemented Lean Healthcare and the repercussions obtained. This is an integrative review following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses – PRISMA guideline. Searches were carried out in health electronic databases and portals, resulting in 24 articles published between the years 2012-2022. It was evident that the last five years presented 88% of the publications, including during the period of the COVID-19 pandemic. Of the health services that implemented Lean, 58.4% did not mention the type of administration, 25% had a private institutional profile and 16.6% were public. The predominance of implementation was in hospitals and university institutions, followed by primary care and laboratory. The most obvious repercussions were the reduction in waiting time, increased patient and professional team satisfaction. It is concluded that the Lean philosophy proved to be effective in different health care scenarios. The importance of longitudinal studies that present the maintenance of the results obtained is highlighted.

Descriptors: Patient Satisfaction; Total Quality Management; Quality Improvement; Health Services; Quality Control.

Resumén

El objetivo fue identificar qué tipos de servicios/sectores de salud implementaron Lean Healthcare y las repercusiones obtenidas. Esta es una revisión integradora que sigue los elementos de informe preferidos para revisiones sistemáticas y metanálisis: guía PRISMA. Se realizaron búsquedas en bases de datos y portales electrónicos de salud, resultando 24 artículos publicados entre los años 2012-2022. Se evidenció que los últimos cinco años presentaron el 88% de las publicaciones, incluso durante el período de la pandemia de la COVID-19. De los servicios de salud que implementaron Lean, el 58,4% no mencionó el tipo de administración, el 25% tenía un perfil institucional privado y el 16,6% era público. El predominio de la aplicación fue en instituciones hospitalarias y universitarias, seguido de atención primaria y laboratorio. Las repercusiones más evidentes fueron la reducción del tiempo de espera, aumento de la satisfacción del paciente y del equipo profesional. Se concluye que la filosofía Lean demostró ser efectiva en diferentes escenarios de atención a la salud. Se destaca la importancia de estudios longitudinales que presenten el mantenimiento de los resultados obtenidos.

Descriptores: Satisfação do Paciente; Gestão da Qualidade Total; Melhoria de Qualidade; Serviços de Saúde; Controle de Qualidade.

Resumo

Objetivou-se identificar quais tipos de serviços/setores de saúde implantaram o *Lean Healthcare* e as repercussões obtidas. Trata-se de revisão integrativa seguindo a diretriz *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* – PRISMA. Realizadas buscas em bases e portais eletrônicos em saúde, resultando 24 artigos publicados entre os anos 2012-2022. Evidenciou-se que o último quinquênio apresentou 88% das publicações, inclusive durante o período de pandemia COVID-19. Dos serviços de saúde que implementaram o *Lean*, 58,4% não citaram o tipo de administração, 25% eram de perfil institucional privado e 16,6% público. A predominância da implementação foi em hospitais e instituições universitárias, seguido da atenção primária e laboratório. As repercussões mais evidentes foram a redução do tempo de espera, aumento da satisfação do paciente e da equipe profissional. Conclui-se que a filosofia Lean mostrou-se eficaz nos diversos cenários da assistência à saúde. Ressalta-se a importância de estudos longitudinais que apresentem a manutenção dos resultados obtidos.

Descritores: Satisfação do Paciente; Gestão da Qualidade Total; Melhoria de Qualidade; Serviços de Saúde; Controle de Qualidade.

Introduction

In recent decades, the Toyota company has developed a management system and perfected its production in the automobile industry with principles of continuous improvement applicable and replicable to other different work segments, in such a way that it became a widespread philosophy such as lean production becoming known by Lean Thinking[1].

In the sphere of health, the search for better service results has brought to light the demand for more effective management of resources and recognition of value to the end customer, together with team satisfaction and the construction of an organizational culture different from the models applied until now. then, as well as the relevance of quality in the performance of organizations[2,3]. In this way, the challenge of remaining competitive in the market and improving quality gives rise to new work methodologies using tools commonly adopted in manufacturing adapted to health, highlighting the philosophy of lean production called Lean Healthcare, presented in the first publications in 2002, can also be found denominations Lean Six Sigma, Lean Management[4].

Lean Healthcare encompasses in its principles the reduction and/or elimination of waste; the excellence of customer satisfaction in delivering the desired value, maintaining patient safety and the quality of services provided, involving employees in order to maintain organizational praxis through jointly constructed, organized and standardized processes that enable understanding of the its value in activities, creating a culture of perfection in a continuous improvement process[5].

The processes and strategies that are part of this culture enable the incessant improvement in health services, in order to obtain the supremacy of quality and generate value for the customer. In this sense, the opposite of value is waste, which was categorized by Toyota as seven plus one, contextualizing the following classification and respective examples within the scope of health: 1) waiting: recurrence of the prolonged time spent waiting in queues for assistance; 2) movement: travel time spent by professionals without effectiveness in tasks such as looking for inputs, organizing materials in tasks and/or moving patients; 3) stock or inventory: of unnecessary and/or too much inputs resulting in idle financial resources and the possibility of increasing costs with disposal of expired materials; 4) overprocessing: does not add value to the patient, inadequate process operations, repetition of activities without adding value, such as filling out the same form that does not contribute to the quality and safety of care; 5) defect: errors in steps that result in spending time doing something incorrectly, inspecting and/or requiring rework; 6) transport: excessive movement of materials and/or equipment that should be at the place of use, such as medical records; 7) overproduction: excess production or producing before demand arises; and the eighth identified, the non-use of employees' talent or human potential, that is, professionals without engagement, who do not actively participate in suggestions/improvements, who do not feel heard and also, those with potential capacity to perform tasks that use knowledge or specific skills, but who perform something that does not require[1-4].

Because it is a philosophy, it is necessary to integrate tools, techniques and targeted practices, characterized in a dynamism of five stages of Lean principles: a) define value: with a focus on meeting the needs and preferences of the customer; b) identify and map the value stream: understand the process from beginning to end, identifying what does or does not add value; c) continuous flow: detect problems, discuss solutions with the team to streamline the process; d) pull system: indicates the pace of activities in the following stages and; e) the continuous pursuit of perfection: systematically and continuously removing what interferes with quality and with achieving the goal of zero defects[6,7].

Publications focused on the Lean Healthcare philosophy began about two decades ago, including studies on the subject during the COVID-19 pandemic period, were carried out[8].

Thus, this study aimed to identify which types of health services/sectors have implemented Lean Healthcare and the repercussions obtained.

Methodology

This is an integrative literature review, with descriptive analysis and a qualitative approach, whose method allows the synthesis of previously published studies, based on the results presented by research, resulting in an expanded analysis[9]. The study design was based on the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses - PRISMA guideline[10], systematized in six methodological steps[9].

In the first stage, the research question for the review based on the PECO11 strategy was established, corresponding to the acronym: P: Patient= health services and/or sectors; E: Exposure= Lean Healthcare; C: comparison= implementation of Lean Healthcare, O: Outcome= repercussions obtained. From it, the guiding question of the study was elaborated: What types of services and/or health sectors has Lean Healthcare already been implemented and what were the repercussions obtained?

In the second stage, a literature search was carried out from July to September 2022, in the electronic bibliographic databases U. S. National Library of Medicine (PubMed), Scientific Electronic Library Online (SciELO), National Library of Medicine (MEDLINE), Latin American Literature American and Caribbean Health Sciences (LILACS) and the Virtual Health Library (BVS) and Higher Education Personnel Improvement Coordination (CAPES) portals.

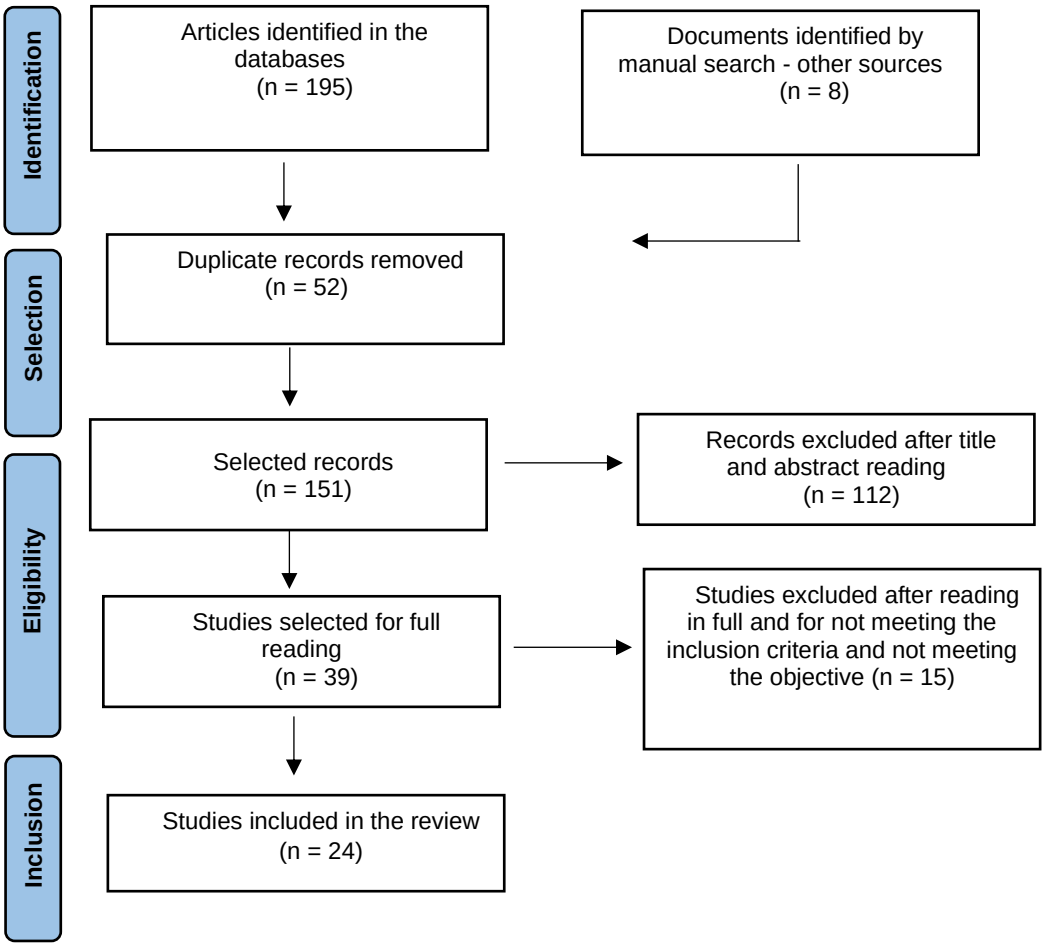
The screening in the electronic databases met the controlled vocabulary of descriptors for the indexing of scientific articles on the platforms Descriptors in Health Sciences (DeCS), Medical Subject Headings (MeSH), using: "Patient Satisfaction", "Total Quality Management", “Quality Improvement”, “Health Services”, “Quality Control” and the combined keyword: “Lean Healthcare” associated with the crossing of Boolean operators “AND” and “OR”, in order to expand the search for scientific evidence.

Portuguese, English and Spanish language filters and time frame of the last ten years (2012-2022) were used in order to expand the search, resulting in 195 documents, in addition to eight articles included manually, previously searched about the theme and the from the verification of the reference lists, totaling 203 documents, being submitted to new selection stages.

The inclusion criteria considered the studies that address the proposed theme and the availability of the full text for the reader. Editorials, letters to the editor, review studies, theses, dissertations, duplicate documents, studies that did not answer the research question or that described only the partial stage of Lean implementation were excluded.

In the third step, the Microsoft Excel® application was used to organize the research results, remove duplications and help with the selection. We excluded 52 repeated studies, resulting in 151 documents. Next, the titles and abstracts were read, excluding those that did not meet the criteria, leaving 39 articles. After a complete and thorough reading of the studies, another 15 studies were excluded for not answering the research question, resulting in a final sample of 24 articles (Figure 1). The search and selection of studies were carried out by two researchers simultaneously and, in situations of divergence, a consensus was sought with the participation of an auxiliary researcher.

Figure 1. Flowchart of search and selection of studies according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)[10]. Campinas, SP, Brazil, 2022



In the fourth stage, the selected studies were organized in a Microsoft Excel® spreadsheet by the authors in order to direct the evaluation and validation of the included studies, containing the following information: first author, year, country, title, objective, health service/ administration and main repercussions.

The fifth stage consisted of the analysis and interpretation of the results and discussion, highlighting the temporal and geographic distribution of publications, type of health services/sectors, repercussions obtained after the implementation of Lean Healthcare. In the last stage, the review, synthesis of the knowledge produced and presentation of evidence were organized.

Results

Of the 24 selected articles, three were indexed in PubMed, seven in the VHL, six in the CAPES Portal and eight articles were included manually. The final sample consisted only of international and English-language publications (Chart 1). It is worth noting that there were national publications referring to Lean Healthcare within the established time frame, however, they did not meet the

inclusion criteria due to the unavailability of the texts in full or did not completely respond to the research question.

Chart 1. Characterization of the studies in relation to the first author, year, country, title, objective, type of health service/administration, repercussions obtained. Campinas, SP, Brazil, 2022

First Author/ Year/Country	Title	Objective	Health Service/ Administration	Obtained Repercussions
Muharam[12] 2022 Indonesia	Lean Management Improves the Process Efficiency of Controlled Ovarian Stimulation Monitoring in IVF Treatment	Identify waste and improve efficiency in the monitoring process of controlled ovarian stimulation during IVF treatment.	In vitro fertilization clinic Does not describe	The total patient waiting time was reduced to 6 hours and 32 minutes in the three visits, 13 hours and 35 minutes of reduction after intervention. In addition, the value-added ratio was increased from 9% to 22%.
Moffatt[13] 2022 Ireland	The Use of Lean Six Sigma Methodology in the Reduction of Patient Length of Stay Following Anterior Cruciate Ligament Reconstruction Surgery	Reduce patient length of stay after anterior cruciate ligament reconstruction, any non-value-added activity in the patient's journey, increasing patient flow, bed capacity, and revenue generation within the hospital system, maintaining patient satisfaction.	Hospital Private	Reduction in hospital stay by 57% and non-value-added activity by 88%. Release of 17 beds for the need for night admissions in a period of 6 months, equivalent to saving 11.3 bed days for the hospital, also having a reduction in costs for the patient of 950 euros (overnight rate).
Zdęba-Mozoła[14] 2022 Poland	Implementation of Lean Management in a Multi-Specialist Hospital in Poland and the Analysis of Waste	Identify and analyze waste and its impact on the process of organizing the provision of medical services and improvements in the patient admission process.	Hospital (gastroenterology ward) Does not describe	The electronic completion of medical documentation brought savings of 368 hours for the nursing team and 175 hours for the medical team, respectively, 2.3 nursing positions and 1.09 medical staff positions. The value of staff working time saved was 3,089 euros/month for nurses and 2,855 euros/month for specialist doctors.
Hung[15] 2021 USA	Patient experiences after implementing lean primary care redesigns	Examine the effect of Lean primary care redesigns on patient satisfaction with care and timeliness of care received.	Primary attention Does not describe	Patients reported a 44.8% increase in satisfaction with the appropriateness of time spent with doctors in consultations, 71.6% more satisfaction with doctors' ability to listen to their concerns, and a 55.4% increase in perceived helpfulness of the visiting team. Gradual reduction of waiting times for consultations by 1.2% and 2% per month, respectively, during the annual observation periods (2011-2016).
Schretlen[16] 2021 Netherlands	Reducing surgical cancellations: a successful application of Lean Six Sigma in healthcare	Reduce cardiac surgery cancellations at a University Medical Center in the Netherlands, where approximately 20% of cardiac surgeries were being canceled.	University Medical Center Does not describe	Reduction of last-minute surgical cancellations by 50%, reduction of repeated pre-operative examinations (X-rays) by 67%, referral time for treatment reduced from 71 to 46 days (35%) and length of stay from 10 .5 to 9.8 days per patient, equivalent to approximately 600 hospital bed days per year, making it possible to perform 96 extra surgeries and an additional 1.15 million euros. Patient satisfaction increased by 14%.
Kam[17] 2021 Australia	Using Lean Six Sigma techniques to improve efficiency in outpatient ophthalmology clinics	Investigate the impact of Lean Six Sigma on reducing patient wait times and increasing care capacity in a publicly funded tertiary referral ophthalmology clinic.	Hospital (Ophthalmology clinic) Public	The median patient time in the clinic was reduced by 18% and the interquartile range by 32%. These results were achieved while patients seen per session increased by 9%. Solutions were implemented without additional capital requirements or ongoing staffing costs.
Tsai[18] 2021	Use of the Smart Lean Method to	Improving hospital admission procedures for	Veterans General Hospital	Increased process cycle efficiency from 35.42% to 42.47%, added value was reduced

Taiwan	Conduct High-Quality Integrated Perioperative Management Prior to Hospitalization	surgical patients by reducing process wait times, streamlining admission processes, emphasizing a patient-centric approach, and providing the most efficient care process.	Does not describe	from 34 to 31 min, and no added value was reduced from 62 to 42 minutes. The integration of different units and the establishment of standardized perioperative management procedures, together with the support of information systems, reduced hospital stays by 472 days in 2019.
Egan[19] 2021 Ireland	Releasing Operating Room Nursing Time to Care through the Reduction of Surgical Case Preparation Time: A Lean Six Sigma Pilot Study	The quest for efficiency uses process improvement methodologies such as Lean Six Sigma.	Hospital (operating room) Private	In 128 laparoscopic hernia surgical cases, total nursing time spent collecting and preparing materials was reduced by 55%, resulting in a more efficient use of time to focus on clinical tasks and the patient experience. Evidenced time savings of 26 minutes per list running two lists per day (Monday-Friday) per OR results in an overall annual time savings of 1800 hours of nursing time in the OR.
Dempsey[20] 2021 Ireland	Lean Six Sigma Redesign of a Process for Healthcare Mandatory Education in Basic Life Support—A Pilot Study	Redesign and improve the Basic Life Support (BLS) scheduling, training and certification process).	Hospital (permanent education/training) Private	This study was conducted between 2020 and 2021, during a COVID-19 pandemic. The redesign of the training program led to a total time savings for each team member of 1 hr 56 min, a 47% improvement in the time taken to complete the BLS process. The training and administration time for BLS instructors was reduced from 5 hours to 1 hour 19 minutes, a 74% improvement in the time needed to deliver the BLS. A 50% increase in BLS class volume and a time savings of 154 hr 30 min for staff and 48 hr 14 min for BLS instructors.
O'Mahony[21] 2021 Ireland	Using Lean Six Sigma to Redesign the Supply Chain to the Operating Room Department of a Private Hospital to Reduce Associated Costs and Release Nursing Time to Care	Standardize inventory handling over the sterile area redline, reduce the amount of inventory that is out of date by a minimum of 50%, remove non-value-added activity for nursing staff, and free up time to care in a pilot operating room for implantation in the other operating room rooms.	Hospital (operating room) Private	Overall reduction in the value of inventory held in the OR by 17.7%, reduction in the value of out-of-date inventory by 91.7%, and reduction in the time spent by clinical staff to prepare the inventory needed for procedures by 45%. Expired products were identified as a key factor to address in inventory management, estimating savings of approximately $213,000.
Scala[22] 2021 Italy	Lean Six Sigma Approach for Reducing Length of Hospital Stay for Patients with Femur Fracture in a University Hospital	Identify critical quality issues and possible solutions to improve the care process.	Universitary hospital (complex operative unit of orthopedics and traumatology) Does not describe	The preoperative hospitalization time was reduced from 5.62 to 3.45, equivalent to 39%, data were collected and analyzed from two groups of patients before and after the implementation of a diagnostic-therapeutic assistance route during a period of 10 years.
Peimbert-García[23] 2021 Mexico	Applying Lean Healthcare to Improve the Discharge Process in a Mexican Academic Medical Center	Reduce the time required for discharge of patients from the Department of Internal Medicine.	Academic medical center Public	Reduction of patient discharge time from 6 h to 3 h, eliminating 57% of non-value-added activities and 70% of errors in discharge orders, representing an annual capacity increase of 2% and a bed of 6,423 h available without investment additional.
Al Hroub[24] 2019 Jordan	Improving the Workflow Efficiency of An Outpatient Pain Clinic at A Specialized Oncology Center by Implementing Lean Principles	Improve time efficiency and patient satisfaction by decreasing waiting time.	Oncology pain clinic Public	Improved time efficiency and patient satisfaction by decreasing waiting time. It decreased from 72.5 min pre-intervention to 19.5 and 21 min in the two post-intervention quarters. Patient satisfaction improved from 75% pre-intervention to 100% and 96.7% in the two post-intervention quarters.

Davies[25] 2019 Ireland	Optimizing nursing time in a day care unit: Quality improvement using Lean Six Sigma methodology	Improving efficiency by generating nursing time and improving patient care and staff satisfaction.	Hospital (pediatrics) Private	Improvements in service and patient and staff satisfaction. Reduction in patient return time, increase in nursing care time and improvement in the nurse-patient relationship. Savings of approximately 200 hours per year per nurse.
Teeling[26] 2019 Ireland	Reducing risk of development or exacerbation of nutritional deficits by optimizing patient access to mealtime assistance	Provide assistance at mealtimes, decrease missed meals, malnutrition, food waste and staff rework.	Universitary hospital Private	Guarantee of assistance during meals, reducing the waste of patients who need assistance, reduction from 3 per day to 0, corresponding to a reduction of 0.43 kg per patient. These patients did not require additional oral supplements and did not develop new pneumonia or swallowing difficulties and were discharged without the need for support. The initiative was introduced in another 10 wards.
Brown[27] 2019 Ireland	Using Lean Six Sigma to improve rates of day of surgery admission in a national thoracic surgery department	Improving admission rates for elective thoracic surgery.	University Hospital (National Department of Thoracic Surgery) Does not describe	Over a 19-month period, admission on the day of surgery increased from 10% to 75%. The duplication of preoperative exams was reduced from 83 to <2%. Staff and patient surveys show greater satisfaction and better understanding of enhanced recovery after surgery. Postoperative hospital stay decreased from 4.2 to 3.9 days during the control phase, from January to December 2017, with more than 75% of patients.
Roy[28] 2018 USA	Improving efficiency in neuroimaging research through application of Lean principles	Optimize the flow of processes; increase efficiency and training of the team.	Therapeutic Neuroscience Laboratory Does not describe	Team members found the overall experience of running an experiment greatly improved after implementing Lean. Five out of six team members indicated a much better reduction in time, with the last team member considering it slightly better. The average experiment time was reduced by 13% after implementing Lean (from 142 and 147 minutes to 124 and 128 minutes).
Ciulla[29] 2018 USA	Lean Six Sigma techniques to improve Ophthalmology clinic efficiency	Decrease flow time driving improvements in healthcare.	Eye clinic Does not describe	The patient flow was redesigned, reducing waiting time by 18% and 4.6 patients hospitalized. Patient and staff satisfaction scores improved.
Improta[30] 2018 Italy	Lean thinking to improve emergency department throughput at AORN Cardarelli hospital	Increase patient flow, improve patient flow through medical treatment steps, and eliminate all queues and wasteful activities.	Hospital (Emergency Room) Does not describe	After analyzing non-value-added activities and implementing actions, a positive increase was observed in the performance of the Emergency Room and hospitalized patients according to triage codes and waiting times.
Valsangkar[31] 2017 USA	Effect of Lean Processes on Surgical Wait Times and Efficiency in a Tertiary Care Veterans Affairs Medical Center	Identify whether processes can be used to improve waiting times for surgical procedures in Veterans hospitals.	Veterans Affairs Medical Center Does not describe	Reduction in patient waiting time for elective surgical procedures from 33.4% in 2012 to 26.0% in 2013. In 2014, waiting times were half the value of the previous year at 12.0 %. Increase in surgeries from 931 patients (2012) to 1,090 (2013) from 2013 and 1,072 (2014). Combined clinical, telehealth, and electronic appointments increased from 3,131 (2012) to 3,460 (2013) and 3,517 (2014), reduced no-shows from 366 (2012) to 227 (2014)).
Hung[32] 2017 USA	Scaling Lean in Primary Care: Impacts on System Performance	Examine performance results after implementing Lean.	Primary attention Public	Increased patient satisfaction. Decrease in departmental operating costs; increase in annual staff and physician satisfaction scores, with key improvements in employee engagement, connection to purpose, relationship with staff, and physician tenure.
Robinson[33] 2016 USA	Improving a Dental School's Clinic Operations	Achieve improvements through tools used in Lean.	College dental clinic Does not describe	The wait time has been reduced from 3 hours to 2 hours and 54 minutes. Elimination of transport waste. Increased patient

	Using Lean Process Lean Improvement			satisfaction with the quality of care provided. Periodic audit.
Hayes[34] 2014 Australia	Applying lean flows in pathology laboratory remodelling	Examine the application and results of the seven Lean flows to pathology lab remodeling as part of a rapid improvement event.	Laboratory Does not describe	Fatigue reduction, employee satisfaction. Comparing the same month of the year, in two years productivity increased from 1900 to 2600 tests per month, identified by the team as the greatest impact of lean improvement.
Chan[35] 2014 China	Lean techniques for the improvement of patients' flow in emergency department	Assess the current patient flow in the ER, identify and eliminate the added valueless process, and modify the existing process.	Hospital (Emergency Room) Does not describe	Waiting time for admission to the emergency medical ward decreased from 54.76 minutes to 24.45 minutes after implementing Lean.

The places of publications were respectively: Ireland (7)[13,19-21,25-27], USA (6)[15,28-30,31-33], Australia (2)[17,34], Italy (2)[22,30] and Indonesia[12], Poland[14], Netherlands[16], Taiwan[18], Mexico[23], Jordan and China, with one publication each[24,26].

It was found that most of the articles were published in the last five years, even with a gap in the year 2020, the critical period of the COVID-19 pandemic. The year with the highest number of studies was 2021 (9)[15-23], followed by 2019 (4)[24-27], 2022 and 2018, with three publications each year[12-14,28-30], 2017 and 2014 two publications year[31-32,34-35] and 2016 (1)[33]. It should be noted that the searches and inclusion of articles were carried out until September 2022, and there may be new publications in the same year.

The parameters of the institutional profile showed a diversity of types of services and/or health sectors that had the implementation of Lean. Four articles describe that they were carried out in a public institution, six in a private institution and 14 did not describe the administration profile. Of the sectors carried out in the research, in the public service, they describe: cancer pain and ophthalmology outpatient clinics located in hospitals, medical clinics in university hospitals and primary care; in the private service: surgical outpatient clinic, surgical service, Basic Life Support training program, operating room and pediatrics located in hospitals and, ward with specialized services in geriatrics and acute stroke unit in a university hospital and, services that did not describe the type of management profile they belonged to: IVF clinic, gastroenterology ward, surgical department of orthopedics/urology/surgery/colorectal/otolaryngology, emergency department, emergency room located in hospitals, complex operative unit of orthopedics/traumatology, department of thoracic surgery, therapeutic neuroscience laboratory, dental clinic in medical centers / teaching hospitals, veterans medical center, eye clinic, pathology laboratory and primary care.

Regarding the category of institutions, they were distributed in: hospital (13), hospital/university medical center (7), primary care (2) and laboratory (2). The reduction in waiting time for consultation/treatment was identified in 12 studies[12,15-18,24-25,29-31,33,35], followed by increased patient satisfaction (eight)[15-16,24-25,27,29,32-33], reduction in length of stay (six)[13,16,18,22-23,27], reduction of time spent without added value/increase in the time of the health team available in the assistance (six)[14,19-21,25-26], reduction of overprocessing (five)[14,16,19,23,27], cost reduction/increase in financial profit (five)[13-14,16,21,26], increase in bed turnover (four)[13,16,23,27], increased satisfaction of the professional team (four)[27-29,34], to a lesser extent the reduction in surgery cancellations and inventory reduction (one study each)[16,21], however, with major relevant impacts. The number of findings of repercussions (n=52) is higher than the final sample of articles (n=24), since the same study can express more than one result according to the reduction and/or elimination of waste and the values added to the client, the professional and the institution.

Discussion

In the analyzes of the selected studies, 88% of the publications were from the last five years with a gap in the year 2020 (critical period of the COVID-19 pandemic). On the other hand, in this same pandemic period between 2020 and 2021, a study was carried out using Lean in the redesign of the permanent education/training program, contributing to gains in optimization of human resources and training of teams[20].

The findings show diversity regarding the scenarios where Lean was implemented. The hospital area was predominant, corroborating with previous studies[9-36], followed by primary care[15,32] and support and diagnostic laboratory[28,34].

We highlight the finding of seven articles in hospitals/university medical centers that bring contact with the Lean philosophy closer to training and/or specialization, stimulating reflective critical thinking and providing access to continuous improvement strategies in health care in different areas of acting. Studies that present academic institutions are present on the European continent in the countries of Ireland[26-27], Netherlands[16], Italy[22], and in North America in the United States of America[28,33], Mexico[23].

The research results pointed to a greater application from the perspective of the client, institution and professional, respectively, focused on hospital sectors where more publications are found, being wards[14,16,22,23,25-27], surgical service[18,19,21,31] and emergency room[30,35], with repercussions in common in the reduction of length of stay, increase in bed turnover, reduction of over-processing, reduction of surgeries cancelled, reduction of patient

waiting time for treatment, increase of patient satisfaction and exponential increase of financial profit[16,18,23-24,31,35]. Concomitant with the findings, research has shown an increase in the satisfaction of the professional team in building the culture that, in addition to placing the patient at the center of care, more dedicated and committed professionals deliver better performance in health care[27-29,34].

The most commonly found repercussions are related to the reduction of waiting times for consultation or treatment, including primary, specialized and surgical care[12]. A public study carried out in Jordan at the Pain Clinic for cancer treatments showed an improvement in efficiency in decreasing waiting time from 72.5 minutes in the pre-intervention to 19.5 and 21 minutes in the two post-intervention quarters. Patient satisfaction improved from 75% pre-intervention to 100% and 96.7% in the two post-intervention quarters[24].

The study of a private hospital addressed the waste of inventory and overproduction, achieved a general reduction in the value of inventory held in the operating room by 17.7%, reduction in the value of outdated general inventory by 91.7%, and the time spent by the body clinician in the preparation of the necessary stock for the procedures in 45%[21]. In the study carried out at a Dutch University Medical Center that did not describe the nature of the administration, it was shown that cancellations of cardiac surgeries were reduced by 50%, repeated preoperative diagnoses (X-rays) decreased by 67%, time referral for treatment reduced from 71 to 46 days (35%), in addition to reducing the length of hospital stay from 10.5 to 9.8 days per patient on average, which is equivalent to approximately 600 days in a hospital bed annually, enabling perform 96 extra surgeries accompanying an additional revenue of 1.15 million euros and a 14% increase in patient satisfaction[16]. The study carried out in an Irish hospital also showed a finding similar to the previous one, in the reduction of the length of hospital stay by 57%, in the reduction of non-value-added activity in 88% and in the release of 17 beds for the need for night hospitalizations, equivalent to savings of 11.3 days of hospital bed, also having a significant cost reduction for the patient of 950 euros (overnight rate)[13].

The findings of primary care with a public institutional profile showed a constancy of continuous improvement in a study carried out from 2011 to 2016, highlighting Lean as a philosophy and not just a one-off strategy for an immediate solution. There was a 44.8% increase in satisfaction with the adequacy of time spent in medical appointments, a 71.6% improvement in satisfaction with the ability of physicians to listen to their concerns, and a 55.4% increase in perceived usefulness of the team in attendance[15]. A previous primary care publication also focused on client satisfaction[32].

As for other findings in private health services, an Irish study, in the hospital operating sector, resulted in a 55% reduction in the total nursing time spent in the collection and preparation of materials in 128 surgical cases of laparoscopic hernia, resulting in an economy of overall annual time of 1,800 hours of nursing time[19]. Reducing time spent without added value can be converted into optimization of human resources and increased time to provide quality care and better patient experiences[25-26,30].

The following studies did not describe the category of health services, whether public or private, however, they showed results with the application of Lean. A study carried out in the ward of a Polish hospital, showed a reduction of waste from overprocessing in the manual filling of forms by doctors in 67% and by nurses in 76% for a newly admitted patient and in 69% for an inpatient, equivalent, the saving of time for the nursing team of 368 hours (2.3 FTEs - Full Time Equivalent, is one of the human resources indicators to calculate the number of people allocated to the company's activities, therefore, it helps to reduce costs and delegate activities without overloading employees), for the 175-hour medical team (1.09 FTEs), consequently saving 3,089 euros/month (14,173.00 PLN/month - Polish currency) for nurses and 2,855 euros/month (13,100 ,00 PLN/month) for specialist doctors. The added value, both for the pre-admitted patient and for the one who remains in the ward, was the saving of waiting time, respectively, of 63 minutes for a hospitalized patient and 38 minutes for a patient already hospitalized[14].

According to the study carried out in the national department of thoracic surgery in a large Irish teaching hospital, during the period of nineteen months, the increase in admission on the day of surgery from 10% to 75% and the reduction of duplicate preoperative examinations was obtained from 83% to <2%, resulting in greater patient and staff satisfaction with better understanding of improved recovery after surgery by optimizing the path from surgical care to discharge[27].

Studies carried out in public services, presented at an academic Medical Center in Mexico, in the Department of Internal Medicine, reduced the time of discharge of patients from 6 to 3 hours, eliminating 57% of non-value-added activities and 70% of errors found in the high orders. This represents an annual capacity increase of 2% and a bed of 6,423 hours available without additional investment[23], already in the Ophthalmology Outpatient Clinic in an Australian hospital, it was identified that poor communication with the patient was responsible for 16% of problems in the clinic and all written communications for the patient were reviewed. In this same service, the most frequently used drugs were often not readily available in the clinic, interrupting the flow of patients, requiring request and waiting time for delivery during the consultation. After implementing Lean, the median patient time in the clinic was reduced by 18%. These results were achieved while patients seen per session increased by 9%. Solutions were implemented without additional capital requirements or ongoing staffing costs[17].

In common with the evaluated studies, critical success factors were the use of a structured, data-driven problem-solving approach, focus on customer value and process flow, leadership support, and involvement of healthcare professionals throughout the entire process path. service and in the vast majority without additional costs[16,23].

The importance of the mindset of all employees involved in the mapped improvement processes is highlighted, from administrators to professionals who are directly working in the sectors, especially the nursing team[37], who are the front line in health care, decompressing work overload and freeing up time for care[21,25].

Because it is a literature review, this study considers limitations related to trained professionals involved in the initial project and implementation of Lean, difference in evaluation time after implementation and the different scenarios evaluated that make comparisons between institutions impossible.

In the field of health, the nursing team is involved in multiple organizational processes and the professional nurse exercises leadership, as well as, in many spheres, the role of manager[37]. This study reinforces the importance of management knowing and monitoring the repercussions achieved with the implementation of Lean Healthcare in the various health services, including contributions in university institutions. In this way, it will be able to establish strategies for monitoring the objectives, supervising, so that the results always seek the principle of continuous improvement and the strategies adopted are in accordance with the respect among employees, the excellence of the service, the reduction of waste and satisfaction of the client, which is the main focus of this philosophy.

Conclusion

Considering the types of health services that implemented Lean healthcare, the results showed versatility in the administration profile, with public institutions being in a smaller proportion, followed by private ones, and most did not describe the type of administration, as well as the variability of services. and sectors that include primary care and prevalence in hospitals, among which the finding of university hospitals/medical centers and academic contact with the Lean philosophy stand out.

As for the repercussions, from the patient's perspective, the main findings were the reduction in waiting time for care, hospitalization and increased satisfaction, whereas, in the institutional scenario, the increase in bed turnover, cost reduction and/or increase in financial gains, reduction in over-processing and time spent without added value/increased time available for care and increased job satisfaction.

It should be noted that Lean is a philosophy, therefore, it is applicable at all levels of health care, not limited to hospitals, where most publications are currently found, including university health institutions. This study presented an in-depth and integrated review on the subject, however, some limitations must be considered, such as the difference in the evaluation time after implementation and the different scenarios evaluated, which make comparisons between institutions impossible.

The importance of extending and continuing research on the applicability of Lean is highlighted, with well-designed and robust methods, to better understand the success factors, professional requirements and barriers to its implementation, in addition to the evaluation of the longitudinal repercussions for the institution , the professional and the patient, as well as the consolidation of the philosophy.

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