

# LEAN HEALTHCARE METHOD AND DENTISTRY: A LITERATURE REVIEW

## METODOLOGIA LEAN HEALTHCARE E A ODONTOLOGIA: UMA REVISÃO DA LITERATURA

Rafael Matheus Lima<sup>1</sup>, Selma Maria de Azevedo Sias<sup>2</sup>, Maurício de Souza Leão<sup>3</sup>

### ABSTRACT

This study aimed to carry out a literature review on the lean method, assessing its applicability in dentistry. The research has a bibliographic, descriptive, and retrospective scope. Thus, we selected scientific articles that addressed concepts on the lean method and dentistry. We researched the following databases: Literatura Latino-Americana e do Caribe em Ciências da Saúde (LILACS), Biblioteca Regional de Medicina (BIREME), Scientific Electronic Library Online (SciELO), and Public MEDLINE (PubMed). We included, essentially, articles from the last 35 years (1987-2022) with abstracts (in English or Portuguese) that presented the following terms: “Lean Methodology” and “Health Management and Dentistry.” Worldwide healthcare has experienced an explosion in knowledge, innovation, and the ability to manage formerly fatal conditions. However, it is still far from the expected standard of quality, results, cost, and equity. Lean Methodology has been implemented in clinics, offices, and hospitals to attain improvements in dental and oral health service processes, resulting in significant advances in these, as well as in the quality of care and cost reduction for organizations. The Lean Method can be applied in dentistry since it can act in reducing waste, eliminating redundancies in activities, and increasing the safety of care.

**Keywords:** Method, Health Management, Dentistry.

### RESUMO

O objetivo do presente estudo foi realizar uma revisão de literatura sobre a metodologia *lean*, avaliando sua aplicabilidade na odontologia. A pesquisa delineada é de natureza bibliográfica, descritiva e retrospectiva. Assim, foram selecionados artigos científicos que abordavam conceitos sobre metodologia *lean* e odontologia. As buscas foram realizadas nos bancos de dados virtuais: Literatura Latino-Americana e do Caribe em Ciências da Saúde (LILACS), Biblioteca Regional de Medicina (BIREME), Scientific Electronic Library Online (SciELO) e Public MEDLINE (PubMed). Foram incluídos sobretudo artigos dos últimos 35 anos (1987-2022) e que apresentaram pelo menos o resumo, em inglês ou português, com os seguintes termos: “metodologia *lean*”; “gestão em saúde e odontologia”. A saúde mundial sofreu uma explosão no conhecimento, na inovação e na capacidade de gerenciar as condições anteriormente fatais. Contudo, ainda está longe do padrão esperado de qualidade, resultados, custo e equidade. O *lean thinking*, ou pensamento enxuto, tem sido implementado em clínicas, consultórios e hospitais com o objetivo de conseguir melhorias nos processos de serviços odontológicos e de saúde bucal, resultando em melhorias significativas nos processos, qualidade do atendimento e redução de custos para as organizações. A metodologia *lean* pode ser aplicada na odontologia visto que pode atuar na redução de desperdícios, eliminação de redundâncias de atividades e aumento da segurança da assistência.

**Palavras-chave:** Metodologia, Gestão em Saúde, Odontologia.

<sup>1</sup>Dental Surgeon, MSc in Maternal and Child Health, Federal Fluminense University, Niterói, Brazil.

<sup>2</sup>Professor at Maternal and Child Health Department of Medical School of the Federal Fluminense University, Niterói, Brazil.

<sup>3</sup>Professor at Administration Department of Administration and Accounting Sciences School of the Federal Fluminense University, Niterói, Brazil.

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## INTRODUCTION

Oral health plays an important role in the quality of life of people given that negligence in this healthcare process culminates in tooth loss caused by caries or periodontal disease, resulting, in some cases, in diseases in other parts of the body (e.g., heart and lungs). This occurs because bacteria present in the gums and dental pulps can move from the infected site and access the patient's bloodstream, affecting other organs and causing certain diseases, as well as generating drastic consequences to people's health (1-3).

To achieve effective management of public health services, it is necessary to regulate some challenges regarding human, financial, logistical, and sanitary resources, as well as coordinate processes and verify the needs of the sector to provide a safe and qualified service. Among the numerous management principles, the principle of lean management – known as Lean Thinking or Method – has been used efficiently for decades in manufacturing companies (4).

In the healthcare area, Lean Thinking began acquiring credibility when people started thinking that the knowledge previously applied in the industries could add value to the patient, and the processes could be reformulated in order to improve process flows and reduce waste (5).

The Lean Method means doing more with less, i.e., a set of tools, a management system, and a philosophy that can change how healthcare organizations are administered. Hence, the aim is to help these organizations to gain a broader view of their activities, providing conditions to improve the quality of care to users by reducing errors and the waiting time for care (6). In this sense, the objective of this study was to elucidate a review of the literature, narrative-like, on the Lean Method, clarifying its applicability in dentistry and highlighting some of its benefits.

Moreover, this article's purpose is to assess how the Lean Method can be used in dentistry. For this purpose, a method of review of the literature was used to demonstrate how the implementation of the Lean Method can contribute to improving dental and oral health service processes, quality of care, and cost reduction for organizations.

## METHODS

The research has a bibliographic, descriptive, and retrospective scope (7-9). Thus, we selected scientific articles that addressed concepts on the Lean Method and dentistry. Hence, a narrative review of the literature was carried out. We researched the following databases: *Literatura Latino-Americana e do Caribe em Ciências da Saúde* (LILACS), *Biblioteca Regional de Medicina* (BIREME), Scientific Electronic Library Online (SciELO), and Public MEDLINE (PubMed). The following terms were used: "Lean Method" and "Health Management and Dentistry."

As inclusion criteria, we highlight the following: scientific articles; books; master's degree thesis; doctoral thesis—all published in full in national and international journals, both in Portuguese or in English. The established period was 35 years (1987-2022). Texts that did not include the objective of the research in their title or abstract were excluded, as well as ones dated prior to January 1987, and the ones that addressed the method in other areas. Forty-three out of the 68 articles that were found ended up being accepted to integrate this review of the literature (Figure 1). The screening was made in a peer-review manner, in which two researchers evaluated whether the text would be included in this study or not. In case of a disagreement, a third researcher would deliberate.

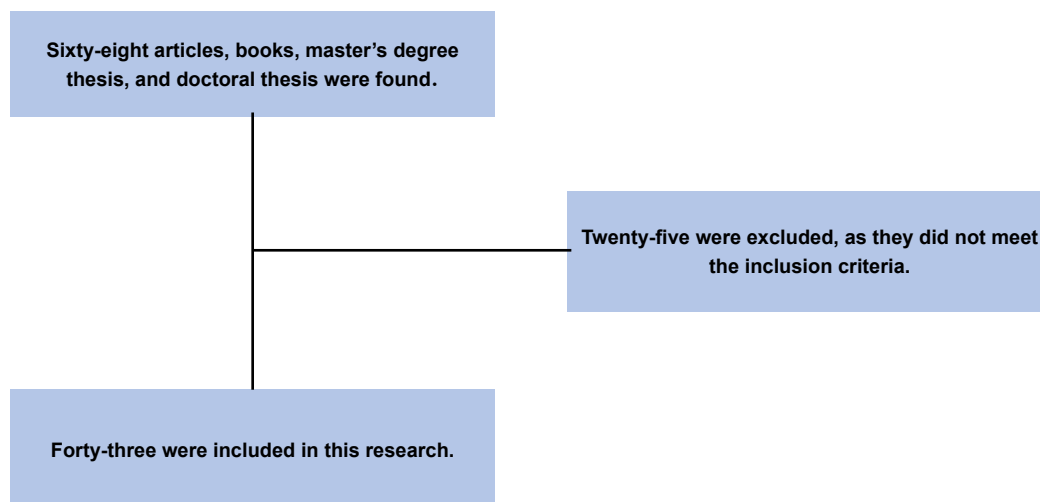


Figure 1 – Flowchart representing the articles' screening.

## LITERATURE REVIEW AND DISCUSSION

Historically, the means of production and large companies have sought ways to improve the quality of products and services, in addition to reducing production costs. Hence, committed to eliminating errors and increasing production, management methods emerged. The Lean Thinking model is one of them, doctrinally known as a kind of management philosophy. It focuses on suppressing seven sources of waste: overproduction; waiting; transportation; overprocessing; inventory; motion; and defects (10).

The term “Lean” first appeared in 1988 in John Krafcik’s master’s thesis at the Massachusetts Institute of Technology (MIT), which studied and analyzed the techniques of the Toyota Production System (TPS) (11-14). Yet, it was only in the 1990s, with the publication of “Beyond Toyota,” by Womack and Jones (15), that “Lean” came to be used to address this management modality. “The machine that changed the world,” based on research developed over five years, concluded that the TPS system was more effective and efficient than any traditional mass production system. This production method was named “Lean.”

In “Lean Hospitals,” Graban stated that Lean Thinking is a systematic approach through which losses are identified and eliminated throughout the

production process (16). Its main goal is to add quality and deliver to the customer only what he considers to be valuable. Thus, this approach has as its main characteristics the valuation of the product for the customer and minimization of the company’s waste, therefore promoting the improvement of technologies, resources, and departments. In this scenario, the productive stages develop more easily.

Additionally, Shiver and Eitel define the Lean Method as a highly effective improvement, which originated in manufacturing processes (17). This model is considered the result of thirty years of evolution of production methods of Toyota Motors Company (18). Although it was conceived in the context of the automotive and manufacturing industry, this method can be adapted and applied to other means of production. Over the years, this management model was adapted and widely applied in other business systems-including service companies (15).

It is by using this system that the company is able to identify, prioritize, and extinguish waste, culminating in the reduction of costs and labor. Through this culture, it is possible to create a continuous flow of value to the customer, eliminating losses throughout the operational process and in the shortest possible time (Charts 1 and 2).

**CHART 1 - LEAN THINKING PRINCIPLES.**

Principle	Objective
Value	Understand what value means to the customer.
Value Stream	Identify which process steps add value by eliminating non-added steps from the time the customer orders to delivery.
Flowing	Keep the process smoothly flowing by eliminating causes of delays such as batches and quality issues.
Pull	Avoid pushing work or materials to the next department, allowing work and suppliers to be pulled when needed.
Perfection	Seek perfection through continuous improvement.

Source: Graban (16).

## CHART 2 - WASTE FROM THE LEAN PRODUCTION.

Waste category	Traditional definition
<b>Overproduction</b>	Produce too much or too early, resulting in excess inventory.
<b>Defects</b>	Frequent errors in information processing, problems in product quality, or poor delivery performance.
<b>Unnecessary inventories</b>	Excessive storage and waiting for necessary information or products, resulting in excessive cost and low-level customer service.
<b>Improper processing</b>	Execute the process with inappropriate tools, procedures, or systems, to the detriment of simpler and more efficient approaches.
<b>Excessive transport</b>	Excessive transportation of goods or information, resulting in increased time, effort, and cost.
<b>Excessive movement</b>	Excessive movement of people, moving and storing parts, including unnecessary physical movements of operators.
<b>Waiting</b>	Long periods of inactivity of people, information, or goods, result in poor and long lead times.

**Source:** *Shiver and Eitel (17).*

All the areas of the company can benefit from the application of lean principles, ensuring lowers costs, high-quality services, and delivery of better services in the time and standards desired by the customer. The adaptation of lean production concepts to the service sector is called Lean Service (19).

Although lean production is usually seen as a manufacturing concept, many of its tools were developed in the service industries (20). According to Bowen and Youngdahl, a basal difference between lean production and the lean approach for services is that it occurs in the presence of the consumer, which does not happen in typical manufacturing (21). The authors presented the successful example of the Shouldice Hospital, which reveals that the lean approach, applied to the standardization and efficiency of the support sectors and in the extensive participation of patients also achieves these objectives in the preparation and performance of surgeries and the recovery phases (22).

In this context, we have the application of the Lean philosophy in the healthcare scenario, or the set of concepts, techniques, and tools that improves the organization and management of hospitals and correlated (16). The functionality of the Lean Manufacturing method was also passed on to the health services area. The health sectors are composed of various processes and variables that need ordering and excellence in management. The implantation of this management in the healthcare area is justified by the growing demand for health services in the search to provide high-efficiency and quality care to patients (23).

To achieve improvements, as well as in the automotive sector, speculations were initiated describing lean production in the healthcare area that sought to understand the possible application of tools and techniques known through common sense and experience in general. The Lean Thinking application in the hospital environment was defended by Womack as a process improvement factor that acts to create value for clients and patients (24). The first report of Lean Thinking assigned to improving patient flow includes Bushell and Shelest, who describes a pilot implementation of it in a medium-sized hospital in the United States (25). In turn, Feinstein *et al.* report 24 good results arising from the implementation of the Lean Healthcare in American hospitals (26).

Laursen presented the evolution of the Lean system over time (27). Even though there is imprecision of the dates of the events due to the vagueness around the first application in the field, the authors consider a delay of ten years in the appearance of Lean Healthcare when compared to other industries that provide services, since it was only around 2002 that hospital managements started applying the Lean Healthcare philosophy in its processes.

The first implantations of Lean Healthcare took place in hospitals in England, the United States, Canada, and Australia (28). The improvements that this brings to the healthcare area are possible to be noticed through the analysis of some studies, such as the ones related to its implementation in an operating room and an emergency room of a North American hospital (29).

In order to ensure the implantation of the lean mentality, the following tools are used: rapid improvement events (Kaizen event); the flow of value mapping; 5S (management program); work standardization, process redesign, pulled system/kanban, and physical arrangement review. Along with the application of these tools and techniques, results were obtained in the reduction of costs of purchase of supply/instrument, expenses of repairs and inventory, improvements in planning, reduction of overtime, increase in capacity, increase in net revenue, and reduction in length of stay (30).

According to Womack and Jones, the concepts within Lean Manufacturing must be applied following five principles: determining what is valuable to the customer; identifying the flow of value; implanting continuous flow; pulled production; and perfection (15). They also consider that the value can only be defined by the final customer (31). In a hospital setting, plenty of customers exist for the very diverse activities and services offered there. The most obvious of the “end” customers is the patient. Most activities and priorities should be focused on this customer (6). According to Graban, there are five principles of Lean Thinking for dental clinics (Chart 3) (6).

**CHART 3 - LEAN THINKING PRINCIPLES FOR CLINICS.**

Principle	Lean clinics should...
Value	Specify value from the perspective of the final customer (the patient).
Value stream	Identify all value-added steps across departments (the value stream) by eliminating those steps that do not create value.
Flow	Keep the process smoothly flowing by eliminating the causes of delays, such as problems with batches and quality.
Pull	Avoid transferring work to the following process or department, letting work and supplies be pulled as needed.
Perfection	Seek perfection through continuous improvement.

**Source:** Adapted from Graban (13).

Lovelock and Wright stated that services have the following characteristics throughout their provision: intangibility, simultaneity, and customer participation (32). The degree of participation may vary depending on the type of service. However, there is always some participation of the customer, being directly or indirectly.

Another characteristic that is worth mentioning is linked to the necessary degree of knowledge for its execution. Miles *et al.* define the Knowledge Intensive Business Service (KIBS) as the kind of service that heavily relies on professional knowledge (33). For the authors, some of these services are part of technological changes, especially those related to information and communication technology. The KIBS is responsible for generating products whose primary source of information is knowledge (consultancies, reports, training, among others).

Given this scenario, the statistical office of the European Union (Eurostat) grouped KIBS into some service sectors: high-tech; financial; other knowledge-intensive services, which include publishing

activities, veterinary activities, public administration and defense, social services, healthcare services, recreational, cultural, and entertainment services (34). It is in the KBIS cluster that dentistry is inserted since it is a branch of healthcare services.

Freire highlights that global health has experienced an explosion in knowledge, innovation, and the ability to manage formerly fatal conditions (35). However, it is still far from the expected standard of quality, results, cost, and equity. The health service, regardless of the country, endures inefficiency and quality problems, which challenge the managers of the area. In Brazil, the history of health services revealed an exponential drop in quality and restriction of access to the population (36).

The health services, dentistry included, constitute a complex environment, and managers of hospitals, clinics, and offices need to understand the peculiarities of their organization. Buzzi and Plytiuk highlighted that there are similarities between healthcare services and other types of services and their respective productive systems: processes; materials

management; human resources management; and customer/patients (37).

Womack and Jones defined the basal principles of the Lean Thinking method as follows: specify the value to the customer; identify the value chain; implement the continuous flow; establish a system of pulled production; perfection (15). Ergo, Lean Thinking is a set of operating philosophies and methods that use the principles of lean production for identifying values to the customers, reducing waste in the production chain, directing steps toward improving the continuous improvement of efficiency and effectiveness of the production system.

The implementation process of lean production is based on the identification and elimination of

waste, which add cost and time to the products and processes. Given this scenario, activities that do not add value to the production chain of the product are classified as waste. Aiming at avoiding it, one must understand the definition of waste and its causes (38).

According to Graban, waste is considered the problem and annoyance that constantly arise in the production process, interfering with the work of the team (6). In a broader context regarding Lean Thinking, everything that does not add value to the product is considered to be waste. Womack and Jones stated that Lean Thinking is a way of producing more with less: less human effort; less equipment; and much less space (15). Besides, there are a few other definitions (Chart 4).

### CHART 4 - LEAN PRODUCTION DEFINITIONS.

Authors	Lean Production Definitions
Womack, Jones, and Roos (13)	Production system aiming at increasing efficiency through the elimination and reduction of activities that do not add value to the product, therefore retaining the value perceived by customers.
Shingo (39)	Production system that aims at eliminating total amount of losses.
Godinho Filho (40)	Strategic, integrated manufacturing management model that includes a series of principles and enablers (tools, technologies, and methodologies for achieving these principles) that help companies achieve certain performance objectives, thereby increasing their competitive power.
Liker and Morgan (41)	A production system that integrates people, processes, tools, and technologies to deliver customer-defined value by developing a waste-free workflow.

Source: Regis, Gohr, and Santos (42).

By applying these concepts in the healthcare area, the results found can bring more quality to the service provided, as well as greater patient satisfaction in the use of the service and employee satisfaction, in addition to making the organizational environment more pleasant. In dentistry, the processes are characterized by repetitive procedures and tasks with intensive knowledge implementation. While the management of materials is basal, given that the excess inventory can compromise the capital invested in some cases (e.g., due to generating waste regarding obsolescence or expiration), it is necessary to ensure the synchronization between the availability of materials and their demand, as well as avoiding that the lack of material makes a procedure unfeasible, which may delay treatment and cause major inconvenience to the patient.

Ergo, applying the abovementioned definitions drawn in Chart 4, with the lean method applied

in dentistry, it is possible to cause a reduction in material waste, which therefore contributes to cost reduction and profit increase. Moreover, applying the principles of this method would positively impact the identification and correction of the activities that impair the progress of the service. Also, it is worth highlighting the integration of people, processes, and technologies that promote the best flow, and, consequently, greater quality and efficiency of the service provided (39-42).

We point out, as limitations of our research, the inclusion of a few articles clarifying the application of the Lean method in the dentistry area. Thus, further studies are necessary for observing this application. Research carried out to elucidate this method would be of outstanding importance, for it could demonstrate the evolution of the dental service after the application, in addition to reducing the cost and increasing the efficiency and quality of the service provided.

## CONCLUSION

Lean Thinking is implemented in clinics, offices, and hospitals to achieve improvements in dental and oral health service processes. It is directed toward reducing waste, eliminating redundancies in activities, and increasing the safety of healthcare. Thus, the lean method can be applied in dentistry to ensure a better service quality.

The authors declare no conflicts of interest.

### Corresponding Author:

Rafael Matheus Lima

Address: Afonso Arinos de Melo Franco 285/1206 – Rio de Janeiro, RJ, Brazil.

Email: rafael.matheus@marinha.mil.br

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