Process Improvement and Stock Management: the case of Pharmacy Ph

Maria Ana Borges Cruz Santos Coelho

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Abstract - The COVID-19 pandemic has had a considerable impact on the retail sector, especially pharmaceutical retail. Due to the needs imposed by the period, pharmacies across the country were forced to adjust their logistics strategies. The Ph Pharmaceutical Group, made up of thirteen pharmacies, was no exception. After the pandemic, standardizing processes and management became a necessity for the group. The main objective of this case study is to develop a methodology to improve the efficiency and productivity of pharmaceutical operations. In order to understand the problem in question and the possible methodologies to be implemented, the study included a literature review focused on this subject. The focus then shifts to the development of a methodology based on the application of Lean tools and the creation of an algorithm to improve stock management. This study focuses exclusively on analyzing the implementation of the initiatives in a pilot pharmacy. The implementations made to the pharmacy's processes resulted in a 75% reduction in product breakages, a 15% reduction in days of stock coverage, as well as a 268% increase in picking productivity, a 40% increase in replenishment and a 66% increase in order taking. In addition, there was also a 23% increase in the average counselor's ticket. The results obtained are positive and show, on the one hand, the beneficial impact of the changes on the Pharmaceutical Group and, on the other, confirm the effectiveness of Lean tools when applied to the pharmaceutical retail sector.

Keywords: Processes; Pharmaceutical retail; Lean; Stock Management; Logistics

1.Introduction

In the retail and service industries, significant challenges have arisen due to technological advancements and market changes resulting from the COVID-19 pandemic (Grewal et al., 2021). According to Beckers et al. (2021), the COVID-19 pandemic had a significant impact on these two sectors, with the retail sector being one of the most affected industries. During lockdown periods, consumers were restricted from freely visiting stores and making purchases. With the adaptation to the new reality, a significant change was observed in the consumption habits of customers.

However, before the pandemic, the retail industry was already undergoing significant transformations due to the introduction of new technologies that impacted all processes, from in-store operations to external operations (Grewal et al., 2017). These changes, along with changes in consumer behaviour, forced retailers to redefine their strategic position in order to survive and stand out in the market. Consequently, there arose a need to develop new methodologies for managing various areas of businesses. While the pandemic adversely affected some retailers, others did not experience such a significant impact. One example of a retail type that was not as negatively affected is the pharmaceutical retail sector.

According to INE (2023), there were 2,921 pharmacies and 191 mobile pharmaceutical posts in operation in Portugal in the year 2021, which translates to an average of 30 pharmacies per 100,000 inhabitants. Based on data reported by the Order of Pharmacists, there were 15,565 practicing pharmacists in that same year, which on average represents 1.5 pharmacists per thousand inhabitants. The values for the year 2023 are similar.

Throughout the entire pandemic period, pharmacies not only remained open but also had to expand and introduce new services into their activities, such as conducting COVID-19 tests. In this context, all pharmacy management and logistics were adapted to fit the new reality.

Increasingly, customers are an essential part of any business, and their loyalty is a decisive factor in ensuring long-term economic sustainability (Grew et al., 2019). Several studies have demonstrated that higher levels of customer satisfaction lead to greater loyalty and better word-of-mouth recommendations (Guo et al., 2009; Kasiri et al., 2017). Therefore, it can be concluded that the customer experience during purchases is a significant and prioritised factor in the management of pharmacies.

Effective stock management and an efficient store replenishment process are crucial factors in ensuring that products are readily available to customers, thus enhancing their in-store experience.

Currently with 13 pharmacies and a clinic, the Pharmaceutical Group Ph is not an exception. The pandemic period has encouraged autonomy and independence in the individual management of pharmacies. This autonomy has in turn driven each pharmacy to become more isolated and to have independent management from the other pharmacies. As the Group Ph has grown significantly and rapidly in recent years, the standardization of all processes and management of the group's pharmacies has become an increasing necessity.

Therefore, this work aims to apply Lean methodology in this pharmaceutical context. The goal is to improve processes, reduce waste, and enhance the operational efficiency of all pharmacy activities. By eliminating unnecessary steps, standardizing processes, and empowering workers to identify and resolve inefficiencies, Lean methodology has the potential to enhance pharmacy operations and consequently have a positive impact on the customer experience.

2. Case Study

2.1. Pharmaceutical group Ph

The Pharmacy Ph is a renowned and well-established company in the pharmaceutical industry in Portugal. Its history dates back to 1911, when the group's first pharmacy was opened in Alentejo. Over the years, several pharmacies have been acquired, and currently, the Group operates a total of 13 pharmacies.

Pharmacies Ph have always recognised the importance of innovation as a driver for improving their services. They were pioneers in implementing various systems and processes to ensure service excellence (Ph Group, 2023). In 1988, they were pioneers in installing the Sifarma (SI) Computer System, becoming the first computerised pharmacy in the country, and in 2015, they introduced a new sales model with the addition of counselors.

The 13 pharmacies are located in different regions of Portugal and employ approximately 300 people, of which almost a third are pharmacists. The group's turnover and its evolution from 2002 to 2023 are shown in percentage terms in Figure 1.

When analysing the development of turnover, two significant peaks in turnover percentages stand out. The peak in 2022, which is more relevant for the analysis as it is more recent, is explained by the significant increase in the number of COVID-19 infections at the end of 2021. This increase in cases triggered the second wave of infections in Portugal. As stated in the magazine "Pharmacists and the Pandemic," April-June 2020 edition the best-selling products in pharmacies during the pandemic were hand sanitisers, five-litre disinfectants, thermometers, and personal protective equipment.

Figure 1 - Group's turnover evolution from 2010 to 2023

2.2. Characterization of the case study

Problems related to inefficient processes in a pharmacy not only compromise internal operations, but also impact the customer experience. Efficiency holds significant importance in ensuring the seamless operation of pharmacies.

In broad terms, the pharmacy's operations appear to function seamlessly. However, upon closer analysis, certain inefficiencies become evident. The most significant issue is the lack of organization in the pharmacy's BackOffice, causing disruptions in internal operations. Consequently, internal communication is compromised, impeding the fluid flow of both information and products.

With the aim of improving internal processes internal processes and aligning with the directives outlined by the top management of the Pharmacies Ph group, critical processes were identified as priorities. As a result of this identification, the following processes were considered critical: ordering and receipt of orders; replenishment process; sales models; stock management.

- **Ordering and receipt of orders**

In Pharmacies Ph, various types of orders are processed: direct orders, which include daily orders for medicines; orders for dermo cosmetics and over the counter (OTC) products; and orders from other pharmacies within the Group. OTC products refer to health items or supplements available without a prescription.

The daily pharmacy orders are placed twice a day through Sifarma (SI), a management software used by pharmacies. The system generates an order note based on existing stock, minimum and maximum stock levels, and average consumption for each product. The person in charge, usually the technical director or an associate pharmacist, adjusts and approves the proposed quantities. Decision-making at this approval stage lacks a consistent rationale and is based on factors such as pharmacy needs and supplier discounts.

Upon delivery, products arrive in separate boxes, which causes delays in retrieval. Orders are validated using the Receiving Orders Separator within the SI

and each product undergoes a detailed check.
Before being organized by storage area or before being replenished, the products remain stationary for some waiting times. In the case of cold products, which are sent in thermal containers, distinct from the rest, they are the first to be replenished in the refrigerator.
Other orders, especially dermo cosmetics and OTC products, are centrally coordinated across the 13 pharmacies. Monthly, a major restocking order is placed at the beginning of the month, followed by smaller supplementary orders. However, this approach leads to initial disorganization in the BackOffice.
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This receiving process shows inefficiencies and highlights the need for a more structured and efficient approach, particularly due to the lack of consistent decision logic.

- **Replenishment process**

The efficiency of product replenishment in a pharmacy plays a crucial role in the availability of items for customers and, therefore, the pharmacy's sales and revenue. However, in the initial phase, the replenishment process was disorganised, and even the ideal time of day for replenishment was not defined. The selection of products and quantities was inefficient, often depending on the individual decision of the replenisher. Some attempts at communication between colleagues via video calls were made to understand which products were out of stock at the pharmacy. The boxes used to transport the products were often filled and due to their weight, were brought to the front of the pharmacy one at a time as they became full.
This resulted in repetitive and unnecessary travel, wasting time and effort. Furthermore, manual replacement was also common, with workers carrying only what they could by hand, contributing to unnecessary travel and ergonomic problems.
The next step after receiving an order is the separation phase, known as sorting. Often, the separation of products into zones depends on who carries it out, which requires a new sorting later or takes a long time to search for products, wasting time on rework.
The lack of a pre-defined route for replenishment, both in the store and warehouse, also contributes to the increase in unnecessary travel. The replenisher wastes time searching for the drawer or space in which to place the product.
The causes of this waste are linked to different factors, the main reason being the disorganization of the workplace.
Breakages of exposed products are also a consequence of inefficient replacement.
In short, the lack of an organized, logical, and effective approach to product replenishment not only caused wasted time and effort, but also hindered the overall operation of the pharmacy.

- **Customer service and sales model**

Service at the pharmacy counter is important in the customer experience. Efficient service is essential for customer satisfaction, but inefficiencies can result in long waiting times. This includes waiting for the customer to be served and waiting while the pharmacist searches for the desired product.
The causes of waste are closely linked to the time spent searching for information and products. Initially, there is time spent searching for information in the Sifarma system. Subsequently, there is an effort to search for medicines in the drawers and look for other items in the store. This time-consuming process contributes significantly to wastage of both time and resources.

- **Stock management**

Initially, it's crucial to emphasize that the pharmacy's stock level is the sum of the stock in the store and the stock in the warehouse. Inaccurate management of pharmacy stock can lead to several problems. On the one hand, inadequate knowledge of stock levels can lead to product shortages, resulting in lost sales opportunities and customer dissatisfaction. On the other hand, overstocking can result in financial waste due to unsold items. In addition, the monthly orders mentioned above further disrupted pharmacy stock levels.
As hAs highlighted in the discussion of ordering and receipt of orders inefficiencies, there is no consistent rationale for decision making at the approval stage. It depends on factors such as pharmacy requirements and supplier discounts.
In addition, pharmacy stock management faces a challenge beyond its control: lack of product availability from suppliers. Several items are consistently out of stock with suppliers, directly impacting the pharmacy's ability to maintain adequate stock levels.

3. Literature Review

3.1 Lean Philosophy

The Lean methodology, widely adopted in business, aims to enhance profitability, operational effectiveness, and efficiency, meeting or exceeding customer needs and expectations (Kwak & Anbari, 2006). Originating post-World War II, Toyota's president and later Chairman, Eiji Toyoda, instructed workers to eliminate all forms of waste in response to Japan's economic crisis (Pepper & Spedding, 2010).

Toyota's Production System (TPS), devised by Shoichiro Toyoda and Taiichi Ohno, aimed to boost production efficiency, reduce costs, and waste. This formed the basis for Lean thinking. Notably, the term gained prominence through the book "The Machine That Changed the World" by James Womack and Daniel Jones. Womack contends Lean Manufacturing is so named because it uses less of everything: half the human resources, production space, factory space, tool investments, and time, yet produces the same mass volume. The essence of Lean is often condensed into five key principles outlined by Womack and Jones (1996), widely cited as the quintessential explanation of Lean thinking. These principles serve as a foundational framework for Lean application in specific areas, although their direct implementation proves challenging in diverse contexts and fields.

The five Lean principles are (Smith A, 2015):

- Define value from the customer perspective

Only part of an organisation's activities create value from the customer's perspective, not from the perspective of individual organisations or departments. Therefore, it is necessary to identify who the end customer is and to separate activities that create value from the end customer's perspective from activities that create no value, i.e. waste.

- Identify the value streams

Map and analyse the entire value stream of a process from start to finish, identifying all the steps that add value and those that do not, eliminating unnecessary activities and optimising the workflow.

- Make the value flow

Create a continuous flow of work, minimising interruptions and delays, and ensuring that value-added steps occur in short succession.

- Implement pull based production

The just-in-time principle is based on producing goods or services only when they are needed, thus eliminating the waste of overproduction.

- Strive for perfection continuously

Focus on continuous improvement, constantly looking for ways to eliminate waste, reduce costs and improve quality.

3.2 Lean Philosophy in Service

Gupta et al. (2016) state that lean can be applied to services, although the transfer of lean manufacturing principles to services has some limitations due to the inherent characteristics of services. However Leite & Vieira (2015) argue that despite the lack of standards and an established methodology for services, the application of Lean in this context can lead to significant benefits from an economic and financial point of view, as well as improvements in employee performance.

With regard to retail operations, the Lean approach aims to optimise operations and services, reduce costs and increase efficiency, as highlighted by Madhani (2022)This focus leads to operational improvements, particularly in inventory management, reducing waste in store operations and optimising the customer experience. Madhani also emphasises the importance of training and educating employees to identify and eliminate non-value-added activities in order to improve performance and increase productivity. Non-value-added activities include various types of waste, such as excess inventory, transportation, movement and waiting, as described by Deshmukh et al. (2022). In addition, queue management and store layout optimisation are key areas where lean principles can be applied to reduce waste and improve efficiency.

The lean manufacturing principles developed by Womack and Jones (1996) provide a solid basis for optimising processes, originally designed for manufacturing.

However, recognising the growing importance of Lean in services, Abdi et al. (2006) dedicated themselves to studying this transition and formulated a specific approach, adapting the Lean principles to the specific characteristics of services.

In addition to adapting the five Lean principles in services, the types of waste were also adapted. In the context of Lean applied to services, the analysis of these wastes is relevant, although the way in which they are identified in the literature may vary between different authors.

Radnor & Walley (2008) categorised eight types of waste in services: delay, rework, unnecessary movements, unclear communication, incorrect inventory, lost opportunities, errors and human inefficiency. On the other hand, Bicheno & Holweg (2016) presented a similar classification of waste in services, identifying only seven types of waste: rework, delay, lost opportunities with customers, unclear communication, incorrect inventory, customer movements and errors in customer transactions.

3.3 Lean Methodology Examples

The practical application of Lean methodology and its continuous improvement aspects have been extensively studied in the literature. Examples from different sectors demonstrate the versatility and positive impact of Lean implementation. In one study of Burgess & Radnor (2013) Lean principles were applied in the UK's National Health Service (NHS), focusing on process standardisation, elimination of non-value-added activities, process simplification and staff training. This approach resulted in significant time and budget savings.

Another study by Trubetskaya et al. (2023) considered a medical device company. By implementing lean tools such as process definition, measurement, analysis, design and verification, the company reclaimed 15% of space in a production department. It also identified opportunities to free up

up to 44.7% of the total factory floor space, resulting in cost savings of more than €2.2 million.
These examples highlight the effectiveness and adaptability of Lean across a range of sectors including insurance, manufacturing, healthcare, IT services and retail. It is clear that Lean is a powerful methodology for addressing process improvement challenges in a variety of industries.

3.4 Stock Management

Inaccurate demand forecasting leads to out-of-stocks, which affects the entire supply chain, highlighting the need to balance supply and demand (Sanchez-Rodrigues et al., 2010). Retail, which is critical for product availability, faces issues such as inefficient order management and fictitious stockouts, as Bijvank & Vis (2011) and Mou et al. (2018) stated.
Accurate stock management is essential in pharmacies; stockouts put patient well-being at risk and require meticulous drug inventory management (Saha & Ray, 2019; Yawara et al., 2023). High stock levels don't guarantee availability, highlighting the need for careful management.
Effective inventory management is critical across all sectors, including pharmaceuticals. Understanding best practices and challenges is critical to operational efficiency and customer satisfaction.
There are several methods for classifying stocks, which can be adapted according to specific objectives. The main techniques include ABC analysis (based on sales volume) and XYZ analysis (sales frequency analysis), as proposed by Scholz-Reiter et al. (2012). ABC classification, the most popular traditional technique, groups items into A, B and C categories based on annual usage value (Khanorkar & Kane, 2023). The criteria is: **A** (high-value products): 15-20% of items representing 75-80% of total annual inventory value; **B** (medium-value products): 30-40% of items constituting around 15% of total annual inventory value; and **C** (low-value products): 40-50% of items representing 10-15% of total annual inventory value.
Additionally, the XYZ analysis complements ABC, focusing on sales frequency rather than cost. It categorizes items as: **X** (relatively constant consumption, rapid fluctuations: coefficient of variation < 0.5); **Y** (stronger consumption fluctuations, usually due to seasonal or moderate trend reasons: coefficient of variation between 0.5 and 1); and **Z** (completely irregular consumption: coefficient of variation > 1).

3.5 Methodological proposal

After studying some of the available methodologies and tools, the approach and methodology chosen to be implemented with the aim of improving efficiency in the Ph Pharmaceutical Group, is outlined and presented in Figure 2. The methodology to be adopted is the Lean methodology, for its versatility and the tools that support it. Within this methodology, the tools most used in this implementation will be Kaizen; VSM; Standard Work and Hoshin Karin.

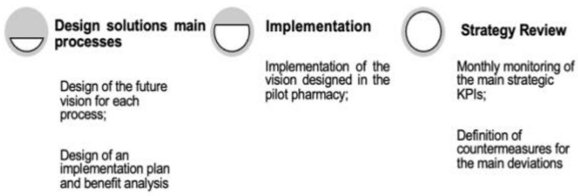

Figure 2 - Methodological proposal

4 Implementation of Proposed Improvements

Once the opportunities for improvement had been identified and the Group was aware of the key areas for improvement, the subsequent implementation phase used Lean tools, focusing on continuous improvement as defined by the Kaizen methodology. The implementation was ensured through workshops, which are characterised by meetings with a well-defined agenda and, whenever possible, held on site where the processes to be improved take place.
To simplify the explanation of the implementation, only the implementations carried out in the pilot pharmacy are described. This is one of the largest pharmacies in the group and therefore one of the most challenging for process improvement.
To cover all the improvements, they were grouped into key processes. The following implementation emphasises these, but smaller processes have also been improved, some supporting complex ones. The description therefore starts with a pre-implementation phase, using Daily Kaizen tools for effective communication.
Until this point processes have been described within the product flow, starting with the order. This chapter focuses first on improving replenishment, a critical element that affects sales, followed by receiving, the sales model and inventory management.

4.1 Daily Kaizen

As the business continues to grow and the number of team members increases, it is vital to establish routines and provide managers with the tools to communicate effectively. Daily Kaizen is an essential tool within the Lean framework, involving the creation of management routines and team monitoring. Key objectives include optimising team organisation, empowering teams for continuous improvement, increasing employee motivation, improving communication transparency and optimising quality, productivity and service metrics. To achieve these goals, it is essential to establish a daily monitoring routine. This includes short daily meetings, maintaining a visual board, tracking pre-defined performance indicators and implementing action plans for better control. Kaizen meetings should be held daily at a set time, are recommended to last no longer than 15 minutes and be held near the daily Kaizen board. During these meetings, non-routine tasks for the pharmacy are planned for the week, key indicators affecting the processes are analysed, and improvement actions are initiated to address any deviations.

4.2 Replenishment process

The replacement process is the first to be improved. To address the initial replenishment challenge, a systematic approach was adopted, categorising replenishment into three types: daily replenishment, which is carried out every morning before the pharmacy opens; selective replenishment, which involves weekly identification and correction of products with incorrect stock levels; and intensive replenishment, which is carried out fortnightly to transfer all stock products to the store. Daily and selective replenishment require the retrieval of replenishment lists from Sifarma, which are generated daily before the pharmacy closes. These lists are made up of products sold the previous day. Only products available in the store are included. Six specific replenishment lists were created, each corresponding to a specific route in both the warehouse and the store.

The entire warehouse was reorganised according to store organisation criteria. Products were arranged alphabetically on shelves for easy access. Following this reorganisation, picking routes were created in the warehouse according to the pre-defined lists. The warehouse routes were arranged in reverse order to the store routes, ensuring that products picked last in the warehouse were the first to be replenished on the store shelves.

In addition, support carts were introduced for replenishment tasks. These carts can hold up to three full trays and can be folded for compact storage when empty.

4.3 Reception and Sorting Process

To address this challenge, two initiatives were implemented: the introduction of a sorting cell and the use of Sifarma's automatic reception.

The sorting cells developed, each capable of accommodating four trays, were fitted with wheels for easy transport. Within these cells, six defined categories were used to facilitate sorting.

In order to implement Sifarma's automatic reception, the presence of the sorting cell in the pharmacy was verified. In the back-office area, specific zones were defined for orders received, orders to be processed and empty trays. Once these requirements had been met, the second step was to activate Sifarma's automatic reception functionality.

Compared to the initial phase, the proposed process eliminated the need for individual item scanning and verification, expiry date checking and product queues. During automatic order receipt, detailed order and product information provided by the supplier was accessible via Sifarma. Product expiry was based solely on the dates recorded by the system from the supplier, even though different boxes of the same product could have different expiry dates - the system always displayed the shortest expiry date.

The reception process involves a detailed check, starting with the total number of references, the quantity of packaging received and the total amount of payment, to ensure consistency with expected order values. Cold items, psychotropic drugs and products over €65 are individually checked due to special care requirements. Sorting follows, with products placed in designated trays within the sorting cell. Prescription medicines with price change alerts are verified, with items with the old price prioritised for sale. Non-prescription items are analysed to adjust margins according to Group policy. At the end of the price check, it is necessary to print the verification sheet or note down the products with price changes for later printing of the new corresponding labels.

Any products that were ordered but did not arrive are reordered from another supplier.

At the end of the process, the trays of product received go directly to the store, following the same route as the daily replenishment and, just in case there is not enough room for everything, the remaining products are stored in the warehouse.

4.4 Sales model

The implementation of the sales model focuses primarily on improving the customer service provided by the counsellor. Counsellor service requires greater investment in training to ensure that customers are served efficiently and correctly. This initiative includes the establishment of a standardised approach for counsellors, coupled with a training programme, coaching sessions and continuous feedback. These measures will enable teams to handle customer objections, navigate through the various stages of the sales process and guide customers according to their health status. To ensure consistent and efficient customer service, specific standards have been developed to guide each stage of the customer interaction. Tailored scripts for different health conditions enable counsellors to provide personalised service. Dealing with objections was a challenge, so response standards were developed.

A comprehensive training programme, including coaching, personalised guidance, continuous feedback and role-play simulations, enhances advisor skills. In addition, a system monitors counsellors' average ticket values, enabling data analysis at both the pharmacy and individual counsellor level. This analysis is used to adjust and improve service efficiency and quality.

Pre-implementation activities included the development of manuals detailing established standards and scripts. Training sessions introduced counsellors to these standards, and role-playing simulations provided practical scenarios. The Kamishibai confirmation system was introduced to ensure compliance with the new standards through pre-defined checkpoints.

4.5 Stock Management

For stock management, a solution named "Pull Planning" was implemented to reduce and optimize the pharmacy's stock value in accordance with desired service levels, customer demand, and supplier delivery times. The Stock tool implementation comprises the following aspects:

1) Analysis and Classification based on consumption volume and frequency

Through ABC and XYZ analysis, products are categorized. In ABC analysis, products are classified as A, B, or C, where A represents 15% to 20% of products contributing to 80% of sales, B represents 30% to 40% of products contributing to 15% of sales, and C represents 40% to 50% of products contributing to 5% of sales. The data used to calculate this are sales in the three months prior to May 2023 and to perform this analysis, the cumulative percentage of sales for each reference was used.

For the XYZ analysis, the calculation involved counting the days out of a total of 90 days on which each product had at least one sale; for example, if a product had sales on 18 days out of the 90 days considered, it would be classified as Y. The final classification results from the combination of the ABC and XYZ analyses.

2) Definition of BTS and BTO strategies

BTS and BTO represent distinct inventory management methods. BTS involves stocking products without specific demand, whereas the original push-based pharmacy strategy used BTS logic for all products, regardless of ABC or XYZ classification. The enhanced approach adopts a pull strategy, responding to actual customer demand. As a result, most products follow BTS, with adjustments in quantities. Only BZ and CZ products follow the BTO strategy. Exceptions include certain items and those with a value of more than €65. Factors such as supplier lead time, batch size, demand forecasts, critical products and supply and demand variations were analysed to design the stock management tool for pharmacy operations.

3) Increasing order frequency and reducing batch size

This step aims to increase order frequency for almost all products, while reducing the batch sizes arriving at the pharmacy. The elimination of the monthly replenishment order ensures consistent order sizes regardless of the time of the month, which simplifies order reception.

4) Definition of the replenishment point and safety stock for each product

Determining replenishment levels and safety stock for each product is critical to developing an effective inventory management tool. Factors such as lead time, customer demand and its variability influence both replenishment levels and safety stock. Lead time is the total time it takes to process an order, including order processing, supplier picking and transport time. To calculate the replenishment level, it is necessary to define not only the lead time but also the safety stock. The safety stock is an additional reserve used to minimise the risk of shortage of a product. The calculation of the safety stock includes statistical values derived from a normal inverse distribution, considering the mean and standard deviation of consumption over three months. The replenishment level is equal to the demand during the lead time plus the safety stock to ensure that sufficient stock is available to meet demand during this period. Defining replenishment levels ensures that sufficient stock is available to effectively meet demand during the lead time.

This tool, integrated in an Excel spreadsheet, calculates the quantity to be purchased for each product or medicine based on analysed variables and minor decisions. These decisions include exceptions, considering factors such as product classification (A or B), value (<65€), whether the product is an ostomy product or a TOP, and whether the product is exposed to customers.

Once the replenishment levels have been calculated for all pharmacy products, these new values must be transferred to Sifarma.

Once the replenishment levels have been transferred, whenever the quantity of each product in the pharmacy is below the minimum and maximum stock levels (which are the same), Sifarma proposes to order what is necessary to return to the replenishment level.

5. Presentation and discussion of results

Monitoring the evolution of indicators makes it possible to assess the progress of each initiative. These assessments provide the knowledge necessary to adjust with a focus on continuous improvement. For this reason, the indicators were measured weekly. Over a period of one week, it is possible to monitor progress and implement the necessary adjustments.

5.1 Daily Kaizen

The Daily Kaizen tools were implemented with the aim of organising and improving the exchange of information within the team. However, this initiative does not have an associated performance indicator, which makes it difficult to quantify the benefits and evolution of this implementation. Despite the lack of an indicator, since the start of the daily kaizen meetings and the introduction of support boards for the meetings, there has been a noticeable improvement in communication and information transfer throughout the pharmacy. There was also a better organisation of the workspace. These improvements were crucial in establishing a solid foundation in the organisation of the teams, which facilitated and supported the implementation of all subsequent initiatives.

5.2 Replenishment process

Improving the replenishment process was the initiative that had the greatest impact on customers, as it is the process that has the greatest impact on customer satisfaction. The key performance indicator for this initiative is the percentage of total product shortage. The results obtained for this indicator are shown in Figure 3 below.
In the first measurements, which correspond to the initial period of implementation, the stockouts in pharmacies were still high and the first measurement, which is taken as a baseline, was 11.80%. After 12 weeks, the breakage rate had already reached the target of 3%. This difference represents a 75% reduction. This indicator was monitored during the following months, but as shown in the graph, the value of the indicator stabilised at the beginning of April.

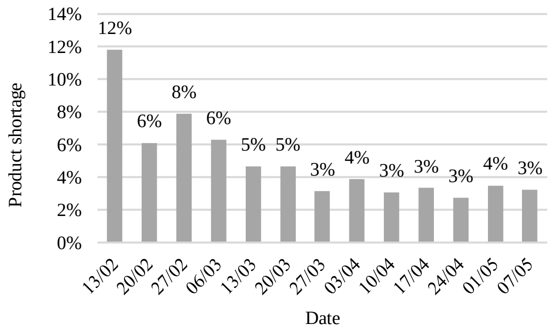

Figure 3 - Product Shortage

5.3 Reception and Sorting Process

The results of the improvements in the receiving, conference and sorting process proved the most challenging. The indicator used is reception productivity, measured in boxes received per hour. The values obtained for this indicator are shown in Figure 4.

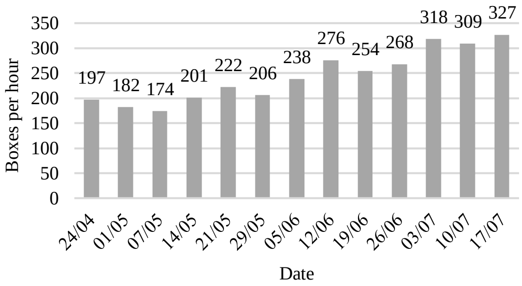

Figure 4 - Reception Productivity

The base value of this indicator is 197 boxes per hour, the remaining values fluctuate over the weeks and the value tends to increase. In the 13 weeks recorded, the value of boxes received increased by 130 units, which means that the number of boxes received per hour increases by an average of 10 units per week. After analyzing this data, it can be concluded that the observed increase is 66% with the introduction of improvements in the process, increasing the base value from 197 boxes per hour to 327 boxes.
Although the results obtained were favorable, this alternative indicator proved to be inefficient to obtain. To obtain this indicator, the pharmacist or back-office personnel receiving the products must record the start and end times of the reception, as well as the number of boxes received during this interval, and these records are not precise. Nevertheless, despite its limitations, it was chosen for use.

5.4 Sales Model

The indicator used to monitor the progress of this process was the average ticket, measured in euros per ticket. Given the monetary nature of the data, and to protect the confidentiality and privacy of the pharmaceutical group, it was decided to present the data obtained multiplied by an x factor. As a result, the absolute values do not reflect reality and only the percentage improvement accurately reflects the progress made. The values obtained, multiplied by a factor x, are shown in Figure 5.
The base value was 59.17 euro per ticket and this value was increased by 23%, resulting in a final value of 73 euro per ticket. To obtain these values, an average of the services provided by all counsellors was calculated each week.
With the beginning of the summer, the values recorded increased, with the highest value being recorded at the beginning of July. This increase in euros per ticket was mainly due to the sale of seasonal products such as sunscreens and moisturising creams.

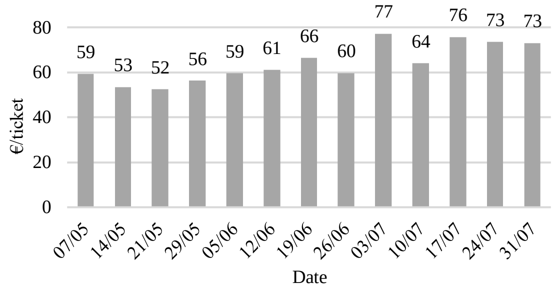

Figure 5 - Average Ticket

5.4 Stock Management

In order to evaluate the efficiency of the proposed stock management tool, the indicators used are days of stock coverage. Stock coverage, measured in days, indicates how many days the pharmacy can satisfy demand with the amount of stock currently available. To calculate this indicator, the total number of products in stock at a given time is divided by the daily consumption, i.e., the number of products sold in one day. The value used to represent daily consumption corresponds to the average of daily sales over a week, while the value related to the stock in the pharmacy is calculated only based on the products in stock on the day the indicator is calculated. These values are shown in Figure 6.
Initially, the indicator value was 40 days of inventory during the monitoring period. After the implementation of the pull planning tool and stabilization, the inventory coverage was reduced to 34 days after 9 weeks. This change represents a 15% reduction from the initial value.

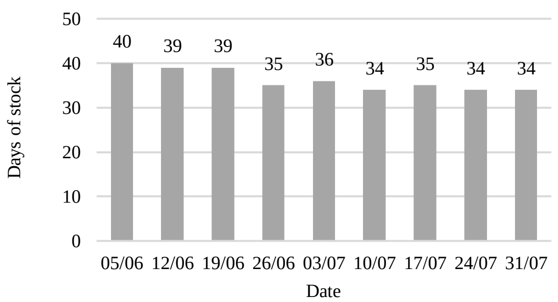

Figure 6 - Stock Coverage

Analysis of the graph shows minimal fluctuations in stock coverage over the weeks, indicating that the reduction wasn't significant. This result is attributed to the resistance of the pharmacy team during the implementation of the tool.
Based on the work and results presented, it's evident that the initiatives and improvements made had a significant impact on operations. Achieving these goals relied heavily on the active participation and performance of the Ph1 Pharmacy team and the Top Management of the Pharmaceutical Group.

6. Conclusions and future work

The aim of this case study was to develop a methodology based on Lean tools to achieve the objectives of the pharmaceutical group. Five improvement initiatives were implemented based on the tools studied: Daily Kaizen, replenishment optimisation, automated receiving, sales model improvement and inventory management using pull planning.
Although there was no qualitative indicator, Daily Kaizen improved communication and organisation in the workplace. Replenishment process improvement reduced out-of-stocks by 75% and automated receiving increased hourly carton productivity by 66%. After consultant training, the average transaction value in the sales model increased by 23%. The new inventory management tool reduced out-of-stocks by 15% and out-of-stocks by 37%. Despite challenges such as resistance to change and difficulties in measuring certain indicators, the improvements had a significant impact on process efficiency, customer satisfaction and sales. The pharmacy team remained motivated, actively participating in meetings, suggesting ideas and addressing challenges.
For future work, the optimisation of other processes and strategies is recommended to support these initiatives. Given the group's thirteen pharmacies, the possibility of a centralised warehouse to coordinate logistics could be explored. It could be beneficial to direct product and medication orders to this central warehouse for subsequent distribution to each pharmacy via an internal distribution network. In addition, it would be advisable to carry out a study of different suppliers with the aim of reducing the number of suppliers for each pharmacy and selecting those that offer excellent service and competitive prices.

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