Issues in Healthcare Supply Chain Management: From Literature to Practice

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***Abstract*— This research aims to identify the main issues on healthcare supply chain management literature, to analyse a real healthcare unit supply chain. The results are a framework compiling literature review, that allowed redesigning the medicines and materials supply chain of a network of hospitals in Brazil. The method consisted in conducting the literature review, describing the actual model of the healthcare units using process management approach and designing the new supply chain, adopting Lean Healthcare tools, such as A3 to guide the analysis and problems solution. The study demonstrates that the literature lacks healthcare supply chain management solutions, since most articles have a pharmaceutical or care bias. Thus, this article contributes with an applied experience, which benefits both literature and organizational practice.**

***Keywords*—** *Supply Chain Management, Healthcare, Process Management, Lean Healthcare, Management of medicines and medical materials.*

1. Introduction

Supply chain management (SCM) represents the combination of business activities, from the beginning of the process to the final consumer, so that all the processes of the organization are within the stipulated deadlines and add value to the product or service provided to the end customer [1]. The main difference from healthcare supply chain to most segments is that its main objective is to save lives, what means it must be projected in a patient-based logic. In this context, medicines and materials management emerge as a relevant factor to overcome healthcare challenges, especially because supply chain management is still seen as a support function, despite the fact that materials and medicines represent the second higher expenditure on hospitals, preceded only by human resources costs [2].

Hospitals are usually the main structure in healthcare networks, and it is much more than a simple link in a complex supply chain [3, 4]. It is one of the most complex units, because it is a center of interaction of several professionals. There is a consensus among analysts about its major deficiencies and inefficiencies, especially in supply chain management context [5].

Considering that the supply chains distinguishes themselves for the planning and control process, the work and organization structure, the types and product flow [6], it is increasingly important to understand and improve supply chain management in new contexts, such as healthcare. This study focuses on analyzing the literature elements about healthcare supply chain management to propose a redesign for a Brazilian hospitals network. From analyzing both literature and previous organizations experience, the redesign aims supporting decision making to improve performance of the resources management. The article is organized in five sections, such as introduction, method, literature analysis, description of the current supply chain of the organization studied, the proposed project and final considerations.

2. Method

The research methods are the base for knowledge creation, being the instrument that serves to reality comprehension [7]. This research is an applied project [8], since it considers the theoretical concepts to solve a real problem, that is reduce wastes and improve efficiency of the selected hospitals network supply chain. To achieve this goal, the first step was a literature review [9]. Then, it

was described the actual supply chain processes of the hospitals network to therefore propose a redesign.

The literature review followed the steps proposed by [10], which are problem formulation, data collect, data evaluation, data analysis and interpretation and conclusions presentation. The two research questions were (i) which are the main issues related to healthcare supply chain discussed in literature and (ii) how to redesign the hospitals supply chain through these issues of healthcare supply chain.

The accessed database was Pubmed because its focus on healthcare themes in qualified journals. The first group of keywords was 'medical material management', 'medicines management', 'medical material flow', 'supply chain', 'distributions of medicines and medical material' and the second was 'health', 'health care', 'public sector', 'public hospitals'. These keywords were combined two by two and searched in database from 27th October 2018 to 29th October 2018. A total of 448 titles and abstracts papers were analyzed and 30 papers were selected by their pertinence to the theme. Then, qualitative analyses were conducted, resulting in a framework highlighting the main issues in healthcare supply chain literature.

The second step was to describe the 'as-is' process of the supply chain management of the selected hospitals network. The ARIS/EPC notation in ARPO tool was adopted to construct the Value-added Chain (VAC). A set of interviews was conducted to the Operations Director, Logistics Managers and Pharmacists, Financial Director and IT Director to acquire enough information about the medicines and material management, from purchasing to the use by the patients. The semi-structured interviews focused on issues related specific constraints of the units associated to planning, demand forecasting and purchasing. Additionally, direct observations in pharmacies and warehouses allowed verifying the real process dynamics, seeking to collect data from the material receiving and distribution flow, storage and stocking until the dispensing to patients.

The problems identified in the current situation were structured and solved in A3 report, a Lean Healthcare tool. For the A3 report conduction, the employees directly related to the respective supply chain processes were invited to contribute with their experience and perspective. The main objective was a collective construction of the solutions for the identified problems. The last step was to propose a redesigned VAC for the future situation, using both elements identified in the literature and proposed solutions in the A3 report.

3. Healthcare Supply Chain Management: Issues in Literature

The extensive development of supply chains appeared in a structured way in the 1990s. Such development took as a reference logistical issues, which were up until then deemed as part of the organizations' agenda for the management, storage and transport of materials [11]. Most practitioners, consultants and academics have considered supply chain management concepts not different from logistics management. Recently, the understanding of SCM has been re-conceptualized from integrating logistics across the supply chain to the current understanding of integrating and managing key business processes across the supply chain [4, 6].

Despite the recent scope of SCM, the Healthcare literature still refers majorly to intra-organization context [3]. The framework highlights processes that start at demand planning and end at patient use of medicines and materials. Figure 1 highlights these processes and the issues and tools related to each of them, detailed in this section 3. Figure 2, Figure 3 and Figure 4 show a zoom in this framework.

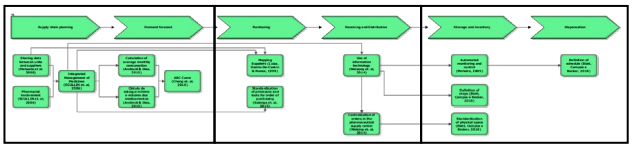


Figure 1 - Medicines and material SCM processes framework from literature

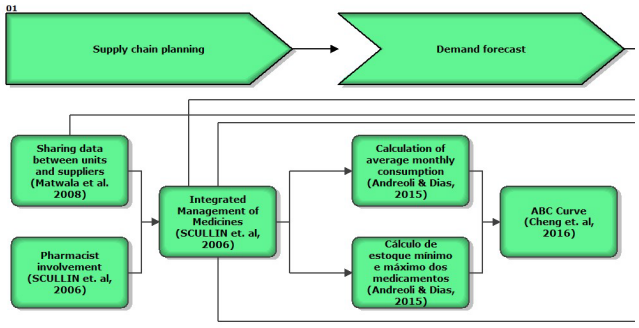


Figure 2 - Zoom 1 in framework from literature

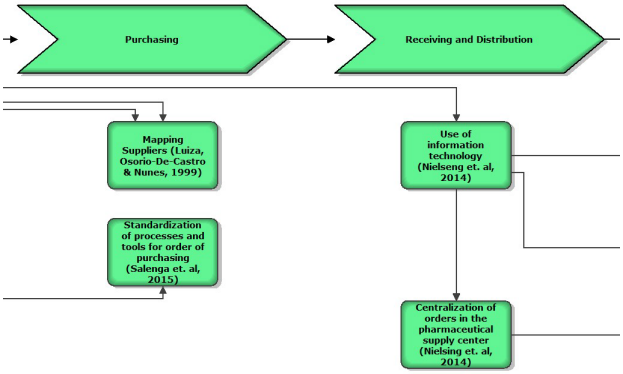


Figure 3 - Zoom 2 in framework from literature

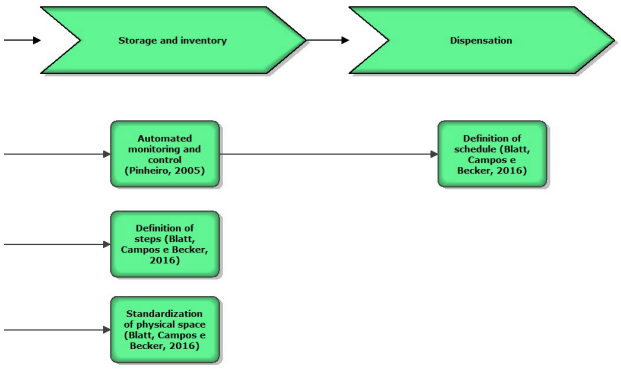


Figure 4 - Zoom 3 in framework from literature

3.1. Supply Chain Planning

The experience of partnerships between hospitals and suppliers in the hospital supply chain was analysed by [2] in order to identify shared organizational goals and projects to achieve those goals. In that experiment, the two organizations agreed to co-employ a full-time employee to unite their supply chain strategies and teams, creating a unique platform for shared initiatives. The experiment demonstrated that working in collaboration with partner organizations can improve operational effectiveness and, consequently, improve patient care. The two organizations analysed the value in sharing data and understanding each other's internal operations. This delay managing, when conducted together can improve patient care by reducing the time and resources required to determine a replacement for an unavailable product.

In opposition, [12] defends an intra-organization approach. They analysed the involvement of pharmacists in primary and secondary healthcare. For the authors, medicines management should encompass all aspects of patient use, being a partnership of efforts between patients and professionals to provide better results to patients and a minimized cost. They propose an Integrated Management of Medicines inside the hospital, which aims to incorporate the key elements and to examine the impact of their delivery to enable the new service to identify areas that could be improved as part of the ongoing hospital quality improvement process. This process consisted of analysing three moments of a patient's stay inside the hospital: admission, monitoring and hospital discharge.

3.2. Demand Forecast

As stated by [13] the demand forecast of materials and medicines is not accurate due to the divergence of professional profiles, mainly regarding the types of medical supplies and their frequency of use, which depend on the nature of the injury, patient age, payment agreements, for example. Therefore, in most cases, medical supplies are requested based entirely on their own previous experience. Due to the imprecision of the definition of demand, [13] observed that sometimes there is excess and other times there is an out of stock of medical supplies. To solve this problem, they initially proposed the implementation of the ABC curve, a method to separate the products into three categories and highlight the 80% most important of the company.

Additionally, [14] identified that the main problem of demand forecasting in a hospital is the lack of measurable parameters to allow a good purchasing. For the authors, frequent irregularities in medicines supply are related to the absence of consistent and systematic logistic information to subsidize the hospital's standardized purchase schedule. They suggested that real and measurable data should be drawn from (1) a list of standardized medicines with their respective description, unit of supply and spread sheet to register the monthly consumption of each item in the hospital, (2) survey of the internal and external processing time of the purchase order of the medicines to calculate the minimum and maximum stock of the standardized medicines, and (3) ABC classification of medicines in stock in the hospital.

3.3. Purchasing

The research of [15] explored the acquisition of medicines in the public sector in Philippines, which, as in Brazil, occurs through competitive public bidding process. The authors found that the lack of coordinated processes to monitor the availability, distribution, and consumption led to overstocking in many times. As [16] state, the situation is unfavorable to the public service. They propose actions to improve relations with suppliers of materials or services such as (1) to know the supplier, to constitute a qualified list of suppliers, based on the construction of an information system that addresses legal capacity, suitability, financial standing and technical suitability, (2) to know the product: medicines are a group of products with a large number of technical specificities. It is important that trained professionals - pharmacists and trained technical professionals - are involved in the logistics process. The substantiated observations of those who use the product in the organizations should be used as additional indicators of the inputs quality.

According to [17], there are several institutions responsible for healthcare supply chains established under the purview of Ministry of Health in Sri Lanka to support the medical supplies required by the healthcare institutions and to ensure the quality and the safety of the service provided. Suppliers who quote against State Pharmaceutical Corporation (SPC) tenders for pharmaceuticals have to register with the Cosmetics, Devices & Drugs Regulatory Authority.

3.4. Receiving and Distribution

The study of [18] mapped the drug distribution chain to evaluate current approaches and use of Information and Communication Technology among health professionals in two rural districts of Tanzania. The study was conducted on two poor districts, where orders for medicines and materials were done through paper forms filled quarterly by each health unit. After a few months, the orders are delivered to the headquarters of the respective districts, and later distributed to the health services individually. As a suggestion to reduce these obstacles was to prioritize essential drugs in their procurement and develop better structured systems to deal with multiple suppliers. At the district level, computers and electronic communication between health facilities were desired to track medicines and obtain stock reports, and thus be able to redistribute medicines on time, if necessary.

3.5. Storage and inventory

The goal of inventory management is to ensure availability to support operations, with lower inventory, purchase and inventory costs, and obsolescence costs [19]. The authors [20] argue that in order to avoid losses of possible shelf-life, misuse and consequent lack of medicines, products in the units must be monitored from their arrival to distribution and dispensing. [19] is also concerned with the control of inventories in the storage of medicines and materials and elaborates a system of inventory control capable of producing sufficient and reliable information for decision making, as well as facilitating the management of investments. For the author, the model must meet at least the following guidelines regarding stock control (1) computerized registration of items, (2) fixing a minimum inventory per item, (3) establishment of quantities ordered per item, (4) establishment of fixed or variable orders and (5) ABC classification of all inventory items.

A drug inventory policy was developed by [21] and it is suitable for each drug category, rather than applying a single Min/Max policy for all categories. It was proposed a planning system, consisting of when to order, how much to order and how to handle the various types of drugs. [21] believe that establishing a suitable policy for each demand type is the way to manage drug inventories in a hospital and it should reduce the total inventory cost while still maintaining the service levels to patients.

3.6. Dispensation

The medicines dispensation is an activity that consists of supplying the health units with medicines in quantity, quality and timing, for later dispensation to the user population [20]. According to [20], it is possible to establish the periodicity for delivery of the products, through a schedule, and this standardized and structured way of the routines of distribution and dispensation of medicines and materials facilitates the work of employees and helps in the sector planning.

4. The Current SCM of a Brazilian Hospitals Network

This section describes the current supply chain of the selected hospitals network. This network is currently composed for five healthcare emergency facilities and it is part of the National Health System (SUS), i.e., the public healthcare context in Brazil. Each hospital assists an average of 500 patients per day, considering low, medium and high complexity patients. Figure 5 represents the current value-added chain of the hospitals network. Figure 6, Figure 7, Figure 8, Figure 9 and Figure 10 show a zoom in this VAC.

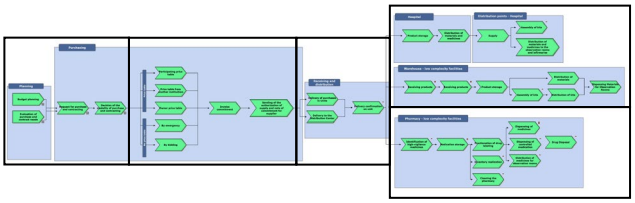


Figure 5 - Current hospitals network VAC

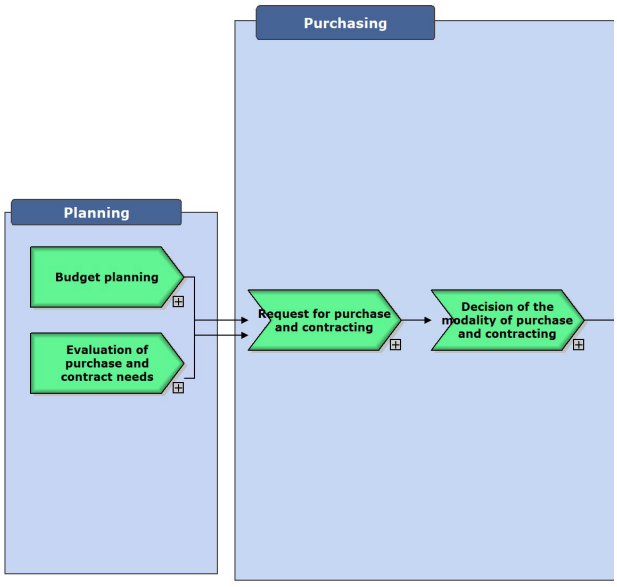


Figure 6 - Zoom 1 of current VAC

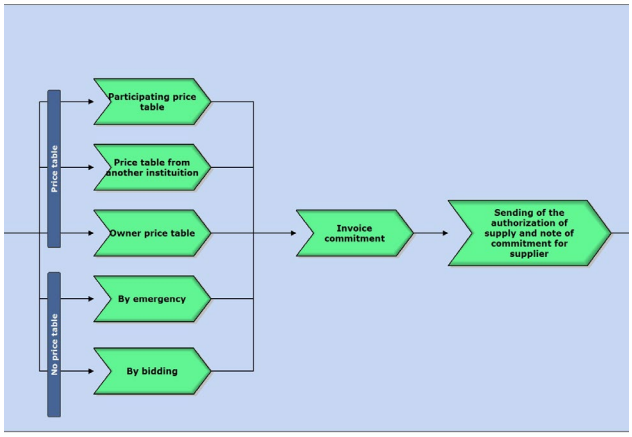


Figure 7 - Zoom 2 of current VAC

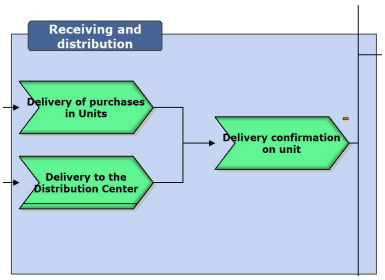


Figure 8 - Zoom 3 of current VAC

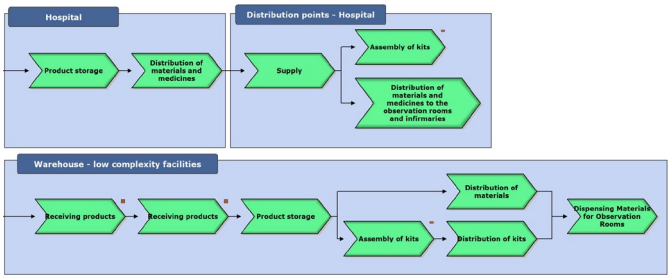


Figure 9 - Zoom 4 of current VAC

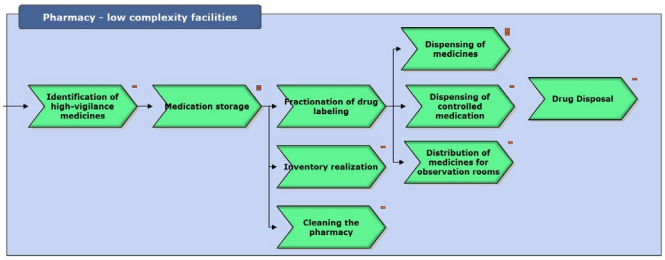


Figure 10 - Zoom 5 of current VAC

4.1. Budget Planning

The budget planning analysts receive annually the detailed information of the amount to be spent per type of medicines and material. In the middle of the year before, analysts prepare the budget proposal. By January of the current year, the proposal must be approved so that the Operations Department can plan the dates of requests for medicines and materials and define the periodicity of the annual stock rotation, currently every two months, and the amount allocated to each nature of expenditure. After date's definition, the Logistics Managers identify the items of medicine and essential materials to fit the presented budget.

4.2. Demand forecasting

Based on the budget planning and the definition of essential items, the Operations Director together with the Logistics Managers and the Supply and Service Planning Manager, meet to analyze the actual consumption rates versus planned consumption and based on this they plan the demand for the next two months. It was observed that the quantity of inputs to be purchased is defined empirically among the employees and often becomes insufficient or excessive to meet the hospital's consumption, generating respectively extra purchase orders or losses by expiring date of the products.

4.3. Acquisition

When the need for orders have been defined for the next two months, the Logistics Managers fill the Material Requisition, a document shared in Google Drive between the pharmacies and warehouses employees, containing the product code, description and quantity for the stipulated period, based on the demand curve, the historical series of the unit and a set of defined adaptations (medicines or materials). Orders must be closed considering the period of 45 days until delivery. The orders must be released by Logistics Managers in the Information System spreadsheet with complete description of the product, including the product code and the quantity per Unit, for the buyer to visualize the need and start the buying process, directly with the supplier. The process of purchase of inputs occurs through public bidding, where the supplier selection criterion for the public sector, in the majority, is the lowest price.

The decision of the purchase modality is taken by the buyer analyst of the company through the bidding process. When requested the price table, the Operations Director must send a memorandum to the Financial Director justifying the acquisition to include the process. If the product requested doesn't have current price table, in addition to the previous documents, it should also be sent a Term of Reference, prepared by Supply and Service Planning Manager of Operations Director for the Financial Director to attach the request to the emergency, bidding or dispensation process.

When the order has been requested, the buyer will receive the information through system and he can proceed with the purchase process. He sends the Commitment Notes and Supply Authorizations to the Logistics Managers, forwards the note to the manager copying in the e-mail the

request to Supplier, for scheduling of deliveries and control of receipt.

4.4. Receiving and distribution

The delivery time by the supplier is 45 days. The administrative assistants of the respective facilities warehouses are responsible for receiving and checking the items. For medicines receiving, this activity is performed by the pharmacy technician. When the receipt comes from purchase, the conference must be made between the invoice or electronic invoice. The administrative assistant or pharmacy technician must check: commitment number, name of the supplier company, name of the recipient company, description of items, quantity, type of operation, unit price e national registry of legal entity. The product can't be received when divergences occur. If there are no differences, the invoice must be certified with the reference date. In addition to the attestation, the administrative assistant must complete the invoice movement information in the information system for registration purposes. The invoice must be registered in the Receipt Protocol Book, which is in the warehouse of the units with the following data: date, company, invoice number and commitment number. The administrative assistant must make a copy of the invoice and file it in a specific folder in the Warehouse. The original invoice, together with the Receipt Protocol Book, must be delivered to the Operations Coordinator of Unit. The Coordinator must sign the receipt of the invoice in the Protocol Book and return it to the administrative.

4.5. Storage and Inventory

To store the products in their respective sectors, it is necessary to identify their specificity to destine them to the correct stock. There are high-vigilance medicines, that offer risks and harm to patients if they are administered incorrectly; medicines subject to special control, which have central nervous system action and may cause physical or chemical dependence; the thermolabile products, temperature sensitive and which require conditioning in cooling or freezing; and photosensitive products, sensitive to light.

The thermolabile products are stored in the refrigerator of the pharmacy. The refrigerator temperature should be between 35,6° F and 46,4° F to allow optimal medicines storage. The pharmacy technician should check daily the refrigerator temperature every 12 hours, and record in the Refrigerator Temperature Record. The light-sensitive products are kept in their own secondary packaging, placing a red warning card containing the sentence: "Photosensitive - Do not expose to light".

Medicines subject to special control must be kept by lock and key or other safety device, in an exclusive place, and under the responsibility of the pharmacist. The high-vigilance medicines should be stored in an appropriate shelf, separated from other medicines, on a specific shelf inside the cabinet for controlled and high-vigilance medicines. Medicines that need to stay in the pallets should have the exclusive pallets for storage. The secondary stock shelf, the dispensing shelf and the controlled cabinet shelves containing the high-vigilance medicines are marked with a red stripe in order to differentiate the packaging from the others.

The pharmacy technician, when removing the secondary stock box, must identify each high-vigilance medicines unit with a red label in half-moon shape and past it in a way of not hiding the original medicine information. The packaging and labels of the high-vigilance product should only be withdrawn at the time of administration of the drug and, if not used, the drug should be returned at the end of the shift.

Other medicines should be stored on plastic pallets, shelves, cabinets in a location that does not receive direct sunlight, and should not be placed directly on the floor. The maximum stacking allowed by the carton shall be observed, observing the packaging identification symbols, avoiding overloading of the weight which may damage the original characteristics of the product. Keep distance between products, walls, ceilings, stacks to facilitate air circulation, at least 10cm away from walls and 50cm ceiling. High-volume solutions should be stored on pallets, away from the walls by approximately 20 cm, with easy identification and respecting manufacturer's instructions on the maximum number of stacking layers. Each bin should have only one batch of each medicine, the remainder should be stored in the box labeled with standardized label containing the product name according to the name that appears on the system.

Disposal of medicines and materials in pharmacy and warehouse stocks should follow ordering criteria that facilitate not only storage, but also visualization and access, such as (1) to sort the products by the name that appears on the drug and materials grid in alphabetical order from left to right and top to bottom, (2) to store products by batch number and by shelf life, following a "first in, first out" (FIFO) criterion for stock control of medicines, (3) to keep the packaging or label of the product facing the access side of the storage place, (4) to fix the product name, batch number, and expiration date on the hard-to-see box for proper identification of the storage area (5) the medicines must be separated into specific shelves by pharmaceutical form: bottle, pill, ampoules, ointment and creams. Antibiotics should be kept on a separate shelf from the others.

Periodic inventories are carried out in the pharmacies and warehouses of the units in order to check if the physical stock reflects the same reality of the inventory of the system. Daily, the pharmacist asks the technician to count three items chosen at random. The Pharmacist checks the

quantity counted with the quantity presented in the system. In case of divergence, it must be notified to the Pharmacy Coordinator. The pharmacy coordinator should analyse the difference between the stocks, looking for the cause of this difference.

4.6. Dispensing

The dispensing of medicines to patients occurs in two distinct ways: the patients being observed in the five units analyzed and the outpatients who take the drug to continue the treatment at home, according to medical prescription. For outpatients, the patient must have the prescription that the doctor prescribed the pharmacy technician.

The technician should check the patient identification data and the professional who prescribed the recipe, with signature and stamp, and the dosage, presentation and route of administration of the prescription. In case of incomplete prescription, without data, shaved, illegible, without stamping, without heading, without identification of the patient or any other inconsistency, the pharmacy technician must inform the patient verbally and write down the pen on the back of the prescription the found inconsistency that prevented the dispensation. The patient should be instructed to present the prescription to the professional who provided it so that the same makes the requested corrections.

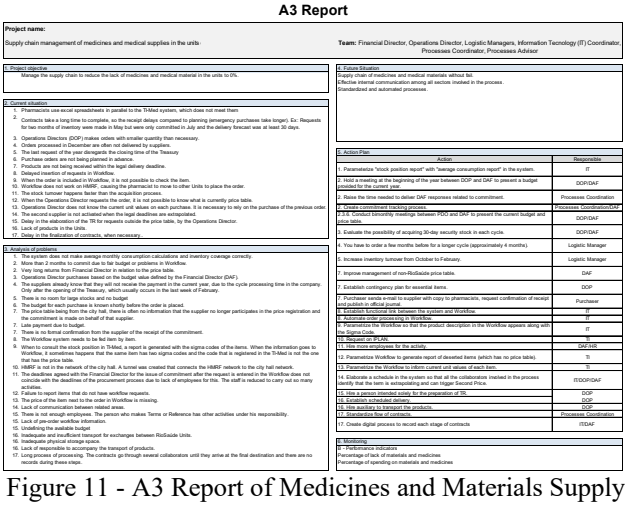
The Pharmacy Technician should calculate the quantity to be dispensed and select the prescribed medication. Then, lower the amount of drugs in the system individually. The technician must stamp the "delivered/date" in the prescription, next to each medicine delivered and give the patient or accompanying person the medication that is being delivered. Always be aware of the 12-hour validity of the prescription prescribed. If the medication prescribed by the doctor is not part of the medication list, the pharmacy technician should explain to the patient that the unit does not receive this type of medication and direct him to seek a basic care or clinic of the family closest to his home.

The distribution of medicines in the observation rooms and infirmaries in the units involves the doctors, the nursing team and the pharmacy technician. Upon receiving the medical prescription in the system, the nurse should print the prescription to accommodate the medication. The appointment should be made only at the times of administration to the patient. The prescriptions are updated every 24 hours, or if necessary, inclusion or suspension of items already prescribed. In cases of new hospitalizations, the prescriptions can be delivered on demand. The Pharmacy Technician must screen, select, separate, pack and dispose of medicines within 90 minutes after the time the medications were ordered, placed in plastic containers and identified with the patient's name, hospitalization room, bed and date.

In cases of medicine for use in emergency situations, dispensing is performed immediately for the applicant himself. Subsequently, the technician should look for the requester to sign, stamp and date - with time - the copy of the prescription. Nursing must return medications that will not be administered due to medical discharge, transfer, among others, filling out the Drug Return Protocol Book that is in the pharmacy, with the information: date, patient's name, reason for return, name of the drug and quantity. The person responsible for the return must sign and stamp.

5. From Literature to Practice: the A3 report

Based on interviews and observations to describe the current situation, it was possible to identify some obstacles that hinder the flow of the processes of management of medicines and materials continue effectively. The main collaborators involved in the processes were gathered to identify the main difficulties in each area and to propose an action plan to solve each problem presented. Figure 11 represents the A3 report, from the definition of the project objective to the determination of the monitoring indicators at the end of the implementation of the action plan.


A3 Report

Project name:
Supply chain management of medicines and medical supplies in the units

Team: Financial Director, Operations Director, Logistic Managers, Information Tecnology (IT) Coordinator, Processes Coordinator, Processes Advisor

1. Project objective
Manage the supply chain to reduce the lack of medicines and medical material in the units to 0%.

2. Current situation
1. Pharmacists use excel spreadsheets in parallel to the TrAMed system, which does not meet them
2. Contracts take a long time to complete, as the receipt delays compared to planning (emergency purchases take longer). Ex: Requests for two months of inventory were made in May but were only committed in July and the delivery forecast was at least 30 days.
3. Operations Directors (DOP) makes orders with smaller quantity than necessary.
4. Orders processed in December are often not delivered by suppliers.
5. The last request of the year disregards the closing time of the Treasury
6. Purchase orders are not being planned in advance.
7. Products are not being received within the legal delivery deadline.
8. Delayed insertion of requests in Workflow.
9. When the order is included in Workflow, it is not possible to check the item.
10. Workflow does not work on HMRF, causing the pharmacist to move to other Units to place the order.
11. The stock turnover happens faster than the acquisition process.
12. When the Operations Director requests the order, it is not possible to know what is currently price table.
13. Operations Director does not know the current unit values on each purchase. It is necessary to rely on the purchase of the previous order.
14. The second supplier is not activated when the legal deadlines are extrapolated.
15. Delay in the elaboration of the TR for requests outside the price table, by the Operations Director.
16. Lack of products in the Units.
17. Delay in the finalization of contracts, when necessary.

3. Analysis of problems
1. The system does not make average monthly consumption calculations and inventory coverage correctly.
2. More than 2 months to commit due to fail budget or problems in Workflow.
3. Very long returns from Financial Director in relation to the price table.
4. Operations Director purchases based on the budget value defined by the Financial Director (DAF).
5. The suppliers already know that they will not receive the payment in the current year, due to the cycle processing time in the company. Only after the opening of the Treasury, which usually occurs in the last week of February.
6. There is no room for large stocks and no budget
7. The budget for each purchase is known shortly before the order is placed.
8. The price table being from the city hall, there is often no information that the supplier no longer participates in the price registration and the commitment is made on behalf of that supplier.
9. Late payment due to budget.
10. There is no formal confirmation from the supplier of the receipt of the commitment.
11. The Workflow system needs to be fed item by item.
12. When to consult the stock position in TrAMed, a report is generated with the sigma-codes of the items. When the information goes to Workflow, it sometimes happens that the same item has two sigma codes and the code that is registered in the TrAMed is not the one that has the price table.
13. HMRF is not in the network of the city hall. A tunnel was created that connects the HMRF network to the city hall network.
14. The deadlines agreed with the Financial Director for the issue of commitment after the request is entered in the Workflow does not coincide with the deadlines of the procurement process due to lack of employees for this. The staff is reduced to carry out so many processes.
15. Failure to report items that do not have workflow requests.
16. The price of the item next to the order in Workflow is missing.
17. Lack of communication between the areas.
18. There is not enough employees. The person who makes Terms or Reference has other activities under his responsibility.
19. Lack of pre-order workflow information.
20. Underlining the available budget
21. Inadequate and insufficient transport for exchanges between RioSaúde Units.
22. Inadequate physical storage space.
23. Lack of responsible to accompany the transport of products.
24. Long process of processing. The contracts go through several collaborators until they arrive at the final destination and there are no records during these steps.

4. Future Situation
Supply chain of medicines and medical materials without fail.
Effective internal communication among all sectors involved in the process.
Standardized and automated processes.

5. Action Plan

Action	Responsible
1. Parametrize "stock position report" with "average consumption report" in the system.	IT
2. Hold a meeting at the beginning of the year between DOP and DAF to present a budget provided for the current year.	DOP/DAF
3. Raise the time needed to deliver DAF responses related to commitment.	Processes Coordination
4. Create commitment tracking process.	Processes Coordination/DAF
4.3.& Conduct bimonthly meetings between PDO and DAF to present the current budget and price table.	DOP/DAF
5. Evaluate the possibility of acquiring 30-day security stock in each cycle.	DOP/DAF
6. You have to order a few months before for a longer cycle (approximately 4 months).	Logistic Manager
7. Increase inventory turnover from October to February.	Logistic Manager
7. Improve management of non-RioSaúde price table.	DAF
7. Establish contingency plan for essential items.	DOP
7. Purchaser sends e-mail to supplier with copy to pharmacists, request confirmation of receipt and publish in official journal	Purchaser
8. Establish functional link between the system and Workflow.	IT
9. Automate order processing in Workflow.	IT
9. Parametrize the Workflow so that the product description in the Workflow appears along with the Sigma Code.	IT
10. Request on PLAN.	IT
11. Hire more employees for the activity.	DAF/HR
12. Parametrize Workflow to generate report of deseted items (which has no price table).	TI
13. Parametrize the Workflow to inform current unit values of each item.	TI
14. Elaborate a schedule in the system so that all the collaborator involved in the process identify that the item is extrapolating and can trigger Second Price.	IT/DOP/DAF
15. Hire a person intended solely for the preparation of TR	DOP
15. Establish scheduled delivery	DOP
16. Hire auxiliary to transport the products.	DOP
17. Standardize the of contracts.	Processes Coordination
17. Create digital process to record each stage of contracts	IT/DAF

6. Monitoring
6 – Performance indicators
Percentage of lack of materials and medicines
Percentage of spending on materials and medicines

Figure 11 - A3 Report of Medicines and Materials Supply Chain Management

To start drafting the A3, it was possible to identify that the main challenges are associated to communication between the related areas, computerization and standardization of processes. In the process of commitment, the reflection of these problems is delays in the intermediate stages, generating delay in the final delivery of the requests. In addition, inventory turnover often happens faster than the entire product acquisition process.

Moreover, the fact of Finance Director and Operations Director don’t align the budget and strategic planning in

advance complicates the programming of applications, since the Finance Director announces the amount available for purchase at short notice to the Operations Director. This mainly entails a lack of necessary inputs in the units, since it is necessary to buy less than expected, late payment to suppliers and, consequently, delay in receiving orders.

Another major challenge is the definition of the purchasing and contracting modality. According to information presented by the directors, the ideal is that all purchases and hiring of the company are made through minutes and bidding. However, because there are many cases of emergency needs, these acquisitions are often made by drawing up terms of reference. It turns out that the process of drawing up Terms of Reference takes more time than necessary.

Moreover, the process of contracting the suppliers is long and has many irregularities. Once the processes pass through several employees in the company until, it is necessary to firstly define all the flow that the contracts cover and to standardize it, so that there is no loss of information and registration of each stage.

Through interviews and observations, it was possible to observe that the problems in the medicines and materials management of the units are mainly between the planning and the acquisition of the products. Upon receipt of the products in the respective units, the flow of storage and dispensing flow in an organized and functional manner. Based on the elements found in the literature and in the elaboration of the action plan through the interviews, observations and meeting for the construction of A3, the proposed future situation is available in Figure 12. Figure 13, Figure 14, Figure 15 and Figure 16 represent zoom in future supply chain.

Figure 12 - Future hospitals supply chain VAC

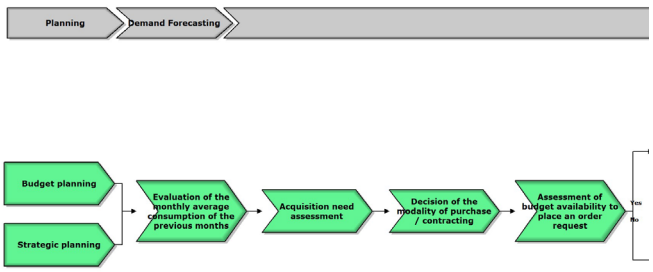


Figure 13 - Zoom 1 of future VAC

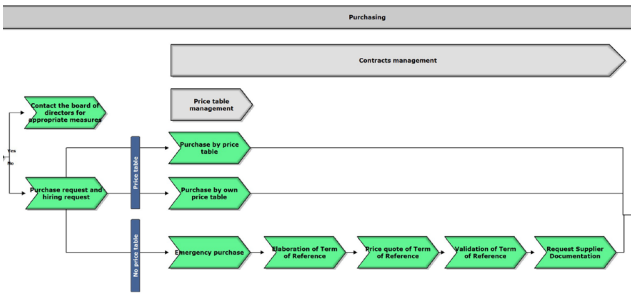


Figure 14 - Zoom 2 of future VAC

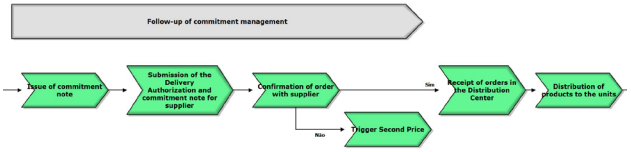


Figure 15 - Zoom 3 of future VAC

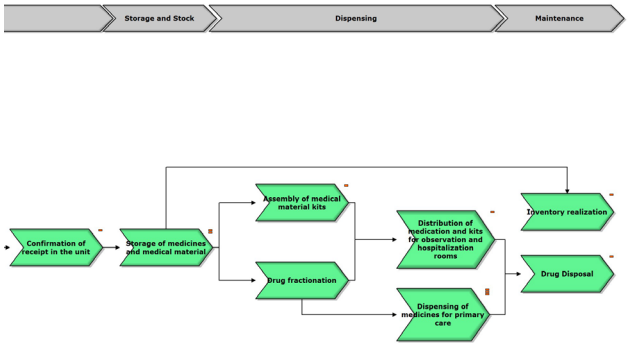


Figure 16 - Zoom 4 of future VAC

According to the action plan, monthly meetings should be held between the Finance and Operations Directors to carry out the planning, both budgetary and strategic concomitantly. In reference to the literature analysis, [2] suggest doing the planning by sharing the data with the supplier from the start so that it reduces the service time and resources needed to determine a replacement for a non-available product. Still observing the literature, [13] recommend that the demand forecast be performed based on the calculation of monthly average consumption and analysis of the ABC curve. These two analytical forms expose more precise ways the quantitative, so it is an alternative to avoid wastage and lack of certain inputs.

The decision of the purchasing and contracting modality must be informed to the applicants before the request is made, so that the request is not made in the name of a supplier who no longer participates in the price registration of the minutes and does not generate rework and late payment to the supplier.

Based on the literature, [16] propose to initially map the suppliers and standardize the processes and the tools used for the acquisition order would contribute significantly to avoid the presented problems.

Having defined the acquisition mode and informed the Logistics Managers, it is necessary to confirm the budget availability for each new request. If the budget doesn't meet the need for a bimonthly application, it is necessary to contact the boards so that all the necessary arrangements are made to the chair so that there is no shortage of inputs in the units.

In the stage of the issuance of the commitment note, when sending the request via e-mail to the supplier, it is important to confirm the receipt of the request, since, from the request that counts the 45 days of delivery of the products in the units. The ideal would be to create an automated process, parameterized with a workflow, to follow the commitment. If the commitment invoice does not go out in the given time, it would be possible to identify in which instance the process had happen failures and for what reason, facilitating the solution of the problems.

At receipt stage, it was observed a lack of medicines and materials due to inadequate transportation or insufficient vehicles to take products to all five units, a lack of responsible collaborator to accompany the locomotion and insufficient physical space to store the products. The suggestion is to unify all the orders in a single space so that they are redistributed according to the demand of each unit. At the dispensation stage, the proposal is to define the schedule of steps for the release of medicines and materials and to align it with the information system used by the care team in a way to standardize the process and to reduce the possibilities of dispensing erroneously to patients.

6. Final Considerations

The research sought to understand and analyse what literature presents about supply chain the management of medicines and materials for healthcare units, as well as propose a project that applies the concepts obtained in a real health unit.

Despite the various approaches found in the literature, the references presented a more biased towards pharmaceutical techniques and medical studies in patient care, when the purpose of the work was to seek fundamentally references on management and process logistics elements. Besides those limitations, a framework that compiles the literature regarding the management of supply chains in healthcare was carefully constructed, as a starting point for comparisons to the company description in its current management scenario. This framework is an intermediate contribution of this work to future researches.

Regarding the contributions to the real case studied, the analysis of the company description allowed to observe some failures throughout the process. According to [22] this quality levels variability is common in most of the hospitals with the exception of a few highly specialized ones and to achieve excellence, hospitals must strive for zero defects and retain every customer that the company can profitably serve. Zero defects require continuous efforts to improve the quality of the service delivery system.

From the moment that the areas do not communicate to define strategies and to align their common objectives, the logistic processes management presents errors, from delays in the request until the wrong dispensation of medicines to the patients. To reduce communication noises and to align the processes of each area, the method adopted in the paper is a direction for the organization to understand the role of each collaborator in the activities, identify the failures, improve the process and standardize procedures to disseminate the information. In addition, it is important to point out that automating the processes would significantly contribute to reduce information loss, delay in deadlines and misuse of resources, both human and financial. Finally, it was also suggested to include, in parallel to the management of medicines and materials, the management of minutes, contracts and commitment in the company, considering that these are the most critical items observed in the management studied.

As indications for future research, we suggest observing a greater number of healthcare units to obtain more information about the topic, with an even more significant sample for defining the elements of the appropriate model for this supply chain management. A second step of future work is to apply the propositions and evaluate the practical results, especially those relating to acquisition costs and order lead-times.

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