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RASTREABILIDADE DE MATERIAIS EM UM HOSPITAL DA REDE FEDERAL NO BRASIL[1]

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RESUMO

No Brasil todos os cidadãos têm livre acesso à saúde pública. Atualmente, o número de pessoas que utilizam este serviço apresentou um crescimento extraordinário devido à crise econômica ocorrida no país, que culminou na incapacidade dos mesmos em manter o seguro saúde. No Rio de Janeiro existe uma preocupação constante com a qualidade dos serviços oferecidos à população. Desta forma, foi elaborado um estudo de caso em um hospital federal, localizado no Rio de Janeiro, com o objetivo de apresentar os problemas enfrentados pelo hospital relacionados à rastreabilidade e gestão de materiais em depósito. Acredita-se que qualquer economia resultante das melhorias na gestão de armazéns deve proporcionar um ganho aos serviços oferecidos à população. Dessa maneira, o objetivo desse estudo é propor melhorias ao processo de rastreabilidade dos materiais dentro do almoxarifado de um hospital público através do estudo dos processos de compra e armazenagem. Como resultado, foi elaborado uma proposta a ser implementada pelo hospital, contendo ajustes em suas rotinas, a

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fim de mitigar os problemas enfrentados por eles que impactam na redução de custos e na melhoria dos serviços.

PALAVRAS-CHAVE: Rastreabilidade; Administração de Materiais; Hospital Público.

THE TRACEABILITY OF MATERIALS IN A BRAZILIAN PUBLIC HOSPITAL

ABSTRACT

In Brazil all citizens have free access to public health. Currently the number of people using public health services presented an extraordinary growth due to Brazilian economic crisis, which resulted from the incapacity to maintain private health insurance. Considering Rio de Janeiro, there is a constant concern regarding the quality of the services offered to the population. In this way, a case study was elaborated in a federal hospital, located at Rio de Janeiro, with the purpose to present the problems faced by the hospital concerning the traceability and management of warehouse materials. Any economy resulting from the improvements of warehouse management should provide a gain to the services offered to the population. In this sense, the objective of this study is to propose improvements to the process of material traceability inside the public hospital warehouse through the study of the purchase and storage processes. As a result, a proposal has been drawn up to be implemented by the hospital, containing adjustments in their routines, to mitigate problems faced by them that impacts the reduction of costs and improvement of the services.

KEYWORDS: Traceability; Materials Management; Public Hospital.

1. INTRODUCTION

Public health is a very important issue in Brazil. All Brazilians have free access to public health service, but due to the economic crisis, especially affecting Rio de Janeiro, public hospitals are struggling to meet the population demands. There are six federal hospitals in the state: Federal Hospital of Andaraí, Bonsucesso, Servidores do Estado, Ipanema, Lagoa and Cardoso Fontes (NERJ, 2016). In the vision of Barbiere and Machline (2009), the economy resulting from the improvements of warehouse management should provide a gain to the services offered to the population. Nerj (2016) affirms that expenses with consumables items in those hospitals are estimated at 66 million USD per year. According to the Brazilian agency EBC (2016), Rio de Janeiro state government spends a considerable amount of financial resources to incinerate out of date materials. In 2016 the value was estimated in 935,500 USD, as informed by EBC agency.

The given situation shows how expressive are the expenses with consumables in hospitals, and that the management of warehouse facilities require further studies. As mentioned by Campos (2008) traceability must be a management tool and not as an obligation. In addition, this study can be justified by the need of observing the current situation materials traceability, from the purchasing process through the warehouse, until the delivery to the medical clinics. One of the most important challenges of public health institutions is to provide a quality service (MARTINS, 2016). The struggle of maintaining the supply available is often due to the difficulty in the efficient management of hospital warehouse, so the materials are not traceable. Considering this scenario the objective of this study is to propose improvements for the process materials traceability in the warehouse of a federal hospital located at Rio de Janeiro state.

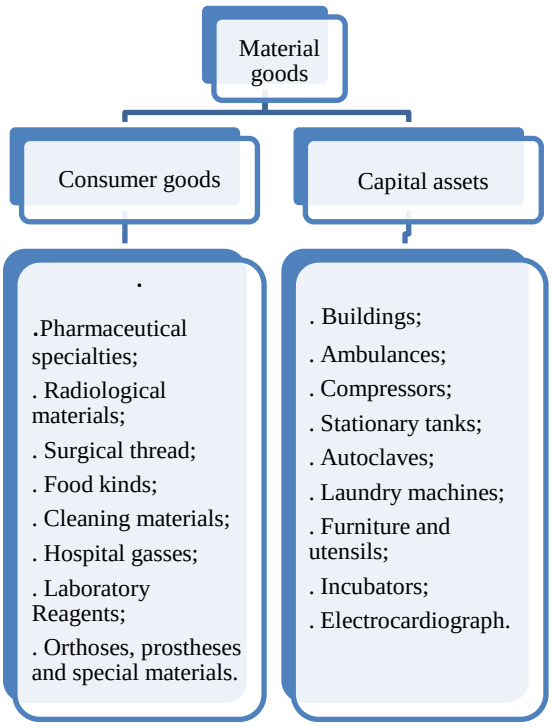
2. LITERATURE REVIEW

2.1 Materials Management

According to Barbieri and Machline (2006) any organization uses materials in its activities, regardless of the nature of its business. The authors conclude that in hospitals, materials play a very important role, so their management becomes essential. Additionally, materials management can be understood as the work done by people to deliver the right material to the right user at the right time and in the right quantities. Viera and Souza (2016) highlighted the importance of effective warehouse management in the current world economic scenario, highlighting the relevance of the supply area in the organizations. According to the authors significant results can be achieved through good management. Reis *et al*. (2017) affirm that internal logistic and warehouses management can propose a reduction of cost and an increase of efficiency. For Rosa *et al*. (2014) consumer goods have short lifetime, i.e., they are consumed as soon as they are acquired or are consumed in less than two years from the acquisition. Assets have more durability and a longer lifetime. Figure 1 shows the difference between consumer

goods and assets in a hospital.

Figure 1: Material goods: classification and examples



Source: Adapted from Barbieri and Machline (2006)

2.1.1 Traceability and Information and Communication Technology

The implementation of Information and Communication Technologies (ICT) can be understood as a way to make the exchange of information more agile and reliable through the digitization and communication in networks (Internet) for the capture, transmission and distribution of information. (CORREIA; SANTOS, 2013). Lovis (2008) argues that traceability is known in several industry segments for decades. The author claims that traceability in logistics refers to the ability to track goods along the supply chain, from suppliers to distributors. In this context, two technologies allow the monitoring and traceability of materials in various segments, the Radio Frequency Identification (RFID), barcode and UDI.

Radio Frequency Identification - RFID is a system for data acquisition based on item labeling. The tag contains signal transmitters that emit messages that can be read by RFID readers themselves. In general, RFID tags store identification numbers such as product or customer number, which allows the transfer of data remotely (TODOROVIC *et al*., 2014). Among the technologies used to improve materials management, Radio Frequency Identification (RFID) has been widely studied as a way to track materials in a wide range of segments.

Considering the advantages established by the RFID technology on bar codes, Andrade Filho and Oliveira (2014) elaborate a comparative table in which they present 10 indicators that compare the two technologies, elaborated together with hospitals – Table 1. Since 6 of the 10 indicators still do not present a concrete response and require more studies, only four indicators are presented in this paper that clearly show the difference between both systems.

Table 1: Comparative indicators between RFID and Bar code

Indicators	RFID	Barcode
1- Allows data exchanging	Yes	No
2- Simultaneous identification	Several at one time	Only one
3- Accuracy	Without professional intervention	Depends on the professional
4- Distance to read	No need to contact	Line of sight

Source: Adapted from Andrade Filho and Oliveira (2014)

From the analysis of the indicators established by Andrade Filho and Oliveira (2014), can be noticed that radiofrequency identification technology is more comprehensive and apparently could be considered better. However, several authors affirm that the cost to implement RFID infrastructure is high. According to Ginters and Martin-Gutierrez (2013) the infrastructure to implement a RFID system, requires the basic components: 1) label; 2) scanner (reader); 3) antennas and 4) software and control equipment.

Bar code technology is widely used along all the supply. This tool can be applied in several segments as shown for example in the study made by Tase *et al*. (2013), where the use of bar code identification wristbands is applied in hospital patients, with the aim of identifying them with at least two qualifying elements. Silva and Albuquerque (2005) affirm that the implementation of a bar code system brings benefits associated with the rationalization of tasks besides reducing the cost of warehouse maintenance. The authors also affirm that the process of warehouse management becomes easier and more reliable with the use of technologies such as barcode. According to Barbosa *et al*. (2010) the management of a hospital is a complex activity. In the same hospital there are services of diverse segments such as hotel services, laboratory, restaurant, laundry and clearly health-related services. This complexity represents a growth in the requirements for the supply sector, especially related to the flow of materials. The resolution - RDC No. 50, from the National Sanitary Agency Anvisa (ANVISA, 2002) - Table 2 – shows the logistics activities in the units of the Brazilian health system.

Table 2: Logistic support activities in health described by Anvisa

Logistical support activities	
1	To support laundry services;
2	To receive, store and distribute materials and equipment;
3	To guarantee technical conditions for the development, printing and storage of "plates" and films;
4	To ensure technical conditions of storage, conservation, wake and removal of corpses;
5	To ensure cleanliness and hygiene of the building, facilities, external areas, materials, instruments, assistance equipment, providing comfort and cleanliness to patients, donors, employees and public;
6	To perform the maintenance of the establishment;
7	To ensure the supply of water, energy, steam generation, water generation and cold air;
8	To perform the maintenance of the establishment;
9	To provide vehicle storage conditions;
10	To manage waste, ensuring the distribution or collection of effluents, solid and radioactive waste;

Source: Adapted from Oliveira (2014)

Ferreira (2005) and Brandalise *et al*. (2009) highlight the need of healthcare institutions to treat logistics sector with a strategic look and not only as a cost center that does not add value to their services.

For Elshennawy (2015) lean is a business philosophy focused on reducing lead times through the elimination of losses and the concentration of efforts on processes that add value. Neuenfeldt Junior *et al*. (2015) complement that the lean manufacturing philosophy is based on the analysis of routines, seeking to identify processes that do not add value to the customer and to eliminate them, maintaining only processes for which customers are willing to pay. When implemented successfully, lean philosophy allows learning the organizational culture focusing on the continuous improvement in all aspects of the organization. Lean not only helps in the reduction of costs, but also improves quality and stimulates the growth of the organization. For this reason it has become a key of business strategy for many companies (ELSHENNAWY, 2015). Timmons *et al*. (2014) state that lean is based on 5 main cores. The first is the maximization of the value perceived by the customer that is more important than the value placed by the supplier. The second concerns the identification of the stages of the process that add value to the customer and the stages that do not add value, being considered wasteful. The third mentions the need for a continuous flow through the process, made possible by the standardization of the stages of the process. The fourth suggests the introduction of a pull system where continuous flows are not possible (this involves focusing on customer demand rather than on production for stocking). The fifth and final core seeks "perfection" so that non-value-added activities are removed from the productive process,

so that continuous improvement remains embedded in the organization (ELSHENNAWY, 2015).

Due to the strong social impact of health-related activities, Rodrigues *et al*. (2016) highlight the growing demand for the improvement of operational performance in this sector. The authors continue to exemplify, through data provided by the Institute of Applied Economic Research (IPEA) in 2006, that the average waiting time for an inpatient stay is around 4.5 days, extolling an opportunity for adaptation and adoption of (like lean) to this sector. For Spear (2005) and Dannapfel *et al*. (2014) the central ideas of "lean thinking" as a focus on the patient, continuous improvement, quality in health services and employee empowerment are aligned with existing values in health organizations. Another example of the application of lean philosophy in health is the study developed by Drotz and Poksinska (2014) in a health service center. The authors explain that lean was considered as a way of improving the work environment. Since the beginning the implementation was focused in the construction of a culture for the empowerment of the employees that would lead the improvement of the work. The authors affirm that in the case cited and in other cases the health organizations have introduced processes and routines that engaged employees in the process of continuous improvement and problems solving. The concepts and cases presented reinforce how the implementation of a lean philosophy can bring positive results for an organization as long as it proposes to incorporate lean as part of its organizational culture and includes its employees in the activities and processes of decision making.

In addition the US FDA (Food and Drug Administration) has established a regulation aiming to identify and track medical devices. Drodza (2018) affirms the institution recognized the need of improving the tracking of medical devices. The system will provide a source for identification of medical devices through distribution and use, and will improve the identification of devices involved in adverse events leading to more rapid resolution of problems (IMDRF, 2013). For Drozda (2016) the benefits of the system include preventing procedure delays, lowering costs, and increasing revenue.

UDI (Unique Device Identifier) is a series of numeric and alphanumeric characters that are create through a coding system, that allows identifying a product without ambiguity (GROSS, 2012). The adoption of UDI will facilitate the traceability of medical devices, especially for field safety corrective actions; adequate identification of medical devices through distribution and use; identification of medical devices in adverse events; reduction of medical errors; and, documenting and longitudinal capture of data on medical devices (GROSS, 2012).

3. METHODOLOGY

The present study can be considered a case study. It has as purpose to observe, describe, analyze and outline proposals for the improvement of services considering the problems related to the traceability of materials in a warehouse of a federal hospital located at Rio de Janeiro state. It has two branches: the theoretical and the empirical basis.

For the theoretical basis, articles and dissertations were searched from the following keywords: materials management, lean, lean healthcare, hospital logistics, material traceability, information and communication technology, information technology, traceability, RFID, bar code, among others terms. Much of the articles used in this study have been researched on platforms such as Science Direct and Emerald Insight in addition to browsing some physical and online books.

For empirical basis data were collected by observation, interviews and meetings with employees of the studied hospital. For Vergara (1998) the observation can be simple or participant. For this work, the technique of simple observation was used, which is defined by Vergara (1998) as the observation in which the subject that collects the data is a no interactive spectator. Despite this definition for the data collection through observation, the authors of this study use questions directed to certain employees in order to obtain more precise information.

For the present study, semi-structured interviews were used. The interviews aimed to give some freedom to conduct the interview in order to collect the best amount of information. Also, in order to better conduct the interview with the staff of the warehouse, a table was drawn up to relate the specific objectives of this work to the questionings made to the hospital member. This table aims to limit the comprehensiveness of the questions. It allows the elaboration of questions that effectively contribute to the goals of the study. The data analysis step is defined by Prodanov and Freitas (2013) as the phase that is developed from the evidences observed according to the baseline obtained by the theoretical reference, the methodology used and the positioning of the researcher. As previously reported, the present study had its source of data collected in meetings with hospital members, visits with on-site observation, as well as interviews with staff in the warehouse. Thus, qualitative analyzes were performed based on the data collected in the target organization.

4. CASE STUDY

The Federal Hospital focus of the study is located at Rio de Janeiro state and has a staff of around 2,700 members. Of this total, there are senior level employees such as administrators, nurses, statisticians, psychologists, physicians, among others; medium level: administrative agent, typist, technicians (nursing, laboratory, accounting, among others); and basic level employees such as janitorial agents, loading and unloading aids, and other positions.

The hospital also has an emergency department, which is responsible for emergency room visits. According to internal information, the emergency sector has around 120 employees, of whom 51% are tied to the Ministry of Health, 48% are temporary contractors and 1% is tied to the Municipality and Foundation. In terms of infrastructure, the Federal Hospital currently has 377 beds installed, of which 47% are for Surgical Specialties, 24% for Clinical Specialties, 9% are for Intensive Care Units and the remaining 20% are destined for several other (obstetrics, pediatrics and emergency).

The main focus of this paper is the study on the hospital warehouse with emphasis on Orthotics, Prosthetics and Special Materials (OPSM). OPSMs are the basic materials for performing orthopedic surgeries, which further reinforces the importance of this study. According to statistics provided by the hospital, it received an average of 6,936 patients per day in 2015, performing on average 395 surgeries per month. These data only reinforce the big structure and importance of the hospital in Rio de Janeiro state, which increases the potential and relevance of the present study.

4.1 Survey of Data and Observed Problems

4.1.1 Warehouse Sector

The warehouse sector in the federal hospital has a total area estimated at 686 m². The warehouse struggles with a serious problem of storage space for materials received and despite this problem, the total space still must be shared with administrative offices. In this way, it is noted that around 547 m² are used for the storage and stock of materials and approximately 74 m² correspond to administrative offices. The rest of the area of the place corresponds to corridors, bathrooms, and others.

The warehouse does not have a very well delimited division for the storage of materials. Due to the space constraint, what decides where the material will be stored is the available space and the volume of the material to be received. The materials stored in the warehouse are classified in basic materials and specific materials (SM). Basic materials are those of routine use, as diapers, gauze, gloves among others, while specific materials require greater caution. Specific materials are more expensive and more restricted such as surgical threads and surgical materials. In addition, OPSM materials are included in the specific materials group due to the cost and very specific uses in surgeries. The area destined to SM has about 98 m² where they are divided into two groups, one destined to the most current materials, and the other functioning as a stock of ME's inside the warehouse. There are shelves in the room to store specific materials, in this sense, the objective is to create a standard to identify them. However due to the space constraints, materials are not always located in the same place. For this reason, although the shelves are labeled with the name of the material stocked, the location of the ME's depends almost exclusively on the knowledge and expertise of the employees working in the warehouse, which is a difficult task for someone who is not used to the daily routine of the sector.

Regarding the operation of the warehouse, it works in a 24 - hour work schedule. However, the sector is facing improvements in its services. That said, the current regime of warehouse operations takes place from 7:00 a.m. to 11:00 p.m., and the nocturnal period is destined to the separation of routine materials that will be delivered to the clinics. Thirty - five employees are allocated in the warehouse sector, and these may work in the central warehouse or in the satellite warehouse, depending on their allocation in the period. It is worth noting that the Federal Hospital satellite warehouse is governed by the provisions of Administrative Rule 403/2015, which states: "The satellite

warehouse of the surgical center shall be managed by an employee of the central warehouse of the Hospital Unit, which shall be responsible for the strict control of OPSM and for all other materials stored there ... ", and the employees were able to work both in the central warehouse and in the satellite warehouse.

Considering the management and control of the warehouse, the procedure is mostly done by the system Hospub. The system that register the receipt, movement and control of materials in the warehouse, has been used for at least 10 years. In addition to the information system, a physical sheet is also used in each set of materials stored in the warehouse. This sheet serves as a more rudimentary control used in the day-to-day of the sector, where are registered movements, dates, responsible official, lot, validity, quantity moved and quantity stocked after the move. As you can see, the control card works in a similar way to the system, being more dynamic and accessible to all employees.

However, since 2014 the Ministry of Health implemented a new system to be used by the institutions, called e-SUS. The e-SUS came as an upgrade of Hospub, and would be able to connect the various sectors of the hospital facilitating communication and internal control. The system was delivered to institutions with a delay in the modules, not integrating for example the financial module, which obliged the use old system simultaneously. In this way the hospital needs to use both systems currently, e-SUS is used by the clinics to order materials and Hospub is used by the warehouse for internal control of all information.

The receipt of materials at the hospital is carried out in two stages. The first is called provisional receipt, this is a less complex step, but of great importance in the process of receiving materials. In the provisional receipt a professional counts the materials delivered and verify if they are in accordance with the request made by the hospital. The second stage is called the definitive receipt. In this moment, a more rigorous verification of the received materials occurs. At this stage the materials received pass through a technical view which will ensure that they meet the standards and comply with the technical specifications required by the hospital. The provisional and definitive receipts are made by different professionals and after the technical validation the products enter the catalog.

5. IMPROVEMENT PROPOSALS

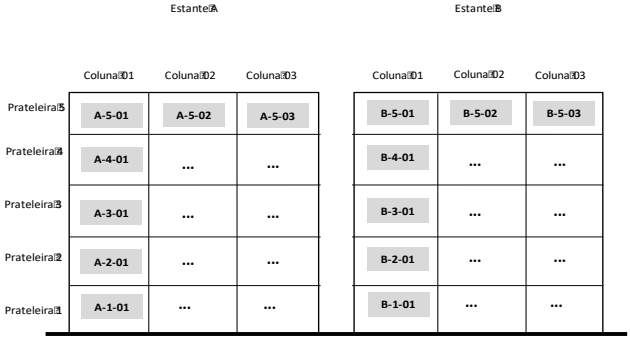
5.1 Fixed Addressing

The warehouse sector of Federal Hospital has a problem of availability of physical space for the allocation of materials. For this reason, the allocation of material in stock is currently giving according to the availability of free, not following standards for storage, which makes the work of identification and separation of materials complex and very time-consuming. Thus, it is proposed the implementation of a system of fixed addressing of materials in the central warehouse of the Federal Hospital. In a fixed addressing system are created identification codes in the places where the materials are stored, where each space must be identified by a string that will produce a code that

represent the position of the item you want to locate. Therefore, the storeroom should be separated by corridors, where each corridor will have several shelves, each shelf with a number of shelves and columns. It would be necessary to identify each rack of the warehouse with an intuitive sequence of characters such as A, B, C, D, and so on. Then, each shelf located on each of the shelves should be classified with the other sequence, also intuitive, as for example 1, 2, 3. Finally, one should identify each of the columns in sequence with characters, so that it is complete the material location code. The column sequence may follow the same patterns as the shelves, where each column would be named according to its position following the logical sequence 01, 02, 03 and so on.

In this way it is possible to create a storage code for all material positions stored in the warehouse, where anyone would be able to locate any material. The code would be formed by joining the identification codes of shelves, shelves and columns providing the location of a certain position. To facilitate the identification of the different divisions, it could also add characters that act as separators (such as "-" dashes), in order to make it easier to understand what each fraction of the code would represent. For example, an arbitrary position in the warehouse would be position A-1-03, this position represents shelf A (which would intuitively be the first shelf located at the entrance to the storeroom), fraction -1- represents shelf 1, depending on the identification criterion may represent the first shelf from bottom to top or vice versa. Finally, partition 03 would represent the third column of shelf A, finalizing the identification code for this particular space. Figure 2 illustrate the process.

Figure 2: Illustration of Fixed Addressing



Source: Elaborated by the author (2016)

It is important to point out that only the creation of codes within the warehouse will not achieve the desired effect if this action is not clearly documented, preferably in an automated system that permits rapid identification of the material. It is necessary that all the materials that enter the warehouse are strictly classified and then allocated in the places previously designated for them, thus obeying their storage point present in the system used. With the implementation of a fixed addressing system in the warehouse, the traceability of the materials would be more simple and effective, since the location of any material present in the warehouse would be widely known, and easily accessible via the system, not depending of the knowledge of employees as it is currently done.

It should be emphasized that this proposal should first be applied in the division of specific materials as a pilot project, since the materials present higher added value and the volume of material stocked is lower. Once successfully applied for specific materials, the fixed addressing system could be replicated to the remainder materials of the central warehouse.

5.2 Barcode Implementation

The warehouse sector has control and is able to track the OPSM materials shipped until certain point. From that point on, the warehouse sector is not able to monitor the materials. This finding is not exclusive to OPSM materials. From meetings with members of the hospital, it was observed that sometimes the materials are not sent directly to the clinics. This is the case of materials sent to the ambulatory sector and also the surgery sector. In these cases the material is sent from the central warehouse to the outpatient department or to the satellite storage room of the surgical center and is then sent to the clinics that need them. It is impossible for the warehouse sector to know precisely where the material is or which clinic is using the material. Due to this difficulty, the warehouse is not able to carry out internal controls and indicators, such as knowing how much of each material each clinic is using, or even identifying where the material was sent, if any type of verification is required more stringent. The current head of the warehouse sector said it would be important for the hospital to know the cost of each clinic, based on the amount of materials used by them. However, due to the above problem this calculation is impossible. In order to solve this problem and to seek a more rigid control of where the materials are, the study propose the use a bar code identification system

Bar code scanner would be implemented in the clinics. Since materials shipped already have codes on their packaging it would be easy to identify them with the reader each time the material passed from one sector to another. The proposal is that each movement of material inside the hospital is recorded by reading the bar code. This allows knowing exactly which clinic is using a certain material. Once the warehouse sector is responsible for the control, issuance and traceability of the stockpiled materials, this sector should remain responsible after the implementation of the bar code identification system. In this way, the warehouse would be responsible for ascertaining if controls are being made rigorously by clinics.

The choice of the bar code technology in detriment of the RFID technology is due to its ease implementation, resulting in significantly reduction of costs when comparing the two technologies.

5.3 Creation of Satellite Warehouses

The interviews with employees at the operational level of the Federal Hospital's warehouse, appointed that the creation of satellite warehouses in all clinics would be important for the day-to-day operation of the sector. It will affect positively the

traceability of materials. The purpose of this study is the elaboration of proposals that can be put into practice. The proposal presented here is the creation of two more satellite warehouses, strategically located within the hospital and near clinics that consume the largest amount of materials, to optimize the distribution of materials to other clinics. In this way, it is proposed that one of the warehouses is allocated in the outpatient sector, where there is a large distribution of the materials to the other emergency sectors. The traceability problem currently present in this sector would be reduced, since the satellite warehouse in the outpatient sector would have greater control and knowledge of the items sent and their destination, which could generate indicators of use and costs. The second satellite should be located near the orthopedic clinic. This clinic consumes a lot of specific materials as well as basic materials.

The satellite warehouses would be of great importance in the process of traceability of materials, but would also act as agents capable of optimizing the distribution of materials internally. Since the central warehouse would be responsible for shipping to the satellite warehouses, they would be responsible for pulverizing the materials internally, increasing control, traceability, distribution and reducing the difficulties of the central warehouse with physical space.

5.4 Demand Control

One of the problems currently faced by public health institutions is the disposal of out of date materials. In 2016 Rio de Janeiro state government spent 935,500 USD for the incineration this materials. It should be noted that this amount refers only to incineration costs, without taking into account the expenses with the acquisition of the material. In addition, it was shown that one of the systems currently used by the warehouse (Hospub) has a report where it is possible to highlight the list of materials that are about to expire. However, some materials in the sector have expired and need to be discarded, resulting in a waste of public money.

The study believe that the implementation of a database, with historical past demands of specific materials would be important to serve as a guide for future purchases. With this measure it would be possible to evaluate the requests of materials made by the clinics, and would allow recording all the demand for the materials throughout the year, creating the basis for further analysis.

Finally, it should be noted that this measure is expected to reduce considerably the obsolescence rate of the Federal Hospital central warehouse, since the quantity of materials purchased and stocked would be much closer to the actual hospital demand. The amount of discarded materials would also decrease, what would reduce expenses with the disposal of materials.

6. FINAL CONSIDERATIONS

The problem of the disposal of out of date materials goes far beyond a simple problem of warehouse management. It is considered a public health problem. The

objective of this study was to propose improvements for the process of traceability of the materials in the warehouse of a federal hospital located at Rio de Janeiro state. Therefore, among the improvements proposed by this study are: the implementation of a system of fixed addressing of materials in the central warehouse facility, the use a bar code as an identification system, the creation of satellite warehouses in all clinics to facilitate day-to-day operations, and the implementation of a database, with historical past demands of specific materials to serve as a guide for future purchases.

The state of Rio de Janeiro is currently facing an economic crisis where a large part of the services offered to the population are suffering from cut of expenses and lack of budget. This scene itself is already a critical point, requiring a great care. However, adding to the current scene of the disposal of out of date materials inside the warehouses, the problem is even bigger, since thousands of patients will no longer receive the necessary materials for their treatments. The government disburses larger amounts for the purchase of new materials in addition to unforeseen expenses with the correct disposal of out of date ones.

A relevant point to be highlighted is that, the implementation of lean philosophy in a health organization could bring several benefits to the internal management of the materials, and to improve quality of services offered to the population. It is true that making the internal management of materials more efficient, would allow the federal hospital to provide more efficient services. These improvements would affect not only the administrative sector of the hospital but all the population that needs it, improving the quality of services perceived by the final client, who in this case would be the patient.

It should be emphasized that this study was limited to the observation of the problems faced by a federal hospital, in order to suggest improvements for its operations. For future studies the expectation is to develop an estimative of operating costs to implement the improvements proposed in this work. In addition, it is also proposed the expansion of this study for warehouses of different public hospitals and eventually to private hospitals at Rio de Janeiro and at others states of Brazil.

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