SYSTEMS & MANAGEMENT
Electronic magazine

INVENTORY MANAGEMENT ANALYSIS AT A HOSPITAL PHARMACY IN MARABÁ-PA: A CASE STUDY

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ABSTRACT

To provide healthcare services, a great diversity of materials and medicines is used, which makes inventory management a challenge for the hospital organization, considering the need to make available large quantities of varied products. The hospital pharmacy is responsible for the management of these items, ensuring safe and rational use, as well as responding to patients' demands. In this way, effective inventory control with reliable data results in a smooth progress of the material operating processes in the institution. This paper aims to classify hospital pharmacy drugs through the XYZ rating, to calculate management indicators (accuracy, safety stock, inventory turnover and re-fulfillment point) for the five drugs that have higher demand. Thus, the current inventory system is analyzed to propose improvements for the management control of pharmacy medicines. The present work is a case study carried out in a hospital pharmacy of the municipal hospital of Marabá-PA. The main data were collected by checking the history of drug withdrawals, conversations with employees involved in the sector and work observation. The methodology followed proved to be adequate, as it generated results compared to the proposed one for the work. It was found that the study was able to achieve its objectives, because the drugs were classified as XYZ, and of the class Z drugs, five of those that obtained the most output were selected so that the indicators were calculated. From the results of the indicators, it was observed that the service provided by the pharmacy, despite functioning, is compromised. Despite the difficulties encountered, such as gaps in historical data, which resulted in the elimination of some medicines, the work concluded its objective and is configured as another source of research for inventory management, this time in a public hospital pharmacy of great importance to the health system and good care of the population.

Keywords: Stock management; Hospital pharmacy; Stock performance indicators; XYZ rating.

PROPPI / LATEC
DOI: 10.20985/1980-5160.2019.v14n4.1573

Electronic Journal of Management & System
Volume 14, Number 4, 2019, pp. 413-423
DOI: 10.20985/1980-5160.2019.v14n4.1573

1. INTRODUCTION

In recent years, government spending on medicines has been increasing, making it a critical component of the government budget. A survey by Brazilian Institute of Geography and Statistics (IBGE – *Instituto Brasileiro de Geografia e Estatística*), published on the institution's news portal, proves the statement, and 9.1% of the country's GDP (Gross Domestic Product) was allocated to health in 2015. "These costs are increasing and are linked to the increase in the average survival of Brazilians, the emergence of new diseases, as well as the complexity of some types of medical treatments" (Silva, 2010, p. 13).

The Unified Health System (SUS - *Sistema* Único *de Saúde*) is one of the largest public health systems in the world and receives good reviews from WHO (World Health Organization) (Sousa, 2011). However, according to Araújo and Pontes (2017) inefficiencies still exist. Dias et al. (2013) expose two key situations that explain such inefficiency: the first is corruption, which is often reported in the most diverse media and afflicts the most diverse levels of public sectors; the second refers to the inefficiency of public management, which, according to the authors, is a "silent disease", and the mismanagement of resources, such as medicines and materials, is one of the symptoms mentioned.

According to Sousa (2011), due to the growing space that hospital management has been gaining, the great complexity of the services provided, and the different materials needed for the service processes, the improvement and efficiency of the logistics management of materials in the hospital sector still has a long way to go.

For Vanvactor (2011), due to the importance of the services provided in a hospital, logistics, when worked in this context, does not admit failures, because according to Sousa's (2011, p. 12) argument, "the product/service offered (life preservation/health recovery) is not subject to change or substitution". Lucena (2011, p. 2) corroborates the statement and suggests that the management of systems of this magnitude "should be focused on both health care and business, optimizing the use of financial resources to provide quality care".

The hospital pharmacy, in addition to stocking, has the duty to ensure the conscious and rational use of medicines and materials, thus ensuring the demand (Lopes *et al.*, 2011). In hospitals, expenditures on materials and medicines represent 15% to 25% of the total, up to 45%, although this may vary from author to author, as explained by Lourenço and Castilho (2007).

Based on these considerations, this article aims to analyze drug inventory management through the application of the XYZ classification and inventory management indicators in a hospital pharmacy of a public hospital located in Marabá-PA and, from the results, propose improvements.

The paper is divided into five main sections: the first is the Introduction, with a contextualization and the purpose of the work; then there is the Theoretical Reference, which addresses topics relevant to the research; followed by the methodology with the classification of the research and the stages of its accomplishment. In the fourth section there is the Case Study, with the analysis and discussion of the results and finally the Conclusion with the verification of the scope of the objectives and the propositions of future work.

2. THEORETICAL REFERENCE

Hospital logistics

In many ways, hospital logistics is more complex than traditional logistics, differing from the second because it deals daily with the preservation and maintenance of human life through health services, as well as with the high variation in the number of procedures (Ribeiro, 2005).

Drucker (1999) states that logistics management in the health sector is more complicated than any other organization and, according to Lourenço and Castilho (2007), this complexity derives from the great diversity of professionals, resources, skills, responsibilities and procedures. However, it is noteworthy that the logistics applied to health follow the same precepts of the traditional when trying to solve problems in relation to costs, waste and sloppiness in planning (Infante; Santos, 2007).

In this context, when observing the hospital pharmacy and understanding its great responsibility for the maintenance of services provided in hospitals, the importance and impact of logistics management is well known. This is because in this sector are and will be stored materials and medicines of great importance for the process of care and patient care, and also because they are essential for spending in a health unit (Vecina Neto; Reinhardt Filho, 1998).

Teodoro (2010) explains that, for the logistics management of hospital pharmacy, the challenges and objectives are to ensure the quality and continuity of care, reduce purchase cost, but without reducing the quality of the items purchased, and perform more effective and optimized control of resources.

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DOI: 10.20985/1980-5160.2019.v14n4.1573

Stock management

For Corrêa and Corrêa (2012), inventories are accumulations of material resources between specific phases of transformation processes, whether physical transformation (manufacturing processes), state (treatment processes, maintenance, and others), or ownership and location (distribution and logistics processes).

Stocks, according to Ballou (2007), are accumulations of raw materials, supplies, components, work in process and finished products that arise in numerous points of the companies' production and logistics channel. The author also states that managing the level of stocks is economically sensible, because the cost of maintaining these stocks can represent 20-40% of their value per year. That is, reducing inventories improves cash flow and return on investments. It is then understood that stocks are any and all items stored (Pontes, 2013).

The health sector needs to worry more than anyone else about managing its stock, because the lack of a drug/material in a hospital can cause the loss of a life (Poulin, 2003). For such management to occur in the right way, managers need to choose the methods and tools to be used according to their objectives.

XYZ rating

According to Pontes (2013), The XYZ classification tool is very effective for inventory management. Lourenço and Castilho (2007), cited by Barbieri and Machline (2006), explain that the XYZ classification uses the degree of criticality/indispensability of the material in the performance of the activities carried out and the total sum of the stock, thus classifying the items (i.e. medicines) into categories X, Y and Z.

In conclusion, the XYZ classification becomes important and more suitable to be applied to the hospital pharmacy, as the tool classifies only the materials, thus excluding equipment, which could, for example, be included in an ABC classification, whose objective is to classify products monetarily (Lourenço; Castilho, 2007; Motta; Camuzi, 2017).

Inventory management indicators

Indicators should be well defined and clear so that there is no error, thus providing a critical and real analysis of the performance of a particular activity or sector (Leite *et al.*, 2017). Within this context, the indicators used in this work are: accuracy, inventory turnover, safety stock, and replacement point. Each of these indicators will be discussed below.

Accuracy

Accuracy brings in its meaning the idea of precision. Stock accuracy can then be defined by measuring (as a percentage) the quantity of materials physically found by the quantity recorded in the information system (Leite *et al.,* 2017 *apud* Sheldon, 2004).

As an indicator of quality and reliability, Nunes et al. (2014) explain that the accuracy relates the information in the control systems, accounting or not, to the physical existence of the controlled items. According to the authors, the lack of or poor relationship among such information can lead the manager to make decisions wrong.

Equation 1 demonstrates the calculation required to verify the accuracy of a single item in stock.

$$\text{Accuracy} = \frac{\text{"No. of items in virtual inventory - No. of shortages"}}{\text{"Number of items in the virtual stock"}}$$

Stock turn

According to Machline (1981), inventory turnover, which has also been called inventory turnover or reach, comprises the most commonly used criterion for judging the efficiency of a purchasing and supply sector. This is the relationship between the cost of goods sold or consumed in a period and the average inventory in the period.

Machline's (1981) Equation 2, adapted for the purpose of the study, relates the amount of items (medications) consumed in a given period and the average stock of the same period.

$$\text{Stock turnover} = \frac{\text{"Qty. consumed in the period"}}{\text{Average inventory in period}}$$

This author expresses that, for organizations, stocks are generally badly regarded, as it is idle capital; however, companies that cultivate this thinking probably do not have good inventory management practices. Freitas (2012), going against this idea, highlights some ways in which inventory turnover can help in management and scenario change.

Safety stock

Ballou (1978) presents safety stocks as a protection against fluctuations in demand, in production or with suppliers. For the author, in an ideal world, demand would be equal to production, although he says that zero stock does not exist.

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According to Reis and Boligon (2014), “the establishment of a minimum safety margin or inventory is the risk that the company is willing to take in relation to the lack of stock”. It is critical that hospital pharmacies maintain some kind of safety stock because their services are essential and their process failures are irreparable.

For Corrêa (2010), the determination of the quantity of safety stock and the level of demand uncertainty must be directly proportional, thus avoiding the lack of materials. In this perspective, Equation 3 presents the calculation for the replacement point system with the economical purchase lot, according to the author.

$$Eseg = FS * \sigma * \sqrt{\frac{LT}{PP}}$$

Where:

Eseg = safety stock

FS = safety factor

σ = standard deviation of past demand

LT = replacement lead team

PP = periodicity of data used in the calculation of the standard deviation

Resupply Point

Balances maintenance costs in case of excess inventory and prevents production from being affected in cases where inventory is low.

According to Vecina Neto and Reinhardt Filho (1998), this model establishes that the replacement level will be a quantity of material needed to meet the supply period, considering the consumption expectation indicated by the moving arithmetic average added to the reserve stock. Whenever the stock level of a particular item reaches this value, the order will be placed.

To calculate this indicator, Equation 4, presented by Vecina Neto and Reinhardt Filho (1998) is used.

$$Q = Eseg + (PA * D)$$

Where:

Q = amount to be purchased;

Eseg = reserve stock;

PA = supply term;

D = average demand (per unit of time).

3. METHODOLOGY

The present work is classified as an applied research, because it aims to generate knowledge for practical application and specific problem solving. It is also classified as explanatory, as it aims to identify how inventory management tools contribute to the inventory management of hospital pharmacies, as well as deepening the knowledge of reality through the analysis of a case.

The research also has quantitative characteristics, as it makes use of statistical methods for collecting, processing and analyzing information, making the conclusion more accurate and reliable to reality (Pronadov; Freitas, 2013). In addition, in relation to the procedures, this research is characterized as a case study, so that the work consists of collecting and analyzing information about a given situation and studying its various aspects, according to the subject matter.

For the present study, the data used in the elaboration of the analyzes and calculations were collected from the control performed at the hospital pharmacy of the public hospital, with the help of pharmacists and technicians. Data correspond to the period from January to September 2018.

In this stage, all data related to medicines were collected, such as: list of standard pharmacy drugs, history of quantities consumed, form of acquisition, control, and dispensation. Data were obtained through on-site visits, conversations with employees, analysis of shelf records used in the pharmacy to control drug stocks, and spreadsheets in MS Excel.

The XYZ classification was performed from the list of these drugs, and all 256 were classified according to their class (X, Y or Z). The class Z drugs underwent a new selection, which analyzed the drugs with higher output, and from this, the choice of the five drugs to be worked on in the case study was made.

Finally, the indicators (accuracy, inventory turnover, safety stock, and replacement point) were calculated for each of the five drugs previously chosen. The next step consisted of performing the critical analysis of the results obtained with the indicators, and finally, the conclusions of the developed analyzes were presented as well as the action plan. None of the last two steps were presented to those responsible for hospital pharmacy management.

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4. CASE STUDY

The institution

The focus institution of the case study is the Marabá Municipal Hospital (HMM - *Hospital Municipal de Marabá*), which is located in the city of Marabá-PA approximately 500 km south of the state capital, Belém. The HMM, also known as Special Public Health Service (SESP - *Serviço Especial de Saúde Pública*), was founded in the 1950s (Almeida, 2008). “In Brazil, hospitals are classified by size according to the number of beds, such as small (1 to 49 beds), medium (50 to 149), large (150 to 499) and special (over 500 beds)” (Mayer, 2010).

The hospital, maintained by the Marabá City Hall, is classified as a medium-sized hospital. It has 91 beds, 41 of which are surgical, 36 are clinical, and 14 are pediatric. It provides outpatient care, hospitalization, Diagnosis and Therapy Support Service (SADT - *Serviço de Apoio à Diagnose e Terapia*), urgency and emergency. It has four operating rooms and one recovery room. It is registered under number 2615797 of National Register of Health Facilities (CNES - *Cadastro Nacional de Estabelecimentos de Saúde*).

It is a general hospital that is able to handle cases of medium complexity. According to Campbell (2017), the institution is the most sought after service to the public of the municipality, because, in addition to providing care to the urban area, it also serves rural areas, towns and neighboring municipalities.

Hospital Pharmacy Sector Description

The Central Pharmacy (CP) of the hospital is responsible for the storage, control and dispensation of medicines and hospital medical supplies for internal hospital care. The standardized drug list has 256 items, and pharmaceutical assistance is open 24 hours a day.

There are two satellite pharmacies located in the operating room and in the emergency room that operate 24 hours a day, and are supplied daily by the CP. There is also a storeroom where the serums and materials used for medical/surgical procedures (gloves, caps, plaster, gases, surgical dressings, bandages, diapers, probes, collectors, 70% alcohol, cotton, catheters, etc.) are stored.

The medication/material inventory management process begins with the purchase of items. The purchase of drugs occurs through a monthly request made in a spreadsheet in MS Excel by the pharmaceutical coordinator, in which the names and characteristics of each drug (dose, presentation), medical material (size), and the required amount of each are entered to meet the demand of the month.

The next step is the submission of the monthly request to the Municipal Health Department (SMS - *Secretaria Municipal de Saúde*) in the Pharmaceutical Supply Center (CAF - *Central de Abastecimento Farmacêutico*) sector. After this process, the lead time for delivery of medicines/materials to CP is four days. In case of increased consumption, an urgent request is made.

XYZ classification construction

The first step was to classify the 256 drugs according to their level of criticality using the XYZ tool. Those classified as X are the least critical, those classified as Y have intermediate criticality, and those classified as Z have a high criticality (Pontes, 2013). For this, the list saved by the pharmacy from 256 standard drugs was printed, and with the help of pharmacists who have the technical knowledge of the drugs, the classification was performed taking into consideration the degree of importance of the items. Then, the quantities of drugs belonging to each class were calculated and a graph representing the percentage of drug classifications in stock was constructed.

The result of the analysis indicated that 43 drugs are classified as Z, 99 are classified as Y, and 114 are classified as X. Items classified as Z have the lowest share in the stock, representing only 17% of the total, Y represents 39%, and X has the largest representation, 44%, as shown in Figure 1.

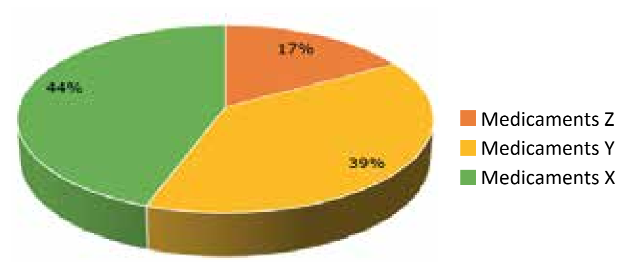

Figure 1. XYZ rating of medicines from the hospital pharmacy.
Source: Authors (2018).

After completing the XYZ classification, drugs belonging to class Z underwent a new selection due to the large volume of items, so that the five items used in this research were chosen, this time taking into consideration the medicines that have the highest number of outlets.

The number of outputs recorded in the shelf cards of each drug belonging to class Z, from January to September 2018, was added. Twenty controlled drugs were excluded from the calculation, since the control of these items is performed differently from the others, as they require recipes to be released. These recipes are recorded in a control book; however, due to the fact that the release of these recipes is

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not made daily, it was out of date during the collection of data for the preparation of this research, without the quantities of outputs from August and September.

Two other medications were also removed from the calculation: Enoxaparin Sodium (60mg), as there is not enough history, since the health department stopped referring it to the hospital pharmacy a few months ago; and Alteplase (50mg), which, despite being classified with high criticality and listed on standard pharmacy drugs, had no history because, according to officials, the municipal health department never sent this medication to the pharmacy due to the use of other medicines that have the same effect.

In total, 22 items were excluded, leaving only 21 for the calculation. With the calculations completed, the data were organized in a spreadsheet, and a graph was made, and it is possible to verify in it the percentage that each medicine output represents of the total outputs of the CP stock, as shown in Figure 2.

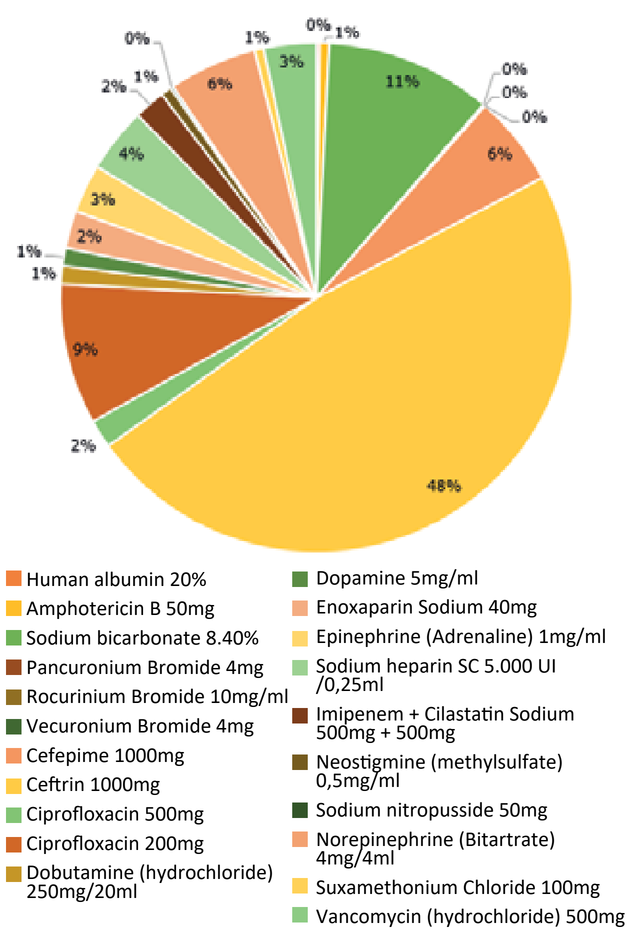

Figure 2. Representativeness of the number of outlets of drugs classified as Z.

Source: Authors (2018).

Medicines with less than 1% representativeness are shown in Figure 1 with 0% due to the number of decimal places adopted.

After these steps, the five drugs with the highest number of output (in units) were chosen. These items were gathered in Table 1.

Table 1. Medicines with higher outflow

MEDICINE	TOTAL OUTPUT	%
Ceftriaxone (1000mg)	20.720	48%
Sodium bicarbonate 8.40%	4.550	11%
Ciprofloxacin (200mg)	3.857	9%
Cefepime (1000mg)	2.490	6%
Norepinephrine (Bitartrate 4mg/4ml)	2.416	6%

Source: Authors (2018).

Analysis of stock management indicators

Accuracy

Accuracy calculations for the drugs used for this research are expressed in Table 2.

Table 2. Accuracy of the most outgoing items

MEDICINES	NUMBER OF ITEMS IN VIRTUAL SYSTEM	SHORTAGES	ACCURACY
Ceftriaxone (1000mg)	950	0	1
Sodium Bicarbonate 8.40%	800	30	0,96
Ciprofloxacin (200mg)	5.500	23	0,99
Cefepime (1000mg)	250	46	0,81
Norepinephrine (Bitartrate) 4mg/4ml	1.300	3	0,99

Source: Authors (2018).

It is shown in Table 2 that, of the items checked, only Ceftriaxone (1000mg) obtained 100% accuracy, a result that expresses that the level of reliability of the information in the system is high. As stated by Souza and Moraes (2016), “the 100% accuracy index represents the ideal, since it means that physical stocks are matching the stocks contained in the movement of inputs and outputs accounted for in the system” (Souza; Moraes, 2016).

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Accuracies of Ciprofloxaxin (200 mg), Norepinephrine (Bitartrate 4mg/4ml) and Sodium Bicarbonate 8.40% were 99%, 99% and 96% reliable, respectively, and showed a divergence below 0.5%, which, according to the authors, also characterizes the results as tolerable.

Cefepime (1000mg), in turn, obtained an accuracy of 81%. Their tolerance percentages were therefore below what was considered tolerable.

Stock turnover

The results obtained indicate a large variance between drug turnovers. Sodium Bicarbonate 8.40% has the highest turnover, which means its use is higher compared to others. The other items also showed positive results, even on a smaller scale, verifying that the stock was renewed at least once during the study period. Such information is expressed in Table 3.

Table 3. Stock turnover of items with more output

MEDICINES	QUANTITY CONSUMED	AVERAGE STOCK OF THE PERIOD	STOCK TURNOVER
Ceftriaxone (1000mg)	20.720	5.487,5	3,77
Sodium Bicarbonate 8.40%	4.550	216,66	21
Ciprofloxacin (200mg)	3.857	2.046	1,88
Cefepime (1000mg)	2.490	502,33	4,95
Norepinephrine (Bitartrate) 4mg/4ml	2.416	892,44	2,70

Source: Authors (2018).

Due to its high turnover, it is concluded that Sodium Bicarbonate 8.40% is the least likely to spoil (win) item. In addition, it does not require a larger storage space and, depending on its purchase value, would not increase the costs in the event of a breakdown.

Safety stock

Safety stocks work as shock absorbers for unexpected variations and with a predefined lead time. Assuming a service safety level of 90%, it is detected that Ceftriaxone (1000 mg) is the medicine that needs the highest safety stock and is also the medicine that presented the highest average consumption during the analyzed data period (Jan/Sep), as can be seen in Table 4.

Standard deviation presents the dispersion in relation to the mean. Thus, it is understood that the greater the demand oscillation, the greater the standard deviation, and consequently the greater the safety stock. Table 4 shows that the five items showed moderate standard deviation, and may conclude that they tend to have stock volume.

Analyzing the default monthly order quantity worksheet, the values found for the safety stock exceed the values requested per month. The standard amount of the monthly application for Ceftriaxone (1000mg), for example, is three thousand units, and the value found for the safety stock is above three thousand units, i.e. if there is an unexpected demand or delay in drug supply, the pharmacy will face shortage of the product.

Resupply Point

It serves to assist replenishment decisions based on the quantity of items in stock after each withdrawal. Upon reaching the predetermined level, the purchase order for new items is issued.

Table 5 shows the values obtained through Equation 4, which relates demand, lead time, and safety stock - already presented in Table 4.

Table 4. Safety stock of items with higher output

MEDICINES	AVERAGE CONSUMPTION	STANDARD DEVIATION	LEAD TIME	SAFETY LEVEL	SAFETY STOCK
Ceftriaxone (1000 mg)	2.302,22	260,26	4	90%	3.024,88
Sodium Bicarbonate 8.40%	505,55	203,78	4	90%	832,21
Ciprofloxacin (200 mg)	428,55	197,88	4	90%	253,59
Cefepime (1000 mg)	276,66	164,94	4	90%	655,87
Norepinephrine (Bitartrate - 4mg/4ml)	268,44	124,28	4	90%	468,85

Source: Authors (2018).

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Table 5. Resupply point of the higher output items

MEDICINES	RESUPPLY POINT
Ceftriaxone (1000mg)	12.233,77
Sodium Bicarbonate 8.40%	2.854,43
Ciprofloxacin (200mg)	1.967,81
Cefepime (1000mg)	1.762,54
Norepinephrine (Bitartrate - 4mg/4ml)	1.542,63

Source: Authors (2018).

Currently, the pharmacy does not work with the replacement point values described in Table 5. It calculates the replacement point by taking into account the predefined number of units to order from the standard drug order list prepared earlier in the year, and also considering the previous month's consumption. Thus, the calculation made allows a value that must be taken into account for the preparation of the standard request list at the beginning of the year.

Failures observed and action plan

During the observation period and data collection to elaborate the research in question, it was noticed that, although the hospital pharmacy inventory management has its parameters, they have flaws. The preparation of the monthly request depends on the technician and the pharmacist and, if the need for replenishment of any item is not noticed, it may be left out of the request. Also, the ordering point of the items is not known. The only system that assists in the identification of the requisition requirement is that of the shelf tokens, which generally differ in the number of items recorded in the inventory control system from the existing physical quantity. This divergence in information results in failures when updating the control system, especially when posting quantities for withdrawn items.

Inaccurate values are sometimes recorded on the tab for the quantity taken from stock due to errors in calculating the quantity taken from the stock value. This type of failure decreases the level of information reliability and, consequently, causes problems for management.

Shipments from CAF for pharmacy replenishment are not properly organized, with some drugs delivered outside their original boxes or in plastic bags. There are also situations where, even when medicines are delivered in boxes, they are mixed with others. In addition, the same drugs are not always in the same box, which makes the storage process difficult, as all boxes/bags will have to be opened for drug separation and counting and be stored only at the end of this process. If the drugs came in an organized manner, the storage process would be facilitated and the time spent on this activity optimized.

Inventories are not regularly performed, as the pharmacy does not have an inventory schedule. If so, this could help with inventory correction. Another flaw observed refers to the write-off of controlled drugs, made exclusively through prescriptions. Because output quantities are posted through the receipts in the control book and this process is not always fulfilled on a daily basis, these receipts accumulate and these output records are not input in the book.

There is no person in the warehouse who is solely responsible for controlling the items stored in their stock, meaning that all pharmacy employees can withdraw materials to supply the CP. For this reason, it is not uncommon for errors in inventories to be found, especially discrepancies between the physical and the system stock, since it is common to remove the item to supply the CP without being written off in the system.

There is also no training for new pharmacy staff. All learning is acquired from experience, which makes the process of adaptation slower. Due to the different types of medicines and medical materials, it is difficult to learn the names and their purposes, which makes it difficult to release the item.

The pharmacy does not have enough space to store large quantities of serums and, due to the large number of morning and afternoon daily departures, boxes with serums are transported to the CP in order to supply it. The boxes are heavy, and this ends up damaging the health of the employee, thus causing some injuries and, consequently, the removal of the employee.

Given the situations observed and hitherto exposed, as a form of intervention and aiming at improving processes within the hospital pharmacy, Table 1 presents the proposals developed through a 5W1H.

The action plan was developed based on the discussions raised through the analysis of the performance indicators, as well as the failures observed during the period in which the data were collected.

Given the complexity of the sector and the hierarchy that the pharmacy must follow, the actions proposed in the action plan were developed based on the real possibility of being applied, as more complex actions would require further study and, consequently, more time to be analyzed and in fact approved and implemented.

5. FINAL CONSIDERATIONS

The main objective of the present study was to perform the XYZ classification and to calculate drug inventory management indicators (replacement point, safety stock, accu-

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racy and stock turnover) in a public hospital pharmacy, and propose improvements from the results.

Through the organization and XYZ rating, the items were classified following a criticality order, in which the medicines classified as Z were considered the most critical, the class Y items were of medium criticality, and the class X items presented low criticality. From this, the class Z items underwent a new selection that this time took into account the amount of drug output. With this in hand, five drugs were selected, and from that, the indicators were calculated for each one.

With the safety stock indicator results, it was noted that the pharmacy works to the limit of what should only be its safety stock, leading to the conclusion that if there is any variation, even small, the pharmacy will not be able to meet the entire demand.

The present work fulfilled its objectives and answered the problem question, because, from the results presented in the XYZ rating, it was possible to categorize the drugs according to their criticality. This leads management to take action on its medicines and the indicators have shown results that are important to management, because from them, it is possible to establish the safety stock and the point of replenishment, verify through accuracy the confidence level amid the information, as well as calculate inventory turnover showing the item with the highest turnover.

Chart 1. Action Plan: Hospital Pharmacy

WHAT?	WHO?	WHERE?	WHEN?	WHY?	HOW?
Verify the possibility of hiring a production engineer.	Board of the hospital together with the city hall.	At the city Hall.	DEC 01, 2018.	To provide appropriate training to employees regarding the proper use of inventory management tools.	By requesting a contract.
Keep track of items from the pharmacy, as well as those from the storeroom.	One drug delivery technician, another storeroom technician, and one pharmacist to control the delivery of prescription drugs.	In the pharmacy and the storeroom.	DEC 01, 2018.	To ensure that all medication outflows are performed on time, thus ensuring greater confidence in the information regarding the quantity of drugs in stock and in the system. This would make it easier to place orders with CAF.	Through the organization of information in spreadsheets in MS Excel.
Verify the viability of the pharmacy, expand its stock and work according to the values presented in Tables 5 and 6.	Pharmaceutical coordinator and board of the hospital.	In the pharmacy.	APR 01, 2019.	So that, in cases of unexpected variation, the pharmacy can meet the demand.	Check the cost--benefit issues that involve purchasing more drugs.
Conducting scheduled inventories.	The technicians and pharmacists.	In the pharmacy.	Every two months, starting on JAN 02, 2019.	To increase the reliability level of information regarding quantities of inventory items recorded in the system.	Count of items in stock.
Implementation of a computerized system for inventory control.	I.T.	In the pharmacy.	FEB 02, 2019.	To reduce the error in item issue records, thereby improving inventory control.	Check the economic viability of the action.
Standardize the process of receiving and checking materials and medicines.	Pharmaceutical Coordinator.	At the hospital.	JAN 01, 2019.	To reduce medication / medical separation time and organization time, facilitate conferencing and reduce clutter due to the large amount of items received.	Those responsible for receiving and checking the items received must follow the pre-established protocol, which can be done through tokens.
Train employees to work according to protocols.	HR.	At the hospital.	JAN 02, 2019.	To decrease the rate of errors caused by employees.	Providing correct training for employees.

Source: Authors (2018).

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DOI: 10.20985/1980-5160.2019.v14n4.1573

Finally, the work done at the hospital pharmacy made clear the importance of inventory management in the pharmaceutical area. Knowledge about inventory management is of great importance to avoid unnecessary expenses, lack of products, and losses due to lack of demand. Thus, the implementation of new suggestions for hospital pharmacy inventory management contributes to the improvement of the service provided to the community. For future work the alternatives described below are proposed.

Apply the indicators to other class Z medicines and in the future work all the stock, thus improving the pharmacy stock management;

Carry out the ABC classification for pharmacy medicines and relate the two classifications (ABC and XYZ), so that decisions about hospital pharmacy drug management are better developed;

Study an ergonomic layout for the pharmacy, because during work hours technicians do a lot of repeating movements, having to climb stairs or lower to get medication/material on the shelves. If these are put in an ergonomically correct manner, they will help preventing these employees from developing illness over time due to the service performed;

Conduct a study on the feasibility of implementing a system in the hospital that interconnects all sectors. This improves the exchange of information, making it more organic, and optimizes the time of operations as technology is used to assist and facilitate service.

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Received: Sept 02, 2019

Approved: Nov 18, 2019

DOI: 10.20985/1980-5160.2019.v14n4.1573

How to cite: Pereira, R. M.; Felix, B. S.; Monteiro, N. J. et al. (2019), "Inventory management analysis at a hospital pharmacy in Marabá-PA: a case study", Sistemas & Gestão, Vol. 14, No. 4, pp. 413-423, available from: http://www.revistasg.uff.br/index.php/sg/article/view/1573 (access day month year).