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WORK ANALYSIS OF DRUG-DISPENSING PROCESS IN A HOSPITAL EMERGENCY PHARMACY

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ABSTRACT

The work organization performs a crucial role in activities that involves problem resolution and decision making. A hospital emergency pharmacy consists in an example where the work environment has several kinds of demands that might be inconsistent and influenced by overcrowding – common situation in Brazilian hospitals – causing harm to work organization and suitability of workload. The objective of this study is to evaluate labor conditions of professionals that work in the emergency pharmacy of a university public hospital, seeking improvement opportunities. A transversal study was developed with a descriptive character to analyze the work conditions. An ergonomic work analysis was conducted and, for fulfillment of its steps, observations in loco were performed and methods Deparis, RULA and ABC analysis were used, pursuing to analyze data collected and rearranging the work situation. The findings allowed propositions of improvement, related mainly to the process of drug dispensation, organization and arrangement of the work environment.



The ABC analysis presented itself as a valuable method for improving drug organization in the pharmacy and might be useful in other work situations where accessibility of items is necessary, but many items must be positioned.

Keywords: Deparis; RULA; Ergonomic Work Analysis; ABC analysis; pharmacy.

1. INTRODUCTION

In the process of work evolution concepts, parameters, goals, objectives and ways of seeing and perform activities were changed. The work was reshaped to new configurations of reality and society, adapting itself to the tasks and its demands (ABRAHÃO; TORRES, 2004).

When the nature of the activity comprehends problem resolution and decision making, the case of a pharmacy in a hospital emergency, work organization (WO) has an important role, contributing to task execution and process improvement. Through WO it is established the norms and parameters that determine all kinds of labor procedures: who, what, how, when and with what will perform activities, as well as, how long, until when, how much and with what degree of quality.

The hospital pharmacy has an important position in assistance context of the Brazilian health system being responsible for activities related with medications and instruments, which have a higher impact in the quality and cost of hospital care. That importance becomes more evident when the pharmacy is inserted in a context of emergency, where higher demands, that usually surpass its capacity, might result in disorganization of pharmacy activities, generating a negative impact in mental and physical health of workers (COELHO et al., 2010).

The activities that comprise the emergency pharmacy are composed by all the ones presented in the regular pharmacy care, contemplating: drugs selection; demand prevision, acquisition and proper storage of drugs; manipulation or development of drugs that are not available in the market; distribution and dispensation with security; supervision of drugs use, guidance to patients and health staff (OSÓRIO-DE-CASTRO; CASTILHOS, 2004).

Errors that might take place in drugs administration in the hospital pharmacies are strongly influenced by work place conditions. Factors related to these errors includes inadequate space, poor lightening, high temperatures, inappropriate storage



of drugs, high workload and the speed demanded for drug dispensation (ANACLETO et al., 2005; KEERS, 2013). Messeder et al. (2007) estimated that the higher level of interdependence between activities in hospital environment, results in higher influence among activities. In this way, if an activity in the emergency is not properly conducted the emergency pharmacy will suffer negative influence.

Anacleto et al. (2007) pointed out that drug dispensation is a sensitive process, where it is fundamental to have organization, security and effectiveness, thus, appropriate conditions of WO are essential. To guarantee these conditions during the task performance, evaluations must be made to verify proper execution, avoiding problems in the workers' health (ONUKA et al., 2011).

In this way, it is important to monitoring and executing periodical evaluations of processes that comprises activities conducted in a hospital emergency pharmacy, allowing the investigation of necessary developments on service quality, something crucial for improving financial aspects, resilience and well-being of the ones involved (SAURIN et al., 2015). One way of describing the work environment and promoting continuous improvement is through the use of Ergonomic Work Analysis (EWA).

According to Guérin et al. (2001), EWA questions the methods typically used to define how work is conducted; in many cases, variations and specific characteristics of workers end up being neglected. In this way, a better form of attending this diversity and variability is pursued, resulting in improved working conditions. Errors and accidents that might occur are now seen as product of situations that must be transformed and not as product of mistakes committed by workers.

Although, when work conditions in Brazilian hospitals are analyzed, especially in the emergency service, a contradiction is faced, once it can be perceived inadequate work conditions inside institutions that have as their main goal health care. The present study in an emergency pharmacy is justified by the fact that a hospital is concerned with the health of its patients and community, but many times neglects the health of its workers, who are daily exposed to inadequate work conditions, resulting in possible impairment of health even inside a hospital.

The objective of this study is to evaluate work conditions of professionals that work in the emergency pharmacy of a university public hospital and identify



improvement opportunities to the establishment of a more efficient and comfortable work place.

2. BIBLIOGRAPHIC REVIEW

According to Guérin et al (2001), the ergonomic action searches for improving the reality of performed work, looking for solutions to inadequate work regarding singularities of each person, comprising relations between constraints of work situations, activities develop and consequence of these activities to all actors involved. Poor fitting of work occurs mainly due to projects of production systems, processes, work organization and tasks, based on predefined stereotypes. Another aspect that must be emphasized is that when work is being structured, usually the pressures of financial, technical and organizational aspects prevail, instead of ergonomic aspects.

Hence, the essence of the ergonomic action is the capacity to using knowledge and methods, adapting to every situation found in work routine, understanding work to transform it (GUÉRIN et al., 2001). It is not only about applying methods, execute measures, doing observations or conducting interviews, it is necessary to take into consideration the whole context. To achieve this goal in the process of work transformation, it is vital participation of different actors involved and analyzing their points of view. One important characteristic is that ergonomists always seeks for an intervention, not being satisfied only by production of knowledge about work conditions (DANIELLOU; BÉGUIN, 2007; GUÉRIN et al., 2001).

To conduct an ergonomic intervention in work there are several methods that can be used, although the researcher must have conscience of the potential and objective of the method that will be used (STANTON; YOUNG, 2003). Ergonomic Work Analysis receives higher attention for being a method of task analysis that allows comprehension of relations between work conditions and workers' health, helping to improve the organization of sociotechnical systems, resulting in a better performance of the company as a whole (GUÉRIN et al., 2001; PIZO; MENEGON, 2010).



2.1. Ergonomic Work Analysis

The EWA has the characteristic of analyzing a real activity in a certain moment under specific conditions (COCKELL; PERTICARRARI, 2008). The methodology proposed by Guérin et al. (2001) divides the EWA in five steps (Figure 1) – Analysis of demand and context, Exploration of company functions and characteristics, Analysis of technical process and tasks and Global and local diagnosis of transformation process. These steps are not essentially followed in a linear manner, allowing the analyst to retake some of the steps in order to comprehend fully problem causes (COCKELL; PERTICARRARI, 2008).

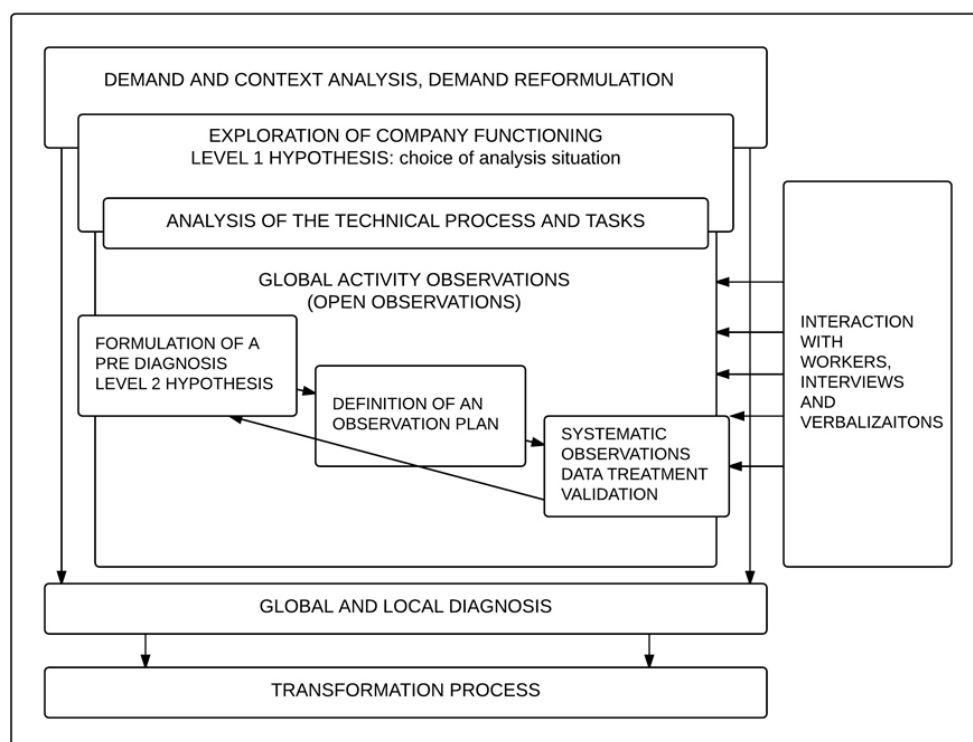


Figure 1: EWA steps
 Source: Guérin et al., 2001.

The first step of the EWA, Analysis of demand and context, seeks to comprehend the origin of the analysis necessity. Demands are formulated in the origin of work conception, which will alter the workers activity, or can come from the constant evolution of work analysis (GUÉRIN et al., 2001).

The second step of the EWA, Exploration of company functions and characteristics, elaborates the first hypothesis directing the choice of situations to be

analyzed. The dimensions to be evaluated are: economic and commercial; social and demographic; laws and regulations; geographic environment; technical; production and its organization (GUÉRIN et al., 2001).

The analysis of technical process and tasks, allows the comprehension of the observed, increasing possibility of action in the process of technical transformation as well as its credibility. The pre-diagnosis is a result of hypothesis formulation based on registers collected in previous steps, followed by formulation of an observation plan (movements, look's direction, communications, postures, flux of communication and materials, among others).

The local diagnosis is the product of the analyses that summarizes observations, measures and interviews results. The global diagnosis is based in the precise information of the local diagnosis, presenting a broader vision of problems that were identified in the steps related to demand analysis and company function (GUÉRIN et al., 2001). At last, the process of transformation occurs by introducing modifications in work situations (GUÉRIN et al., 2001).

3. METHOD

The study was conducted in an emergency pharmacy of a large university hospital. This transversal study had a descriptive character, consisting on observations and data collection performed in the period from November 2014 to February 2015. Target population was pharmacy workers consists in pharmaceuticals and pharmacy technicians. An EWA starts with the demand analysis and knowing better how the system being studied operates.

For analyzing the work environment and conduct the preliminary diagnostic, the method *Deparis* (MALCHAIRE, 2002) was used for investigating the current working conditions in the pharmacy. This method composes the Screening step of SOBANE (Screening, Observation, Analysis, Expertise) strategy from the same author. It was chosen because it approaches in an objective way a larger number of risks that can exist in the work environment, being orientated to questioning how workers felt, allowing main issues that need to be resolved to become exposed.

Visits were conducted to analyze physical work space. They aimed to identify work stations, furniture disposition and space available. Also, pictures were taken of



technicians conducting their normal working routine, so that work postures could be analyzed latter, as well as physical space restriction and infrastructure.

Procedures conducted in the pharmacy were also observed and characterized, allowing identification of main ergonomic problems related to procedures and workstations. This analysis permitted the identification of which items from Deparis method should be a priority for improvement actions.

After the application of Deparis, it became clear that workers were exposed to risks related to workstations layout and the fact that work was repetitive. In this way, an analysis of workers' risks to acquire injuries in upper limbs was conducted with the Rapid Upper Limb Assessment (RULA) method (MCATAMNEY; CORLETT, 1993), this consisted in the step Analysis of technical process and tasks of the EWA.

RULA was developed to ergonomic investigation in workstations where there is the possibility of developing musculoskeletal diseases in upper limbs. RULA is based in a diagram of body postures and three tables that evaluate exposure level to risk factors, where main constructs are: number of movements, static posture, strength, work posture imposed by equipment and furniture and pause time. The methodology is executed in three stages: (i) identification of work postures; (ii) score system application; and (iii) application of risk level scales.

In this way, pictures taken of workers in their normal routine on workstations were analyzed through the RULA protocol, thereby generating a final risk score of developing injuries in the upper limbs. The photographic observation respected all ethic issues. The sector manager authorization was acquired and the workers signed a Term of Consent, presenting the objectives of the study and ensuring secrecy and confidentiality of data.

The RULA analysis indicated that postural problems were emerging due to localization of medications in the pharmacy. To identify medications that have a higher demand and need to be dispensed often, an ABC analysis was conducted. The ABC analysis is commonly employed in materials classification and is based in the Pareto's principles, considering the importance of materials, quantity used and their demands.



4. RESULTS

4.1. Work characterization

The hospital emergency service is characterized by constant overcrowding. There are occasions that capacity is surpassed two or three times. This scenario results in overloading to all workers associated with the emergency, including the emergency pharmacy, subject of this study.

The main function of the pharmacy is dispensing medication prescribed by doctors; this task might be accomplished by two distinct fluxes. One flux is through a document denominated Internal Communication (IC), which is taken by the nursing technician (NT) responsible for the patient to the pharmacy. After receiving the IC, the pharmacy technician (PT) searches for the medication in the stock and delivers to the NT.

The second dispensation flux of medications involves patients hospitalized in emergency. In these cases, the doctor evaluates the patient condition and defines treatment for the next 24 hours, doing prescription through the system. This prescription is called "next day prescription" and will be valid from 8 PM of current day to 8 PM of next day. The pharmacy receives the prescription that is evaluated by the clinical pharmacist, for verifying if medications do not present any risk to the patient, observing, for example, occurrence of drug interaction.

When the prescription is approved by the pharmacist, the medication is dispensed by the PT. Dispensation comprises searching for medication in the pharmacy stock, reading the bar code through the system, packing medication and delivering to the NT.

Dispensation demand is influenced by the time of physicians prescription, in this way, an agreement was made that physicians must do next day prescription until 4 PM, allowing time for the medication arrive to the patient until 8 PM. This agreement generates a demand peak, because prescriptions are usually done all at the same time and must be dispensed in the interval between 4 and 8 PM.



4.2. Preliminary diagnosis

As a result of observations and talks with the PT it was possible to define main risks that were perceived by them. To guide this process, criteria presented in Deparis method were used. Each criteria can be classified as satisfactory (☺), intermediate (☹) and unsatisfying (☹). Attention must be held on items that were classified as intermediate or unsatisfying; in the latter case immediate changes must be made. Table 1 presents the classification established for each criterion, according to the work developed by PT.

Table 1: Preliminary diagnosis.

Criteria evaluated by Deparis			
1. Work zones	☺	☹	☹
2. Technical organization between work stations	☺	☹	☹
3. Places of work	☺	☹	☹
4. Risk of accidents	☺	☹	☹
5. Commands and signals	☺	☹	☹
6. Work tools and materials	☺	☹	☹
7. The repetitive work	☺	☹	☹
8. Handlings/weightlift	☺	☹	☹
9. Mental load	☺	☹	☹
10. Illumination	☺	☹	☹
11. Noise	☺	☹	☹
12. Temperatures	☺	☹	☹
13. Biological and chemical risks	☺	☹	☹
14. Vibrations	☺	☹	☹
15. Working relationships	☺	☹	☹
16. Social environment	☺	☹	☹
17. Work content	☺	☹	☹
18. Psycho social environment	☺	☹	☹

Source: authors.

Items classified as intermediate are related to proper illumination, medication organization, communication between staff, monotonous work and psychosocial environment. It appears to be necessary evaluate medication displacement according to its frequency of use, seeking to make them more accessible. Besides that, improvements in visual communication and time management would be positive for workers, taking into account different shifts and times that need to be fulfilled. Regarding content of work, it can be characterized as monotonous, but it is not considered as something critical.

Items that were evaluated as unsatisfying are related to work zones, work place, repetitive work and biological and chemical risks. The work stations are not in



best displacement, they are small and several boxes are clogging the space. The pharmacy has no windows and there is no visual contact with other colleges, besides that, the great number of black boxes around make the place darker, increasing the poor illumination problem. It was also perceived that it is necessary to reach for objects in different heights, demanding from workers constant trunk twisting and arms lifting. The objects manipulated usually are not heavy, but continuous repetition may cause pain and musculoskeletal discomforts.

An evident risk that can be observed is due to the pharmacy location, contiguous to the emergency. There is no proper air circulation, making the workers exposed to biological risks. The only window present faces to the corridor where patient's stretchers pass.

Pharmacy's layout is presented in the Figure 2, where PT's workstations are in the two chairs on upper left corner. The other two workstations are where pharmacists stay. There are almost no free walls, being all occupied with cabinets.

In each PT's workstation (Figure 2) there are one computer for receiving the prescriptions to be dispensed, one barcode reader, one printer and one chair with adjustable height. Each workstation has its medication stock, located in a shelf above the computer and between workstations. Yet, these stocks are not replicated, when compared with each other. The workstation one has 125 boxes of stock and the workstation two has 133 boxes, each box has one type of medication.

A stock of medication that is less used also exists in this area (74 boxes), it is located in the left side of workstation one. In this space is also located the refrigerator, that contains medications that need refrigeration. In the section where pharmaceuticals work, the main stock of the emergency pharmacy is placed, the PT picks up these medications for supplying workstations stocks.

Criteria evaluated as unsatisfactory are related to quality of the workstations and postural issues, becoming clear that a more in-depth analysis was necessary, seeking to support improvement propositions. To execute this analysis the RULA method was applied. The RULA analysis allowed a quantitative classification of postural problems that was diagnosed by Deparis. In this way, problem existence was confirmed and critical aspects of workstations identified.



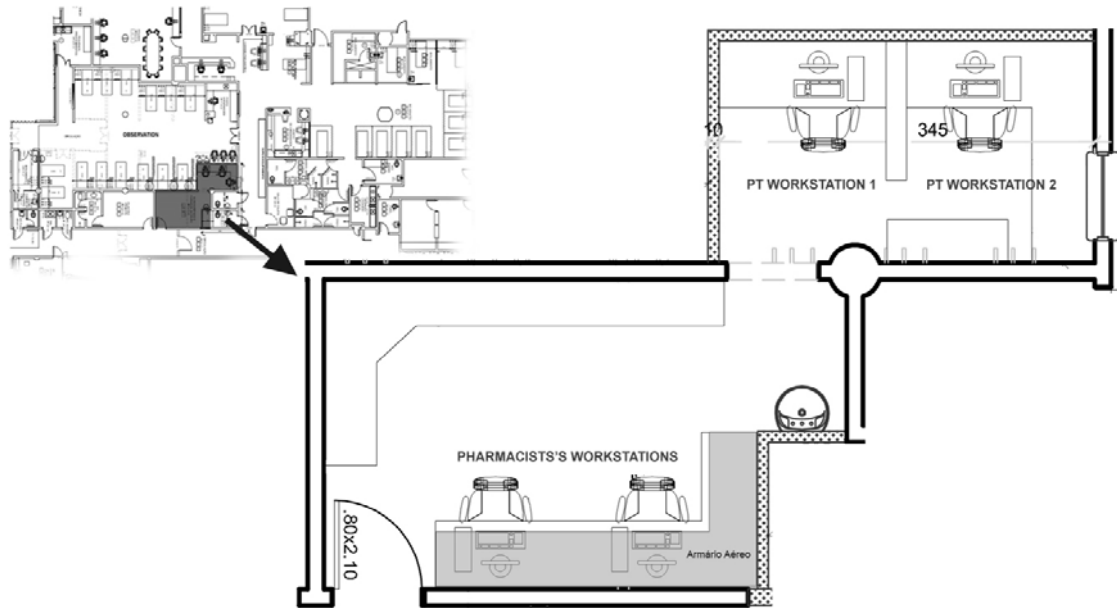


Figure 2: Pharmacy layout.

4.3. Workers posture analysis

The postures analyzed with RULA, were the ones that workers do with more frequency. Frequent postures done in the two workstations and in the stock area were observed. Figure 3 presents images utilized in the analysis and the results are in Table 2.

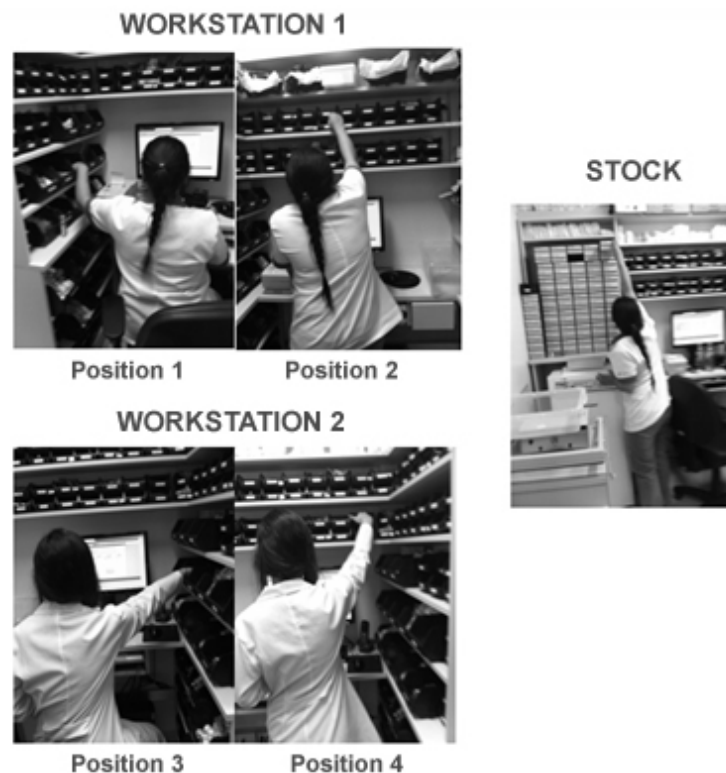


Figure 3: Work postures analyzed.

Table 2: RULA analysis results.

RULA	Workstation 1				Workstation 2				Stock	
	Position 1		Position 2		Position 3		Position 4			
	Value	Adjust	Value	Adjust	Value	Adjust	Value	Adjust	Value	Adjust
Arm	3	1	4	1	3	1	3	1	3	1
Forearm	2	1	2	1	2	1	2	1	2	1
Fist	3		3		3		3		2	
Neck	2	0	4		1		1	0	4	0
Torso	2	1	1		1	1	1	1	1	2
Twisted fist	1		1		1		1		1	
Legs	1		1		1		1		1	
Muscular use of arms	0		1		0		0		0	
Load A	0				0		0		0	
Muscular use of torso	1				1		1		1	
Load B	0				0		0		0	
Final Score	6		7		4		4		6	

Source: Authors.

According to RULA, a score equal or superior to 5 demands immediately change. Looking to the results and images, it is possible to perceive simple changes that can be done, so that workers will have a better posture. It is hoped that these changes will lower the score to 4, which does not characterize an ideal situation, but makes it more favorable. These measures can be taken in a short span of time and are of lower cost.

First, the need to altering the monitor height is perceived, so the head will be upright when looking the monitor, being on this way aligned with the torso, generating a better analysis result. The barcode reader is used constantly during the task execution, presenting itself as one of the main work instruments; however its position is not adequate.

It is necessary that it be centralized in the table, in front of the computer screen, closest as possible of the worker. This would reduce torso twist for reading barcodes. It was also realized that many times the worker leans to the front for reaching the barcode reader, this way in none of the analyzed positions he is sitting with his torso leaning against the back of the chair. It is expected that changing the barcode reader position will also improve the torso position, generating a better score.



Several medications are placed in higher places, which makes that some postures present high scores. It is not possible to place all medications in the most suitable height, due to space limit constraints, whereas it is viable to identify medications that are dispensed with more frequency and place them in most comfortable heights. Use of boxes with smaller dimensions is also possible, resulting in more places available in appropriated heights. Another solution that might reduce the need of fist twist is use sloping shelves, facilitating the grip of drugs.

The workstations 1 and 2 have similar dimensions, but the results of the workstation 2 are more adequate then the workstation 1, due to the height of the PT that works in this workstation. This emphasized the need of changes so that the configuration is proper for everyone.

4.4. Improvement proposals

To reduce the frequency of arm lifting movements, or even the necessity to reach for objects in inappropriate heights, drugs must be placed in a way that the ones used more often are in more accessible positions. To discover drugs that are dispensed more frequently, data of mensal consumption was analyzed.

Figure 4 presents consumption distribution of each drug for the month of October 2013, seeking to exemplify the analysis that was conducted. Using the ABC analysis, it was possible to verify that 404 typologies of drugs were consumed, whereas 80% of the consumption is concentrated in 77 types of drugs. On this way, it is practicable to rethink drugs placement, so that the ones used with more frequency are placed in easy access positions.

The number of drug units dispensed that are in the 80% interval is 135 units for the month of October 2013. Seeking to guarantee an interval of confidence, medications with consumption superior to 100 mensal units were considered in the analysis. After that, it was observed which drugs were part of this group in the months of September 2013 to September 2014. When the typologies of drugs were compared it was possible to identify that they were the same over the months, with few exceptions, generating a total of 86 drugs that represent around 80% of the total pharmacy consumption.



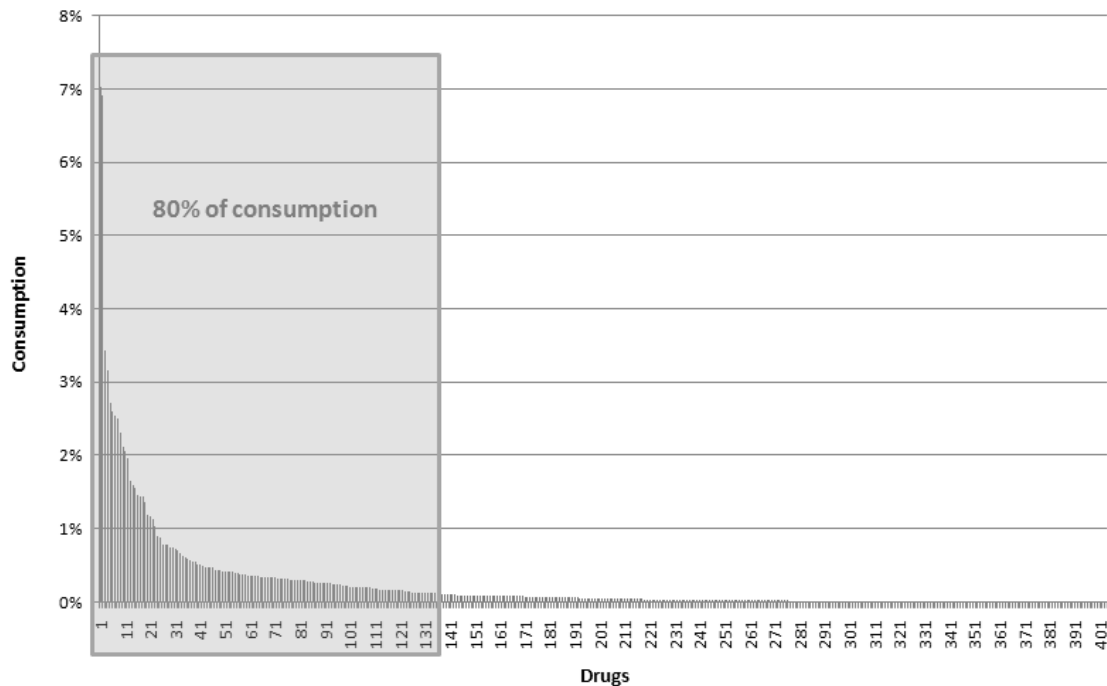


Figure 4: Distribution of drugs consumption (October 2013).

For drugs that were in the 80% group it was calculated the average consumption in the period, subsequently they were classified in descendent order of consumption. The places more suitable for the PT are located in the shelf between the workstations. Figure 5 presents the position that the drugs should have. The grey scale represents the easiness of access, where darker tones represent better places.

Other modifications recommended are related to air circulation, positioning of work instruments and comfort increase. Avoiding direct air exchange between the pharmacy and the area where patients stays is important. Thus, placing a glass structure in windows might be useful for the insulation and biological protection of workers. It is also suitable think in an analysis of the pharmacy air quality, being possible to confirm the existence of biological risks.

Simple modification as repositioning the monitor to eyes height, placement of the barcode reader in front of the monitor, closest as possible of the PT, and placing the printer in opposite side of the drugs shelf, are changes that might generate improvement in workers posture and efficiency. Lastly, replacing the black boxes for transparent ones will make the atmosphere cleaner, improving the visual management, and corroborating for a better control on need of drug supply.

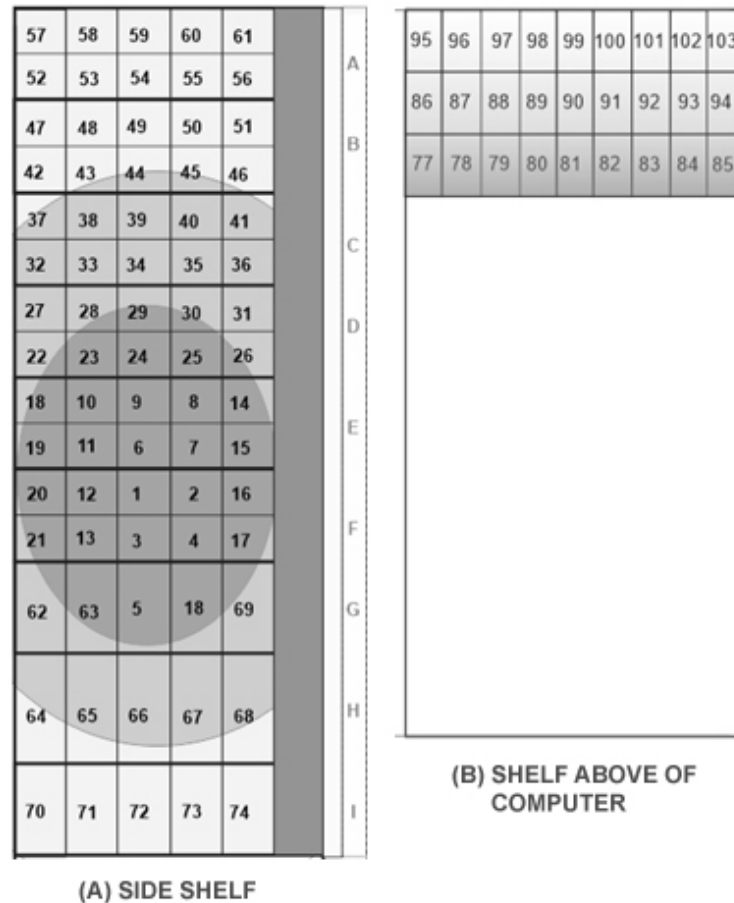


Figure 5. Workstation shelves and best drug displacement.

5. CONCLUSIONS

The pharmacy analyzed in this study is inserted in the environment of a hospital emergency, where demands are from different natures and do not have constancy. Overcrowding is recurrent and results in a workload that most of times is not suitable and do not have a regular distribution.

Observations conducted in the pharmacy work environment resulted in realization that workers share a limited space with problems of organization and layout. Besides, workers are exposed to biological risks, executing monotonous and repetitive tasks that require high attention. These aspects are limiting and damaging the work execution, once work environment can have high influence in results that will be reached.

The findings allowed improvement propositions related in great deal with organization and disposition of the work place. It is important that these measures be implemented in order to support an adequate work environment, more comfortable

and that increases collaborators' efficiency. Also, the measures suggested in this study are in its majority of low or no cost, which will not result in a considerable financial impact for the institution, since, in many occasions, the financial aspect might be seen as an obstacle for pursuing improvement actions.

After implementation of suggested changes, it is advisable that new observation be performed, as the ones executed in this study. New analyses with the methods Deparis and RULA are fundamental to verify if improvement proposals were effective regarding the workers comfort and better work organization, acting as well as an opportunity to identify new improvement measures. Whereas, it is important to observe the period demanded for adaptation to new routines and layout changes. Execution of trainings to adequate workers actions to the new scenario is also necessary.

Regarding the instruments used in this study, it is important to emphasize the use of ABC analysis. The ABC analysis presented itself as a valuable method for improving organization of drugs in the pharmacy and might be useful in other situations where accessibility of items is necessary, but many items must be positioned. In this way, as a suggestion for further studies, the use of the ABC analysis is recommended to organize stocks and improve ergonomic work conditions.

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