

ASSESSMENT OF OCCUPATIONAL EXPOSURES TO ANTINEOPLASTIC DRUGS IN A HOSPITAL OF HIGH COMPLEXITY

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Abstract

The hospital sector has been considered one of the most susceptible to occupational exposures, because it has patient' groups with various infectious diseases and carry out many procedures with risk of accidents and diseases for healthcare professionals. Among the factors that most affect health workers can stand out chemical components such as antineoplastic agents that expose the trader to different forms of contamination. This study features a case study in a university hospital with a high complexity oncology sector to assess the occupational risk levels involved in the activities carried out. We emphasize that in any of the activities analyzed the risk can be considered negligible. Regarding consequences and the probability associated to the occurrence of the risk, it was observed that half the activity is associated with risks routine and a considerable number of these high risk is therefore allowing classifies them as non-tolerable risks. In conclusion, we note that the methodology used for risk assessment in hospitals, is being a useful tool and an important source of information for managers to promote the implementation of improvements in hospital processes in order to to minimize the risks that each healthcare worker is exposed.

Keywords: Hospital, antineoplastic drugs, occupational exposure, risk assessment

1. INTRODUCTION

In activities within productive processes, there is always the possibility of occurrence of events that can expose workers to situations that compromise their safety (Rocha *et al.*, 2015). Labor accidents are caused by unsafe acts and/or unsafe conditions. In the first case, there is normally person's behavior or activity that deviates from normally accepted safe procedure. The second case involves a hazard or an unsafe mechanical or physical environment. Thus, accidents are related to actions considered reckless or lack of action to eliminate unsafe conditions, so it is essential that actions to mitigate such exposure be shared not only by companies but also by governments and society (Shin *et al.*, 2014).

Recent biomedical, technological, and normative changes have led healthcare organizations to an increasingly complex environment. However, Occupational Safety procedures do not always follow the evolution of new technologies. Another important factor is the presence of patients with various

infectious diseases as well as hazardous materials necessary for the implementation of hospital activities. This scenario makes the hospital one of the most complex environments in relation to exposure to occupational hazards. (Cagliano *et al.*, 2011).

Among risks that can affect the health and integrity of health professionals and that potentialize the possibility of industrial accidents and occupational diseases, of critical importance are the physical, chemical, biological, psychological and ergonomic ones. Chemical risks are associated with agents that are able to penetrate the body through ingestion, by the respiratory route through dust, mists, gases and vapors or by skin contact (Martins *et al.*, 2012).

Among chemicals used in the hospital environment, we highlight the antineoplastic drugs (AD) used in cancer treatment. The use of these substances has increased considerably due to the increased incidence of cancer in the population. The first associations between adverse health effects of occupational exposure to AD were made almost forty years ago. The handling practices of these

drugs have advanced in recent years, increasing the safety of the professionals involved, but the growing use of these substances must be accompanied by a more critical look at the impact related to the occupational health of workers involved throughout all stages related to antineoplastic therapy (Hon *et al.*, 2014).

Assessment of healthcare workers exposure to antineoplastic drugs is still a challenging issue since new, critical, and emerging factors can expose pharmacists who prepare hazardous drugs or nurses who administer anti-cancer agents to an increased risk of developing adverse health effects (Sottani *et al.*, 2012). Studies over the past two years have mainly focused: monitoring and exposure (Capron *et al.*, 2012, Lalande *et al.*, 2012, Wakui *et al.*, 2013, Kopp *et al.*, 2013, Bobin- Dubigeon *et al.*, 2013, Zhang *et al.*, 2013) and analysis of the consequences of exposure (El-Ebiary *et al.*, 2013, Moretti *et al.*, 2014, Ladeira *et al.*, 2014, Connor *et al.*, 2014).

The present study aims to identify and evaluate occupational exposure to antineoplastic drugs in a university hospital of high complexity, located in Rio de Janeiro, Brazil.

2. OCCUPATIONAL RISKS ASSOCIATED WITH HANDLING OF CHEMOTHERAPY

Many cytotoxic drugs have shown to be mutagenic, teratogenic and carcinogenic with second malignancies known to be associated with several specific cancer drugs. Occupational exposure to cytotoxic drugs presents significant danger to healthcare staff, and unwarranted handling of these drugs should be avoided (Meade, 2014).

In a literature review study, Connor *et al.* (2014) state that, although the magnitude of health effects has varied according to the sample size and population, occupational exposure appears to increase the risk of adverse reproductive effects such as congenital malformations and abortions, both in patients and in professionals subjected to a long-term exposure. (Silva, 2011).

A wide variety of studies have warned on contamination by residues of these drugs on work surfaces, walls, floors, treated patients beddings and containers that collected secretions or excretions at all stages of anticancer therapy, both in the preparation of medication by pharmacists or administration by nursing professionals (Suspiro *et al.*, 2012).

Sottani (2011) examined eight hospital pharmacies, where there is the preparation of antineoplastic drugs and nine specific areas where these medications are administered to patients. In 54% of the samples traces of

at least one antineoplastic drug were detected. The author showed that comparatively pharmacies are more exposed to these agents than the areas allocated to patients.

Viegas *et al.* (2014) analyzed the furniture surfaces of pharmacies and administration sectors of two Portuguese Hospital Units. Of the total of Three hundred twenty-seven analyzed samples, in One hundred twenty-one (37%) it was possible to detect and quantify at least one antineoplastic drug. In addition, Twenty-eight samples (8.6%) indicated contamination by more than a drug, particularly in the management unit in both hospitals.

The increased use of these drugs as the main form of cancer treatment has provoked the need for development of safer handling practices among health professionals. Menonna-Quinn (2014) points out that although there is greater availability of security tools, there is still a lack of awareness of health professionals in relation to occupational hazards associated with improper handling of chemotherapeutic agents.

Among the factors that can contribute to greater exposure of health professionals, we can highlight the handling of these products along the supply chain without the use of appropriate personal protective equipment. This fact, combined with the development of new chemotherapy drugs, makes it possible to provide that the occupational risks associated with these drugs tend to increase considerably (Kopjar, 2009).

Taking into consideration that risk factors related to antineoplastic drugs at a hospital environment are present in several stages (Figure 3), they are not just limited only to health professionals but also involve the patients themselves and cleaning professionals responsible for management of residues of these drugs. Castiglia (2008) suggest mechanisms to reduce such exposure, for example, training and monitoring of the biochemical and professionals involved and the development of techniques for detection of these drugs at workplace.

Current security and occupational health programs, due to a limited view prevailing in most companies, have poorly performed, mainly due to the emphasis to risk situations that may violate the law and could generate penalties (Frick, 2011).

In hospitals, the management of workers safety is still at an early stage, since the means of exposure can occur by workers interaction with chemical agents in rooms with poor ventilation and inadequate spaces and can be exacerbated by problems with equipment, long journeys and shortages of collective protection measures (Costa, 2005).

2.1. MANAGEMENT OF OCCUPATIONAL EXPOSURES

Risk can be defined as a condition or set of conditions that have the potential to cause an adverse effect. This adverse effect can be related to deaths, injury, illness or damage to health, property or the environment. Risk is associated with the possibility of an adverse event, the uncertainty of occurrence, the distribution in time and magnitude (Neves, 2007).

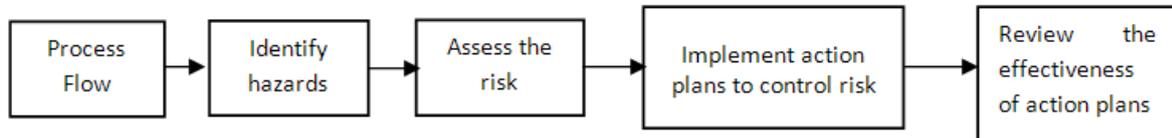
The early identification of occupational hazards can work as a preventive attitude to disease and accidents at workplace, allowing for the reduction of accidents. Knowledge of such risks by health professionals themselves is important as they can act as internal agents of the

institution for the prevention and promotion of occupational health (Leitao, 2008).

Several agencies suggest risk assessment should be performed at the beginning of the activity and whenever there are changes in procedures, equipment or use of toxic substances. In this type of evaluation are analyzed the conditions that can compromise the security of systems and the risk to which workers are exposed, the magnitude of exposure and individual sensitivity of the workers involved in the process (Canastro, 2011).

Seiffert (2010) developed a diagram depicting the various risk assessment phases (Figure 1).

Figure 1: Risk assessment phases.



Source: Adapted from Seiffert (2010).

Some of the tools that can collaborate in the occupational risk management process are the rules focused on management of occupational health and safety that aim to evaluate the process of implementation of health and safety systems in organizations. OHSAS 18001, which is based on BS 8800, aims to ensure that a company can develop and maintain a safe workplace and protect workers from accidents and illnesses. By anticipation, recognition, evaluation and subsequent control of existing occupational hazards that may exist, companies under this regulation can establish pre-selection criteria for risks and most adequate controls measures to their reality (Lo *et al.* 2014).

The OHSAS 18001 standard is applicable to any organization that has as objectives the following guidelines: establish a health and safety system at work in order to minimize employee exposure to risks; implement, maintain and continuously improve the system security management and health; and conduct a self-assessment of compliance (Battaglia *et al.*, 2015).

Among internal factors that motivate the implementation of OHSAS 18001 we can highlight the reduction of material losses and disruption in production processes. Furthermore, the introduction of a safety framework that promotes the prevention and control of occupational hazards and reduce the number of accidents also allows reduction of costs related to accidents (Abad *et al.*, 2013).

2.3 Studies on occupational risks at hospitals

We conducted a literature review in SCOPUS database using the term "occupational exposure to antineoplastic

drugs" in order to identify studies related to occupational risks of antineoplastic drugs. We obtained Sixty-one publications, among which Fifty-five were articles, distributed over time as in Figure 2.

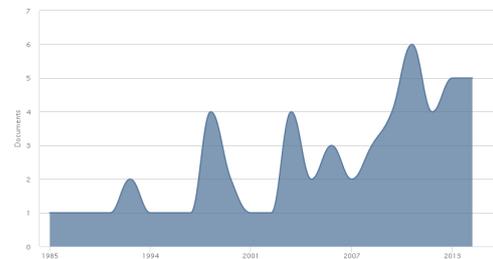


Figure 2 – Articles by year

Source: SCOPUS

Inhalation and skin or mucosa adsorption are considered to be the main potential routes of exposure. The inhalation of powders and aerosols may occur when opening vials of the product. Contact with skin or mucosae can occur accidentally at any stage in the handling of these substances (transport, preparation, administration, and disposal) (Moretti *et al.*, 2014).

Studies of occupational exposures carried out in hospital units have shown detectable levels of cytotoxic agents in the air, on surfaces and on different body sites (Moretti *et al.*, 2014). The first reported association between occupational exposure and increased urine mutagenicity was in 1979 (Falck *et al.* 1979).

Recently published works showed that occupational exposure to antineoplastic drugs (ANDP) is still frequent in hospital facilities, regardless of significant safety policy

improvements (Moretti *et al.*, 2014). These authors concluded that their results provide further evidence that handling ANPD, even if under safety controlled conditions, represents a considerable genotoxic risk to healthy individuals occupationally exposed to these chemicals.

Connor *et al.*(2014) presents an increase of the risk of both congenital malformations and miscarriage in ANPD. These authors assert that health care workers with long-term, low-level occupational exposure to these drugs also seem to have an increased risk of adverse reproductive aftermath. Additional precaution to prevent exposure should be considered.

Sottani *et al.*(2012) detected antineoplastic drugs in all related work environments at Italian hospitals. Pharmacies were generally more contaminated than patient areas with the exception of one site where a nurse had an acute exposure during the cleaning-up of a hazardous drug solution spillage.

3. METODOLOGY

In this research we chose to conduct a case study at an antineoplastic therapy unit of a hospital of high complexity. The question that drove the development of the case study was: how activities regarding chemotherapy management

on internal hospital activities could lead to occupational risks to health professionals?

The chosen facility for this study was the high complexity in oncology unit of a university hospital, which is considered one of the largest in the State of Rio de Janeiro. Currently, it is considered in the hierarchy of the Unified Health System (SUS) as a tertiary and quaternary level hospital serving an estimated population of over two million inhabitants. It performs clinical, surgical and oncology care, and laboratory and radiological tests, with capacity of Two hundred beds.

The hospital’s oncology unit comprises the hematology and oncology departments, responsible for the care and chemotherapy administration to patients, and the pharmacy sector, responsible for meeting the demand of these sectors.

The pharmacy sector is divided into 4 sections: Pharmaceutical Supply Center, Outpatient Pharmacy Chemotherapy and Distribution of Pharmacy. The Pharmaceutical Supply Center serves as warehouse, accounting for receiving the drugs purchased by the hospital and supplying other storage locations. Chemotherapy Pharmacy is the pharmacy focused on the preparation of drugs to be administered in the clinic. Souza *et al.* (2013) detail the steps related to the administration of a chemotherapeutic drug in a hospital setting (Figure 3).

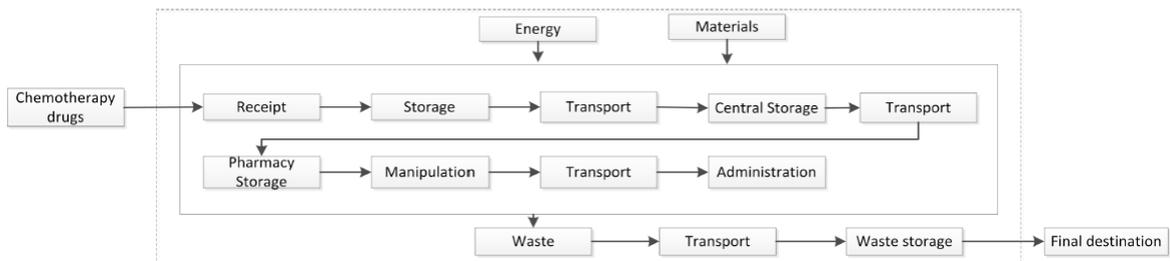


Figure 3 – Stages related to the administration of chemotherapy in the hospital environment.

Source: Souza *et al.* (2013).

To evaluate the occupational risks involved in handling activities of chemotherapeutic drugs, we used the methodology proposed by Seiffert (2010) which characterizes the probability of the risk and its consequences and is summarized in Table 1.

Table 1- Framework of probability and consequence of occupational risk.

Probability	Risk Consequence
Unlikely	Low
Likely	Average
Frequent	High

Source: Seiffert (2010)

An unlikely risk is defined as one whose occurrence is expected in above ten years. Potential risk is a risk likely to occur between 1 and 10 years. Routine risk is one that has the possibility of occurring more than twice per month.

Regarding the consequence of risks, a low character of damage is one that causes mild disturbances to health of employees, like temporary discomforts. Average damages are injuries involving lacerations and burns. Consequences of a high risk include damages such as amputations and occupational cancer.

In order to estimate the level of occupational risks, we used a correlation between the probability and severity of the damage, proposed by Seiffert (2010), according to OHSAS 18001, which is described in Table 2.

Table 2 - Occupational risk level assessment

Probability	Consequence		
	High	Average	Low
Unlikely	Manageable risk	Negligible risk	Negligible risk
Likely	Manageable risk	Manageable risk	Negligible risk
Frequent	Non tolerable risk	Non tolerable risk	Manageable risk

Source: Seiffert (2010)

According to the same author, risk is *classified* as negligible if no additional control over the process is necessary. It is *manageable* if the probabilities and magnitudes are controlled in order to be accepted by the community. It is classified as *not tolerable* when combined probabilities and magnitudes require actions that seek to minimize them.

A detailed description of all activities related to handling of antineoplastic drugs and respective occupational risks in the pharmaceutical supply center, pharmacy and outpatient chemotherapy was held.

Data collection was carried out through a participant observation from March to December 2012, in which researchers participated in the execution of daily activities of the pharmacy service.

4. RESULTS AND DISCUSSION

4.1. Anticancer drugs logistics chain description

In order to facilitate the understanding of the activities carried out in the three sectors analyzed, we initially carried out an analysis of the various activities in the chemotherapeutic management process along the supply chain.

4.1.1. Activities of Pharmaceutical Supply Center

In the central supply system, a previously trained pharmacy assistant receives the product from suppliers. This professional is responsible for checking, at the time of delivery, if there is equivalence between what is established in the invoice and the delivered medicine, as well as the amounts and transport conditions, as there are cancer drugs that are thermo labile.

Another highlight in the inspection process is to analyze the product's integrity as it may have been transported improperly, because much of these medicines are perishable. After the inspection, drugs are stored in a specific quarantine sector in which they remain until they are input in the inventory management system.

Further the drugs are stored in specific locations, and chemotherapy pharmacy performs a weekly request for inventory replenishment. It involves the separation of drugs depending on the lot, the drug description and the requested amount.

Another activity carried out in this sector is the segregation of expired items in specific drums that are collected by a third party service waste management of health services.

Occupational hazards associated with activities in a storage area were analyzed according to probability. Results of damage and risk levels are shown in Table 3.

Table 3 - Occupational risk levels of outpatient activities

Central of pharmaceutical supply activities	Associated Risk	Risk Probability	Risk Consequence	Risk Level
Receiving Drugs	Transportation under inappropriate conditions	Unlikely	High	Manageable risk
Internal transport of drugs	Packing damage	Unlikely	High	Manageable risk
Conditioning of drugs	Packing damage	Unlikely	High	Manageable risk
Temporary storage of waste	Improperly Storage	Unlikely	High	Manageable risk
Temporary storage of waste	Emission of antineoplastic particles	Frequent	High	Non tolerable risk

Regarding risks associated with activities of the Central pharmaceutical supply, there is much risk coming from failures in the management of these drugs, such as transport in unsuitable conditions, packaging breakage, and storage in inadequate conditions.

Risks mapping and their association to the failures in management is corroborated by the study of Leitão (2009), who argued that early identification of occupational risks can enable the development of procedures to reduce the occurrence of accidents.

Analyzing the probability of risks, there is a dominance of unlikely probabilities, since many of these activities are carried out by professionals who necessarily undergo an initial training process for such tasks. However, Castiglia *et al.* (2008) point out that not only technical training should serve as a mechanism for risks reduction, but also highlight the need for development of techniques to detect these drugs at workplace, as well as the biochemical monitoring of the professionals involved in the management.

Among the risk probabilities presented, only the issue of chemotherapeutic particles in waste storage is considered routine, which is worrisome since, as pointed out by Menonna-Quinn (2014), there is still lack of awareness of health professionals in relation to occupational hazards they are exposed to while carrying out their activities.

Kopjar (2009) points out that many professionals do not realize the toxicity of these drugs affects their activities, and one of the main consequences of this lack of awareness of risks is the misuse of personal protective equipment.

The result of risks for all activities are considered high, what reflects the reality described by Costa (2005) in which most of the hospitals are still at an early stage with regards to management of workers safety and health. The routine of hospitals to which these workers are linked is usually associated with inadequate space and equipment faults to carry out various activities, what makes mapping of risks associated with management of these drugs of paramount importance.

Despite the foregoing, only the risk associated with the emission of particles chemotherapy is deemed as not tolerable with regard to the risk level, and all the other risks are considered manageable. However, Frick (2011) states that not only the existing occupational safety and health programs in hospitals are targeted only to situations of risk that may infringe the legislation and which may be the target by any supervisory body, once these programs are more reactive rather than preventive, and ultimately impact risks that professionals are exposed to.

4.1.2. Activities of Chemotherapy Pharmacy

The replacement of the stock of medicines in the pharmacy is carried out upon request from the central supply that separates the order and informs the requester to withdraw the packages containing the products.

At the time of storage in the pharmacy, employees conduct a checklist in order to see whether the separate amounts, medicines and lots are equivalent to those ordered at the system.

After they are subjected to a cleaning process using water, soap and alcohol and are stored in an area close to the place of manipulation. At the moment of manipulation, medications are separated and taken to the security booth in which they are handled by the pharmacist, who must wear individual and collective safety equipment. In the process of manipulation, the content of the bottles of medicines are transferred to bags containing the appropriate diluents for each drug.

At the end of the handling process, vials, syringes, bandages, gloves and needles that can contain traces of medicament are properly disposed in canisters intended for disposal.

Bags containing chemotherapy drugs are properly identified with labels containing patient data such as name, medical record and medication being used, and are subsequently placed in a bag that serves as means of transporting these drugs to the clinic in order to be held by a nurse technician. Waste materials are constantly removed from the end of the day by cleaning professionals. Occupational hazards associated with activities in chemotherapy pharmacy were analyzed according to probability. Result of damage and risk levels are shown in Table 4.

As for the pharmacy activities, in relation to respective associated risks, there is an initial resemblance to the central pharmaceutical supply, since risks associated with the initial activities are concentrated at breaking of package. However, as we advance towards the core activity of this sector, which is the preparation of the product, we notice that there are risks associated with flaws in processes both at arising from the core business and the generation of waste.

The variety of activities, and consequently of risks, reinforces the importance that Sottani (2011) and Viegas *et al.* (2014) gave to this sector in their studies, demonstrating that there is a significant possibility that this working environment presents contamination by various drugs.

Table 4 - Occupational risk levels of pharmacy activities

Chemotherapy pharmacy activities	Associated Risk	Risk Probability	Risk Consequence	Risk Level
Receiving the drugs	Packing damage	Unlikely	High	Manageable risk
Hygienization of the drug	Packing damage	Unlikely	High	Manageable risk
Storage of the drugs	Packing damage	Unlikely	High	Manageable risk
Product separation	Packing damage	Unlikely	High	Manageable risk
Internal transport of drugs	Packing damage	Unlikely	High	Manageable risk
Preparation of the Product	Failure in the exhaustion equipment	Unlikely	High	Manageable risk
Preparation of the Product	Failures in the management of the medication by the handler	Unlikely	High	Manageable risk
Preparation of the Product	Waste generation containing antineoplastic	Frequent	High	Non tolerable risk
Preparation of the Product	Waste generation containing antineoplastics	Frequent	High	Non tolerable risk
Temporary storage of waste	Improperly Storage	Unlikely	High	Manageable risk
Temporary storage of waste	Emission of chemotherapy particles	Frequent	High	Non tolerable risk

Regarding the likelihood of risks, there is a predominance of the probability of unlikely risk, which reinforces the hospital's concern of describing and constantly updating procedures related to the end sector activity. Nevertheless, Lo *et al.* (2014) emphasize that especially the recognition of a risk assessment and followed control can give a more preventive character to these procedures making them more appropriate to the context these professionals are inserted.

Of the three risks considered as *routine*, two are associated with the generation of waste, reinforcing the concept of Seiffert (2010) to point out that often risks associated with an activity permeate the workday and the health institution, occurring not only by exposure of workers involved in that risk but all the staff and the general population, making it an occupational hazard problem and public health.

As in central pharmaceutical supplies, the consequences of the risks for all activities are high, since, as pointed out by Meade (2014) these are drugs classified as carcinogenic,

mutagenic and cytotoxic that have set up great health danger to professionals involved in handling. Neves (2007) highlights that this danger can be related to the possibility of causing injury, illness or damage to health.

As the level of risk, the vast majority of risk is manageable. However, three risks are not considered tolerable which enhances the perception of Moretti *et al.* (2014) that, based on recently published research, exposure of health professionals still occurs. This somehow goes against Costa (2005) who states that the hospital is still at an early stage when it regards management of occupational risk and occupational health, turning mainly towards the fulfillment of the law.

4.1.3. Ambulatory activities

At the ambulatory occurs the administration of drugs, established according to the recommendation described in the protocols, when outpatients are infused into specific and pre-scheduled times.

The process of antineoplastic administration is accomplished by a specially trained nursing professional who, before infusion, queries if the information set forth in bags corresponds to the patient who undergoes the administration. After the infusion, all waste from the administration of drugs as bags, syringes and needles are properly disposed of in specific locations.

As in pharmacy, the administration rooms are cleaned daily by trained professionals vested with personal protective equipment. Containers are also daily replaced and sent to a temporary storage industry of healthcare waste. Occupational risks associated with activities in the ambulatory were analyzed according to probability. The results of damage and risk levels are described in Table 5.

Table 5. Assessment of occupational risk levels of ambulatory activities

Description of ambulatory activities	Associated risk	Risk probability	Consequently risk	Risk Level
Internal transport drugs	Rupture of the product packaging	Probable	Elevated	Manageable risk
Infusion of antineoplastic	Rupture of the product packaging	Probable	Elevated	Manageable risk
Infusion of antineoplastic	Waste generation of antineoplastic	Routine	Elevated	Not tolerable risk
Infusion of antineoplastic	Generation of waste containing antineoplastic	Routine	Elevated	Not tolerable risk
Infusion of antineoplastic	Infectious waste generation	Routine	Elevated	Not tolerable risk
Infusion of antineoplastic	Particle emissions of antineoplastic	Routine	Elevated	Not tolerable risk
Infusion of antineoplastic	Generation of excreta containing antineoplastic	Routine	Elevated	Not tolerable risk
Temporary storage of waste	Inappropriate storage	Improbable	Elevated	Manageable risk
Temporary storage of waste	Particle emissions of antineoplastic	Routine	Elevated	Not tolerable risk

We also observed the existence of failures arising from the equipment used, as the rupture of the package, which as pointed out by Costa (2005) is a reflection of the hospital reality to which these professionals are subjected due to lack of adequate infrastructure and often the lack of adequate equipment to performing their activities.

Analyzing the probability associated with occupational risk, it is observed that six are routine type and that only one of the risks is classified as improbable. This corroborates the study by Suspiro *et al.* (2012), which shows the detection of anticancer drugs in various stages of antineoplastic manipulation, exposing not only nurses but also the cleaning professionals responsible for the collection and disposal of waste medicines and excretions of patients.

In addition, the prevalence of routine risks is worrisome because, as quoted by Menonna- Quinn (2014) there is an increased use of these drugs as the main form of treatment,

while there is still a lack of awareness of the risks involved in handling of antineoplastic drugs by the various health professionals.

As a result of this risk, it is observed that all activities results in a high level of damage, which reinforces the analysis by Meade (2014) which points out that occupational exposure to these drugs has been configured as a danger to health employees. In addition, results corroborate what is described by Kopjar (2009) in their study, which pointed out that the development of new antineoplastic and combination with existing drugs with different toxicities tends to considerably not only increase the occupational hazard, but also the risk of consequence associated to these drugs. They also corroborate the data obtained by Connor *et al.* (2014) in a bibliographic review carried out on the topic, noting the potential negative impacts of these drugs both for patients and for professionals involved in their management.

With regards to risk level, there is a balance between the controllable and intolerable risks, what means that the process of handling antineoplastic is an activity that needs to be continually managed due to the occupational risk associated with it. It was observed that the all risks considered not tolerable are part of the clinic's routine activities, which confirms the articles by Sottani (2011) *et Viegas et al.* (2014) that detected, in different sectors in which handling antineoplastic drugs is made, the presence of at least one drug. This reinforces the need to use tools that can facilitate the management of these risks as that proposed by Seiffert (2010), used in this study.

5. CONCLUSION

This study aims to assess the main risks involved and subsequently the probability, frequency and significance levels related to risks in the management of chemotherapy drugs in the internal activities of a hospital as well as the consequences of exposure in all the sectors involved.

It was observed, in relation to risks associated with management, that they are diverse and related both to the failures in the processes and equipment as well as to the risks that are inherent in the process, like the generation of waste and emission of particles chemotherapeutic. This demonstrates the complexity of risks involved in the management of these drugs to patients and health professionals involved. In this regard, an initial mapping of risks involved in this activity is significant because it allows both managers and health care professionals to have an overview of the risks in the process.

When considering the probabilities of risks, it is noted that risks associated to the activity goals of each sector, due to the initial training process, is often configured as unlikely to occur. However many risks are inherent to the process and occur routinely. Thus, the study shows that not only the continuous training of these professionals but also the adoption of methodologies, as the one used in this study, allow these professionals to have an increased perception of risks and consequently the development of a proactive stance in terms of their occupational safety, mainly by using personal protective equipment.

The study also demonstrated the necessity of hospitals to provide conditions so that professionals involved, through their daily work, can focus their occupational safety as well as other health professionals'.

The advancement of technologies used in health treatment has contributed to increase the quality of patient care. However, it carries an equal increase in complexity of the activities carried out and also the risk exposure of health professionals. A tool as that used in this study can be useful for an easy perception by the managers of the main risks

present in the different hospital activities, and to propose improvements to the production process. The focus on handling antineoplastic drugs emphasizes the increasing importance that this drug has achieved both in Brazil and in the world mainly due to the greater number of cancer cases records and to the use of this product as the main form of treatment.

Analyzing particularly the Brazilian literature, it is noticed that this paper can contribute considerably to a better analysis of the risks involved in hospital processes. It is noteworthy that although risks in hospital has a multiprofessional character, the research has focused in journals that end up being more directed to nurses, who are the most exposed workers to different risks in hospital professional activities.

The focus on the chemical risk was intended only to emphasize the importance that different drugs can have on the occupational exposure of workers, although often there is a lack of awareness of the professionals in relation to the risks to which they are exposed by handling these drugs often without personal protective equipment suitable.

As contributions of this research, we can also emphasize the possibility of using a common user-friendly tool in other activities to analyze the risks present in hospital activities even if, at first, certification is not the primary goal. Another benefit is to get health professionals themselves to perceive, through this tool, the risks to which they are daily exposed and promote the development of a critical view of their own activities, in order to identify who is exposed to risks and act together with managers to implement improvements.

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