



**OCCUPATIONAL RISKS OF THE NURSING TEAM'S EXPOSURE TO
CHEMOTHERAPEUTIC AGENTS: INTEGRATIVE LITERATURE REVIEW**
**RISCOS OCUPACIONAIS DA EXPOSIÇÃO DA EQUIPE DE ENFERMAGEM A QUIMIOTERÁPICOS:
REVISÃO INTEGRATIVA DE LITERATURA**
**RIESGOS LABORALES DE LA EXPOSICIÓN DEL EQUIPO DE ENFERMERÍA A QUIMIOTERAPÉUTICOS:
REVISIÓN INTEGRADORA DE LITERATURA**

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ABSTRACT

Objective: to identify in the scientific literature what are the main risks to which nursing professionals are exposed during clinical practices in oncology services. **Method:** this is a descriptive study, with an integrative review nature, ruled by this question: "What are the main occupational risks to which nursing professionals are exposed when handling chemotherapeutic agents?" The literature survey was carried out in the Lilacs database and in the SciELO collection, within the period between September and November 2011, using the following descriptors: *chemotherapy*, *biosafety*, *nursing*, and *occupational risks*. Twelve papers were selected for analysis. **Results:** it was possible to identify the main sources of exposure and recognize that most of them are due to failures of professionals, besides characteristics which are inherent to the work process. **Conclusion:** the nursing team still demonstrates insufficient knowledge on the chemical occupational risks factors to which it's exposed in the work environment, thus requiring training courses and continuing education. **Descriptors:** Nursing; Chemotherapy; Biosafety; Occupational Health.

RESUMO

Objetivo: identificar na literatura científica quais são os principais riscos aos quais os profissionais de enfermagem estão expostos durante as práticas assistenciais em serviços de oncologia. **Método:** trata-se de estudo descritivo, do tipo revisão integrativa, norteado por esta questão: "Quais são os principais riscos ocupacionais aos quais os profissionais de enfermagem estão expostos ao manusear quimioterápicos?" O levantamento bibliográfico foi realizado na base de dados Lilacs e na coleção SciELO, no período entre setembro e novembro de 2011, utilizando os seguintes descritores: *quimioterapia*, *biossegurança*, *enfermagem* e *riscos ocupacionais*. Foram selecionados doze artigos para análise. **Resultados:** foi possível identificar as principais fontes de exposição e reconhecer que a maioria delas decorre de falhas dos profissionais, além de características intrínsecas ao processo de trabalho. **Conclusão:** a equipe de enfermagem ainda demonstra conhecimento insuficiente sobre os fatores de risco ocupacionais químicos aos quais se encontra exposta no ambiente laboral, necessitando, assim, de cursos de capacitação e educação continuada. **Descritores:** Enfermagem; Quimioterapia; Biossegurança; Saúde do Trabalhador.

RESUMEN

Objetivo: identificar en la literatura científica cuáles son los principales riesgos a los que los profesionales de enfermería están expuestos durante las prácticas clínicas en servicios de oncología. **Método:** esto es un estudio descriptivo, del tipo revisión integradora, guiado por esta cuestión: "¿Cuáles son los principales riesgos laborales a los que los profesionales de enfermería están expuestos al manipular quimioterapéuticos?" El levantamiento bibliográfico fue realizado en la base de datos Lilacs y en la colección SciELO, en el periodo entre septiembre y noviembre de 2011, utilizando los siguientes descriptores: *quimioterapia*, *bioseguridad*, *enfermería* y *riesgos laborales*. Doce artículos fueron seleccionados para el análisis. **Resultados:** se logró identificar las principales fuentes de exposición y reconocer que la mayoría de ellas es resultado de fallas de los profesionales, además de características intrínsecas al proceso de trabajo. **Conclusión:** el equipo de enfermería aún demuestra conocimiento insuficiente acerca de los factores de riesgo laborales químicos a los que está expuesto en el ambiente laboral, requiriendo, así, cursos de capacitación y educación continua. **Descriptores:** Enfermería; Quimioterapia; Bioseguridad; Salud Laboral.

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INTRODUCTION

In Brazil, cancer has occupied a prominent position along with circulatory diseases, external causes, and respiratory diseases. If one excludes ill-defined causes, cancer constitutes the third leading cause of death, losing to cardiocirculatory diseases and external causes^{1,2}, and, since 2003, it represents almost 17% of deaths due to a known cause, reported to the Mortality Information System.³

Cancer may be defined as an uncontrolled growth of cells which invade the tissues and organs, and they can spread to other body regions. These cells tend to be quite aggressive and uncontrolled, determining the formation of a set of over 100 diseases.²

There're several oncology treatment modalities. Chemotherapy is, among treatment modalities, that presenting the highest incidence of cure in many tumors and that presenting the highest survival rate of cancer patients, thus, it's the commonly used treatment among several types of cancer¹; it consists of the use of cytotoxic substances which interfere with the process of cell growth and division and they're preferably administered by intravenous route.^{1,2}

Antineoplastic agents are toxic to all tissues of rapid proliferation, which have as a characteristic high mitotic activity and short cell cycles, whether normal or cancerous. It should be highlighted that, from the standpoint of professionals who work in health care services, among the main agents available for treatment, antineoplastic drugs are those causing the highest number of occupational diseases to the professionals working within the hospital environment.⁴

Occupational exposure to these drugs can cause problems ranging from simple effects, such as headache, vertigo, dizziness, vomiting, alopecia, and skin hyperpigmentation, to the most serious and complex ones, such as carcinogenesis, mutagenic and teratogenic effects, which can be observed in professionals who prepare or administer antineoplastic agents without using collective or individual protective equipment, something which implies considerable and undue absorption of these substances.⁴ The risks caused by handling of antineoplastic agents are due to the toxicity inherent to the drug and to the time of exposure of individuals for antineoplastic agents.^{4,5}

Understanding the risks inherent to the clinical practices in oncology services, the National Agency for Sanitary Vigilance

(ANVISA), which regulates and supervises health services, created the so called Resolucao da Diretoria Colegiada (RDC) 220/2004, approving the technical regulation for the operation of Antineoplastic Therapy Services (ATS), with the aim of establishing their minimum requirements.⁶ To do so, it took into account the guidelines of the federal Law 8,080, which deals with the conditions for health promotion, protection, and recovery, comprising actions for the promotion and protection of workers' health.^{7,8}

RDC 220/2004 states that the nurse shall, according to resolution from the Federal Council of Nursing (COFEN), administer antineoplastic chemotherapeutic agent, in accordance with the drug's pharmacokinetics and the therapeutic protocol, and its optional for this professional to prepare these drugs.⁹

The administration of medicines constitutes an usual practice performed by the nursing team in hospital institutions and oncology treatment services, and it's regarded as one of the activities with highest responsibility performed by this team.¹⁰ Intravenous administration is one of the most used routes in the treatment with chemotherapeutic agents. Researches show that technical problems during this procedure, when handling antineoplastic drugs, comprise a high risk of occupational exposure to chemical agents.²

In this sense, it's extremely important that all professionals involved in the care to a patient who undergoes chemotherapy are properly informed, trained, and supervised, in compliance with the needed individual protection measures, since the exposure to antineoplastic chemotherapeutic agents produces cumulative damage to workers' health which can be irreversible.⁴

NR 32, the Ruling Norm on Safety and Health at Work in Health Service (NR) 32, also highlights the exposure to chemotherapeutic agents as one of the major occupational risks that nursing professionals face within the context of hospital work process.^{5,11}

Therefore, this study is justified by the significant growth of cancer in Brazil, thus demanding a labor force trained and aware of the risks to which the individuals are exposed, being able to develop its practices in a safe manner, minimizing these risks.

OBJECTIVE

- To identify in the scientific literature what are the main risks to which nursing professionals are exposed during clinical practices in oncology services.

METHOD

Descriptive study, with an integrative review nature, which allows a synthesis of knowledge through the systematization and analysis of results. To provide it with a basis, the following research question was prepared: “What are the main occupational risks to which nursing professionals are exposed when handling chemotherapeutic agents?”.

The bibliographical survey was carried out by consulting the website of the Virtual Health Library (VHL), the Latin American and Caribbean Health Sciences Literature (Lilacs) database, and the Scientific Electronic Library Online (SciELO) collection. The search was performed within the period from September to November 2011, using the following descriptors found in the vocabulary Descriptors in Health Sciences (DeCS): *chemotherapy*, *biosafety*, *nursing*, and *occupational risks*.

To constitute the sample the following inclusion criteria were used: papers published in Portuguese; available in full version; which refer to the study theme; and indexed in the databases mentioned, within the period from 2006 to 2011. The exclusion criterion was repetition in the LILACS database and the SciELO collection. Three papers were selected in Lilacs and twelve in SciELO. It’s worth stressing that out of the 15 papers, 3 were simultaneously found in Lilacs and SciELO, thus making a total of 12 papers which meet both the inclusion and exclusion criteria.

For analysis and subsequent synthesis of papers, a synoptic box was used (Figure 1), which included aspects regarded as pertinent: paper’s title, publication year, author’s professional category, and how it answers to the guiding question.

The first moment of data collection was a survey of the literature in the databases mentioned, using the descriptors. Later, there was a thorough and careful reading, in order to check the inclusion and exclusion criteria. Finally, the interpretation of results was performed.

The presentation and discussion of results were carried out through descriptive analysis from the interpretation and synthesis of data from the figures and tables.

RESULTS

By applying the descriptors in the Lilacs database and the SciELO collection, a total of 977 papers was found, being 22 related to the Lilacs database and 955 to the SciELO collection. Out of all these papers, 965, about

98.7%, weren’t selected taking the inclusion and exclusion criteria into account; most of them weren’t available in full version and others approached the disease and therapeutic effects.

Paper's title	Publication year	Author's professional category	Answers to the guiding question: What are the main occupational risks to which nursing professionals are exposed when handling chemotherapeutic agents?
Nursing work and occupational risks exposure	2009	Nurse	- Patient handling - Administration of medicines
Antineoplastic therapy services: worker safety and chemical risk	2011	Nurse	- Patient handling - Administration of medicines - Connection and disconnection of scalp, catheters, and syringes
Chemical occupational risks identified by nurses in a hospital environment.	2006	Nurse	- Aerosol inhalation from the environment - Patient handling
Occupational risks in a hospital environment: a challenge for workers' health	2009	Nurse	- Aerosol inhalation from the environment
The nurse as the coordinator of clinical studies on oncology	2011	Nurse	- Aerosol inhalation from the environment
Tool for the preventive management of occupational risks for workers in nursing: statement of risks	2010	Nurse	- Patient handling - Aerosol inhalation from the environment
Chemotherapeutic's extravasation: knowledge of the nursing team	2011	Nurse	- Aerosol inhalation from the environment - Medicines extravasation
Nursing team: knowledge on handling antineoplastic drugs	2011	Nurse	- Administration of medicines - Connection and disconnection of scalp, catheters, and syringes
Assessment of risk factors related to failure during drug administration	2008	Nurse	- Administration of medicines - Aerosol inhalation from the environment
Assessing the knowledge of a nursing staff about occupational risks when administering chemotherapy drugs	2010	Nurse	- Patient handling - Administration of medicines - Medicines extravasation
Chemotherapics administration: a proposal for a nursing protocol	2007	Undergraduate Nursing student	- Administration of medicines - Medicines extravasation
Work accidents suffered by nursing of a study hospital in Parana - Brazil	2007	Nurse	- Administration of medicines

Figure 1. Representation of selected papers according to the inclusion criteria of the research, presenting title, publication year, author's professional category and answers to the guiding question.

Table 1. Papers found and selected according to the search between 2006 and 2011

Database	Descriptors	Papers found	Total of selected papers
Lilacs	Chemotherapy and occupational risk	11	02
	Chemotherapy and biosafety	04	00
	Nursing and chemotherapy and occupational risk	07	01
SciELO	Chemotherapy and occupational risk	500	08
	Chemotherapy and biosafety	183	07
	Nursing and chemotherapy and occupational risk	272	09
Total		977	12

The total number of selected papers is smaller than the sum according to descriptors, since a large number of papers repeated at

different results of descriptors intersection, so, the total number of papers listed below comprises the selection without repetitions.



Figure 2: Analysis of all selected papers by publication year.

By analyzing Figure 2, it's possible to observe, in a general basis, that over the years there's a growing increase in the number of papers published per year.

Regarding the answer to the guiding question concerning the major sources of exposure, one finds out the representations of Table 2.

Table 2. Risk sources and number of papers mentioning them

Major sources of exposure to chemical risk	Number of papers mentioning	%
Patient handling	5	41.6%
Administration of medicines	7	58.3%
Connection and disconnection of scalp, catheters, and syringes	2	16.6%
Aerosol inhalation from the environment	6	50.0%
Medicines extravasation	3	25.0%

The papers under analysis show among the major exposure sources the characteristics intrinsic to the work environment (50%), such as exposure to and inhalation of aerosols, as well as the handling of patients (41%). In addition, those occurring due to failure in the

completion of the team’s technical procedures are highlighted.

Table 3 presents the main prevention and protection actions to minimize exposure to risk.

Table 3. Prevention and protection actions and the number of papers mentioning them

Prevention and protection actions	Total number of papers mentioning	%
Use of individual protective equipment (IPE)	06	50%
Use of protocols with specific safety measures for handling this type of medicine	05	41.6%
The environment should contain collective protection equipment (CPE)	02	16.6%
Presence of the extravasation kit	03	25%
Training of workers on the risks, protective measures, and conducts in face of accident	08	66.6%
Mapping of risks and exposure to them within the work environment	01	8.3%

The analysis shows as major corrective measures mentioned by the papers the need for training the professionals (66%), besides the importance of their use of IPE (50%).

Table 4 presents the limitations found for implementing prevention and protection actions.

Table 4. Limitations found to implement prevention and protection actions and number of papers mentioning them

Limitations found to implement prevention and protection actions	Total number of papers mentioning	%
Inadequate work conditions	05	41.6%
Inadequate attitudes and habits (non-use or misuse of IPE)	06	50%
Lack of information or knowledge	03	25%
Difficulty for developing and implementing clinical protocols	04	33.3%

The analysis of papers shows that 50% of the limitations are related to the attitudes of professionals themselves, which lead them to be more exposed to risk. It’s also noteworthy the representation of 41.6%, indicating the inadequacies of the work environment as a limiting factor.

DISCUSSION

Through the analysis of Figure 1 one may observe that there was a significant increase in publication last year, reaching 50% in relation to the previous years, and one should also take into account that, with regard to 2011, the last publication analyzed was from the first quarter, and new publications can emerge during the year. One can relate the result to the increased number of cancer cases in Brazil, as well as the advances in the field of occupational health.

When analyzing the professional category of the paper’s authors, one finds out that 75% were written by nurses, most of them professionals working in oncology treatment

or teaching institutions. The other 25% correspond to undergraduate Nursing students. Besides, 100% of perpetrators were female, a fact matching the feminization of the profession, an event which is part of its historical development.⁸ It’s also worth emphasizing that only 25% of works are co-authored by professionals from another category, being physiotherapists in 2 papers a physician in 1 paper.

Nursing is among the major categories subject to occupational exposure, deserving a special attention. It has the largest number of workers employed in the health field and it performs a wide diversification of which, sometimes, require physical contact.¹² So, when analyzing data from Table 2, one finds out that 41.6% of papers mention patient handling as a factor of exposure risk. It’s worth noting that when handling patients who received chemotherapy in the last 48 hours, there’s a need to use procedure gloves, masks, and long sleeve aprons, since their

feces and body fluids up to this period are still eliminating toxic substances.⁷

The administration of antineoplastic drugs comprises one of the major conditions which generate chemical risks, as shown in Table 2, being the main source of exposure, presented in 58.3% of the papers which mention it.¹³ Mistakes during the administration of these medicines represent a sad reality for patients, health professionals, and hospital institutions, causing serious consequences to all people involved.¹⁰

Regarding the exposure during connection and disconnection of scalp, catheters, and syringes, despite its little representation in papers, with only 16.6% of occurrences in Table 2, it comprises an exposition which deserves careful attention. The exposure risks during administration of antineoplastic agents most commonly occur during the injection of the drug and in the connection and disconnection of instruments. Among the major safety measures in the administration of these drugs one finds the need for maintaining gauze next to the connections, especially at the time of introduction or removal of catheters and connectors.⁷

Regarding the exposure to aerosols mentioned in 50% of papers, as shown in Table 2, although it's hard to be observed, deserves to be highlighted, since researches revealed the existence of a strong association between the occurrence of genetic toxicity, manifested by changes in cellular DNA, in professionals who administer antineoplastic agents, and the service time, when it's over ten years, regardless of the daily exposure time.⁴

The chemotherapeutic agents' extravasation, presented in 25% of papers in Table 2, comprises an event which occurs with the patient and it also can cause an occupational accident.² Therefore, there's a need to take some precautionary measures in order to avoid environmental contamination and a consequent exposure of workers. The person responsible for decontamination should dress appropriately before starting the procedure and the spillage area, after identification and access restriction, must be demarcated with absorbent pads. Therefore, there's a need to have the spillage kit in the sector.⁴

Through the analysis of Table 3, one can verify that, in the vast majority, 66.6% of papers, professional training was indicated as a major means able to contribute to the promotion and protection of workers' health. Some papers analyzed bring up data stressing the need for this training, since out of the

employees interviewed in antineoplastic therapy services, on average, only 15% report having had access to it.^{4,5}

The professionals' training is closely related to the improvement of work processes and the prevention of accidents; it should be done through continuing education programs within institutions, which can be offered by the nurse himself, the Commission of Hospital Infection Control or the Internal Commission for Accident Prevention, among others.¹¹

The safety standards used in a chemotherapy center indicate the need for a periodic evaluation of exposure to occupational risks and the use of IPE and CPE provided by the company, in order to minimize or eliminate risks existing in the environment.⁵ It's also worth emphasizing that the use of this equipment is sometimes forgotten or ignored by employees and the awareness obtained through training can become a valuable tool for promoting and protecting the workers' health.

The importance of establishing protocols also deserves to be highlighted in Table 3, being pointed out in 41.6% of papers. It's worth emphasizing the nurse's role in the continuing and permanent education process with the nursing team, it's a task of this professional to develop nursing care protocols and also to guarantee their use. They're able to set clinical priorities, always stressing the needed care measures, especially those specific to the administration of chemotherapeutic agents.^{2,14}

According to RDC 220/2004, to avoid environmental contamination in the areas of preparation, storage, and administration, an identified spillage kit should be always available, which must include, at least: procedure gloves, waterproof apron, absorbent pads, respiratory protection, eye protection, soap, identified container for waste collection, and procedure description.⁴ The importance of this kit, mentioned by 25% of papers, according to Table 3, is due to the fact that it minimizes the risk of exposure to the chemical agent in spillage cases, a commonly occurring event during the administration of medicines.

The mapping of environmental risks, despite being mentioned by only one paper (Table 3), is an important strategy to achieve the prevention of harm to workers' health, since it exposes in each workplace the risks found there. Thus, it constitutes an important educational tool and it must be used in order to reduce the health problems of nursing professionals.¹²

Several reasons can be related to bad habits, among which the non-use of IPE by health care professionals is included, mentioned as a major obstacle to implement prevention actions (50%) in Table 4. One may mention lack of knowledge, hurry in procedures due to insufficient human resources, professional disincentive related to the excessive workdays, low wages, and stress as factors which lead to these situations.⁵

Furthermore, the internal environment of the institution often doesn't offer the most desirable work conditions so that workers can perform their activities with no risk or with a reduced risk.⁵ The need to improve work conditions, indicated in 41.6% of papers, according to Table 4, is able to protect workers, resulting in the reduction of accidents and occupational diseases.^{5,13}

The design and implementation of protocols indicated in Table 4 also includes one of the difficulties found, mentioned by 33.3% of papers. This difficulty is due to the fact that the nurse responsible for their preparation is often related to many other clinical and bureaucratic activities. Moreover, the protocol design requires time to survey indicators, communication with regulatory bodies, adaptation of the clinical protocol to the institution's reality, scheduling and participating in specific trials within clinical sectors, among other compulsory steps.¹⁴

The lack of information and knowledge deserves attention in 25% of papers (Table 4). It's known that preventing is one way to avoid occupational health problems which can be triggered by this exposure. For this, these workers need to acquire more knowledge with regard to the chemical occupational risks to which they're exposed, thus being able to identify the risk situation and make a decision on the way of preventing it.¹⁵

CONCLUSION

It was possible to observe that the scientific literature on the occupational risks to which nursing professionals are exposed within the services where chemotherapy is used have in mind problems with multifactorial causes, especially coming from human causes and work environment conditions.

It was also possible to observe the lack of studies concerning the issue, something which indicates the need for further researches and studies able to direct towards the solution of problems listed.

Finally, one can observe that the nursing team still shows insufficient knowledge on

factors of occupational chemical risks to which they're exposed. In order to minimize this situation, one suggests that this theme is included in the continuing education services of institutions, which comprise a set of education practices designed to promote professional improvement opportunities, on a continuous and systematic basis¹⁶. There's a need to specifically make apparent the chemical risks and their adverse effects on workers' health, as well as the importance of appropriate safety measures to reduce occupational risks.

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