ASIA PACIFIC JOURNAL of MEDICAL TOXICOLOGY
APJMT 14;2 http://apjmt.mums.ac.ir June 2025

ORIGINAL ARTICLE

State of knowledge of healthcare staff on the risks associated with the handling of cytotoxic drugs: preliminary study carried out at the regional oncology center and the hematology department of the regional hospital of Beni Mellal (Morocco)

HASNA ELMORTAJI[1,*], ILHAM ZAHIR[1]

[1]Polyvalent Team of Research and Development (EPVRD), Polydisciplinary Faculty, Sultan Moulay Slimane University, 23000, Beni Mellal, Morocco

Abstract

Background: This study assessed the knowledge of nursing staff regarding the handling of Antineoplastic Agents and their associated risks at the Regional Oncology Center and Hematology Department of the Regional Hospital Center in Beni Mellal, Morocco.
Methods: This mixed-methods descriptive study evaluated nurses' knowledge regarding the handling of Antineoplastic agents (ANAs). A pilot study involved 31 nurses from the oncology and hematology departments at Beni Mellal Regional Hospital. Data collection utilized a multi-method approach, including: (i) a questionnaire, (ii) observational studies of nursing staff, and (iii) interviews with department heads.
Results: The findings revealed concerning gaps in nurses' knowledge and practices regarding Antineoplastic Drugs. Notably, 69% of nurses were unaware of the occupational risks associated with ANAs, and the same percentage had experienced at least one accident while handling these drugs. Moreover, 66% of nurses lacked continuing education training on ANAs. All nurses in the hematology department reported receiving no training after their assignment, which the department head confirmed. Department heads also acknowledged that ANAs received no specific storage or handling precautions but were treated like ordinary drugs. The study identified significant discrepancies between nurses' self-reported use of protective measures and their observed practices.
Conclusion: Recommendations for reducing risks associated with Antineoplastic and other Hazardous Drugs (ANAs) among nurses were developed from these findings. A subsequent study will examine the health impacts of ANA handling among healthcare staff in Moroccan oncology centers.

Keywords: Nursing Staff, Hospital, Risk Assessment, Manipulation Antineoplastic agents

How to cite this article: Elmortaji H, Zahir I. State of knowledge of healthcare staff on the risks associated with the handling of cytotoxic drugs: preliminary study carried out at the regional oncology center and the hematology department of the regional hospital of Beni Mellal (Morocco). Asia Pac J Med Toxicol 2025; 14(2): 29- 34.

INTRODUCTION

The World Health Organization (WHO) recognizes cancer as a significant public-health issue, ranking as the second-leading global cause of death [1]. Nationally, approximately 50,000 new cancer cases are detected annually, with a significant mortality rate of 13.4% of total deaths [2]. These epidemiological data have prompted Morocco, as part of regionalization, to increase the supply of care across the kingdom through the construction of regional oncology centers [3]. However, healthcare workers who manage patients undergoing chemotherapy, a routine treatment that targets the entire body [4], are exposed to potential health risks [5].

The drugs used in chemotherapy, known as Antineoplastic Agents (ANAs), can pose health risks to healthcare workers due to their action on healthy cells as well as cancerous cells [6]. Occupational exposure to these compounds can lead to various immediate and delayed adverse effects, ranging from local reactions to teratogenic, mutagenic, and carcinogenic risks [4, 7], following inhalation, ingestion, or skin exposure [8]. Furthermore, according to a study conducted by Poupeau [9] in United States of America, high contamination rates by these cytotoxic products were reported among the studied population (nurses, pharmacy assistants). In Morocco, a study showed that 15% of hospital staff feared accidental contact with certain antineoplastic drugs [10].

Despite progress in the classification of carcinogens [11], the exact impact of these substances on handlers remains insufficiently understood. It is, therefore, imperative to implement preventive measures to reduce the occupational risks associated with these exposures.

The national cancer prevention and control plan emphasizes medical surveillance of exposed workers and

*Correspondence to: Hasna Elmortaji. Polyvalent Team of Research and Development (EPVRD), Polydisciplinary Faculty, Sultan Moulay Slimane University, 23000, Beni Mellal, Morocco.
E-mail: hasnamortaji5@gmail.com, Tel: +212701127755

recommends training covering various aspects of safe anticancer drug handling [3]. However, no national epidemiological study has yet assessed the impact of these substances on the health of staff working in oncology departments.

This preliminary study aims to explore the knowledge level and assess compliance with individual preventive measures by nursing staff working in the regional oncology center (ROC) and the hematology department of the Regional Hospital Center (RHC) in Beni Mellal, Morocco.

METHODS

Study type: This mixed-methods descriptive study aimed to assess nurses' knowledge regarding the handling of anticancer drugs (ANAs). A pilot study was conducted with 31 nurses from the oncology and hematology departments at Beni Mellal Regional Hospital. A multi-method approach was employed for data collection, including a questionnaire, observational studies of nursing staff, and interviews with department heads.

Study location: The Beni Mellal Regional Oncology Center is the only facility dedicated to cancer treatment in the Beni Mellal-Khenifra region. It comprises three units: the radiotherapy unit, chemotherapy day hospital, and hospitalization unit. The center decentralizes oncology care in the region, treating approximately 3,000 patients annually. The Regional Hospital Center is a second-level center providing curative, preventive, and educational care. It is the primary center in the Beni Mellal region. The selection of the hematology department is justified by its care for patients with blood cancers (acute or chronic lymphoblastic leukemia, myeloma, etc.).

Study population: The target population comprises two groups: nurses working in the ROC and hematology care unit of the Beni Mellal (RHC), and managers of the centers concerned. The study population specifically included nursing staff exposed to chemical risks in these centers. Given the small population size (31 individuals), an exhaustive sampling was chosen, including all nursing staff handling these substances at the study sites.

Inclusion criteria: This study includes nurses who administer anticancer drugs and contact the excreta of patients undergoing chemotherapy.

Exclusion criteria: Persons absent during data collection, those declining participation, and those accompanying patients undergoing chemotherapy.

Methods and instruments for data collection:

The research methods include a questionnaire containing open and closed questions, divided into three sections. The first section addresses participants' sociodemographic data (age, sex, work experience, region). The second section describes the oncology department's organization (nursing staff numbers, protective equipment availability). The final section examines participants' understanding of ANAs and their knowledge about handling ANAs, observation of nursing staff to compare theoretical knowledge with actual practices, and interviews with department heads.

Statistical analysis:

The data were reported, examined, and analyzed using Microsoft Excel (Microsoft, 2016). Dynamic cross-tabulations calculated training percentages, degrees of knowledge, and frequencies of protective measures. They enabled efficient processing of observation grid and interview data to summarize results and generate visualized trends.

Ethical considerations:

The study addressed several ethical criteria: obtaining authorization from the Beni Mellal delegation (Ref.N°04591), acquiring approval from the Oujda Biological Research Ethics Committee of Morocco (CERBO) (Ref.N.52/2023), maintaining information confidentiality, ensuring participant anonymity, and informing all participants of the study's purpose.

RESULTS

Results of the questionnaire analysis

The cohort had an average age of 31 years, ranging from 20 to 50 years. The majority of nurses were female (64.51%). The study sample was constituted by 65% state-qualified nurses, 21% auxiliaries and only 14% orderlies. 79% of nurses had between 1 and 5 years of service. The following points were noted:

- 83% of nurses confirmed that the number of nursing staff was insufficient, while 12% reported that the number of caregivers was sufficient.
- 93.10% of nurses felt that the means of protection were insufficient.
- 100% of nurses reported the absence of an emergency kit in the department.
- 100% of nurses working in the oncology center and hematology unit had not received basic notions about the chemical risks associated with handling cytotoxic products.
- 100% of nurses considered continuous training to be essential. However, 66% of nurses had not received ongoing training on the risks of ANAs. Whereas 34% of nurses had received only one continuing training course on the risks of ANAs. In addition, in this group, 100% of nurses confirmed that only one training course is not satisfactory.
- All the nurses working at the hematology department of the RHC did not receive any training after their assignment.
- 52% of interviewers stated that their knowledge about the chemical risks involved in handling ANAs was superficial, while 41% having no knowledge at all, and only 7% having in-depth knowledge.
- 69% of nurses had no idea about the chemical risks involved in handling ANAs, while 31% of participants claimed they knew of few risks. In this group, 70% declared carcinogenic, mutagenic, toxic for reproduction risks (CMR) and 30% declared skin irritation and necrosis.
- 58.63% of nurses reported a lack of knowledge about contamination routes. On the other hand, 41.37% knew some of them (Figure 1).
- Sixty-six percent of nursing staff had no awareness of exposure sources involved in handling ANAs, while 34% recognized that the preparation and administration of ANAs constitute potential exposure sources.
- 41.37% were aware that patients could be potential contamination sources through their excreta, whereas over

half of the nurses (59%) lacked this awareness (Figure 2).

• 79% of nurses are aware of the importance of all the protective measures when handling antineoplastic agents. Wearing single-use gloves and protective masks were the most frequently cited means of protection (Figure 3).

• 68.97% of nurses were unfamiliar with ANA waste management standards, compared with 31% who cited compliance with color codes as a waste management standard.

• 68.97% of nurses confirmed the occurrence of at least one accident when handling ANA (Figure 4).

• All nurses who reported an accident during the handling of ANA indicated that they did not report these incidents to their managers according to the reasons presented in Figure 5.

• 79.31% of the surveyed staff did not know what to do during an accident when handling ANAs. On the other hand, 20.69% knew what action to take (Figure 6).

Results analysis of the observation grid

According to the observation grid carried out at the two study sites, we can conclude that:

○ Over 75% of nurses did not wash their hands before and after handling ANAs,

○ The majority of nurses (93.10%) did not wear sterile gloves when handling cytotoxic compounds,

○ 95.55% of participants did not wear protective gowns when handling ANAs,

○ 100% of participants neglected the importance of protective glasses,

○ 24% of nurses did not wear protective masks when handling these molecules,

○ 79% of nurses did not wear specific shoes in their departments,

○ The majority of participants (90%) did not wear double gloves when handling cytotoxic drugs,

○ 100% of participants did not change gloves every 30 min. Even more, 86.21% did not modify gloves between two patients,

○ Only 20.69% of participants threw away their gloves immediately after use, but 79.31% used them in other activities, such as handling the information system,

○ 34.38% of participants did not comply with the color codes for antineoplastic agent waste disposal, and over 65% of nurses did not wear all the personal protective equipment (PPE) required for handling patient excreta,

○ Moreover, observation of practices in the hematology

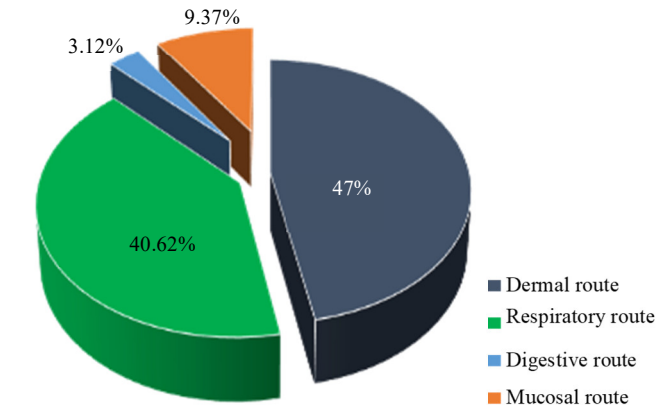

Figure 1. Distribution according to knowledge of contamination route

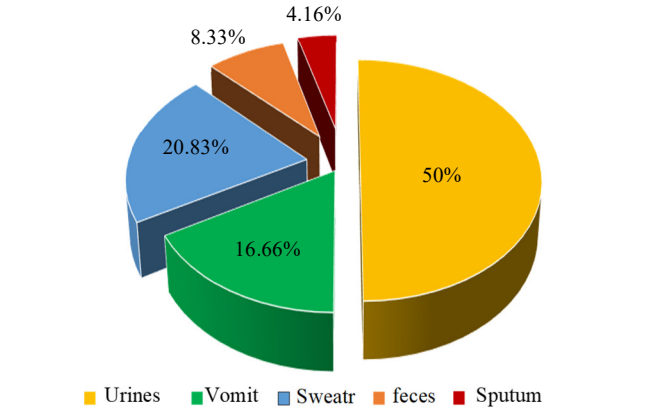

Figure 2. Distribution of nurses regarding knowledge of patient excreta as a possible source of contamination

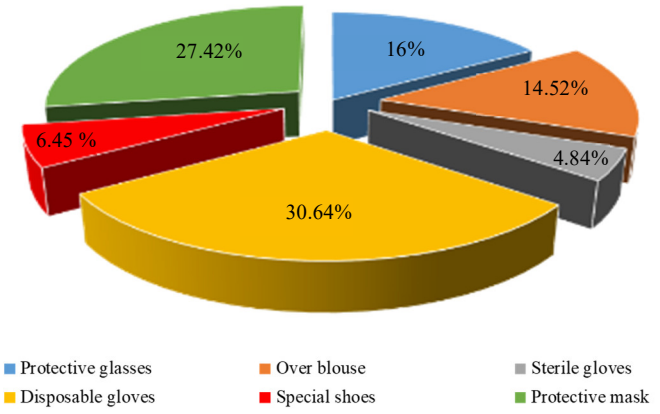

Figure 3. Distribution of nurses according to knowledge of means of protection

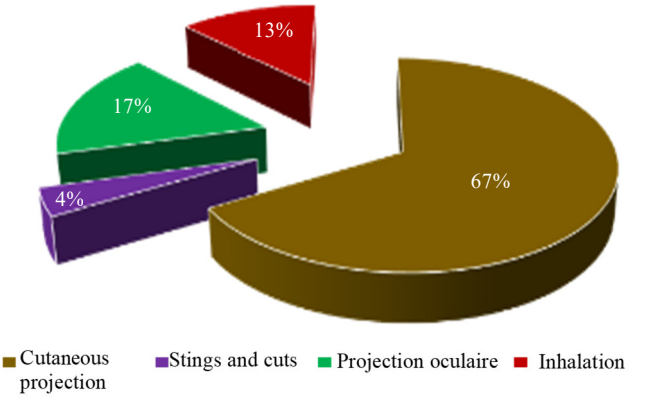

Figure 4. Participants by type of accident

department revealed regular use of anticancer drugs, particularly cyclophosphamide, a cytotoxic agent. Although it was often administered alone or combined with other treatments, it was handled without the necessary protection, as if it were a harmless product.

Results of the interview with the two managers of the oncology of ROC and hematology department of RHC in Beni Mellal:

The head of the hematology department declared that:

- The nurses in this department had received no training in handling ANAs,
- The department has no specific procedure for accidents involving the handling of ANAs,
- No medical follow-up was established for staff in contact with ANAs,
- The absence of specific precautions when receiving and storing ANAs, which are considered to be ordinary medicines, and
- There is no specific procedure for disposing of anticancer waste.

The head of the oncology department declared that:

- The department organized periodic training sessions on the risks involved in handling ANAs,
- In the event of an accident, the department limited its procedures to accident reporting,
- The manager mentioned the existence of medical follow-up, although the staff neglected its importance,
- The absence of specific precautions when receiving and storing ANAs, which are considered to be ordinary medicines,
- Anticancer waste was managed according to a circuit set up for cytotoxic waste, and staff disposed of it in brown bags.

DISCUSSION

Sixty-five percent of participants were female. Moreover, 90% of the staff surveyed fell within the 20-40 age bracket, a period representing reproductive years for women. These results align with those of Bouaziz [12], who demonstrated that women of childbearing age exposed to anticancer products face an increased risk of reproductive toxicity, including risks of abortion, fetal mortality, congenital malformations, and ectopic pregnancies.

Twenty percent of nurses had more than 4 years' seniority. According to Boughattas [13], professional seniority correlates with the duration of exposure to Antineoplastic Agents. The longer the service duration, the higher the exposure risk.

Regarding nursing staff numbers, 83% of participants indicated that staffing was insufficient, suggesting nurses might administer large quantities of ANAs daily, thereby increasing exposure risk. The WHO has implemented the Cytotoxic Contact Index (CCI) to evaluate ANA exposure risks and adjust staffing levels for safer working environments [12].

Of the nurses surveyed, 93.10% reported insufficient protective measures in their wards, corroborating Bennece's findings [14] where 100% of nurses handling ANAs reported inadequate protection. Similarly, Leball [15] identified equipment shortages as the primary reason for insufficient protection, cited by 55% of nurses. This corresponds with Bouaziz's study [12], which found that 23% of nurses never wore gloves due to equipment shortages or discomfort.

The questionnaire revealed that 100% of nurses lacked initial training in chemical risks associated with ANA handling. Similarly, Belal [6] discovered that 80% of nurses received no instruction about ANA handling in the "oncology" module during basic training, despite the cancer center's emphasis on institutional training for nurses regarding ANAs and associated risks [16].

In addition, 66% of nurses have not received any ongoing training in handling ANAs, as confirmed by the hematology department head, who reported that his department had never organized any training in handling these drugs. This finding explains the observations made in the same department, where nurses handle cyclophosphamide, a cytotoxic agent classified as carcinogenic to humans [11], repeatedly without adequate protective measures, thus compromising their health and safety. Indeed, Fransman's work [17] showed that nurses exposed to cyclophosphamide for 40 years had an increased risk of leukemia, with an excess risk of 1.04 per million. Similarly, Bennece's study [14] showed that 94% of nurses had never received initial or continuing training regarding

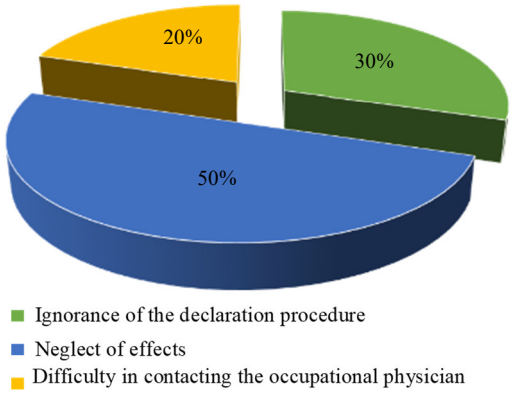

Figure 5. Distribution of responses according to reasons for not reporting accidents

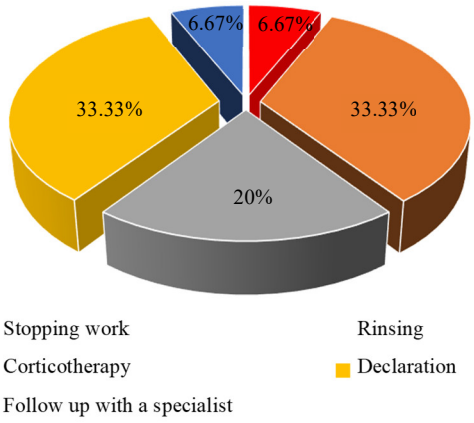

Figure 6. Distribution according to knowledge of what to do in the event of an accident

ANA handling, although 100% of participants in the present study expressed the importance of continuing education for handling these molecules. Similarly, the oncology center head asserts that his department organizes training courses regularly. However, 34% of nurses at this center have received only one training course in ANA handling since their assignments. Moreover, all these nurses reported that having only one course is insufficient. Employee information and training relating to carcinogenic, mutagenic, and reproductive risks (CMR) is a legal obligation, stemming from the French law of December 31, 1991, amending the Labor and Public Health Code to promote occupational risk prevention and Directive 2004/37/EC [18]. This training gap demonstrates the crucial importance of educating staff who should be aware of ANA risks. Thus, training should cover emergency procedures and safety equipment use, as well as awareness of everyday risks. Regular training sessions and awareness campaigns help reinforce safety culture [19].

Additionally, over 69% of nurses in the present study were unaware of the occupational risks involved in handling ANAs. Similar findings were demonstrated in Abas's [20] study. Indeed, 60% of nurses were unaware of these risks' existence. Conversely, 31% of those surveyed said they had been informed of the risks involved in handling ANAs. 30% of these participants mentioned skin irritations, and 70% were aware of the CMR nature of these drugs but were unaware of other irritation types. These results align with Leball's [15] findings, who found that 35% of nurses reported only skin irritations, 20% mentioned eye irritations, and 20% mentioned CMR effects, completely overlooking nasal mucosa ulcerations.

Regarding contamination routes, 58.63% of participants had no knowledge of these routes, compared with 41.37% who reported that contamination could occur through cutaneous (46.37%), respiratory (40.62%), and digestive (3.12%) routes. The same routes were cited in Villa et al.'s study [21] with percentages of 98%, 71%, and 5%, respectively.

Regarding means of protection, 69% of participants in this study were aware of the measures to adopt when handling ANAs. This is in line with the findings of Belal [6], who found that 73% of respondents mentioned the same. However, the observation grid revealed that 90% of nurses did not wear double gloves, 100% did not change them every 30 minutes, and only 20% disposed of them immediately after use. On the other hand, 79% reused gloves for other activities after their initial use.

Kamoun [22] reported that 70% of staff practiced hand washing before and after each manipulation, whereas in the present study, 75% of nurses did not, thus increasing the risk of digestive contamination via hand-to-mouth contact. This phenomenon was also observed by Villa [21], who noted that a quarter of nurses performed this activity daily.

In this study, over 68% of participants reported an accident while handling ANAs, including skin splashes (67%), eye projections (17%), inhalations (13%), and stings or cuts (4%). These results are consistent with the study by Bennece (14), who found that 85% of accidents involved skin splashes (100%), stings or cuts (56%), and eye projections (41%).

For effective management of these accidents, it is recommended that they be declared, as was pointed out by [23]. However, in this study, none of the accidents were reported. The main reasons given were ignorance of procedures (30%), neglect of risks (50%), and difficulty in contacting the occupational physician (20%). These results are in line with those of Bennece [14], who reported a lack of reporting in 100% of cases.

In addition, 79.31% of the participants in this study were unaware of the procedures to be followed in the case of an accident. The same finding was reported by Leball [15], who observed that 75% of staff were unaware of these procedures.

Finally, the head of the regional oncology center confirmed the existence of a medical follow-up. This result is in line with the study by [21], which reported that medical follow-up was provided in 92% of cases.

LIMITATION

The scarcity of literature and research at the national and regional level in Morocco, and the limited sample size due to staffing shortages in the studied services, restricts the generalizability of the findings.

CONCLUSION

This preliminary study carried out in the hematology department and the ROC revealed that the level of knowledge among nursing staff regarding the handling of cytotoxic products is low. This translates into a lack of awareness of risks and accident procedures involving these dangerous substances, alongside non-compliance with protection standards. Such knowledge gaps expose staff to heightened dangers, particularly during handling accidents. Moreover, improper cytotoxic waste management elevates toxic substance exposure risks. Therefore, a comprehensive study is necessary to examine the current situation in Morocco's regional oncology centers, focusing on all healthcare professional categories who contact ANAs or chemotherapy patients, who constitute potential contamination sources.

ACKNOWLEDGEMENT

The authors of the current study are grateful to all the health workers (in the ROC and “hematology” care unit of Beni Mellal RHC) who contributed to the research, as well as to the delegation of Beni Mellal for their assistance.

Conflict of interest: The authors have no conflicts of interest relevant to this article.

Funding and support: This research did not receive any specific grant from funding agencies in the public, commercial, or not profit sector.

REFERENCES

1. Cicolella A. The 2nd public health revolution. Health Environ, 2010; 22 (3): 343-51. (accessed on18/07/24.)
2. National Cancer Prevention and Control Plan 2020-2029 (NCPCP). (2020, October). Report by the Moroccan Ministry of Health and Social Security, 75 p.
3. Ministry of Health and Social Protection. National Cancer Prevention and Control Plan 2020-2029 (PNPLC). Report by

the Moroccan Ministry of Health and Social Security, 2020: 75p.
4. Roussel O, Guibal A, Belhadj-Tahar H, Sad N. Exposure to cytostatics: Toxicological risk in hospitals. Occup. Med, 2006; 108(4): 461.
5. Canadian Union of Public Employees (CUPE). Cytotoxic drugs: Health and safety, issues and research, 2011. https://scfp.ca/node/304 (accessed on 07/12/24)
6. Belal N, Bekkar M. Impact of Handling Cytotoxic Products on Staff: A Survey Conducted at Hakim Saadane and Ben Amor El-Djelani EPH Oncology Departments, Biskra. Professional Memoir, National Higher Institute of Paramedical Training, Biskra, 2016: 92p.
7. Roussel O. Exposure to cytostatics. Institut de recherche criminelle de la Gendarmerie nationale, Documents for the occupational physician, 2005; 108: 478.
8. Baabba M. Centralized Unit for Cytotoxic Reconstitution. Dissertation, Mohamed V University, Faculty of Medicine and Pharmacy, Rabat, Maroc. 2021: 91p.
9. Poupeau C, Roland C, Buissières J. Chemical risk related to occupational exposure to Atineoplasic Agents. SFSP, 2016; 68: 136. https://doi.org/10.1177/1078155216643860
10. Kassbi, A., Ghorfi, S. F. E., & Achelhi, H. Identifying occupational risks related to the patient care process. Int. J. Account, 2021; 2: 121-134.
11. International Agency for Research on Cancer (IARC). IARC Monographs - Overview Volumes 2023:1-134. https://www.cancer-environnement.fr/fiches/publications-du-circ/classification-du-circ-par-localisations-cancereuses/ (accessed on 18/6/24).
12. Bouaziz NT, Tourab D, Nezzal A. Cytostatic handling in the oncology departments of an Algerian University Hospital Center. SFSP, 2017; 29(2): 285-91.
13. Boughattas AB, Bouraoui S, Debbabi F, El Ghazel H, Saad A, Mrizak N. Evaluation of genotoxic risk in nurses handling cytostatics. Annales de Biologie Clinique, 2010; 68 (5): 545-53. https://doi.org/10.1684/abc.2010.0464
14. Bennece B, Mekharbech D, Yezzaoui I. Risks associated with handling cytotoxic drugs. Professional dissertation, National Higher Institute of Paramedical Training, Biskra 2017:75p.
15. Leball S, Meghchouche H. Handling Chemotherapy Products: A Professional Dissertation. National Higher Institute of Paramedical Training, Batna, 2012:53p.
16. Centers for the Fight Against Cancer (CFAC): National Collective Agreement for Cancer Centers of January 1, 1999 - Annexed Texts - Amendment No. 2008-02 of February 21, 2008, regarding career development for non-medical staff - Legifrance. https://www.legifrance.gouv.fr/conv_coll/id/KALITEXT000019209104 (accessed on 07/12/24)."
17. Fransman W, Kage, H, Meijster T, Heederik D, Kromhout H, Portengen L, et al. Leukemia from dermal exposure to cyclophosphamide among nurses in The Netherlands: Quantitative assessment of the risk. Ann Occup Hyg, 2014; 58(3): 271-82.
18. Alleaume MJ, Mirjol L, Clément M, Munck K, Frion L, Pineau C, et al. "Eliminating chemical and toxic risks associated with healthcare waste". School of Public Health, IPPHM, 2015;16.
19. Occupational Health and Safety at Work in Morocco. Complete Guide. Human Resources 2024. Retrieved from: https://www.ressourceshumaines.ma/sante-securite-travail-maroc/ (accessed on 13/1/25)
20. Abas K, Bekouche R. Handling chemotherapy products at the hematology department. Professional dissertation, National Higher Institute of Paramedical Training, Batna 2017; 83p.
21. Villa A, Kiffer N, Bibolet S, Canal-Raffin M, Lehucher-Michel MP. Survey of nurses' knowledge of chemical risk to Antineoplastic Agents. Arch Occup Environ Dis, 2020; 81(5): 464-66.
22. Kamoun H, Sassi O, Zhaira S, Mezlini A, Slimene FB. Risks associated with handling cytotoxic products in the hospital environment: Evaluating the practices of care staff. Arch Occup Environ Dis. 2016; 77(3): 545. https://doi.org/10.1016/j.admp.2016.03.440.
23. Desplat L. Exposure of healthcare personnel to Antineoplastic Agents, Master's thesis, Aix-Marseille Université, Faculty of Pharmacy, 2016: 62p.