

## Research article

## Occupational Risks of Handling Anticancer Drugs Among Nursing Staff in Fez, Morocco: A Cross-sectional study

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### Abstract

Scientific, technological and organizational advances have led to significant progress in the drug management of cancer patients. However, these anticancer drugs can have risks on healthcare professionals and assessing these risks in all departments of oncology is required for the use of anti-cancer drugs in healthcare settings. The aim of this study is to describe risk prevention measures related to the handling and management of anticancer drugs by nursing staff working at Hassan II University Hospital in Fez HUH-Fez, Morocco. A cross-sectional study. A tested and validated self-administered questionnaire of 30 items was conducted among 28 nurses of HUH-Fez. The response rate to the questionnaire was 96.42%. The study revealed that most nurses did not use sterile medical devices during drug preparation. The study also showed that more than half of the nursing staff (54%) don't rinse the lines at the end of each administration, and that the majority of nurses don't wear personal protective equipment. In terms of environmental protection and health, the study showed that more than half of the nursing staff (52%) were unaware of the risk of exposure to surfaces contaminated by anti-cancer drugs, 85% of participants did not use decontamination kits to clean their premises, and cytotoxic waste was not separated from other hospital waste. The handling of cytotoxic drugs is a high-risk process for the patient, the environment and the personnel handling them. This study showed that measures to prevent risks associated with the handling and management of these drugs by nursing staff in oncology departments are not strictly adhered to. In order to improve working conditions in these units, certain recommendations have been made

**Keywords:** Anticancer drugs, Risk, Prevention, Nursing staff, University Hospital Fez-Morocco.

**Citation:** Mohamed Hmidani, Inass Sabirou, Youssef Mouacha, Naoual Allali, Zineb El Othmani, Milouk Fatima Zahra, Nabila Chahboun, Mustapha Allali occupational Risks of Handling Anticancer Drugs Among Nursing Staff in Fez, Morocco: A Cross-sectional study. Journal of Nursing, Education Sciences, and Medical Practice. 2025, 1 (1), 50-59. <https://doi.org/10.69998/n52mm514>

**Edited by:** El Moussaoui Abdelfattah

### 1. Introduction:

Cytotoxic drugs are mainly used to treat cancer as part of chemotherapy (antineoplastic drugs). More recently, their use has been extended to treat certain autoimmune inflammatory diseases. These drugs are potentially dangerous to those who handle them because of their toxicity. The health effects can be caused during several activities and exposure may be through skin contact, skin

absorption, inhalation of aerosols and drug particles, ingestion, and needle stick injuries (Marie et al., 2017). Indeed, nurses and pharmacy preparers may be exposed to anticancer drugs during the preparation and administration of these products, or during the disposal of used equipment (e.g., empty bottles, syringes, etc.). Patients themselves are a potential source of contamination through their excretions (urine, faeces), vomit, or sweat, in which the drug is found

Received: January 27, 2025; Revised: September 15, 2025; Accepted: October 30, 2025; Published: March 8, 2026

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unchanged or as active metabolites (Bouley, 2002; Latouche, 2015). There is also indirect exposure through the transfer of contamination via work surfaces, non-specific equipment (computer, telephone, clothing), or equipment containing the cytotoxic drug (infusion bags or administration tubing (Garlantezec, 2001)). This can have serious health consequences. As a matter of fact, cytotoxic drugs exhibit intrinsic toxicity associated with their mechanisms of action in cells.

The literature mentioned various problems associated with the use of these drugs: irritative, allergic and general effects (headaches, dizziness, hair loss, liver damage, asthma, eczema, etc.) (Kusnetz, 2003; Krstev, 2012; Tigha-Bouaziz, 2012), carcinogenic, i.e. they can cause mutations that lead to the development of tumors in otherwise healthy cells (Fransman, 2014; Blair, 2001, Morton, 1993, Sessions, 1993, Sankila, 1990), mutagenic i.e. they alter the DNA of a living being, increasing the likelihood of mutation (chromosomal aberrations, sister chromatid exchanges, micronuclei) (Burgaz, 2002; Goloni-Bertollo, 1992; Testa, 2007; Anwar, 1994; Bouraoui, 2011; Brayen, 2010; Ursini, 2006) and reprotoxic (abortion, sterility, stillbirths, congenital malformations) (Peelen, 1999; Selevan, 1985; Stucker, 1990; Shortridge, 1995; Dranitsaris, 2005). However, no scientific study has yet shown that repeated, long-term occupational exposure to small amounts of cytotoxic drugs causes cancer. As a result, protective measures must be taken throughout the entire cytotoxic cycle. Recommendations for handling cytotoxic drugs were published in the 1980s. The authors recommended working in a vertical laminar flow hood, wearing single-use sterile gloves, and separating waste for incineration. Subsequently, recommendations were drawn up by professional associations and government institutions. In 2004, the National Institute for Occupational Safety and Health (NIOSH) issued a document on the safety of workers handling hazardous drugs, followed by the publication of a list of such drugs in 2006 (NIOSH, 2004). Even when safety guidelines are followed, a non-negligible amount of cytotoxics remains in the work environment. Specialists suggest the use of closed-circuit devices despite their high cost (Nishigaki, 2010; Sessink, 2013; Sugiura, 2014; Yoshida, 2009). Staff must be informed and receive theoretical and practical training focused on raising awareness of the risks associated with handling these substances, with an annual reassessment of knowledge, as well as occasional assessments in the form of questions and reminders by the head of department (Alleaume, 2015).

In Morocco, there are no laws or texts governing the preparation of anti-cancer drugs, and they are limited to ministerial instructions and circulars.

The aim of our work was to assess the conditions under which cytotoxic drugs are handled in oncology departments (from receipt to administration to patients and final disposal of related waste) by nursing staff at the Fez oncology hospital, Morocco, with a view to proposing appropriate

recommendations. After pre-selecting quality and safety items from various recognized references on safe handling practices, a survey was conducted.

## 2. Methodology

### 2.1. Study Design, Time, Setting, and Population

A quantitative questionnaire (survey) was employed to describe risk-prevention measures for the handling and management of anticancer drugs among nursing staff at Hassan II University Hospital in Fez. The study was conducted over a timeframe of two months (February–October 2022).

The sample was drawn from the entire population of nursing staff working in the departments of the Fez Oncology Hospital at Hassan II University Hospital in Fez, Morocco. A total of 28 respondents were accessible during the data collection period. The questionnaire was distributed to 28 nurses, yielding a 100% response rate.

### 2.2. Theoretical Framework

#### 2.3. Data Collection

The instrument for data collection was a self-administered questionnaire comprising 57 items distributed across three sections (A–C) and a seven-point Likert scale. Section A pertained to demographic characteristics and encompassed ten items, including gender, age, highest level of education attained, nursing teaching length, and professional category (6 items). Then, Section B (11 items) comprised 4 items designed to evaluate the Irritant effects or allergic reactions to chemotherapy drugs and 7 items about continuing formation. Lastly, Section C consisted of 39 items: preventive measures (27 items), Medical surveillance and monitoring (7 items), and environmental protection (6 items).

The questionnaire was developed based on an analysis of the existing literature on the research questions. Given that the participants were educated, the questionnaire's self-report nature was deemed appropriate for this study. The questionnaire was distributed to 28 nurses working in the central pharmacy (04), the internal medicine department (09), and the Oncology Centre (15) at the Fez University Hospital. The validity and reliability of a questionnaire were determined via a small-scale pilot test.

#### 2.4. Data Analysis

All processed data were entered and analyzed using Epi Info version 7.2, and the results were presented in graphs using Microsoft Excel.

#### Ethical considerations

Permission to conduct the study was obtained from the Nursing Institute in Fez, Morocco, and the Regional Health Directorate of Fez-Meknes. No further permission was necessary. All participants were briefed, both in writing and verbally, on anonymity, confidentiality, and their right to withdraw from the study at any time without consequence, and they received no monetary rewards or gifts. The data will

be destroyed using a confidential records-destruction company following the research term limit of 5 years from study completion. After collecting the data, I conducted a confidential analysis and stored the results on my password-protected personal computer. Data will be destroyed at the end of the study period, which is 5 years from the study's end.

### 3. Results and discussion

The analysis resulted in five main themes: sociodemographic, Irritant effects or allergic reactions to chemotherapy drugs, preventive measures, Medical surveillance and monitoring, and environmental protection.

### *Sociodemographic characteristics*

Table 1 shows that two-thirds of participants were females. In addition, the teachers ranged in age from 33 to 60 years, and 86% of participants were under 35, with a mean age of 43 years. On the other hand, regarding respondents' years of service, the range was 2–24 (mean = 10.53).

In terms of educational attainment, 14 % (4/28) were bachelor's degree holders, 26 % were 2nd cycle degree holders (bachelor's degree holders who complete the course in two years of full-time study in paramedical education), and 26 % were master's degree holders.

**Table 1.** Sociodemographic characteristics of participants.

Participants		28
Age, years		Mean = 43, range 33–60
Gender:	Women	19 (67%)
	Men	09 (33%)
work experience, years		Mean = 10.5, range 2–24
Educational level: Bachelor's degree/Master's degree		4 (14.2%) /24 (85.7%)
Formation of risks associated with the handling of anti-cancer drugs		Number of nurses 6/28
Age, years	< 25	6 (22%)
	25-35	18 (64%)
	35-45	2 (7%)
	> 45	2 (7%)
Seniority, years:	< 1	2 (7%)
	1-5	16 (56%)
	> 5	10 (37%)

### *Reactions to chemotherapy drugs*

This study shows that while preparing or administering anti-cancer drugs, all nurses had experienced reactions to anti-cancer drugs. Among the risks reported were allergic reactions, including skin irritation and respiratory allergies, in 59% of respondents. Similarly, 34% of nurses reported digestive problems (vomiting, diarrhea, nausea), and 70% of nurses had experienced headaches or constant headaches. These results are comparable to those of an empirical study carried out by Meziene et al. (2010) at the University Hospital of Tlemcen on the exposure of nurses to cytostatic

drugs, which shows that the reactions observed in nurses following exposure to anticancer drugs are generally headache, dizziness and skin irritation in 35% of cases, and reproductive problems such as abortion in 10% of cases. Similarly, Podilsky (2011), Kaestli (2008) and Bouley (2002) state that increased exposure to anticancer drugs poses serious health risks to nurses. These risks are immediate in the case of skin contact (reddening, irritation, burning) or inhalation of vapors (cough, respiratory problems), and are especially common symptoms (sickness, vomiting, allergy, etc.).

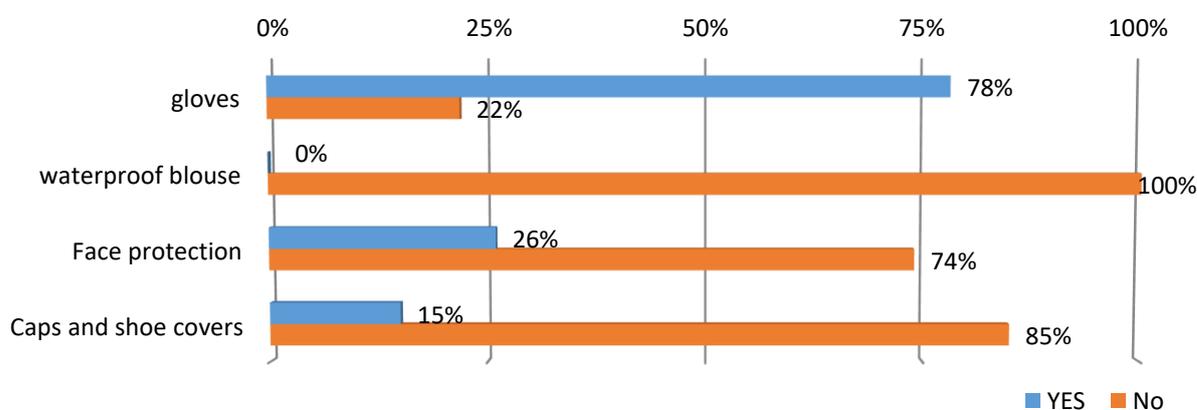
**Table 2.** Reactions to chemotherapy drugs/cytotoxic

Reactions to chemotherapy drugs/cytotoxic	absolute frequency	relative frequency
Allergic reactions		
Yes	17	60.71 %
No	11	39.28 %
Types of allergic reactions		
skin	13	46.42 %
respiratory	8	28.58 %
ocular	7	25 %
Headaches and cephalalgia		
Yes	20	71.42 %
No	8	28.58 %

**Protective measures when handling anti-cancer drugs**

Figure 1 shows that not all staff handling anticancer drugs wear waterproof gowns; the majority of them (74%) do not use face protection, and 85% do not wear caps or shoe covers. These results are in line with a 2008 study conducted at the National Institute of Oncology in Rabat, which found that 96% of the nursing staff surveyed did not use personal protective equipment (Boukrim, 2006). Similarly, a survey carried out at the Sidi-Bel-Abbès University Hospital by Mal in 2007 showed that the protective equipment used when handling cytotoxics was modest: no gowns, only short-sleeved gowns, 62.5% of nursing staff wore gloves, 62.5% did not use masks, and 87.5% did not wear goggles (Mal, 2007). This is also consistent with the findings of LE and Caudron (2015), who stated that protective clothing

(waterproof gowns, overshoes, caps, facial protection) was not always used in the chemotherapy preparation or administration unit. When administering cancer drugs, not all nurses in the unit use single- or multiple-arm systems due to equipment limitations, and 54% do not flush the lines at the end of each dose. These findings are in line with a 2008 study conducted at the National Institute of Oncology in Rabat, which found that the place and equipment used to prepare chemotherapy don't comply with recommendations for the use of anticancer drugs. According to this study, 57% of staff prepare cancer drugs in the treatment room, more than a quarter in a special room and 17% at the patient's bedside (Boukrim, 2006; Latouche, 2015; Hubert, 2009). It is clear that preventive and corrective measures should be implemented and integrated into the procedural documentation system in the event of failure in any process across the various areas (Daoudi, 2023).



**Figure 1.** Protective equipment used when handling anti-cancer drugs.

**Table. 3** Protective measures during the anticancer drugs circuit.

Variable	Frequency	%
<b>Do you wear gloves when handling chemotherapy drugs ?</b>		
Yes	22	78.57%
No	6	21.43%
<b>the type of gloves used :</b>		
vinyl	9	32.15%
latex	12	42.85%
nitrile	0	0%
neoprene	7	25%
<b>Do you wear blouses that meet the criteria for waterproof blouses?</b>		
Yes	28	100%
No	0	0%
<b>type of face protection used :</b>		
Face shield	28	100 %
Safety goggles	0	0%
Mask	0	0%
Surgical mask	0	0%
<b>Do you wear Bouffant caps and shoe covers in the chemotherapy unit?</b>		
Yes	4	14.28%
No	24	85.72%
<b>you wash your hands before wearing PPE</b>		
Yes	20	71.42%
No	8	28.68%
<b>Do you wash your hands before wearing personal protective equipment PPE?</b>		
Yes	12	42.85%
No	16	57.15%
<b>Do you remove and replace PPE (personal protective equipment) in the event of contamination or a spill?</b>		
Yes	15	53.57%
No	13	46.43%
<b>Do you use single-arm (SATs) or multi-arm (MATs) trials for administering chemotherapy drugs?</b>		
Yes	0	0%
No	28	100%
<b>Do you flush the infusion lines at the end of the administration of chemotherapy drugs ?</b>		
Yes	13	46.42%
No	15	53.58%

### Medical surveillance and monitoring

All respondents had undergone a fitness assessment before starting work in the cancer preparation unit, oncology centre or internal medicine department, and were not monitored to determine their level of exposure to chemotherapy drugs. Only about 16% of the women changed jobs during pregnancy or breastfeeding. These findings are in line with a study conducted by Boukrim at the National Institute of Oncology in Rabat in 2008, which showed that almost all nurses involved in the preparation of anti-cancer drugs had not undergone a medical examination prior to their

assignment to these departments, only 17% (4 people) of them had a medical file with the occupational physician and only one person had undergone clinical, biological and radiological examinations (Boukrim, 2006).

This does not correspond to the recommendations of the National Institute for Occupational Safety and Health (NIOSH). Similarly, authors such as Benzarti-Mezni, (2016) and Caillaud, (2002) have recommended that nurses should undergo an aptitude test to assess the absence of contraindications to working in oncology departments and to provide information on the risks associated with handling cancer-related drugs. In line with this, Libbey (2004) and

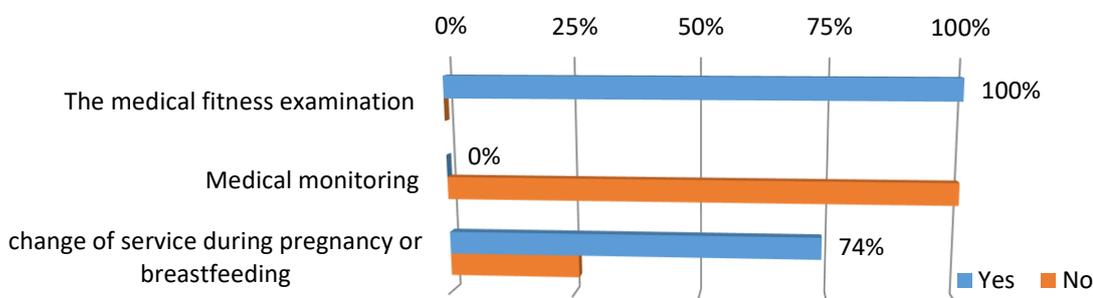
Meziane et al. (2010) recommend that staff exposure levels should be determined by calculating the cytotoxic contact index. In the event of an accident or contamination by cytotoxic agents, a doctor should be consulted, the accident should be reported as an occupational injury and the victim should be regularly monitored by the occupational physician to ensure that he or she is progressing well (Mal, 2007). Furthermore, Figure 2 shows that 84.2% of pregnant or

breastfeeding women do not stop work in the preparation unit, the oncology centre, or the internal medicine department. This is not in line with recommendations. Indeed, Chatti, M, and Nouaigui (2016) and Desplat, (2017) recommend that pregnant or breastfeeding women should not be assigned or kept at workstations that expose them to agents toxic to reproduction.

**Table 3.** Medical surveillance and monitoring

Variable	Frequency	%
<b>Did you have an aptitude test before preparing chemotherapy drugs?</b>		
Yes	28	0 %
No	0	100%
<b>Have you had a medical check-up to determine your level of exposure?</b>		
Yes	0	0 %
No	28	100%
<b>If you were pregnant or breastfeeding, did you stop working in the chemotherapy preparation or administration unit?</b>		
Yes	5	(17.85%) 26.31 % of women
No	14	(50%) 73.69 % of women
<b>Did your basic training include a course on preventing and managing hazards associated with handling chemotherapy drugs?</b>		
Yes	3	10.71 %
No	25	89.29 %
<b>Before you started working in the chemotherapy or radiotherapy department, were you told about the dangers of handling chemotherapy drugs?</b>		
Yes	13	46.42%
No	15	53.58%
<b>Are you aware of the risks associated with touching surfaces contaminated with chemotherapy drugs?</b>		
Yes	13	46.42 %
No	15	53.58%
<b>Have you received regular training in handling chemotherapy drugs?</b>		
Yes	10	35.71%
No	18	64.29%
<b>Do you know what to do if you are contaminated by an chemotherapy product (contaminated needle, skin contact...)?</b>		
Yes	11	39,28%
No	17	60,72%
<b>Are you aware of the risk of exposure to contaminated surfaces with chemotherapy drugs?</b>		
Yes	13	46.42%
No	15	53.57%
<b>Do you use decontamination kits in the event of spills or surface contamination by chemotherapy drugs?</b>		
Yes	4	14.28 %
No	24	85.72 %

<b>Do you use a space on the preparation table when preparing chemotherapy drugs?</b>		
Yes	0	0
No	28	100%
<b>Do you sort waste after preparation and administration of chemotherapy drugs?</b>		
Yes	4	14.29 %
No	24	85.71 %
<b>Nursing staff satisfaction with safety conditions in the cancer preparation and administration unit</b>		
very satisfied	0	0 %
satisfied	3	10.72 %
disatisfied	5	17.85 %
very disatisfied	20	71.43 %

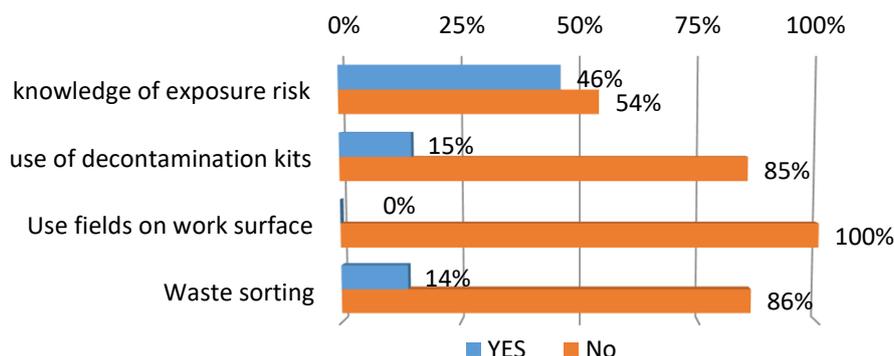


**Figure 2.** Monitoring of nurses handling anti-cancer drugs

**Environmental protection**

About half of the respondents (51.90%) were unaware of the risk of exposure to surfaces contaminated with cancer drugs, and 85% of the nurses did not use decontamination kits in the event of spills or surface contamination. The entire population surveyed did not use an impermeable drape during the preparation and administration of cancer drugs, and the majority (85%) did not sort waste at the end of handling cancer drugs. These results are in line with a study carried out at the INO in Rabat in 2008, which showed that 35% of the nurses interviewed did not comply with environmental protection measures during preparation, and

that only one unit had a room that appeared to meet the isolation criterion, protected from draughts, with no air treatment system, a non-functioning sluice and smooth surfaces (Boukrim, 2006). These results do not correspond to the environmental protection measures recommended by authors such as Joly and al., who require surface decontamination using decontamination kits containing absorbable and non-absorbable elements (Joly, 2015). The work surface must be smooth, non-absorbent, washable, and easy to disinfect. It must be protected by a drape (sterile or not) with an absorbent side and an impermeable side (Kaiser et al., 2001). Waste must be sorted and disposed of efficiently to ensure safety and protect the environment (Omédit haute Normandie, 2011).



**Figure 3.** Preventive measures to protect the environment.

### **Recommendations:**

We proposed corrective actions to improve the handling of cytotoxics for all involved, including preparers and nurses, in order to minimise cytotoxicity. We recommended:

The development of a guide of best practices and the incorporation of the the National Institute for Occupational Safety and Health (NIOSH) recommendations. Enforce Personal Protective Equipment use with supervision and penalties for non-compliance. In the event of contamination and after each chemotherapy session, systematically change work surfaces, gloves, examination sheets, and bed linen. Regular cleaning of the office and equipment. Collect the waste in these units as cytotoxic waste and apply the same measures recommended for cytotoxic waste, or place it in a separate area. Mandatory annual training sessions on cytotoxic drug handling for Healthcare workers. Creation of an oncology nursing option. A Creative and probant research can be undertaken in order to increase the stock of knowledge using a qualitative research design in order to improve practices of healthcare workers.

### **4. Conclusion**

In the light of our study, it seems appropriate to improve the conditions under which cytotoxic drugs are handled by setting up a medical and environmental monitoring programme involving all the nursing staff in the medical, oncology and central pharmacy departments of the Hassan II University Hospital (HUH) in Fez, Morocco. This study will make it possible to improve working conditions in these units, taking into account recommendations, and will also open the door to other, more in-depth studies to identify the problem and better control the precautions to be taken by professionals at work, according to the correct procedures for preparing and administering these dangerous drugs. Finally,

although this study was interested in describing the specific actions to be taken to optimise each failure and thus protect staff, patients and the environment from the risks with the handling of anti-cancer drugs in the departments of the Fez Oncology Hospital. It would be relevant to verify these measures in other centres in Morocco and to check the impact of continuous training on improving nursing practice and preventing the risks associated with the handling of anti-cancer drugs by nursing staff in the Fez Oncology Hospital.

### **Conflicts of Interest**

Nil to declare.

### **Funding**

This was an unfunded study.

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