Bulletin de veille n° 80

1er septembre 2026 – 31 octobre 2026

Surveillance biologique de l'exposition professionnelle aux médicaments cytotoxiques. Etude de terrain.

Objectif : *Disposer d'une connaissance actualisée du sujet en accompagnement des demandes d'assistance qui découlent de la valorisation de l'étude sur la surveillance biologique de l'exposition aux médicaments cytotoxiques en milieu hospitalier.*

La validation des informations fournies (exactitude, fiabilité, pertinence par rapport aux principes de prévention, etc.) est du ressort des auteurs des articles signalés dans la veille. Les informations ne sont pas le reflet de la position de l'INRS. Les éléments issus de cette veille sont fournis sans garantie d'exhaustivité.

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- ***Articles de périodique (PREPRINT)***

Lema-Atán J., Lendoiro E., Cruz A., Bernardez B., Cobo-Golpe M., Mayo N., Blanco-Ces M., Tourís M., López-Rabuñal Á., Zarra I., López-Rivadulla M. and de-Castro-Ríos A.
How safe is occupational exposure to citostatic drugs? Results from environmental and biological monitoring.
Farmacia Hospitalaria, 7 septembre 2026

Résumé: *OBJECTIVE: Occupational exposure to cytostatic drugs has been associated with acute and chronic toxicity. Despite the publication of guidelines and measures for safety handling, contamination is still reported in most recent studies. The aim of the present work was to assess contamination of cytostatic drugs in a hospital from the North of Spain. METHODS: Working surfaces from the Pharmacy and the Onco-Hematology services were tested for gemcitabine, dacarbazine, methotrexate, cyclophosphamide, doxorubicinol, doxorubicin, epirubicin, irinotecan, vinorelbine, etoposide, docetaxel and paclitaxel. Urine samples from workers were also analyzed. RESULTS: Within the Pharmacy service, contamination was detected in 57.6% of the collected samples, with cyclophosphamide and gemcitabine being the most detected compounds. At the Onco-Hematology service, contamination was present in 32.3% of the samples collected from infusion pumps, armchairs and surrounding floors, and in all samples collected from the toilets (all positive for gemcitabine, irinotecan and paclitaxel). Low concentrations (<100 pg/cm(2)) were detected in ≥76% of the contaminated samples in all the locations, except for the outpatients' area bathrooms, where this value was <40%. In addition, 60.7% of vials, blisters and infusion bags sampled were contaminated. Only 2 of the 82 bracelets worn by workers showed contamination with cyclophosphamide. Finally, all the urine samples were negative. CONCLUSIONS: Despite the low levels of contamination, it is advisable to carry out monitoring campaigns to maintain workers' awareness and to take corrective actions to minimize occupational exposure.*

https://doi.org/10.1016/j.farma.2026.06.012

O'Halloran A., Sessink P., Rankin K., O'Neill K., Clarito R.Z. and Drury A.
Assessing Surface Contamination by Hazardous Drugs in a Comprehensive Cancer Centre in Ireland Using Surface Wipe Sampling.
Seminars in Oncology Nursing, 29 septembre 2026

Résumé: *OBJECTIVE: To assess surface contamination by hazardous drugs in a comprehensive cancer centre in Ireland using surface wipe sampling. METHODS: This is a cross-sectional study using surface wipe sampling to assesses surface contamination by hazardous drugs in a Haematology Oncology Department. Wipe samples were collected from 42 surfaces across three clinical areas. Samples were analysed for six hazardous drugs: cyclophosphamide, etoposide, 5-fluorouracil, gemcitabine, ifosfamide and paclitaxel using liquid chromatography-tandem mass spectrometry. RESULTS: This study found all hazardous drugs were detected at one or more sample sites across three clinical Haematology and Oncology areas. The detected hazardous drugs found included cyclophosphamide, 5-fluorouracil, etoposide, gemcitabine, ifosfamide and paclitaxel. Across all three areas, patient bathrooms were the most commonly contaminated surfaces. This study found the Haematology Oncology Day Ward had the highest number of surfaces contaminated with hazardous drugs, with five of fourteen surfaces tested and five of six drugs detected. CONCLUSION: This research emphasizes, surface wipe testing as an essential occupational safety data tool, to obtain a full picture of hazardous drugs contamination in clinical areas. IMPLICATIONS FOR PRACTICE: The importance of compliance with correct personal protective*

equipment to all nursing staff is a key implication for practice. This study's results can be used in national Systemic Anti-Cancer Therapy training programmes for new nurses to the area of Cancer Care. Nurses are in a prime position to monitor for hazardous drugs contamination. This allows a clinical area to benchmark hazardous drugs contamination on an annual basis.

https://doi.org/10.1016/j.soncn.2026.152393

Yoshida K., Maeda A., Asano K., Tomiyasu N., Iida Y., Takahata C. and Uchida K.
Environmental contamination with fluorouracil on floors and ceilings in antineoplastic drug preparation and nonpreparation areas of a Japanese cancer center.
Journal of Oncology Pharmacy Practice, 9 octobre 2026

Résumé: *IntroductionEnvironmental monitoring of antineoplastic drug contamination has primarily focused on medication preparation areas and frequently touched surfaces. Consequently, contamination in nonpreparation areas and on infrequently touched surfaces, such as ceilings, remains poorly characterized. This study evaluated fluorouracil contamination on floors and ceilings in preparation and nonpreparation areas.MethodsThis study was conducted at Aichi Cancer Center, Japan. Samples were collected from floor and ceiling surfaces in the hospital pharmacy, outpatient chemotherapy center, and inpatient ward. Cleaning practices at the sampling sites were also assessed. Fluorouracil concentrations were measured using liquid chromatography-tandem mass spectrometry. At the time of sampling, closed-system drug-transfer devices (CSTDs) were not used for fluorouracil preparation or administration.ResultsFluorouracil was detected on all sampled floor and ceiling surfaces, including those in nonpreparation areas where antineoplastic drugs were not handled. The highest contamination levels were detected on the preparation room floor (3.104 ng/cm(2)) and the pharmacy break room ceiling (2.440 ng/cm(2)). In the outpatient chemotherapy center, relatively high contamination levels were detected on the nursing station floor (0.622 ng/cm(2)) and nursing break room ceiling (0.419 ng/cm(2)).ConclusionsFluorouracil contamination was detected in nonpreparation areas and on ceiling surfaces near air-conditioning units that were not routinely touched or cleaned. These findings suggest that contamination may spread through the movement of healthcare workers and materials and may accumulate on infrequently cleaned surfaces. As part of contamination control, the use of CSTDs may need to be implemented and environmental monitoring may need to be extended beyond medication preparation areas.*

https://doi.org/10.1177/10781552261495860

- ***Articles de périodique***

Chang Y.L., Lin Y.C., Hung L.C., Chen H.M., Hsieh T.Y. and Yen C.H. (Préprint dans Bulletin n° 79)
Virtual reality simulation for chemotherapy drug spill management training in pharmacy education: A cohort-allocated crossover quasi-experimental study in Taiwan.
BMC Medical Education, Volume 26, 2026, article 1544

Résumé: *BACKGROUND: Hazardous drugs such as antineoplastic agents pose occupational risks to healthcare workers, making appropriate chemotherapy spill management essential for workplace safety. Hands-on training opportunities in pharmacy education are often limited by safety concerns and resource constraints. Virtual reality (VR) simulation may provide immersive, guided rehearsal without hazardous-*

drug exposure, but comparative evidence remains limited. OBJECTIVE: This study examined changes in pharmacy interns' self-perceived knowledge, understanding, and ability following VR simulation-based training and traditional instructor-led instruction and explored whether short-term changes differed between the two cohort-defined instructional orders. METHODS: This cohort-allocated crossover quasi-experimental study included 37 pharmacy interns at a tertiary medical center in Taiwan. Instructional order was assigned by training cohort rather than by individual randomization and was completely confounded with cohort and calendar period. Cohort 1 (n = 17) received instructor-led instruction followed by VR training; Cohort 2 (n = 20) received the reverse order. Four single-item domains-knowledge of spill-kit contents, understanding of spill-management procedures, ability to independently don personal protective equipment (PPE), and ability to independently manage a spill-were assessed using a 5-point response scale at baseline, after the first intervention, and after crossover. Non-parametric tests were used. RESULTS: After the first session, self-perceived scores increased significantly across all four items in both cohorts (all $p < 0.001$). The instructor-led-first cohort showed greater first-phase changes than the VR-first cohort in self-perceived knowledge of spill-kit contents ($p = 0.006$) and ability to independently don PPE ($p = 0.047$); differences in the other two items were not statistically significant. These findings could not be attributed to instructional modality alone. Following crossover, second-phase change scores did not differ significantly between the cohort-defined orders ($p = 0.221$-0.956). All participants met the prespecified satisfaction criterion for the VR training (37/37, 100.0%; rating ≥ 4/5); 27 (73.0%) identified instructor-led explanation combined with VR as the most helpful option, and 28 (75.7%) indicated that VR could not replace instructor-led explanation. CONCLUSIONS: Both first-session instructional approaches were followed by short-term increases in pharmacy interns' self-perceived knowledge, understanding, and ability. Because instructional order was completely confounded with cohort and calendar period, the absence of significant second-phase differences neither establishes equivalence between the orders nor rules out an instructional-order effect. VR may serve a complementary rather than competing instructional role and provide a safe approach for rehearsing hazardous-drug spill-management procedures. These conclusions are limited to short-term self-perceived outcomes and post-training learner perceptions.

https://doi.org/10.1186/s12909-026-09864-7

Sun J., Liu B., Li Z., Hu R. and Bai S.
Exploring the occupational protection potential of an intravenous compounding robot across the cytotoxic drug workflow.
Frontiers in Public Health, Volume14, 2026, article 1901687

Résumé: *OBJECTIVE: To evaluate an intravenous compounding robot's occupational protection across the full workflow (compounding, packaging, administration) by measuring cytotoxic drug residues, and to assess its cleaning protocol and cross-contamination risk for subsequent non-cytotoxic drug compounding. METHODS: (1)Questionnaire survey: Cytotoxic drug handlers at various workflow stages were surveyed for occupational protection and awareness. (2) Experimental study: Cyclophosphamide and fluorouracil were selected for a 3-day robotic vs. manual compounding comparison. Surface wipes samples from 168 sites were quantified by HPLC-MS/MS. (3) Recommendations were derived by integrating the questionnaire and experimental results. RESULTS: The survey revealed that all respondents (100%) acknowledged that their work stage involved an occupational exposure risk and that protective measures were necessary, but only compounding staff strictly adhered to protection, 18.2% of packaging staff, 14.3% of transport workers lacked gloves, while only 45.5% of nurses always wear gloves each time. Experimental data showed that robotic compounding substantially reduced surface residues at compounding sites (gloves and gown sleeves) compared with manual compounding, with manual groups showing sporadic extreme values (e.g., fluorouracil on gloves: 834.340 ng/cm(2)). Residues were also detected on packaging and administration-particularly in the manual group (fluorouracil on bags:*

up to 734.704 ng/cm(2))-indicating that exposure risks extend beyond the compounding stage. Internal robotic residues were low, though a single post-cleaning detection of 0.018 ng/cm(2) suggests minor cleaning blind spots. No detectable cross-contamination was observed when non-cytotoxic drugs were subsequently compounded. CONCLUSIONS: This preliminary study suggests that the intravenous compounding robot shows potential for reducing occupational exposure across compounding, packaging, and administration, with the most pronounced effect observed during compounding. However, exposure risks persist in packaging and administration, particularly in manual operations, and inadequate protective awareness among staff calls for improved supervision and training. Additionally, initial findings indicate that internal contamination after cytotoxic compounding is low and can be further reduced by cleaning, supporting the tentative feasibility of using the same robot for subsequent non-cytotoxic compounding. Cross-contamination risk appears low and controllable, as yet, it has not been possible to translate residue value directly into actual cancer risks for staff, further validation is needed.

https://doi.org/10.3389/fpubh.2026.1901687

Zheng Y., Yang H., Zhao J., Zhang B., Luo J., Wen H., Sheng C. and Lu Q.
Factors Influencing the Use of Personal Protective Equipment in the Handling of Chemotherapy Drugs Among Nursing Staff in Cancer Hospitals: A Cross-Sectional Study.
Journal of Nursing Management, 2026, article e9110778

Résumé: *AIM: To assess the current use of personal protective equipment (PPE) among nurses handling chemotherapy drugs in cancer hospitals in China and to explore the factors associated with PPE use by nurses. BACKGROUND: Nurses, the primary handlers of chemotherapy drugs, face significant exposure risks. Accurately assessing PPE use and its determinants is therefore crucial for developing targeted interventions to mitigate exposure and increase occupational safety. METHODS: Convenience sampling was used to select nurses from cancer hospitals in 30 provinces in China from December 1, 2024, to January 6, 2025. A cross-sectional survey was conducted that utilised a general information questionnaire and the Hazardous Drug Handling Questionnaire. Data analysis was performed using SPSS 24.0 and SmartPLS 4.0 software. RESULTS: SmartPLS analysis revealed significant direct effects of interpersonal influences, workplace safety, self-efficacy, perceived barriers, and perceived risks on PPE usage. The mediation analysis revealed that self-efficacy, perceived risk, perceived barriers, and chemotherapy exposure knowledge mediated the relationship between chemotherapy handling experience and PPE use, whereas perceived barriers and interpersonal influences mediated the effect of workplace safety factors on PPE use. Perceived conflict of interest sharing negatively moderated the interaction between interpersonal influences and PPE usage and moderated the mediating effect of interpersonal influences. CONCLUSION: The results validated and extended the applicability of the health promotion model in the field of occupational safety behaviour. The findings revealed that a multilevel intervention system should be developed to increase the PPE utilisation rate among oncology nursing staff. IMPLICATIONS FOR NURSING MANAGEMENT: Management should foster safe environments that enable positive peer interactions, systematically transform nurses' experience into knowledge and risk awareness, and reduce perceived nurse-patient conflicts to strengthen trust and safety norm effectiveness.*

https://doi.org/10.1155/jonm/9110778

Botha R., Nelson G., Sessink P. and Brouwer D. (Préprint dans Bulletin n° 70)
Assessing antineoplastic drug contamination in South African oncology pharmacies: Workplace and biological monitoring.
Journal of Oncology Pharmacy Practice, Volume 32, Numéro 6, septembre 2026, page 1066-1075

Résumé: *IntroductionAntineoplastic drugs (ADs) are hazardous substances commonly used in medical oncology, posing health risks to pharmacy personnel through occupational exposure. Despite safety guidelines, contamination of surfaces in oncology pharmacies remains prevalent. In this study, we assessed surface contamination and biological uptake of ADs in selected South African oncology pharmacies.MethodsSix pharmacies (three from each of two medical oncology service providers, SP1 and SP2) participated. Surface wipe samples were collected from three areas in each pharmacy (containment-primary engineering control (C-PEC), floor, adjacent surface) before and after decontamination procedures. Nine ADs were quantified, using high-pressure liquid chromatography tandem mass spectrometry (HPLC-MS/MS). 24-h urine samples were collected from six pharmacy personnel. The DeRmal Exposure Assessment Method (DREAM) was used to estimate exposure risks. The results were compared with those from an observational study that assessed compliance with safety protocols in the same six pharmacies.ResultsSurface contamination was higher in SP1 than in SP2 pharmacies, with 5-fluorouracil (5-FU) being the most frequently detected AD. Post-decontamination samples showed a 17.4% reduction in 5-FU contamination, although SP1 pharmacies still had higher post-decontamination concentrations than SP2 pharmacies, especially on floors. Cyclophosphamide and ifosphamide were detected in the urine of two participants from SP1.ConclusionWe demonstrated higher contamination and occupational exposure risks in SP1 than in SP2 pharmacies, indicating a need for strict decontamination protocols and better use of personal protective equipment in the SP1 pharmacies. The SP2 pharmacies may serve as a model for oncology pharmacy safety in South Africa.*

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Feldmann A., Powell M.A., Jin H., Silva N.J., Spasojevic I. and Walton A.L.
Evaluation of Closed-System Transfer Devices in Reducing Surface Contamination With Antineoplastic Drugs in Two Patient Administration Areas.
Clinical Journal of Oncology Nursing, Volume 30, Numéro 5, octobre 2026, page 380–387

Résumé: *BACKGROUND: Antineoplastic drugs (ADs) are widely used in healthcare settings and dangerous to healthcare workers who may be exposed. Closed-system transfer devices (CSTDs) are engineering controls designed to reduce environmental exposure to ADs. OBJECTIVES: This study documents AD residue on surfaces in a high-volume outpatient infusion clinic and an inpatient oncology unit before and after the implementation of CSTDs to determine whether this engineering control decreased contamination with ADs. METHODS: The authors collected 60 surface wipe samples pre- and postimplementation in each setting to assess the detection of etoposide and cyclophosphamide. The authors also conducted semistructured interviews with nurse managers and observed environmental services workers to evaluate training and cleaning practices, respectively. FINDINGS: This study did not find a significant difference between contamination for either drug in either clinical setting after the implementation of CSTDs. Implications for nursing practice include standardizing appropriate cleaning products and protocols, assigning specific cleaning tasks to nursing, and ensuring that institutional policies for safe handling of ADs are followed.*

https://doi.org/10.1188/26.Cjon.380-387

Sessink P., Tans B. and Devolder D.
Contamination on inner walls of syringes used for compounding and administration of hazardous drugs.
Journal of Oncology Pharmacy Practice, Volume 32, Numéro 7, octobre 2026, page 1249–1255

Résumé: *PurposeThe aim of the study was to measure contamination on inner walls of syringes used for compounding hazardous drugs. As the syringes have an open connection to the environment, evaporation of the drugs could result in environmental contamination and potential exposure of healthcare workers.MethodsForty-three 50 mL BD Plastipak luer lock syringes were collected after single use in compounding hazardous drugs. The inner wall of the barrel was wiped for each syringe. Potential remaining contamination was also measured by liquid extraction to verify the effectiveness of the wiping procedure. Six hazardous drugs were tested. Liquid chromatography tandem mass spectrometry was used for the analysis of cyclophosphamide, doxorubicin, 5-fluorouracil, ifosfamide, and methotrexate. Platinum analysis of cisplatin was performed with voltammetry.ResultsContamination was found for all cyclophosphamide, doxorubicin, ifosfamide, and methotrexate syringes, for eight out of ten 5-fluorouracil syringes, and for none of the cisplatin syringes. Contamination as part of the dose transferred differs between the drugs showing the highest contamination for doxorubicin (median 21.90 ppm) followed by cyclophosphamide (median 1.24 ppm), and ifosfamide (median 0.60 ppm). The lowest contamination was measured for 5-fluorouracil (median 0.02 ppm) and methotrexate (median 0.006 ppm).ConclusionContamination was found on almost all syringes and differs between the drugs indicating some drugs stick more to the inner walls and plunger shafts than others. Contamination implies a potential exposure risk as hazardous drugs could evaporate from the open syringes, contaminate the working environment, and expose healthcare workers.*

https://doi.org/10.1177/10781552251332884