

Bulletin de veille n° 77

1^{er} mars 2026 – 30 avril 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*

Benoist H., Busson A., Faveyrial A., Bouhier-Leporrier K., Divanon F., Breuil C., Roger-Leenaert S., Palix A., Odou P., Simon N., Saint-Lorant G. (**Préprint dans Bulletin n° 55**)

Perception, knowledge, and handling practice regarding the risk of exposure to antineoplastic drugs in oncology day hospitalization units and compounding unit staff.

Journal of Oncology Pharmacy Practice, Volume 32, Numéro 2, mars 2026, page 173-183

Résumé : BACKGROUND: Antineoplastic drug exposure is a major problem in regard to caregivers' health. The aim of the present study was to assess the perception, knowledge, and handling practices of all occupation level categories of two oncology day hospitalization units and two compounding units regarding the risk of exposure to antineoplastic drugs. METHODS: This descriptive study, performed through face-to-face interviews, concurrently assessed the perception, knowledge, and handling practices of antineoplastic drugs in five different job categories in four different settings. This work was part of a larger comprehensive project examining surface and blood contamination. Different scores were assigned to evaluate responses to a questionnaire about the perception, knowledge, and handling practices of healthcare workers, a risk global score including a risk perception score, and education/knowledge and handling practices scores. RESULTS: In the survey, continuous training was associated with the global risk score ($p = 0.03$), particularly with the handling practices risk score ($p = 0.01$). Job category was also significantly associated with the global risk score ($p < 0.001$), particularly with the handling practices risk score ($p < 0.001$) and the education/knowledge score ($p < 0.001$). Pharmacy technicians had the highest score regarding risk perception (71.4%), indicating a higher perception of risk, and had a lower score regarding handling practices (25.0%) as well as a lower score (15.7%) regarding risk knowledge. Nurses and physicians had a high score (50%) regarding the risk of handling practices and a score of 57.1% regarding risk perception, indicating an increased perception of safety. Auxiliary caregivers had the highest global score (43.5%) and a score of 30.0% regarding handling practices. CONCLUSIONS: This study identified significant differences among healthcare workers depending on job categories in the antineoplastic drug handling practices and in the knowledge of the risks associated with occupational exposure to antineoplastic drugs. These differences were particularly important between trained and untrained participants, revealing the importance of implementing a continuous training program.

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Lee S., Park J., Lee M., Yoo M., Bang C., Hwang S., Kim D., Bae S.K., Kim H. and Yoon C.

Occupational Exposure Risk and Safety of Novel Intraperitoneal Oxaliplatin Delivery via Heated CO₂ and Dual-flow Nozzle System.

Safety and Health at Work, Volume 17, Numéro 1, mars 2026, page 127-133

Résumé: BACKGROUND: Peritoneal carcinomatosis is challenging to treat, with poor prognosis. Although pressurized intraperitoneal aerosol chemotherapy (PIPAC) and hyperthermal PIPAC (HPIPAC) aim to improve patients' quality of life, there is a potential risk of antineoplastic drug exposure to healthcare workers during surgery. This study evaluates the risk of oxaliplatin exposure among healthcare workers during PIPAC and HPIPAC compared to systemic intravenous chemotherapy (IV). METHODS: Oxaliplatin was administered to a swine model via IV, PIPAC, and HPIPAC in the operating room. Surface samples ($n = 484$) were collected from the operating room and

personal protective equipment (PPE), while air samples ($n = 144$) were taken near the respiratory tract. Platinum, as an indicator of oxaliplatin, was measured using inductively coupled plasma mass spectrometry (ICP-MS). **RESULTS:** Platinum was undetectable in 98.6% of the air samples, except one PIPAC leakage case. Surface contamination occurred in 8.7% of room samples and 13.9% of PPE, with gloves being most affected. Platinum contamination was also found on instruments like endoscope cameras and injectors, and cross-contamination on floors and injectors before PIPAC indicated suboptimal cleaning. No platinum was detected in the experimenter's blood and urine. **CONCLUSION:** Airborne platinum exposure was minimal when no drug leakage occurred, but surface contamination, particularly on gloves and instruments, highlighted the need for stringent protective measures to reduce occupational exposure risk. Although the possibility of inhalation exposure was low and there are no legal exposure standards for oxaliplatin, precautions should be taken to avoid potential exposure.

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Pinto T.G., da Silva Avanci L., de Aguiar G.C., de Souza D.V., Cury P.R., Renno A.C.M. and Ribeiro D.A.

Is Micronucleus Assay a Suitable Biomarker for Evaluating the Cancer Risk in Professionals Exposed to Antineoplastic Drugs? A Systematic Review.

Journal of Applied Toxicology, Volume 46, Numéro 3, mars 2026, page 733-753

Résumé: *The widespread use of antineoplastic drugs in cancer treatment has led to significant concerns regarding the potential health risks posed to healthcare professionals involved in the preparation, administration, and handling of these chemical compounds, including genotoxicity. This systematic review investigates the genotoxicity of various anticancer drugs through the micronucleus assay in mammalian cells through a comprehensive analysis of studies retrieved from PubMed, SCOPUS, and Web of Science. A systematic search conducted in May 2025 identified 28 relevant studies, all of which employed the micronucleus assay. The results indicated that 23 of the reviewed studies observed genotoxic effects linked to several drugs. As for the quality assessment, all studies (but one) were categorized as either strong or moderate; therefore, we consider our findings to be reliable. These findings raise significant concerns regarding the potential health risks associated with oncologic drugs, warranting further investigation and regulatory oversight to ensure professionals' safety. Finally, such findings are very important for clarifying the role of the micronucleus assay as a putative biomarker for evaluating the cancer risk due to anticancer drug exposure in humans.*

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Serquén López L.M., Mendoza Cornejo G.M., Torres Merino V.B., Pacheco Gonzales B., Lloclla Gonzales H. and Vélez Chicoma R.L.J.

Genotoxicity Assessment in Occupational Health Personnel Exposed to Cytostatic Drugs in a Peruvian Hospital.

Genes (Basel), Volume 17, Numéro 4, 31 mars 2026, article 418

Résumé: *The use of cytostatic drugs for cancer treatment is currently the main weapon in the fight against cancer; however, prolonged exposure of healthcare personnel can cause adverse toxic effects. Objective: To determine the genotoxicity caused by exposure to cytostatic drugs, using the comet assay, in workers in the oncology department of a tertiary hospital in northern Peru. Methodology: Descriptive, quantitative, correlational, and cross-sectional study. The population consisted of two*

groups of workers: exposed ($n = 40$) and unexposed ($n = 40$). The alkaline lysis comet DNA technique was used on peripheral blood cells; tailing moment and tailing percentage indicators were evaluated. Results: Using nonparametric tests, the percentage and tail moment showed no significant differences, with p values of 0.8928 and 0.4675, respectively. The distribution observed in the group exposed to cytostatic drugs (pharmacists and pharmacy technicians) compared to the control group showed a normal distribution, with a tail moment of 8.29 vs. 3.03 and a percentage of tail of 37.12 vs. 23.24, respectively. Multivariate analysis showed that the tail moment variable was 11.56% greater in the group of pharmacists and pharmacy technicians ($p = 0.0119$) compared to the other participants. Conclusions: Although no significant difference was found, a trend toward a higher percentage and tail moment was observed in the group exposed to cytostatic drugs. Furthermore, the group of pharmacists and pharmacy technicians, compared to the other professions, showed significantly greater damage.

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Ni X.Y., Wang H., Chen W.W., Meng X., Zhang M.P., Shao H., Zhang F. and Wang C.J.

Field-ready detection of antineoplastic drugs in workplaces using a wearable flexible surface-enhanced Raman spectroscopy platform.

Sensors and Actuators B-Chemical, Volume 452, 1er avril 2026, article 139447

Résumé: Occupational exposure to icotinib and gefitinib poses a significant health risk, underscoring the necessity for effective monitoring to safeguard environmental and occupational health. The present study introduces a wearable SERS platform designed for field-ready detection of antineoplastic drugs' contamination. The SERS substrate can be assembled on gloves within medical settings exposed to antineoplastic drugs. HOF-101 nanorods coated with gold nanoflowers were loaded on a piece of cellulose fiber membrane (HOF-101@AuNFs/CF). Benefitting from the triple synergistic effects of efficient enrichment of porous HOF-101, abundant SERS hotspots of AuNFs, and adsorption of CF, a simple, field-ready sample-processing workflow and SERS detection of drug residues on workbench's surface and pharmaceutical packaging was realized. This platform demonstrates a clear logarithmic correlation between SERS intensity and the concentration of icotinib and gefitinib within 10 ppb to 2 ppm, achieving satisfactory recovery and reproducibility. Rapid fingerprint identification and quantitative analysis of icotinib and gefitinib in different samples (workbench's surface and pharmaceutical packaging) were achieved within 5 min, with the detection limits as low as 2.26-3.00 ppb. This in-field sampling and detecting method shows promise for mitigating risks from exposure to antineoplastic agents in the medical workplace.

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Botha R., Brouwer D. and Nelson G.

A critical appraisal of South African oncology pharmacy standards: A comparison with international best practice standards.

Journal of Oncology Pharmacy Practice, Volume 32, Numéro 3, avril 2026, page 435-445

Résumé: IntroductionThe demand for oncology pharmacy services is set to increase as the burden of cancer rises in sub-Saharan Africa. Oncology pharmacists may be exposed to antineoplastic drugs (ADs) and need comprehensive health and safety guidelines. The objective of the study was to assess the effectiveness of the local oncology pharmacy practice standards, by critically evaluating them against international best practice standards.MethodsWe compared the Independent Clinical Oncology

Network (ICON) administration of ADs standards resource document (ICON standards) and Good Pharmacy Practice (GPP) standards with the International Society of Oncology Pharmacy Practitioners (ISOPP) Standards for the safe handling of cytotoxics, and the Quality standard for the oncology pharmacy service (QuaPos), using 10 domains: transport of ADs, working arrangements, education and training, engineering controls, use of personal protective equipment, risk management, medical monitoring of personnel, cleaning procedures, accident management and documentation, labelling and checking procedures. Results The ICON standards align closely with international best practice standards, but the GPP standards focus only briefly on the compounding of ADs. The GPP standards are outdated and some of the stipulations are erroneous. Oncology pharmacists would do better to adhere to the more comprehensive ICON standards, although these standards also need to be updated in line with best practice. Conclusion Revising and improving both these local standards in consultation with key role players in the oncology pharmacy industry will go a long way in protecting the health and safety of oncology pharmacists in South Africa.

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Reis A., Silva V., Joaquim J.J., Matos C., Valeiro C., Freitas C., Pereira O.R., Mateos-Campos R. and Moreira F.

Cytotoxic Drug Handling Practices Among Pharmacy Technicians in Portugal: The Dig Deeper Study.

Healthcare, Volume 14, Numéro 7, avril 2026, article 963

Résumé: Background: Occupational exposure to cytotoxic drugs remains a major concern for pharmacy personnel, due to their well-established, carcinogenic, mutagenic and organ-specific effects. Despite the existence of robust international guidelines, evidence suggests substantial variability in compliance, training quality and operational conditions across healthcare settings. Objective: This study aimed to characterise current handling practices, assess working conditions, training, safety procedures, exposure patterns, and perceived risk factors among pharmacy technicians involved in the preparation of cytotoxic drugs in Portugal. Methods: A cross-sectional descriptive study was conducted using a structured questionnaire grounded in international standards (ISOPP, NIOSH, ASHP, USP <800>). The instrument was developed through literature review, expert panel validation (n = 42), and pre-testing. Data were collected electronically between April and May 2025 from pharmacy technicians actively handling cytotoxic drugs in Portugal. Results: A total of 124 valid responses were analysed. Most participants were female (78%) and under 50 years, with nearly one-third having less than one year of experience. Prolonged daily exposure (31.5% participants worked ≥ 5 h/day) extended uninterrupted handling periods (28.2% worked > 120 min), and high preparation workloads were common. While adherence to core protective measures—such as reinforced gowns, double gloves, and Class II B2 biological safety cabinets—was high, important gaps were identified, including incomplete use of closed system transfer devices, inconsistent respiratory and foot protection, limited automation, and insufficient environmental monitoring. Structured competency assessment, periodic training, and formal documentation were frequently absent. Institutional policies on reproductive risk showed strong protection for women but less clarity for male workers. Conclusions: Cytotoxic drug handling practices in Portugal demonstrate satisfactory adherence to fundamental protective measures but reveal significant structural and organisational gaps related to workload management, environmental monitoring, and continuous training. The absence of unified national guidance contributes to variability across institutions. These findings highlight the need for greater standardisation of occupational safety practices.

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Zhao L., Guo C., Wang B.Y., Yu X.Y., Wang Q.Q. and Wu W.W.

Study on the diffusion mechanism of particulate contaminants in compounding room under multi-factor coupling in China.

Journal of Building Engineering, Volume 124, 15 avril 2026, article 115979

Résumé: With increasing demands for professional protection and pharmaceutical quality during drug compounding, pharmacy intravenous admixture services (PIVAS) have rapidly become widespread in Chinese hospitals. However, the diffusion mechanisms of particulate contaminants within these high-ventilation cleanrooms used for large-scale compounding of antineoplastic drugs (ADs) remain insufficiently characterized, raising concerns about potential occupational exposure risks. This study analyzed the effects of static occupant disturbances, the exhaust slot structure and operating modes of the biological safety cabinet (BSC) on indoor airflow characteristics and particle diffusion pathways in scenarios involving multiple pollution sources. A numerical model based on a compounding room in a Chinese hospital was constructed and experimentally validated. The fully transient Euler-Lagrange approach was employed to analyze flow field structures and particle distributions under different scenarios. Quantitative evaluations were conducted using air age, air change efficiency, concentration distribution index, and contamination removal index. The results showed that: (1) Occupants are the primary disturbance source disrupting indoor air distribution and inducing lateral airflow migration, making regular dynamic inspections necessary; (2) Inwardly inclined BSC exhaust slots can significantly reduce contaminant concentrations in the breathing zone; (3) Increasing BSC exhaust airflow enhances contaminant removal while accelerating particle diffusion within the room; (4) Room entrances/exits and areas under BSCs represent high-risk zones for particle retention and accumulation. These findings will provide valuable reference for inspecting, designing, operating, and disinfecting similar medication compounding rooms.

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