

# Surface Contamination With Antineoplastic Drugs on Two Inpatient Oncology Units

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**OBJECTIVES:** To measure surface contamination with antineoplastic drugs on inpatient oncology units and to characterize nursing staff personal protective equipment (PPE) use and factors that predict this use.

**SAMPLE & SETTING:** A descriptive pilot study of two inpatient oncology units at Duke University Hospital in Durham, North Carolina, administering etoposide and cyclophosphamide.

**METHODS & VARIABLES:** Surfaces in four patient rooms and select shared areas were swabbed with methanol, acetonitrile, and water. Samples were analyzed by liquid chromatography tandem mass spectrometry. Nursing staff (N = 27) answered questions about their demographics, PPE use, and factors that influence PPE use via online survey.

**RESULTS:** Contamination with cyclophosphamide and etoposide was detectable and quantifiable in 61% and 31% of surfaces tested, respectively. Nursing staff reported suboptimal use of PPE when administering, disposing, and handling excreta of patients. Workplace safety climate was predictive of PPE use.

**IMPLICATIONS FOR NURSING:** The potential for contamination with antineoplastic drugs in inpatient oncology units presents exposure risks for healthcare workers, patients, family members, and visitors. Future research and interventions to limit exposure and increase routine surface sampling should focus on those areas of greatest contamination, including toilet seats, a prominent finding from the current study.

**KEYWORDS** surface contamination; antineoplastic drugs; personal protective equipment

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Antineoplastic drugs (ADs) are among the most toxic of the hazardous drugs administered in healthcare settings. Even low levels of AD contamination put healthcare workers at risk for genotoxicity, carcinogenicity, teratogenicity, fertility impairment, reproductive toxicity, and/or serious organ toxicity from repeated exposures to multiple drugs (Boiano et al., 2014; National Institute for Occupational Safety and Health [NIOSH], 2004; Suspiro & Prista, 2011). Whereas inhalation, ingestion, injection, and even ocular exposure are possible, dermal exposure is the most common route of entry for healthcare workers. Dermal exposure may occur through direct contact with the AD or indirectly through surfaces contaminated with the AD.

Data on surface contamination exist, but there are still gaps in knowledge. First, there is currently no acceptable limit for AD surface contamination; rather, it should be as low as reasonably achievable (Suspiro & Prista, 2011; U.S. Pharmacopeia [USP], 2019). Second, there is a limited understanding of the areas that are most at risk for surface contamination. Most published data on surface contamination have been collected in outpatient oncology administration areas or pharmacy compounding areas (Kopp et al., 2013; Maeda et al., 2010; Salch et al., 2019; Yoshida et al., 2009). The extent of surface contamination in inpatient oncology areas, including patient rooms and shared areas, has been less studied. In addition, some studies grouped all shared and patient areas together, making it difficult to ascertain the most contaminated ones (Bussi eres et al., 2012; Connor et al., 2010, 2016; Janes et al., 2015). Understanding which surfaces are the most likely to be contaminated in patient rooms and in shared areas (surfaces where the medications are not administered and where employees are unlikely to be wearing personal protective equipment [PPE]) is needed.