



Nurses' Use of Hazardous Drug-Handling Precautions and Awareness of National Safety Guidelines

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Abstract

Purpose/Objectives: This study aims to analyze the utilization patterns of personal protective equipment (PPE) among oncology nurses during the handling of hazardous drugs (HDs) and to evaluate their awareness and adherence to safety guidelines, specifically focusing on the impact of the latest National Institute for Occupational Safety and Health (NIOSH) Alert.

Design: Descriptive and correlational research design.

Setting: The study was conducted among oncology nurses in various healthcare facilities in a metropolitan area.

Sample: The sample includes 250 oncology nurses involved in the preparation and administration of chemotherapy.

Methods: Data was collected through a self-report survey where nurses described their use of HD safe-handling precautions and their awareness of safety guidelines, including the NIOSH Alert.

Main Research Variables: The study focused on the availability and utilization of biologic safety cabinets, as well as the usage of PPE among oncology nurses.

Findings: The study revealed that a significant proportion of nurses had a high level of education, experience, and certification in oncology nursing. However, a considerable percentage of respondents were unaware of the NIOSH Alert. The use of gloves during HD handling was widespread, but gown use remained relatively low, especially during drug preparation and administration. Double-gloving was uncommon. Nurses in certain healthcare settings reported less access to chemotherapy-designated PPE and lower adherence to safety protocols.

Conclusions: The study highlights the need for increased awareness among nurses regarding HD exposure risks and the importance of proper PPE utilization. It also emphasizes the role of employers in providing adequate PPE and promoting its consistent use. Additionally, there is a need for improved methods of disseminating safety guidelines to ensure better adherence among healthcare professionals.

Implications for Nursing: The findings underscore the importance of ongoing education and training for nurses on HD safety measures. Healthcare institutions should prioritize the provision of appropriate PPE and create a culture that encourages its regular use to minimize the risk of exposure to hazardous drugs.

Introduction

Hazardous drugs (HDs) encompass pharmacologic agents exhibiting characteristics such as carcinogenicity, teratogenicity, genotoxicity, reproductive toxicity, or organ toxicity at low doses (American Society of Health-System Pharmacists, 2006). Primarily used in cancer treatment, these drugs pose a significant

occupational hazard for oncology nurses who may encounter them during preparation, administration, or handling of patient excreta. Such exposure has been linked to various acute and long-term health effects, including adverse reproductive outcomes and an increased risk of cancer.

Numerous studies have documented adverse health effects among healthcare workers exposed to chemotherapy drugs, including mutagenic activity and increased risk of genetic mutations (Falck et al., 1979; Polovich, 2003). Reports from pharmacists and nurses indicate acute symptoms like skin irritation, sore throat, and allergic reactions, as well as adverse reproductive outcomes such as miscarriages, infertility, and longer time to conception (Harrison, 2001; Kyprianou et al., 2010; Valanis et al., 1993a, 1993b; Martin, 2003).

Safe-handling guidelines recommend a combination of engineering controls, work practices, and personal protective equipment (PPE) to reduce healthcare worker exposure to HDs (American Society of Health-System Pharmacists, 2006; National Institute for Occupational Safety and Health [NIOSH], 2004; OSHA, 1996; Polovich et al., 2009). The use of biologic safety cabinets (BSCs), appropriate PPE (gowns, gloves, eye protection, and respiratory protection), and education/training are emphasized to mitigate exposure risks (NIOSH, 2004).

Despite the availability of guidelines, nurses' adherence to safe-handling precautions has historically been low (Mahon et al., 1994; Martin & Larson, 2003; Nieweg et al., 1994; Stajicj et al., 1986; Valanis et al., 1991, 1992). Studies have consistently reported suboptimal use of recommended PPE, indicating ongoing challenges in ensuring adequate protection for healthcare workers handling HDs (Kyprianou et al., 2010).

The Purpose

The purpose of the current study was to investigate the self-reported utilization of Personal Protective Equipment (PPE) among oncology nurses in handling Hazardous Drugs (HDs) and to evaluate nurses' familiarity with the latest national guidelines concerning HD safe-handling precautions. The specific objectives included:

- Describing the implementation of safe-handling precautions among oncology nurses during HD handling.
- Examining the relationship between the demographic characteristics of oncology nurses and their adherence to safe-handling practices.
- Investigating the correlation between reported handling practices and factors such as worksite characteristics and geographic location.
- Assessing nurses' knowledge regarding the National Institute for Occupational Safety and Health (NIOSH) Alert titled "Preventing Occupational Exposures to Antineoplastic and Other Hazardous Drugs in Healthcare Settings."

Methods

Sample and Setting

This study employed a descriptive, correlational design. The participants were a convenience sample of nurses attending the Oncology Nursing Society . Oncology nurses who were involved in preparing or administering chemotherapy, or both, were invited to participate. Return of the survey was considered as implied consent.

Instrument

The Hazardous Drug Handling Questionnaire, a 24-item self-report survey, was utilized based on current guidelines for handling Hazardous Drugs (HDs). The instrument gathered data on the availability and usage of Biologic Safety Cabinets (BSCs) and Personal Protective Equipment (PPE). Frequency of PPE use was rated on a 3-point Likert scale ranging from 1 (usually) to 3 (rarely). The questionnaire also included inquiries about the availability of safe-handling policies and medical surveillance in participants' practice settings. Demographic information such as employment details, nursing education, years of experience in nursing, oncology, and chemotherapy administration, and certification status were collected. Two questions were specifically related to the NIOSH Alert.

The questionnaire was adapted from the 20-item Chemotherapy Handling Questionnaire used in a previous study (Martin & Larson, 2003), which had undergone content and construct validity evaluations. Test-retest reliability over two to three weeks was found to be 0.8 in a subset of respondents.

Procedure

Surveys were distributed at the start of three educational sessions focused on HD safe handling and collected at the sessions' conclusion. The survey took approximately 5-10 minutes to complete. Descriptive statistics were used to summarize demographic data and employment setting characteristics. The chi-square statistic was employed to analyze differences in safe-handling practices based on employment setting, geographic area, nursing experience, and other variables.

Results

Participant Characteristics

The study included nurses who attended educational programs at the ONS 31st Annual Congress. Out of 400 questionnaires distributed, 335 were returned (response rate = 84%). After eliminating incomplete surveys, the final sample size was 330. Participants had a mean nursing experience of 19 years ($SD = 10.2$), a mean oncology experience of 12 years ($SD = 7.9$), and a mean chemotherapy experience of 11.5 years ($SD = 7.8$). Most participants were certified, held the OCN® credential, and worked in outpatient settings.

Adherence to Safe-Handling Guidelines

Availability of Personal Protective Equipment (PPE):

A significant portion of respondents prepared chemotherapy (about one-third), and almost all administered chemotherapy. Gloves were available for HD preparation (98%), administration (99%), and spill cleaning (100%). Chemotherapy-designated gloves were commonly provided, although latex and vinyl gloves were also used. Gowns were available to 91% of nurses for HD preparation and 84% for administration, with lower availability in private practices. Eye and respiratory protection were less frequently available than other PPE, especially in private practices.

Use of Personal Protective Equipment (PPE):

Nearly all nurses reported usually wearing gloves for HD preparation and administration. Double-gloving was uncommon (11% for preparation, 18% for administration) and more prevalent in organizations with updated safe-handling policies. Gown use varied, with 62% using gowns for preparation and 52% for administration. A significant percentage reused disposable gowns, with varying discard frequencies. Chemotherapy preparation was mainly done by pharmacists (46%), followed by nurses (35%) and pharmacy technicians (20%). Spill kits were available (97%) but not always used, especially in private practices.

Management of Spills:

While most participants reported access to spill kits, not all used them for recent spills, particularly in private practices.

Medical Monitoring

Only 47% of nurses reported that their employers provided any form of medical surveillance for those involved in HD handling. The most common form of health appraisal reported was a pre-employment physical (52%), followed by an annual screening questionnaire (30%) and an annual physical (22%). Assessment of cancer and/or reproductive history and periodic laboratory testing were performed infrequently. Nurses in inpatient settings had more access to medical surveillance compared to those in outpatient or private practice settings. However, availability did not vary by geographic region.

National Institute for Occupational Safety and Health Alert

Only 47% of nurses in the survey reported having received information about the 2004 NIOSH Alert. Nurses in inpatient settings, especially those in academic settings, were more likely to have heard of the NIOSH Alert. Nurses in public or government hospitals and health maintenance organizations were least

likely to have received information about it. Among those who were informed about the guidelines, most received the information from their employer or an ONS program.

Safe-Handling Policies and Procedures

Eighty-nine percent of nurses reported having written policies and procedures regarding HD handling. Inpatient settings were more likely to have written policies than other settings. The written policies covered various aspects such as drug administration, spill management, disposal, drug preparation, and handling of excretions. Organizations that were aware of the NIOSH Alert were more likely to update their policies to reflect the recommendations.

Discussion

The discussion of the survey results reveals several important findings regarding the use of safe-handling precautions by oncology nurses during HD handling. Firstly, the availability of PPE, especially chemotherapy-designated PPE, varies across settings, indicating a potential gap in employers' provision of appropriate protective equipment. This finding aligns with the NIOSH Alert's recommendation that employers should ensure the availability of suitable PPE for HD handling. (Fransman et al., 2007)

The study also highlights an increase in glove use among nurses, although double-gloving remains uncommon despite being recommended in recent guidelines. Gown use has improved but still presents opportunities for exposure, particularly during HD administration and disposal. Reusing disposable gowns, as reported by some nurses, raises concerns about contamination and underscores the importance of single-use protective clothing. (Kyprianou et al., 2010)

The availability and use of spill kits were generally positive, although some nurses did not use them during clean-up, indicating a need for further exploration of the reasons behind this behavior. The study also noted a lack of emphasis on medical monitoring, with less than half of participants undergoing any form of health appraisal related to HD handling. (Martin, 2005)

A notable finding is the limited awareness of the NIOSH Alert among nurses, especially those working in certain settings like government or public hospitals. This lack of awareness hinders compliance with safety recommendations and suggests the need for alternative methods of disseminating crucial safety information to all healthcare workers involved in HD handling. (McDiarmid et al., 2010)

Overall, the study underscores the importance of ensuring adequate provision of PPE, promoting adherence to safe-handling guidelines, enhancing medical monitoring practices, and improving awareness of safety recommendations among healthcare workers to minimize risks associated with HD handling. (Polovich et al., 2009).

Conclusions:

PPE use has generally improved since OSHA guidelines, but concerns remain about the inconsistent use of chemotherapy-designated gloves and lower-than-expected gown use. Inadequate provision of appropriate PPE by employers is a significant issue.

Implications for Nursing:

Further research is needed to explore barriers to implementing safe-handling precautions and understand individual and organizational factors influencing nurses' PPE use. Disseminating NIOSH Alert recommendations to all healthcare settings is crucial for implementing protective measures effectively. Improving PPE use among nurses handling HDs is essential to mitigate exposure risks and protect their health.

References

1. American Society for Testing and Materials. (2005). ASTM D6978-05 standard practice for assessment of resistance of medical gloves to permeation by chemotherapy drugs. West Conshohocken, PA: Author.

2. American Society of Health-System Pharmacists. (2006). ASHP guidelines on handling hazardous drugs. *American Journal of Health-System Pharmacy*, 63, 1172–1191. doi:10.2146/ajhp050529
3. American Society of Hospital Pharmacists. (1985). Technical assistance bulletin on handling cytotoxic drugs in hospitals. *American Journal of Hospital Pharmacists*, 42, 131–137.
4. Connor, T.H. (1993). An evaluation of the permeability of disposable polypropylene-based protective gowns to a battery of cancer chemotherapy drugs. *Applied Occupational and Environmental Hygiene*, 8, 785–789.
5. Falck, K., Gröhn, P., Sorsa, M., Vainio, H., Heinonen, E., & Holsti, L.R. (1979). Mutagenicity in urine of nurses handling cytostatic drugs. *Lancet*, 1, 1250–1251. doi:10.1016/S0140-6736(79)91939-1
6. Fransman, W., Roeleveld, N., Peelen, S., de Kort, W., Kromhout, H., & Heederik, D. (2007). Nurses with dermal exposure to antineoplastic drugs: Reproductive outcomes. *Epidemiology*, 18, 112–119.
7. Fuchs, J., Hengstler, J.G., Jung, D., Hiltl, G., Konietzko, J., & Oesch, F. (1995). DNA damage in nurses handling antineoplastic agents. *Mutational Research*, 342, 17–23. doi:10.1016/0165-1218(95)90086-1
8. Harrison, B.R. (2001). Risks of handling cytotoxic drugs. In M.C. Perry (Ed.), *The chemotherapy source book* (3rd ed., pp. 566–582.). Philadelphia, PA: Lippincott Williams and Wilkins.
9. Harrison, B.R., & Kloos, M.D. (1999). Penetration and splash protection of six disposable gown materials against fifteen antineoplastic drugs. *Journal of Oncology Pharmacy Practice*, 5, 61–66.
10. Kyprianou, M., Kapsou, M., Raftopoulos, V., & Soteriades, E.S. (2010). Knowledge, attitudes and beliefs of Cypriot nurses on the handling of antineoplastic agents. *European Journal of Oncology Nursing*, 14, 278–282. doi:10.1016/j.ejon.2010.01.025
11. Mahon, S.M., Casperson, D.S., Yackzan, S., Goodner, S., Hasse, B., Hawkins, J., . . . Witcher, V. (1994). Safe handling practices of cytotoxic drugs: The results of a chapter survey. *Oncology Nursing Forum*, 21, 1157–1165.
12. Martin, S. (2003). *Chemotherapy handling and effects among nurses and their offspring* (Unpublished doctoral dissertation). Columbia University, New York, NY.
13. Martin, S. (2005). Chemotherapy handling and effects among nurses and their offspring [Abstract]. *Oncology Nursing Forum*, 32, 425.
14. Martin, S., & Larson, E. (2003). Chemotherapy-handling practices of outpatient and office-based oncology nurses. *Oncology Nursing Forum*, 30, 575–581. doi:10.1188/03.ONF.575-581
15. McDiarmid, M.A., Oliver, M.S., Roth, T.S., Rogers, B., & Escalante, C. (2010). Chromosome 5 and 7 abnormalities in oncology personnel handling anticancer drugs. *Journal of Occupational and Environmental Medicine*, 52, 1028–1034. doi:10.1097/JOM.0b013e3181f73ae6
16. National Institute for Occupational Safety and Health. (2004). Preventing occupational exposure to antineoplastic and other hazardous drugs in health care settings. Retrieved from <http://www.cdc.gov/niosh/docs/2004-165/>
17. Nieweg, R.M., de Boer, M., Dubbleman, R.C., Gall, H.E., Hesselman, G.M., Lenssen, P.C., . . . Slegt, J.H. (1994). Safe handling of antineoplastic drugs: Results of a survey. *Cancer Nursing*, 17, 501–511.
18. Occupational Safety and Health Administration. (1986). Guidelines for cytotoxic (antineoplastic) drugs (Publication No. 8-1.1). Washington, DC: Author.
19. Occupational Safety and Health Administration. (1995). Controlling occupational exposure to hazardous drugs. Retrieved from http://www.osha.gov/dts/osta/tom/tom_vi/otm_vi_2.html
20. Occupational Safety and Health Administration. (1996). Controlling occupational exposure to hazardous drugs. Occupational Safety and Health Administration. *American Journal of Health-System Pharmacists*, 53, 1669–1685.
21. Oncology Nursing Society. (1988). *Cancer chemotherapy guidelines: Modules I–V*. Pittsburgh, PA: Author.
22. Polovich, M. (2003). *Safe handling of hazardous drugs*. Pittsburgh, PA: Oncology Nursing Society.

23. Polovich, M., Whitford, J.M., & Olsen, M. (2009). *Chemotherapy and biotherapy guidelines and recommendations for practice* (3rd ed.). Pittsburgh, PA: Oncology Nursing Society.
24. Selevan, S.G., Lindbohm, M.L., Hornung, R.W., & Hemminki, K. (1985). A study of occupational exposure to antineoplastic drugs and fetal loss in nurses. *New England Journal of Medicine*, 313, 1173–1178. doi:10.1056/NEJM198511073131901
25. Stajicj, G.V., Barnett, C.W., Turner, S.V., & Henderson, C.A. (1986). Protective measures used by oncologic office nurses handling parenteral antineoplastic agents. *Oncology Nursing Forum*, 13(6), 47–49.
26. Stücker, I., Caillard, J.F., Collin, R., Gout, M., Poyen, D., & Hémon, D. (1990). Risk of spontaneous abortion among nurses handling antineoplastic drugs. *Scandinavian Journal of Work, Environment and Health*, 16, 102–107.
27. Testa, A., Giachelia, M., Palma, S., Appolloni, M., Padua, L., Tranfo, G., . . . Cozzi, R. (2007). Occupational exposure to antineoplastic agents induces a high level of chromosome damage. Lack of an effect of GST polymorphisms. *Toxicology and Applied Pharmacology*, 223, 46–55. doi:10.1016/j.taap.2007.05.006