

WORKPLACE SOLUTIONS

From the National Institute for Occupational Safety and Health

Medical Surveillance for Healthcare Workers Exposed to Hazardous Drugs

Summary

Healthcare workers who prepare, administer, or transport hazardous drugs or dispose of hazardous drug waste may face risks to their own health such as skin disorders, reproductive disorders, and possibly cancer. NIOSH recommends that employers establish a medical surveillance program as part of a comprehensive prevention program that also minimizes worker exposure through engineering controls, good work practices, and personal protective equipment (PPE) and provides education about working with hazardous drugs. Medical surveillance involves collecting and interpreting data to detect changes in the health status of working populations potentially exposed to hazardous substances. The elements of a medical surveillance program are used to establish an initial baseline of workers' health and then monitor their future health as it relates to their potential exposure to hazardous agents. This information can be used to identify and correct prevention failures leading to disease. Early identification of health problems can also benefit individual workers.

Description of Exposure

Drugs are considered hazardous if studies in animals or humans show that they have the potential to cause cancer, reproductive toxicity, birth defects, or damage to organs at low doses [NIOSH 2004]. In the United States, an estimated 8 million healthcare workers are potentially exposed to hazardous drugs or drug waste at their worksites [BLS 2011]. Healthcare workers who should be included in the medical surveillance program are workers who may be exposed to hazardous drugs directly such as nurses, pharmacists, and pharmacy technicians; or other workers (e.g., nurses' aides, laundry workers) who may come into contact with hazardous or patient waste [OSHA 1999; NIOSH 2004; ASHP 2006; ONS 2011]. Table 1 lists job titles that may involve handling hazardous drugs. Workers may be exposed to hazardous drugs when they create aerosols, generate dust, clean up spills, or touch contaminated surfaces when compounding, administering, or disposing of hazardous drugs or patient waste [NIOSH 2004].

Exposure to hazardous drugs may occur through skin contact, inhalation, ingestion, or injection. Skin contact and inhalation are the most likely ways



Figure 1. Multi-channel infusion pump for delivery of chemotherapy.

Table 1. Job titles that may involve exposure to hazardous drugs:

1. Pharmacists and pharmacy technicians
2. Nurses (RNs, ARNPs, LPNs)
3. Physicians and physician assistants
4. Operating room personnel
5. Home healthcare workers
6. Veterinarians and veterinary technicians
7. Environmental service workers (housekeeping, laundry, maintenance workers)
8. Workers who ship, transport, or receive hazardous drugs

a worker may be exposed to hazardous drugs. However, ingestion (from hand to mouth) or injection through a needle stick or sharps injury is also possible.

Many hazardous drugs are used to treat illnesses such as cancer or HIV infection (see Figure 1). For the patients, the potential benefits of hazardous drug treatment outweigh the possible negative side effects. However, exposed healthcare workers risk the same side effects with no benefit. Workers exposed to hazardous drugs have developed skin disorders, adverse reproductive effects, and possibly leukemia and other cancers. For example, nurses and pharmacists who were exposed to hazardous drugs at their worksite reported an increase in adverse reproductive events including spontaneous abortions, stillbirths, and congenital malformations compared with unexposed healthcare workers [NIOSH 2004]. A recent epidemiological evaluation of nurses found a statistically significant, nearly 2-fold increase in risk for spontaneous abortion among those exposed to antineoplastic agents for more than 1 hour per day during the first trimester [Lawson et al. 2012].

Medical Surveillance

NIOSH recommends medical surveillance of workers who handle hazardous materials and are therefore at risk of adverse health effects from exposure. The goal of medical surveillance is to minimize adverse health effects in workers exposed to hazardous substances. By identifying and correcting failures in exposure prevention (identified through medical surveillance), employers can limit exposure and prevent adverse health outcomes in other workers (primary prevention). In addition, by identifying the earliest reversible biologic effects, exposure can be reduced or eliminated, and further adverse health effects can be limited in individual workers (secondary prevention). Medical surveillance is a second line of defense, augmenting the protection afforded by engineering controls, other administrative controls, work practice controls, PPE, and worker education about the hazards of the materials they work with or they may come into contact with in the course of their duties [NIOSH 2004; 2009]. An effective surveillance program begins with a hazard identification program that is integrated with surveillance for disease or illness. The following types of data are often obtained and evaluated by medical surveillance programs:

1. Medical (including reproductive) and occupational history
2. Physical examination
3. Laboratory studies
4. Biological monitoring

Elements of a Medical Surveillance Program

Several important issues should be considered in designing a medical surveillance program for workers responsible for handling hazardous drugs. The first is to develop an organized approach to identifying workers who are potentially exposed to hazardous drugs on the basis of their job duties. The second is to provide medical surveillance that is appropriate to the exposure because the various classes of hazardous drugs differ in their modes of action and may affect specific target organs. Because healthcare workers are typically exposed to numerous hazardous drugs [NIOSH 2004; 2012], no single biological monitor is suitable for all of these drugs. Organizations should use the information obtained through medical surveillance to help affected workers and to identify and correct system failures that may have resulted in harmful exposures.

Elements of a medical surveillance program for workers exposed to hazardous drugs should include the following:

- Reproductive and general health questionnaires completed at the time of hire and periodically thereafter (see ONS 2011 for a sample questionnaire). Unless information about relevant symptoms and medical events such as spontaneous abortions is deliberately sought, their occurrence is likely to go unreported. Opportunities to identify patterns of occurrence implying defects in engineering controls, technique, or other preventive measures may be similarly missed.
- History of drug handling as an estimate of prior and current exposure, including dates of duty assignment related to hazardous drugs and similar types of information.
- A plan to provide initial baseline clinical evaluation, including appropriately targeted medical history, physical examination, and laboratory testing for workers identified as being potentially exposed to hazardous drugs that anticipates their potential toxicities.
- A follow-up plan as needed for workers who have shown health changes suggesting toxicity or who have experienced an acute exposure (substantial skin contact or inhalation exposure, cleaning a large spill [a broken IV bag, leaking IV line], etc.).

If clinical laboratory studies and/or biological monitoring is contemplated, a rational approach to selecting clinical studies would consider the toxicity patterns of the drugs to which workers are exposed.

Medical surveillance program results should be examined in aggregate for trends that may be a sign of health changes because of exposure to hazardous drugs. If health changes are found during follow-up evaluations, the employer should take the following actions:

- Evaluate current protective measures that are already in place:

- Engineering controls (Class II biological safety cabinets/compounding aseptic containment isolators, robotic systems, ventilation, closed system transfer devices, and closed IV systems).
 - Compare performance of controls with recommended standards.
 - Conduct environmental sampling when analytical methods are available.
- Policies for the use of PPE and worker compliance with PPE use and policies.
- Availability of appropriate PPE such as double gloves tested for use with hazardous drugs [ASTM 2005], nonpermeable gowns, and respiratory protection [NIOSH 2009].

- Verify that all controls are in proper operating condition and monitor worker compliance with existing policies or when new policies go into effect.
- Develop a plan of action that will prevent further worker exposure.
- Ensure confidential two-way communication between a worker and the employee health unit regarding notification:
 - By any worker wishing to discuss a change in health condition such as pregnancy or chronic illness with the employee health unit, or
 - By the health unit, when communicating the finding of an adverse health effect and instructions for follow-up back to the workers.
- If an employee health unit is not available for a facility, workers should be encouraged to address exposure issues with their primary medical provider.
- Provide ongoing medical surveillance for all workers at risk to determine whether the new plan is effective.

Acknowledgments

The principal authors of this document were Melissa McDiarmid, University of Maryland; Martha Polovich, Oncology Nursing Society; Luci Power, Power Enterprises; and Thomas H. Connor and David Weissman of NIOSH.

The current document supersedes DHHS (NIOSH) Publication No. 2007-117, written by Melissa Leone, Apria Healthcare; Melissa McDiarmid, University of Maryland; Martha Polovich, Oncology Nursing Society; Barbara Coyle, Wisconsin State Laboratory of Hygiene; Luci Power, University of California Medical Center in San Francisco, and Thomas H. Connor and Laurence D. Reed of NIOSH. John J. Whalen,

under a contract with the Division of Federal Occupational Health, served as the lead writer/editor.

References

- ASHP (American Society of Health-System Pharmacists) [2006]. ASHP guidelines on handling hazardous drugs. *Am J Health-Syst Pharm* 63:1172-1193.
- ASTM [2005]. Standard practice assessment of resistance of medical gloves to permeation by chemotherapy drugs. West Conshohocken, PA: American Society for Testing and Materials. ASTM D 6978-05.
- BLS [2011]. Occupational employment statistics homepage. May 2011 employment and wage estimates. Washington, DC: Bureau of Labor Statistics [<http://www.bls.gov/oes.home.htm>].
- Lawson CC, Rocheleau CM, Whelan EA, Lividoti Hibert EN, Grajewski B, Spiegelman D, Rich-Edwards JW [2012]. Occupational exposures among nurses and risk of spontaneous abortions. *Am J Obstet Gynecol* 206:327.e1-8.
- NIOSH [2004]. NIOSH Alert: preventing occupational exposures to antineoplastic and other hazardous drugs in health care settings. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2004-165 [<http://www.cdc.gov/niosh/docs/2004-165/>].
- NIOSH [2009]. NIOSH: Workplace Solutions: Personal Protective Equipment for Health Care Workers Who Work with Hazardous Drugs. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2009-106 [<http://www.cdc.gov/niosh/docs/wp-solutions/2009-106/>].
- NIOSH [2012]. NIOSH list of antineoplastic and other hazardous drugs in healthcare settings (2012). Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2012-150 [<http://www.cdc.gov/niosh/docs/2012-150/>].
- ONS (Oncology Nursing Society) [2011]. Safe handling of hazardous drugs. Polovich M, ed. 2nd ed. Pittsburgh, PA: Oncology Nursing Society.
- OSHA [1999]. Controlling occupational exposure to hazardous drugs. In: OSHA technical manual (TED 01-00-015: TED 1-0.15A), Section VI, Chapter 2. Washington, DC: Occupational Safety and Health Administration [http://www.osha.gov/dts/osta/otm/otm_vi/otm_vi_2.html].

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health
4676 Columbia Parkway
Cincinnati, OH 45226-1998

Official Business
Penalty for Private Use \$300



For More Information

NIOSH has published an Alert describing measures to control worker exposure to hazardous drugs: www.cdc.gov/niosh/docs/2004-165/

Additional information about hazardous drugs is available on the NIOSH Web site at www.cdc.gov/niosh/topics/haz-drug/default.html. To receive copies of NIOSH publications, contact NIOSH at

Telephone: 1-800-CDC-INFO (1-800-232-4636)
TTY: 1-888-232-6348 ■ E-mail: cdcinfo@cdc.gov
or visit the NIOSH Web site at www.cdc.gov/niosh

For a monthly update on news at NIOSH, subscribe to *NIOSH eNews* by visiting www.cdc.gov/niosh/eNews.

**Medical Surveillance for Health Care Workers
Exposed to Hazardous Drugs**

This document is in the public domain and may be freely copied or reprinted. NIOSH encourages all readers of the *Workplace Solutions* to make them available to all interested employers and workers.

As part of the Centers for Disease Control and Prevention, NIOSH is the Federal agency responsible for conducting research and making recommendations to prevent work-related illness and injuries. All *Workplace Solutions* are based on research studies that show how worker exposures to hazardous agents or activities can be significantly reduced.

**DHHS (NIOSH) Publication No. 2013-103
(Supersedes 2007-117)**