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# Closed-System Transfer Devices Reduce Exposure to Contaminants

## When Choosing an Appropriate System, Pharmacists Must Consider All Data, as Not All CSTDs Are Equally Effective

BY KEN MAXIK, MBA, BSPHARM; CRAIG KIMBLE, PHARM.D, MBA, MS, BCACP; AND ALBERTO COUSTASSE, DRPH, MD, MBA, MPH



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**C**LOSED-SYSTEM TRANSFER DEVICES (CSTDs) are used during the preparation of hazardous drugs (HDs) as a mechanism to reduce the transfer of drugs or vapors into the environment.<sup>1</sup>

When evaluating these systems, pharmacists should consider which drugs in the pharmacy would benefit the safety of health care workers and patients using the systems. Medication types include neoplastic agents, such as bleomycin, cisplatin, and methotrexate, and other agents, such as cyclosporine, oxytocin, and progesterone.<sup>2,3</sup>

Antineoplastic drugs are generally nonselective in their mechanism of action, affecting both cancerous and noncancerous cells; this leads to adverse effects, including skin irritation, and severe effects, such as pregnancy complications and some forms of congenital disabilities. Exposure is even linked to some forms of cancer.<sup>1</sup> Therefore, nurses, pharmacists, and pharmacy technicians handling these medicines face exposure to aerosols, droplets, and vapors of dangerous chemotherapy drugs, which can easily escape standard syringes and contaminate the workplace. Furthermore, because of the adhesive properties of chemotherapy drugs, these contaminants can leave the designated workspace.<sup>4</sup> Traces of chemotherapy drugs have been found on unlikely places, such as doorknobs, keyboards, and other surfaces, placing other hospital staff members, patients, and their families at risk.<sup>2,4,5</sup>

In addition, it has been well documented that health care workers who prepare or administer these drugs may be at risk for their harmful effects.<sup>3</sup> Health care workers who are of childbearing age or pregnant are most at risk. As a result of these potentially

harmful effects, professional organizations and government entities, such as the National Institute for Occupational Safety and Health (NIOSH), have developed guidelines to protect these health care workers from unnecessary occupational exposure and adverse events related to antineoplastic drugs.<sup>1</sup>

NIOSH has defined CSTDs as drug transfer devices that mechanically prevent the transfer of environmental contaminants into the system and the escape of HDs or vapor concentrations outside the system, and has deemed CSTDs as additional engineering controls to deliver supplementary levels of safety during the compounding and administration of HDs.<sup>1</sup> CSTDs transfer medication from one reservoir to another, while limiting the potential for drug aerosolization, contamination, and HD and sharps exposure. This is important for nurses, pharmacists, and technicians. When evaluating systems, staff members face many challenges, including difficulty in assessing different systems' performance, high costs, and training.<sup>1,4,6</sup>

### How They Work

Once connected to a drug reservoir, typically a drug vial, CSTDs equalize the pressure gradient between the vessel containing the drug and the syringe. Without a pressure equalization system, pressure differences can lead to the generation of fine aerosols that may escape into the air and expose health care professionals, patients, and the environment to HDs. Other CSTDs have used an integrated filter to cleanse escaping air contaminated with HD aerosols or vapors. The use of CSTDs has been proved to reduce exposures and the presence of surface contamination.<sup>2,5</sup>



## Update on Manufacturers

The CSTD market is segmented by closing mechanism, such as click-to-lock systems, color-to-color alignment systems, leaker lock systems, and push-to-turn systems; by component, such as bag access devices, syringe safety devices, and vial access devices; by end use, such as hospitals, oncology centers, and oncology clinics; and by type, such as membrane-to-membrane and needleless systems. The market is also separated by geographic region, including Africa, Asia-Pacific, Europe, the Middle East, and North and South America.<sup>7</sup>

## Regulatory Front

Recognizing risks posed by handling antineoplastic drugs, the United States Pharmacopeial Convention (USP) has issued and continues to develop its recommendations for the safe handling of HDs in *USP <797>*, on pharmaceutical compounding and sterile preparations, and in *USP <800>*, specifically on the handling of HDs.<sup>8,9</sup> These recommendations include the required use of CSTDs when administering hazardous antineoplastic drugs and their recommended use during the compounding process.<sup>8</sup>

NIOSH recommends that health care workers use a CSTD throughout the HD-handling chain, from pharmaceutical compounding to patient dose administration.<sup>1</sup> Although all CSTDs may not be equally protective, research results show that CSTD use can reduce HD contamination.<sup>10</sup> NIOSH also reinforces the point that CSTDs should not be the only means of worker protection but should be used as part of an HD safety program and with other engineering controls.<sup>1</sup>

## Conclusion

As more research has been conducted to demonstrate the efficacy of CSTDs as a critical protective measure in oncology practice and as more regulation is implemented, CSTDs could become a

requirement in even more places rather than simply an added protective measure. When choosing an appropriate system, pharmacists must consider all available cost and efficacy data and make an informed choice, as not all CSTDs are equally effective in containing hazardous medications. Examining and comparing the design characteristics of different systems is a critical consideration. All systems, however, can improve worker safety and reduce incidental exposure to neoplastic drugs. ■

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