Medication disposal is a hot topic in pharmacy today, and it is rapidly gaining the attention of more and more professionals and consumers alike. Pharmacists have the potential to be on the forefront of this movement, but it is essential that their knowledge of proper medication disposal is current, complete, and accurate. Only about 20% of pharmacists report learning about medication disposal in pharmacy school. This article is designed to provide a background into the importance and significance of proper medication disposal, describe the correct way to dispose of unwanted medications, and provide pharmacists with examples of existing medication disposal programs. It also contains a list of resources that can be used to further expand and supplement pharmacists' knowledge of this subject.

**Pharmaceutical Waste In the Environment**

In a series of investigations performed by the US Environmental Protection Agency (EPA), multiple pharmaceutical products were detected as contaminants in various ecosystems. Compared with what is known about the effects of pesticides, little is known about the overall impact of pharmaceutical waste on the environment. Although pharmaceuticals tend to be present in relatively low levels, and the results of short-term exposure seem to be minimal, the results of long-term exposure to these low levels of pharmaceutical waste remain unknown. This uncertainty is compounded by the fact that research in this area tends to focus on acute effects of pharmaceutical waste, whereas the more subtle and chronic effects of such exposure have yet to be investigated thoroughly. Although more than 100 individual pharmaceutical and personal care products have been identified in various environments that have been studied, the presence of certain drug classes in particular is cause for elevated concern. Antimicrobials, as well as natural and synthetic steroids, which have the potential for substantial effects on the endocrine systems of exposed organisms, are among the drugs that fall into this category, along with selective serotonin reuptake inhibitors, which have been shown to affect spawning and other behaviors in shellfish, and calcium channel blockers, which can inhibit sperm activity in some aquatic organisms.

Not only does pharmaceutical waste pose an environmental risk, it potentially poses a public health risk as well. According to an Associated Press article published in 2008, both prescription and over-the-counter drugs were detected in the drinking water of at least 41 million Americans. Many water treatment systems are unable to remove all pharmaceutical products from tap water, and testing for the presence of pharmaceutical products in drinking water is not a regular practice because it is not required by the federal government. As with contamination of the environment with drug products, levels of drug contamination in tap water were considerably low, but there remains much speculation as to what risk is associated with long-term, chronic exposure to these drug products.

Most medications found in water sources originate from human waste; the body only absorbs a fraction of a medication taken orally, and the rest is generally excreted unchanged and subsequently flushed into the sewer system. This makes it even more important to refrain from flushing unused medicines or washing them down the drain because this practice increases the pharmaceutical burden on the waste stream and waterways.

**Current Medication Disposal Practices**

It was previously believed that the best way to prevent accidental consumption of prescription medications was to dispose of any unused or expired medications in the toilet or down the drain, as opposed to discarding them in the trash, where animals or humans would be more likely to encounter them. However, as awareness of the possible ecological and public health effects of medication flushing spread, recommendations for medication disposal practices began to shift. The White House Office of National Drug Control Policy (ONDCP) released an official guidance in 2007 (updated in 2009) for proper medication disposal that advises people NOT to flush their medications down the toilet or wash them down the drain and provides explicit directions for how to dispose of medications safely in the trash as solid waste.

It is unclear, however, how well these recommended disposal practices have been communicated to the general public. A study performed in 2006, in which 301 patients were surveyed in an outpatient setting, found that 53.8% of patients reported flushing their unused medications down the toilet, while 35.2% reported disposing of medications by rinsing them down the sink. A similar study completed in 2010 found that 74.2% of patients still disposed of medications via an inappropriate method, although the proportion of patients flushing their medications (27.2%) was substantially lower than in the earlier study. A significant portion of the patients surveyed disposed of medications inappropriately in the trash, either reporting that they threw their medications directly into the trash (17.7%) or dumped the medication from the bottle directly into the trash (16.9%). Although it appears practices may have shifted over time, there is still a knowledge deficit when it comes to the appropriate methods for medication disposal.

Although the disposal of hazardous pharmaceutical waste generated by health care facilities is regulated by the Resource Conservation and Recovery Act (RCRA), no such regulation governs the disposal of household hazardous wastes, which includes unused medications. Therefore, it is crucial for frontline health care professionals, and, in particular, pharmacists—who already counsel and field medication-related questions—to educate their patients on the importance of proper medication disposal and the correct way to dispose of medications, and to encourage patients to be proactive with this process. Evidence shows that this effort by pharmacists can have a substantial impact on patient behaviors. Studies have shown that educating patients on medication disposal can inspire them to change the way they dispose of their medications. One study found that previous counseling by a health care provider on how to properly dispose of medications, as well as having more recent pharmacy visits, was highly associated with returning medications to a pharmacy, as opposed to disposing of them in the toilet or sink.

When pharmacy students were used as community educators during one pharmacy's medication disposal event, a survey following the education session revealed that 80.1% of patients were motivated to change their disposal practices. Participants also reported an increased knowledge of the environmental problems associated with medication waste following the session.

**Proper Drug Disposal**

As discussed previously, a large number of pharmaceutical products are already present in the environment and in various water sources. Although it is unclear the extent to which these contaminants will ultimately impact the environment and human health, it is important to limit the amount of pharmaceutical waste that is inappropriately introduced into these areas. Proper disposal of drugs also can mitigate drug diversion, the misuse and abuse of prescription products, and the accidental ingestion of harmful substances by children or animals. Removing unwanted medications from the home reduces the risk for unintentional consumption of the wrong medication, an issue that has proven to be a significant one; in 2007 alone, there were more than 23,000 cases of accidental exposure to another person's medicine reported to poison centers across the United States.

To control the quantity of pharmaceutical products released into the environment, it is recommended that patients do not flush their unwanted medications. There are, however, certain exceptions to the “no-flush” rule, and the FDA's Web site contains a list of drugs for which the FDA does rec-
The best method for medication disposal is incineration because, even with proper disposal in the trash, pharmaceutical waste may eventually leak into the ground. However, incineration requires the collection of unwanted medicines by a third party. Community drug take-back programs or household hazardous waste collection events collect unused prescription drugs and arrange for them to be safely destroyed.

If a take-back program is unavailable, there are recommendations for disposing of medications in household trash designed to maximize the safety of this method. The ONDCP recommends removing prescription medications from their original containers and mixing them with an undesirable substance, such as kitty litter, coffee grounds, or sawdust inside of a sealable container (a plastic bag or empty margarine container are recommended). All personal information should be removed from the container label of the original prescription bottles, including the prescription number; then the sealed container with the drug mixture and the empty bottles should be disposed of in the trash. The American Pharmacists Association recommends that unwanted medications be crushed or dissolved with water prior to mixing with the undesirable substance.

Alternative recommendations published by state governments and health care organizations suggest that medica-

### Table. Medication Disposal Resources for Pharmacists and Patients

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<th>Resource</th>
<th>What They Provide</th>
<th>Where You Can Find Them</th>
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<tr>
<td>State and local governments</td>
<td>Agencies at the state and local levels are able to provide regulations for drug take-back programs, locations of controlled substance take-back collection boxes established by police departments or local drug enforcement agency field offices, waste management household hazardous waste programs, or other programs established by the state, city, or county. State boards of pharmacy also may have regulations that dictate what a pharmacist is allowed to do with respect to medication take-back programs.</td>
<td><a href="http://www.justice.gov/dea/agency/domestic.htm">http://www.justice.gov/dea/agency/domestic.htm</a> (DEA field office locations)</td>
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<tr>
<td>SMARxT Disposal</td>
<td>This public awareness campaign is the result of a partnership between the US Fish and Wildlife Service, the American Pharmacists Association, and the Pharmaceutical Research and Manufacturers of America. The Web site provides instructions for the proper disposal of medications; links to safe disposal resources, including campaign materials; news about pharmaceuticals in the environment; and answers to common questions about medication disposal.</td>
<td><a href="http://www.smarxtdisposal.net/index.html">http://www.smarxtdisposal.net/index.html</a></td>
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<tr>
<td>Dispose My Meds</td>
<td>This online resource was created by the National Community Pharmacists Association, along with various other partners. The Web site contains a tool that will locate independent pharmacies with medication take-back programs within a certain zip code, city, or state. Dispose My Meds also has information about the safety and environmental risks associated with improper medication disposal, and a media center with links to news articles, videos, and audio related to proper medication disposal.</td>
<td><a href="http://disposeymeds.org/">http://disposeymeds.org/</a></td>
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<tr>
<td>The Drug Take-Back Network</td>
<td>A joint effort by the Product Stewardship Institute and King Pharmaceuticals, this Web site contains links to local resources and events, as well as suggestions and tips for planning a take-back event. It also provides descriptions and advice from successful take-back programs, along with resources for pharmacies and organizations to adapt for their own events, such as waste inventory spreadsheets.</td>
<td><a href="http://www.takebacknetwork.com/index.html">http://www.takebacknetwork.com/index.html</a></td>
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<tr>
<td>No Drugs Down the Drain</td>
<td>Developed by the California Pharmacists Association, this Web site contains a link to search waste collection agencies that will accept unwanted medications across the United States, as well as more detailed instructions for California residents. It also contains information about the importance of safe drug disposal, with links to several other helpful medication disposal sites.</td>
<td><a href="http://nodrugsdownthedrain.org/">http://nodrugsdownthedrain.org/</a></td>
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<tr>
<td>Private companies</td>
<td>Private companies, such as Waste Management and Sharps, Inc, will provide mail-back disposal services for a fee. Patients must be advised to verify what types of medications and devices are accepted through these programs. Sharps, Inc also provides a take-away service for pharmacies that are interested in collecting patients’ unused medications on-site.</td>
<td><a href="http://www.wm.com/products-and-services/residential-curbside-pickup/household-hazardous-waste.jsp">http://www.wm.com/products-and-services/residential-curbside-pickup/household-hazardous-waste.jsp</a> (Waste Management) <a href="http://www.sharpsinc.com/unused-medications.htm">http://www.sharpsinc.com/unused-medications.htm</a> (Sharps, Inc)</td>
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tions be disposed of in their original containers. This ensures that if they are accidentally ingested, the contents can be readily identified. Personal information on the medication bottles still should be removed, and water or soda should be added to tablets and capsules to dissolve them. Again, medications should be mixed with kitty litter, coffee grounds, or a similar unappealing substance. The lid of the medication bottle should be shut and sealed with duct tape or packing tape. Then, the medication bottle(s) should be placed inside a container that is not see-through, which then should be taped shut. This container should be disposed of in the trash.10

Liquid medicines should be mixed with salt, flour, charcoal, or a nontoxic powdered spice, such as turmeric or mustard, to give the mixture an unappealing smell and texture. Medicines that come in blister packs should be wrapped in multiple layers of duct or opaque tape, and then placed inside an opaque container for sealing. Most importantly, medications should NEVER be concealed with food products because this could lead to inadvertent consumption by animals.10

Medication Disposal Programs

Several programs across the United States have been established to help patients dispose of their unused and expired medications. These programs range from local efforts organized by a single pharmacy, to statewide initiatives designed to reduce prescription medication misuse and abuse.

In 2007, the state of Maine implemented a statewide prescription mail-back program authorized to handle both non-controlled and controlled prescription medications. The program was enacted through the state legislature with help from an EPA Aging Initiative grant. The program began by targeting older adults, and eventually phased in all adult populations. Maine’s drug take-back program distributes postage-paid disposal kits to participating pharmacies and several other locations throughout the state. Contained within the kit are a postage-paid envelope, an instruction packet, and a survey. Unused medications are placed inside the envelope and returned to the Maine Drug Enforcement Agency, where they are destroyed.11

As of April 2010, the Maine take-back program had received 3,925 envelopes and disposed of more than 2,300 pounds of unwanted medications. About 17% of the returned medications were scheduled drugs (CII-CIV). The survey provided important information about the reasons users of the service possessed the unused medications. These included statements such as the following: the medications belonged to a deceased relative (19.6%), the physician told the patient to stop taking the medicine or gave the patient a new prescription (27.3%), or the patient had a negative reaction or allergy to the medication (11.9%).11

Individual pharmacies also have been getting involved on a smaller scale by organizing drug take-back events in coordination with local police or drug enforcement authorities. It is important to note that pharmacies cannot take possession of unwanted controlled substances, and, therefore, for an event to be successful, local law enforcement must be involved early in the planning process.12 It also is essential to verify if there are any state board of pharmacy regulations for pharmacist-operated medication take-back events, controlled substance laws, public safety laws concerning law enforcement possessing noncriminal evidence, and privacy laws that could impact the way an event is run within a particular state.13

When planning a medication take-back event, there are other important considerations as well. It is vital to establish a secure place to store the collected medications during the event to ensure they will not accidentally get mixed in with inventory if the event is held in a pharmacy. Other steps in planning an event include arranging adequate staff to greet, direct, and counsel patients, as well as collect, identify, and log medications; arranging for hazardous waste hauling or disposal; determining what will and will not be collected (eg, whether or not nonprescription items, sharps, thermometers will be collected); arranging for equipment and supplies such as tables and chairs, hazardous waste con-
tainers, drug references for identifying medications, computers for logging what is collected; arranging for advertising; and planning how data will be collected. Before the medication take-back event takes place, it is important to establish what the responsibilities of each person involved will be, and to ensure that correct procedures for handling (eg, wearing gloves) and packing the collected medications are understood and are followed on the day of the event.13 Medication disposal education and take-back events also are excellent opportunities for pharmacists and pharmacy organizations to coordinate with students and involve them in community outreach projects. During one such student-aided take-back event, the majority of patients reported that pharmacy students were a good resource for information on safe medication disposal.17 Not only does using students help accommodate the issue of staffing a take-back event, but getting them involved helps to impart important drug disposal knowledge to the next generation of pharmacists.

Conclusion
As drug experts and some of the most accessible health care practitioners, pharmacists are in an excellent position to educate patients on drug disposal. Pharmacists can help patients locate medication take-back services in their area, and/or plan their own event. Counseling patients on the correct ways to dispose of their medications can make a difference in their beliefs and behaviors. By getting involved in promoting safe medication disposal, pharmacists can make a difference regarding an issue that affects both public health and the environment.

References


