

Trashing old, unused medications best for reducing environmental impact

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Returning extra medicine to the pharmacy for disposal might not be worth the extra time, money or greenhouse gas emissions, according to a University of Michigan study that is the first to look at the net effects of so-called take-back programs.

The new evidence suggests that discarding unused drugs in the trash is a better option to limit the risk of poisoning and at the same time curb pollution of both water and air.

To arrive at this conclusion, the researchers compared the total emissions created by take-back, trash and toilet disposal methods. This included emissions of pharmaceutical active ingredients as well as releases of other water and air pollutants.

"National policy seems to be changing to support take-back programs, and we don't know if that's justified," said Sherri Cook, a doctoral student in the U-M Department of Civil and Environmental Engineering. Cook is first author of a paper on the findings published in the May 16 edition of *Environmental Science & Technology*.

U.S. households accumulate an estimated 200 million pounds of unused pharmaceuticals every year, the researchers say. In most cases today, the FDA recommends throwing them away, but only if you don't have access to a take-back program. Cities, states and even some stores have initiated them. From collection sites, the returned drugs are transferred to another facility where they're incinerated as hazardous waste.

Health officials caution that unused pills should be out of the house as soon as possible to prevent poisoning and drug abuse by other family members. But that need must be balanced with pollution control, both for human health and environmental reasons. Flushing unused pills down the toilet is no longer advised, as the active ingredients in drugs have been found in drinking water and aquatic environments.

The new study found:

- If half of people threw away unused medications and half took

them back to the drug store, the amount of active pharmaceutical ingredients in the environment would be reduced by 93 percent compared with today.

- If everyone trashed their extra drugs, those amounts would be reduced by 88 percent.
- That 5 percent improvement in pharmaceutical emission reduction due to take-back programs would come at a significant cost, possibly more than a billion dollars annually, along with a 300 percent increase in other emissions such as greenhouse gases and smog-forming substances.

"Nobody has ever added up all the emissions associated with disposing of medication," said Steve Skerlos, a professor in the departments of Mechanical Engineering and Civil and Environmental Engineering and a co-author of the study. "When you look at the available evidence to support take-back, it just doesn't add up."

The researchers focused on a 50 percent take-back compliance rate based on actual practice in Sweden, which has had a national take-back program for 40 years. The compliance rate there is just 43 percent. Drugs that aren't returned tend to stay in the medicine cabinet, defeating the goal of getting unused medications out of the home quickly, the researchers say.

The U-M researchers considered a wide range of factors, including how often people would return medication, how far they live from take-back sites, how rainfall might affect landfill leachate leaking into groundwater, and what percentage of residents could be expected to comply. The results surprised the team.

"We didn't expect that landfilling would be the best option, because when you incinerate something, it's gone, and when it's in a landfill, it can remain for some time," said Nancy Love, a professor in the

Department of Civil and Environmental Engineering and a co-author of the study. "However, once we considered all the environmental emissions for the three options, the results made sense."

The researchers encourage policymakers to focus on getting more people to get rid of medicines by trash, rather than take-back.

"Trashing unused medications reduces the consumer's inconvenience relative to take-back, and if there is a clear message perhaps we could increase the percentage of people putting them in the trash," Cook said.

Currently, about 60 percent of people already use trash disposal, while 40 percent of people still flush unused medication down the toilet.

When discarding pills in the trash, the FDA recommends mixing them with an unpalatable substance such as coffee grounds in a plastic bag. This helps to deter would-be abusers from picking them out of the garbage.

More information: Life Cycle Comparison of Environmental Emissions from Three Disposal Options for Unused Pharmaceuticals, *Environ. Sci. Technol.*, 2012, 46 (10), pp 5535–5541. [DOI: 10.1021/es203987b](https://doi.org/10.1021/es203987b)

Abstract

We use life cycle assessment methodology to compare three disposal options for unused pharmaceuticals: (i) incineration after take-back to a pharmacy, (ii) wastewater treatment after toilet disposal, and (iii) landfilling or incineration after trash disposal. For each option, emissions of active pharmaceutical ingredients to the environment (API emissions) are estimated along with nine other types of emissions to air and water (non-API emissions). Under a scenario with 50% take-back to a pharmacy and 50% trash disposal, current API emissions are expected to

be reduced by 93%. This is within 6% of a 100% trash disposal scenario, which achieves an 88% reduction. The 50% take-back scenario achieves a modest reduction in API emissions over a 100% trash scenario while increasing most non-API emissions by over 300%. If the 50% of unused pharmaceuticals not taken-back are toileted instead of trashed, all emissions increase relative to 100% trash disposal. Evidence suggests that 50% participation in take-back programs could be an upper bound. As a result, we recommend trash disposal for unused pharmaceuticals. A 100% trash disposal program would have similar API emissions to a take-back program with 50% participation, while also having significantly lower non-API emissions, lower financial costs, higher convenience, and higher compliance rates.

Provided by American Chemical Society

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