

# Pharmaceutical Waste Disposal Current Practices and Regulations: Review

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## ABSTRACT

The improper disposal of pharmaceutical waste has become an increasingly important environmental and public health concern in recent years. Pharmaceutical waste includes unused, expired, or unwanted medications that can be harmful if they end up in the environment or are improperly handled. This can include prescription drugs, over-the-counter medications, and veterinary drugs. Pharmaceutical waste can be generated by a variety of sources, including healthcare facilities, households, and veterinary clinics. Improper disposal of these medications can lead to water and soil contamination, as well as potential harm to wildlife and humans. In addition, pharmaceutical waste can contribute to the growing problem of antibiotic resistance and other environmental issues. To address these concerns, various disposal methods have been developed to ensure the safe and effective management of pharmaceutical waste. These methods include disposal in the trash, take-back programs, incineration, and landfill disposal. However, there is still a need for improved awareness and education on proper disposal practices among healthcare professionals, patients, and the general public. This review article aims to provide an overview of the current practices and regulations related to pharmaceutical waste disposal and the challenges and opportunities for improvement in this area. Through a comprehensive analysis of the existing literature on this topic, this article will highlight the importance of proper pharmaceutical waste disposal and the need for continued research and policy interventions to ensure a safe and sustainable approach. Our article highlights the importance of proper pharmaceutical waste disposal and the need for improved awareness and education on this topic among healthcare professionals, patients, and the general public.

**Keywords:** Pharmaceutical waste, disposal practices, environmental health, Public health

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## INTRODUCTION

The improper disposal of pharmaceutical waste has become an increasingly important environmental and public health concern in recent years. Pharmaceutical waste includes unused, expired, or unwanted medications that can be harmful if they end up in the environment or are improperly handled.<sup>1</sup> This can include prescription drugs, over-the-counter medications, and veterinary drugs. Pharmaceutical waste can be generated by a variety of sources, including healthcare facilities, households, and veterinary clinics. Improper disposal of these medications can lead to water and soil contamination, as well as potential harm to wildlife and humans. In addition, pharmaceutical waste can contribute to the growing problem of antibiotic resistance and other environmental issues.<sup>2</sup> To address these concerns,

various disposal methods have been developed to ensure pharmaceutical waste's safe and effective management.<sup>3</sup> These methods include disposal in the trash, take-back programs, incineration, and landfill disposal. However, there is still a need for improved awareness and education on proper disposal practices among healthcare professionals, patients, and the general public.<sup>4</sup> This review article aims to provide an overview of the current practices and regulations related to pharmaceutical waste disposal and the challenges and opportunities for improvement in this area. Through a comprehensive analysis of the existing literature on this topic, this article will highlight the importance of proper pharmaceutical waste disposal and the need for continued research and policy interventions to ensure a safe and sustainable approach.

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## Study Methodology

This review article on pharmaceutical waste disposal practices used a systematic approach to identify relevant studies and synthesize the findings. A comprehensive search was conducted on PubMed, Scopus, and Web of Science databases, using pre-determined search terms and inclusion criteria. The 62 studies were screened based on their title and abstract, and out of them 15 full text of the remaining studies was reviewed to determine their relevance and quality.

The quality of the 15 studies was assessed using established criteria, the Newcastle-Ottawa Scale for observational studies. The findings of the studies were then synthesized and summarized in the review article using a narrative approach. Our article highlights the importance of proper pharmaceutical waste disposal and the need for improved awareness and education on this topic among healthcare professionals, patients, and the general public.

## Common Pharmaceutical Waste Disposal Practices<sup>2-6</sup>

### *Disposal in the trash<sup>2,3</sup>*

Disposing of pharmaceutical waste in the trash is not the best method because it can pose a risk to public health and the environment. Pharmaceutical waste can contain chemicals that are harmful to humans and wildlife, and if it is not properly contained, it can lead to contamination of soil and water sources.<sup>2</sup>

Additionally, certain medications can be dangerous if they come into contact with other waste or are ingested by animals. For example, opioids and other controlled substances can be attractive to animals and pose a risk of accidental ingestion. Therefore, we must dispose of pharmaceutical waste in the trash. It is important to take steps to contain it properly. This may include placing medications in a sealed container or bag, adding water or other substances to make them less appealing to animals, and placing the container in a sturdy trash bag or can. However, it is important to note that disposing of pharmaceutical waste in the trash should be a last resort, and other methods, such as take-back programs or incineration, may be more appropriate for certain types of waste.

### *Disposal in the toilet or sink*

Disposing of pharmaceutical waste in the toilet or sink is not recommended. Flushing or pouring pharmaceutical waste down the sink can contaminate water sources and harm aquatic life. This is because sewage treatment plants are not equipped to remove all types of pharmaceutical waste, which can end up in rivers, lakes, and oceans.<sup>4</sup>

Additionally, certain medications can be harmful if ingested by animals, and flushing them down the toilet or sink can increase the risk of accidental ingestion. Suppose we need to dispose of liquid medications. In that case, it is recommended to mix them with an unpalatable substance such as coffee grounds or kitty litter before placing them in a sealed container and disposing of them in the trash. However, it is important to check local regulations, as some areas may have specific requirements for the disposal of liquid medications. Overall,

it is important to avoid disposing of pharmaceutical waste in the toilet or sink and to use other appropriate methods for the safe and responsible disposal of these materials.<sup>5</sup>

### *Take-back programs*

Many communities and pharmacies offer take-back programs for unused or expired medications. These programs allow individuals to safely dispose of their pharmaceutical waste without risking contamination of the environment or harm to public health.<sup>6</sup>

Take-back programs are an effective way to dispose of unused or expired medications safely and responsibly. Pharmacies, hospitals, other healthcare facilities, and local government agencies typically offer these programs.<sup>7</sup>

Take-back programs allow individuals to bring their unused or expired medications to a designated location, where they can be properly collected and disposed of. This helps prevent pharmaceutical waste from ending up in landfills or water sources, which can harm the environment and public health.<sup>8</sup>

There are several benefits to participating in take-back programs, including:<sup>4-6,9</sup>

- **Convenience:** Take-back programs are often available at multiple locations, making it easy for individuals to dispose of their pharmaceutical waste without having to travel long distances.
- **Confidentiality:** Take-back programs typically allow individuals to dispose of their medications anonymously, which can help reduce stigma associated with certain medications.
- **Safety:** Take-back programs ensure that medications are disposed of properly, reducing the risk of misuse or abuse by others.
- **Compliance:** Participation in take-back programs helps individuals and healthcare facilities comply with local and national regulations regarding the proper disposal of pharmaceutical waste.

Thus, take-back programs are a safe, convenient, and responsible way to dispose of pharmaceutical waste. They help to protect public health and the environment by ensuring that medications are disposed of in a way that minimizes their impact on the environment and reduces the risk of misuse or abuse.

### *Incineration*

Incineration is a method of disposing of pharmaceutical waste that involves burning the waste at high temperatures. This process can help to destroy harmful substances and reduce the volume of waste that needs to be disposed of.<sup>10</sup> Incineration can be a useful method for disposing of certain types of pharmaceutical waste, such as controlled substances or hazardous materials. However, it is important to note that incineration can also release harmful chemicals and pollutants into the air, which can have negative impacts on public health and the environment. To minimize the negative effects of incineration, it is important to ensure that the incinerator meets all local and national regulations and that proper controls are in place to prevent the release of harmful pollutants. Additionally,

it is important to prioritize other disposal methods, such as take-back programs or recycling, before incineration. Thus, incineration can be useful for disposing of pharmaceutical waste in certain situations, but it should only be used when other methods are not feasible or appropriate. It is important to prioritize safe and responsible waste disposal practices to protect public health and the environment.<sup>9,10</sup>

#### *Landfill disposal*

Landfill disposal is a common but not ideal pharmaceutical waste disposal method. When pharmaceutical waste is disposed of in landfills, it can contaminate soil and water sources, which can negatively impact public health and the environment. Many pharmaceuticals contain chemicals that can be harmful if they are released into the environment. In addition, landfill waste can produce methane, a potent greenhouse gas contributing to climate change.<sup>9</sup>

If landfill disposal is the only available option for disposing of pharmaceutical waste, it is important to take steps to minimize the negative impacts of this method. This may include properly sealing pharmaceutical waste in containers that are resistant to leaks and ensuring that the waste is placed in a designated area of the landfill that is separate from other types of waste. However, it is important to note that landfill disposal should be a last resort, and other methods such as take-back programs or incineration, may be more appropriate for certain types of waste. Prioritizing safe and responsible waste disposal practices can help to protect public health and the environment from the negative impacts of pharmaceutical waste.<sup>10,11</sup>

In conclusion, proper disposal of pharmaceutical waste is crucial for protecting public health and the environment. The most effective disposal method will depend on the type and quantity of waste and local regulations and guidelines. It is important for individuals and organizations to take responsibility for the proper disposal of pharmaceutical waste to ensure a safe and healthy environment for all.

#### **Pharmaceutical Waste Disposal - Importance<sup>9-12</sup>**

Pharmaceutical waste disposal is important for several reasons, including:

##### *Protection of public health*

Pharmaceutical waste can contain harmful substances that pose a risk to human health if disposed of improperly. These substances can include expired medications, contaminated syringes, and other medical supplies.

##### *Prevention of environmental contamination*

Pharmaceutical waste can contaminate the environment and harm wildlife if it is not disposed of properly. For example, chemicals from medications can seep into the soil and groundwater, which can affect drinking water sources and wildlife habitats.

##### *Compliance with regulations*

Local and national regulations require proper disposal of pharmaceutical waste. Failure to comply with these regulations can result in fines and legal consequences.

#### *Reducing the risk of drug diversion*

Proper disposal of pharmaceutical waste can help prevent the misuse or abuse of medications. Improperly disposed of medications can be scavenged and abused, leading to addiction and other negative consequences.

Thus proper disposal of pharmaceutical waste is essential for protecting public health and the environment and complying with regulations. It is important for individuals and organizations to follow appropriate waste disposal practices to ensure the safe and responsible handling of these materials.

#### **Pharmaceutical Waste Disposal – Regulations<sup>10-12</sup>**

Regulations regarding pharmaceutical waste disposal can vary by country, state, and even municipality. These regulations are put in place to protect public health and the environment by ensuring that pharmaceutical waste is disposed of safely and responsibly.

In the United States, the Environmental Protection Agency (EPA) has established regulations regarding pharmaceutical waste disposal.<sup>10</sup> These regulations include guidelines for the proper disposal of medications and requirements for healthcare facilities to manage and dispose of their pharmaceutical waste safely and responsibly.<sup>11</sup> Additionally, many states and municipalities have their own regulations regarding pharmaceutical waste disposal. For example, some states may require pharmacies or healthcare facilities to participate in take-back programs or to use specific methods for the disposal of pharmaceutical waste. It is important for individuals and healthcare facilities to be aware of local regulations regarding pharmaceutical waste disposal and to comply with these regulations to ensure safe and responsible waste management. Failure to comply with regulations can result in fines and other penalties, as well as negative impacts on public health and the environment.<sup>12-14</sup>

Proper management and disposal of pharmaceutical waste are crucial for protecting the environment and public health. This review article provided an overview of the current practices and regulations related to pharmaceutical waste disposal and highlighted the challenges and opportunities for improvement in this area. We found that disposal in the trash and flushing down the toilet or sink are common but inappropriate disposal methods that can lead to environmental contamination and public health risks. Take-back programs, incineration, and landfill disposal are more appropriate methods for handling pharmaceutical waste, but they also have limitations and challenges. Our review also identified the need for improved awareness and education on proper pharmaceutical waste disposal practices among healthcare professionals, patients, and the general public. There is also a need for continued research and policy interventions to ensure a safe and sustainable approach to pharmaceutical waste management.<sup>15-19</sup>

#### **CONCLUSION**

In conclusion, the proper management and disposal of pharmaceutical waste require a comprehensive and

collaborative effort from various stakeholders, including healthcare professionals, regulators, manufacturers, and consumers. By implementing appropriate disposal methods and improving awareness and education, we can ensure a safe and sustainable approach to pharmaceutical waste management and protect the environment and public health.

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