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# Optimizing Waste Reduction in Healthcare: A Nursing Perspective

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**Abstract**
Healthcare waste is a growing environmental concern, contributing significantly to pollution and greenhouse gas emissions. With over two billion tons of waste generated globally annually, healthcare systems face challenges in managing the waste effectively while minimizing environmental harm. Nurses, as frontline healthcare providers, are in a unique position to lead waste reduction initiatives. This paper explores the challenges of healthcare waste management, the impact on environmental and human health, and the significant role of nurses in addressing these issues. By implementing strategies such as proper waste segregation, education, and sustainable practices, nurses can influence policies and reduce resource consumption. Additionally, adopting a waste optimization framework and promoting sustainable procurement can help mitigate the adverse effects of healthcare waste. The discussion emphasizes the need for further research into waste management practices and the critical role nurses play in promoting environmental stewardship within the healthcare sector.
**Keywords:** Nursing, Waste reduction, Environmental health

## Introduction

Health care waste significantly contributes to environmental pollution, as evidenced by various studies (Health Care Without Harm, 2019; World Health Organization, 2018). Globally, over two billion tons of waste are generated each year (World Bank, 2022), with more than five million tons of health care-related waste being produced annually in the United States alone (Karliner et al., 2019). This amounts to an average of 29 pounds of waste per patient bed daily in the U.S. (Practice Greenhealth, 2022a). This article explores the challenges posed by waste in the healthcare sector, proposes potential solutions, and examines the critical role nurses play in managing and mitigating the impact of healthcare-generated waste.

Nurses, as frontline healthcare providers, hold a pivotal role in addressing and reducing the environmental impact of healthcare-generated waste. By incorporating sustainable practices into their daily routines, nurses can

significantly contribute to reducing waste production and promoting environmentally responsible behaviors within healthcare settings. This begins with proper waste segregation, which ensures that different types of waste—general, infectious, and hazardous—are correctly separated for disposal or recycling. Proper segregation not only reduces the volume of waste destined for landfills but also minimizes the risk of environmental contamination.

Education and awareness are crucial tools in enabling nurses to become effective agents of change in waste reduction. Training programs focusing on sustainable healthcare practices equip nurses with the knowledge and skills needed to identify waste reduction opportunities and advocate for environmentally conscious policies. These programs emphasize the importance of reducing single-use plastics, encouraging reusable alternatives, and adhering to safe pharmaceutical disposal practices. Nurses can also promote these practices among other healthcare professionals, fostering a culture of sustainability within their organizations.

Moreover, nurses can play an instrumental role in policy development and advocacy. By participating in institutional committees and influencing procurement decisions, nurses can push for the adoption of eco-friendly products and technologies. For instance, opting for biodegradable materials and energy-efficient equipment not only aligns with sustainability goals but also ensures long-term cost savings. Nurses can further advocate for policies that prioritize environmental health, such as green building certifications for healthcare facilities and comprehensive waste management systems.

Finally, research and innovation are areas where nurses can make a lasting impact. Nurses involved in interdisciplinary research can help identify evidence-based practices for sustainable waste management. Through collaboration with environmental scientists and policymakers, nurses can contribute to developing innovative strategies that reduce the ecological footprint of healthcare facilities.

In conclusion, addressing healthcare waste requires a multi-faceted approach, and nurses are uniquely positioned to lead the charge toward a more sustainable and environmentally friendly healthcare system.

**The Challenge of Waste in Health Care**

The healthcare sector, characterized by resource overuse and energy-intensive processes and facilities, contributes substantially to greenhouse gas (GHG) emissions, a significant driver of climate change (Eckelman et al., 2020; Eckelman & Sherman, 2018). In the United States, the healthcare sector is responsible for 8.5% of the nation's GHG emissions. Globally, healthcare contributes 4.4% of total GHG emissions, with the United States accounting for 27% of global healthcare-related GHG emissions (Karliner et al., 2019). According to the US Climate Assessment, climate change adversely impacts public health through rising temperatures, extreme weather, poor air quality, heightened allergen potency, increased vector-borne diseases, and flooding. These factors collectively exacerbate challenges for environmental, social, and economic systems worldwide, with disadvantaged populations facing disproportionate health risks (US Global Change Research Program, 2018; Portner et al., 2022). Healthcare systems are often the most significant resource users within their communities, amplifying their environmental footprint (Frumkin, 2021).

According to the World Health Organization (2018), approximately 85% of healthcare waste is solid waste, comprising used medical supplies, packaging materials, cleaning products, food waste, and other landfill-destined items. Such waste can contaminate groundwater and release harmful pathogens and toxins into the environment (WHO, 2018). Hazardous and regulated medical waste is typically incinerated or autoclaved before landfill disposal, methods that indirectly contribute to environmental degradation (WHO, 2018).

Emerging research highlights the concerning presence of microplastics within human lungs and bloodstream, demonstrating the adverse health implications of plastic waste (Uildriks, 2022). Pharmaceutical waste poses a particularly alarming environmental threat (Chander et al., 2016). As global pharmaceutical consumption increases, the risk of environmental contamination from pharmaceuticals also rises (Wu et al., 2009). Pharmaceuticals enter the environment through improper disposal of expired medications, waste from manufacturing processes, and human or animal excretion, which contaminates soil, groundwater, and food supplies (Wu et al., 2009). Despite strict regulations in the U.S., inconsistencies in pharmaceutical waste disposal persist. Poor segregation practices can result in hazardous chemicals being sent to landfills, while liquid pharmaceuticals are frequently flushed into wastewater systems, posing additional risks. Enhanced efficiency, education, and environmentally safe procurement policies could mitigate these environmental health hazards, benefiting both clinical staff and the general population (Wu et al., 2009).

**Why Should Nurses Care About Waste?**

The waste generated by the healthcare sector significantly impacts the environment, and consequently, the health of communities, as human health is closely interconnected with the health of the planet (Potter, 2021; Kalogirou, Olson, & Davidson, 2020). Nurses regularly care for patients suffering from the adverse health effects of climate change (Maibach, Frumkin, &Adhoot, 2021; Portner et al., 2022). With the growing impact of climate change on human health and the healthcare sector's contribution to greenhouse gas (GHG) emissions, it is essential that nurses are well-informed and actively participate in efforts to mitigate climate change (Portner et al., 2022; Travers, Schenk, Rosa, & Nicholas, 2019; Kurth, 2017). Waste management is an area where nurses can have a substantial influence on reducing healthcare's GHG emissions (Johnson & Schenk, 2020).

Additionally, by collaborating across healthcare disciplines to address waste reduction, nurses can spearhead these improvement initiatives while delivering more efficient and sustainable care.

A significant portion of healthcare's extensive waste stream is managed by nursing professionals (Leffers & Butterfield, 2018). Both the International Council of Nurses (ICN) and the American Nurses Association (ANA) emphasize that nurses have a professional responsibility to engage in waste management and contribute to the development of climate-resilient healthcare systems (ANA, 2021; ICN, 2018; Leffers & Butterfield, 2018). Nurses, often in decision-making roles, can influence policies and purchasing choices that affect resource consumption and waste generation. Given their frontline responsibilities in handling healthcare waste, it is critical for nurses to understand waste streams and their impact, enabling them to make informed decisions and drive sustainable practices.

The World Health Organization (WHO) underscores the importance of comprehensive waste management systems, awareness programs, and safe disposal options to address healthcare waste (2015, 2018). Promoting environmental stewardship (ES) within healthcare settings is vital to ensure that nurses are educated, supported, and empowered to engage in waste reduction efforts (Boone, 2012; Leffers & Butterfield, 2018). As educators and advocates, nurses are recognized as trusted conveyors of public health information, positioning them to play a pivotal role in reducing healthcare's environmental footprint, including waste management (ANA, 2021; Maibach, Frumkin, &Adhoot, 2021; WHO, 2021; Gaines, 2022). Nevertheless, education and guidance on healthcare waste management remain inconsistent and non-standardized (Windfeld & Brooks, 2015).

In the United States, nurses are acutely aware of how their practices affect patient quality, safety, and outcomes, with the national database of nurse quality indicators serving as a benchmark for guiding nursing practices (Oner et al., 2020). Johnson and Schenk (2020) suggest that similar indicators could be developed to guide nurses in reducing the environmental harm caused by healthcare pollution through improved waste management. However, research on nurse-sensitive environmental indicators is still in its infancy. Some organizations, such as Practice Greenhealth (PGH) and Healthcare Without Harm (HCWH), have developed guidelines and toolkits for healthcare waste management, but these are directed primarily at institutions rather than individual practitioners (PGH, 2022a; HCWH, 2022). Despite the lack of standardized guidance, nurses can leverage their clinical expertise in resource use and waste management to lead efforts in reducing healthcare waste (Leffers & Butterfield, 2018).

**A Solution: Waste Optimization Plan**

Implementing an effective waste reduction and management program is crucial to addressing the environmental challenges posed by healthcare-generated waste (WHO, 2015). While recycling, composting, and other landfill diversion strategies are integral components of waste reduction, the most significant impact lies in transforming purchasing behaviors. Approximately 64% of GHG emissions associated with U.S. healthcare originate from the supply chain (Karliner et al., 2019). Sustainable purchasing practices, including minimizing reliance on single-use products and investing in reusable alternatives, can significantly reduce carbon emissions and yield long-term cost savings (Karliner et al., 2019; Mortimer et al., 2018).

The complexity of healthcare waste management is reflected in the existence of 25-30 distinct waste streams that require proper handling. A large healthcare system in the western United States provides an exemplary model through its environmental stewardship team's "Waste Optimization" strategy, which includes clearly defined goals, a detailed playbook, and an actionable guide. Waste optimization is described as directing waste to the appropriate stream at the lowest cost and with minimal environmental impact. The system aims to divert over 50% of total waste from landfills and hazardous streams by 2030. Achieving this goal requires staff to comprehend waste streams, including waste quantities, disposal costs, and best practices for segregation and safe handling. To facilitate understanding and tracking, the system categorizes waste into three main types: disposed, diverted, and avoided.

Disposed waste encompasses municipal solid waste (MSW), biohazardous waste, and hazardous waste. Municipal solid waste typically ends up in landfills or waste-to-energy facilities. Biohazardous waste, also known as regulated medical waste (RMW) or infectious waste, is either autoclaved and landfilled or incinerated, depending on its classification. Hazardous waste, as defined by the Resource Conservation and Recovery Act (RCRA, 2022), is usually incinerated. These disposal methods are significant sources of greenhouse gas emissions.

Diverted waste refers to waste that would have been discarded as MSW but is redirected to less environmentally harmful streams, such as recycling, composting, universal waste, or donations. Depending on the availability of local services, a significant portion of healthcare-generated waste can be safely diverted into these streams.

Avoided waste represents waste that is never produced in the first place. This is achieved through source reduction, improved efficiency, and minimizing the use of disposable products. For example, using reusable items in clinical care, as well as for dishware, storage, and transport, reduces the need for new products. This, in turn, lowers greenhouse gas emissions associated with the production, packaging, and transportation of supplies,

while also reducing costs related to procurement and disposal. Figure 1 illustrates the organization of waste categories under this model.

**Helping Staff Achieve Waste Reduction Goals**

To support staff in meeting the goal of a 50% reduction in waste, the organization introduced a *Waste Optimization Playbook*. This playbook categorizes each type of waste, outlines typical management methods, and identifies best practices for reducing waste while ensuring safe handling. Understanding the quantity and costs associated with each waste stream is fundamental to developing data-driven action plans for waste reduction. To facilitate this, the health system implemented a scorecard to track this data, enabling staff at each hospital to easily monitor their progress and compare it with other facilities within the system. This data-driven approach helps staff segregate waste effectively, establish diversion streams, and plan to avoid waste through informed purchasing decisions. Continuous process improvement is supported by setting incremental targets, regularly reporting on progress, and tracking outcomes. A similar waste optimization strategy could be adapted and implemented in other healthcare systems to enhance waste management and improve outcomes.

**Nurses' Clinical Expertise in Waste Reduction**

Nurses play a crucial role in reducing waste across various categories, including disposed, avoided, and diverted waste. To achieve this, they must understand and effectively utilize the waste streams in their organizations, ensuring proper segregation and strategically placing collection containers for easy and logical access. Nurses can minimize waste creation by assessing their habits, such as avoiding the stockpiling of unnecessary supplies in rooms or procedural areas. Additionally, they can identify redundant items or excessive packaging in kits and supplies, reporting these issues to purchasing committees for resolution.

Municipal solid waste (MSW), which constitutes most unregulated hospital waste, includes items such as food, packaging, gloves, and disposable medical devices like IV bags and tubing. It is typically disposed of in landfills, contributing to greenhouse gas (GHG) emissions due to methane production during decomposition. Nurses can mitigate MSW by diverting waste to safer streams, educating others about the environmental impact of MSW, and advocating for reduced use of disposable items (Howard et al., 2015). Biohazardous or regulated medical waste (RMW) includes materials such as blood and other potentially infectious substances, often autoclaved and landfilled or incinerated. Nurses should ensure the proper segregation of biohazardous waste to prevent nonhazardous materials from being mistakenly included, as well as promote effective signage and education about proper waste disposal practices (PGH, 2022). Hazardous waste, as defined by the U.S. Environmental Protection Agency (EPA), includes materials with properties that pose risks to human health or the environment. Nurses need to understand and adhere to guidelines for disposing of hazardous waste safely (Environmental Protection Agency, 2022). Pharmaceutical waste, which includes hazardous and nonhazardous drugs, must also be segregated and disposed of appropriately. Nurses can educate clinical and pharmacy staff on reducing overprescribing, using smaller-dose vials, and ensuring proper segregation between hazardous and nonhazardous pharmaceutical waste streams.

Nurses can also support waste diversion efforts through initiatives such as composting and recycling. Food waste constitutes 10-15% of hospital waste, which can be composted to reduce methane emissions from landfills and create soil for landscaping purposes. Nurses can collaborate with food service departments to establish effective composting programs and encourage facilities staff to compost landscape waste (PGH, 2022b). Recycling materials such as paper, cardboard, aluminum, glass, and metals is another critical area. Nurses can partner with local recycling centers to expand recycling opportunities, establish clear processes for collecting materials, and advocate for recycling of items not commonly found in patient care areas. Additionally, many single-use devices can be reprocessed, inspected, sterilized, and reused, significantly reducing environmental impact and costs. Nurses can facilitate the collection of such items and educate staff about reprocessing programs, which can yield substantial savings for healthcare facilities (Medline Renewal). Universal waste, which includes items like batteries, electronic waste, and fluorescent bulbs, can also be recycled with proper services. Nurses should ensure these materials are segregated appropriately to maximize recycling opportunities (Environmental Protection Agency, 2022). Donations of items such as furnishings, food, and medical supplies to organizations, schools, and shelters are another avenue for waste diversion, and nurses can help establish collection streams and track donated materials.

Nurses can also contribute to avoiding waste by choosing reusable items over disposable ones. For example, reusable sharps containers, isolation gowns, surgical drapes, linens, and dishware reduce resource consumption, raw material use, and waste generation. Nurses can advocate for reusable options in clinical and nonclinical settings and educate others on the benefits of these choices. Similarly, avoided purchases through the reformulation of procedural kits and instrument trays can lead to significant waste reduction. Nurses in perioperative areas, for instance, can review kits regularly to identify underutilized items, thereby reducing waste and lowering costs (Herrick, 2015). This approach also decreases energy and water use associated with the production and disposal of unused materials. By adopting these strategies, nurses can lead efforts to optimize healthcare waste management, reduce environmental impact, and promote sustainable practices within their organizations.

**Discussion and Call to Action**

Waste often goes unnoticed in healthcare settings, as it is typically discarded and forgotten—out of sight, out of mind. However, waste represents a significant environmental challenge and is a critical concern for nursing professionals (Leffers & Butterfield, 2018; Schenk & Johnson, 2022). Nurses are responsible for managing large volumes of waste daily across various practice environments. The sheer quantity of waste produced in clinical practice, coupled with the complexity of its management, can seem daunting. To be effective stewards of the environment, nurses must understand waste streams, adopt best practices for handling and disposing of waste, and implement strategies for minimizing waste generation. The structured and strategic approach outlined in this article can provide valuable guidance for nurses, particularly in acute care settings.

Given that nurses have a professional responsibility to practice in environmentally safe and health-conscious ways, they must be knowledgeable about the pollution and greenhouse gas (GHG) emissions associated with the consumption of resources and the waste generated. Nurses are uniquely positioned to manage and segregate waste effectively and to contribute to the reduction of overall waste. While this holds true across all healthcare delivery settings, it is especially critical in procedural areas where waste generation can be substantial. Additionally, nurses play an essential role as educators, sharing their expertise on waste reduction with other healthcare professionals across both clinical and non-clinical disciplines (Leffers & Butterfield, 2018; Lilienfeld et al., 2018).

The healthcare sector's heavy reliance on single-use disposable items is a significant contributor to excessive waste. The disposal of such items in landfills and incinerators releases greenhouse gases that exacerbate global warming. Furthermore, the production, packaging, and transportation of these clinical items through global supply chains generate additional environmental harm. Beyond mindful use of supplies, nurses can advocate for their organizations to implement sustainability initiatives and adopt policies aimed at reducing GHG emissions associated with the supply chain (Leffers & Butterfield, 2018).

As highlighted earlier, waste reduction within nursing practice remains an under-researched area. While numerous opportunities exist for nurses to play a pivotal role in reducing healthcare waste, further investigation is required. Research could focus on assessing the health impacts of waste-related toxic exposures on clinical staff, identifying best practices for waste segregation in clinical environments, evaluating durable alternatives to single-use items, and developing educational strategies to keep nurses informed and updated on waste reduction and management practices. Expanding knowledge in these areas could further empower nurses to lead waste reduction efforts and contribute to the broader goal of sustainable healthcare delivery.

**Conclusion**

Healthcare waste poses a significant challenge due to its environmental impact, complex waste streams, and the reliance on single-use items. Nurses are key players in addressing this issue, as their clinical expertise and daily interactions with waste streams uniquely position them to lead waste reduction efforts. By employing strategic waste management practices, promoting sustainability initiatives, and educating others, nurses can make a substantial impact on reducing greenhouse gas emissions and overall waste generation. While challenges persist, including the lack of standardized waste reduction guidance, further research and investment in sustainable alternatives can empower nurses to champion environmental stewardship in healthcare. Achieving sustainable healthcare requires collaborative efforts, with nurses at the forefront of implementing and advocating for environmentally responsible practices.

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