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The Relationship between Waste Management Practices and Human Health: New Perspective and Consequences

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ABSTRACT

Waste management, an integral aspect of modern life, exerts a profound influence on both public health and the environment. While existing research explores the environmental impact of various waste management practices, there is a paucity of studies investigating the direct health effects on humans from these practices. This article aims to address this gap by examining the intricate interplay between specific waste management strategies, such as open burning or landfill leachate management, and their potential to cause respiratory illnesses, birth defects, or other health problems in urban areas. Drawing from existing knowledge and recent research, it underscores the imperative of adopting an integrated waste management approach that harmonizes environmental preservation and health considerations. Furthermore, the review spotlights emerging technologies and innovative methodologies that hold promise in mitigating potential health hazards associated with conventional waste management practices. It accentuates the intricate connection between waste management and human health, underscoring the need for holistic strategies that encompass both community welfare and environmental sustainability. This paper advocates for sustainable waste management approaches that not only alleviate health concerns but also promote resource recovery and community engagement. Policymakers, urban planners, and stakeholders are encouraged to collaborate in the adoption of effective waste management methods that safeguard both the environment and human health. By recognizing the intrinsic link between environmental and health issues, a harmonized approach can be forged to address them.

INTRODUCTION

Waste refers to any unwanted or discarded material, substance, or byproduct generated from human activities, processes, or consumption patterns. Waste can take various forms, such as solid, liquid, or gaseous, and it can be organic, inorganic, or hazardous in nature. It includes everything from household trash, industrial byproducts, agricultural residues, construction debris, electronic waste (e-waste), and more. Waste is typically categorized based on its source, composition, and potential impact on the environment and human health (Zolnikov et al., 2018). Waste refers to the collection of these many, undesired, solid materials that cities accumulate through various home activities and is a serious environmental issue in emerging nations. The expected increase in the cost of waste management in developing countries is a significant source of concern (Niazi et al. 2016). In 2012, Africa produced 125 million tons of solid waste management (SWM), as reported by Scarlat et al. (2015). According to studies by Kaza et al. (2018)

and Debrah et al. (2021), there could be up to 244 million tons of rubbish created annually by 2025.

To limit its detrimental effects on the environment and public health, waste management entails gathering, distribution, treatment, recycling, disposal, and surveillance of waste products. It includes a variety of methods and tactics intended to manage trash effectively and sustainably. Reducing the amount of garbage produced, recovering valuable materials from waste, preventing environmental degradation, and minimizing potential health risks are the main objectives of waste management.

The theoretical underpinnings of waste and waste management are based on some interdisciplinary principles that allow for a thorough analysis of the intricate interactions between the production of waste, disposal techniques, environmental effects, and the well-being of people. To offer a comprehensive knowledge of waste-related processes, this framework integrates environmental science, social dynamics, economics, public health, and sustainability ideas.

The framework is based on systems theory, which acknowledges waste management as an intricate structure made up of interrelated components, feedback loops, and constantly changing relationships. To fully understand the complex interactions between garbage, ecosystems, and societies, it highlights the necessity of taking into account the entire lifetime of waste, from its origin to its ultimate fate.

The theoretical framework of a circular economy places a strong emphasis on the transition from linear "take-make-dispose" models to closed-loop systems. According to Kirchherr et al. (2017), it emphasizes the value of resource recovery, recycling, and reuse of substances to minimize waste generation and lessen environmental consequences. This enables waste management methods to be in line with economic development that is sustainable.

The philosophy of environmental justice emphasizes the way various communities are unfairly burdened and benefited by waste management. It emphasizes the value of providing everyone with equal access to clean surroundings and effective waste management services, addressing any potential inequalities in health risks and social vulnerabilities associated with trash (Jutta and Sayed, 2018).

This approach, which is based on public health theory, takes waste management into account as a public health indicator. It evaluates the potential dangers that poor waste management may have to human wellness, placing special emphasis on preventive actions, risk assessment, and the adoption of waste management techniques that protect community wellness (Ziraba et al., 2016).

The financial effects of various disposal options are taken into account by economic theories like cost-benefit analysis and market-based approaches to inform waste management policies. Incentives for corporations, individuals, and sectors of society to adopt environmentally friendly garbage disposal techniques are examined in this framework (Heckler, 2017).

Based on sustainability theory, this approach places waste management within the context of more general environmental and social sustainability objectives. Through waste reduction, resource recovery, and ecosystem protection, it highlights the need to strike a balance between environmental conservation, economic viability, and societal well-being (Zasz, 1994; Amui et al., 2017).

This portion of the framework investigates how rules, guidelines, and institutional frameworks influence waste management practices by drawing on governance theory. It evaluates how well regulatory systems perform at reducing harmful effects on the environment and the health of people.

To assess the role innovation plays in waste management, the framework combines technological concepts. It looks at how modern technology, such as waste-to-energy processes, intelligent waste collection systems, and sophisticated recycling technologies, can improve waste management sustainability and efficiency (Esmaeilian et al., 2017; Ehtasham, 2022; Lagman-Bautista, 2020).

This section takes into account psychological, educational, and human behavior theories. It looks at methods for fostering ethical trash disposal practices, recycling, and community involvement in waste reduction projects.

By including these several theoretical ideas, the framework offers a thorough lens through which waste generation, management techniques, and their

wider ramifications can be analyzed. This interdisciplinary approach offers a more detailed knowledge of waste-related issues and guides the creation of efficient, long-lasting solutions that strike a balance between environmental, social, and economic factors.

Insufficient disposal of waste has been a significant issue for humanity, according to Adogu et al. (2015), and it impacts both rural and urban locations. There are many different ways to dispose of waste, and this research evaluated how the people of Owerri Municipality in Imo State, Nigeria, handle their waste. A total of 282 people from Owerri Municipality were chosen for the descriptive cross-sectional study using a multistage sampling procedure, and they completed self- and interviewer-administered questionnaires. According to the findings, 97.5% of respondents had a positive attitude toward waste management and 90% of respondents were aware of it. Food remnants and vegetable products made up the majority of the garbage produced by households (97.1% and 95.4%, respectively). Public dumping and burning are two additional bad waste management methods that locals engage in, with 66.3% and 62.4% of respondents, respectively. Wheelbarrows were the most popular method of moving rubbish to the final disposal location. The respondents' gender and educational level had a significant impact on their knowledge, attitude, and waste management practices (p 0.05). The key to sustained, good health in every area is effective waste management. The people of Owerri require approved permanent dump locations, regular supplies of garbage collection facilities, and health education. These will promote among them strict adherence to acceptable and adequate waste management methods.

Lema et al. (2019) evaluated the state of incorrect SWM and related variables in Asella town using a community-based cross-sectional study approach. Four kebeles were chosen at random by lottery from a total of eight kebeles (Ethiopia's smallest administrative entity). There were 413 households in the sample. The residences were distributed evenly across the kebeles that were picked at random. A pre-tested questionnaire in the regional tongue was used to gather the data. Epi Info version 7 was used to enter the data, which was then transferred to SPSS version 21. To provide an overview of the respondents' socioeconomic level, descriptive data analysis was done. The link between the state of solid waste management and other factors was demonstrated using chi-square. The probable causes of incorrect SWM were identified using binary logistic regression. According to the study's findings, the majority of the population engaged in poor solid waste management. The alleged incorrect solid waste operation may have been caused by inadequate solid waste management expertise and a lack of availability of door-to-door solid waste pickup. Thus, there exists an urgency to raise the public's understanding of effective SWM and enhance the town municipality's door-to-door waste disposal service.

In addition to examining the findings under the concepts of sustainability and circularity methods, Maia et al. (2021) designed to determine and analyze the amounts, typologies, and disposal possibilities for waste created in the electricity sector using declared data gathered from a sample of companies worldwide in GRI reports from 2017 to 2019. The proposed technique took into account the selection of enterprises in the power sector in the GRI database and the assessment of the gathered waste management data following sustainability standards. The findings identified 26 holding entities, 15 of which reported waste management but did so in an unusual way overall. A little over 55% of the total generated garbage was delivered to landfills during the studied period, even though a significant portion of it was recyclable, with an estimated 51.2 Mt of rubbish being declared, 99.2% of which are non-hazardous waste. Despite this, the sample indicated a 17% decrease in overall waste generation and a 56% decrease in landfilling in the two-year analysis, which may indicate a trend in internal policies to raise the level of sustainability and circularity in the electricity sector regarding waste management. To the best of our knowledge, the recent literature has not yet addressed the present practices for waste management and how they are evolving toward more sustainable patterns in the power sector. This study innovated by addressing these practices, which are still developing subjects for discussion.

Teshome et al. (2022) utilized a binomial logistic model to identify the variables that affect the process of solid waste management. The findings showed that the main categories of solid

waste in the research region included plastics/bags/bottles, food waste, paper/cartons, tins/cans, and glassware. Plastics were cited by the majority of respondents (45%) as the most prevalent solid trash in Kebridehar city. The traditional method of solid waste management was not significantly negatively impacted by marital status, gender, or occupation. On the contrary hand, there were statistically significant impacts of age ($p = 0.030$) and proximity to the town center ($p = 0.000$) on solid waste management practices. A large majority of those surveyed (76.2%) said they had not been informed about how solid wastes affect the environment and people's quality of life. Their residences were also far from any public solid waste disposal facilities. According to the review's findings, there are no public solid trash dumpsters anywhere near the residences of neighborhoods, and the locals are not aware of how solid wastes affect the environment. In light of the key findings of the current paper, the authors encourage the city administration to place trash cans close to the residences in the communities. Local governments in urban areas should educate citizens on the impact solid waste has on the well-being of humans and the environment.

The purpose of this review article is to provide information on the following topics: (1) What are the typical methods for waste management in urban areas? (2) How may waste management procedures be improved in urban settings to reduce harmful health effects? (3) What are the effects of garbage on human health, specifically in urban areas? (4) What possible health hazards are connected to various garbage disposal techniques employed in urban settings?

The article may look into novel and understudied perspectives on how waste management practices and waste-related practices impact the health of people and neighborhoods. The main objective might be to offer significant knowledge to help public health groups, environmental agencies, and lawmakers make knowledgeable choices about waste management plans that promote sustainable development for the environment and the health of people.

METHODS

For existing peer-reviewed meta-analyses of waste management research looking at the relationship involving waste management and human health, we conducted a thorough search on online databases. The following subsections contain information about waste management studies and health risk assessment. Additionally, for the case studies that were undertaken to compare the meta-analysis research, the original papers were collected. The main databases used for this literature search include PubMed (MEDLINE), Springer, Elsevier, and others. These are some of the best and most extensively used resources for environmental and sustainable research. Studies published from 1994 through 2023 are the studies that were searched for. Additionally, reference lists for any pertinent papers appropriate for this review were hand-searched to identify further investigations. The sole language that was used for published articles was English. Waste, waste management, epidemiological study, cohort study, and health risk evaluation are among the search terms. Meta-analyses detailing the immediate and long-term consequences of waste management on the well-being of people were included as inclusion criteria. This evaluation also includes studies that estimated the health implications using techniques for health risk assessment. The first author, publication year, risk factors, study design, study duration, population, and health outcome were all searched for in the data-gathering procedure.

RESULTS AND DISCUSSION

Common Waste Management Approaches

Garbage management procedures differ greatly depending on the kind of garbage, local laws, the availability of infrastructure, and economic concerns (Kaza et al., 2018; Tomita et al., 2020; Fadhullah et al., 2022). The following are typical waste management techniques:

1. Source Reduction

This review is a proactive approach to waste management, and source reduction—also known as waste reduction or prevention—focuses on lowering the production of trash at its very source. This strategy understands that the best way to deal with the problems caused by waste is to stop it from being created in the first place. Source reduction seeks to reduce the negative effects that waste generation has on the environment, the economy, and society by fostering sustainable consumption

habits, resource efficiency, and ethical industrial practices.

The term "source reduction strategies" refers to a broad range of initiatives, from promoting the adoption of durable items with longer lifespans to designing products with less packaging (Wani et al., 2023). Additionally, it entails encouraging behaviors like recycling, repairing rather than replacing products, and implementing circular economy models that place an emphasis on the durability and recovery of materials.

By streamlining their manufacturing procedures to generate less waste, encouraging eco-friendly packaging, and creating goods with end-of-life concerns in mind, businesses may play a significant part in source reduction. Similarly, individuals may make a difference by choosing wisely, such as choosing reusable things, buying products with little packaging, and composting organic waste.

Adopting source reduction practices saves money, lessens the load on landfills and incinerators, and also lessens pollutants and greenhouse gas emissions related to waste management. Source reduction is emerging as a key pillar in the larger strategy to achieve sustainable waste management and a healthier world for future generations as communities and companies increasingly grasp the advantages of reducing waste before it is even generated.

2. Recycling and Reuse

To reduce the negative effects of garbage on the environment, recycling and reuse are crucial elements of sustainable waste management (Figure 1). Recycling entails the gathering, sorting, and processing of items like paper, plastic, glass, and metals to make new products while using less virgin resources. This method relieves stress on natural ecosystems, conserves energy, and lowers greenhouse gas emissions.

Figure 1. Picture depicting recycling and reusing wastes
Sources: Shutterstock (2023)

In addition to recycling, reuse also helps things last longer. Items are fixed, upgraded, or reused for continued use rather than being discarded. This strategy encourages a circular economy, where goods are used repeatedly while generating the least amount of waste and using resources as effectively as possible.

Individuals, organizations, and governments must all actively participate in recycling and reuse (Gnimadi et al., 2022; Yang et al., 2018). Communities may set up efficient recycling systems, and businesses can create innovative packaging with a focus on recycling. By choosing to recycle properly and supporting goods manufactured from recycled materials, consumers play a crucial part.

Recycling and reuse considerably contribute to environmental conservation and a lower carbon footprint by keeping waste out of landfills and minimizing the extraction of raw materials. These actions pave the way for a more sustainable and peaceful future for our world by encouraging responsible consumerism in addition to energy conservation.

3. Composting

According to Hassan et al. (2023), composting is a sustainable waste management practice that harnesses the power of nature to convert organic waste into nutrient-rich soil amendments (Figure 2). This process involves the decomposition of biodegradable materials such as food scraps, yard trimmings, and plant matter, facilitated by microorganisms like bacteria and fungi. As these microorganisms break down the waste, they transform it into a valuable resource known as compost.

Figure 2. Conversion of waste into nutrient
Source: Shutterstock (2023)

In addition to enhancing water retention and encouraging healthier plant development in gardens, farms, and landscapes, composting has many advantages. Because less organic waste is dumped in landfills, less methane, a strong greenhouse gas, is released into the atmosphere (Zhou et al., 2020). Composting helps to close the nutrient loop by bringing organic materials back to the earth.

Initiatives for personal and neighborhood composting enable people to take an active role in trash reduction. Municipalities can also set up composting initiatives to divert organic waste from landfills, aiding in environmentally friendly waste management.

Composting encourages a healthy link between human endeavors and the environment by acknowledging trash as a precious resource that can nourish the planet and support a more regenerative method of farming and beautification.

4. Landfilling

To reduce their negative effects on the environment, waste is typically dumped in approved areas of the land and covered with dirt. Modern landfill methods have evolved to reduce potential dangers and environmental harm even though it is a widely employed strategy.

Figure 3. Picture showing landfills on a site
Source: iStock (2023)

Leachate, the liquid created as garbage decomposes, is captured by collection systems in landfills (Figure 3), which are designed to prevent pollution of nearby soil and water. By using methane gas, a byproduct of decomposition, as a source of energy, landfills can have even smaller environmental impacts.

Nevertheless, landfills continue to provide problems despite these precautions. Leachate and methane emissions may affect groundwater quality and accelerate global warming. Finding ideal places for landfills can also be challenging in metropolitan settings due to the lack of available land.

Source reduction, recycling, and composting are becoming more and more important components of waste management techniques to reduce the quantity of garbage that is dumped in landfills. The transition to more sustainable waste management techniques is still a top objective to lessen the reliance on landfills and its associated environmental implications. Efforts to improve landfill technology and improved site selection are underway.

5. Incineration

A technique for managing garbage called incineration includes burning waste under controlled conditions at high temperatures to produce heat, ash, and gases. In addition to reducing the amount of garbage produced, this method also produces energy that can be used to produce electricity or heat homes (Kenny and Priyadarshini, 2021). Although this may not be recommended, but it is still an approach used.

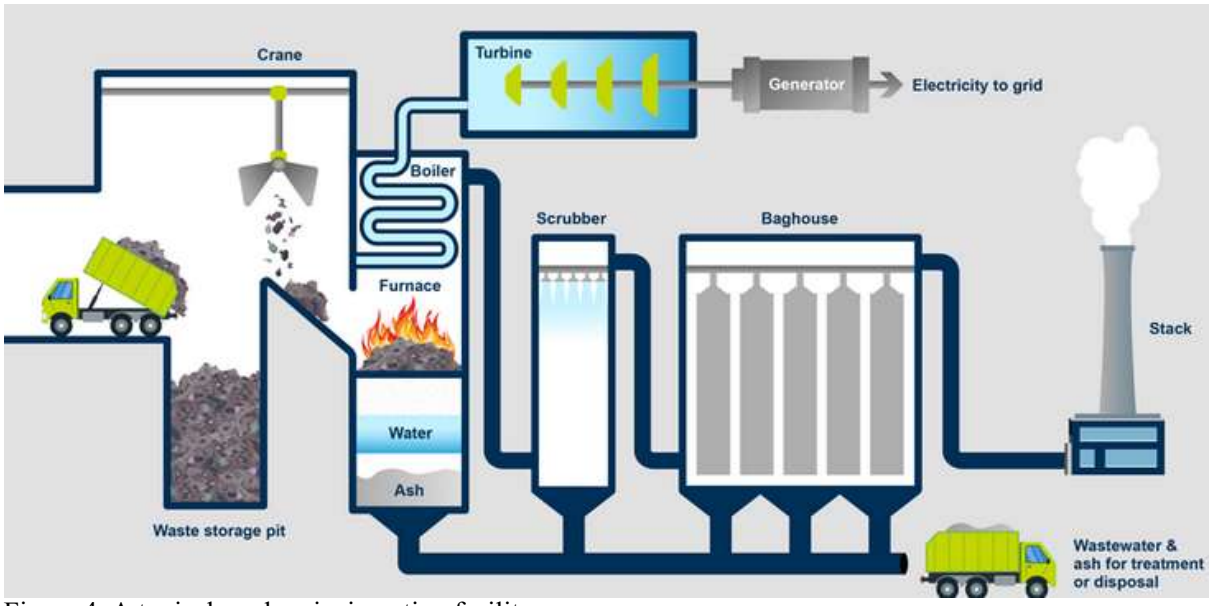

Figure 4. A typical modern incineration facility
Source: Central Queensland University (2021)

To reduce their negative effects on the environment, contemporary incineration facilities are outfitted with cutting-edge technology (Figure 4). Systems for reducing air pollution help to catch and treat harmful pollutants, such as toxic gases and particulate matter. Additionally, energy recovery systems use the heat created during incineration to produce electricity, improving the process' overall efficiency.

Yet, there are worries about the potential emission of heavy metals and dioxins from the cremation process. For incineration facilities to operate within acceptable environmental limitations, certain restrictions and emission requirements are essential.

Even though incineration is a potential waste management strategy, it is frequently most effective when used for non-recyclable and non-compostable garbage. Energy recovery benefits must be weighed against any potential environmental hazards. Incineration can contribute to a varied waste management portfolio that satisfies both waste reduction and energy needs while limiting its environmental impact when used in conjunction with initiatives to decrease waste output and promote recycling.

6. Hazardous Waste Management

A specific area of waste management, hazardous waste management, deals with substances that pose serious threats to the environment, human health, and other living things. These wastes consist of poisonous, flammable, corrosive, or reactive materials. Hazardous waste must always be handled, treated, and disposed of properly due to the potential threat it poses (Bagui & Arellano, 2021; Ghasemi and Yusuff, 2016; Bashaar et al., 2017; Padmanabhan and Barik, 2019).

To avoid mishaps, pollution, and contamination, the handling of hazardous waste is subject to strict rules (Shi et al., 2017). Normally, hazardous garbage is collected separately from other rubbish and carried in specialized vehicles and containers. Chemical, physical, or biological processes can be used as treatment options to reduce or eliminate potentially harmful qualities.

Common techniques for disposing of hazardous trash include incineration and secure landfilling. While secure landfills are designed to retain hazardous waste to stop its migration into soil and water, incineration aids in the destruction of the poisonous components.

A significant objective is reducing the production of hazardous trash. Industries are urged to utilize safer production methods, use fewer hazardous products, and look for less damaging substitutes (Sharma et al., 2020). Effective management of hazardous waste ensures the safety of employees, communities, and future generations from the potential risks connected with these materials while also safeguarding the environment.

7. Waste-to-Energy

Waste-to-Energy (WtE) is a cutting-edge waste management strategy that involves turning non-recyclable garbage into energy using procedures like anaerobic digestion or incineration. By decreasing the amount of waste going to landfills and simultaneously producing electricity or heat, this technique provides a dual benefit.

A common WtE technique is incinerating trash, which produces heat that can be converted into energy. Energy recovery is maximized while harmful pollutants are kept to a minimum thanks to advanced incineration technology. On the other hand, anaerobic digestion entails the breakdown of organic waste in the absence of oxygen to create biogas that can be used for the generation of energy.

By replacing the requirement for energy sources based on fossil fuels, WtE facilities help to lower greenhouse gas emissions. The need for strict rules and efficient pollution control systems is highlighted by worries about air emissions and the possibility of harmful consequences.

Although WtE offers chances for energy recovery and waste reduction, it's crucial to combine this strategy with source reduction, recycling, and composting to ensure a comprehensive waste management plan. When using WtE to its full potential, which includes helping to create a future that is more sustainable and resource-efficient, it is essential to strike a balance between energy production and environmental protection.

Combining these techniques in a way that is appropriate for the region's unique waste streams and conditions results in effective waste management. To ensure sustainable waste treatment and reduce its negative effects on the environment and public health, cooperation between government organizations, businesses, communities, and individuals is necessary.

Composting Methods

The most popular ways to compost in a home or business setting are the eight options listed below. They are the practical methods provided by Direct Compost Solutions (2024).

1. Open-air compositing

A backyard compost pile made of green and brown materials is the conventional setup for open-air composting. In most cases, it's a cheap, easily assembled bay made of whatever you can get your hands on. Alternatively, it may have a few overturned bins, similar to the Gedye bins purchased from stores, stacked on the ground. To retain water and heat, wire cages with piping inlay around the edges are also utilized. For hot water systems in sustainable scenarios, this can then be applied.

In general, open-air composting is regarded as a hot composting technique. Because it doesn't produce as much heat when smaller amounts of garbage are used, some people frequently refer to it as “cold composting”. Cold composting is not truly cold composting because it still generates heat. Since letting things rot in the refrigerator is the only way to fully cold compost anything, it would be better described as warm composting.

2. Direct compositing

Digging a trench or hole in the earth and burying your scraps is known as direct composting. In addition to being the most traditional and successful method, it has certain drawbacks just like any other composting technique. The primary one is that unless it chops things up, it takes a long time to decompose. Fruit and vegetables must be buried to avoid being unearthed by a variety of garden creatures, including birds and rodents. And it has to keep excavating. On the other hand, it does yield a large number of worms, which enhance the soil and provide nutrients for your crop.

3. Tumbler compositing

Professional tumbler composting may be bought at a hardware store or made at home. It is available in a variety of sizes and forms for single to double units. This is a terrific system for a lot of people if they are eager to turn it in every day or every few days and are reasonably strong. For others, particularly those who are becoming older, it is a demanding task. However, several automated ones simplify turning. To let one sit for several months to completely disintegrate before emptying it, one usually needs two of these systems. Fill the other one while all of this is going on. If one has a lot of green and brown waste to get rid of and the area to accommodate this system, it might be a good method. However, much like the Bay System, producing a tiny amount of soil requires a large amount of waste. A bay system would work just as well if one is only filling it with green and brown garbage, but one wouldn't have the space and would

have to keep an eye out for rats and snakes that might be breeding in the warm compost.

4. Worm farm compositing

Because worm farms can create compost and compost tea, breed worms, and keep rats out of your compost, they are the most popular and favored method of composting. In comparison to conventional composting techniques, the worms generate concentrated nutrient-lower nitrogen castings. It is believed that everyone has attempted, to varied degrees of success, to build their worm farm at some point using whatever inexpensive materials they could find. Copper leaches out of metal containers and is poisonous to your worms, so avoid housing them in these.

Foam containers have been tried, however, it was discovered that the worm juice eats through the foam, causing leaks everywhere. It winds up having a huge mess unless it is placed somewhere on the ground where the nutrients can seep into the soil. The juice can be collected by using plastic containers, but a tap will be installed to remove the juice or find a technique to rotate the containers to collect the worm tea. They must be kept somewhere that isn't too chilly and out of the sun, frost, and rain. Because they are erratic tiny creatures, worms will attempt to leave their containers if something is wrong or they are unhappy.

5. Effective Microorganism (EMO) compositing

Effective Microorganisms, or EMO Composting, is a composting system that is typically used indoors, but anyone who likes this kind of composting or who may live in an apartment can use it. The product that uses EMOs the most frequently is the Bokashi, but other indoor systems can also utilize them, and some systems filter odors using a carbon filter in the lid. Usually, you need two of these, so fill the other while the resting one is done. Juice can be collected for use in gardening.

6. Combination Composting

Composting, sometimes known as combination composting, is a technique that combines EMO, vermicomposting, direct composting, and open-air composting. Composting includes all the components that work for most home situations. It presents issues of its own to some people. However, I find that there are fewer obstacles and greater benefits. Not just “some” of your kitchen waste, but ALL of it can be composted. In the end, you have more than 50% less rubbish to put in your council container every week. Fill it, forget it, refill it when you're ready, and give it a thorough cleaning once a year or more often as you see fit. In comparison to most other composters, it works faster and needs less effort. And all of your trash feeds back into your soil. It seems like the simplest composting technique I have ever used.

7. Commercial compositing

The ingredients used in commercial composting are different from those used in backyard composting. Long rows of materials, including sawdust, pine bark, sand, ferrous sulfate, and possibly some ammonia sulfate, are combined to make compost. It is usually ready for bagging after six weeks, and it is turned every three to four days. The low-cost commercial compost has very little nutritional content. However, compared to huge commercial compost companies, there are independent small businesses that make composts of higher quality. But they cost more money. A few producers, like McLeod's Agriculture, also hold organic certification.

When it comes to commercial compost, the adage “you get what you pay for” definitely holds. Commercial compost, which is less expensive, works well as a filler for raised garden beds and as a backfill for Compots in sandy or clay soil. Alternatively, it can be combined with decomposed soil to fill raised garden beds or possibly a container plant. When purchasing commercial-grade compost for gardening purposes, it is advisable to get a superior propagation mix.

8. Mechanical compositing

Using power to generate the necessary heat and rotating the contents, mechanical composting is an effective way to compost garbage that yields semi-composted waste in as little as 24 hours. This technique is appropriate for large establishments producing copious amounts of trash from numerous patrons, such as restaurants, hotels, motels, hospitals, schools, and kindergartens. Rather than having your waste sent to the council tips, you can manage it inside using this method. But, to continue composting the trash, you will need someone to gather the residual contents and place them in a garden bed or bay composting system.

Smaller systems are also available that work well for certain individuals in their homes, but they

can be pricey and will cost you electricity over time. They have advantages and disadvantages like any composter, but they do yield semi-composted soil quickly.

Impact of Waste Management Practices and Human Health

If waste management procedures are not implemented properly, there may be several negative effects on people's health. These effects result from the incorrect collection, transportation, and treatment of trash. Among the major effects are:

Pollutants may be released into the air and water as a result of poor waste management. Methane, organic chemicals (VOCs), and various other harmful gases can be released from landfills and waste disposal sites, which contributes to air pollution. Leachate, a liquid formed during the decomposition of trash, may pollute surface and groundwater, endangering the health of people who depend on these sources of water.

Inadequate management of hazardous waste materials might increase exposure hazards. Waste-derived chemicals and contaminants can contaminate soil and water, harming agricultural output, and entering the food chain. Direct exposure to hazardous trash or contaminated water can cause both short-term and long-term health difficulties, such as respiratory problems, skin conditions, and even cancer.

Inadequate waste management can result in the proliferation of rats and mosquitoes, which are disease-carrying vectors. A breeding ground for mosquitoes and a source of stagnant water in improperly disposed of waste can result in the spread of diseases like dengue fever, malaria, and the Zika virus.

If they don't have the right safety gear and training, workers who gather, process, and dispose of waste may be exposed to health risks (Babaee Tirkolaee and Aydn). Without taking the necessary safeguards, exposure to potentially harmful compounds and biohazardous waste can lead to illnesses and accidents (Devi et al., 2019; Chew et al., 2023).

Environmental injustice results from bad waste management techniques, which frequently have a disproportionately negative impact on vulnerable groups. Minority and low-income populations may be near garbage disposal facilities, putting their health at greater danger from contamination and pollution.

1. Aesthetic and Psychological Impact: Poor garbage management can cause visual pollution, which lowers a location's aesthetic value. Living in a neighborhood with trash, waste piles, and ugly landscapes can make residents stressed and depressed.
2. Resource Depletion: Ineffective waste management results in the loss of precious resources due to inappropriate disposal. Materials that could be recycled or used again end up in landfills, contributing to the depletion of resources and a squandered chance for positive effects on the economy and environment.
3. Climate Change: Climate change may be exacerbated by some waste management techniques, such as incorrect landfilling and incineration. The methane emissions from organic trash that is decomposing and the release of greenhouse gases during incineration can both contribute to the acceleration of global warming.

Adopting extensive waste management techniques that place a priority on source reduction, recycling, correct disposal, and public awareness is necessary to mitigate these possible effects (Coracero et al., 2021). Societies can work toward more sustainable practices that safeguard the environment and general well-being by being aware of the potential effects waste management may have on the health of people.

The Health Risks Associated with Different Waste Disposal Methods

Depending on the type of waste, the technology employed, the management policies in place, and the possible health concerns linked to various waste disposal techniques can change. Here is a summary of the potential health risks connected to popular trash disposal techniques:

1. Landfills

Air Pollution: Methane, a powerful greenhouse gas, and volatile organic compounds, which can cause pollution and respiratory problems, are two toxic gases that landfills may release. *Groundwater Contamination*: Leachate, a poisonous liquid created by decomposing garbage that can transfer contaminants into the soil and water supplies, may pollute groundwater when landfills are not

adequately managed. *Odor and Aesthetic Concerns*: Unpleasant smells from landfills can affect the local air quality and the way of life for people living close by.

2. Incineration

Air Emissions: Incineration releases air pollutants including heavy metals, dioxins, and furans, which can have harmful effects on respiratory health and potentially contribute to long-term health issues. *Ash Residue*: Incineration generates ash that may contain toxic substances, and improper disposal or handling of this ash can lead to environmental contamination. *Community Health Concerns*: Communities near incineration facilities might be exposed to pollutants in the air and ash, potentially leading to increased health risks.

3. Recycling

Exposure to Hazardous Materials: Recycling processes can expose workers to hazardous substances in electronic waste (e-waste) or other materials that may not have been properly cleaned or handled. *Inadequate Sorting and Contamination*: Poorly sorted recycling streams can lead to cross-contamination, making recycled products potentially harmful if they contain mixed hazardous materials. *Occupational Health Risks*: Workers in recycling facilities can face risks from machinery, sharp objects, and exposure to hazardous materials if safety measures are inadequate.

4. Composting

Microbial Exposure: Employees and neighboring households may be exposed to germs during composting which can lead to illnesses and respiratory problems. *Odor and Allergen Concerns*: Strong scents and allergens that result from decomposing organic debris might affect the air quality and perhaps aggravate respiratory disorders. It's crucial to remember that many of these dangers can be reduced by improvements in waste management technology, appropriate regulatory monitoring, and adherence to best practices. The health dangers connected to trash disposal techniques also highlight the significance of appropriate waste management plans that put environmental preservation and the health of people first.

CONCLUSION

It's important to keep in mind that many of these risks can be decreased through advancements in waste management technology, adequate governmental monitoring, and compliance with appropriate standards. The health risks associated with trash disposal methods further emphasize the importance of effective waste management strategies that prioritize environmental protection and safety for everyone.

As society advances, the need to harmonize waste management practices with the preservation of human health becomes more pressing than ever. This review underscores the imperative for collaboration among policymakers, industries, communities, and individuals to enact informed waste management policies and practices that prioritize both environmental integrity and public well-being.

Further study and innovation are required in light of the discovered knowledge gaps as well as the potential health concerns connected to some waste management practices. We can improve waste management techniques to reduce negative health effects while simultaneously utilizing waste as a resource by utilizing technology, data-driven insights, and interdisciplinary collaboration.

Waste management is a crucial thread that is delicately woven into the fabric of environmental prosperity and human health in the vast tapestry of sustainable development. This evaluation acts as a stepping stone, directing subsequent investigations, the creation of policies, and community involvement in the direction of peaceful cohabitation with our planet and the welfare of future generations. By accepting the lessons learned from this investigation, we may collectively navigate toward a future where waste management functions as a conduit for health improvement, environmental stewardship, and sustainable development.

Several recommendations are made based on the insights and consequences discussed in this article that can direct future research, policy development, and practical measures to improve waste management procedures and protect human health:

1. Integrated Approaches: Recognize waste management as a multidimensional endeavor that intertwines environmental, social, and health considerations. Develop integrated waste management strategies that prioritize both

waste reduction and the mitigation of health risks.

2. Promote Source Reduction: Put source reduction methods as a top priority to reduce waste production at the source. Encourage businesses to use environmentally friendly manufacturing techniques, make products that last a long time, and reduce packaging waste.
3. Enhance Recycling and Reuse: Support and incentivize recycling initiatives that promote the recovery of valuable materials from waste streams. Encourage communities to embrace reuse practices and foster a culture of resource conservation.
4. Advance Composting: Promote the widespread adoption of composting practices to divert organic waste from landfills. Encourage individuals, municipalities, and businesses to compost organic materials and improve soil health.
5. Modernize Landfill Practices: Implement innovative landfill technologies that mitigate the environmental impact of waste disposal. Embrace techniques that minimize leachate and methane emissions, ensuring safe and responsible waste containment.
6. Embrace Clean Incineration: Where appropriate, adopt advanced incineration technologies that prioritize energy recovery while minimizing air emissions and toxic byproducts. Strive for transparent emissions monitoring and adherence to stringent regulatory standards.
7. Prioritize Hazardous Waste Management: Strengthen regulations and enforcement mechanisms for the proper handling, treatment, and disposal of hazardous waste. Ensure comprehensive training and protective measures for workers in hazardous waste management.
8. Maximize Waste-to-Energy Potential: Explore opportunities to harness waste-to-energy technologies that reduce landfill waste and contribute to renewable energy generation. Couple these efforts with robust pollution control measures.
9. Public Awareness and Education: Encourage programs to raise public knowledge about proper waste management procedures and how they affect people's health. Give people the information they need to dispose of waste intelligently.
10. Cross-Disciplinary Research: Encourage interdisciplinary research collaborations between environmental scientists, public health experts, policymakers, and urban planners. Such collaborations can yield holistic waste management solutions that prioritize both environmental integrity and human well-being.
11. Environmental Justice: Address environmental justice concerns by ensuring equitable access to proper waste management practices and reducing the burden of waste-related health risks on marginalized communities.
12. Long-Term Vision: Develop and adopt long-term waste management visions that align with broader sustainability goals. Strive to balance economic development with ecological stewardship and public health considerations.

By implementing these recommendations, we can collectively navigate towards a future where waste management becomes a driver of environmental regeneration and human health enhancement. The interplay between waste management practices and human well-being holds immense potential for positive transformation, and it is our responsibility to navigate this path with foresight, innovation, and a steadfast commitment to a healthier planet and thriving communities.

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