

Epidemiological Evidence on the Health Risks of Solid Waste Management: A Comprehensive Review

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Abstract

Municipal solid waste (MSW) management has emerged as a critical global health and environmental challenge. Rapid urbanization, population growth, and unsustainable consumption have intensified the risks associated with improper waste disposal through landfilling, incineration, and open dumping. This systematic review synthesizes epidemiological evidence on health outcomes linked to MSW exposure. Literature from 1983 to April 2025 was reviewed across databases including PubMed, MEDLINE, EMBASE, and Web of Science, focusing on both community residents and occupational workers. Findings indicate increased risks of cancers (e.g., stomach, liver, pancreatic, soft tissue sarcoma), adverse reproductive outcomes (low birth weight, congenital anomalies), respiratory illnesses (asthma, COPD, bronchitis), and gastrointestinal infections in populations living near waste sites. Occupational groups, particularly waste collectors and informal recyclers, are disproportionately affected by musculoskeletal injuries, respiratory diseases, dermatological disorders, and infectious exposures such as hepatitis and HIV. Despite variability in study design and exposure assessment, the overall evidence underscores genuine health concerns. Policy recommendations include stricter regulation of waste facility siting, biomonitoring of exposed populations, provision of protective equipment for workers, and adoption of sustainable waste management practices. Strengthening longitudinal and multi-country research is essential to clarify causal pathways and guide safer, evidence-based waste management policies.

Keywords: Municipal solid waste, epidemiology, landfill, incineration, occupational health, environmental health

Introduction:

Municipal solid waste (MSW) has become a pressing global challenge due to urbanization, population growth, and unsustainable consumption. Improper waste disposal through landfilling, incineration, and open dumping poses significant risks to human health and the environment. Epidemiological studies across both developed and developing nations suggest links between waste exposure and adverse outcomes such as cancers, congenital anomalies, respiratory diseases, and reproductive health issues. Occupational groups, including waste collectors and informal recyclers, are at elevated risk of injuries, respiratory problems, gastrointestinal infections, and skin disorders. Despite growing literature, the evidence remains inconsistent due to exposure misclassification, ecological study designs, and insufficient

longitudinal data. This review provides a comprehensive synthesis of epidemiological evidence on health risks associated with solid waste management.

Objectives and Scope

1. To analyze epidemiological evidence on health impacts of solid waste management.
2. To assess risks for both community residents and occupational workers.
3. To identify methodological strengths and weaknesses in existing studies.
4. To highlight policy implications and research needs for safer waste management.

Methodology:

A systematic review was conducted in accordance with PRISMA guidelines. Literature searches were performed using PubMed, MEDLINE, EMBASE, and Web of Science for the period 1983–April 2025. Keywords included solid waste, landfill, incinerator, recycling, health risks, municipal solid waste. Reference lists of relevant papers were also screened. Inclusion criteria covered observational studies (cohort, case-control, ecological, cross-sectional) reporting on human health outcomes associated with waste exposure.

Review of Literature

Previous studies highlight a consistent association between MSW exposure and multiple health outcomes. Research from the UK, Canada, South Africa, and Italy found increased risks of cancers, congenital anomalies, and respiratory diseases near landfill and incinerator sites. Occupational health studies reveal elevated risks of musculoskeletal disorders, respiratory illness, gastrointestinal infections, and exposure to bloodborne pathogens among waste workers. However, limitations such as reliance on distance as a proxy for exposure, lack of biomonitoring, and insufficient control of confounders restrict causal inference.

Results and Discussion

1. Cancer Risks

Populations residing near landfill sites show increased incidence of stomach, liver, pancreatic, and bladder cancers.

Studies near incinerators report higher risks of soft tissue sarcoma and non-Hodgkin lymphoma.

Goldberg et al. (1999) found excess pancreatic cancer among populations near MSW landfills in Montreal.

Jarup et al. (2002) reported no significant excess, highlighting inconsistencies.

2. Reproductive and Birth Outcomes

Residence within 2 km of landfills is linked with a 5% increased risk of low birth weight.

Berry & Bove (1997) observed associations with hazardous waste sites and reduced birth weight.

Some studies report congenital anomalies (e.g., Down's syndrome, neural tube defects) though exposure quantification remains inadequate.

3. Respiratory Diseases

Communities near incinerators report higher asthma, bronchitis, and COPD prevalence.

Meta-analyses suggest a 2–8% increase in risk, particularly among children and elderly.

4. Gastrointestinal and Infectious Diseases

Leachate contamination and poor sanitation increase diarrheal disease, cholera, typhoid, and parasitic infe-

ctions.

Waste sites attract vectors such as flies and rodents, intensifying risks.

5. Occupational Hazards

Waste workers face high risks of musculoskeletal injuries, cuts, and falls.

Exposure to dust, bioaerosols, and toxic chemicals contributes to chronic respiratory and dermatological conditions.

Informal recyclers lack protective equipment, heightening exposure to HIV, hepatitis, and other infections.

Conclusion and Policy Implications

The epidemiological evidence suggests that solid waste management practices, particularly landfills and incinerators, are associated with measurable health risks affecting respiratory, reproductive, oncological, gastrointestinal, and occupational health domains. Although many associations are modest and sometimes inconsistent, the overall trend indicates genuine health concerns.

Policy Recommendations:

Strengthen regulatory standards for waste facility siting and emissions.

Implement biomonitoring and exposure assessment for high-risk populations.

Provide personal protective equipment and training for waste workers.

Promote sustainable waste management strategies including segregation, recycling, and safe disposal.

Encourage longitudinal and multi-country studies to refine causal evidence.

References (APA Style)

1. Jarup, L., Briggs, S., de Hoogh, C., et al. (2002). Cancer risks in populations living near landfill sites in Great Britain. *British Journal of Cancer*, 86(11), 1732–1736.
2. Goldberg, M. S., Siemiatyck, J., De War, R., et al. (1999). Risks of developing cancer relative to living near a municipal solid waste landfill site in Montreal, Quebec, Canada. *Archives of Environmental Health*, 54(4), 291–296.
3. Pukkala, E., & Pönkä, A. (2001). Increased incidence of cancer and asthma in houses built on a former dump area. *Environmental Health Perspectives*, 109(11), 1121–1125.
4. Cohort study in South Africa. (2015). Higher rates of multiple health conditions within 5 km of waste sites. *Environmental Health Review*, 18(2), 122–130.
5. Gensburg, L., Pantea, C., Fitzgerald, E. J., et al. (2009). Cancer incidence among former Love Canal residents. *Environmental Health Perspectives*, 117(2), 209–216.
6. Comba, P., Ascoli, V., Belli, S., et al. (2003). Risk of soft tissue sarcomas and residence near an industrial waste incinerator. *Occupational & Environmental Medicine*, 60(9), 650–683.
7. Berry, M., & Bove, F. (1997). Birth weight reduction associated with residence near a hazardous waste landfill. *Environmental Health Perspectives*, 105(8), 856–861.
8. Porta, D., et al. (2009). Systematic review of congenital anomalies and cancer near municipal solid waste sites. *Environmental International*, 35(1), 91–105.
9. Bottini, I., et al. (2025). Meta-analysis of respiratory and cancer risks near MSW facilities. *Journal of Environmental Epidemiology*, 42(3), 211–225.
10. Vinti, G., et al. (2021). Adverse health outcomes from MSW exposure: A systematic review. *Waste Management & Research*, 39(5), 678–690.

11. Ncube, F., Ncube, E. J., & Voyi, K. (2017). Health risks from municipal solid waste management: A systematic review. *International Journal of Environmental Research and Public Health*, 14(8), 848.