Health and Sustainability at Risk: An Empirical Study on the Household Solid Waste Challenge in Panama

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1. Introduction

Global municipal solid waste generation exceeds 2 billion tons annually, projected to reach 3.4 billion by 2050 (World Bank, 2018). Panama exemplifies the challenges faced by countries with inadequate solid waste management (SWM) infrastructure, where 75% of households use waste collection services, leaving a quarter to burn, bury, or dump waste unregulated. Despite having access to collection services, Panamanian households face inefficiencies in frequency of collection, limited recycling, and overburdened landfills, exacerbating environmental and public health issues, including diarrhea in children. In other developing countries, prior research links dwelling characteristics with health outcomes (Brueckner, 2013) and poor sanitation with children's health (Orgill-Meyer & Pattanayak, 2020). However, there is a noted gap in the literature using econometric methods to understand how specific household SWM methods affect children's health and the implications of inefficient solid waste collection services. Therefore, using national repeated cross-sectional data from Panama's Living Standard Measurement Surveys (1997, 2003, 2008) of 6,063 children, our study contributes to previous literature by analyzing the heterogeneous impact of solid waste disposal methods such as public collection, backyard disposal, and burying/burning on the probability of diarrhea in children aged 0 to 4 years in Panama. Moreover, using cross-sectional data from 154 households in Panama City collected in 2023, we investigate how the frequency of public collection services affects the incidence of poor SWM-related diseases and the occurrence of blocked sewage and floods.

Our findings indicate that children in households disposing of solid waste in backyards have the highest likelihood of experiencing diarrhea. Additionally, inconsistent public collection services contribute to waste accumulation, generating disease vectors, and causing blocked sewage and floods during Panama City's rainy season.

2. Methodology and Data

The base linear probability model is expressed as follows,

$$H_{ijt} = \sigma_0 + \sigma_1 PC_i + \sigma_2 BY_i + \gamma X_i + \delta_j + \pi_t + \varepsilon_{ijt}$$

where H_{ijt}, PC_i, BY_i, X_i, δ_j, π_t, ε_{ijt}, represent a dummy variable equal to 1 if child i experienced diarrhea, a dummy variable equal to 1 if the household of the child uses solid waste public

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collection, a dummy variable equal to 1 if they dispose of solid waste in their own backyard, a vector for household and child characteristics, district control, year control, and the error term, respectively. Burying and burning method is used as the reference category. Furthermore, to address potential endogeneity of solid waste disposal method we use dummy variables of ownership, use of gas for cooking, and composite household as Instrumental Variables. Finally, we analyze how the probability of poor SWM-related diseases, floods, and blocked sewage occurrences is affected by the frequency of collection services and other relevant household characteristics.

To examine the probability of children suffering from diarrhea, we use data from Panama's Living Standard Measurement Surveys. And to estimate the effects of collection service frequency in Panama City, we use our own cross-sectional data collected in 2023.

3. Results

Our results demonstrate that children in households with access to public collection services have a 14% higher probability of suffering from diarrhea compared to those using burying and burning methods. Notably, backyard disposal is associated with a 53% higher incidence of diarrhea in children, likely due to direct exposure to untreated waste in living areas, which facilitates the spread of diseases and environmental pollutants.

We discuss that households with less frequent solid waste collection have less probability of suffering dengue and diarrhea as their access to tap water increases. Additionally, we found that the longer solid waste remains uncollected, the higher the likelihood of blocked drains. This situation is worsened by animals scattering the waste, which can then be washed into storm drains during rainfall.

Our research reveals that improving the regularity of solid waste collection and ensuring consistent access to tap water are effective strategies for reducing solid waste-related diseases. Further research should explore causal pathways and contextual factors, such as community practices and local government policies, to optimize health outcomes in different settings.

Reference

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