A Cross-Sectional Study About Household Solid Waste Management Practices Among Residents in Urban Slum Area of Mumbai

Anish Krishna CU[1], Rujuta S. Hadaye[2]

[1]Senior Resident, Community Medicine Department, Government Medical College, Ernakulam, India
[2]Professor & Head, Community Medicine Department, Topiwala National Medical College & B.Y.L. Nair Ch. Hospital, Mumbai, India

Correspondence: Dr. Anish Krishna CU, Email: krishnaunni1993@gmail.com

Abstract:

Introduction: Household solid waste management is a primary step to curb environmental pollution. **Objective:** To determine household solid waste management practices among residents in urban slum area in Mumbai. **Methods:** A Cross-sectional study was conducted in a community field practice area. Two hundred participants were selected by using systematic random sampling method. Data were collected using a structured questionnaire. **Results:** The study revealed 151 (75.5%) of families used wastebins in households, 129 (64.5%) used public bins for disposal of waste, and 133 (66.5%) of households did not segregate the waste generated. Statistically significant association was found between education and waste management practices. **Conclusion:** This study showed that majority of waste generated was kitchen waste, and very small percentage of people segregated waste material, even though the appropriate method for waste disposal had been practiced. Measures must be taken to reduce generated waste and create awareness regarding proper waste disposal methods.

Keywords: Household, solid waste management, waste disposal

Introduction:

Household waste, also known as solid waste composed of garbage and rubbish, which are disposable materials generated by households. Solid waste management is a prime problem for many urban local bodies in India, where industrialization has resulted in increased solid waste generation per person.[1] Household wastes can be classified as biodegradable and nonbiodegradable wastes.[2] Open dumping of wastes is a non-sanitary and non-engineered approach that manifests the surrounding environmental pollution issues, which also causes health risks.[3]

Waste segregation practices should be socially acceptable, affordable, and participatory with efficient management, essential for promoting waste segregation.[4] A key component of composting is the efficient segregation of waste, where mixed waste is often dumped in open areas. This is one of the major contributors to global warming. Segregation can help to reduce the burden of handling waste and greenhouse gas (GHG) emissions.[5]

There is a need to practice an integrated solid waste management approach such as incorporating more environmentally and economically friendly concepts of

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source separation, recycling of wastes, and public-private partnership.[6]

The study aims to determine household solid waste management practices among residents in urban slum area in Mumbai.

Methods:

This cross-sectional study was conducted in the field practice area of the Community Medicine Department of a one of the Medical College in Mumbai. The sample size was calculated using a previous study about knowledge, practices, and household waste management in Kaiparambu panchayat of Thrissur district, Kerala[7], which showed that 59.2% of people segregated their waste. By taking 59.2% as prevalence and 7% as the allowable error sample size was 200 as per $4pq/L^2$ where p = prevalence rate, q=100-p, L=allowable error. The families residing in the area for at least 6 months were included in the study, and the respondents were adult persons, preferably women, who were available at the household. Household where adult person not available on 3 visit or not willing to give consent were excluded. The study period was from August 2022-November 2022. The study was approved by the Ethics Committee for Academic Research Projects (ECARP/2022/138).

The study was conducted in an urban slum with a population of 92,596 (2011 census). It consists of a total of 11 sectors with 13,975 houses altogether. All the houses are numbered. The first house was selected by simple random sampling and after that, with the help of systematic random sampling, the next household was selected till 19 samples were collected from each plot. The consecutive house was included if any house was found locked or inclusion criteria were not fulfilled.

From each house, one participant was selected. Data were collected from all sectors. Prior informed consent was obtained from the study subjects. The purpose of the study was fully explained to the participants. Sociodemographic details of the study subjects were collected first, followed by questions about household waste management practices. Data were collected using a structured interview schedule and a checklist. Information about sociodemographic data and questions regarding household waste collection, waste segregation, waste disposal, waste management practices, and its effects was obtained. Measurement of the waste was done by digital weighing scale.

Qualitative data was represented in the form of frequency and percentage. Quantitative data was represented using Mean ± SD. Association between variables was assessed by the Chi-Square test. SPSS (Statistical Package for Social Sciences) version 23 was used for statistical analysis.

Operational definitions:

Waste segregation is sorting out or separating wastes into biodegradable and non-biodegradable wastes, into separate bins.

Waste disposal is the management of unwanted materials from generation point to final disposition.

Waste management practices include separation of wastes, collection, treatment and disposal methods.

Effects of waste management refers to the consequences of handling waste materials such as diseases, air pollution and flood.

Results:

Socio-demographic factors of the study population

Two hundred households were included in the study. The mean age of respondents was 38.67 ±10.80. A majority (93.5%) of the participants were females, 79% of the study population belonged to the Muslim religion, 21% belonged to the Hindu religion, 20.5% were illiterate, 21% had completed primary education, 47.5% had completed secondary education, 8.5% had completed higher secondary, 2.5% were graduated. Also, 75% of the participants were unemployed, 81% were married, 4.5 % were unmarried, 1% were divorced, 0.5% were separated, 1.5% were in live-in relationships and 11.5% were widows. More than half (59.5%) belonged to nuclear family, 33% belonged to the joint family and

Table 1: Distribution of Wastes and their Disposal Methods in the Households (N=200)

Variables	n	%
Category of generated waste		
Kitchen Waste	148	74
Plastic	42	21
Paper	15	7.5
Clothes	2	0.5
Others	2	0.5
Disposal of generated waste		
Cardboard box	3	1.5
Plastic bags	43	21.5
Wastebin	151	75.5
No storage	3	1.5
Disposal of collected waste		
Public bin	129	64.5
Open dumpsite	12	6
Road/street side	3	1.5
Drains/gutters	25	12.5
Municipal vehicle	52	26

7.5% belonged to 3-generation family. According to the Modified BG Prasad Scale, in 2021 the majority (48%) belonged to the middle class,27% to the lower middle class, and 16% to the upper middle class.

Household solid waste management

Waste segregation was done in only 33.5% of households. About 73% (146) of households generated 1 kg of waste daily, 12% (24) generated 2 kg of waste, 1% (2) generated 3 and 4 kg of waste and 12.5% (25) of household generated less than 1 kg of waste.

Among the study population, 87% emptied the waste container daily, and 9.5% once in 2 days. Only 3.5% used composting methods for kitchen waste and 11% were aware of e-waste. Only 13.5% of households' house-to-house collection of waste was carried out. The majority (91.5%) carried shopping bags while grocery shopping, 62.5% carried cloth bags, and 36.5% carried plastic bags. More than half of the study population (65.5%) agreed that burning plastic waste caused health hazards. They believed that the presence of heaps of solid wastes caused diseases (55.5%) and air pollution (56%).

Table 2: Comparison Between the Segregation of Waste and Factors Influencing Practice (N=200)

Variable	Segregation		Chi-square	p-value
	Segregating	Not segregating		
Education				
Illiterate	8 (11.9%)	32 (24.1%)	4.09	0.01
Literate	59 (88.1%)	101 (75.9%)		
Occupation				
Employed	20 (29.9%)	30 (22.6%)	1.26	0.26
Unemployed	47 (70.1%)	103 (77.4%)		
Socioeconomic status				
I (Upper class)	3 (4.5%)	2 (1.5%)	6.37	0.17
II (Upper middle class)	12 (17.9%)	20 (15%)		
III (Middle Class)	32 (47.8%)	64 (48.1%)		
IV (Lower middle class)	13 (19.4%)	41 (30.8%)		
V (Lower class)	7 (10.4%)	6 (4.5%)		
Perception of risk of disease				
Yes	30 (44.8%)	81 (60.9%)	4.61	0.03
No	37 (55.2%)	52 (39.1%)		

Table 3: Comparison Between Wastebin Usage and Factors Influencing Practice (N=200)

Variable	Wastebin usage		Chi-square	p-value
	Yes	No		
Education				
Illiterate	24 (15.9%)	16 (32.7%)	6.49	0.01
Literate	127 (84.1%)	33 (67.3%)		
Occupation				
Employed	34 (22.5%)	16 (32.7%)	2.02	0.15
Unemployed	117 (77.5%)	33 (67.3%)		
Socioeconomic status				
I (Upper class)	4 (2.6%)	1 (2%)	3.87	0.42
II (Upper middle class)	24 (15.9%)	8 (16.3%)		
III (Middle Class)	73 (48.3%)	23 (46.9%)		
IV (Lower middle class)	43 (28.5%)	11 (22.4%)		
V (Lower class)	7 (4.6%)	6 (12.2%)		
Perception of Risk of Disease				
Yes	82 (54.3%)	29 (59.2%)	0.36	0.62
No	69 (45.7%)	20 (40.8%)		

Discussion:

Socio-demographic characteristics

In the present study, women were chosen as they mostly managed household waste. The study area had a Muslim majority and had completed their secondary education. Based on the Modified BG Prasad Scale, most of the participants (48%) belonged to the middle class. In contrast to the present study, a study conducted by Nivya and Usha in Northern Kerala showed a majority of the participants were Hindus (83%) and 65.8% of women had an education level up to high school, 47% belonged to the upper middle class based on BG Prasad classification 2016 but a majority (57%) belonged to family size with less than or equal to four members.[8]

Household solid waste management

Most of the wastes generated in the present study (Table 1) were kitchen wastes and plastics and 73% of households generated about 1 kg of waste daily. Similarly, a study conducted by Rinnie and Falendra in Jammu City showed that slum areas produced (95%) 0-2kg of waste per day, and a majority of waste was food waste followed by plastic waste, paper, and cardboard waste.[9] In the present study, 75.5% of households used waste bins for waste disposal, and only 33.5 % segregated their waste. Among these, 87% emptied waste containers daily, and 64.5% used public bins for the disposal of waste. In a survey conducted by Pooja and Vandana in Mumbai, most of them (87.2%) stored their garbage in the dustbin, while the remaining household garbage was stored in plastic bags, buckets, *etc*. Regarding garbage disposal, 78.9% of the respondents handed it over to the garbage collector to whom they paid to collect the waste at their doorstep,19.3% threw it in the community bin or the vehicle and 63.3% of households segregated their waste.[10]

In the present study, in 13.5% of households, house-to-house waste collection happens,12.5% disposed of their wastes near drains/gutters, and only 3.5% used the composting method for the disposal of wastes. Waterlogging due to blockage of gutters during the rainy season in Mumbai creates damage to both the physical and biological environment. Similarly, the study conducted in Jammu City showed that the percentage of

households availing of door-to-door collection services was rarer in slum areas, and some of the respondents (43.3%) openly dumped the waste on roadsides or nearby vacant spaces, and only 4.17% practiced composting of household waste in their homes.[9]

In the present study, 12% of study participants were aware of e-wastes, and 65.5% agreed that burning plastics caused health hazards. People were aware of the side effects of plastic usage. A similar study conducted in Thrissur showed that 45.6% of people had an idea about e-wastes, and 94.4% of people thought that burning plastics causes health hazards.[7]In the present study, 11% of households used the recycling method of waste disposal. A study conducted in Bangladesh showed that 43% of participants reused old materials.[11]

In the present study, we found that there was a significant association between waste management practice and the perception of risk of disease conditions among households (Table 2) If segregation of waste did not happen risk of disease was high according to the study population. Similarly, a study conducted on the East coast of Malaysia showed that the majority (95.9%) of the respondents suggested poor waste management could contribute to disease occurrence, whereas 2.7% suggested it does not cause diseases and another 1.5% were unsure if it causes any diseases.[3]

Also, in the present study, we found that there was a significant association between education and waste management practices (Table 3) Literate people demonstrated proper waste management practices, such as using bins for waste disposal and segregation of waste. A study conducted in northeastern Ethiopia found that lower educational status was significantly associated with poor waste management practices.[12]

Limitations:

Despite the findings, there are some limitations to the present study. As the study is limited to an urban slum area, findings cant be generalized.

Conclusion and Recommendations:

The segregation of waste material was lacking even though municipal services like public bins were utilized well by people. The majority of waste generated in households was kitchen waste, but the usage of the composting method was very low. Literate people had better practices of waste bin usage and waste segregation methods. Education is an important factor that helps in proper waste management practices. Environmental education should be given. Measures need to be taken to reduce waste generation. Awareness creation and behaviour change are needed to promote source segregation of waste and make a "Garbage Free" India. Activities such as door-to-door collection should be encouraged.

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Conflict of Interest: Nil

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