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Household Waste Management in Rural Puducherry, India–A Descriptive Study

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ABSTRACT

Solid waste management continues to be a matter that is under-addressed in low and middle income countries, although they have direct and indirect health implications. India, with almost one-eighth of the world population, continues to lack logistic support and community awareness about this social problem, particularly in rural areas. Few studies have been undertaken to understand the household waste management practices in rural India. This study aimed to describe the waste management practices of a village in puducherry with a focus on plastic wastes. This community-based cross-sectional study was conducted in one of the four field practice areas of a tertiary care institute in South India. The study was conducted over a period of one month in 2019 using a pre-tested questionnaire. All households irrespective of duration of stay in the village were included into the study. Any adult member of the household available at the time of the survey acted as the participant. A total of 234 households were sampled of which the majority belonged to middle class. Although waste collection bins were available, over 50% of the households resorted to open dumping or burning of wastes. Around 10% of households practiced open defecation. Segregation of waste and reuse of plastic bags were done by 12.8% and 18.8% of households respectively. This study provides a basic framework for agencies regarding the areas in which more work is required. Evidence-based policy formulation, implementation and enforcement are the need of the hrs.

INTRODUCTION

India is the second most populous country in the world with a population of 1.3 billion, which is projected to rise by another 17% by 2030[1]. With the steady rise in population there will be a constantly increasing pressure on the natural carrying capacity of the planet. This could give rise to several environmental problems. One of the major and often neglected problems is Solid Waste Management. Solid Waste Management (SWM) can be defined as the full life-cycle management of the wastes from the point of generation up to the point of successful disposition of residual material into the mainstream. These involve steps like segregation, handling, collection and treatment in addition to steps like monitoring, prevention of waste generation and reusing of generated waste constructively[2]. Although many countries in the West improved upon the logistics of SWM, many developing countries have started to set frameworks in this direction only recently[3]. India is in the forefront in this regard with its recent initiative of Swachh Bharat Abhiyan (SBA)[4] and other initiatives wherein waste minimization, storage, reducing and reusing environmental considerations of development is being pioneered along with education and training to spread awareness regarding the same.

SWM is an area which is also a part of the United Nation's (UN) Sustainable Development Goals (SDGs) and yet, literature regarding the peculiar contexts and constraints of the Indian scenario are minimal. There are even fewer studies that look into the waste management practices in the light of the SBA. The study concentrates on household wastes and the manner in which it is being dealt with now. It also looks to collate the assessment regarding various practices regarding waste segregation and plastic waste management among the population in the villages subjected to the study. The objective of the current study is to describe the waste management practices of a village in puducherry with a focus on plastic wastes.

MATERIALS AND METHODS

It was a community based cross sectional study conducted in Thondamantham, one of the four villages catered to by the rural health training centre of JIPMER, Puducherry. The village has a population of around 4000 individuals, belonging to a total of 1124 households, as per an enumeration undertaken by the centre in 2017. SBA is implemented in the village in the form of public waste collection bins and cash incentives for construction of toilets. In addition, solid waste gets collected street to street twice in a week when municipal vans arrive to empty the bins. All households irrespective of duration of stay in the village were included into the study. Any adult member of the household available at the time of the survey acted as the participant. The study was done in the month of June 2019 as part of a learning programme in environmental health by the department of preventive and Social Medicine for the MBBS students of JIPMER. The survey was carried out by the students under the supervision of junior resident doctors in the department. Training sessions on questionnaire administration were done prior to initiation of the survey to ensure uniformity of the data collected. The questionnaire consisted of two parts details of socio-demographic features followed by information about the waste management practices.

The sample size was calculated to be 196 presuming the proportion of households disposing solid wastes at the waste disposal bins to be 50%, with 7% absolute precision and 95% confidence interval. An additional 20% was added to account for non-response and missing data, bringing the sample size to 234. The proportion of 50% was presumed, as there was no existing data available related to waste management practices under the SBA. Systematic random sampling was done in each street with a sampling interval of[4]. If a house was found to be locked the next open house was approached for data collection. All the approached households consented to take part in the survey.

Variables: Socio-demographic details collected from the participants included gender, educational status, family income, number of family members and type of house. Socio-economic status was computed based on per capita income according to the B.G. Prasad Classification. Details of waste disposal were collected separately for solid wastes, sewage and sullage. Details of waste segregation and plastic waste management were collected separately.

Data analysis: Data was entered in Microsoft Excel version 2016 and analysed on STATA version 12. All the variables were treated categorically and expressed as proportions.

RESULTS

A total of 234 participants responded to the survey conducted in the village of Thondamanatham, one of the four villages catered to by the rural health training centre of JIPMER, Puducherry. Seventy three point five percent of the respondents were female. A quarter of the respondents had no formal education and another quarter had formal education up to the secondary level. The socio-economic status was also found to be well-dispersed in various strata with the maximum of 38.5% in the lower middle income group. While 25.6% were in the middle class and 20.5% in the upper middle class, there were about 11.1% in the lower class (Table 1). Of the 234 houses from which the data was

Table 1: Socio-demographic details of the study participants (N = 234)

Socio-demographic characteristics	n (%)
Gender of respondent	
Male	62 (26.5)
Female	172 (73.5)
Educational status	
No formal education	58 (24.8)
Primary (1-5)	30 (12.8)
Upper primary (6-8)	28 (12.0)
Secondary (9-10)	58 (24.8)
Senior Secondary (11-12)	32 (13.7)
Graduate (>12)	28 (12.0)
Socio-economic status	
Upper	10 (4.3)
Upper middle	48 (20.5)
Middle	60 (25.6)
Lower middle	90 (38.5)
Lower	26 (11.1)
Family type	
Nuclear	142 (60.7)
Extended	92 (39.3)
House Type	
Kutcha	8 (3.4)
Semi-pucca	80 (34.2)
Pucca	146 (62.4)

Table 2: Household waste disposal practices (N = 234)

Categories	n (%)
Refuse disposal	
Municipal waste collection point	112 (47.9)
Open dumping	106 (45.3)
Burning	16 (6.8)
Sullage disposal	
Public drainage system	128 (54.7)
Open drain	86 (36.7)
Soak pit	20 (8.6)
Sewage disposal	
Household toilet	206 (88.0)
Open air defecation	22 (9.4)
Public latrine	6 (2.6)

Table 3: Practice regarding segregation and plastic waste disposal (N = 234)

Variables	n (%)
Practice of waste segregation	
Present	30 (12.8)
Absent	204 (87.2)
Practice of reusing plastics	
Present	44 (18.8)
Absent	190 (81.2)
Practice of burning plastics	
Present	82 (35)
Absent	152 (65)

collected almost an equal number depended either on municipal machinery (47.9%) or open dumping (45.3%) for their waste disposal. Most of the participants (54.7%) used the public drainage system for sullage disposal with a majority (88%) having household toilets for sewage disposal (Table 2). A majority of the sample (87.2%) did not practice waste segregation. Though a large chunk (65%) did not engage in the practice of burning plastics, they weren't particularly keen on reusing plastics either as responded by 81.2% of the respondents (Table 3).

DISCUSSIONS

The study revealed a mixed picture regarding the present scenario of household waste generation and awareness regarding its proper disposal among the rural public in puducherry. In the study, 73.5% of the respondents were female. This was important to note as in rural parts of the country, household chores are predominantly seen as an area dominated by females. Therefore, to understand how decisions are taken in this regard, such a sample with more women is ideal. The educational status of the sample space is an important indicator with regards to how important they perceive SWM to be. 24.8% of the respondents had no formal education, while 12.8% had a primary education, 24.8% had a secondary education and only 12% of the respondents were graduates. It was, therefore, expected that without concerted efforts to spread awareness among them as most of them were educated the public in Thondamanatham shouldn't be expected to know about household waste management. Knowledge and attitudes regarding SWM and its implications exhibit direct correlation with the educational levels and income standards of the people under consideration[5].

Even though the study was conducted in rural background the houses which were encountered were mostly Pucca (62.4%). With another 34.2% houses being semi-pucca, this showed an improving trend in the level of basic infrastructure available in the region. This data is important considering how the housing status is an important variable which positively impacts the other associated variables concerning waste management awareness and attitudes[5]. Increasing status of households from kutcha to pucca encourages better cleanliness in the surroundings. This is also suggested by studies in other countries where per capita income is seen as a variable, which when increases, directly impacts waste management results[3].

In accordance with the trends across the country which show nuclear families rising in rural areas while extended families show a rising trend in urban areas the nuclear families were in majority in this sample space too at 60.7%[6]. The size of the family is also having a direct impact on the waste disposal practices. Nuclear families with lesser members result in lesser waste generated per household but may use up more resources like water and power. However, when size of the family is combined with educational status and income levels the correlation to SWM practices are noteworthy. The higher the educational status and income levels the more informed the person seemed to be about SWM practices and their attitudes were more inclined towards healthier and more environmental friendly systems[7].

Once we set up the framework of the kind of society we are dealing with it becomes easier to put their waste management practices into perspective. The refuse disposal practices are in line with what is expected in India, where municipality presence is sketchy. Majority (47.9%) of the respondents used municipal waste collection points to dispose their

household wastes while 45.3% resort to open dumping. 6.8% even burnt their wastes openly. This mirrors the findings of Jayasubramaniam *et al.* where the municipality's activities were perceived as unsatisfactory by 57.1% of the public in Coimbatore, on an average[2]. The fact that 52.1% of the respondents had no accredited methods of refusal disposal shows the lack of municipal infrastructure which translates to poor waste handling and disposal. Sullage disposal was on a slightly more solid ground with 54.7% of the respondents having access to public drainage systems. However, 36.7% had to make-do with open drains while 8.6% were left with soak pits to dispose domestic waste water. The Swachh Bharat campaign concentrates on sewage and on reducing open defecation, while sullage disposal takes second priority.

Even with 96.6% of the houses being either pucca or semi-pucca, many didn't have access to public drainage infrastructure. This has been attributed to the apathy displayed by the successive governments as seen by the plan outlays of Planning Commission providing less than 2% for water supply and sanitation infrastructure up until the 8th plan[8]. The steps taken recently with regards to the infrastructure are commendable but it will take some time before the historical neglect can be remedied. An important comparison was between two cities in Brazil and India with respect to how wastes are handled which shows that efforts are piecemeal and patchy with several gaps in how wastes are handled in Coimbatore, while in Vitoria the healthy cooperation between the municipality and the independent and organised *catadores* sector help provide a seamless mechanism of waste collection, recovery and recycling[3]. Sewage disposal is an area where rising income levels have shown a noticeable effect. Eighty eight percent of the households have household toilets, which are in line with Tamil Nadu's Swachh Bharat-Abhiyan-Gramin (SBA-G) numbers[4]. Since SBA-G doesn't have union territories data, we have to extrapolate based on regional similarities. 9.4% of the respondents practised open defecation while 2.6% used public latrines. This shows a need for behavioural change. Even with public latrines available people resorting to open defecation is an issue. The government's awareness programs need to be broader based. Even NGOs and institutions like JIPMER need to spread out more with the cleanliness drives.

When it comes to solid waste disposal and recycling, one of the major steps in the process is that of segregation. Segregation is the process, ideally done at an individual household level, which involves separating the wastes into their dry and wet, degradable and non-biodegradable, recyclable and non-recyclable constituents to assist in easier management and disposal[9]. Segregation can be done either at the source of the waste or at a central processing facility, depending upon the type of society and efficiency of the civic infrastructure. In the sample only 12% practiced waste segregation. One of the reasons for this could be the lower levels of education and a consequent lack of awareness regarding the direct link between poor waste disposal and health concerns. Also, attitudinal problems persist as found in a study where more than 75% of a society chose not to participate in awareness programs conducted by various governmental and non-governmental agencies[2]. The minority who were engaged in segregation said that 12.8% of them conducted it within their houses itself while another 15.4% had other places where segregation was done. This is usually a central location within the community, used for "communing" of similar wastes and is usually done by private third-parties[3].

The "4 Rs"- Refuse, Reduce, Re-use and Recycle of plastics is suggested by Plastic Waste management rules 2016. The entire Gram Panchayats, blocks and districts are asked to abide to these rules[10]. Use and reuse of plastics when assessed in our study, it was found that 81.2% of the respondents do not engage in reusing of plastics. This increasing use of single-use, disposable plastics result in burgeoning waste dumps, clogged public drainages, soil and water pollution and consequent catastrophic environmental problems in the long term[11-12]. However, 65% the respondents in Thondamantham did not practise burning of plastics, which is a positive sign.

CONCLUSION

Household wastes form a major chunk of the total solid wastes generated in an economy and therefore a study on SWM, with emphasis on household wastes is imperative. In a country like India, where plan heads are mostly limited to the paper, even if the implementation is underway, it is usually constrained to the urban areas. Planning for civil amenities and basic infrastructure in rural areas is often a neglected area. In this situation, this study on household waste generation and awareness regarding the same provides a basic framework for the governmental and non-governmental agencies regarding the areas in which more work needs to be done. Evidence-based policy formulation, implementation and enforcement is the need of the hrs. All students and the participants are acknowledged for their contribution to the study.

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