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Awareness and Practices of Biomaterials in Solid Waste Management in Urban Pune

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Abstract

Biomaterials in solid waste management has been a main public concern and sensitivity to the environmental issues particularly in Urban India recently. Urban environmental management of Biomaterials in solid waste in India needs the massive reforms in order to ensure better environmental safety. Reviewing the effectiveness of all waste minimization instruments and identifying potential new instruments that could be made operational at the country level has been on agenda globally especially for biomaterial substances. In this paper we discuss the result of a survey conducted in Urban Pune regarding the awareness and practices adopted by the residents on biomaterials in solid waste management. We studied statistically the practice and awareness of the biomaterials and solid waste management issue with age, gender and the educational qualification of the residents which revealed a few prominent features about the attitude and the public concern in general. Our findings will help the policymakers to plan and execute the reforms effectively to address the most contemporary issue in urban India.

Keywords: Biomaterials; Solid waste; Solid waste management; Awareness and Practices; Urbanization; Health hazards.

Introduction

In India, the collection, transportation and disposal of waste especially waste containing biomaterials has been a cause of concern since many years [1 – 2].

The problem is most severe at the urban level, since massive urbanization is taking place at a rapid pace [3]. This rapidly increasing urbanization is significantly associated with the rampant economy and the environmental imbalance. Moreover, the urbanization has resulted into the industrialization where the modern science and technology is introducing the hazardous chemicals and pollutants without addressing the ill-effects for human life [4 – 5]. This resulted into the most contemporary issue that the man has to face as a consequence of environmental imbalance. Recently, the important concern such as air pollution, noise pollution, sanitation, water contamination and solid waste management has further triggered the issue for the urban residents in India. The uncontrolled dispersal of solid and liquid waste in the environment would further worsen the biological processes which are important for the sustainability of human life. There is an urgent need to implement the necessary preventative measures to improve the sanitation and the solid waste management in general [5]. It is therefore required to know the general awareness, practices and attitude of the people regarding the environmental issues happening around them [6]. On the other note, unlike the study by Sah Mahesh Kumar et al, further studies are required to understand and appreciate by the urban and rural dwellers; the efforts for the development of biocompatible materials from the solid waste generated in the urban areas [7]. Moreover, it is high time that the awareness regarding "Garbage In, Biomaterials Out (GIBO)" concept, that not only recycles the solid wastes, but also adds to biomaterial raw products for further product development in tissue regeneration industries needs to be tested among the Indian residents [7].

Pune is the cultural capital of Maharashtra. Since the 1950-60s, Pune has had traditional old-economy industries which continue to grow. The city is now also known for Manufacturing, Automobile, Government & Private sector Research Institutes, Information technology (IT) and Educational, Management, Training institutes that attract migrants, students and Professionals not only from India but also from abroad. Pune is slowly becoming a cosmopolitan city and is now an important commercial center in Maharashtra. However, recently Pune city is witnessing a very high volume of floating population and daily commuters after Mumbai [5], which has become a cause for road littering. In many areas of the city, streets are in ill-maintained conditions due to lack of timely street sweeping and there is clogging of surface water drains due to solid waste dumped into it. At present, the door-to-door collection of waste is not adequate. Because of non-segregation, part of the waste that gets dumped on the disposal sites is recyclable in nature. This has led to increase in quantity of waste required to be disposed.

The slum dwellers do not have good access to proper services and hence dispose their waste in the public spaces like roads, drains or railway tracks. Also, hawkers tend to contribute in littering of roads. No doubt, the effective waste management requires the awareness and good practices by the citizens. In this paper we discuss the result of a survey conducted in urban Pune regarding the awareness and practices adopted by the residents on solid waste management.

Methodology

Data collection:

A structured questionnaire was prepared comprising several relevant questions on awareness and practices of biomaterials and solid waste management at the household. The questionnaire was tested for its validity during a pilot survey. It was then circulated among the residents situated near camp area of urban Pune in Maharashtra state. A total of 500 questionnaires were circulated among the urban/slum residents during 15th to 31st January 2014 and 396 returned the completed questionnaire (response rate 79.2%). Sixty-two respondents did not completely filled-up the questionnaire hence were discarded from the subsequent analysis; thus, the final analysis was processed on responses of 334 questionnaires.

Statistical analysis:

We used Chi-Square test (Fisher's exact probability test) to test the equality of distribution of responses related to

awareness and practices of solid waste management across residential location, gender, and educational status. The entire data was entered and cleaned in MS Excel and was statistically analyzed using statistical package for social sciences (SPSS, version 24.0) for MS Windows. P-value less than 0.05 is considered to be statistically significant and are marked as 'S' in the result tables, while the non-significant p-values (P-values>0.05) are marked as 'NS'.

The responses regarding awareness and practices of biomaterials and solid waste management have been analyzed separately. The results regarding the distribution of awareness of solid waste management across place of residence, gender and educational status are shown in tables 1a, 1b and 1c; while the results regarding the distribution of practices of biomaterials in solid waste management across place of residence are shown in table 2.

Result and Discussion

TABLE 1A THE DISTRIBUTION OF BIOMATERIALS AND SOLID WASTE MANAGEMENT AWARENESS ACCORDING TO RESIDENTIAL LOCATION.

	Urban Middle Class (n=291)	**Urban Slums (n=43)**	**All (n=334)**	**P-value**
Aware about Biomaterials and Solid waste management techniques				
Yes	234 (80.4)	10 (23.3)	244 (73.1)	0.001 (S)
No	57 (19.6)	33 (76.7)	90 (26.9)	
Aware about the health hazards of poor biomaterials and solid waste management				
Yes	264 (90.7)	13 (30.2)	277 (82.9)	0.001 (S)
No	27 (9.3)	30 (69.8)	57 (17.1)	

Values are n (% of residents). P-values by Chi-square test if cell frequencies are larger than 5, else Fisher's exact probability test is used on pooled data. P-value<0.05 is considered to be statistically significant. S: Significant.

TABLE 1B THE DISTRIBUTION OF BIOMATERIALS AND SOLID WASTE MANAGEMENT AWARENESS ACCORDING TO THE GENDER.

	Male (n=130)	**Female n=204)**	**P-value**
Aware about biomaterials and solid waste management techniques			
Yes	98 (75.4)	146 (71.6)	0.443(NS)
No	32 (24.6)	58 (28.4)	
Aware about the health hazards of poor biomaterials and solid waste management			
Yes	109 (83.8)	168 (82.4)	0.724 (NS)
No	21 (16.2)	36 (17.6)	

Values are n (% of residents). P-values by Chi-square test if cell frequencies are larger than 5, else Fisher's exact probability test is used on pooled data. P-value<0.05 is considered to be statistically significant. NS: Non-significant.

TABLE 1C THE DISTRIBUTION OF SOLID WASTE MANAGEMENT AWARENESS ACCORDING TO THE EDUCATIONAL STATUS.

	Educational status				
	Illiterate (n=8)	**Primary/Secondary (n=129)**	**Graduate/Post Graduate (n=148)**	**Professional (n=49)**	**P-value**
Aware about biomaterials and solid waste management techniques					
Yes	4 (50.0)	91 (70.5)	113 (76.4)	36 (73.5)	0.335 (NS)
No	4 (50.0)	38 (29.5)	35 (23.6)	13 (26.5)	
Aware about the health hazards of poor biomaterials and solid waste management					
Yes	4 (50.0)	103 (79.8)	128 (86.5)	42 (85.7)	0.035 (S)
No	4 (50.0)	26 (20.2)	20 (13.5)	7 (14.3)	

Values are n (% of residents). P-values by Chi-square test if cell frequencies are larger than 5, else Fisher's exact probability test is used on pooled data. P-value<0.05 is considered to be statistically significant. S: Significant, NS: Non-significant.

TABLE 2 THE DISTRIBUTION OF BIOMATERIALS AND SOLID WASTE MANAGEMENT PRACTICES ACCORDING TO RESIDENTIAL LOCATION.

	Urban Middle Class (n=291)	**Urban Slums (n=43)**	**All (n=334)**	**P-value**
Location of storage for household waste				
In each room	82 (28.2)	8 (18.6)	90 (26.9)	0.275 (NS)
One main room	203 (69.8)	33 (76.7)	236 (70.7)	
No waste bin	6 (2.1)	2 (4.7)	8 (2.4)	
Waste bin management within the society/area				
Private collection centers	77 (26.5)	3 (7.0)	80 (24.0)	0.012 (S)
Municipal waste bins	209 (71.8)	38 (88.4)	247 (74.0)	
None of these	5 (1.7)	2 (4.7)	7 (2.1)	
Waste sorting done at home				
Yes	184 (63.2)	11 (25.6)	195 (58.4)	0.001 (S)
No	107 (36.8)	32 (74.4)	139 (41.6)	

Values are n (% of residents). P-values by Chi-square test if cell frequencies are larger than 5, else Fisher's exact probability test is used on pooled data. P-value<0.05 is considered to be statistically significant. S: Significant, NS: Non-significant.

Awareness towards biomaterials and solid waste management:

Awareness according to place of residence:

The distribution of awareness of biomaterials and solid waste management according to the place of residence is shown in table 1a. Of 291 urban middle class residents, 234 (80.4%) were aware about the techniques of managing the solid waste, the corresponding figure

for slum dwellers was 10 (23.3%) which was statistically significant (P-value<0.001). Of 291 urban middle class residents, 264 (90.7%) were aware about the health hazards of poor solid waste management, the corresponding figure for slum dwellers was 13 (30.2%) which was statistically significant (P-value<0.001).

Awareness according to gender and education:
The distribution of awareness of biomaterials and solid waste management according to gender is shown in table 1b. The distribution of awareness did not differ significantly between men and women residents (P-value>0.05), as 75.4% of men and 71.6% of women had awareness regarding the techniques of solid waste management. Of 130 men, 109 (83.8%) and of 204 women, 168 (82.4%) had the awareness regarding the health hazards of poor solid waste management, the difference was not statistically significant (P-value>0.05). The distribution of awareness of solid waste management techniques and distribution of awareness on health hazards of poorly managed solid waste according to educational status is shown in table 1c. Relatively higher proportion of graduate/postgraduate or professional educated residents were more aware about the techniques of solid waste management compared to the illerates or primary/secondary educated residents, though the difference was not statistically significant (P-value>0.05). Significantly higher proportion of graduate/postgraduate or professional educated residents were more aware about the health hazards of poor solid waste management compared to the illerates or primary/secondary educated residents, the difference was statistically significant (P-value<0.05).

Practices of solid waste management:
Practices across urban middle class and slums:
The distribution of biomaterials and solid waste management practices according to the residential location has been shown in Table 2. Relatively large proportion of residents from both urban middle class and slum locality had at least one waste bins located in their main room (69.8% urban middle class, 76.7% slums), the difference was not statistically significant (P-value>0.05). Relatively higher proportion of urban middle class residents had waste bin in each of their rooms (28.2%), the corresponding proportion for slum dwellers was 18.6%, which was not statistically significant (P-value>0.05). Significantly higher proportion of slum dwellers (88.4%) revealed that they had a municipal waste bin near their society for centralized collection of waste within a distance of less than 100meters. Also, significantly higher proportion of urban middle class residents had private collection centre (26.5%) in addition to the centralized collection centre, the corresponding proportion for slum dwellers was 7.0%, the difference was statistically significant (P-value<0.05). The significantly higher proportion of urban residents (63.2%) practice waste sorting at their homes while only 25.6% of the slums dwellers practice the same, the difference being statistically highly significant (P-value<0.001).

Conclusions

Our results reveal some prominent features regarding awareness and practices of urban residents towards the biomaterials and solid waste management. It is interesting to note that significantly higher proportion of urban residents had better awareness and had better practices towards solid waste management compared to the slum dwellers. In general awareness did not differ between men and women but it differed significantly across different education groups implicating the direct role of education in appreciating the importance of better solid waste management. Our findings will help the policy makers to plan and execute the awareness campaign of solid waste management across urban Pune targeting relatively less educated slum dwellers.

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