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ADDRESSING WASTE ASSOCIATED PROBLEMS IN ALIGARH CITY

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Abstract

Indian cities have a striking similarity when it comes to heaps of garbage, overflowing waste bins and drains, a sign of municipality's inefficiency in managing waste. The problem of waste is not just limited to large cities but has seeped into smaller cities like Aligarh. In this paper an attempt has been made to assess the waste associated problems both inside the homes and in the neighbourhoods. The study is mainly based on primary data which were collected through city/ household surveys with the help of a questionnaire interviews. The sample size consisted of 1,629 households belonging to different income groups. Field work was done during the years 2006 and 2007. City and household surveys helped in identification of three most important problems associated with waste – problem of pests inside the house, problem of waterlogging in the neighbourhood and health problems.

Introduction

With the increase in population, urbanization, improvement in the standard of living and the rising demand for food and other essentials there has been a rise in the quantity of waste being generated daily by each household. Urban population of India at present is 285 million and the per capita solid waste generation is between 350 to 1,000 grams per day (Census of India, 2001, Bhide A.D. et. al., 1993). The per capita waste generation in urban areas also varies according to size of the population of the urban areas. It has been estimated that in cities with a population of less than 1 million people the per capita waste generation is 0.21 kg. per day while in cities with a population of more than 5 million the waste generated goes up to 0.50 kg per day per capita (NEERI, 2000). In India about 22,900 million litres of waste water is generated per day and of this 75 per cent of untreated waste water reaches the Indian rivers (CSE, 2005).

There is just too much of waste and all of us contribute liberally every day. But what if the waste collecting municipal worker does not come? The lanes of residential colonies are seen overflowing with garbage and with the stench of rotting wastes, dogs and other stray animals are seen rummaging through them. Waste, whether solid or liquid if not properly managed it creates problems. Uncollected waste whether lying inside the house or in the neighbourhoods attracts flies, cockroaches, rats and other creatures which in turn spread diseases. The plague outbreak in Surat (1994) is appropriate example of a city which suffered due to callous attitude of the municipal body in maintaining cleanliness in the city.

Indian cities have a striking similarity when it comes to heaps of garbage, overflowing

waste bins and drains, a sign of municipal inefficiency in managing waste. The problem of waste is not just limited to large cities but has seeped into smaller cities like Aligarh.

People in the larger cities are aware and have some knowledge regarding the problems associated with waste but such awakening is missing in smaller cities. Aligarh city now has overloaded waste bins and dump yards, open overflowing drains in plenty. It is in this background that there appears a need to assess the waste associated problems and Aligarh city has been selected as the study area. In this paper an attempt has been made to assess the waste associated problems both inside the homes and in the neighbourhoods.

Database and Methodology

The study is based on primary data which have been collected through city/ household surveys with the help of a questionnaire interviews. Field work was done during the years 2006 and 2007.

For selecting the sample, multi-stage stratified sampling design was adopted. From the 60 wards of the city, about 16 wards (10 wards from old city zone and 6 wards from the civil lines zone) were selected on the basis of population and location. From these selected wards, 5 per cent households from each ward were selected on the basis of income. The total sample size consisted of 1,629 households belonging to different income group (69 from very high income group (Rs. > 20,000 per month), 167 from high income group (Rs 14,000 -20,000 per month), 612 from medium income group (Rs.8, 000- 14,000 per month), 490 from low income group (Rs. 2, 000-8,000 per month) and 291 from very low income group (Rs. <2,000 per month). An interview schedule was prepared and applied to collect information regarding the waste associated problems occurring both inside and outside the homes.

Study Area

Aligarh (27053' N latitude and 780 4' E longitude) a medium sized city located in the fertile Gangetic plain of north India was chosen as the study area. Aligarh city can be described as having dirty roads filled with vegetable and animal refuse, without proper sewers and gutters, having open foul smelling putrid drains with stagnant dirty water. The city is located along the Delhi – Kolkata railway line, about 130 km. away from New Delhi. This railway line divides the city in two parts, on the east lies the congested old part while on the west lies the new part or the civil lines area. The city covers an area of nearly 44.82 sq. km. and has a population of 0.66 millions. The city is divided into 60 wards and 427 *mohallas* and has 102,004 households (AMC, ADA, 2008).

Collection and Disposal of Waste

The Aligarh Municipal Corporation is responsible for collection, transportation and disposal of solid waste from within the municipal area of the city. It is estimated that on an average each resident of the city produces 0.5 kg of garbage per day. This means that within the city the waste generation is about 400 metric tonnes /day. The city waste content may vary depending on the sources generating waste and season. Mainly it consists of silt (30 per cent) and plastic (20 per cent) while rest of the waste consists of paper, organics, glass, inert materials and various other components. The main sources of waste generation are residential, commercial and industrial areas apart from hospitals, hotels, restaurant etc. Collection (includes street sweeping and door-to-door collection from the source and transporting it to secondary sites), transportation (from secondary sites) and final disposal (to landfill site) is done by the

municipality.

Discussion and Results

Household surveys helped in gathering information regarding the nature and type of solid waste, its storage/disposal practices and type of drainage facilities available in the different sampled households.

The higher income households (both the very high and high) generate more of both biodegradable (60-67 per cent) and non-biodegradable waste (41-50 per cent). They generate maximum waste because they are high class consumerist of modern articles as a result a sea change in the composition of waste has occurred. With emerging pepsi-coke culture and fast readymade food culture the amount of waste has increased in higher income households. Economic prosperity increases the amount of solid waste generated. Household waste if not properly stored indoors it creates problems. The higher income households are aware of this so they store waste inside their homes in closed containers and have proper dust bins in every room. Most of the waste is disposed at least once a day by servants in the municipal waste bins. They reported of clean neighbourhoods without waste heaps (75 per cent) and the frequency of solid waste collection/disposal by the municipal workers was almost daily (76 per cent). The water wastage was the highest in these households. They have pucca drains (90 per cent) around their house and waste water is disposed in these drains.

The medium income households also generate both biodegradable (37 per cent) and non-biodegradable waste (32 per cent) but lesser than the higher income households. About 90 per cent of them store waste (62 per cent in close containers and 28 per cent in opens containers and in polythene bags) while rest of them (10 per cent) did not store waste. About 63 per cent of them disposed their waste by themselves at least once a day in the municipal waste bins while rest dumps their waste in the streets. They reported dirty neighbourhoods as waste was seen pilfered in their surroundings in huge quantities. About 48 per cent of the households reported that the municipal workers collect the waste weekly while 18 per cent reported fortnightly collection of waste from the neighbourhoods. About 67 per cent households have access to *pucca* drains while rest dispose the waste water in and around the house/yards.

The lower income households also generated both biodegradable and non-biodegradable waste but in much lesser amount. They generate less solid waste because they generally reuse their articles. Nearly half of them reported of not storing their waste properly inside their homes. Rest of them stored in open containers or in polythene bags. This shows that income and education level of the households is significantly related with the type of storage and disposal practices adopted by the households. The frequency of waste disposal from their houses is more because whatever waste they have is thrown out by them just outside their house, in the open drains or in plots or in waste dumps. There is poor coverage by the municipal workers for collection and disposal of waste from these colonies occupied by poor people. Waste heaps/accumulation of waste is a common sight in the neighbourhoods. There is no proper drainage system in these colonies. Mostly water is disposed off in dug-out drains / *kutcha* drains which were made by them. Waste water is mostly disposed in the yards around the house. Thus, waterlogging is a frequent problem in these poor localities.

Waste Associated Problems

The household surveys also helped the

researcher in the identification of waste (both solid waste and waste water) associated problems occurring both inside the house and in the neighbourhood. It was observed that household solid waste has more of kitchen waste which is organic in nature. If it is not stored properly in closed containers inside the house and if it is not regularly/frequently disposed off at least once a day from the house to disposal sites, it will accumulate inside the house. Since it has more of organic components, high densities and moisture content which helps the waste to decompose and this increases the risk of attracting disease causing pests such as flies, cockroaches, rats and mice. These pests are both filth feeders and breeders. They make their home in the waste heaps inside the homes and help in spreading of diseases. Again due to faulty household waste water disposal practices especially by the lower income households in dugout *kutcha nalis*, inside/around the house or in the yards/open plots or along the roads/streets which results in waterlogging around the houses, in lowlying areas and on roads/streets. These waterlogged areas provide ideal breeding ground for mosquitoes which are also disease carriers.

Secondly due to disposal of household waste at unauthorized sites (i.e. near/ around the house, into the drain, on road, in open plots), inadequate (half of the waste is not collected) and irregular collection/ transportation services by the municipal workers from the secondary sites to final disposal site leads to accumulation of waste or dumps in the secondary authorized (municipal waste bins) and unauthorized sites in the neighbourhood. It has been observed that only a small quantity of waste reached the final disposal site. Good part of waste remains uncollected leaving the neighbourhood population vulnerable to pungent smells, germs and bacteria, harmful gases and pests. Stray animals especially cattle, pigs and dogs were seen eating the uncollected waste. Even rag pickers were seen rummaging through it. Rats were reported to come from these waste dumps along with flies and cockroaches inside the house.

The three most important problems associated with the solid waste disposal identified in Aligarh city are:

(i) Problem of Pests inside the House

An important problem associated with improper storage of waste, inadequate and irregular disposal of waste was the occurrence of pests inside the house. The heaps of wet garbage inside the house increases the risk of attracting disease causing pests such as flies, cockroaches, rats and mice. Table 1 reveals the relationship between income level of the respondent's household and the prevalence of pests inside the house. These pests were more prevalent among the households belonging to the low income group (Table.1). Waste accumulation inside the house can become a nuisance – because of the foul smells, the disease vectors and pests which are attracted to it. The diseases they cause or carry include some of the major causes of ill health. Of all the pests the housefly is found in all homes. The house fly is both a filth feeder and breeder. Flies are mechanical carriers and can contaminate human food or drink through direct contact or by defecating or regurgitating stomach contents. Unsanitary conditions attract more flies and hence there is a higher risk of diseases that the flies will spread.

A perusal of Table 1 reveals that flies are common in both kitchen and toilets. The difference between poor and wealthy households was more striking with respect to flies in the toilets than with respect to flies in kitchen. The lower income households have access of flies in both the places while the higher income households reported of having

Table 1

Aligarh City: Income-wise Distribution of Sampled Households (in percentages) according to Prevalence of:

(i) Pests Inside the House

Income group	Prevalence of pests* inside the house		Flies in food preparation area			
	Yes	No	Almost never	Occasionally	usually	Almost always
Very high	19.49	80.51	49.1	45.3	5.6	-
High	26.68	73.32	39.3	43.1	13.7	3.9
Medium	85.68	14.32	30.5	29	29.8	10.7
Low	100	-	6.4	24	41.2	28.4
Very low	100	-	3.9	13.7	49.1	33.3
Total	89.04	10.96	25.84	31.02	27.8	15.26

* (flies, cockroaches, rat/mice)

(ii) Flies in Food Preparation Area and in Toilets

Income group	Flies in toilets			
	Almost never	Occasionally	usually	Almost always
Very high	92.1	5.9	2	-
High	82.4	9.8	5.8	-
Medium	54.2	17.6	16.7	11.5
Low	14.3	16.3	23.8	45.6
Very low	3.9	13.9	27	55.2
Total	49.38	12.7	15.06	22.46

(iii) Cockroaches and Rats/ Mice

Income group	Prevalence of cockroaches			
	Never	Occasionally	Often in small numbers	Often in large numbers
Very high	42.4	37.3	12.2	8.2
High	39.6	35.3	16.5	8.6
Medium	19.6	32.1	21.9	32.1
Low	7.7	15.4	30.1	46.8
Very low	3.7	8.1	38.2	50
Total	22.6	25.64	23.78	29.14

Income group	Prevalence of rats/ mice			
	Never	Occasionally	Often in small numbers	Often in large numbers
Very high	72.4	14.3	2.3	11
High	62.8	17.6	3.9	15.7
Medium	32.1	37.4	14.5	18
Low	18.8	24.4	18	38.8
Very low	11.6	20.5	27.5	40.4
Total	39.54	22.84	13.24	24.7

Source: Based on field survey (2006-07)

no flies in their toilets. Under such conditions, cockroaches like flies, can also be mechanical carriers of disease.

While not inherently attracted to human faeces, they sometimes live in houses where contact is likely. Pathogenic bacteria may then be deposited on food as the cockroaches forage in a kitchen or food area. Cockroaches could be playing a role in the transmission of bacterial diarrhoea. In addition to the potential health risk, cockroaches are generally considered as a nuisance, and can produce an unpleasant odour. Again this indicates the complex combination of sanitary and insect-related conditions which are faced by many households. Not surprisingly, like flies cockroaches are also more prevalent in lower income households. Rodents consume stored food, damage property and can contaminate human food with their faeces and urine. Rodents also transmit disease. Historically, rats are infamous for their role in spreading the plague. Rodents tend to be common in certain neighbourhoods as a result of the quality of housing and the environment as a whole. Houses in low income areas are not only closely built, but are typically in a very

Table 2

Aligarh City: Income-wise Distribution of Sampled Households (in percentages) according to:

(i) Problem of Waterlogging in the Neighbourhoods

Income group	No waterlogging	Waterlogging	Type of water logged		
			Waste water	Rain water	Both waste and rain water
Very high	72.81	27.19	19.22	9.77	71.01
High	66.86	33.14	24.42	8.27	67.31
Medium	37.02	62.98	37.96	26.06	35.98
Low	15.27	84.73	41.06	46.43	12.50
Very low	10.62	89.38	49.94	38.44	11.62
Total	30.38	69.72	34.53	25.79	39.68

Income group	Type of waterloging		
	Permanent	Seasonal	Occasional
Very high	10.63	20.81	68.56
High	9.28	27.01	63.71
Medium	38.69	21.73	39.58
Low	46.43	40.43	13.14
Very low	49.59	37.80	12.61
Total	30.93	29.55	39.52

(ii) Prevalence of Mosquitoes

Income group	Never	Occasionally	Often	Every night
Very high	84.3	10.7	5	-
High	72.5	12.3	10.2	5
Medium	29.5	28.3	20.1	22.1
Low	9.5	32.2	25.1	33.2
Very low	-	34.2	27.4	38.4
Total	39.16	23.54	17.56	19.74

Source: Based on field survey (2006-07)

poor state of conditions favourable for these pests. Thus lack of adequate facilities to handle domestic waste in most of the low income households has compounded the problem.

(ii) Problem of Waterlogging in Neighbourhoods

Due to sauce-pan shaped topography and the city being located in the centre of the lowlying tract, the city suffers from the faulty natural drainage. Not only the dirty water of the city collects here but water from surrounding areas finds its way to this place. The water accumulates here on road/streets, lowlying residential areas, open plots etc. The city has a network of open drains which gets blocked with garbage thrown in it, this make the waste water from these drains to overflow. Due to lack of proper municipal drains around the houses especially in the lower income colonies; due to the faulty waste water disposal practices (in/around the house, in the yards, on the roads etc.) adopted by the low income households, has also resulted in pools of water. These pools of stagnant water provide an ideal breading ground for mosquitoes and other insects causing many diseases (Singh and Rehman, 2001).

Perusal of the Table 2 (i) shows that it is the lower and medium income households who complain about severe problem of waterlogging. Almost all the lower income households (80-90 per cent) have reported of the problem of waterlogging where as 63 per cent of medium, 33 per cent of high and 27 per cent of very high income households were facing such problem. Nearly 50 per cent of the lower income households complained about permanent waterlogging, while only 9-10 per cent higher income have the such problem.

There are only few areas (*Upper Kot* area) in the city centre where waterlogging does not occur while almost the whole city is engulfed with seasonal/occasional waterlogging. Seasonal and occasional waterlogging is caused by rain, overflowing of drains and collection of household waste water in low lying areas. This phenomenon is increasing in the city due to congestion, increased constructional activities, poor drainage system (both natural and man made) disposal of sullage in open drains, which are permanently blocked by garbage, polythene etc. Since the city is located in a depression therefore, there is hardly any flow or very sluggish flow of water in the drains. About 13 per cent of the low income group, 64 per cent of high income group and 60 per cent of very high income group reported occasional waterlogging (Table 2)

The water seems to be either standing in the drains or overflowing. These pools of stagnant water in different parts of the city provide ideal breeding ground for mosquitoes and other insects causing many diseases. Mosquitoes are in abundance in this city. Table 2 (ii) is showing the prevalence of mosquitoes inside the house. Again we have observed that mostly the lower income households reported of occurrence of mosquitoes biting often/ almost every night. As the income increases the prevalence of mosquitoes in house decreases. Poor sullage disposal, blocked drains and the generally poor drainage system facilitate mosquito breeding. An anopheles mosquito, the vectors of malaria, generally prefers unplanned, natural breeding sites. Moreover, continual urban water uses combined with poor drainage has created a situation where mosquitoes are common throughout the year. Excluding households with full screening, the responses were quite similar in different areas of the city and among poor and wealthy households.

(iii) Health Problems

Waste (solid waste and waste water) is not a direct threat to health, but if it is allowed to accumulate whether inside the house or in the neighbourhoods it becomes a health hazard. It decomposes and favours fly breeding. It attracts rodents and vermin. The pathogens which may be present in the solid waste may be conveyed back to man's food through flies, cockroaches and dust. It creates possibilities for water and air pollution. Heaps of refuse present an unsightly appearance and nuisance from bad odour. Stagnant pools of waste water also creates nuisance, unsightliness and unpleasant odour, provide breeding ground for mosquitoes, pollutes of soil and water supplies, leading to contamination of food and increases the incidence of diseases.

Due to accumulation of waste a large number of disease vectors live, breed or feed within the house or in the neighbourhoods. The diseases they cause are malaria (anopheles mosquitoes) and diarrhoeal diseases (houseflies, cockroaches and blowflies) but there are many other diseases caused or carried by insects and mites like dengue fever (aedes mosquitoes), hepatitis A (houseflies, cockroaches), plague (certain fleas), scabies (scabies flea).

During the household survey, questions were asked regarding the occurrence of diarrhoeal diseases, cholera, typhoid fever, amoebiasis, hookworm infections, conjunctivitis, and malaria among the households during the last 2 years. Eight frequently occurring waste associated diseases reported by the sampled households were diarrhoreal diseases (51.41 per cent), malaria (50.91 per cent), typhoid fever (49.82 per cent), infectious hepatitis (43.75 per cent), hookworm infections (38.99 per cent), amoebiasis (38.77 per cent), cholera (36.62 per cent), and conjunctivitis (28.02 per cent) (Table. 3). These diseases were not only reported by the respondents but they were the most frequently reported health problems at the Out Patient Department (OPD) of J.N. Medical college of Aligarh Muslim University, Malkhan Singh Government Hospital and at various private clinics and nursing homes of the city.

Table 3

Aligarh City: Income-wise Distribution of Sampled Households (in percentages) according to Occurrence of Waste Associated Diseases

Income group	Diarrhoreal Diseases	Malaria	Typhoid fever	Infectious hepatitis	Hookworm infections
Very high	10.05	15.15	26.46	6.51	5.56
High	12.50	18.84	34.34	7.78	6.54
Medium	61.32	65	48.74	51.32	41.29
Low	80.45	69.16	62.77	70.45	60.71
Very low	92.69	86.37	76.79	82.69	80.85
Total average	51.41	50.91	49.82	43.75	38.99

Amoebiasis	Cholera	Conjunctivitis	Total average of 8 diseases
10.95	7.37	4.32	10.79
26.75	8.73	6.23	15.22
46.31	43.05	26.91	44.35
52.56	45.72	44.83	57.16
56.84	78.23	57.83	73.07
38.77	36.62	28.02	10.79

Source: Based on field survey (2006-07)

A perusal of the Table 3 shows that all the diseases are greatly influenced by the level of economic development and other environmental factors like, poor disposal of solid waste, poor drainage, dirty neighbourhood etc. The analysis of occurrence of the waste associated diseases reveals that:

- The diseases were greatly associated with the level of income.
- Improper and inadequate arrangement of storage and disposal of solid waste not only promotes transmission of the diseases but also provide breeding ground for pests, houseflies, cockroaches, rodents and other vectors.
- Inadequate sanitation/ drainage facilities enable feacal-oral contamination which again helps in transmission of the above mentioned diseases. Such conditions also attract rodents and other pests which act as disease vectors.

The health risk associated with heaps of uncollected solid waste both inside the house and in neighbourhood is the highest among the lower income households. In some part of the city, the lower income groups are at greater risk also due to secondary impacts such as proliferation of disease vectors and contamination of surface and ground water caused by inadequate management of solid waste. Waste water especially faecal contaminated (due to disposal of faecal matter in open drains) poses a high health risk both through direct ingestion and contact and indirect contamination. The most important domestic risk factor is human faeces. Bulk of this potentially biodegradable material is disposed off with little or no treatment exposing residential areas to a wide range of health problems. Faeces dumped along with waste without destruction of pathogens, enter the soil and water sources and contaminate surface and ground waters. The flushing of excreta into water carriage sewerage systems causes major health hazards when it is discharged directly or indirectly into local surface waters or rivers.

Houseflies which are in abundance in Aligarh city, are linked to waste. The most obvious health risk is that they provide possible short cuts to faecal-oral routes. Some flies are likely to be in contact with human faeces and later land on human food and drink. Open uncollected piles of garbage increase the fly population. Open food preparation areas and open food storage provide opportunities for flies to land on food. In areas where the risks are already high, flies are likely to increase the prevalence of diarrhoeal diseases, infectious hepatitis, typhoid fever, hookworm infections, amoebiasis, cholera and conjunctivitis, associated with bad water and sanitation. Cockroaches like flies can also be mechanical carriers of disease pathogenic bacteria that may be deposited on food. Cockroaches play a role in transmission of bacteria.

Conclusion

The study highlights the three most important problems associated with unhygienic disposal of solid waste and waste water. It has been observed that these problems have occurred mainly due to faulty storage practices adopted by the households and irregular disposal practices by the municipal workers which resulted into heaps of waste in the neighbourhood which provide the habitat for disease spreading pests. Since the natural drainage is also faulty, so the water instead of flowing out remains stagnating in the lowlying areas and provides the breeding ground for mosquitoes. All these pests help in the spreading of various types of diseases like diarrhoeal diseases, malaria, cholera, helminthic infection etc.

In such a situation, the researcher would

like to suggest that the city waste should be properly managed. Two approaches, primary and secondary for waste collection have been proposed. Primary waste collection includes segregation and proper storage of waste inside the house, door-to-door primary collection, daily street sweeping etc. and secondary waste collection includes use of separate waste containers for biodegradable and non-biodegradable wastes, day-to-day cleaning of the *compostable* wastes to avoid foul smell and decomposition, transportation to the compost plant, the landfillable waste should be cleared atleast once in two days. The health risk can be minimized by regular cleaning of drains, repairing of city sewerage system (drains, pumps and pipes) and making pumping stations operational throughout the year, so that the waste water can be drained out from the city. If this is practiced no waste will accumulates either inside the house or in the neighbourhoods. There is also need for active participation of NGO's, public cooperation and community participation to tackle this problem. A clean city is not an accident but is a concerted effort of the residents, the city managers and the society.

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