Impact of Interventions on households' waste disposal behavior: Field Evidence from Delhi

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Abstract

Why do households in Delhi not segregate their waste? Despite the Municipal Solid Waste Management Rules (MSWM), 2016 stating that landfills are to be used only inert, non-recyclable and non-biodegradable waste, landfills are being used as dump sites for all kinds of waste. While it makes sense for households to segregate their waste as it will reduce emissions to air, groundwater and lesser requirement of landfills but in reality households do not segregate waste at source. The paper frames this problem of non-compliance as that of a **'social dilemma'**. It analyzes the effect of information, norms and economic incentive on households' compliance to rules using field experiments. In order to be policy relevant, Resident Welfare Associations (RWAs), which are legally recognized entities within each locality, were roped in from the beginning of the study. The results show that of the households who received the treatment, the percentage of households segregating increased from 4% to 54%, a week after giving the interventions. The study also found the garbage collector to be an important factor in ensuring that segregated waste at the household also stays segregated at the collection level. Thus, the study concludes that interventions such as information interventions, and incentives (taxes) are effective in achieving compliance with the rules.

Keywords: Field Experiment; Segregation at source; waste management; Delhi

1. Introduction

a. Growing Problem of Waste

Delhi generates approximately 9250 Tonnes per day (TPD) of municipal solid waste (MSW) (DPCC, 2015). Studies have shown that there is a clear linear relationship between per capita solid waste generation rates and income levels for Indian households (Viswanathan, 2006]). India's per capita MSW generation rates are likely to keep pace with the economic growth rates (Goel, 2008), which means that already burgeoning mountains of waste will only grow further.

Generation and disposal of waste can be thought of as a public bad. While disposal of waste at the household level includes only their private cost in terms of the cost paid to the garbage collector, the social cost of waste disposed of (in landfills) also includes the cost of methane emissions to air, contamination of groundwater. Other environmental costs include odor and noise from heavy truck traffic (Repetto et al., 1992). These environmental impacts are also strongly related to the density of the population- they might be greater in densely populated areas as compared to less densely populated areas. In addition, land values add to the non-market costs of the landfills but few municipalities charge a rent reflecting these values (Repetto et al., 1992). Charging a flat fee for waste collection services means that the cost of every additional unit of waste generated by a household is zero, resulting in the generation of more waste. Moreover, due to lack of information on the social costs and benefits, each household chooses to either dispose or recycle depending on its whims and fancies. As long as municipal solid waste disposal and recycling is privately costless, households will not have an incentive to recycle (Porter, 2002).

The studies reviewed and our discussions with households during the course of this research reveals that there is a clear disconnect between the rules formulated at the level of authorities, type of information being disseminated and implementation at the household level. While the policy framework and the knowledge of negative externalities should be leading the society as a whole to reduce the generation of waste at source and to ensure proper disposal of waste, individual households waste disposal behavior shows otherwise.

However, in India, it is common practice for urban households to recycle glass bottles and newspapers and for households that engage in gardening activities to compost their kitchen waste. Other forms of recyclable waste such as packaging materials and milk packets are usually collected by rag pickers to earn a living. At present, rag pickers are part of the informal sector foraging the Dhalaos (garbage collection points) to collect recyclables but in the process coming in contact with animal excreta, sputum, dead

animals and at times, medical waste and thus susceptible to a lot of diseases (Sarkar, 2003). Segregating waste at the source will not only improve the work environment of the rag pickers (Sarkar, 2003) but legitimizing their role would help decrease the burden on the municipalities and thus benefit the society as a whole. It would not only provide the waste pickers with better work conditions but would also reduce emissions to air, soil, and water and increase the amount that can be recycled.

This paper focuses on the actions of the household as this is the beginning of the problem. Moreover, segregation at source will also lead to efficient composting of biodegradable waste and increase the amount that can be recycled. In addition, it will reduce the requirement of transportation of waste. The study uses field experiments in housing localities of Delhi with the following objectives:

The objectives of the study were to:
- Investigate the determinants to segregation at household level;
- Understand the effect of interventions- information, norms, and incentives, to ensure compliance with MSW Rules, 2016;
- Understand how the interventions differ across the socio-economic characteristics.

The paper is organized as follows: Section 2 describes the policies adopted by the Indian Government to manage waste generated. Section 3 summarizes findings from existing research on waste management across other countries. Section 4 describes the design and methodology of the study. Section 5 gives the analysis of survey data through summary statistics and econometric results. Section 6 provides discussion on the results and Section 7 gives the conclusions and policy implications of the study.

2. Municipal Solid Waste Regulations in India

Environment Protection Act enacted in 1986 gave power to the Central Government to regulate all forms of waste and to tackle specific problems that may be present in any region of India.

Municipal Solid Wastes (Management and Handling) Rules (MSW Rules), 2000, highlighted that it is the responsibility of the generator of waste to ensure delivery of waste in accordance with the collection and segregation system notified by the municipal authority and in order to encourage this, the municipal authorities shall undertake a phased programme to ensure community participation in waste segregation. The Rules also specified that landfilling will be permitted only for non-usable, non-biodegradable and non-recyclable inert waste (MoEF, 2000).

In 2006, the National Environment Policy (NEP) identified municipal waste as a major cause of soil pollution. It recognized the need for strengthening the capacity of local bodies for segregation, recycling and reuse of municipal solid waste to efficiently deal with municipal waste (MoEF, 2006). In 2010, the Government of India's National Mission on Sustainable Habitat (NMSH) again emphasized recycling of material and urban waste management as a major component for ecologically sustainable development. The reports also identified insufficient segregation of municipal solid waste as one of the reasons for the failure of efforts to compost and generate energy from waste (MoEF, 2010).

The MSW Rules 2016 which replaced MSW Rules 2000 mandates the waste generator to segregate the waste into biodegradable and non-biodegradable waste before it is collected, thus, shifting the onus of segregation onto the household (MoEF, 2016).

Further to the new rules, the National Green Tribunal (NGT) in its judgment on December 22, 2016, has directed every State and Union Territory to implement and enforce the MSW Rules 2016 in all respects and without any further delay.

3. Insights from International Experience

Countries have employed different regulations to manage waste efficiently, from voluntary participation to using the 'polluter pays principle'. For example, mandatory one-way deposit system implemented in Germany in 2003 resulted in 98.5% of refillable bottles being returned by the consumers. Similarly, in Sweden recovery rates reached 86% for cans and 77% for PET bottles after the introduction of the scheme in 1984 for PET bottles and in 1994 for cans[1].

Unit pricing of the traditional waste collection provides an incentive for households to divert their waste flows towards recycling collection- thereby increasing social welfare (Van Houtven and Morris, 1999). Virginia implemented a 'pay per unit' policy for garbage collection in 1994. In response to this price, households reduced the weight of garbage (per week) by 14% and volume (per week) by 37%. However, the researchers find evidence of a 32% increase in density of garbage and most importantly, an estimated increase in illegal disposal of .42 pounds per week

1: https://www.zerowasteeurope.eu/tag/germany-deposit-refund-system/

which accounted for 28% of the total waste reduction (Fullerton and Kinnaman, 1994). On the other hand, studies have also found that households are more sensitive to marginal private costs of waste reduction as compared to costs of waste disposal (Reschovsky and Stone, 1994). Thus, efforts to increase recycling by imposing high quantity based fees or stringently enforcing mandatory recycling without providing a convenient means for households to recycle will be unpopular and ineffective (Reschovsky and Stone, 1994).

In addition to incentives, studies find activation of social norms to achieve desired behavior can also be effective. Social norms marketing campaigns have emerged as an alternative to conventional marketing (information campaigns, fear-inducing messages) to reduce undesirable conduct. Such campaigns are based on a simple rationale, that majority of individuals overestimate the prevalence of undesirable conduct and individuals use this perception of others' conduct as a standard against which they compare their own behavior (Schultz et al, 2007 a). Tucker and Speirs (2003) highlighted the importance to recognize and identify predisposition, and attitudes are important to ensure take up of strategies. In addition to this, studies have also found that high levels of institutional trust and provision of information towards actors involved in providing these facilities to resolve environmental problems (Jones et al., 2010). This study also finds that enforcement of social trust among neighbors is essential. It suggests that this may be achieved by promoting citizens' participation and through meetings of neighbors to discuss relevant issues.

'Naming and Shaming' campaigns have also been used as a deterrent to undesired behavior. For e.g. In 2015, Hong Kong launched a city-wide campaign 'The Face of the litter' which uses DNA testing to construct a digital portrait of the perpetrator. Posters of the perpetrators are then plastered across the city and on the internet as a means to bring about desired social change[2]. Similarly, in 2014 Boston Borough Council launched a name and shame campaign fourth time in the city. The council uses CCTV evidence of instances of littering, as a means to encourage citizens to dispose of their litter responsibly. The campaign is said to have reduced litter in the past years[3].

The discussion above shows the various measures adopted by the countries worldwide to control solid waste and littering. We chose three interventions to understand the determinants of segregation at source. In the next section, the design and methodology of the experiment are explained.

2: http://time.com/3890499/hong-kong-littering-campaign/

3: http://www.boston.gov.uk/index.aspx?articleid=7523

4. Data and Methods

4.1 Study area and Sampling Strategy

Delhi has five municipal corporations-- New Delhi Municipal Council (NDMC), Delhi Cantt. Board (DCB), East MCD, North MCD and South MCD. The three MCDs manage 97% of the area and population of Delhi (DoES, 2014). Thus, in order for the study to be policy relevant to Delhi, we conducted it in the areas falling under the three MCDs. (**Figure 1**). MCD property taxes were used to stratify the wards on the basis of income. We clubbed A, B and C category of the property taxes (**category 1**) and D, E and F category (**category 2**) together to stratify the colonies for the purpose of the study. Category 1 is relatively higher income group as compared to category 2. From each of the three corporations, we chose one ward for the study. The sampling frame of the study is group housing societies/ apartment colonies in the selected wards. Group housing societies/ apartment colonies were chosen in order to maintain consistency in the waste collection services availed by the residents. Federations of Resident Welfare Associations (Vasundhra Enclave Co-operative Group Housing Joint Forum, East Delhi RWAs Joint Forum, United Residents Joint Action, Federation of Rohini Co-operative Group Housing Societies) were contacted to approach Resident Welfare Associations (RWAs)[4] across Delhi as dissemination of Government rules and policies and notifications to its members is one of the objectives of RWAs. Apartments in North and East Delhi (8 apartment colonies in total) belonged to category 2 while those in South Delhi (7 apartment colonies) belonged to category1. This was done to compare the impact of interventions across different socio-economic groups. Among the colonies chosen, six were randomly assigned to be treatment colonies and two as control, in category 2. In category 1, five localities were chosen as treatment while two remained as control localities. The sampling technique employed was cluster randomization, wherein we randomized the localities instead of the individuals. This was done in order to avoid spillover effects. Figure 2 gives a diagrammatic description of the sampling design for the experiment. **(Figure 2)**

4.2 Field Setting

A typical waste collection chain in these localities is as follows: waste is generated at the household level and is collected by the garbage collector who is usually appointed/ contracted by the Resident Welfare Association (RWA) or collected by the Urban Local Body (ULB). The garbage collector often segregates the waste collected in order to earn a commission from selling the recyclables. Garbage is then dumped at the community bin (dhalao) located outside the locality. This community bin could also serve other surrounding localities and marketplaces. The waste dumped in the dhalao is lifted by

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4: RWAs are associations registered under the Co-operative Societies Act, 1986. One of its aims includes improving common facilities in the areas like Parks, drainage, scavenging, street lights etc. (http://www.rwabhagidari.com/registerRWA.htm)

the ULB to be taken for further processing or to the landfill.   Figure 3 gives a diagrammatic description of this waste collection chain. (**Figure 3)**

4.3 Experiment Design and Interventions

The experiment involved three stages. We first conducted a baseline survey for a month to record household waste disposal practices and weight of the waste generated. After the baseline survey, we introduced three types of interventions—information only, information and norms, information and monetary incentive. Different colonies were randomly chosen to receive any one of these interventions.

All the houses in the treatment localities were also provided with dustbins and garbage bags and information brochures. The information intervention was common to all the treatment localities. A group of enumerators involved in the project distributed the dustbins, garbage bags, and brochures. The brochure detailed the Municipal Solid Waste Management Rules 2016 as applicable to the householder. The enumerators explained in Hindi and English what constitutes the biodegradable waste and how segregation is beneficial to the environment and the rag pickers as well. The intervention on information and norms included additional information on the comparison of the weight of the waste generated by the household with that of others' in the locality. For the localities chosen to receive information and economic incentive intervention, the households were informed that they would receive a cash rollout of Rs. 50 if they segregate their waste.

Out of 11 treatment colonies, four colonies each received the 'information' and 'information+ norms' treatment while three localities received the 'information+ economic incentive' treatment.

We conducted two rounds of monitoring to find out if the treatments brought about any behavioral change in the waste disposal practices of the household- one week and five weeks after the intervention. Figure 4 gives a diagrammatic representation of the timeline followed. (**Figure 4).**

The interventions given followed a simple rationale. The intervention on 'norms' and 'economic intervention' was combined with information intervention as an exclusive provision of norms or monetary incentive would not give the householder the opportunity to pick up the information on benefits of segregation. The colonies with exclusive information intervention would help to disentangle the effect of individual interventions from compound interventions.

In the baseline survey, we recorded data on household characteristics, their environmental preferences, and waste disposal practices. We also asked households about their awareness of municipal solid waste rules, landfills or waste processing

plants existing in Delhi. Even the garbage collectors were informed of the study from its onset. Since the garbage collectors segregated recyclables of value, we informed the garbage collectors in the treatment colonies about segregation as well.

4.4 Data Collection

Once the colonies were identified a consent letter from the president/ secretary of the Residential Welfare Association was taken. Banners were displayed at strategic locations around the colony a week before the survey. Households were also informed through brochures distributed to individual houses.

5. Results

5.1 Summary Statistics

5.1.1 Household Characteristics

The study draws its sample from 880 households across 15 localities in North, South and East Delhi. Table 1 gives the demographic characteristics of the households interviewed. **(Table 1)**

Table 1 shows that nearly, 90% of the respondents are well educated (graduate and above) and a majority of the respondents were females. The appendix contains detailed demographic characteristics of the sample.

5.1.2 Environmental Preferences

Households' environmental preferences were elicited through their awareness of the plastic bag ban, reuse of old plastic bags. 92% respondents were aware of the plastic bag ban. However, respondents also stated that while they are aware, there seems to be no implementation of the same. For this reason, households were also asked how many of them voluntarily carried their own bags while going shopping. 80% of the respondents reported that they carried their own bags almost always when they went shopping while 20% reported that they carried bags as and when they remembered. Households were also asked how they reused the plastic bags—44.2% of the respondents used these plastic bags as garbage bags, 21% of the respondents reported that they did not accept plastic bags from the shopkeeper, 19% threw the bags in the dustbin and another 14% reused them as shopping bags.

5.1.3 Awareness

While the households are aware of the different types of wastes generated at home, the results show that 96% of the households are unaware of the MSW Rules, 2016.

5.1.4 Behavioral change as a result of interventions

Of the 654 households in the treatment localities, 543 received the intervention. A few households in the intervention locality did not receive the intervention as the houses were locked on the day of intervention. The experimental interventions introduced showed that there was some behavioral change in the households who started segregating their waste before giving it to the garbage collector. The results show that of the households who received the treatment, the percentage of households segregating increased from 3.69% to 54%, a week after giving the interventions. However, five weeks after receiving the intervention the percentage of households segregating fell to 43% (Graph A.1). We then analyze the adoption rates by the different interventions. Table 2 gives adoption by different types of interventions. (**Table 2)**

Table 2 shows that interventions had an impact on the waste disposal behavior of the households. However, monetary incentive had the most impact as compared to other interventions. Also, while the percentage of households that were segregating earlier fell after five weeks, in comparison to the first monitoring, the drop in the households that belonged to 'monetary incentive' intervention was far lesser than those that received the other interventions. During the baseline surveys, an important aspect that came out was that households in East Delhi complained of odor from the landfill at Ghazipur while households in North Delhi saw the landfill at Bhalswa almost on a daily basis. Thus, it would be worth to examine the uptake of the interventions by zone. Table 3 gives the adoption of interventions by the zone (only for the treated localities). (**Table 3).** Table 3 shows that the drop in the second round of monitoring for the South zone in comparison to the North and East zone is quite steep and is significant at the 5% level.

5.2 Econometric Analysis

The summary statistics in subsection 5.1.4 showed that the interventions did have an effect on waste disposal behavior of the households. In this section, we test econometrically the effect of interventions on waste disposal behavior after controlling for household characteristics.

We model the change in disposal behavior as a function of the age of the respondent, household size, education, ownership of the house, the number of retired/ non-earning members and the zone in which the locality is situated and an indicator variable that equals 1 if a particular intervention was applied in the locality. We also examine how individual's environmental preferences define their behavior.

We hypothesize that households choose their actions in order to maximize their utility, which is latent. We, however, observe a binary variable, that is, whether or not the household segregates.

We express the regression model for segregation as

$$Y_{it} = \alpha + \sum_{m=1}^{M} \beta \, I_m + \sum_{k=1}^{K} \gamma_k \, X_{ik} + \varepsilon_{it}$$

Where Y_{it} is the binary variable that equals 1 if the household I has changed its waste disposal behavior in comparison to the baseline survey and 0 otherwise. There were no households who were segregating at the baseline that stopped doing so in the monitoring rounds. Thus, Y_{it} takes the value 1 for those households who started segregating after the study began and 0 for households that did not change their waste disposal behavior. I_m is an indicator variable that is 1 if the locality received that intervention and 0 otherwise. X_{ik} are the k household characteristics for household i.

Assuming normal distribution of the error term, we use a probit model in this paper. The following table gives the marginal effects of the variables for both rounds of monitoring. Table 4 gives analysis using a probit model. (**Table 4**)

The variables of interest are the intervention variables, which appear to be significant at the 1% level of significance. Monitoring 1 reflects the behavior of households a week after the receipt of intervention and monitoring 2 reflects the behavior of households 5 weeks after the receipt of intervention. Model 1 investigates the impact of interventions on the households. Model 2 we interact the income category with the type of interventions to elicit the impact of the interventions across different income categories. In the face of interventions, the effect on the probability to segregate is 0.48, 0.45 and 0.6 for information, information + norms, information + monetary incentive respectively in Model 1. Again, results for Monitoring 2 show that all three interventions had a significant impact on the behavior of the households, though the coefficients do drop for this round. The results show that even information has a substantive effect on the behavior of households, though 'information + monetary incentive' has a higher impact on the probability to segregate. The socio-economic variables also show some interesting results. Model 1 in the first round of monitoring shows that in the beginning gender of the respondent and household size were also significant in inducing behavioral change; however, this is no longer significant in the second round of monitoring. This finding is in line with past research (O. Hage et al., 2009). Age of the respondent, on the other hand, has a positive and significant effect in both rounds of monitoring. The negative sign for age^2 signifies that as age increases, people are more

likely to segregate their waste; however, with further increase in age, this tendency also declines.

The variable 'income category' also seems to explain part of the variation for the second round of monitoring. In our model, it is not significant in the first round, though is significant and negative in the second round of monitoring. The results show that the effect on the probability of segregating is -0.04 for income category. In addition, since the study had categorized the localities using MCD property taxes, we introduced an interaction term between income category and interventions received, to gather an insight into the impact of the interventions with respect to the income category. In both rounds of monitoring, the effect of 'information + monetary incentive' on the probability to segregate was higher in the high-income category as elicited by Model 2. A possible explanation for this is, that the household help plays a bigger role in housekeeping in high-income groups so the monetary incentive could actually be acting as an incentive for the 'help' to continue segregating. The literature points to the impact of income levels as being ambiguous (O. Hage et al., 2009). Since the opportunity cost of time is high for higher income groups, the incentive could act as a price for the time they invest in segregating.

6. Discussion

The purpose of the study was to investigate the determinants to household waste segregation. Emphasis has been put on information, norms and economic motivations. The results confirm that even low-cost interventions such as the provision of information influence the waste disposal behavior of households, though monetary incentive had the largest impact. This section discusses the results in two sub-sections—at the household level and at the society level.

6.1 Individual level- Engaging the Households

Field observations highlighted the importance of 'distance from the landfill' and monetary incentive as a feedback mechanism in inducing the household to continue segregation. Households in North and East Delhi mentioned the nuisance caused by the foul odor and the direct visibility of fires in the landfill during the surveys. During discussions, households also shared that feedback, on the efforts taken by authorities to ensure segregation done by households is maintained at every level of collection till final disposal or processing, is given to the households.

The images in the Appendix show the approx. the distance of the field sites from the nearest landfill. Landfill in both North and East Delhi was 15 minutes (approx.) away

from the field sites while 40 minutes away in the case of South Delhi. This could also have had an impact on the behavior of the households as the households were able to perceive the negative externality caused by the landfills. In our study as well, income category is positively correlated with distance from the landfill. The reactions of the households, as stated above, in North and East Delhi can also explain the 'negative' sign of the 'income category' variable in Monitoring 2.

Field observations highlighted that households are aware of the distinction between biodegradable and non-biodegradable waste. However, the summary statistics given in subsection 5.1.1 shows that there is a lack of awareness of the Rules among the households. Thus, we see that when informed of the Rules, there is a significant change in households' waste disposal behavior.

A few households offered the monetary incentive refused to accept it, as they believed that segregation of waste is for their own good. Researcher's perception of the proportion of households refusing monetary incentive in North and East Delhi was greater than that in South Delhi. However, in all three zones, researchers also observed that in case, segregation was done by the household help, the incentive was passed on to them by the householder, as a means of motivation.

6.2 Societal level- Engaging the Garbage Collector, RWAs, and ULBs

The non-segregating households reported that it is not worthwhile to segregate as the garbage collector mixes it together. Households also reported that the garbage collector has asked them not to segregate waste as he segregates later on. Such responses highlight that garbage collector could nullify the actions of the household, so it is important to educate the garbage collector of the Rules as well. Even though garbage collectors were informed of the objective of the study and its benefits, we found that they were still apprehensive about it. One garbage collector even conveyed her fears regarding loss of her job as a result of this.

Incentive-based mechanisms have been used as a tool for environmental management. The subsidy approach followed in this study is also an incentive-based mechanism which implies cash payments to firms for reducing emissions. In this study, the households that segregated their waste were incentivized. Literature suggests that subsidies mirror taxing pollution[5]. Hence, the impact of the monetary incentive in inducing compliance with the MSW Rules, 2016 and sustaining the behavior highlights the effect that penalties would have on individual behavior. However, penalizing requires actions to be monitored. For this, we believe RWAs could act as a monitoring agency for compliance to rules and could report to the ULBs on non-compliance.

5:      https://yosemite.epa.gov/ee/epa/eerm.nsf/vwAN/EE-0216B-04.pdf/$file/EE-0216B-04.pdf

7. Conclusion and Policy Implications

Waste is a growing menace, especially in cities like Delhi. Ministry of Environment, Forests and Climate Change in April 2016 notified the revised Municipal Solid Waste Handling Rules for efficient management of wastes. The rules put the onus of segregation at source on the generator of waste. However, our baseline surveys showed that segregation at source is not being practiced. The study aimed at understanding the impact of information, peer effects and monetary incentives on the waste disposal of the households.

From the above discussion, it is clear that information campaigns, detailing the benefits of segregation for the environment and rag pickers, had an impact on changing the waste disposal behavior of the households. In addition, field observations also highlighted that feedback to the residents, in terms of the amount of waste diverted from landfill—composted or recycled would also influence their actions.

The study makes the following policy implications. For the Rules to be complied with, households have to be informed of the process and benefits of segregating. Second, there has to be feedback on the processes undertaken to ensure segregated collection and for appropriate processing of the segregated waste. As highlighted by the study, the greater impact of 'information+ monetary incentives' as compared to other two interventions also highlights the role that penalties could play in achieving compliance with the Rules. The rules also allow the ULBs to charge a user fee as deemed appropriate. However, the efficacy of incentive highlights the importance of defining a differential user fee- one for those who segregate and a higher amount for those not segregating. This would give the waste generators an explicit incentive to segregate.

Though not considered in the study, it would be worthwhile to study the impact of posters and newspaper awareness campaigns in comparison to the house to house awareness campaign conducted in the study. Also, exploring the impact of differentiated monetary incentive could give insights into determining the "spot fines".

Being unable to elicit the reasons for not being a part of the study or for moving out at a later stage, from the households is a limitation of the study.

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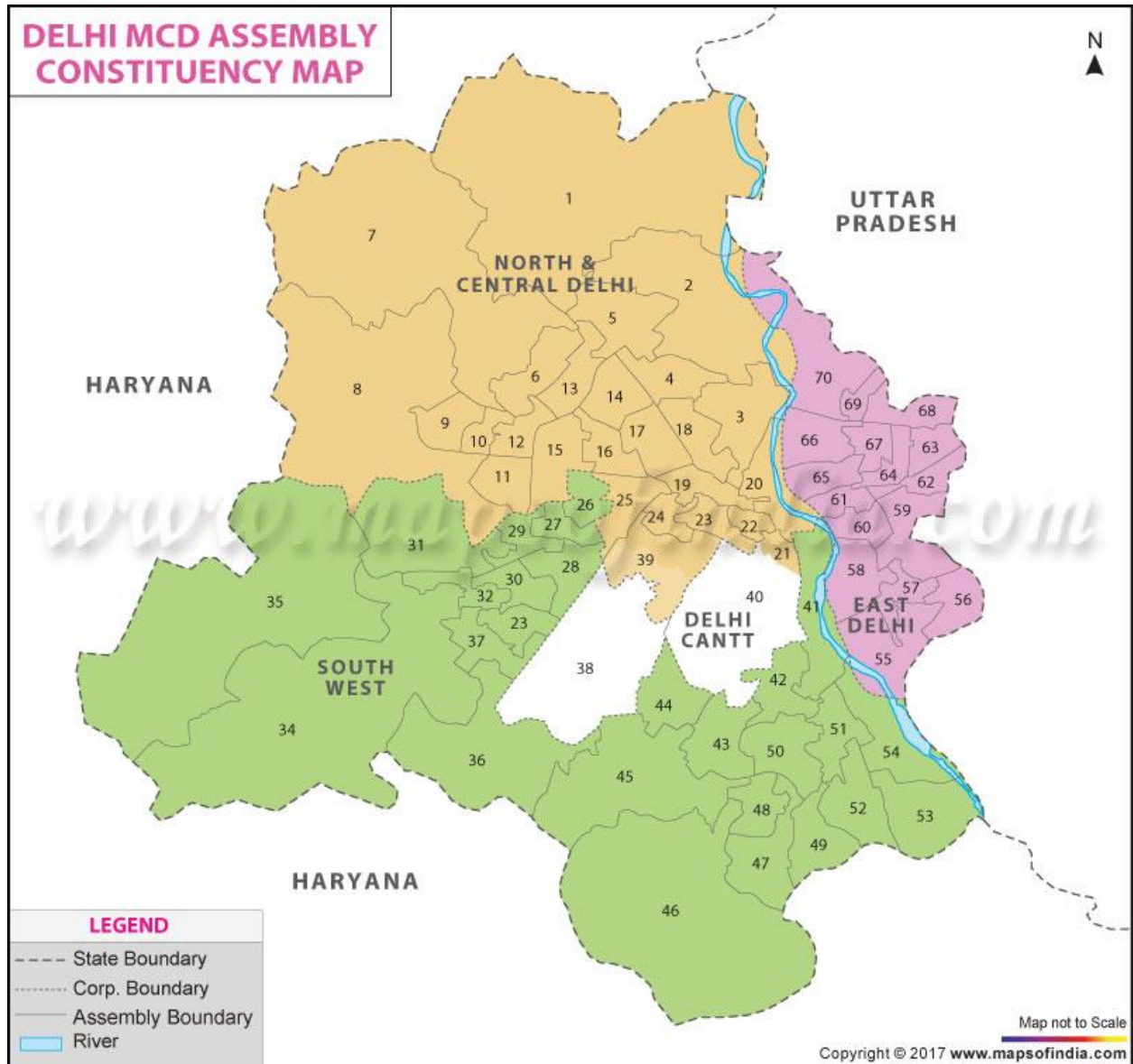
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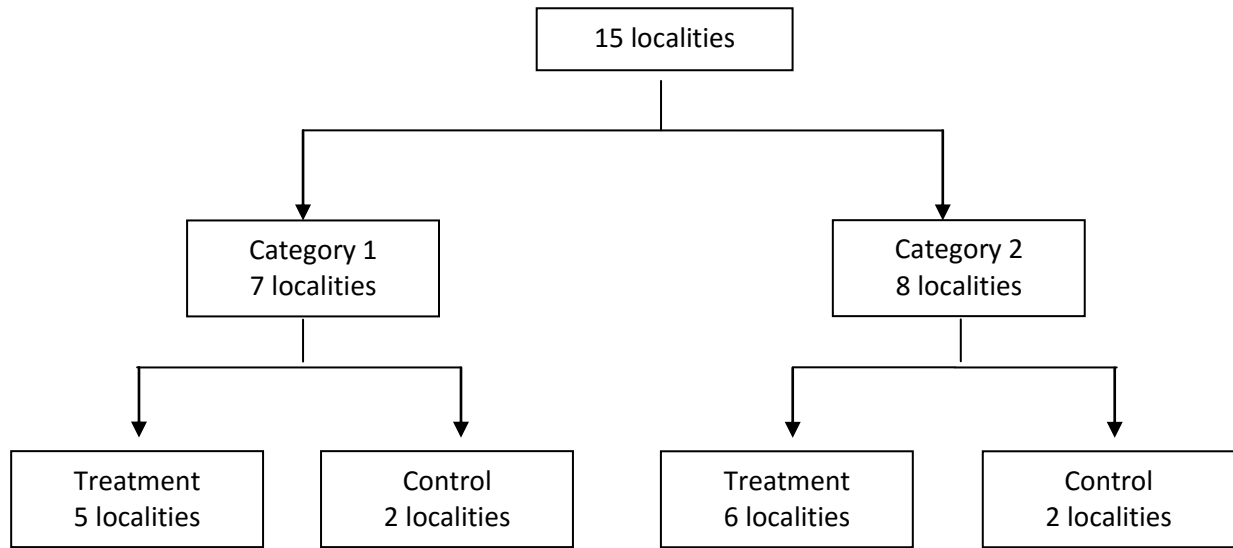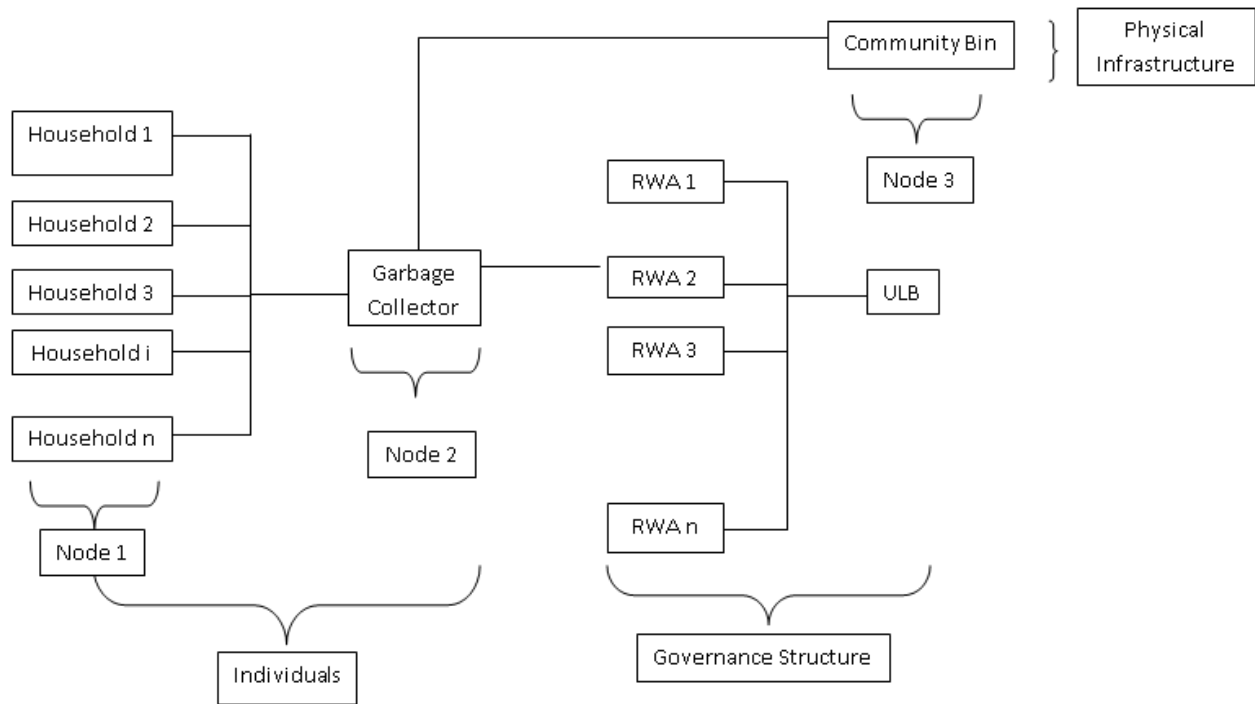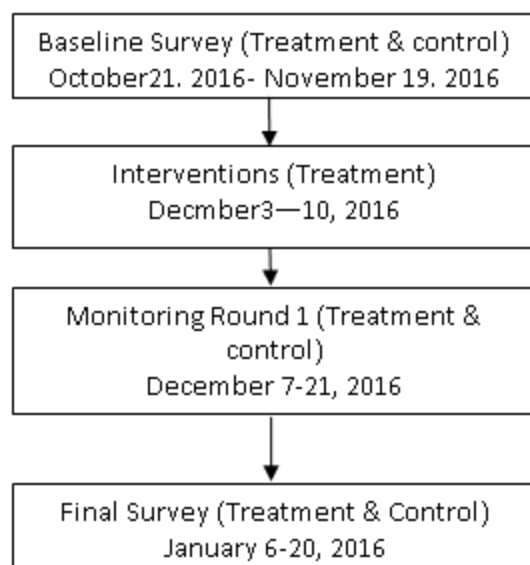**Figure 1: MCD zone-wise map of Delhi**

Figure 2: Sampling Design of the Experiment

Figure 3: Diagram depicting the Institutions involved in waste generation and collection

Figure 4: Timeline of the Survey

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┌─────────────────────────────────────────┐
│  Baseline Survey (Treatment & control)   │
│    October21. 2016- November 19. 2016    │
└─────────────────────────────────────────┘
                    │
                    ▼
┌─────────────────────────────────────────┐
│         Interventions (Treatment)        │
│           Decmber3—10, 2016              │
└─────────────────────────────────────────┘
                    │
                    ▼
┌─────────────────────────────────────────┐
│      Monitoring Round 1 (Treatment &     │
│                 control)                 │
│           December 7-21, 2016            │
└─────────────────────────────────────────┘
                    │
                    ▼
┌─────────────────────────────────────────┐
│   Final Survey (Treatment & Control)     │
│           January 6-20, 2016             │
└─────────────────────────────────────────┘
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List of Tables

Table 1: Household Characteristics

Household Characteristics	Average
Household Size	3.6
Age of the Respondent	48.8 years
Retired/ Non-earning Members	2.1
Education	**% of Respondents**
Up to Class 12	9.89
Graduate	51.93
Post Graduate and above	48.07
Gender	**% of Respondents**
Female	61.6
Male	38.3
House Ownership	**% of Respondents**
Owned	78.03
Rented	21.97

Table 2: Adoption by different types of interventions

Type of Intervention	Time Period		
	Baseline	Monitoring 1	Monitoring 2
Control	1.35%	2.54%	2.78%
Information	5.29%	54% (-11.28)***	38.8%(-8.46)***
Information+ Norms	2.1%	47.4%(-10.34)***	37.9%(-8.4)***
Information+ Monetary Incentive	3.76%	61.6%(-12.22)***	54.9%(-10.71)***

Values in parenthesis are the z statistic for the proportion difference between the control and each type of intervention given to the households at r.

Table 3: Adoption of interventions by zone (from those households who belonged to the intervention locality) (checked)

Zone	Time Period	
	Monitoring 1	**Monitoring 2**
East	51.0%	47.2% (0.65)
North	56.3%	46.75% (1.72)*
South	53.5%	38.25% (3.4)***

Values in parenthesis are the z statistic for the difference in proportion between the two monitoring rounds for intervention households by zone.

Table 4: **Analysis of Waste Segregation using Probit Model** (checked)

Change in behavior	Monitoring 1 Model 1	Model 2	Monitoring 2 Model 1	Model 2
	Marginal Effects with Robust Standard Errors			
Gender[5]	-.043***	-.043***	-.018	-.016
	(0.00)	(0.00)	(0.01)	(0.01)
Age	0.008**	0.008**	0.010*	0.010*
	(0.00)	(0.00)	(0.01)	(0.00)
Age^2	-.000***	-.000***	-.000***	-.000***
	(0.00)	(0.00)	(0.00)	(0.00)
Household size	-0.021*	-0.020	-0.010	-0.007
	(0.01)	(0.01)	(0.01)	(0.01)
Education				
Diploma and Graduate	-0.017	-0.013	0.006	0.011
	(0.05)	(0.04)	(0.03)	(0.03)
Post Graduate and above[4]	-0.01	-0.008	0.005	0.01
	(0.05)	(0.05)	(0.05)	(0.05)
No. of Non-Earning/ Retired members	0.013	0.011	-0.016	-0.018
	(0.02)	(0.02)	(0.02)	(0.02)
Income Category				
Category 1[6]	0.019		-0.041***	
	(0.02)		(0.00)	
Ownership of House[3]	-0.044	-0.04	-0.009	-0.007
	(0.06)	(0.06)	(0.04)	(0.04)
Environmental Preference				
2	-0.03	-0.032	0.019	0.018
	(0.05)	(0.05)	(0.05)	(0.04)
3[2]	-0.055	-0.056	-0.003	-0.003
	(0.08)	(0.07)	(0.05)	(0.05)
Type of Intervention				
Information	0.478***		0.327***	
	(0.02)		(0.03)	
Information + Norms	0.449***		0.339***	
	(0.01)		(0.05)	

Information + Monetary Incentive[1]	0.596*** (0.04)		0.487*** (0.06)	
Intervention type X Income category				
Information and category 2		0.472*** (0.04)		0.395*** (0.01)
Information + Norms and category 2		0.451*** (0.03)		0.37*** (0.06)
Information + Monetary Incentive and category 2		0.564*** (0.06)		0.483*** (0.08)
Information and category 1		0.486*** (0.01)		0.265*** (0.01)
Information + Norms and category 1		0.445*** (0.02)		0.304*** (0.01)
Information + Monetary Incentive and category 1[1]		0.665*** (0.01)		0.526*** (0.00)

Notes: * significance at 1% level, ** significance at 5% level, * significance at 10% level**

Standard Errors clustered at zone level

1. **Omitted Category: Control**
2. **Omitted Category: Throwing plastic bags in garbage**
3. **Omitted Category: Owned**
4. **Omitted Category: Up to Class 12**
5. **Omitted Category: Female**
6. **Omitted Category: Category 2**