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Determining Factors Affecting Defection And Health & Economic Impact of Sanitation Practices: Case Study of Urban Slums in Delhi

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Abstract:

Who (2008) states that 10% of the total global burden of diseases can be averted by making sanitation, water and hygiene related improvements including 1.4 million avertable diarrheal deaths every year. Highest burden of such diseases falls upon less developed nations. While it is important to quantify the burden of disease, it is also crucial to understand what factors lead to such prevalent use of open defecation and improper hygiene. Such factors may vary geographically, culturally, politically. In our study we focus on urban population of national capital of India. In India diarrhea is reportedly the third largest cause of child mortality and causes a whopping 13% of child deaths each year (NCBI 2015).

Through our study, we wish to understand what are the factors that impact the choice of modes of defecation among urban slum population. Another component of the study tries to address the health and economic impact of sanitation practices. For the purpose, we choose two slums of Delhi which come under the same municipality but have different defecation patterns. The chosen slums of Mansarovar park and Seelampur have high and no open defecation respectively. Using random sampling method, we collect data from 139 households (68 and 71 respectively) on sanitation, water, hygiene, illness and expenditure components. We compare the slums based on incidence of Diarrhea as a proxy of health outcomes.

We use multinomial logistic regression analysis and try to impact of various factors that affect the choice of mode of defecation. Finally, we adopt cost of illness method to come up with economic quantification of burden of disease of diarrhea, separately for each slum. We try to

explain the difference in the costs between the two slums by employing a logistic regression modeling. Consequently, we shall be able to make some policy suggestions. We shall be able to comment on whether providing access to toilets is the only step that needs to be taken or are there some other factors to design policies for eliminating open defecation and diarrheal disease burden and what is the reach of present government policies on sanitation.

Keywords: *Sanitation, Open defecation, Private toilets, Community toilets, Diarrhea, Cost of illness*

INTRODUCTION

The importance of water, sanitation and hygiene globally has been highlighted in the United Nations Millennium Declaration. It's importance for development and poverty reduction has been highlighted mainly in the eight Millennium Development Goals. Making water bodies clean and usage of proper sanitation is not only capable of saving lives, making lives better but also has many direct and indirect economic benefits.

"Millennium Development Goal 7:Ensure environmental sustainability

Target 10: Reduce by half the proportion of people without sustainable access to safe drinking water and basic sanitation"

"Indicator 30: Proportion of the Population with Sustainable Access to an Improved Water Source"

"Indicator 31: Proportion of the Population with access to Improved Sanitation"(United Nations Millennium Declaration 2000).

WHO report (2008) claims that 1.6 million deaths of children per year can be attributed to unsafe water, poor sanitation, and lack of hygiene majorly concentrated in developed countries. The total burden of global diseases attributable to water, sanitation and hygiene for the year 2002 is given in WHO (2008). The highest fraction of global burden of disease attributable to water, sanitation and hygiene is that of diarrheal disease, greater than 4%.

According to UNICEF India report(2013), 594 million people in India go for open defecation and 44 per cent mothers dispose their children’s feces in the open, this exposes the Indian population to microbial contamination (bacteria, viruses, amoeba) of water which is a major cause of diarrhea.

Frequent diarrhea can make children weak. Approximately 48 per cent of children in India are suffering from malnutrition of some degree. Diarrhea and worm infections are considered to be two major causes of this. More than 6 lacs child deaths were reportedly caused by Diarrhea in India in 2010.

As per the NSS 69th round survey (2015), there are more than 6000 recognized slums in Delhi with households above 10 Lac. About 22% of the urban slum population does not have any private, shared or community type toilet. Only 31.45% slums practiced safe waste disposal mechanisms.

India has a huge urban population which does not have access to safe water and sanitation related facilities. Arguably, literature primarily focuses on rural set up and has a limited number of studies on the problem in the urban settings. Through our study we try to assess sanitation related decisions, health and economic impacts of sanitation. We choose the urban slums of Delhi for the purpose of this study .

Broadly, we address three research questions:

1. What are the behavioral, socio-economic aspects that impact the decisions of the households about the choice of the mode of defecation ?

2. What is the impact of ‘using latrine facilities’ private or community on the health outcomes vis-à-vis open defecation ?

3. What are the economic benefits of ‘not defecating in open’ vis-à-vis open defecation to a household ?

CASE STUDY: BACKGROUND

Almost half of the Delhi population lives in slums without access to basic and civic amenities. According to NSS (2015) data on Delhi slums, slum population in Delhi has been estimated to be around 10.2 Lac in 2012 with an average of 161 households per slum.

86.5% of all slums use tap water or hand pump as their major source drinking water. Major portion of 30% of the slums are using tank/flush type latrine facility while 22% of the slums do not have any type of latrine facilities (Table 1).

In the context of our case study two slums has been chosen from north- east Delhi. A large portion of slum population is absorbed by North and East Delhi. The slums under study are 4.4 km apart.

Mansarovar park basti has approx. 165 *jhuggis* along the railway track. The place is full of litter, clogged water, animal excreta. Within 500 meters of the Jhuggi is a railway track along which bushes and weed have grown which is defecation place for the slum dwellers for years. Majority of population defecates in open in this slum.

In the Seelampur area we conducted our survey in New Seelampur[1]. There are around 200 households in the community. Majority of people either have private toilets or use community toilets which is within 500 meters of the colony.

METHODOLOGY

Survey and data collection

The slums of Mansarovar Park and Seelampur were surveyed for our study. Data was collected by the method of random sampling. A total of 68 households were surveyed in Mansarovar Park which is roughly 41.2% of the basti population and a total of 71 households were surveyed in Seelampur which is about 35.5% of the total population. The questionnaire consisted of 77 questions. The data was collected in the month of January 2017.

First part of our study is dedicated to finding the importance of various socio- economic factors that affect the choice of modes of defecation of these households. In order to ascertain this, we included questions broadly on the general information of the households, social factors, accessibility factors, provisional factors and awareness factors. We collected data on the modes of defecation under three heads- open defecation, community toilets or private facility. In order to find the individual impacts of the factors, we constructed a qualitative response econometric model. Given our dependent variable we constructed a multinomial logistic model.

Multinomial Logistic Model

[1] Throughout our study, we call the New Seelampur community as Seelampur.

Qualitative response models are used when the dependent variable, y, is a random variable with only a finite number of outcomes. In cases where the number of outcomes is only two, it becomes a binary response variable. Traditionally,

success is defined as y = 1 while failure is defined as y = 0.

In the case of binary models, it is of interest to find the difference in the response probabilities when x_k is 1 and x_k is 0.

Depending upon the type of distribution the error term (*e*) follows, we choose among the two index models of logistic or probit for the construction of our model. In the case of a standard logistic distribution, logistic model is followed.

Logistic model is of interest to us due to the data under study.

However, dependent variable in our study has more than three outcomes namely- open defecation, community toilet and private toilets. In such circumstances, logistic model extends to a case where the unordered response has more than two outcomes. In this case, y is defined as a random variable taking the values {0,1,.....,J}.

Here also, we are interested in the finding how a change in the xi (elements of **x**) affect the response probabilities, ceteris paribus. The impact of the components of **x** on the y variable is given by the partial or the marginal effects. This is what we eventually report in our results.

Health and Mortality

We report the incidence of illness attributable to water , sanitation and hygiene. This is done by reporting at least one case of Diarrhea, Malaria, Chikangunya, Skin infection, Jaundice and Typhoid in a household in the past 6 months.
Further discussions on health are carried out by taking diarrheal illness episodes.
"*The category "diarrhoea" includes some more severe diseases, such as cholera, typhoid and dysentery—all of which have related "faecal–oral" transmission pathways*" (WHO 2008).

WHO reports in *'Safe water, better health: Costs, benefits and sustainability of interventions to protect and promote health'* (2008) that diarrhea has the highest contribution (39%) to the water, sanitation and hygiene-related disease burden globally.

Cost of illness: Framework

The basic framework of cost of illness used is as followed by Poulos et. al. (2011). the total cost of illness of a disease of a household as follows-

Direct private costs+ Indirect private costs = INR ___

These calculations will be done for only Diarrhea for a particular household.

We obtain the probability of a person belonging to a representative household from a household falling sick by diarrheal disease. The expected cost of diarrheal disease per household is obtained as a product of the probability multiplied by the estimate of cost of diarrheal illness per household. The estimate of cost of illness from diarrheal disease for entire slum population is obtained by extrapolating by multiplying expected cost of illness and number of households.
The variables included tabulated in annexure (Table 2).

Direct costs

Household costs of diarrhea episodes include out-of-pocket payments made by the households for the treatment of diarrhea and the opportunity costs for time used by the patients and/or caregivers during the entire diarrhea episode.

Out-of-pocket payments consisted of direct medical and non-medical costs.

Direct medical costs included –

doctor fees which is the consultation cost per visit multiplied by the number of visit in one episode of illness, medicine cost will be calculated by asking the medicine cost per prescription dividing by the number of days for which the medicine was taken in one go and multiplying it by the number of days medicine was taken of which we take number of sick days as proxy.

In case of hospitalization, total costs were asked since the recall for amount spent on an episode of hospitalization is good as it is generally borrowed or spent from savings.

Direct non- medical costs include-

Transportation costs will be calculated as number of visits to the doctor multiplied by the Travel Cost to Doctor Clinic (transportation cost from one side multiplied by 2). If a person had accompanied them, then travel costs of that person will also be added.

Total direct costs= Doctor fees* number of visits to the doctor+ transportation cost per visit*number of visits to the doctor+ per day medicine cost*number of days taken

Following M N Murty and P Dasgupta (2004).

If the probability of a household being affected is α,

Given the average size of the family (s), the cost of treatment for a representative household (c1) is derived as:

$$C1 = s \acute{} \alpha (Cd)$$

Where,

Cd is the calculated average direct cost of treatment.

It is then extrapolated to the entire slum by multiplying it with the slum population.

Indirect Costs

Indirect costs were those related to income or productivity loss and were measured by applying the human capital approach.

Income loss

Income loss for paid workers was measured by multiplying the number of lost working days due to a illness episode with the actual wage rate of the patient. Self-reported monthly wages have been divided by 30 to get per day wage rate is used in this study.

Productivity loss

In case a non-employed person fell ill, such calculations will be made for care givers in case care givers are employed.

Following Poulos et. Al. (2011) and M N Murty ,

Total indirect cost= work day lost of employed person* Avg. slum wage per day+ workday lost of care giver* Avg. slum wage per day

If the probability of a household being affected is α,

Given the average size of the family (s), the indirect cost for a representative household (c2) is derived as:

C2 = s ´ α (Ci)

Where,

Ci is the calculated average Indirect cost.

It is then extrapolated to the entire slum by multiplying it with the slum population.

After computing the summation of treatment costs and the wage forgone for each slum, we compare the monthly and annual results.

However, it is in place to enlist some of the limitations of cost of illness study of this paper. For the purpose of this study, productivity losses due to forgone non-market activities including housework and childcare, leisure forgone, social costs and intangible costs are not included. We assuming perfect re-call for the period of six months. Due to small number of infants, distinction between infant and adult diarrhea is not taken up. We also assume equal weights for Diarrhea across months due to 6 month recall period as followed by U. Gupta (2008).

In order to justify the difference in costs between the two slums we do a logistic regression. This helps us explain what factors are affecting the occurrence of an episode of diarrhea.

In order to do this, we take dependent variable-

Dependent variable

1= Occurrence of at least one episode of diarrhea in a household in past 6 months

0= otherwise

In the next section, we present the summary statistics and the results of our computations.

RESULTS &ANALYSIS

Survey Data: Field insights (Descriptive Statistics)

In this section, we present the summary statistics of the collected data. A total of 68 households were surveyed from Mansarovar Park and 71 from Seelampur.

Out of all the respondents, 29 were the heads of the household. 41 females and 27 were BPL card holders in Mansarovar Park while in Seelampur the numbers were 32, 37 and 44 respectively. Mean and variation[2] in age of the respondents was 32.3 and 19.09 in Mansarovar park while the figures were 35.03 and 11.60 in Seelampur.

The average monthly income of the households were enquired in both the slums. The mean monthly income of a representative household in Mansarovar park is INR 9583.3 while the figure in Seelampur is slightly above Mansarovar park INR 9866.1.

Data on social parameters such as gender, religion and caste was gathered. According to our data, females are more likely to use both private toilets and community toilets in both the slums.

It was observed that more number of Hindus uses private and community toilets as compared to Muslims. However, these figures can be misleading as 79% and 83% of all respondents in Mansarovar Park and Seelampur were respectively Hindus. An interesting observation is that in Seelampur, respondents of general category are more likely to use private toilets while those belonging to backward classes are more likely to use community toilet.

Now, we present some household level information relating to the water, sanitation, hygiene and diseases related indicators (Table 3).

Usage of community toilets and open defecation is practiced in Mansarovar park while in Seelampur, almost two-third households use private toilets. Community toilets are less popular in Seelampur due to the presence of private toilets. Seelampur slum follows better sanitation practices with no open defecation while Mansarovar park has wide spread open defecation practice. Sewage connection is not present in any household in Seelampur while 81.6% of Seelampur slums reportedly have sewage connections in good working conditions. The occurrence of diarrhea is much higher in Mansarovar park, we shall comment more on this in the subsequent sub sections.

[2] As measured by standard deviation

Data on distance from their defecation place and time taken to reach there is also reported. In Mansarovar park, more than 90% of the households going of open defecation report that it is within 500 meters from their place of dwelling while more than 50% community toilet users state that it is more than 500 meters away from their place of dwelling. In Seelampur, 100% of the community toilet users state that the facility is less than half a kilometer away from their place of dwelling. This is expected to have some repercussions on the choice of defecation which we discuss in the following sections.

Community toilets are built near Mansarovar Park Basti yet more than 40% of the respondents defecate in open. It was of interest to us to investigate what keeps them from using the facility. 57.5% of the concerned respondents reported long queues at community toilets as their reason of not using it. 12.1% of the respondents (females) had faced harassment at the community toilet space and same percent of respondents reported that community toilets are dirty as the reason.

The level of awareness of the slum dwellers about the various sanitation, provision of toilet related government subsidies were learned. Surprisingly, Only 2 out of 68 households in Mansarovar park were aware that government provides subsidies for building household toilets while the number was just 1 out of 71 in Seelampur. Government has been spending sums on print and electronic media advertisements. This is done to make people aware about the health impact of open defecation and to encourage people to use safer sanitation practices. In order to find out the reach of such advertisements among the urban slum dwellers of Delhi, we asked our sample in both the slums if they had come across such advertisements through the following sources-

A. Doorstep advertisement

B. Television

C. Newspaper

D. Radio

Only 13.2% respondents in Mansarovar park slum said that government spreads door to door awareness about open defecation in that area while in Seelampur, 33.8% people said that. T.V. advertisements are able to reach the urban slum population. Yet in both the slums number of

people untouched by such awareness programs is 41% and 46% respectively. The trends are similar across slums.

In order to find the willingness of households without toilets to build a private toilet we asked two questions. The responses are tabulated as follows (Table 4).

The reported numbers are less than expected. The most reported reason for this is space constraint. This is the reason that even though 25% of the respondents defecating in open reported harassment and 24% reported that the place is dirty, yet most would not like to participate in any such program.

Apart from sanitation practices, water source and purification related information was also collected. More than 70% of sample in both the slums was using pipeline water (Table 5). None of the households in any slums used to purify water in any form. Some households boiled water in case of sickness, numbers of which are negligible and we haven't accounted for it.

We now report water source data with respect to diarrhea cases. In Mansarovar park, out of the total 25 households where diarrhea has occurred in the past 6 months, 76% of the households use piped drinking water, 20% use hand pumps and 4% use water obtained from Jal board tankers. 37.2% of the pipeline water users, 14.2% of hand pump users and 50% of Jal board tanker water users reported at least a single case of diarrhea in the past 6 months. In Seelampur, out of the total 11 households where diarrhea has occurred in the past 6 months, 63.6% of the households use piped drinking water, 18.1% use hand pumps and 18.1% use water obtained from Jal board tankers. 14% of the pipeline water users, 15.3% of hand pump users and 25% of Jal board tanker water users reported at least a single case of diarrhea in the past 6 months.

33.8% of the respondents in Mansarovar park basti and 44.2% of Seelampur slum state that it takes them 0-15 minutes to reach the nearest hospital. 63.23% of the respondents in Mansarovar park state that it takes them 15-30 minutes to reach the nearest hospital while the corresponding figure in Seelampur is 57.7%. Only 3 cases of hospitalization (in the past 6 months) were reported in Mansarovar park and 2 in Seelampur, where only one was due to Diarrhea. The reported case was that of an adult female. Funds were sourced using cash and mobilizing savings and total expenditure of INR2000 was incurred. Nobody reported Sale of livestock / assets, Cut

back on purchase of non-essential products, Free care, Micro-credit, Eating less in terms of quantity, Support from Community as a source of funds.

We now present the results of the estimated regression model.

Econometric Analysis and Regression Results

Given our data, we estimate a multinomial logistic regression model. For our study we define the y variable as-

1 = open defecation

2 = private toilets and,

3 = community toilets

and the explanatory variables are presented in Table 6.

Hence the model construct is as follows:

Mode of defecation= $\beta 0 + \beta 1$Location + $\beta 2$Gender + $\beta 3$Caste + $\beta 4$Monthly Income + $\beta 5$Number of household members + $\beta 6$Age + $\beta 8$Awareness + $\beta 7$BPL card holding + $\beta 8$Secondary education + $\beta 9$Earth Flooring + $\beta 10$Roof + $\beta 11$Distance from community toilet+μ

For the purpose of our study, we are only concerned with the reported marginal effects (Table 7). The marginal effects report the predicted probabilities. Since there are three possible outcomes, we report margins three times, one for each outcome value. The probability of a woman going for open defecation is 0.149 less than that of a male. As family income increases by 1000 rupees, the probability of open defecation reduces by 0.3. Flooring is a measure of poverty. The probability of a household to go for open defecation is 0.17 higher for people who have earth flooring as compared to other flooring times. Concrete roof corresponds to a better standard of living, in accordance with the literature the probability of a household to go for open defecation is 0.68 lower as compared to non- concrete roof households. Interestingly, for the households

from where the distance from the community toilet is less than 500 meters , the probability of open defecation is 0.26 lower.

The probability of households using private toilets is 0.26 lower in Mansarovar park as compared to Seelampur. As family income increases by 1000 rupees, the probability of using private toilets increases by 0.29. With an additional member in the household, the probability of using private toilets decreases by 0.1. The probability of a household to go for private toilets is 0.15 lower for people who have earth flooring as compared to other flooring times.

The probability of households using community toilets is 0.33 higher in Mansarovar park as compared to Seelampur. Interestingly, backward caste households are 0.18 more likely to use community toilets as compared to forward caste households. With an additional member in the household, the probability of using community toilets increases by 0.08. Households with concrete roof status are 0.50 more likely to use community toilets.

According to our data, awareness through advertisements is not likely to impact the choice of mode of defecation. There can be various possible explanations for this. Even when they see advertisement, they do not have the space, funds or willingness to build private toilets. Community toilets are reported to have long queues by 57% non users, while 12 percent each report lack of cleanliness and harassment (Table 8).

Education above primary level is also not likely to impact the choice. As per our data, students are not taught about improving sanitation practices. When asked if they are taught about defecation in schools, only 1 out of 140 respondents said yes.

Cost of illness calculations

Direct cost calculations

Given the framework discussed in section 4.4, we calculate the total direct costs of each slum. The consultancy fees of the doctor are multiplied with the number of visits to the doctor. We add transportation and the medication cost to consultancy costs. The transportation costs per visit are again multiplied with the number of visits to the doctor while the medicine costs per day were calculated and multiplied with the number of days the medicine was taken.

Hence, the calculated direct costs of Mansarovar for six months for the total sample households is 8740 Rupees. Therefore, the direct cost for the sample for an year is 17480 Rupees. Now, assuming equal monthly weights[3] the calculated sample monthly cost is 1456.6 Rupees.

The estimated probability[4] of occurrence of Diarrhea for Mansarovar park slum is 0.33. The calculated average house size[5] is 4.8. Using the estimates, we come up with the monthly direct cost[6] for a representative household in Mansarovar park of 33.93 Rupees. Now, in order to get the monthly figures for the entire Basti we extrapolate the figure by multiplying it with the

number of households in the slum (164 Rupees). Thus the estimated monthly direct economic burden of Diarrheal illness for Mansarovar park basti is 5564.52 Rupees. Yearly, the direct cost of diarrheal disease for Mansarovar Park Slum is estimated to be 66,774.24 Rupees.

Similar calculations were carried out for Seelampur slum. Direct costs of Seelampur for six months for the sample was estimated to be 3975 Rupees. Similar calculations as above were carried out to arrive at the monthly costs for the sample. Now, the probability of Diarrhea in Seelampur was 0.16. The calculated average household size is 4. Sample monthly cost of 662.5 rupees was adjusted[7] to arrive at the monthly cost of one representative household amounting to 6.30 rupees. Therefore extrapolating to the entire slum we get 1260 rupees as the monthly burden of diarrheal illness of the entire slum while the estimated yearly figures are 15,120 rupees.

Indirect cost calculations

Work days lost are accounted in order to calculate the indirect costs of an episode of diarrhea. In case of an employed person falling sick, we multiply the average daily slum wage[8] with work days lost of the employed person. In case when an unemployed person had fallen sick and an employed person had taken leaves to take care of him/her, we add the care giving costs. These

[3] Since we have collected six month collective data, we do not differentiate between the seasonal variations in the Diarrheal disease.
[4] Probability of occurrence of Diarrhea = Number of sample households reporting at least one case of Diarrhea in past six months/ Total number of households surveyed
[5] We collected data on total number of members in a given household and calculated average.
[6] Calculated as 4.8*.33*(1456.6/68)
[7] 4.0*.169*(662.5/71)
[8] The daily slum wage was calculated by adding all the monthly wages of the bread earner of the sample households. This was divided by the sample population of the respective slum to arrive at the average daily wage figure of the slum.

are calculated by multiplying the average slum wage per day with the work days lost of the care giver. We now present the calculations of cost of illness of both the slums.

The calculated indirect costs of the sample population (Mansarovar park) are 13857.59 rupees for the past six months. Hence the monthly sample indirect costs are 2309.59 rupees. Hence the monthly indirect costs[9] of a representative household is 53.79 rupees. The monthly figure for the entire slum being 8823.17 and the yearly costs are estimated to be 105,878.12 rupees.

Similarly, the calculated indirect costs for six months for Seelampur sample is 1000.699 rupees. Monthly sample costs 166.78 rupees. Monthly costs for a representative household is 1.58 rupees. Finally, the monthly indirect burden of diarrheal illness on Seelampur slum is 317.5 rupees while the year estimate is 3810.35 rupees.

Total costs

The total costs are calculated by adding the direct and the indirect costs for each slum. For Mansarovar park, the total monthly burden of a representative household is calculated by adding direct costs (33.93) and the indirect costs (53.79) amounting to 87.72 rupees. While the yearly burden of diarrhea is 172,652.36 rupees.

The corresponding figures for Seelampur are 7.88 rupees monthly and 18930.35 rupees yearly.

The figures are depicted in the table 9.

There is a huge variation between the slum diarrheal costs. We try to explain the main reasons behind the difference. We run a logistic regression on the pooled slum data.

The Dependent variable

1= Occurrence of at least one episode of diarrhea in a household in past 6 months

0= otherwise

[9] 4.8*.33*(2309.59/68)

The independent variables included are as tabulated (Table 10).

The model is as specified,

Mode of defecation= β0 + β1Location + β2Gender + β3Caste + β4Monthly Income + β5Number of household members + β6Age + β8Awareness + β7BPL card holding + β8Secondary education + β9open defecation + β10water source+μ

As in (Table 11) the location dummy is significant at 99% level of significance. The probability of occurrence of diarrhea in a representative household is higher by 0.24 in Mansarovar park as compared to Seelampur.

Other variable that explains occurrence of diarrhea at 99% confidence interval is open defecation. For a household going for open defecation, the probability of occurrence of diarrhea in a representative household increases by about 0.321. This result is aligned to the WHO reports and the literature. Mansarovar Park has 40% open defecation while Seelampur has no open defecation.

CONCLUSION AND POLICY SUGGESTIONS

Through our study, we have tried to focus on the urban slum sanitation. As explained in the previous chapter, defecation practices explain the difference in costs of illness between the two slums. In P Dasgupta (2004), costs are attributed to water sources. However, in our study water source does not explain the difference in costs because the source of water is similar in both the slums. Hence, policy measures that induce the slum dwellers to use safer sanitation practices are highly encouraged. We suggest the measures to bring about this change.

Women have reported to have faced harassment both at the open defecation fields and community toilets. Women are less likely to go for open defecation than men which suggest that the factors like harassment and shame play a role in defecation practices. Gender is an important factor that determines the choice of mode of defecation. More than 25% of the Mansarovar park

households with private toilets report that they wouldn't have built the toilets if they didn't have female family members.

Hence, government should come up with more female centric sanitation policies. Backward classes do not significantly explain the open defecation and ownership of private toilets however, they are more likely to use community toilets.

Income and living standard are the two of the most important determinants according to our data. It suggests that if the incomes or the living standard of the slum dwellers rise, their sanitation practices tend to improve. Therefore, measures that help the slum dwellers improve their income is likely to also translate into better sanitation practices in the medium and long term. This also brings about one social factor in consideration. The households with concrete roof (living standard) tend to use more of both private and community toilets. This suggests that among the slum dwellers the households which are better off, practice better sanitation practices. Hence, the measures that improve the overall living standards would also lead to safer sanitation practices by the slum dwellers.

The distance and the lack of maintenance discourage the slum dwellers from using community toilets.

As described in the previous chapter, government direct spending on building private toilets is not a very welcome proposal among the slum dwellers. The ongoing discussion suggests that mainly due to the space constraints, the measures that improve the income and standard of living of the slum dwellers are more likely to give desired results as compared provision of private toilets.

However, the provision of community toilets is a welcome step as this does away with the space constraint. Payment at community toilets is also a discouraging factor. Respondents report that 2-5 rupees per use is a very high price to pay for defecation. In order to reduce this constraint, monthly pass system of payment should be encouraged at very low costs. This will not only reduce the money constraint but also inculcate regular community toilet usage among slum dwellers since they have already paid for the entire month. Family passes covering all family members could also be introduced at further lower costs.

Community toilets can become more popular if they are regularly cleaned and are built very close to the slum. As the distance from the community toilet increases, the usage declines. It is recommended that wherever possible, the community toilet should be built near the place used

for open defecation. This will incentivize the users of the field to use community toilets as they will not have to change the regular place of defecation and it will be at the same distance as the earlier field of use. The community toilets should have more number of facilities in order to reduce queues.

Awareness was expected to play an important role however, it didn't. It is observed that in person explanation of the benefits of safer defecation are expected to be more effective than media based advertisements especially for the urban slum population. It is suggested that door to door awareness campaigns by Anganwadi workers and NGOs are encouraged. Sanitation practices should be taught in primary classes as well since some of the slum dwellers drop out after this level of education. The toilets in the schools should also be provided and clean since usage in schools encourages usage in the place of dwelling as well. Parents should also be educated at special meetings with the school teachers. Women and the backward classes will be the most benefitted sections of the society with such programmes.

These measures in totality as expected to inculcate safer sanitation practices and reduce the burden of diseases attributable to water, sanitation and hygiene among the urban slum population.

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ANNEXURE

Table 1: Distribution of Slums by type of latrine facility used

Latrine facility used	Number of slums	Percentage
Owned		
Septic tank/flush	117	1.84
Pit	1002	15.8
Service	24	0.38
Shared		
Septic tank/flush	0	0
Pit	0	0
Service	835	13.16
Public/Community		
Septic tank/flush		
Pit	23	0.36
Service	1156	18.22
No Latrine	1371	21.61
Total	6343	100

Source: NSSO 2015

Table 2: Cost of illness variables included

Relation with Head	Diseases (code:Diarrhea, Cholera, Typhoid, Skin and eye Infection, Malaria, Pneumonia, Jaundice, Chikungunya)	No. of days of illness	No. of workdays lost Office, school, daily routine, sick days, restlessness, etc. (in case of child school days + work days of care taking parent)	How did you treat your ailment(s)? a. (Govt. Hospital b. Private Hospital c. Govt. dispensary d. Pvt. Dispensary e. Chemist f. Homeopathy g. Hakim (Ayurveda) h. Traditional home Treatment Others _____				
Mitigating Expenditure								
Total Time (waiting & Travel)	No. of visits to the doctor	Travel Cost to Doctor Clinic	Person along (y/n)	Doctor Fees	Medicine Cost (For all days)	No. of days' medicine taken	Total Cost	

Source: Delhi sanitation slum survey(2017)

Table 3: Water, sanitation and health indicators

Information	**Count**	
	Mansarovar Park	Seelampur
Whether toilet facility in house	06 (8.6%)	45 (63.3%)
Whether using community toilet	35 (50.7%)	26 (36.6%)
Whether defecating in open	28 (40.5%)	-
1 or more infant in HH	19 (27.9%)	06 (8.3%)
Diarrhea in past 6 months	24 (35.3%)	11 (15.5%)
Sewage connection	-	58 (81.6%)

Source: Delhi sanitation slum survey(2017)

Table 4: Willingness to participate in toilet building programs

Proposal	**Number and percentage of people responding 'yes'**	
	Mansarovar Park	Seelampur[10]
If more community toilets are built in future will you still go for open defecation?	11 (16.1%)	5 (7%)
government pools in money to construct a toilet in your house, will you be willing to participate?	12 (17.6%)	6 (8.4%)

[10] 63.3% of respondents were already using private toilet and 36.6% were using community toilet.

you be willing to get a fully funded toilet and will you be using it?	17 (25%)	5 (7%)

Source: Delhi sanitation slum survey(2017)

Table 5: Source of water

Source of water	Pipeline	Hand Pump	Jal Board Tankers
Mansarovar park	51 (75%)	14 (20.5%)	02 (2.9%)
Seelampur	50 (70.4%)	13 (18.3%)	08 (11.2%)

Source: Delhi sanitation slum survey(2017)

Table 6: Explanatory variable description Multinomial logistic

Variable	**Description**	**Specification**
Location (Dummy)	Slum Location	1= Mansarovar Park, 0 =Seelampur
Gender (Dummy)	Gender of the respondent	1= female, 0= male
Caste (Dummy)	Caste of the respondent	1= Backward class, 0= other caste
Income	Income of the head of household	continuous
Total household members	Total members in a household	discrete
Age	Age of the respondent	continuous
Awareness (Dummy)	Awareness about the problems related to open defecation	1= seen TV advertisement, 0= not seen
BPL card holding (Dummy)	BPL card holding in the household	1= BPL card holder, 0= otherwise
Education (Dummy)	Education of the respondent above class 5^{th}	1= educated above primary level 0= educated below primary level
Flooring (Dummy)	Flooring status of the household	1= Earth flooring 0= otherwise
Roof status (Dummy)	Roof status of the household	1= Concrete roof 0= otherwise
Distance from community toilet (Dummy)	Distance between household and community toilet	1= distance from community toilet <500 m, 0= >500 m

Source: Delhi sanitation slum survey(2017)

Table 7: Multinomial logistic regression results and marginal effects

	Open defecation				Private toilets				Community toilets	
	Model 1		dy/dx		Model 2		dy/dx		dy/dx	
Variable	**coeff**	**std.err**	**coeff**	**std.err**	**coeff**	**std.err**	**coeff**	**std.err**	**coeff**	**std.err**
Mansarovar_Location	-1.375	0.876	-0.075	0.103	-3.123**	1.335	-0.26474**	0.116	0.339***	0.116
Gender	-1.073**	0.504	-0.14963**	0.059	0.427	0.649	0.076	0.058	0.073	0.07
Backward Caste	-0.317	0.652	0.031	0.083	-2.253**	0.929	-0.212	0.077	0.181***	0.083
Monthly Income	-0.00007	5.6	-0.300**	6.48	0.0001*	0.00005	0.290**	5.23	2.9	6.72
Total Household Members	-0.139	0.199	0.017	0.023	-0.113***	0.258	-0.105***	0.018	0.087***	0.023
Awareness	0.0154	0.527	-0.0297	0.067	0.998	0.624	0.098	0.062	-0.068	0.07
Secondary_Education	-0.047	0.628	-0.030	0.075	0.765	0.669	0.077	0.06	-0.046	0.082
Flooring	1.045	0.854	0.172*	0.094	-1.256	0.749	-0.157***	0.059	-0.015	0.106
Distance_Community toilet	-2.11***	0.813	-0.266***	0.094	-0.028	1.616	0.064	0.152	0.202	0.123
Roof	-13.943***	1.082	-0.683***	0.285	-2.639**	1.216	0.181	0.193	0.501***	0.230
Constant	3.136**	1.535			5.874***	1.84				
Log pseudo likelihood	0									
Pseudo R2	0.43									
Number of Observation	140									

***,** and * represents 99%, 95 %and 90 % level of significance

Source: Delhi sanitation slum survey(2017)

Table 8: Reported reasons of not using community toilets

Problems	**Number of people (Mansarovar Park)**
Fun in going in open	1 (3%)
Long queues at community toilets	19 (57.5%)
Community toilets are paid	3 (9%)
Community Toilets are dirty	4 (12.1%)
Distance	2 (6%)
Harassment of women	4 (12.1%)

Source: Delhi sanitation slum survey(2017)

Table 9: Total cost of diarrheal illness (Total of treatment costs and wage lost)

Burden of Diarrheal illness	**Mansarovar Park (In INR)**	**Seelampur (In INR)**
Representative household (Monthly)	87.72	7.88
Representative household (Yearly)	1052.64	94.56
Entire slum (Monthly)	14,387.7	1577.5
Entire slum (Yearly)	172,652.36	18930.35

Source: Delhi sanitation slum survey(2017)

Table 10: Logistic regression variable description (*Dependent variable: 1= Occurrence of at least one episode of diarrhea in a household in past 6 months 0= otherwise*)

Variable	**Description**	**Specification**
Location (Dummy)	Slum Location	1= Mansarovar Park, 0 =Seelampur
Gender (Dummy)	Gender of the respondent	1= female, 0= male
Caste (Dummy)	Caste of the respondent	1= Backward class, 0= other caste
Income	Income of the head of household	continuous
Total household members	Total members in a household	discrete

Age	Age of the respondent	continuous
Awareness (Dummy)	Awareness about the problems related to open defecation	1= seen TV advertisement, 0= not seen
BPL card holding (Dummy)	BPL card holding in the household	1= BPL card holder, 0= otherwise
Education (Dummy)	Education of the respondent above class 5^{th}	1= educated above primary level 0= educated below primary level
Open Defecation (Dummy)	If the respondent is defecating in open	1= Open defecation 0= otherwise
Water source (Dummy)	Source of water of the household	1= Pipeline, 0= otherwise

Source: Delhi sanitation slum survey(2017)

Table 11: Bivariate Logistic Results (dependent variable = Diarrheal illness)

Variables				
	Coef.	**Std. Err.**	**dy/dx**	**Std. Err.**
Mansarovar_Location	1.681***	0.522	0.243***	0.068
Gender	0.199	0.542	0.029	0.078
Caste	-0.223	0.484	-0.032	0.07
Monthly Income	0.000**	0	0.000**	0
Total Household Members	-0.057	0.181	-0.008	0.026
Age	0.038*	0.021	0.005*	0.003
Open_defecation	2.221***	0.535	0.321***	0.061
Education	0.567	0.574	0.082	0.082
Awareness	0.54	0.565	0.078	0.081
Bpl card holding	-0.549	0.506	-0.079	0.073
Avg. monthly medical expenditure	0	0	0	0
water source	-0.201	0.495	-0.029	0.071
Constant	-2.047	1.319		
Log pseudo likelihood	-2.046532	1.318972		
Pseudo R2	0.304			
Number of Observation	140			

***,** and * represents 99%, 95 %and 90 % level of significance

Source: Delhi sanitation slum survey(2017)