

# Neighbour-shared versus communal latrines in urban slums: a cross-sectional study in Orissa, India exploring household demographics, accessibility, privacy, use and cleanliness

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**Introduction:** A growing proportion of the global population rely on shared sanitation facilities, despite their association with adverse health outcomes. We sought to explore differences between neighbour-shared and communal latrines in terms household demographics, accessibility, facilities and use.

**Methods:** We conducted surveys among 295 households relying on shared sanitation in 30 slums in Orissa, India, 60.3% (178) of which relied on neighbour-shared latrines while the balance relied on communal latrines. We collected household demographic data, conducted latrine spot-checks and collected data on indicators of use, accessibility, privacy and cleanliness.

**Results:** Compared to neighbour-shared facilities, households relying on communal facilities were poorer, larger, less educated, less likely to have access to piped water and more likely to have a member practicing open defecation. Communal latrines were also less accessible, less likely to have water or a hand washing station on site and cleaned less frequently; they were more likely to have visible faeces and flies present.

**Conclusions:** We found significant differences between neighbour-shared and communal facilities in terms of user demographics, access, facilities and cleanliness that could potentially explain differences in health. These findings highlight the need for a shared sanitation policy that focuses not just on the number of users, but also on maintenance, accessibility, cleanliness and provision of water and hand washing facilities.

**Keywords:** Environmental health, India, Public health, Shared sanitation, Toilet facilities, Vulnerable populations

## Introduction

Inadequate sanitation is associated with diarrhoea, soil-transmitted helminths, trachoma and schistosomiasis<sup>1</sup> and recent figures indicate that 280 000 deaths could be attributed to inadequate sanitation in low- and middle-income settings.<sup>2</sup> Globally, an estimated 2.4 billion people lack access to improved sanitation, 710 million of whom live in urban areas.<sup>3</sup> India represents a particular challenge, with 769 million people without improved sanitation and 597 million people practicing open defecation—representing nearly two-thirds of the global estimate.<sup>3</sup>

'Shared' sanitation facilities—those used by two or more households—have been excluded from the definition of 'improved sanitation' used to monitor progress toward international targets.<sup>4</sup> The reason stems from concerns that shared facilities may be unacceptable in terms of cleanliness (shared toilets may not be as hygienic as non-shared ones or they may result

in increased contact with human waste) and accessibility (facilities may not be available at night, or easily used by women and children).<sup>5</sup> The health benefits of using shared sanitation has also been questioned—there is evidence that shared sanitation may be a risk factor for diarrhoea in children,<sup>6,7</sup> though recent cross-sectional studies found no difference in health, water quality or hygiene levels between shared and non-shared facilities.<sup>8,9</sup>

Nevertheless, shared facilities represent a large and growing proportion of sanitation options available in low-income countries, with approximately 638 million users of a shared sanitation facility (of an otherwise improved technology).<sup>3</sup> In India, 9% of the overall population accesses some form of shared sanitation, which has steadily increased from 5% in 1990.<sup>10</sup> In urban areas, one fifth (20%) of the population is reported to access shared sanitation (up from 17% in 1990), though this is likely to be an underestimate as slums are not always included in the surveys.<sup>10</sup> However, the latest Census of India estimates that over 65 million

people live in slums, up from 52 million in 2001.<sup>11</sup> Communal or public latrines are considered by some to be the only realistic option for high-density populations in urban slums.<sup>12,13</sup>

An analysis of data on shared sanitation and diarrhoea from 51 Demographic and Health Surveys reported that sharing sanitation facilities was a risk factor for diarrhoea, though differences in socioeconomic status were important.<sup>7</sup> One hypothesis about the association between shared sanitation and potential adverse outcomes is that the users are different. A more detailed analysis of Joint Monitoring Programme (JMP) data suggests, however, that the increased risk associated with shared sanitation may be due to other factors, as people who rely on shared sanitation tend to be poorer, have less access to improved water supplies, live in households with more young children and are managed by people with no formal education.<sup>14</sup> These differences were also found present in our previous work in Orissa slums.<sup>8</sup>

While it is difficult to implement policies that address these demographic differences, there is another hypothesis about the association between shared sanitation and health that may be more susceptible to intervention: that shared facilities present obstacles that limit their use and increase potential exposure due to poor access and maintenance. Biran et al. conducted a comprehensive quantitative survey assessing the determinants of communal latrine usage in Indian slums.<sup>15</sup> The study reports that distance and opening hours were strongly associated with use. Similarly, residents of slums in Mumbai reported using the railway tracks as toilets, even though public toilets were available 30 minutes away on foot.<sup>16</sup> The distance, lack of cleanliness and long queues induced them to use the tracks instead. Studies in Kenya, Ghana and Uganda reported similar issues, with users often preferring open defecation or using plastic bags in the home to using shared toilets, which they considered to be dirty and smelly.<sup>17–20</sup> Inadequate water at the shared facilities has also been noted as a barrier to use. In a study in rural Maharashtra, despite the presence of community latrines, 67% of the respondents resorted to open defecation.<sup>21</sup> The main reason for not using the community latrine was inadequate water supply (48.6%).

The JMP has suggested that any increased risk associated with shared sanitation may be mitigated where the latrine is used by a limited number of people that know each other. They are therefore considering a revision to the policy that would treat shared sanitation as ‘improved’—and thus scored toward international coverage targets—if the facility otherwise meets the definition of improved sanitation and is shared among no more than five families or 30 persons, whichever is fewer, and if the users know each other.<sup>10,22</sup> While this proposed amendment is based on advice from an expert committee, some have questioned the change due to the extensive heterogeneity in shared sanitation use.<sup>6</sup> A policy brief by Water and Sanitation for the Urban Poor (WSUP) notes that the boundaries between the different types of shared facilities are often unclear, especially in dense urban settlements.<sup>23</sup> Others recommend categorising shared sanitation facilities by ownership, management, location and finance, rather than technological considerations.<sup>24</sup> For example, the large public sanitation facilities constructed and managed by Sulabh (Sulabh International Social Service Organisation, a non-profit voluntary social organisation founded in 1970) are often cited as success stories—they have provided safe and acceptable sanitation to many underserved communities<sup>25</sup>—yet they are considered

‘unimproved’, and will remain so under the proposed policy change due to the large number of users.

We undertook this study in informal settlements in Orissa, India, to explore whether two different forms of shared sanitation facilities—shared with neighbours or the broader community—vary in terms of user demographics, patterns of use, privacy and cleanliness in ways that may render them more likely to present health risks.

## Methods

### Study design and setting; selection of slums and households

We conducted a cross-sectional design study in a convenience sample of 30 informal settlements (slums), half in Bhubaneswar and half in Cuttack, the largest cities in Orissa, India. Shared sanitation facilities were identified in the context of another study that compared them to private latrines and the methods used for slum and household selection have been described previously.<sup>8</sup> Working from lists of slums provided by municipal authorities and local NGOs, we visited slums to identify 15 in each city that had a combination of shared and non-shared latrines. Within each slum, we targeted a total of 10 households using shared sanitation. An adapted EPI approach<sup>26</sup> was chosen as no accurate population or household data was available for the 30 selected slums. This consisted of selecting households for inclusion by randomly choosing directions in the slum (pencil-spinning) and selecting every second household on the left. This purposive sample was intended to provide an overview of the situation, rather than a representative sample of the slum populations of these two cities. As the size of the slum could not be accurately determined, no weighting was applied.

### Household questionnaire and latrine spot-checks

The household questionnaire and latrine spot check forms were extensively piloted in slums which were not included in the final sample, and the enumerators were thoroughly trained on the use of both tools. The structured questionnaire, conducted in the local language Oriya, was used to collect demographic and socio-economic data, as well as information on latrine cleaning, faecal sludge management and open defecation habits from the main caretaker of each household. In addition, the households were asked with whom they shared their latrine, the accessibility (e.g., opening times, time to facility) and associated costs of use, if any. Respondents were asked if anyone in the household had suffered from diarrhoea at any time in the past 7 days, as well as on the day of the questionnaire or the two days prior. If the individual with diarrhoea was present, it was recorded as ‘self-reported’. Diarrhoea was defined using the WHO definition of three or more loose stools in 24 hours.<sup>27</sup>

Enumerators conducted spot-checks of the latrines that householders identified as their primary sanitation facility, noting the average time it took to walk there to determine accessibility. They recorded observations on various factors, including if the latrine cubicle floor was wet, whether there was a door or roof and if faecal material was present in the cubicle—this information was collected for each cubicle in each facility. During the spot-check, enumerators also recorded observations on the presence

of rubbish or leaves blocking the squatting pan, functionality of the pan and whether the cubicle itself was blocked preventing it from being used properly i.e., through storage. Data on the presence of space for bathing at the shared facility was also collected. After checking consistency in answers, the duplicate latrine spot-checks (for households reporting use of the same facility) were removed from the analysis to ensure each latrine facility was counted only once. Data on a place for hand-washing was collected both during the household questionnaire and during the latrine spot-check. A designated hand-washing place was defined as a specific location in the home or the courtyard, or at the shared facility, with water (and possibly soap) available.

### Definition of shared sanitation sub-categories

We defined shared sanitation as any facility used by more than one household (a household was self-defined as those living together and 'sharing of a cooking pot' or eating together). In this study setting, this included neighbours or families sharing a single cubicle as well as tenants sharing a sanitation facility with their landlord. These users were grouped together and considered 'neighbour-sharing' households. Households using a facility managed by the community or a pay-per-use facility run by a third-party (such as a Sulabh Toilet Complex) were grouped together and considered 'communal' latrine users. As all facilities assessed were of the 'pour-flush' (and thus 'improved') technology, the 'neighbour sharing' facilities would be expected to correspond to the 'improved' shared category, as per the proposed JMP policy. Due to the number of users, the 'communal' facilities would be expected to remain 'unimproved' under the revised policy, irrespective of the technology.

### Statistical analyses

All data were double entered into Epi-Info 3.5.4 (Epi Info, CDC, Atlanta, GA, USA) and were analysed using Stata 12 (StataCorp LP, College Station, TX, USA). In order to generate a relative asset index, we combined household-level information on assets such as type of cooking fuel and ownership of specific items (e.g., fridge, bicycle) using principal component analysis to define the summed weights.<sup>28</sup> This score was then categorised into 'poor', 'middle', and 'least poor'. Two sample t-tests and  $\chi^2$  tests were used to assess any differences between the two groups (households using neighbour-shared or communal facilities). Where appropriate, other descriptive statistics (means, SE) are presented.

The spot-check data were double entered and checked for consistency. Cubicles reported to be non-functional (presence of leaves or rubbish in the squatting plate, broken pan or absence of water in the pan) were not used for further analyses. Composite variables for use (wet floor surrounding squatting plate, any yellow discolouration in pan), privacy (presence of door, roof), and cleanliness (absence of faecal matter, few or no flies, and little or no smell in cubicle) were created for each facility. For example, if at least one of the cubicles in the facility had a wet floor or yellow discolouration, it was considered used. Similarly, if at least one cubicle in a facility had no faecal matter, or no flies or smell, the facility was considered clean. These composite variables were used to test for any associations using  $\chi^2$  tests.

The study was approved by the Ethics Committee of the London School of Hygiene and Tropical Medicine and the Ethics

Committee of Xavier University. Informed consent was obtained from all individuals participating in the study. Household questionnaire participants signed a consent form and were provided with an information sheet on the study with contact information in case of questions.

## Results

### Household questionnaire

The basic characteristics of the households sharing sanitation facilities can be seen in Table 1. A total of 295 households were included, the majority of which had access to neighbour-shared facilities (60.3%, 846 individuals in 178 households). Most of the female headed households used communal facilities (26/47, 55.3%) whilst the male headed households were more likely to use neighbour-sharing options (157/248, 63.3%,  $p=0.02$ ). Significantly, household respondents with no formal education ( $n=65$ ) were more likely to use communal facilities ( $n=42$ ) compared to the neighbour-sharing households ( $n=23$ ) (36.2% vs 13.4%,  $p<0.001$ ). Households accessing communal facilities were larger than households using neighbour-shared (average of 5.2 individuals per household, as compared to 4.8,  $p=0.03$ ).

Almost twice as many households using communal sanitation had a 'below poverty line' card (BPL cards are provided by the Government indicating financial disadvantage and identifies households and individuals in need of assistance) as compared to the neighbour-sharing households (Table 1). Similarly, more households using neighbour-shared facilities ( $n=50$ ) than households using communal facilities ( $n=8$ ) were categorised as 'least poor' (28.1% vs 6.8%,  $p<0.001$ ). In terms of housing structure, households accessing neighbour-shared facilities ( $n=60$ ) were more likely to have a house constructed with durable materials (cement walls and roof) than users of the communal sanitation facilities ( $n=26$ , total households  $n=86$ ; 33.7% vs 22.2%,  $p=0.01$ ).

Piped water was used by the majority of the households ( $n=238$ , 80.7%), and most of these were users of communal latrines ( $n=101$ , 86.3% neighbour-shared vs  $n=137$ , 77.0% communal,  $p=0.05$ ). The majority of users of communal latrines ( $n=87$ ) had to go outside their house or dwelling to collect water (74.4%). This was significantly more than for the users of neighbour-shared sanitation facilities ( $n=60$ , 33.7%,  $p<0.001$ ) (Table 1).

Significantly more households using communal sanitation reported that at least one member of their household practiced open defecation on some occasions ( $n=29$ , 24.8% vs  $n=13$ , 7.4%,  $p<0.001$ ). Though the overall numbers were low (two individuals in neighbour-shared households versus 10 individuals in communal households), the 7-day period prevalence of diarrhoea was significantly higher in users of communal sanitation compared to neighbour-sharing users (1.64% vs 0.24%,  $p=0.004$ ). Of these individuals, eight self-reported their diarrhoea status. Five of the 12 individuals reporting diarrhoea resided in households which disclosed open defecation practice on some occasions—four of these five households accessed communal sanitation.

### Latrine spot-checks

Only functional cubicles were included in the analysis of the latrine spot-checks (functionality determined by presence of

**Table 1.** Basic characteristics of households

Characteristics	Total	Neighbour-shared latrines		Communal latrines		Tests of significance <sup>a</sup>
		n	%	n	%	
Total no. households	295	178	60.3	117	39.7	NA
No. individuals in households	1455	846	58.1	609	41.9	NA
Gender of head of household						
Male	248	157	63.3	91	36.7	p=0.02
Female	47	21	44.7	26	55.3	
Education level of household respondent						
No formal education	65	23	13.4	42	36.2	p<0.001
Some or complete primary	81	47	27.3	34	29.1	
Some secondary or higher	142	102	59.3	40	34.7	
Average no. individuals in household. Mean (SD)	NA	4.8 (1.77)	NA	5.2 (2.4)	NA	p=0.03 <sup>b</sup>
Average no. children <5 in household. Mean (SD)	NA	0.58 (0.62)	NA	0.67 (0.73)	NA	NS <sup>b</sup>
Average no. rooms used for sleeping in household. Mean (SD)	NA	1.46 (0.71)	NA	1.55 (0.73)	NA	NS <sup>b</sup>
Has BPL card <sup>c</sup>						
Yes, verified	84	37	20.8	47	40.5	p<0.001
Yes, reported	24	13	7.3	11	9.5	
No	186	128	71.9	58	50.0	
Wealth tertile						
Poor	138	69	38.8	69	59.0	p<0.001
Middle	98	58	32.6	40	34.2	
Least poor	58	50	28.1	8	6.8	
House structure						
Cement wall and roof pucca)	86	60	33.7	26	22.2	p=0.013
Cement wall (semi pucca)	171	103	57.9	68	58.1	
No cement (kucha)	37	15	8.4	22	18.8	
Water source (drinking water)						
Piped water	238	137	77.0	101	86.3	p=0.046
Non-piped water	57	41	23.0	16	1.4	
Location of (drinking) water source						
In own dwelling	72	49	27.5	23	19.7	p<0.001
In own yard/compound	76	69	38.8	7	6.0	
Outside of dwelling	147	60	33.7	87	74.4	
Open defecation practiced <sup>d</sup>	42	13	7.4	29	24.8	p<0.001
Diarrhoea (individual) <sup>e</sup>	12	2	0.24	10	1.64	Two sample test of proportions p=0.004 Fishers exact p>0.01
Diarrhoea (household) <sup>f</sup>	11	2	1.12	9	7.7	

NA: not applicable; NS: not significant.

<sup>a</sup>  $\chi^2$  test unless otherwise specified.

<sup>b</sup> Two-sample t test with equal variances.

<sup>c</sup> Below poverty line card, provided by the Government indicating financial disadvantage and identifies households and individuals in need of assistance.

<sup>d</sup> At least one member of household, on some occasions.

<sup>e</sup> At individual level, reported in the past 7 days.

<sup>f</sup> At least one member of household reported diarrhoea in the past 7 days.

water in latrine pan, no broken latrine pans and no rubbish or leaves blocking the latrine pan). At least one cubicle from 148 facilities (out of 230 screened facilities) was functional, with an average of 1.9 functional cubicles per facility (Table 2).

The majority (n=118, 79.8%) of the facilities had a bathing facility, though the latrine cubicles themselves were often used as the location for bathing (Table 2). Almost twice as many neighbour-shared facilities (n=91) had a designated hand-washing facility

**Table 2.** Latrine spot checks of neighbour-shared and communal facilities

	Total n (%)	Neighbour- shared n (%)	Communal n (%)	Two sample t-test of proportions
No. facilities assessed	148	131	17	NP
No. cubicles assessed	277	138	139	NP
Average no. cubicles per facility	1.9	1.05	8.2	NP
Facility has space for bathing (either in cubicle or just outside)	118 (79.8)	104 (79.4)	14 (82.4)	NS
Facility has place for hand-washing	98 (54.8)	91 (69.5)	7 (41.2)	p=0.02
No. cubicles with water inside	177 (63.4)	97 (70.3)	80 (57.6)	p=0.03
Privacy				
No. cubicles with door or screen up to 1 m	230 (83.0)	131 (94.9)	99 (71.2)	p<0.001
No. cubicles with roof	244 (88.1)	129 (93.5)	115 (82.7)	p=0.01
Privacy (at least one cubicle in facility). Composite variable	146 (98.6)	129 (98.5)	17 (100)	NS
Use				
No. cubicles where floor is wet	229 (82.7)	130 (94.9)	99 (71.2)	p<0.001
Colour change in pan	170 (61.4)	66 (47.8)	104 (74.8)	p<0.001
Use (at least one cubicle in facility). Composite variable	142 (95.9)	125 (95.4)	17 (100)	NS
Cleanliness				
Faeces in cubicle	36 (13.0)	6 (4.3)	30 (21.6)	p=0.01
Flies in cubicle	n=231	n=116	n=115	
Few (<5)	70 (30.3)	55 (47.4)	15 (13.0)	p<0.001
Several (>5)	53 (22.9)	40 (34.5)	13 (11.3)	p<0.001
Many	108 (46.8)	21 (18.1)	87 (75.7)	p<0.001
Smell in cubicle	n=227	n=116	n=111	
No detectable smell	41 (18.1)	26 (22.4)	15 (13.5)	p=0.07
Some detectable smell	71 (31.3)	71 (62.9)	0 (0)	p<0.001
Strong detectable smell	115 (50.7)	19 (17.2)	96 (86.5)	p<0.001
Cleanliness (at least one cubicle in facility). Composite variable	135 (91.2)	124 (94.7)	11 (64.7)	p<0.001

NP: no statistical test performed; NS: not significant.

compared to communal facilities (n=7) (69.5% vs 41.2%, p=0.02). As all facilities assessed were 'pour-flush', the availability of water inside the cubicle increased ease of use. Significantly more neighbour-shared facilities had water available (n=97), as compared to the communal cubicles (n=80) (70.3% vs 57.6%, p=0.03).

In terms of privacy, half of the latrine facilities assessed provided segregated facilities for men and women (n=104), with the remainder making no distinction. The majority of these (n=91, 87.5%) were community or Sulabh latrines. None of the facilities in the study catered specifically for children (data not shown). No difference was found in levels of privacy (composite variable) between latrines used by neighbours or those used communally (Table 2).

A similar number of cubicles in either sharing category had a wet floor at the time of the spot-check, a likely indicator of use. Twice as many communal squatting pans had a slight colour change—this may be as a result of inadequate cleaning, or intense use of the cubicle. No difference in the level of use between neighbour-shared and communal facilities was found for the composite use variable (Table 2).

In terms of cleanliness, faeces were visible in 21.6% (n=30) of the communal cubicles, compared to only 4.3% (n=6) of the

neighbour-shared cubicles (p=0.01) (Table 2). Similarly, the communal cubicles had significantly higher number of flies and a reported stronger smell than the neighbour-shared facilities. The composite variable, bringing together the presence of faecal matter, number of flies and smell, found that neighbour-shared sanitation facilities were significantly cleaner as compared to communal facilities (p<0.001).

### Sanitation facilities, accessibility, lighting and water access

Most of the neighbour-shared facilities were open 24 hours a day, but only 38.8% (101/260) of the communal were accessible at all times (Table 3). Users of these facilities also reported the highest average one-way travel time of 6.5 minutes, as compared to 2.6 minutes for users of the neighbour-shared facilities.

Four times as many cubicles in the communal facilities (n=15) had lights inside as compared to the neighbour-shared facilities (n=5) (12.8% vs 3.0%, p<0.001), whereas almost a quarter of the neighbour-shared latrines had water inside the cubicle (n=38, 23.0%) compared to 17.1% of communal latrines (n=20) (Table 3). For those households using a cubicle without

**Table 3.** Characteristics of the sanitation facility, as reported by households

	Total	Neighbour-shared	Communal	Two sample t-test of proportion
No. households responding	282	165	117	NA
Accessibility				
Facility open 24 h, every day	260	159 (97.6)	101 (86.3)	p<0.001
Average time (minutes, one way) to travel to latrine from household (SD)		2.6 (2.3)	6.5 (4.1)	p<0.001
Lights at facility (reported), n (%)				
Near facility (i.e., streetlight) or at the facility	83	51 (30.9)	32 (27.4)	NS
Lights inside each cubicle/stance	20	5 (3.0)	15 (12.8)	p<0.001
No lights	170	100 (60.6)	70 (59.8)	NS
Availability of water at latrine, n (%) (reported)				
Yes, just outside the latrine	81	40 (24.2)	41 (35.0)	p=0.03
Yes inside the cubicle	58	38 (23.0)	20 (17.1)	NS
No, everyone brings their own	143	87 (52.7)	56 (47.9)	NS
Average distance in meters water has to be carried from source to latrine (SD)		11.8 (8.7)	16.8 (14.7)	p<0.001
Faecal sludge management				
Where the waste from the latrine goes, n (%)				
Septic tank	173	113 (68.5)	60 (51.3)	p=0.001
Sewer	77	37 (22.4)	40 (34.2)	p=0.02
Canal/gutter	10	3 (1.8)	7 (6.0)	p=0.05
Don't know	22	12 (7.3)	10 (8.5)	NS
When the (septic) tank was last emptied, n (%)	168 <sup>a</sup>	n=109 <sup>b</sup>	n=59 <sup>c</sup>	
Last month	4	3 (2.8)	1 (1.7)	NS
In the last year	63	52 (47.7)	11 (18.6)	p<0.001
Don't know	57	26 (23.9)	31 (52.5)	p<0.001
Not emptied	44	28 (25.7)	16 (27.1)	NS
How the latrine is emptied	151 <sup>d</sup>	n=107 <sup>e</sup>	n=44 <sup>f</sup>	
Vacuum pump	62	52 (61.9)	10 (22.7)	p<0.001
Manually	36	31 (36.9)	5 (11.4)	p=0.002
Don't know	53	24 (28.6)	29 (65.9)	p<0.001
Cleaning				
How often facility is cleaned, n (%), (reported)	269	n=163 <sup>g</sup>	n=106 <sup>h</sup>	
Once a day	55	35 (21.5)	20 (18.9)	NS
Once a week	154	118 (72.4)	36 (34.0)	p<0.001
Less than once a week	8	3 (1.8)	5 (4.7)	NS
No cleaning	17	2 (1.2)	15 (14.2)	p<0.001
Don't know	35	5 (3.1)	30 (28.3)	p<0.001
Who cleans the facility, n (%)	228	n=158 <sup>i</sup>	n=70 <sup>j</sup>	
Sweeper/cleaner	79	23 (14.6)	56 (80.0)	p<0.001
Households themselves	149	135 (85.4)	14 (20.0)	p<0.001
Rotation system for households cleaning?		n=134 <sup>k</sup>	n=13 <sup>l</sup>	
Yes, everyone cleans in turn	22	15 (11.2)	7 (53.9)	p=0.001
No, people clean as they have time	114	109 (81.3)	5 (38.5)	p=0.007
No, usually few people/households cleaning	11	10 (7.5)	1 (7.7)	NS
Payment				
Do you pay to use the facility?				
Yes, n (%)	21	6 (3.6)	15 (12.8)	p=0.004
Average amount paid per n (average INR)				
Use	15	4 (2.25)	11 (3.5)	NA
Month	6	2 (225)	4 (72.5)	NA
Do you pay for pit emptying? n (%)	128	n=84	n=44	
Yes	56	48 (57.1)	8 (18.2)	p<0.001

Continued

**Table 3.** *Continued*

	Total	Neighbour-shared	Communal	Two sample t-test of proportion
No	42	15 (17.9)	27 (61.4)	p<0.001
Don't know	30	21 (25.0)	9 (20.5)	NS
Amount paid for emptying, average (INR)				
Per month		4 (400)	0 (0)	NA
Per year		30 (9733)	6 (150)	NA
Per occasion		8 (1337.5)	1 (100)	NA
Do you pay for the sewage connection? n (%)	77	n=37	n=40	
Yes	7	7 (18.9)	0 (0)	p=0.004
No	70	30 (81.1)	40 (100)	p=0.004
If yes, average INR paid (frequency)		300 (per month); 200 (per year)	no data	NA
Do you pay for the sweeper? Yes (%)	39	13 (56.5)	26 (46.4)	NS
Average payment for cleaning/sweeper (INR), n (average)				
Amount paid per month		1 (20)	10 (20.5)	NA
Amount paid per week		11 (30.9)	7 (21.4)	NA
Amount paid per occasion/cleaning event		1 (20)	7 (12.1)	NA
Who pay for cleaning materials? n (%)				NA
None used, only use water for cleaning	1	1 (0.8)	0 (0)	NS
Collect money to pay for supplies	7	3 (2.2)	4 (30.8)	p<0.001
Household who cleans provides	139	130 (97.0)	9 (69.2)	p<0.001

INR: Indian Rupees (exchange rate July 2015, 1 USD=63.5 INR); NA: not applicable; NS: not significant.

<sup>a</sup> Missing data, n=5, 2.9%.

<sup>b</sup> Missing data n=4, 3.5%.

<sup>c</sup> Missing data n=1, 1.7%.

<sup>d</sup> Missing data, n=17, 10.1%.

<sup>e</sup> Missing data n=2, 1.8%.

<sup>f</sup> Missing data n=15, 25.4%.

<sup>g</sup> Missing data n=2, 1.2%.

<sup>h</sup> Missing data n=11, 9.4%.

<sup>i</sup> Out of 156 households reporting cleaning frequency.

<sup>j</sup> Out of 61 households reporting cleaning frequency.

<sup>k</sup> Missing data n=1, 0.7%.

<sup>l</sup> Missing data n=1, 7.1%.

water, the average distance water had to be carried for neighbour-shared users was 11.8 m, compared to 16.8 m for the communal sanitation users (p<0.001).

## Cleaning, fees and sludge management

### Faecal sludge management

Septic tanks were the most frequently used faecal sludge management system (n=173, 61.3%) (Table 3). Over half of the users of the communal facilities did not know when the tank was last emptied (n=31, 52.5%). Similar numbers of the neighbour-shared users reported not knowing when it was emptied (n=26, 23.9%) or reported that it was not emptied at all (n=28, 25.7%). Two-thirds of the communal users did not know how the tank was emptied (n=29, 65.9%), 61.9% (n=52) of the neighbour-shared users reported emptying by vacuum pump,

compared to only 22.7% of communal latrine users. Three times as many of the neighbour-shared latrines (n=31) were emptied manually, compared to communal latrines (n=5) (36.9% vs 11.4%). Irrespective of emptying mode, just over half of the neighbour-shared respondents report payment for this service. Very few households reported paying for a sewage connection (n=7, 18.9% of neighbour-shared users).

### Cleaning

For both users of neighbour-shared (n=118) and communal sanitation (n=36), the sanitation facilities were most likely to be cleaned just once a week (72.4% neighbour-shared vs 34.0% communal, p<0.001) (Table 3). Significantly more households using communal facilities (n=15) reported that there was no cleaning at all (14.2% vs 1.2%, p<0.001), and over a quarter of the users of these facilities did not know the cleaning frequency

( $n=30$ , 28.3%). The majority of the households using neighbour-shared facilities cleaned their sanitation facilities themselves (135/158, 85.4%), whereas for communal facility users, this was only a fifth ( $n=14$ , 20.0%) ( $p<0.001$ ). The majority of the neighbour-shared households cleaned the facility when they had time ( $n=109$ , 81.3%), with only 11.2% ( $n=15$ ) reporting a cleaning schedule for each household. Similarly, in almost all instances ( $n=130$ , 97.0%), the household doing the cleaning provided the cleaning materials, with only 2.2% ( $n=3$ ) of the neighbour-shared households and 30.8% ( $n=4$ ) of the communal households collecting money to purchase supplies.

### Fees

Four times as many users of the communal facilities pay for the use of the facility (either per use, or per month) as compared to neighbour-shared users ( $p=0.004$ ) (Table 3). However, overall, only 21 respondents (7.4%) report paying for use of the facility, with the majority ( $n=15$ ) paying per use. The average price to use the facility per month was considerably more expensive for users of neighbour-shared facilities (Indian Rupee 225, approximately US\$3.40) vs users of communal (Indian Rupee 72.5, approximately US\$1.10). However, as there are so few paying-users, these figures may not be the norm in this setting. The majority of the neighbour-shared users contributed money to pit emptying ( $n=48$ , 57.1%) or a sewage connection ( $n=7$ , 18.9%), whereas only 18.2% ( $n=8$ ) of the communal users paid for pit emptying, and none for a sewage connection. It is expected that in the majority of the communal users, the user fee covers all costs (cleaning, maintenance, emptying) and thus many of the respondents were not sure if they paid for additional services. Twice as many users of communal facilities paid for a sweeper and were more likely to collect money to pay for cleaning supplies.

Though no direct measure for use of a cubicle was available, the composite 'use' variable was applied to assess the impact of various factors on the utilisation of the facility. No association was found between use and lighting or water in the facility, time taken to walk to the facility, privacy or cleanliness (data not shown).

## Discussion

In our study population, important differences exist among households that rely on neighbour-shared versus communal latrines, and on the accessibility, privacy and cleanliness of these sanitation facilities. Some of these differences may be associated with significant differences in their risk profiles.

In terms of demographics and household characteristics, households relying on communal facilities were poorer, had more members, and were headed by individuals with less formal education. They were less likely to have access to piped water and more likely to have a member practicing open defecation.

Communal latrines were less accessible than neighbour-shared latrines both in terms of distance, opening times and fees for use. They were less likely to have water or a hand washing station on site. They were cleaned less frequently than neighbour-shared facilities and were more likely to have visible faeces and flies present.

Our results did not find an association between use and a range of factors which have previously been shown to impact use (distance, cleanliness). Studies in varying settings have

shown that distance to the shared latrine was an important determinant of use,<sup>15,18,20,29,30</sup> and in Uganda inadequate lighting in shared facilities was a barrier to use.<sup>19</sup> Elsewhere, cleanliness of a shared sanitation facility has also been shown to be an important indicator of use.<sup>16–18</sup>

Our study had several important limitations. First, the manner for selecting slums and households in this exploratory study was purposely designed to achieve balance and internal validity and not external validity. While our approach allows us to make comparisons between householders in the same slums that rely on different shared sanitation facilities, our results should not be generalized beyond the slums comprising our study population. Second, as a cross-sectional study conducted over a period of three months, we had no ability to capture potentially important differences over time and seasons that a longitudinal study would reveal. Third, much of our data was self-reported and is subject to recall, courtesy and other reporting biases. Lastly, no accurate data was collected on the number of households sharing a particular facility. Assumptions can be made based on the type of sharing (i.e., smaller number of households using neighbour or family-shared latrine versus larger households accessing communal facilities) but additional data would have to be collected to justify these assumptions. In this study we combined users of communal and Sulabh facilities—though there may be differences we have not accounted for—as the small number of households reporting Sulabh use ( $n=12$ ) did not allow for a separate analysis.

Despite these limitations, we identified important differences between users of neighbour-shared facilities versus communal latrines. These differences raise questions about the proposed policy of counting shared latrines as 'improved' provided they have a limited number of known users. While the policy may capture a lower risk profile, much of this may simply be due to differences in household demographics—characteristics that the policy will not be able to impact directly. On the other hand, if the policy focused on accessibility, facilities and maintenance—establishing criteria for each in order for shared latrines to meet the definition of 'improved sanitation'—it would directly encourage attention, resources and creative solutions in these areas.

Our findings are consistent with a growing recognition for a more focused policy on shared sanitation. Mazeau et al. suggest that the focus should be less on the users and more on the facility itself,<sup>24</sup> and Kwiringira et al. argue that sanitation provision needs to go beyond technology or user-numbers, and include factors of culture, affordability and ownership.<sup>19</sup> Rheinländer et al. argue for functional sanitation which protects human health, and acknowledge that the current definitions of improved or unimproved sanitation do not account for the diversity of shared sanitation.<sup>31</sup> A policy that counts neighbour-shared latrines as 'improved' simply acknowledges important differences in demographics, access, and maintenance. By focusing on the factors that actually contribute to exposure and adverse health outcomes—such as maintenance, accessibility, cleanliness and provision of water and hand washing facilities—a more enlightened policy could actually encourage these important conditions among communal latrines, thereby reducing risks to the growing number vulnerable people that must still rely on communal latrines. Shared sanitation is especially prevalent in dense urban settlements, and as the level of urbanisation increases globally, the challenge of providing adequate sanitation in these settings will only intensify.



Providing adequate, safe and accessible sanitation for all users in slums is a public health priority which will require a multifaceted approach, focussing not only on the sanitation facilities, but also increasing education and women's empowerment amongst slum dwellers, as well as accountability from landlords and local government. In addition, further research, focussing on barriers to private latrine construction (which may include cost of construction, land ownership, perceived importance and family size) in different settings may help shed light on ways to encourage people to move up the sanitation ladder.

## Conclusions

As 2015 and thus the Millennium Development Goals draw to a close, the challenges for urban sanitation, especially in slums, are larger than ever. Shared sanitation is expected to serve a growing number of people globally, whether technologically improved or unimproved. However, in order for these shared facilities to be a sustainable step on the sanitation ladder, policy makers, programme implementers and target communities must join forces to ensure sanitation facilities are culturally appropriate, affordable, well-maintained and user-friendly. We argue that the status of shared sanitation in terms of 'improved' or 'unimproved' should focus on cultural acceptability, cleanliness, accessibility and privacy as well as technology rather than user numbers alone.

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