International Health 2021; **13**: 13–21
doi:10.1093/inthealth/ihaa011 Advance Access publication 31 March 2020

ORIGINAL ARTICLE

Characteristics of sanitation and hygiene facilities in a slum community in Kampala, Uganda

Charles Ssemugabo*, Solomon Tsebeni Wafula, Rawlance Ndejjo, Jimmy Osuret, David Musoke and Abdullah Ali Halage

Department of Disease Control and Environmental Health, School of Public Health, Makerere University College of Health Sciences, Kampala, Uganda

*Corresponding author: Tel: +256 779 625 182; E-mail: cssemugabo@gmail.com

Received 21 September 2019; revised 6 February 2020; editorial decision 17 February 2020; accepted 14 February 2020

Background: This study assessed characteristics of sanitation and hygiene facilities in a slum community in Kampala, Uganda.

Methods: We conducted a household-based cross-sectional study among 395 households in Kasubi slum using a semi-structured questionnaire and observational checklist to collect data.

Results: Almost 98.0% (387/395) of households owned a sanitation facility and 77.0% (298/387) shared it with other households. The most common type of sanitation facility was a pit latrine with slab (66.9% [259/387]). Most (90.5% [305/337]) latrines had a door or shutter, a roof (92.9% [313/337]) and a depth >1.5 m (68.2% [229/337]). Overall, 21.3% (84/395) and 65.6% (259/395) of households had improved and functional sanitation facilities, respectively. Only 16.5% (65/395) of the households had a hand-washing facility. Student-led (adjusted prevalence rate [PR] 2.67 [95% confidence interval [CI] 1.83–3.94]) and households that owned their house (adjusted PR 2.17 [95% CI 1.33–3.53]) were 2.67 and 2.17 times more likely to have improved sanitation facilities, respectively. Households that owned their house (adjusted PR 1.90 [95% CI 1.18–3.05]) were 1.9 times more likely to possess a hand-washing facility.

Conclusions: The coverage of improved sanitation and hygiene facilities was low. The majority of households were using a shared pit latrine with a slab that had no hand-washing facility. Sanitation and hygiene interventions should prioritize improving sanitation and hygiene facilities.

Keywords: sanitation facilities, hand washing, coverage, status, slum, household, Uganda

Introduction

The World Health Organization (WHO) stipulates that improved sanitation facilities should hygienically separate human excreta from human contact.[1] Globally, the use of improved sanitation facilities increased from 28% in 2000 to 45% in 2017.[2] Despite the progress that has been made globally, 4.5 billion people still have no access to improved sanitation facilities.[3] Of these, 2.3 billion have no access to basic sanitation facilities and 892 million practice open defeacation.[3] The availability of hand-washing facilities has also increased to 60% globally,[2] but it is still a challenge, especially in sub-Saharan Africa where only 25% of the population has access to hand-washing facilities,[2] with one in four people able to access facilities with water and soap.[3]

Uganda has also made progress with national sanitation facility coverage, estimated at 79% on average.[4] However, access to improved sanitation facilities is still low, especially in urban areas, at 36.3%, with over 12.6% practicing open defaecation.[4] Ownership of hand-washing facilities in urban areas is also still low, at 39.6%. In the Rubaga division, where this study was conducted, access to sanitation facilities (improved or unimproved) was reported to be 99.9% in 2018.[5] However, frequent outbreaks of cholera and typhoid[6,7] are still reported in these communities, which could imply poor or inappropriate use of sanitation facilities. In fact, the literature shows that sanitation facilities are abandoned if improperly used and cleaned, especially shared facilities.[8]

Indeed, the characteristics of the sanitation facility greatly affect its use and coverage. The quality of improved sanitation

and hygiene facilities, especially in slums, deteriorates with the increase in the number of households using the facility,[9] cleanliness of the facility and other characteristics.[10] More than 78% of slum households in Kampala share sanitary facilities.[10,11] Sharing sanitation facilities has been reported to affect cleaning behaviours and maintenance, which results in the abandonment of facilities.[8,12] Other characteristics that affect use include the nature and type of facility.[11] Despite the high coverage of sanitation and hygiene facilities reported in census reports in Uganda,[5] it is important to understand the characteristics of sanitation and hygiene facilities. This could possibly explain the poor use of sanitary and hygiene facilities in low-resourced communities in Uganda. This study assessed the characteristics of sanitation and hygiene facilities in the Kasubi slum in Kampala, Uganda.

Methods

Study design

This was a household-based cross-sectional study that used a semi-structured questionnaire administered to household heads and an observational checklist to collect data.

Study area

The study was carried out in the Kasubi slum, one of the largest slum communities located in the Rubaga division in Kampala, the capital city of Uganda. Kasubi is comprised of informal and substandard housing that is used for residential purposes, as well as small-scale businesses. Kasubi parish has a population of >384 386 people living in nine zones.[13] We purposively selected Kasubi parish because of its high population density, uneven terrain and high sanitary facility coverage, yet sanitation-related diseases are still reported in this community.

Sample size and sampling

Using the Kish Leslie formula for cross-sectional studies,[14]and assuming an α of 0.05, power $(1-\beta)$ of 0.80, a sampling error of 5%, a non-response rate of 5% and a statistically conservative prevalence of 50% for households with improved sanitation and hygiene facilities, a final sample size of 401 households was obtained. The 50% prevalence of households with improved sanitation and hygiene facilities was used to obtain an unbiased sample, because similar studies did not assess the status of sanitation facilities.[8,12] The sampling strategy has been previously described in an earlier publication.[15] Concisely, the sample size was distributed proportionately based on the population size across six of the nine zones of Kasubi parish. The number of households in each zone was obtained from the Rubaga division offices and sampling proportionate to size was used to obtain the number of target households from each zone. Households were defined by the Uganda Bureau of Statistics (UBOS) as a group of persons who normally live and eat together[13] and were selected using systematic random sampling. The number of households in each zone was divided by the number of households to be selected from the zone to create a sampling interval. Within each zone, the first household was selected randomly. Subsequent households were selected by skipping a number of households equivalent to the calculated sampling interval based on the population of the selected zone until the sampled number of households in that zone was achieved. All households within the area were included in the study. However, those where the household head or another adult person was not available during data collection were excluded.

Data collection

Data were collected using a semi-structured questionnaire and observational checklist developed based on reviewed literature on the coverage and status of sanitation and hygiene facilities.[16–19] Using the semi-structured questionnaire, we collected data on household sociodemographic characteristics, ownership and characteristics of sanitation and hygiene facilities. In order to ensure accuracy and expound on the data collected, we observed sanitation and hygiene facilities using an observational checklist. The checklist included the nature, type and state of sanitation and hygiene facilities. For sanitation facilities, cleanliness, access, safety/security, rooting, ventilation, fill status, nuisance (flies and foul smells), anal cleansing material, distance from household and screening were observed. Distance from the latrine/toilet, presence of clean water and soap, presence of foul smells and visibility were observed for hand-washing facilities. Data collection tools were pre-tested in the Mulago slum within Kampala, which has similar characteristics to those of the study area. Makerere University Environmental Health Students were trained in ethics and data collection techniques and collected data from all selected households.

Data management and analysis

Data were cleaned on a daily basis during data collection and entered in EpiData version 3.02 (EpiData Association, Odense, Denmark). Data were analysed using Stata version 15.0 (StataCorp, College Station, TX, USA) for possession of improved sanitation facility and ownership of hand-washing facilities. Categorical data were summarized using frequencies and proportions and their differential distribution according to the status of the binary outcomes compared using χ^2 statistics. The outcome variables, 'coverage of improved sanitation facility, and hand washing facility', were assessed using the questionnaire and confirmed by observations. Coverage of the sanitation facility was ascertained by asking the respondent 'Does your household have a latrine or toilet?', accompanied by observation of the latrine or toilet. Those that answered affirmatively and were duly observed were classified as having a sanitation facility. Sanitation facilities were classified as improved or unimproved using the criteria outlined in the Joint Monitoring Program (JMP) for Water Supply and Sanitation.[20] Among households with a sanitation facility, enumerators visually examined the latrine and assessed its functionality.[21–23] Latrines were classified as 'functional' if the pit walls were >1.5 m (if the research assistant could not see the bottom of the pit), had a door/shutter or blinds for privacy, an unbroken and unblocked toilet pan and a functional pan/pipe/pit connection. For coverage of a hand-washing facility, households were asked if they had a hand-washing facility with clean water and detergent or soap or ash. This was confirmed by observation.

We separately applied a modified Poisson regression to assess the predictors of improved sanitation and possession of a hand-

washing facility. This method uses a generalized linear model of the Poisson family with the log link and reports relative risks. We preferred this approach, as opposed to ordinary multiple logistic regression, since our binary outcomes were highly prevalent, that is >10%, in which case the prevalence ratios would be overestimated by the odds ratio.[24,25] In the modified Poisson models, overestimation of relative risk was rectified using a robust error variance procedure.

In the multivariable models, all epidemiologically meaningful explanatory variables were considered for a fully saturated model. We then applied a stepwise backward elimination method where variables were removed systematically until we had a parsimonious model. These models consisted of variables significant at the 5% level of significance and those that improved model fit. The adjusted prevalence ratios (PRs), corresponding 95% confidence intervals (CIs) and p-values are presented in this article.

Ethical considerations

Ethical approval for the study was obtained from the Makerere University School of Public Health Higher Degrees, Research and Ethics Committee (101) and registered by the Uganda National Council for Science and Technology (HS 867). Participation in the study was voluntary and study participants provided written informed consent.

Results

Individual and household characteristics

A total of 395 households participated in the study, resulting in a response rate of 98.5%. The majority (75.9% [300/395]) of the female-headed households had no access to improved sanitation (78.7% [236/300]) and hygiene facilities (84.0% [252/300]). The median age was 27.0 years (interquartile range [IQR] 23–35). Most of the household heads had attained secondary education (44.1% [174/395]) but had no access to improved sanitation (82.2% [143/174]) and hygiene (70.5% [140/174]). The majority of the household heads were married (64.8% [256/395]) and did not have access to improved sanitation (77.3% [198/256]) and hygiene (82.8% [212/256]) facilities. Most (45.1% [178/395]) of the household heads were involved in business, but their households had no access to improved sanitation (83.7% [149/178]) and hygiene (83.7% [149/178]) facilities. The majority (67.3% [266/395]) of the household heads were tenants and did not have access to improved sanitation (86.5% [230/266]) and hygiene (88.0% [234/266]) facilities. Most (51.1% [201/395]) of the respondents had lived in the slum for >5 years and did not have access to improved sanitation (83.2% [168/201]) and hygiene (86.6% [175/201]) facilities (Table 2).

Characteristics and functionality of sanitation and hygiene facilities

A sanitation facility was present in 98.0% (387/395) of the households. The most common type of sanitation facility was a pit latrine with slab (66.9% [259/387]) or a ventilated improved pit (VIP) latrine (14.2% [55/387]). The majority (77.0% [292/387]) of the households were using a shared latrine/toilet facilities that were shared among five or fewer people (53.4% [159/298]). Most (90.5% [305/337]) of the latrines observed had a door or shutter, a roof (92.9% [313/337]) and a depth >1.5 m (68.2% [229/337]). A hand-washing facility was present at 22.7% (88/387) of the sanitation facilities, of which 78.9% (71/88) were small jerry cans with water and soap. Offensive smells and flies were observed in 49.0% (165/337) and 63.2% (213/337) of the latrines, respectively. Overall, 21.3% (84/395) and 65.6% (259/395) of households had improved and functional sanitation facilities, respectively (Table 3).

Table 1. Sample size distribution across selected zones and their sampling interval

Zone	Total number of households	Sampled households per zone	Sampling interval
Kawaala 1	3500	100	35
Kasubi zone 1	2000	64	31
Kasubi zone 3	2800	84	33
Kawaala 2	2400	67	36
Kasubi zone 4	1700	50	34
Kasubi zone 2	1600	36	44

Characteristics and functionality of hand-washing facilities

From the observations, only 16.5% (65/395) of the households had a hand-washing facility. Of the 65 households, 58 (89.2%) had water and 21 (32.3%) had detergent or soap or ash for hand washing. Only 16 (24.6%) of the 65 hand-washing facilities were functional (Table 4).

Predictors of improved sanitation facilities in slums

The prevalence of improved sanitation facilities was two and three times higher in student-led households (adjusted PR 2.17 [95% CI 1.33–3.53]) and those occupied by their owners (2.67 [95% CI 1.83–3.94]) compared with households whose heads were engaged in business and did not own their houses (Table 5).

Predictors of hand-washing facilities in slums

The prevalence of households that possessed hand-washing facilities was twice as high among households owned by the occupants (adjusted PR 1.90 [95% CI 1.18–3.05]) compared with tenants (Table 6).

Discussion

We assessed the coverage and status of sanitary facilities among households in the Kasubi slum in Kampala, Uganda. The coverage of sanitation facilities was high and above Uganda's national average. The most common type of facility was a pit latrine with

Table 2. Socio-economic, demographic, sanitation and hygiene facility characteristics

Characteristics	Total, N (%)	Improved sanitation facility		p-Value	Possession of hand-washing facility		p-Value
		Yes	No		Yes	No	
Sex of household head							
Male	95 (24.1)	20 (21.1)	75 (78.9)		17 (17.9)	78 (82.1)	
Female	300 (75.9)	64 (21.3)	236 (78.7)	0.954	48 (16.0)	252 (84.0)	0.664
Age of household head (years)							
18–29	250 (63.3)	47 (18.8)	203 (81.2)		43 (17.2)	207 (82.8)	
30–45	104 (26.3)	23 (22.1)	81 (77.9)		13 (12.5)	91 (87.5)	
≥46	41 (10.4)	14 (34.2)	27 (65.9)	0.081	9 (22.0)	32 (78.0)	0.335
Mean age (SD)	30.0 (10.8)						
Education level of household head							
None	27 (6.8)	5 (18.5)	22 (81.5)		2 (7.4)	25 (92.6)	
Primary	86 (21.8)	21 (24.4)	65 (75.6)		11 (12.8)	75 (87.2)	
Secondary	174 (44.1)	31 (17.8)	143 (82.2)		34 (19.5)	140 (70.5)	
Tertiary	108 (27.3)	27 (25.0)	81 (75.0)	0.429	18 (16.7)	90 (83.3)	0.301
Marital status of household head							
Single	84 (21.3)	14 (16.7)	70 (83.3)		15 (17.9)	69 (82.1)	
Married	256 (64.8)	58 (22.7)	198 (77.3)		44 (17.2)	212 (82.8)	
Widowed or separated	55 (13.9)	12 (21.8)	43 (78.2)	0.505	6 (10.9)	49 (89.1)	0.484
Religion of household head							
Christian	306 (77.5)	66 (21.6)	240 (78.4)		46 (15.0)	260 (85.0)	
Muslim	89 (13.9)	18 (20.2)	71 (79.8)	0.785	19 (21.3)	70 (78.7)	0.157
Occupation of household head							
Business	178 (45.1)	29 (16.3)	149 (83.7)		29 (16.3)	149 (83.7)	
Formal employment	72 (18.2)	15 (20.8)	57 (79.2)		11 (15.3)	61 (84.7)	
Casual labour	57 (14.4)	12 (21.0)	45 (79.0)		6 (10.5)	51 (89.5)	
Student	41 (10.3)	16 (39.0)	25 (61.0)		10 (24.4)	31 (75.6)	
Others[a]	47 (11.9)	12 (25.5)	35 (74.5)	**0.028**	9 (19.2)	38 (80.2)	0.454
Monthly household income (US$)							
<30	78 (19.8)	18 (23.1)	60 (76.9)		12 (15.4)	66 (84.6)	
30–60	155 (39.2)	33 (21.3)	122 (78.7)		20 (12.9)	135 (87.1)	
>60	162 (41.0	33 (20.4)	129 (79.6)	0.891	33 (20.4)	129 (79.6)	0.193[+]
Household ownership							
Tenant	266 (67.3)	36 (13.5)	230 (86.5)		32 (12.0)	234 (88.0)	
Owner	129 (32.7)	48 (37.2)	81 ([+]62.8)	<**0.001**	33 (25.6)	96 (74.4)	**0.001**
Number of household members							
1–3	174 (44.1)	28 (16.1)	146 (83.9)		22 (12.6)	152 (87.4)	
4–6	162 (41.0)	35 (21.6)	127 (78.4)		28 (17.3)	134 (82.7)	
≥7	59 (14.9)	21 (35.6)	38 (64.4)	**0.007**	15 (25.4)	44 (74.6)	0.068
Duration of stay in area (years)							
≤5	202 (51.1)	34 (16.8)	168 (83.2)		27 (13.4)	175 (86.6)	
>5	193 (48.9)	50 (25.9)	143 (74.1)	**0.028**	38 (19.7)	155 (80.3)	0.090

Bold entities are statistically significant.
[a]Others includes commercial motorcycle rider, farming and unemployed.

a slab, with most of the sanitary facilities shared by five or fewer households. The majority of the sanitary facilities were functional but not improved and had no hand-washing facility. The majority of the sanitary facilities were easy to clean and access, had shutters and a roof and were not soiled. However, most of the sanitary facilities were not well ventilated, were infested with flies and lacked anal cleansing material. Of the 395 households, only 65 had a hand-washing facility. The majority of the hand-washing facilities had water but were without soap/detergent. Household heads who were students were more likely to own an improved sanitary facility. Households that owned their house were more likely to own an improved sanitary facility with a

Table 3. Characteristics of sanitation facilities

Characteristic	n	%
Household had a sanitation facility (n=395)		
Yes	387	98.0
No	08	2.0
Type of sanitation facility (n=387)		
VIP latrine	55	14.2
Ecosan toilet	51	13.2
Pit latrine with a slab	259	66.9
Pit latrine without a slap	22	5.7
Latrine/toilet facility is shared (n=387)		
Yes	298	77.0
No	89	23.0
Number of households using the latrine (n=298)		
≤5	159	53.4
>5	139	46.6
Distance of household to latrine (m) (n=387)		
≤10	288	74.4
11–20	72	18.6
>20	27	7.0
Latrine had a hand-washing facility (n=387)		
Yes	88	22.7
No	299	77.3
Type of hand-washing facility (n=88)		
Small jerry can/jug	71	78.9
Tippy tap[a]	08	9.1
Tap	9	10.2
Sanitation facility improved		
No	311	78.7
Yes	84	21.3
Sanitation facility functional		
No	136	34.4
Yes	259	65.6
Latrine characteristics (n=337)		
Slab easy to clean	243	72.3
Located more than 10 m from the house	150	44.6
Has proper access	285	84.8
Has a door/shutter	304	90.5
Has a roof	312	92.9
Has a squat hole cover	77	22.9
Has a good ventilation	202	59.9
Bottom cannot be seen (1.5 m from top)	229	68.2
Not soiled	200	59.4
Not smelly	172	51.0
Not infested with flies	124	36.8
Has anal cleansing material	31	9.2

[a]Simple and economical hand-washing stations, made with commonly available materials and not dependent on a piped water supply.

hand-washing facility compared with those that lived as tenants. Understanding the characteristics of sanitation facilities is important in explaining the variation between coverage and use, especially in limited-resource settings.

Table 4. Characteristics of hand-washing facilities

Characteristics	n	%
Hand-washing facility present (n=395)	65	16.5
Hand-washing facility within 2 m from latrine (n=65)	54	83.1
Had water (n=61)	58	89.2
Detergent/soap/ash present (n=65)	21	32.3
No foul ouder (n=62)	30	48.4
Easily seen (n=65)	41	63.1
Functional hand-washing facility[a]	16	24.6

[a]Functional hand-washing facility had both water and detergent/soap or ash

Almost all (98%) of the households in the Kasubi slum possessed a sanitary facility, with the most common type being a pit latrine with a slab. However, the majority of the sanitary facilities were shared by five or fewer households. The coverage of sanitation facilities in the study area was lower than that reported in Rubaga division (99.9%).[5] This high sanitary facility coverage is greater than Uganda's national average of 79%.[4] Our findings are similar to findings from a study carried out in several slum communities in Kampala, which found that the majority of the households shared latrine/toilet facilities.[11,12,26] The use of shared latrines has implications for maintenance as a result of negligence during use as well as cleaning by other households. This results in abandonment of the sanitary facility because of its poor state of cleanliness, hence promoting open defaecation. Therefore sanitation programmes in low-resource settings should promote ways of motivating slum dwellers to maintain and use shared sanitation facilities.

The majority of the sanitary facilities were unimproved (78.7%) but functional (65.6%). In fact, the facilities were observed to have easy-to-clean slabs, a roof, a shutter (door) and easy access. Given the overcrowding in slums, sanitary facilities that are able to separate faecal matter from human contact (improved sanitary facility) are crucial to reduce diarrhoeal diseases. Conversely, many of these facilities did not have anal cleansing materials and squat hole covers, while other were soiled and had bad odours. Despite the efforts of providing sanitary facilities that cut off faecal matter from human exposure, a lack of anal cleansing material and soiling tendencies are likely to expose users to faeces and consequently diarrhoeal diseases. This is not surprising, as the water and sanitation performance report of 2018 highlights that only 26% of the urban households use safely maintained (improved) sanitation facilities. Our findings are similar to those from studies that assessed sanitary facility characteristics in Nepal, Ethiopia and India, which found that the majority of the sanitation facilities were functional but poorly maintained.[16–19,27] Therefore sanitation interventions in Kampala slums should focus on changing household behaviour towards use and maintenance of sanitary facilities.

Besides the low coverage of hand-washing facilities (16.5%), only 25% were functional with water and soap. Our findings are

Table 5. Predictors of improved sanitation facilities in a slum community

Characteristic	Crude PR (95% CI)	p-Value	Adjusted PR (95% CI)	p-Value
Sex of household head				
Male	1			
Female	1.01 (0.65 to 1.58)	0.954		
Age of household head (years)				
14–29	1			
30–45	1.17 (0.75 to 1.83)	0.473		
>45	1.82 (1.10 to 2.99)	**0.019**		
Education level of household head				
None	1			
Primary	1.32 (0.55 to 3.16)	0.532		
Secondary	0.96 (0.41 to 2.26)	0.929		
Tertiary	1.35 (0.57 to 3.18)	0.493		
Marital status				
Single	1			
Married	1.36 (0.80 to 2.31)	0.256		
Widowed/separated	1.31 (0.65 to 2.62)	0.446		
Occupation of household head				
Business	1		1	
Formal employment	1.28 (0.73 to 2.24)	0.390	1.36 (0.79 to 2.34)	0.263
Casual labour	1.29 (0.71 to 2.36)	0.405	1.44 (0.80 to 2.58)	0.224
Student	2.40 (1.44 to 3.98)	**0.001**	2.17 (1.33 to 3.53)	**0.002**
Other	1.57 (0.87 to 2.83)	0.137	1.32 (0.74 to 3.94)	0.348
Monthly household income (US$)				
<30	1.13 (0.68 to 1.88)	0.630		
30–60	1.04 (0.60 to 1.61)	0.840		
>60	1			
Household ownership				
Tenant	1		1	
Owner	2.74 (1.88 to 4.01)	<**0.001**	2.67 (1.83 to 3.94)	<**0.001**
Number of household members				
1–3	1			
4–6	1.34 (0.86 to 2.10)	0.199		
≥7	2.21 (1.36 to 3.59)	**0.001**		
Length of stay (years)				
≤5	1			
>5	1.54 (1.04 to 2.27)	**0.030**		

Bold entities are statistically significant.

lower than those reported by the 2018 water and sanitation performance report, which showed that 39.6% of urban households had hand-washing facilities. However, this report covers all urban settings, including resource-rich urbanites, which could partly explain the difference from our study findings. The low hand-washing facility coverage in our study can be explained by the fact that many households shared sanitary facilities, hence individual household members could have opted to wash their hands elsewhere due to poor maintenance associated with communal hand-washing facilities. However, hand-washing facilities that are distant from the sanitation facility might discourage people from washing their hands and hence lead to contraction of diarrhoeal diseases. Our findings are similar to those of a water, sanitation and hygiene survey carried out in slum communities prior to a WASH project in Uganda, which found that many households did not have hand-washing facilities at baseline.[28] In contrast, a study in Ethiopia showed a relatively high coverage of hand-washing facilities in an urban setting.[17] Our findings demonstrate the need to increase hand-washing coverage in order to ensure hand washing at critical times in slum communities.

Student-led households were more likely to own improved sanitary facilities compared with those headed by business persons. This is not surprising, as students are expected to be knowledgeable about sanitation-related issues as well as translate what they learn and practice at school to their households. However, household heads in formal employment were less likely to own improved sanitary facilities, yet it is presumed that their education level is high. Formally employed

Table 6. Predictors of hand-washing facility in a slum community

Characteristic	Crude PR (95% CI)	p-Value	Adjusted PR (95% CI)	p-Value
Sex of household head				
Male	1			
Female	0.89 (0.54 to 1.48)	0.663		
Age of household head (years)				
14–29	1			
30–45	0.73 (0.41 to 1.29)	0.279		
>45	1.27 (0.67 to 2.42)	0.454		
Education level of household head				
None	0.44 (0.11 to 1.80)	0.256		
Primary	0.77 (0.38 to 1.53)	0.456		
Secondary	1.17 (070 to 1.97)	0.548		
Tertiary	1			
Marital status				
Single	1			
Married	0.96 (0.57 to 1.64)	0.888		
Widowed/separated	0.61 (0.25 to 1.48)	0.275		
Occupation of household head				
Business	1			
Formal employment	0.94 (0.50 to 1.78)	0.844		
Casual labour	0.65 (0.28 to 1.48)	0.301		
Student	1.49 (0.79 to 2.82)	0.212		
Other	1.18 (0.60 to 2.31)	0.640		
Monthly household income (US$)				
<30	1			
30–60	0.84 (0.43 to 1.63)	0.603		
>60	1.32 (0.72 to 2.42)	0.362		
Household ownership				
Tenant	1		1	
Owner	2.12 (1.37 to 3.30)	**0.001**	1.90 (1.18 to 3.05)	**0.008**
Number of household members				
1–3	1			
4–6	1.36 (0.82 to 2.29)	0.235		
≥7	2.01 (1.12 to 3.62)	**0.020**		
Length of stay (years)				
≤5	1			
>5	1.47 (0.94 to 2.31)	0.094		
Sanitation facility improved				
No	1		1	
Yes	1.89 (1.20 to 2.98)	**0.006**	1.54 (0.95 to 2.52)	0.082

Bold entities are statistically significant.

household heads living in slums might have low levels of education and consequently low levels of knowledge on sanitation and hygiene. Several sub-Saharan Africa studies have demonstrated that attending school has a big influence on improving sanitation in households.[29–33] Therefore, education is a big determinant in improving sanitation practices in slum communities.

Occupant-owned households were more likely to own improved sanitary facilities and hand-washing facilities. Unlike tenants, permanent residents are likely to have lived longer within the community. As such, they are expected to have organized themselves and constructed improved sanitary facilities. In fact, occupant-owned household members are more likely to make improvements to their sanitation facilities than those who are renting, because tenants might not have the autonomy to make improvements to their facilities. Unfortunately, landlords may deny tenants access to sanitation facilities.[34] In addition, the socio-economic status of permanent residents is expected to be higher than that of tenants and thus they can afford to construct improved facilities (both hand-washing as well as other sanitation facilities). Economic challenges that hinder households from accessing sanitation and hygiene facilities are

emphasized in studies that were carried out in urban and rural settings in Bangladesh and Ethiopia.[33,35,36]

Our study provides findings on characteristics of sanitation and hygiene facilities that have been reported and confirmed through observations. This is a significant contribution to the existing literature on coverage and status of sanitary facilities, given that many existing studies, especially in Uganda, have not examined the status of facilities in slums. In addition, assessing characteristics of sanitation and hygiene facilities based on self-reports promotes social desirability bias. By using observations, our study ensured that the characteristics reported are actually a true reflection of the facilities being studied. However, the fact that most facilities were shared among households implies the reported coverage is for unimproved sanitation facilities, which is not a true measure of improved sanitation facility coverage. In addition, we did not qualitatively explore the reasons for the low access to improved sanitation and hygiene facilities. This would have provided evidence-based reasons for future interventions geared towards improved sanitation and hygiene indicators in slums.

Conclusions

Coverage of improved sanitation and hand-washing facilities was low among slum households. The majority of the households owned unimproved sanitary facilities, with pit latrines with a slab as the common sanitary facility. Households that owned their house and those that were led by students were more likely to own an improved sanitation facility. Households that owned their house were also more likely to own a hand-washing facility than tenant households. Therefore, while prioritizing coverage of sanitation and hand-washing facilities in slum communities, interventions should focus on their characteristics, including the type of facility and cleanliness.

Authors' contributions: CS, STW, DM and AAH conceived and designed the study protocol. CS, STW, RN and JO collected and analysed the data. CS and STW carried out analysis and interpretation of the data. CS and STW drafted the manuscript. CS, STW, DM and RN critically revised the manuscript for intellectual content. All authors read and approved the final manuscript. CS, STW, DM and AAH are guarantors of the paper.

Acknowledgements: We thank the Environmental Health Science students of Makerere University, who collected the data, for their time and commitment during the course of the research. Special thanks go to the community health workers and local leaders for their support offered during data collection.

Funding: This work was supported by Stanbic Bank, Uganda Limited. CS is also supported by the Consortium for Advanced Research Training in Africa (CARTA), which is funded by the Carnegie Corporation of New York (grant B8606.R02), Sida (grant 54100029) and the DELTAS Africa Initiative (grant 107768/Z/15/Z).

Competing interests: None declared.

Ethics approval: Ethical approval for the study was obtained from the Makerere University School of Public Health Higher Degrees, Research and Ethics Committee (101) and registered by the Uganda National Council for Science and Technology (HS 867). Participation in the study was voluntary and study participants provided written informed consent.

References

1 United Nations Children's Fund, World Health Organization. Progress on drinking water and sanitation: 2012 update. New York: United Nations Children's Fund, 2012.
2 United Nations Children's Fund, World Health Organization. Progress on household drinking water, sanitation and hygiene 2000–2017: special focus on inequalities. New York: United Nations Children's Fund, 2019.
3 World Health Organization, United Nations Children's Fund. Progress on drinking water, sanitation and hygiene: 2017 update and SDG baseline. Geneva: World Health Organization, 2017.
4 Ministry of Water and Environment. Water and environment sector performance report 2018 Kampala. Uganda: Ministry of Water and Environment, 2018.
5 Uganda Bureau of Statistics. The national population and housing census 2014, area specific profile series, Kampala, Uganda. Kampala, Uganda: Uganda Bureau of Statistics, 2017.
6 Kabwama SN, Bulage L, Nsubuga F, et al. A large and persistent outbreak of typhoid fever caused by consuming contaminated water and street-vended beverages: Kampala, Uganda, January–June 2015. BMC Public Health. 2017;17:23.
7 Bwire G, Malimbo M, Maskery B, Kim YE, Mogasale V, Levin A. The burden of cholera in Uganda. PLoS Negl Trop Dis. 2013;7(12):e2545.
8 Kwiringira J, Atekyereza P, Niwagaba C, Günther I. Descending the sanitation ladder in urban Uganda: evidence from Kampala slums. BMC Public Health. 2014;14:624.
9 Simiyu S, Swilling M, Cairncross S, Rheingans R. Determinants of quality of shared sanitation facilities in informal settlements: case study of Kisumu. Kenya. BMC Public Health. 2017;17:68.
10 Günther I, Niwagaba CB, Lüthi C, Horst A, Mosler H-J, Tumwebaze IK. When is shared sanitation improved sanitation? The correlation between number of users and toilet hygiene. MPRA paper 45830. ETH Zurich: Zurich, 2012.
11 Tumwebaze IK, Orach CG, Niwagaba C, Luthi C, Mosler HJ. Sanitation facilities in Kampala slums, Uganda: users' satisfaction and determinant factors. Int J Environ Health Res. 2013;23(3):191–204.
12 Tumwebaze IK, Mosler H-J. Shared toilet users' collective cleaning and determinant factors in Kampala slums. Uganda. BMC Public Health. 2014;14:1260.
13 Uganda Bureau of Statistics. National population and housing census 2014 provisional results. Kampala, Uganda: Uganda Bureau of Statistics, 2014.
14 Wiegand H, Kish L. Survey sampling. John Wiley & Sons, Inc., New York, London 1965, IX + 643 S., 31 Abb., 56 Tab., Preis 83 s. Biometrische Zeitschrift. 1968;10(1):88–89.
15 Ssemugabo C, Wafula ST, Ndejjo R, *et al*. Knowledge and practices of households on safe water chain maintenance in a slum community in Kampala City. Uganda. Environ Health Prev Med. 2019;24:45.
16 Budhathoki SS, Shrestha G, Bhattachan M, Singh SB, Jha N, Pokharel PK. Latrine coverage and its utilisation in a rural village of eastern Nepal: a community-based cross-sectional study. BMC Res Notes. 2017;10:209.
17 Admasie A, Debebe A. Estimating access to drinking water supply, sanitation, and hygiene facilities in Wolaita Sodo town, southern Ethiopia, in reference to national coverage. J Environ Public Health. 2016;2016:8141658.
18 Ross RK, King JD, Damte M, *et al*. Evaluation of household latrine coverage in Kewot *woreda*, Ethiopia, 3 years after implementing interventions to control blinding trachoma. Int Health. 2011;3(4):251–258.

19 Awoke W, Muche S. A cross sectional study: latrine coverage and associated factors among rural communities in the District of Bahir Dar Zuria. Ethiopia. BMC Public Health. 2013;13:99.
20 World Health Organization, United Nations Children's Fund. Progress on sanitation and drinking water: 2015 update and MDG assessment. Geneva: World Health Organization; 2015.
21 Diallo MO, Hopkins DR, Kane MS, *et al*. Household latrine use, maintenance and acceptability in rural Zinder. Niger. Int J Environ Health Res. 2007;17(6):443–452.
22 Montgomery MA, Desai MM, Elimelech M. Assessment of latrine use and quality and association with risk of trachoma in rural Tanzania. Trans R Soc Trop Med Hyg. 2010;104(4):283–289.
23 Barnard S, Routray P, Majorin F, *et al*. Impact of Indian Total Sanitation Campaign on latrine coverage and use: a cross-sectional study in Orissa three years following programme implementation. PLoS One. 2013;8(8):e71438.
24 Davies HTO, Crombie IK, Tavakoli M. When can odds ratios mislead? BMJ. 1998;316(7136):989–991.
25 Montreuil B, Bendavid Y, Brophy J. What is so odd about odds? Can J Surg. 2005;48(5):400–408.
26 Isunju JB, Etajak S, Mwalwega B, *et al*. Financing of sanitation services in the slums of Kampala and Dar es Salaam. Health. 2013;5(4):783–791.
27 Bhar D, Bhattacherjee S, Mukherjee A, Sarkar TK, Dasgupta S. Utilization of safe drinking water and sanitary facilities in slum households of Siliguri. West Bengal. Indian J Public Health. 2017;61(4):248–253.
28 Musoke D, Ndejjo R, Halage AA, Kasasa S, Ssempebwa JC, Carpenter DO. Drinking water supply, sanitation, and hygiene promotion interventions in two slum communities in central Uganda. J Environ Public Health. 2018;2018:3710120.
29 Onyango-Ouma W, Aagaard-Hansen J, Jensen BB. The potential of school children as health change agents in rural western Kenya. Soc Sci Med. 2005;61(8):1711–1722.
30 O'Reilly CE, Freeman MC, Ravani M, *et al*. The impact of a school based safe water and hygiene programme on knowledge and practices of students and their parents: Nyanza province western Kenya. Epidemiol Infect. 2006;136(1):80–91.
31 Yimam YT, Gelaye KA, Chercos DH. Latrine utilization and associated factors among people living in rural areas of Denbia district, northwest Ethiopia, 2013, a cross-sectional study. Pan Afr Med J. 2014;18:334.
32 Leshargie CT, Alebel A, Negesse A, *et al*. Household latrine utilization and its association with educational status of household heads in Ethiopia: a systematic review and meta-analysis. BMC Public Health. 2018;18:901.
33 Akpakli DE, Manyeh AK, Akpakli JK, Kukula V, Gyapong M. Determinants of access to improved sanitation facilities in rural districts of southern Ghana: evidence from Dodowa Health and Demographic Surveillance Site. BMC Res Notes. 2018;11:473.
34 Foggitt E, Cawood S, Evans B, Acheampong P. Experiences of shared sanitation – towards a better understanding of access, exclusion and 'toilet mobility' in low-income urban areas. J Water Sanit Hyg Dev. 2019;9(3):581–590.
35 Luby SP, Halder AK. Associations among handwashing indicators, wealth, and symptoms of childhood respiratory illness in urban Bangladesh. Trop Med Int Health. 2008;13(6):835–844.
36 Yohannes T, Workicho A, Asefa H. A cross sectional study: availability of improved sanitation facilities and associated factors among rural communities in Lemo Woreda, Hadiya zone southern Ethiopia. Open Access Library J. 2014;1(8):1–10.