

Health in perspective: framing motivational factors for personal sanitation in urban slums in Nairobi, Kenya, using anchored best–worst scaling

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ABSTRACT

Severe health, safety and environmental hazards are being created by the growing population of urban poor in low-income countries due to lack of access to sanitation and to inadequate existing sanitation systems. We developed a multi-faceted motivational framework to examine the constituents that explain user motivation regarding a personalised sanitation system. In 2012 we interviewed slum dwellers in Nairobi, Kenya, to estimate individual motivational factor importance rankings from anchored best–worst scaling (ABWS) using hierarchical Bayesian methods. We found that personal safety, avoidance of discomfort with shared toilets, cleanliness and convenience for children were ranked of highest importance. Motivational factors related to health were only relatively highly ranked. Thus factors contributing to overall individual wellbeing, beyond health benefits, drive adoption and use of the low-cost personal sanitation solution studied. This suggests that non-health benefits of low-cost sanitation solutions should be better acknowledged and communicated to raise awareness and encourage adoption of improved sanitation in urban slums. These findings may help develop policies to promote personal sanitation, improve public health and safety and reduce environmental risks.

Key words | anchored best–worst scaling, factor importance, motivation, personal sanitation, slums

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ABBREVIATIONS

ABWS	anchored best–worst scaling
BWS	best–worst scaling
CV	coefficient of variation
HB	hierarchical Bayesian (model)
KSh	Kenyan shilling
M	independent-samples median
M-W	Mann–Whitney

INTRODUCTION

The demand for sanitation infrastructure is a growing challenge, especially in urban slums of low-income countries. Owing to the informal nature of slum settlements, sanitation infrastructure is typically not planned and services are

provided in an ad hoc manner, a problem often ignored by municipal authorities. For instance in our study area, Kibera slum in Nairobi, Kenya, between 50 and 90% of households do not have access to adequate sanitation and child mortality rates are among the worst in the world, with 1 in 5 children not surviving beyond 5 years of age (Schouten & Mathenge 2010).

Slum sanitation is characterised by shared or communal facilities as a result of high population density, lack of space, high poverty levels and non-feasibility of constructing conventional sewage systems (Jenkins & Scott 2007; Katukiza *et al.* 2010; Isunju *et al.* 2011). However, investment in communal sanitation facilities has proven to be an unsustainable solution, not meeting the needs of urban slum dwellers (Joshi *et al.* 2011). Studies in urban slums in Kenya (Schouten

& Mathenge 2010), Uganda (Katukiza *et al.* 2010; Isunju *et al.* 2011) and Mozambique (Carolini 2012) indicate that sanitation facilities have higher use frequencies than they are designed for and suffer from lack of resources for emptying and maintenance. Physical constraints due to hilly topography and dense housing add to the burden of emptying (Isunju *et al.* 2011), making such facilities health and environmental hazards (Dellström Rosenqvist 2005).

Local authorities and governments generally consider public health an important driver for investments in sanitation (Isunju *et al.* 2011). However, the unsustainable features of current communal systems in low-income countries suggest that there could be a demand for solutions that better match the way users value, for example, accessibility, cleanliness, comfort and personal safety of sanitation facilities, and the underlying social and environmental factors. Despite many attempts to address the water, sanitation and hygiene challenges in low-income countries, little attention has been paid to individual motivation for improved sanitation in relation to the mix of sanitation challenges faced by slum dwellers, not least access to a personal, instead of a communal, sanitation solution.

This study investigated the concept of individual motivation in the adoption and use of a personal sanitation solution. Based mainly on previous findings on sanitation adoption and use in sub-Saharan Africa (Jenkins & Curtis 2005; Jenkins & Scott 2007; Schouten & Mathenge 2010; Isunju *et al.* 2011; Whaley & Webster 2011), we developed a framework of hypothetical factors motivating choice to use the sanitation solution studied. The main aim of the study was to extend the stream of research on household demand for improved sanitation in low-income countries to include motivational factors for adoption of a low-cost solution for personal sanitation in urban slum settings, where financial and geographical constraints do not allow for construction of home toilets. The overall aim was to provide an understanding of driving factors for sanitation adoption and use, so that policies to increase demand for sanitation can be further developed and directed to meet the needs of the urban slum population in the above-mentioned settings. The examination of user-orientated priority settings for a multi-faceted concept such as personal sanitation required reliable and valid methods to obtain individual-based concept measurements. Straightforward, accurate and easy-to-administer data

collection methods are also needed to help inform public policy makers about individuals' preferences for sanitation.

Background

For the purposes of this study, we selected the Peepoo toilet bag to illustrate a low-cost, new technology solution for personal sanitation. Peepoo is similar to the 'flying toilet' in its functional characteristics. The 'flying toilet' is a polythene bag used for defecation, especially in slum areas, and disposed of in the approximate environment (drainage, roadsides, rooftops, etc.), often causing an environmental and health hazard when in contact with drinking water supply and humans. However, Peepoo is biodegradable and self-sanitising because it contains urea, which inactivates and breaks down harmful human faecal pathogens into ammonia and carbonates within 2–4 weeks, allowing faeces to be safely used as fertiliser. It was first introduced in the Kibera slum in Nairobi, Kenya, in 2010 and currently an estimated 4,500 individuals and 30 schools use the bag in the area (Peepoople 2012). The bags are sold by self-employed women (sales ladies) and by street kiosks, for 3 Kenyan shillings (KSh). Used bags can be dropped off at a drop point or are collected by women who have started a used Peepoo bag collection service. At the drop points the used bags are refunded at KSh1 each. The used bags are then further developed into marketable fertiliser. Sales events and supply to schools are accompanied by training in personal hygiene, such as hand washing with clean water and soap and correct use and disposal of the bag.

Motivational domains for personal sanitation

Motivation is an inner drive that reflects goal-directed arousal (Jenkins & Curtis 2005) with the result being a drive to satisfy needs and wants, in this case through the adoption and use of a personal sanitation service. When examining preferences and decision-making that explain household demand for sanitation, determination of individual attitudinal and structural determinants instead of socio-economic characteristics is recommended (Jenkins & Scott 2007). Consideration should also be given to how biological drivers such as disease avoidance are shaping hygienic behaviour towards sanitation in general and defecation in particular.

The disgust emotion has been found to function as an adaptation for disease avoidance (Curtis & Biran 2001). Prototypical objects of disgust are waste products of the human body such as faeces (Phillips *et al.* 1998) and dirty latrines (Curtis & Biran 2001). Furthermore, the need for comfort and cleanliness, perception of safety and disgust and mental and physical avoidance of excreta are guided by social ideas and perceptions. These perceptions have been shown to be difficult to change (Dellström Rosenqvist 2005), making adoption of new sanitation solutions challenging as well as contextual. Furthermore, physiological needs concerning sanitation are in general considered secondary to status-related needs. Solutions to overcome established ideas and perceptions of sanitation should therefore be introduced together with a solution to status, comfort, safety and physical needs (Dellström Rosenqvist 2005).

Hence a wider approach beyond physical health, encompassing physical, mental and social wellbeing, is necessary for analysing the motivation for adoption of sanitation (Jenkins & Curtis 2005; Isunju *et al.* 2011). We identified six motivational categories which together contribute to how sanitation can enhance quality of life within the framework studied. These categories are hygiene and cleanliness; comfort and convenience; value for money; safety; dignity and self-esteem; and health.

Hygiene and cleanliness

Regardless of their social status or geographical location, 'people try to use as clean toilets as possible' (Dangert 2004, 5). The urban poor are especially aware of cleanliness, since stigmatisation as a dirty person is associated with poverty (Joshi *et al.* 2011). Dangert (2004) reported a positive association between hygienic perception of toilets and the absence of visible faeces. Generally speaking, sanitation adoption is associated with cleanliness and a better home environment. Cleanliness of the sanitation facility proved to be the most important factor for users in a study assessing communal sanitation facilities in Kibera (Schouten & Mathenge 2010), whereas in rural and peri-urban Ghana bad odour and dirtiness were related to dissatisfaction with the facilities (Jenkins & Scott 2007). Similar findings have been reported from the Philippines (Cairncross 1992) and from latrine adopters in rural areas in Benin (Jenkins &

Curtis 2005). In this study we took the presence of flies and odour as indicators of uncleanness.

Convenience and comfort

Convenience and comfort are mostly considered endowment factors within the literature (i.e. being most valued by those who have already considered or actually chosen to invest in sanitation; e.g. Jenkins & Scott 2007). The most common motivation for constructing a toilet in rural and peri-urban Ghana is to provide a toilet for sick or old relatives (Jenkins & Scott 2007). We assumed that this type of convenience consideration for others may extend to children, since women household members are likely to assist children with using a toilet. A personal, in-house sanitation solution could thus save time for other activities. In addition, convenience typically relates to aspects of ease of physical use and accessibility. Previous studies have shown that technology itself plays a role in sanitation adoption. The toilet design and its management have been found to be important factors for users of communal sanitation facilities in Kibera (Schouten & Mathenge 2010). For individual sanitation systems like the Peepoo bag, the size and design should thus be adapted to how people are expected to use it.

Distance to communal toilets and restricted hours of operation were the most determining factors of latrine usage in urban poverty environments in Bhopal, India (Biran *et al.* 2011) and were associated with dissatisfaction among non-adopters of a household toilet in rural and peri-urban Ghana (Jenkins & Scott 2007). These factors were drivers for latrine adoption in rural Benin (Jenkins & Curtis 2005). Accessibility is particularly relevant in Kibera, where public toilets are open only during daytime hours. Ability to avoid public toilets and easy disposal of Peepoo enhance convenience for users.

Value for money

Value for money is conceptualised to mean the good or bad feeling arising from the perceived quality of service or utility provided by the sanitation technology relative to the price paid for it. Therefore the price paid for a sanitation service may relate to technology uptake. In general, user fees for communal facilities burden the poor (WSP 2012) and the

high costs of constructing private toilets hinder toilet adoption (Jenkins & Scott 2007). Affordability of communal facilities is an important factor in urban slum settings, such as Kibera (Schouten & Mathenge 2010). Furthermore, reduced healthcare costs due to improved sanitation may raise value. Regarding Peepoo, there are two types of value-for-money aspects to consider. Firstly, users can be expected to attribute a value to the bag because the cost is partly refunded upon return and may attribute additional value for the amount they are compensated. Secondly, the opportunity to utilise used bags as fertiliser to grow vegetables provides the potential to save money otherwise spent on purchasing vegetables, or offers otherwise unaffordable vegetables to the household at a low cost.

Safety

Safety was ranked of high importance in previous studies, for instance in both rural and peri-urban Ghana (Jenkins & Scott 2007) and in the Kibera slum (Schouten & Mathenge 2010). This is most likely due to people's preference for defecating in a safe location (Dellström Rosenqvist 2005), for reasons of physical protection from accidents, injuries and violence and associated emotional fears. Restricted access to toilets for women, who often rely on the early morning and night hours to defecate (Cairncross 1992) and are subjected to risks of sexual violence in the vicinity of communal toilets (Amnesty International 2010), places this group in a vulnerable position.

Dignity and self-esteem

Toilets tend to convey social dignity and therefore empower people (Biren *et al.* 2011). A multi-country study in peri-urban areas in East Africa and Sweden showed that men are driven by prestige and status to adopt latrines (Dangert 2004), whereas women in rural and peri-urban Ghana prefer wellbeing factors such as convenience, comfort and privacy (Jenkins & Curtis 2005). Cairncross (1992) found that privacy and avoided embarrassment toward visitors were highly ranked in terms of desire for a latrine in various urban communities in low-income countries. Such positive qualities may invoke feelings of pride, which can further accentuate technology adoption. Having to share a toilet is

a factor of dissatisfaction to users in rural and peri-urban Ghana (Jenkins & Scott 2007), whereas in the Kibera slum people would prefer to have the sanitation facility in their house (Schouten & Mathenge 2010), hence reflecting a desire for privacy. Privacy includes 'visual screening, social comfort and restricting access to personal information' (Jenkins & Curtis 2005); seeing other people's faecal matter causes embarrassment and reduces the feeling of privacy. Sounds and odours may also harm social relations (Dellström Rosenqvist 2005). In a study of 10 communities in Zimbabwe, Whaley & Webster (2011) found that adoption of sanitation is driven by a need for conformance with prevailing social norms and gaining of social acceptance.

Health

Exposure to odour and appearance of excreta are considered indicators of health hazards and poor social status (Dangert 2004; Jenkins & Curtis 2005; Jenkins & Scott 2007; Aiello *et al.* 2008; Whaley & Webster 2011). Despite the human instinct to avoid faecal matter, avoidance of faecal-oral transmission of diseases has been a less significant driver for adoption of sanitation in both rural and urban settings (Cairncross 1992; Jenkins & Curtis 2005; Schouten & Mathenge 2010). Nevertheless, the public sector's demand for sanitation is usually associated with health in terms of absence of disease (Jenkins & Sugden 2006; Aiello *et al.* 2008; Whaley & Webster 2011).

A broader approach to health, such as quality of life and wellbeing, may be a more suitable driver for demand for sanitation (Isunju *et al.* 2011). It may therefore be relevant to consider the extent to which users of a personal toilet recognise a wellbeing benefit and a link between disease prevention and quality of life indicators such as school attendance.

METHODS

Methods to investigate and compare the relevance of motivational factors

One of the primary objectives of this study was to examine slum residents' reasons for choosing to use the Peepoo bag

sanitation service. Therefore information on each individual's assessment of the importance of the motivational factors was needed.

Best-worst scaling (BWS) is a theory-driven preference scaling procedure (Marley & Louviere 2005) commonly used in health treatment (Flynn *et al.* 2007) and social care (Potoglou *et al.* 2011). Based on an assumption that all motivational factors included can be ordered transitively (i.e. from most to least important), BWS is an extension of paired comparison, but provides more information and requires less input, since the choice sets contain a larger set of factors. The method allows for further discrimination among factors and is devised to invoke trade-offs in the choices between the relevant factors competing for the concerns of the interviewees. A BWS study is based on an experimental design which generates choice sets containing factors under consideration. Figure 1 shows an example of a BWS choice task used in this study. For each choice set, interviewees are asked to indicate which factor they like most and which they like least. The analysis of BWS data generates individual estimates of the probability that a given factor is being chosen as most important relative to a single reference factor. However, the relativism of BWS means that the degree of factor importance is only comparable within a respondent, but not across respondents (Lagerkvist *et al.* 2012). Thus a limitation of BWS is that

the method excludes information useful for comparing individual preferences or for dividing respondents into groups with distinctive preferences. However, compared with rating or ranking techniques, use of BWS may reduce social desirability, as well as extreme response biases.

Anchored best-worst scaling (ABWS) overcomes the relativism of BWS by introducing a dual-response format to augment the standard BWS method (Lagerkvist *et al.* 2012). In Figure 1, the dual format is introduced by asking the interviewees, for each choice set respectively, an additional choice question to consider the extent of importance for all five factors jointly using three alternatives. Across all choice sets, this question establishes each individual respondent's threshold between 'important' and 'unimportant' ratings. By assigning the value 'zero' to each respondent's threshold point, a common scale origin or anchor is created that allows different respondents' importance ratings to be compared and linked.

Study site and sample description

The study site, Silanga village in the Kibera slum in Nairobi, has a population of approximately 17,363 (Kenya National Bureau of Statistics 2010). Existing sanitation options include: open defecation, flying toilets, biogas latrines, pit latrines, ventilation-improved pit latrines, pour flush toilets

Please now consider how important different features are to you when you are using and have access to Peepoo as toilet:

Considering only these five features, which is the <u>Most Important</u> and which is the <u>Least Important</u> ?		
Least Important	Feature	Most Important
	I can use Peepoo as fertiliser when I grow vegetables	
	The use of Peepoo reduces the smells in my house/garden	
	Peepoo makes going to the toilet cleaner	
	It is easy for me to dispose of the bag to a collector	
	Peepoo is easy to use	

Considering just these five features...

- None of these five are important
- Some are important, some are not
- All five are important

Figure 1 | Example of ABWS scaling choice set.

Table 1 | Sample description

Category	Characteristic	Mean $n = 122$	Standard deviation	Min	Max
Age (years)		31	10.5	18	64
Gender (share)	Female	0.75			
	Male	0.25			
Marital status (share)	Married	0.61			
	Single	0.37			
	Widow	0.02			
No. of household members		4.7	2.54	1	15
No. of children in household	< 2 years old	0.5	0.61		
	2–5 years	0.7	0.91		
	5–15 years	1.2	1.32		
Employment (share)	Unemployed	0.33			
	Work less than once per week	0.12			
	Work 2–3 days/w	0.21			
	Work 4–5 days/w	0.09			
	Work 6–7 days/w	0.19			
	No information	0.06			
No. of Peepoo bags used per day by household		5.6	3.25	0	15
Usage ratio (no. of bags used divided by household size)		1.27	0.74	0	4.5
Usage ratio < 1 (share)		0.471			
Usage ratio > 1 (share)		0.521			

and WCs with sewer connection. Lack of space, poor soil quality and layout of the area make it difficult to construct more communal sanitation facilities or to transport construction material (Schouten & Mathenge 2010).

In 2012, a convenience sample of 122 individuals (men $n = 31$; women $n = 91$) was recruited from among Peepoo users (see Table 1). Recruitment was conducted by the Peepoo sales ladies who informed their clientele about the study. The main criterion for selection was prior experience of Peepoo. The aim was to obtain a gender-balanced sample of adult users covering a wide range of ages. Literacy was not necessary, since each choice set was read out loud to the participants and two facilitators helped with translation, clarified questions and helped illiterate respondents fill in the socio-economic part of the questionnaire. Oral informed consent was obtained from participants when introducing the survey. A participation fee of KSh200 was paid. Respondents lived predominantly in households of five members sharing one room and one-third of the respondents were

unemployed. The respondents used on average one (1.27) Peepoo per household member per day.

Empirical application

We started the study with a ‘voice of the consumer’ perspective, to examine the face validity of the measurement model. A list of 27 factors, representing the six motivational areas of the framework (Table 2) and drawn from existing research and communication with local scientists and sanitation experts, was subjected to focus group discussions with Peepoo users ($n = 7$). The focus group discussions provided a preliminary insight into perceived factor importance. Face validity of the list of factors was considered good, i.e. representative of the experiences users associated with the sanitation solution. No changes were made to the list of 27 factors and respondents reported the content and presentation of the factors to be comprehensible.

Table 2 | Motivational factors, rank and factor importance of Peepoo

Motivational category	Motivational factor	Best-worst scaling rank (<i>n</i> = 122)	Best-worst factor importance weight (%)
1. Hygiene and cleanliness	10) Peepoo makes going to the toilet cleaner	3	4.81
	23) The surroundings of my house and my house itself are cleaner when using Peepoo	5	4.44
	24) The use of Peepoo reduces the number of flies in my house/garden	14	3.66
	25) The use of Peepoo reduces smells in my house/garden	13	3.70
2. Comfort and convenience	1) It is easy for me to access Peepoo bags	12	3.87
	5) It is easy for me to dispose of the bag at a certain point of collection	18	3.45
	6) I save time by not needing to walk to public toilets or queue for public toilets	11	4.11
	9) Peepoo is easy to use	10	4.27
	11) Peepoo allows me to go to the toilet whenever I need to	6	4.37
	12) Peepoo is convenient to use when outside my home	27	2.10
	13) It is easy for me to dispose of the bag to a collector	20	3.28
	14) The size of the bag is suitable for my use	23	3.05
	17) Peepoo makes it easier for old/sick people to go to the toilet	8	4.35
	18) Peepoo makes it easier for children to go to the toilet	4	4.53
3. Value for money	22) Using Peepoo allows me to avoid the discomfort of common toilets or 'flying toilets'	9	4.33
	2) The price paid for the bag offers 'value for money'	19	3.34
	3) I receive compensation for a used Peepoo bag	25	2.34
	4) The price I receive currently for the used bag is sufficient for me	24	2.59
	15) My household's healthcare costs decrease when using Peepoo	15	3.64
	16) I can use Peepoo as a fertiliser when I grow vegetables	16	3.49
4. Dignity and self-esteem	7) I have more privacy when using Peepoo for going to the toilet	21	3.25
	8) I have a more modern life when using Peepoo	22	3.16
	20) I feel proud of using Peepoo	17	3.47
5. Safety	27) Using Peepoo allows me to avoid dangers at night and at public toilets	1	4.89
6. Health	21) My health and that of my household members is better when using Peepoo	7	4.36
	26) Using Peepoo allows my children to attend school more frequently	26	2.19
Average percentage explained (APC)			47.0
Standard deviation of percentage explained			8.25
Chance-ratio			2.82

An ABWS survey was prepared to measure the relative importance of the 27 motivational factors. Choice sets in the ABWS experiment were specified using the MaxDiff designer v.2.0.2. (Sawtooth Software). The design meant that 17 choice sets of five factors were generated. Each factor was presented on average 3.2 times and each pair of factors appeared together on average 0.5 times (std 0.5). Before administering the ABWS survey, a short exercise was undertaken to allow the respondents (*n* = 122) to

understand the technique for choosing most important and least important within a set of choices. Five daily items were placed on the table for the respondents to choose the object that was most and least important to them. In groups of 8–13 participants, respondents individually filled in the ABWS questionnaire, presented in Swahili. Respondents had the possibility to ask for clarification and translation to English. Sessions lasted on average 45 min.

Data analysis

Hierarchical Bayesian (HB) models have recently been shown to outperform aggregate (multinomial logit) and latent class methods in estimations of best-worst choice data (Lagerkvist *et al.* 2012). Estimation of the HB models was performed using CBCHB v.5.0.4 (www.sawtoothsoftware.com), resulting in 80,000 iterations before results were used and an additional 20,000 iterations to calculate, for each interviewee, the share of preferences for each factor, respectively, i.e. the predicted probability that each factor is picked as the most important. For ease of interpretation, the importance weight of factor k within the full set of factors in Table 2 was obtained by dividing the share of preference for factor k by the sum of share of preferences over all factors for each interviewee, after which results were averaged over interviewees. The factor importance measure in Table 2 was then expressed on a common ratio scale (with minimum 0 and maximum 1), meaning that if one factor has an importance value twice that of another factor, the former factor is twice as important as the latter. This procedure followed Lagerkvist *et al.* (2012), from which ranks were obtained.

To predict the effectiveness of a system for personal sanitation, it is important to understand whether, and to what extent, different groups of users differ in their motivational structures (i.e. factor importance). To this end, we examined differences in factor importance due to gender, work status and level of Peepoo bag use (to capture extent of user experience).

Categorical covariates were used when examining differences in factor importance across segments of respondents based on the findings by Seaman & Richardson (2001). To examine pair-wise equality in medians and distributions of importance shares across segments of respondents based on the HB estimations with covariates, the independent-samples median (M) and Mann-Whitney (M-W) rank tests were employed.

The average percentage certainty (APC) measure (Hauser 1978), obtained as the difference between the log likelihood of each model and the log likelihood of a chance model, was used to assess model fit. In addition, a chance ratio measure defined as APC divided by the predictive power of a chance model was used to compare the predictive accuracy between model specifications with and

without covariates for segmentation of sub-samples of respondents. In this study, a chance model has a predictive power of 16.7% (one out of six choice options).

RESULTS AND DISCUSSION

Anchored best-worst scaling

Table 2 presents the estimated factor importances, which are based on 5,331 observations (43.7 observations per respondent). The anchored dual-response alternative 'all five of these are important' was selected 1,225 times, leaving only 13 observations for the 'none of these are important' alternative. This pervasive result indicates the difficulty respondents had in discriminating between the factors. The estimated ABWS model had an average percentage explained of 47.0, suggesting that the ABWS model had a predictive accuracy that was 2.82 times higher than that of a pure chance model. The estimated standard deviation of 8.4 (coefficient of variation (CV) = 0.17) indicates relatively low levels of heterogeneity in the sample in terms of importance placed on motivational factors.

Priority to safety

Overall, the results of the ABWS and of the focus group discussions corroborated findings from previous studies on demand for sanitation. Focus group discussions confirmed that sexual violence after sunset is feared by both male and female sanitation users. The human preference for defecation in a safe location (Dellström Rosenqvist 2005) was confirmed by the Peepoo users choosing a safety-related factor (27) as most important. The importance of safe sanitation in terms of avoiding danger and violence therefore seems to be similar among shared and personal toilet users.

Personal sanitation provides comfort and convenience

The second most important factor (22) represents a motivation for comfort. This could be connected to the Peepoo bag users' desire for a proximate and personal sanitation solution, considering the non-existence of other options for household-owned toilets and having to share with strangers

the poorly maintained public toilets. The convenience of being able to use the Peepoo bag whenever necessary was also rather highly ranked (6). This is due to saved effort in walking to and queuing at a communal toilet and avoiding open defecation at night-time. In the focus group discussions, the easy access to Peepoo and the availability of Peepoo at any time were mentioned as important by the discussants, who said that they can call their sales lady at any time to come and replenish their Peepoo stocks. In addition, the convenience of Peepoo when suffering from diarrhoea was named by a focus group discussant. Despite similarity to a flying toilet, the hygienic character of Peepoo could be considered to provide comfort to users. Providing convenience and comfort for sick and old relatives is among the top three motivations for constructing a household toilet in rural and peri-urban Ghana (Jenkins & Scott 2007), whereas for Peepoo users it was the eighth most important motivational factor, although it was rated of higher importance in the focus group discussions. Considering that an adult is incapacitated an average of 2 days when suffering from diarrhoea and sick children require care for an average of 2 hours per day (WSP 2012), it is surprising that this convenience factor was not ranked higher.

Factor 18 'ease of use by children' was perceived to be among the top five in importance. Focus group discussions confirmed that it is inconvenient for mothers to have to assist children at communal and shared toilets (most often pit latrines), whereas Peepoo can be used at home by the children themselves.

Saving time in walking to public toilets was only the 11th most important motivational factor, whereas in other studies distance to defecation sites emerged as an important factor of dissatisfaction and a motivator to build a household latrine in rural and peri-urban Ghana and rural Benin (Jenkins & Curtis 2005; Jenkins & Scott 2007). The low significance of saved time from using Peepoo may be due to the proximity of communal toilets or plot toilets in this slum setting, compared with the rural and peri-urban settings in the majority of other studies.

Desire for cleanliness

Hygiene and cleanliness was the third most important motivational category for Peepoo users, which is consistent with

findings in other studies on sanitation adoption in rural and urban settings (Cairncross 1992; Jenkins & Curtis 2005; Jenkins & Scott 2007; Joshi *et al.* 2011). Despite Peepoo being a bag, much like the 'flying toilet', users appreciate the hygiene and cleanliness it provides relative to their alternatives of public or flying toilets. Training in use of the bag may be a significant contributor to the correct use of the bag and perceived cleanliness. However, factors related to elimination of odour were ranked as only of average importance, suggesting either that those aspects are not fully recognised by the users, or actually confirming the anecdotal evidence that the odour remains after some time. This was a somewhat unexpected result, since Peepoo allows users to avoid the sight and smell of their own and others' faecal matter, thus providing an alternative to dirty and often full communal facilities (Schouten & Mathenge 2010).

Health, value for money and usability away from home of secondary importance

When considering health aspects, the overall evaluative aspect of perceived improved health (factor 21) was ranked as the seventh most important motivational factor, demonstrating a link between user experience and perceived improved health. Future research could examine the health impacts of using personal sanitation, including the causal relationship between personal sanitation and improved health. Surprisingly, the health-related factor relating to improved school attendance by children (26) was ranked next to last in importance, while the factor reduced health-care costs was ranked of moderate importance. The moderate connectivity between general health consequences and economic outcome may be explained by a shortage of household funds for medical services, respondents' poor general health status (e.g. other pathways of faecal-oral transmission), requiring other treatments or the free medical care provided by non-government organisations. However, the focus group discussions confirmed the reasons to be related to lack of causal identification.

Value-for-money aspects of the sanitation solution were not considered of high importance. The low importance of receiving a refund may be explained by the fact that people are already saving money using the bags, which are cheaper than public toilets and also more convenient.

(This potential explanation was suggested by a reviewer for which we are grateful.) Hence, the value of the refund is not sufficient to compensate for the extra effort and possible inconvenience of storing used bags and taking them to drop-off locations. Another potential explanation is fear of negative social evaluation (i.e. shyness) when presenting used bags for refund, which is a situation that can invoke disgust in others. The focus group discussions suggested that people prefer to simply give the bags to collectors, who then obtain the refund. The collectors present in the focus group discussions reported that this refund is an important source of income for them. Thus whether the low importance given to value for money can be assigned to altruism or negative social evaluation remains an open question.

The least important factor was convenience when away from home (factor 12), due to lack of privacy when outside the home and the need for a plastic or tin bucket to hold the bag.

Motivational factors are not gender-sensitive in the sampled group

Unexpectedly, no gender differences in importance were revealed in motivational factor importance. Lack of dignity, privacy and safety due to inadequate sanitation, but also caring for incapacitated children and the elderly, place a greater burden on women than men. Women are also less likely to leave the slum for work during the day and therefore less accustomed to alternative toilets. The segmentation based on covariates showed that the hypotheses of equality in medians and distributions for factor importance between men and women, and that of equality between respondents with a usage ratio higher and lower than one, could not be rejected.

Interestingly, the overall model fit was somewhat lower when categorical covariates were considered in the estimation. The APC was reduced to 43.6, corresponding to a chance ratio of 2.62 and a CV of 0.19. Factor importance equality for the hypotheses of equality of medians and distributions, respectively, was rejected for some employment-related covariates. Specifically, respondents who were unemployed or worked a maximum of three days per week were found to assign low levels of importance to

factor 2 (Median test statistic (M) = 4.817, p = 0.028; M - W = 2.501, p = 0.012); factor 13 (M = 4.817, p = 0.028; M - W = 2.667, p = 0.008); factor 14 (M - W = 1.946, p = 0.052); and factor 26 (M = 3.224, p = 0.073; M - W = 2.545, p = 0.011).

Limitations and lessons learned from using ABWS in the study setting

It was a challenge to recruit a gender-balanced sample in the study area, since men seemed to work during the day time and administering the survey after sunset was considered too dangerous. Saturday was the only day male Peepoo users could participate in the survey. This made the proportion of male respondents in the study smaller than wished for and the sample was therefore unbalanced. However, the choice data revealed relatively little heterogeneity across sub-groups of the sample, including gender. This, together with the advantage of HB in generating individual-specific data from sparse data sets (Lagerkvist *et al.* 2012), should make generalisations of sub-group characteristic-related findings less problematic. Moreover, on the same argument, generalisation of the results over the whole population of Kibera or even Silanga village should not be problematic. A more important caveat is that the data for this study were obtained from existing users. The gap between preferences, intentions and choice, as noted by Jenkins & Scott (2007), makes generalisation of results to current non-users the most challenging aspect when seeking to understand drivers of adoption of this personalised sanitation system. However, we believe that even a small sample can provide information on the importance of the different factors for a larger population, since people living in the same area are likely to share the socio-cultural context and interpersonal associations leading to socially constructed meanings, including emotions.

We believe that the ABWS exercise was rather simple to perform for the respondents. The survey was in written format but each choice set was read aloud to illiterate respondents (which were only two elderly respondents). The literate respondents filled in the questionnaire at their own pace and the illiterate participants followed the reading of the choice sets at the pace of the slowest respondent. The two facilitators were a necessary resource, especially for the

illiterate respondents and for clarifying any questions that were raised by the respondents in general. The simple choice exercise we conducted prior to starting with the questionnaire helped the respondents understand the kind of choice decision being requested.

CONCLUSIONS

This study examined people's motivation to use a personal sanitation solution, the Peepoo bag. A framework of motivational factors for personal sanitation was developed. The focus on behavioural motivations can and should form an important complement to infrastructure-oriented interventions. Anchored best-worst scaling was used to determine the importance attributed by urban slum dwellers in Nairobi to the personal toilet. The results were slightly different from those of previous studies in that no support was found for the presence of gender differences in motivational factors for personal sanitation. However, the small sample size (122) and small number of men (31) participating in the study may have contributed to this result. All respondents ranked highly factors of wellbeing such as privacy, comfort and convenience, and hygiene and cleanliness. Status, in terms of pride in having such a sanitation solution and in contributing to a modern lifestyle, which was a leading motive for latrine adoption amongst men in other studies, was not supported in this study, most likely due to the low and unmanly profile of the Peepoo bag. Construction of pit latrines and similar technologies is relatively costly, making it reasonable to generate certain endowment values (such as prestige) at the community level, as well as social pressure at the individual level. However, the less expensive, and more accessible, personalised Peepoo system means that personal safety and convenience are leading motivational factors.

As in previous studies, hygiene and cleanliness were ranked high in importance, presumably because of their connection with dignity, social acceptance and fitting in with society. Motivational factors directly related to a general sense of health improvement were relatively highly ranked, but health seemed to be secondary to other aspects of wellbeing, such as safety, cleanliness and comfort. Policies and investments directed toward adoption and use of low-cost personal sanitation systems should acknowledge and further

communicate these non-health benefits, which contribute to meeting basic human needs, raising awareness of health consequences and inducing adoption of new sanitation systems.

Employing the straightforward, accurate and easy-to-administer data collection methods used in this study could help public policy makers become informed about public preferences for sanitation. The ABWS method provides an understanding of motivational needs for personal sanitation based on information on why households adopt such a personal solution. This can further guide sustainable sanitation planning and public health management and facilitate the marketing of low-cost sanitation solutions to the poor.

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