Sanitation in developing countries: a systematic review of user preferences and motivations

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ABSTRACT

Empirical research on sanitation in emerging regions has shown that user preferences and behaviors do influence usage of sanitation technologies. The purpose of this review is to examine the existing literature investigating user preferences and perceptions on sanitation, with particular focus on satisfaction and motivation for usage. The scope was limited to research that provided detailed statistical information about the sample population and sanitation technologies examined. Selected literature is summarized into four areas: descriptive studies about sanitation user satisfaction; comparative work analyzing preferences for sanitation technologies; perspectives on sanitation usage and ownership; and importance of factors driving household sanitation installation. Our results indicate that the implementation of improved sanitation is not indicative of overall higher user satisfaction levels. In addition, motivations for usage of sanitation systems vary by technology and geographical setting.

Key words | adoption, attitude, behavior, preferences, sanitation

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INTRODUCTION

Despite progress made towards increasing sanitation access in the developing world, the United Nations Millennium Development Goal (MDG) target to decrease the population without basic sanitation by 2015 will not be met (UNICEF & WHO 2012). Expanding the definition of 'improved sanitation' to include sewage treatment prior to disposal suggests that 4.1 billion people – nearly twice the previous estimate of 2.6 billion people – are now identified as lacking access to improved sanitation (Baum *et al.* 2013). The overwhelming majority of these individuals live in the developing regions of Asia, Africa, and Latin America (UNICEF & WHO 2012).

There are several challenges associated with providing the inhabitants of developing regions with sanitation access, including political instability, water scarcity, unreliable energy supplies, and financial constraints (Moe & Rheingans 2006). From a policy perspective, multiple approaches are implemented to provide sanitation access across a wide range of socioeconomic levels. Individuals of a higher socioeconomic class typically benefit from having relatively adequate, sewerage-based sanitation system designed to provide central collection, treatment, and disposal. These conventional approaches – proven and well established in industrialized nations – require minimal social acceptance from the users; thus, individuals that are provided with this type of service delivery typically do not participate in making decisions about their sanitation needs. Alternatively, the need to involve individuals in lower socioeconomic classes when selecting their sanitation delivery options has been well established, and the lack of participation from this user subset continues to be identified as a barrier preventing increased access and use of sanitation technology (Paul 1958; McPherson & McGarry 1987; United Nations 2010).

Informal growth, population density, and challenging topography often exclude the extension of conventional service delivery in developing regions and, as such, there is a need to develop sanitation technologies for lower socioeconomic classes. These technologies are designed to facilitate the hygienic containment and/or removal of pathogens, nutrients, and organic matter, provided that user interaction adheres to design guidelines. Furthermore, proper user

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interaction with sanitation technologies is an essential step toward realizing optimal utilization. Therefore, sanitation technologies designed and implemented for users of a lower socioeconomic class must be technically feasible, affordable, and user-accepted (Paterson *et al.* 2007).

The user-centric nature of sanitation practices demands that sanitation interventions incorporate user preferences in a holistic fashion. Moreover, the specificity of previous relevant literature makes it difficult to generalize results to a broader community. Previous work examining various user perceptions for sanitation systems often focus on a specific geographical region, type of sanitation technology, or user adoption classification. The objective of this paper is to systematically review user experiences and to examine overall user satisfaction with various sanitation systems, analyze commonalties and variances throughout sanitation user preference studies, and investigate perceived drivers and deterrents of sanitation adoption. Given the shift in sanitation research towards behavioral change, this work will explore reported evidence regarding the attitudes and beliefs that structure user perceptions for sanitation service delivery. Categorical variables, including geographical setting, technology type, and adoption mode, are also included to provide a contextual framework. For the purpose of this study, the user adoption classification identified by Jenkins (1999) is used; households that possess improved sanitation, regardless of its location relative to the dwelling, are considered adopter households. Non-adopter households represent those individuals who, regardless of stated preferences or intent, have yet to make an observable choice about installing improved sanitation. This review focuses on sanitation behavioral change and analyzes the relationship between user perceptions and sanitation technology. It concludes with the outlook for future work in the field.

METHODS

The following criteria were used to help determine which case studies should be included in the systematic review: sanitation must have been referred to as the collection, removal, and/or disposal of human excreta, not refuse. Furthermore, at least one sanitation technology had to be examined and studies that investigated, in addition to sanitation, other infrastructure systems, such as solid wastes or water services, were included if appropriate data was available. Selected case studies were geographically restricted to areas that were deemed as low- or middle-income countries – as classified by the World Bank country income-criterion classification (World Bank 2012).

The investigation of sanitation preferences, perceptions, and measured outcomes was a major selection criterion. Each case study had to include one or more of the following: measures of overall satisfaction or dissatisfaction, reasons for satisfaction or dissatisfaction levels, views of drivers or deterrents on sanitation facility usage, perceptions on preferences between sanitation technologies, or insights on user adoption of sanitation technology. Case studies also had to include a rigorous data analysis that detailed pertinent statistical information, such as sample sizes and percentages, for comparison.

Various combinations of the following key words were used to select case studies: sanitation, toilet, wastewater, latrine, user, preference, behavior, attitude, and belief. Case studies published in English on or before December 2013 were obtained from Web of Science, JSTOR, Google Scholar, and ProQuest. A manual bibliographical cross-search was also conducted.

The collected case studies were reviewed and divided into four groups: descriptive studies about sanitation user satisfaction; comparative work analyzing preferences for sanitation technologies; perspectives on sanitation usage and ownership; and importance of factors driving household sanitation installation. The following information was determined from each case study: the sampling characteristics, including the mean household size, total sample size and proportion of female respondents; characteristics of the investigation, including country of origin, the sanitation technology investigated, geographical setting (urban, peri-urban, rural), designation (household, community/shared); and outcomes sampled for sanitation users.

RESULTS

User satisfaction with existing sanitation options

Case studies exploring the acceptability of sanitation systems in developing countries have examined general

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satisfaction levels with existing technology. Satisfaction levels measured in the observed studies were based on the subjective, surveyed approach of determining user contentment. Various bipolar psychometric measures (measuring relating to the degree of satisfaction) were used, including the Likert scale and the semantic differential scale. Measurements of user satisfaction were examined to understand how users perceived various sanitation options; for users to be considered 'satisfied,' they must indicate their satisfaction with their existing sanitation as 'good,' 'somewhat satisfied,' or 'very satisfied.' The lack of expressed dissatisfaction by users was not interpreted as satisfaction nor was the lack of expressed satisfaction interpreted as dissatisfaction. A summary of the case studies included in the analysis is shown in Table 1.

Stated user satisfaction levels are dependent on sanitation technology and user adoption classification. In general, improved sanitation technologies had higher percentages of satisfied users than unimproved sanitation technologies. Specifically, technologies that utilized water as a conveyance operation mode, such as cistern flush toilets and ablution blocks, consistently had higher numbers of satisfied users than dry pit-based technologies. Communal ablution blocks with cistern flush toilets, and cistern flush toilets lead to satisfaction levels of 69% and 53%, respectively (Roma *et al.* 2010; Roma & Jeffrey 2010). One study indicated that a high percentage of surveyed users (83%) were generally satisfied with open defecation (Walker 2011).

Six articles analyzed shared and/or communal sanitation facilities; the rest were non-communal or privately owned facilities. Satisfaction with shared facilities was found to be dependent on sanitation technology type. Cistern flush toilets and ablution blocks with shared access to the community had higher percentages of satisfied users than shared pit latrines (Roma *et al*. 2010; Roma & Jeffrey 2010; Bolaane & Ikgopoleng 2011).

Regardless of geographical region, designation approach, or respondent sample size, pit latrines consistently have lower percentages of satisfied sanitation users. Lack of cleanliness of pit latrines was a reported concern at both the household and communal level. Whittington *et al.* (1993a) reported 90% of communal pit latrine users and 56% of household pit latrine users rated their overall satisfaction of cleanliness as 'poor' or 'fair.' Furthermore, privacy and convenience were additional factors for communal sanitation users with each reporting a poor ranking of 54% and 70%, respectively (Whittington *et al.* 1993a). Jenkins & Scott (2007) stated that the foremost reasons for dissatisfaction with communal pit latrines were malodorous air (mentioned by 27.1% of communal users) and uncleanliness (mentioned by 26.6% of communal users).

Willingness to pay for sanitation technologies

Few studies have been developed to examine preferences for sanitation systems (Whittington *et al.* 1993a, 1993b; Altaf 1994; Altaf & Hughes 1994; Fujita *et al.* 2005). In these studies, user perspectives for sanitation systems were gathered by assessing the willingness to pay for various technology or implementation alternatives. Using this methodology, the price point that users were willing to pay for improved sanitation was established based upon the selection of a bid price in a hypothetical market. All studies were conducted in urban areas and with a sample population size that ranged from approximately 600 households (Altaf & Hughes 1994) to 1,200 households (Whittington *et al.* 1993a, 1993b).

Whittington *et al.* (1993a, 1993b) examined user willingness to pay for water and sanitation services delivery options in Kumasi, Ghana. This study sampled 1,224 households and focused on ventilated improved pit (VIP) latrines and sewer connections for water closets. The study was conducted in a manner that allowed respondents to state their willingness to pay based on a choice set of sanitation alternatives that included improvements to their individual existing sanitation situation. Respondents indicated that they were willing to pay equal proportions of the household income on improved sanitation, regardless of the technology (Whittington *et al.* 1993b). Operational costs being equal, water closets were slightly preferred (54%) over VIP latrines by users who did not have current access to water closets (Whittington *et al.* 1993a). Socioeconomic characteristics, including income status and education level, did not predict preference likelihood for water closets. Of the respondents preferring VIP latrines, 47% indicated that their preference was a result of the ability to access sanitation

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Table 1 | Summary of satisfaction levels with existing sanitation technologies

Study Location/area type)	Data collection method n = number of responses	Existing technologies examined (adoption, % of sample population)[a]	Key results
Whittington *et al.* (1993a) Ghana/urban	Household survey; two-stage stratifying sampling $n = 1,224$ households Refusal rate: 4%	Pit latrine (adopter, 7%) Pit latrine (non-adopter, ~40%) Water closet (shared, ~25%) Bucket latrine (25%) Open defecation (5%)	- 38% of the water closet users rank their overall satisfaction with their existing sanitation as 'good' compared to the 1% of the communal pit latrine users that ranked their overall satisfaction as 'good.' - 6% of household pit latrine users ranked their sanitation level 'good.'
Altaf & Hughes (1994) Burkina Faso/rural	Household survey; two-stage stratifying sampling $n = 593$ households Refusal rate: 1%	Simple pit latrine (adopter, 57.2%) Lined pit latrine (adopter, 24.1%) Water closet (adopter, 12.5%) No pit latrine (adopter, 6.5%)	- 57% of the respondents indicated their overall dissatisfaction with use of household pit latrines. The major contributions to dissatisfaction were smells (13%) and inconvenience in use (11%).
Jenkins & Scott (2007) Ghana/rural and peri-urban	Household survey; $n = 536$ households	Pit latrine (adopter, 11%) Pit latrine (shared, 14.6%) Pit latrine (non-adopter, 58.2%) Open defecation (14%)	- The majority of communal sanitation users (65.3%) were dissatisfied with their existing option, stating lack of cleanliness as the least preferred feature.
Oswald & Hoffman (2007) Peru/peri-urban	Household survey; $n = 52$ households	Ecological sanitation (adopter, 100%)	- 65% of the surveyed respondents with ecological sanitation latrines indicated it was a 'very useful' technology.
Davis *et al.* (2008) India/urban	Household survey; $n = 919$ households	Toilet with sewer connection (adopter, 58%) Toilet with sewer connection (shared, 3%) Open defecation (39%)	- Approximately half (47%) of the respondents indicated themselves to be at least somewhat dissatisfied with their existing defecation practices. Reasons listed for dissatisfaction included inconvenience, embarrassment, and unhygienic conditions.
Walker (2011) Ghana/rural	Household survey; $n = 31$ respondents	Pit latrine (adopter, 35%) Open defecation (93%) (multiple responses were allowed)	- Twelve respondents using no facilities were 'somewhat' or 'very' satisfied with current defecation practices. - Highest dissatisfaction levels were due to high installation costs (stated by ~80% of respondents) as well as the lack of deterrent mechanisms from flies and odors (mentioned by ~30% of respondents).
Roma *et al.* (2010) South Africa/peri-urban	Household semi-structured interviews $n = 86$ households	Ablution blocks (adopter, 100%)	- 52.3% of the respondents reported being overall satisfied with existing sanitation. - While user satisfaction of sanitation option was correlated to cleanliness, the ability to pay for daily use of sanitation does not correlate to higher satisfaction.

(*continued*)

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Table 1 | continued

Study Location/area type)	Data collection method n = number of responses	Existing technologies examined (adoption, % of sample population)[a]	Key results
Schouten & Mathenge (2010) Kenya/peri-urban	Household semi-structured interviews $n = 76$ respondents	Seven communal sanitation facilities were examined; technologies included biogas toilets, VIP latrines, pour flush toilets, and water closets.	- On a scale of 1 to 10 (with 10 being the highest), all tested facilities averaged a satisfaction ranking of 7.1 from the surveyed respondents.
Bolaane & Ikgopoleng (2011) Botswana/peri-urban)	Household survey plus contingent valuation; $n = 405$ households	Flush toilets (adopter, 55.6%) VIP latrine (adopter, 26.5%) Simple pit latrine (non-adopter, 17.6%) Open defecation (0.3%)	- 44% of the respondents are satisfied with using pit latrines and plan on continual usage. Reasons for satisfaction include the ability to use cheaper anal cleaning methods.
Roma & Jeffrey (2011) Indonesia/ peri-urban	Household survey and qualitative interviews $n = 122$ respondents	Flush toilets (non-adopter, 100%)	- 66.3% of the respondents reported being overall satisfied with existing sanitation. - 81.7% of the respondents indicated that their existing sanitation fulfilled their defecation needs.

[a]Adopter households are those that own improved sanitation; non-adopter households are those that have not yet chosen to install their own improved sanitation but are able to use communal facilities.

technologies independent of a water source (Whittington *et al.* 1993a).

Altaf (1994) probed approximately 1,000 respondents to determine the priority preference among infrastructure services (water, sanitation, or solid waste) in Gujranwala, Pakistan. This study assumed that the municipality could provide all services free to citizens, but only in a phased introduction as a result of budgetary constraints. Although respondents recognized the interdependency between water and sanitation services, they prioritized sanitation the most; respondents also indicated that they were more willing to pay for sanitation services than water services (Altaf 1994).

Altaf & Hughes (1994) conducted a study to determine willingness to pay for sanitation for 593 households located in Ouagadougou, Burkina Faso. The researchers attempted to decouple past experiences with sanitation from current perspectives by asking respondents about the sanitation attributes for their tested technologies as they considered their sample population's unfamiliarity with them. The technologies tested included simple off-site wastewater disposal, pour flush toilets, and VIP latrines. To understand preferences among the tested technologies, the study asked respondents to identify their preferred option assuming equivalent costs. The study revealed that user preferences for sanitation systems depended on the technology attributes, not simply having access to sanitation. In general, 64% of the respondents preferred pour flush toilets in comparison to 30% of the respondents preferring VIP latrines (Altaf & Hughes 1994). While 42.9% of respondents stated preference towards VIP latrines was a result of their water efficiency, pour flush toilets were perceived as being more 'hygienic and modern' by 58.1% of respondents who preferred that technology (Altaf & Hughes 1994).

Fujita *et al.* (2005) examined the desire of 1,000 households in Iquitos City, Peru to pay for their wastewater to be treated prior to river disposal. Existing sanitation services in the sample area included households without any connection to sewerage or access to pre-treatment effluent disposal, households with sewerage connection but no protection against rain overflows, and households with both sewerage connection and protection against rain overflows, representing 38.3, 27.4 and 34.3% of the sample population, respectively (Fujita *et al.* 2005). The study concluded that female respondents and younger respondents were willing to pay higher costs for pre-treatment effluent disposal; it also correlated a higher willingness to pay with individuals without indoor sanitation facilities (Fujita *et al.* 2005).

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Perspectives on sanitation usage/ownership

Several studies examined perceived benefits and constraints to sanitation usage in various geographical settings or different designation approaches. Although perspectives examined are similar throughout several of the studies, the number of surveyed respondents who consider the benefits and constraints varied significantly. Table 2 details the perceived advantages of sanitation usage and/or ownership. For studies that included adopter and non-adopter households, the frequency and percentage of the subpopulation that mentioned the advantage is provided accordingly. Certain motivational factors are mentioned throughout several studies are highlighted.

Comfort, cleanliness and convenience

The desire of sanitation users to utilize sanitation facilities that are comfortable, clean and convenient was mentioned throughout the case studies. When installed at the household level, pit latrines were considered more convenient and comfortable to adopter households than to non-adopter households (Jenkins & Curtis 2005; O'Loughlin *et al.* 2006; USAID 2009). These desires were seen in both rural and urban sanitation users; approximately half of the households in both urban and rural areas examined in Ethiopia mentioned convenience as a major benefit to using sanitation (O'Loughlin *et al.* 2006).

Prestige

The sense of prestige given to users was also mentioned as an advantage for rural sanitation users. It was measured by the ability to have a preferred sanitation option for guests to use (USAID 2009; Fu 2010), the association of sanitation with elite status (Jenkins & Curtis 2005), and increased amounts of self-esteem (USAID 2009).

Health benefits

The frequency of sanitation users stating disease prevention as an advantage of sanitation usage appears to be dependent on household adoption status. While adopter households were more likely to mention the health benefits of sanitation, non-adopter households still recognized sanitation interventions as mechanisms to prevent diseases and improve family health (Jenkins & Curtis 2005; O'Loughlin *et al.* 2006; USAID 2009).

Two studies also reported some constraints relating to sanitation ownership; the perceived disadvantages of sanitation ownership are detailed in Table 3. The most frequently mentioned disadvantages related to land conditions, including poor terrain and lack of space, financial constraints of construction, as well as lack of knowledgeable and experienced artisans to build the sanitation facility appropriately (Hernandez *et al.* 2009; USAID 2009).

Importance of drivers toward household sanitation installation

Several studies have analyzed the importance of factors motivating a household's decision to install private sanitation (Jenkins 1999; Jenkins & Curtis 2005; Jenkins & Scott 2007; Hernandez *et al.* 2009; Santos *et al.* 2011). Although the studies included different geographical settings and investigated various sanitation technologies, the use of similar rating scales allowed for proportional comparisons to be inferred. In the aforementioned studies by Jenkins (1999), Hernandez *et al.* (2009), and Santos *et al.* (2011), respondents were asked to indicate the relative importance of drivers and barriers toward sanitation use based upon a four-point importance scale, ranging from 1 = not important to 4 = very important. In addition, these surveys stratified respondent households similarly such that households with previously installed private sanitation were classified as adopters, whereas those households without private sanitation were considered non-adopters. The statistical significance (p-value) of responses between the adopters and non-adopters was also determined.

The pioneering work conducted by Jenkins and others (Jenkins 1999; Jenkins & Curtis 2005; Jenkins & Scott 2007) conveyed the importance of understanding drivers and barriers to predict the likelihood that households would install private sanitation. Jenkins (1999) detailed a behavior-decision model that conceptualized the decision-making process of installing private sanitation into three stages: the preference towards improving existing sanitation practices, the intention to change sanitation practices, and the choice to improve sanitation conditions based upon

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Table 2 | Reported advantages of sanitation use/ownership

Study (Location/area type)	Technology examined	Number of respondents	Driver	Frequency of response (%) Total	Adopters	Non-adopters
Jenkins & Curtis (2005) (Benin/rural)	Pit latrine (household)	$n = 40$ total 25 adopters 15 non-adopters	Affiliate with urban elite	12 (30)	8 (20)	4 (10)
			New experience/lifestyle	13 (33)	8 (20)	5 (13)
			Intergenerational status	4 (10)	2 (5)	2 (5)
			Aspire to emulate royalty	3 (8)	3 (8)	–
			Family health/safety	13 (33)	8 (20)	5 (13)
			Convenience/ comfort	12 (20)	8 (20)	4 (10)
			Protection	8 (20)	6 (15)	2 (5)
			Cleanliness	5 (13)	5 (13)	–
			Privacy	4 (10)	4 (10)	
			Restricted mobility	5 (13)	5 (13)	–
			Increase rental incomes	5 (13)	5 (13)	–
O'Loughlin *et al.* (2006) (Ethiopia/rural and urban)	Pit latrine (household)	$n = 116$ total 81 adopters 35 non-adopters	Cleanliness	56 (48)	39 (48)	17 (49)
			Health benefits	49(42)	33 (41)	16 (46)
			Privacy	28(24)	24 (30)	4 (11)
			Reduced flies	25(21)	19 (23)	6 (17)
			Convenience	21(18)	19 (23)	2 (6)
			Reduced smell	15(13)	9 (11)	6 (17)
USAID (2009) (Uganda/rural)	Pit latrine (household)	$n = 30$ total 16 adopters 14 non-adopters	Health benefits	25 (83)	15 (94)	10 (71)
			Visitors' convenience	17 (57)	11 (96)	6 (43)
			Self esteem	14 (47)	7 (44)	7 (50)
			Proper feces disposal	11 (37)	7 (44)	4 (29)
			Privacy	10 (33)	6 (38)	4 (29)
			Reduced smell	10 (33)	4 (25)	6 (43)
			Comfort/convenience	8 (27)	5 (31)	3 (21)
			Reduced flies	8 (27)	3 (19)	5 (36)
			Avoid conflicts with neighbors	3 (10)	1 (6)	2 (14)
			Lack of other alternative	2 (7)	2 (13)	–
Hernandez *et al.* (2009) (Ethiopia/rural)	Pit latrine	$n = 2{,}000$ total	Status	43 (4)		
			Comfort	85 (12)		
			Convenience	200 (27)		
			Privacy	19 (3)		
			Security	93 (13)		
			Health benefits	93 (13)		
			Ownership	21(3)		
			Proper feces disposal	297(41)		
Fu (2010) (Uganda/ rural)	Ecological sanitation	$n = 57$ total 36 adopters 21 non-adopters	Permanent structure		18 (32)	
			Less smell		6 (11)	
			Cannot fill with water		5 (9)	
			Get manure		8 (14)	
			Cheaper		4 (7)	
			Visitors' convenience		3 (5)	
			Less flies		2 (4)	
			Cleanliness		2 (4)	
			Durability		2 (4)	
			Reliability		1 (2)	
			Ease of cleanliness/maintenance		1 (2)	
			Convenience		1 (2)	
Roma *et al.* (2010) (South Africa/peri-urban)	Ablution blocks (communal)	$n = 86$ total	Comfort	43 (50)		
			Cleanliness	40 (46)		
Roma & Jeffrey (2011) (Indonesia/peri-urban)	Flush toilets (communal)	$n = 122$ total	Health benefits	102 (84)		

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Table 3 | Reported disadvantages of sanitation use/ownership

Study (Location/area type)	Technology examined	Number of respondents	Constraints	Frequency of response (%)		
				Total	Adopters	Non-adopters
Hernandez *et al.* (2009) (Ethiopia/rural)	Pit latrine	$n = 2{,}000$ total	Land ownership	155 (12)		
			Shortage of available land	144 (11)		
			Poor soil conditions	53 (4)		
			Lack of construction materials	64 (5)		
			Lack of technical expertise	54 (4)		
			Lack of experienced artisans	221 (18)		
			High cost of materials	53 (4)		
USAID (2009) (Uganda/ rural)	Pit latrine	$n = 30$ total 16 adopters 14 non-adopters	Low income	16 (53)	8 (50)	8 (57)
			Rocky soils	16 (53)	8 (50)	8 (57)
			Heavy rains	11(37)	8 (50)	3 (21)
			Weak construction materials	8 (27)	7 (44)	1 (7)
			Termites	10 (33)	5 (31)	5(36)
			Lack of construction materials	11 (37)	4 (25)	7 (50)
			Laziness	5(17)	3 (19)	2 (14)
			High cost of materials	4 (13)	3 (19)	1 (7)

capacity. Successful adopters were defined as those households in the final stage of the decision-making process whose desire for an improved sanitation condition represented a new demand for sanitation. The model further characterized drivers to install private sanitation based upon three motivating factors: the ability to provide prestige to its owners, the capacity to mitigate health and safety concerns, and household-specific factors (Jenkins 1999).

Using the behavior-decision model developed by Jenkins (1999), Jenkins & Curtis (2005) examined household desire to install private sanitation in rural Benin. Using in-depth probing interviews, 40 household heads, including 25 heads with private household latrines (adopters), were questioned to determine the drivers and barriers toward their ownership of private sanitation (Jenkins & Curtis 2005). While sanitation users' desire for prestige and well-being were listed as motivating factors for sanitation adoption, the prevalence of those drivers were dependent on demographic and socioeconomic factors (Jenkins 1999; Jenkins & Curtis 2005). Jenkins & Curtis (2005) also reported that health benefits were not a statistically significant driver towards motivating adopters to install private sanitation.

Jenkins & Scott (2007) re-examined the behavior-decision model and considered the impact of targeted social-marketing approaches towards persuading households to install private sanitation. Through the examination of 536 latrines installed in Ghanaian rural and peri-urban households, the authors categorized respondents based upon their adoptive or non-adoptive practices. An analysis of the non-adopter households indicated that health benefits, convenience, and ease of maintenance were the primary motivating factors involved in the decision-making process to install a latrine (Jenkins & Scott 2007).

Hernandez *et al.* (2009) compared similar drivers for sanitation adoption as Jenkins (1999) did and investigated household motivations to build a pit latrine in rural Ethiopia. Focusing on females with children, 745 respondents in 22 villages were interviewed to determine their perspective on sanitation ownership. Both user adoption classifications groups, regardless of private sanitation ownership, indicated that the ease of maintenance, privacy, and health benefits were their motivating factors. Furthermore, the sanitation adopters also designated prestige, modernity, and popularity as significant drivers (Hernandez *et al.* 2009).

Santos *et al.* (2011) sought to expand the framework described by Jenkins & Scott (2007) by examining the impact that socioeconomic, demographic, and socio-psychological variants had on household sanitation adoption. The study evaluated the purchasing decisions of 721 households to install household toilets connected to sewer systems in peri-urban Brazil. Prestige, modernity, and popularity were examined as well; yet, the difference between household adopters and non-adopters was not significant for the factors tested (Santos *et al.* 2011).

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Relative importance of prestige

Review of the literature indicated inconclusiveness regarding the significance of the prestige driver among adopter and non-adopter households. Using the importance scale ranking scale with 4 being 'very important,' gaining prestige is ranked consistently between 3.39 and 4.00, regardless of household adoption status. However, the significance of this driver varied among the three studies. In Jenkins (1999), the average importance (indicated as '*M*') of the driver 'gain prestige from visitors' indicated that all adopter households surveyed considered this driver to be 'very important.' A *t*-test revealed a statistical significance between the relative importance of this driver for adopter households ($n = 22$ users, $M = 4.0$) and non-adopter households ($n = 298$ users, $M = 3.96$), $p < 0.05$. Prestige was also a significant driver in the Hernandez *et al.* (2009) study; the mean of adopter households ($M = 3.98$) was statistically significantly different than non-adopter households ($M = 3.91$), $p < 0.001$. In Santos *et al.* (2011), a *t*-test failed to show statistical significance for the need to expand social status; adopter households ($n = 647$ users) have a mean ranking for 'gain prestige' as $M = 3.43$, while non-adopter households ($n = 71$ users) indicate a ranking of $M = 3.53$, $p = 0.512$.

Relative importance of health benefits

The ability of improved sanitation to provide health benefits has indeterminate results for being a driver. Jenkins (1999) reported spontaneous mentions of health benefits as being the third most frequently mentioned driver ranked most important by heads of households overall. When broken into household adoption groups, none of the 22 adopter households considered health benefits as their most important driver; 7.3% of the non-adopters mentioned it as their most important factor, ranking it third most important for this adoption class as well (Jenkins 1999). Adopter households ranked the average importance of health benefits ($M = 1.05$) lower than of non-adoption households ($M = 1.29$), $p < 0.005$, indicating that health, even though one of the most frequently mentioned drivers, was not an actual driver to persuade adoption of technology (Jenkins 1999). On average, non-adopter households placed a higher importance on health than adopter households. However, households questioned in Hernandez *et al.* (2009) placed a higher importance on health, with adopter households ranking the ability for improved sanitation adoption to prevent disease ($M = 3.92$) higher than non-adopter households ($M = 3.89$), $p = 0.10$. Santos reported the lack of statistical significance ($p = 0.274$) among adopter households ($M = 3.70$) and non-adopter households ($M = 3.71$).

DISCUSSION

The published research suggests that individuals see benefits to using sanitation, and that they are willing to pay a higher premium for those services relative to certain other infrastructure services. Prior research has also acknowledged the differences between households who choose to install private sanitation than those who use shared and/or communal sanitation facilities.

An interesting finding from the review is that many of the included studies indicated a lack of overwhelming satisfaction with existing sanitation options, regardless of whether the technology implemented was improved or not. Examining the studies collectively, satisfaction levels with improved sanitation technologies were comparable to dissatisfaction levels of unimproved sanitation technologies. Thus, implementation of improved sanitation appears to not be indicative of higher satisfaction levels.

In addition, the overwhelming majority of the studies that investigated the motivational factors influencing sanitation users focused primarily on adoption classification. The absence of gender and socioeconomic stratifications limits the generalizability of the published research to adoption of sanitation technology. One study did provide further stratification, including gender and occupational classifications for latrine adoption (Jenkins 1999). Statistically significant differences were observed in the motivational factors between males and females, specifically with those drivers relating to intergenerational status and privacy (Jenkins 1999).

As new explorations in sanitation-user preferences continue, it would be beneficial if a systematic approach were to be applied, addressing methodological deficiencies discussed in the studies examined. First, sanitation preference studies should distinguish, for both the sanitation users

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and the research community, how satisfaction is measured. The majority of the studies did not explain the definition of satisfaction or provide scales used to record degree of satisfaction for sanitation. Instead, most studies only detailed the percentage of users 'satisfied' or 'dissatisfied' with their existing sanitation option. Providing clarity on how a study classifies satisfaction would improve interpretation and comparison of results. Second, sanitation preference studies should examine ways to probe users for further understanding of drivers influencing adoption. Jenkins (1999) suggested an approach of using multiple questions to ascertain the validity of tested drivers and develop a composite index. Conducting cognitive interviewing to ascertain robustness of draft survey questions and incorporating probing techniques into the survey methodology may also be beneficial in gaining further clarity. These approaches could assist in seeking clarification, requesting elaboration, or gathering additional feedback on possible drivers. As motivational factors, such as prestige and health benefits, were found to have indeterminate results on the adoption of sanitation, additional research is needed to examine stratification based on other possible determinants, including possible financial capacity, environmental conditions, and user knowledge base. A comprehensive identification of factors driving sanitation adoption could lead to further understanding of user satisfaction levels and willingness to pay for sanitation.

Knowledge gaps

This review seeks to highlight existing literature investigating user preferences and perceptions on sanitation, with particular emphasis given to satisfaction and motivation for usage. As noteworthy contributions have been made to address the challenges of increasing sanitation coverage from the examined case studies, there remains a need for further research within the field of sanitation user preferences. Knowledge gaps include

- Current adoption classification of sanitation users does not identify individuals who share improved household-level sanitation among several households and/or individuals. This distinction in classifications has vast implications for the United Nations MDG indicator metrics tracking improved sanitation progress. Currently, these individuals are grouped with those who use communal sanitation facilities. It is unknown if the adoption practices for those individuals who share private sanitation are more similar to those who choose to purchase household sanitation or those who use communal sanitation.
- While it has also been shown that drivers can motivate individuals to adopt improved sanitation technologies, it remains unclear if there are specific design attributes of sanitation technologies that are preferred over others. Although the willingness-to-pay studies did compare preferences for several sanitation technologies; they did not capture user insight regarding the technical characteristics of these various sanitation technologies. Instead, opinions were gathered regarding cost considerations for pre-fabricated sanitation designs, leaving the user unable to express their satisfaction (or dissatisfaction) for specific design and/or implementation components related to sanitation technology. Furthermore, the priorities and trade-offs sanitation users make when determining their preferences of certain sanitation technologies over others remain unknown.
- An understanding of how user preferences for various sanitation design and implementation attributes impact overall user adoption and usage is unknown. Previous studies analyzing the desire to adopt sanitation systems individually focused on one type of sanitation technology. Based on those studies, it is unclear if those types of sanitation technologies were installed because they were the preferred sanitation alterative or if other alternatives were unknown. Furthermore, for sanitation users who are unable to install private household sanitation, it is unclear if the sanitation design and implementation characteristic impact overall desire to use shared and/or communal sanitation on a continuing basis.

With recent trends in sanitation access moving towards increasing user demand, understanding these further perspectives will help to provide additional insight.

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