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Characterizing the Last Latrine Nonowners in Rural Malawi

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Abstract. Open defecation is a public health problem worldwide. Non-governmental organizations in developing countries use various approaches to increase latrine coverage, but for little-understood reasons, some of the population does not adopt latrine construction. The objective of our research was to uncover which of the factors predicting latrine construction are relevant to the last nonowners of latrines, termed laggards in the diffusion of innovations theory. In a cross-sectional study, quantitative face-to-face interviews were conducted in households in rural Malawi (N = 824) to assess the behavioral determinants of latrine construction, mental health, and leadership. Around 14% of the households interviewed did not own a latrine. Study results suggest that nonowners have limited economic resources and perceive that latrine construction is expensive, that it is difficult to find money for latrine construction, and that it needs a lot of time and effort. The last nonowners of latrines live in smaller groups than latrine owners, communicate less with others about latrine construction, and are less influenced by the opinion of their leaders. They consist, in particular, of socially vulnerable households, are younger, are less educated, often have more impaired mental health, feel more vulnerable to contracting diseases, are less aware of the latrine construction of others in the village, feel less personally obliged to construct their own latrines, and are less confident in their ability to rebuild latrines damaged by flooding. The study confirmed that the assumptions of the diffusion of innovation theory are useful in combination with the risks, attitudes, norms, abilities, and self-regulation behavior change approach for developing evidence-based behavior change strategies in developing countries.

INTRODUCTION

Despite an increasing number of people with access to sanitation, approximately 946 million people worldwide still practice open defecation.[1] The detrimental effects of open defecation on health include water, sanitation, and hygiene (WASH)-related diseases, such as diarrhea, cholera, and typhoid. These reduce physical growth, lead to malnutrition, and cost developing countries roughly 260 billion dollars per year.[2] To eliminate open defecation, the governments of developing countries and international organizations have deployed a variety of approaches to behavior change, such as Community-Led Total Sanitation (CLTS), which have shown good results.[3] The aim of every open-defecation-free campaign is to reach 100% latrine coverage and latrine usage in a target population or community. However, this goal is often difficult or impossible to achieve and sustain[4] because a certain proportion of the target population, for unknown reasons, does not become open-defecation-free.

The objective of this article is to analyze this group, the last households that do not own a latrine, to understand the mechanisms underlying this behavior and derive interventions tailored specifically for them. The theory of the diffusion of innovations[5] defines five different types of adopters. 1) Innovators are the first in adopting an innovation. They are interested in new ideas and could be described as cosmopolitans with many possible communication channels around the world. 2) Early adopters are integrated much more into a local social system than innovators, and they have a very high rate of opinion leadership in all local social systems. 3) The early majority accepts the innovation before an average individual of the system and interacts actively with other people; they are the followers of new innovations, not the leaders. 4) The late majority (34%) follows the innovation after an average member of the system; they are skeptical, lack resources, and need a guarantee that an innovation is necessary for them. Finally, 5) laggards constitute the last part of a population to adopt an innovation.[5] Laggards are characterized as people who perceive a high risk in adopting a new behavior, are less influenced by opinion leaders, and are isolated from the social network. They refer to the past and hold traditional views. They have limited economic resources and a long innovation-decision process. Laggards will accept an innovation only after the confirmation of other people who are satisfied with the innovation.[5]

In our study, in rural Malawi, we performed a detailed analysis of the motives of the laggards group (the last 14% of nonowners of latrines) using the risks, attitudes, norms, abilities, and self-regulation (RANAS) model of behavior change[6] because it contains a large number of psychosocial factors that influence behavior. The usefulness of this model in explaining latrine cleanliness was demonstrated in a recent study in rural Burundi.[7]

The five factor blocks of the RANAS model cover risk, attitude, norm, ability, and self-regulation factors. Risk factors represent factual knowledge about the transmission of a disease, methods for prevention, and personal consequences, and perceived vulnerability and perceived severity of contracting a disease. Attitude factors represent beliefs about the costs and benefits of the particular behavior and feelings arising when thinking about the behavior. Norm factors, such as the behavior of others, others' (dis)approval, and personal importance, represent perceived social influence. Ability factors represent people's confidence in performing the behavior. Self-regulation factors represent management of conflicting goals, distracting cues and barriers, including commitment, and remembering the relevant behavior.

In our analysis, in addition to psychosocial factors, we include contextual factors relevant for latrine construction. The contextual factors are divided into three categories: the social, the physical, and the personal. The social context reflects

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culture, social relations, laws and policies, economic conditions, and the information environment communication. The physical context consists of the natural and built environment. Finally, the personal context is formed by sociodemographic factors, such as age, gender, education, and the physical and mental health of the person and by physical conditions like experiencing hunger. In addition to the context factors, we aimed to detect how opinion leaders foster WASH behaviors in communities and applied the theory of transformational leadership (TFL).[8] TFL consists of four dimensions: idealized influence, inspirational motivation, intellectual stimulation, and individual consideration. Research suggests the universality and applicability of the theory of TFL to different settings, such as military, hospital, industry, government, education, church, sports, music, and others.[8]

The RANAS approach to behavior change in this case draws conclusions by comparing households that have built a latrine with the last people in a population, the laggards, who have not yet built a latrine. From the significant differences, we identify the psychosocial factors that steer the behavior of the last latrine nonowners and then choose corresponding behavior change techniques (BCTs) from the RANAS catalog of BCTs.

This article addresses two research questions: 1) What are the differences in the psychosocial factors between owners and nonowners of a latrine in the households of rural Malawi? 2) What are the differences in the context factors between owners and nonowners of a latrine in the households of rural Malawi?

The present study. The objective of the present study was to develop evidence-based behavior change interventions to alter latrine construction in rural Malawi for the last 14% of the population who are nonowners of a latrine. To our knowledge, World Vision triggered CLTS in this study region in 2008, but only few villages were declared open-defecation-free. This article includes cross-sectional results from a baseline data survey in households of rural Malawi (N = 824) and aims to identify behavioral and context factors associated with latrine construction. We use the study results to design various promotion activities that will be implemented by the local partner, Malawi Red Cross Society.

METHODS

Study design. The study design includes a prestudy and a baseline survey. The prestudy involved in-depth qualitative interviews with Malawian Red Cross officers, pretests of the questionnaires and spot-checks in the field, focus group discussions with community members, observations of the households (for the general hygiene and sanitation situation, latrines, handwashing facilities, and availability of water and soap), and recruitment interviews with data collectors. The objective of this phase was to gain knowledge about barriers to and conditions facilitating the targeted behavior. The data from the prestudy were used to create quantitative questionnaire that were then used in a baseline survey. A research permit application was also submitted in Malawi. Finally, the data from the baseline survey identified significant differences in the behavioral and contextual factors steering latrine construction between owners and nonowners.

Research area. The study was conducted in households in a rural area in Malawi, the Kasungu district, which is located within the traditional authority of Kapelula. To conduct the household interviews, five villages were chosen randomly from a group of 12 in the Kapelula region. The villages chosen were Chikgang'ombe, Kapelula, Chinyanga, Chimwaye, and Msulira.

Sample. Quantitative data were collected from 824 households using a random-route method. The target respondent in the survey was the primary care provider of the household or a person responsible for latrine construction. Most of the study participants (N = 496) were women, who are the primary care providers of their families. The rest of the study participants (N = 324) were men, responsible for the decision to construct the latrine.

Data collection method and interviewer training. Data collection took place between April and May 2016 and was accomplished by tablet devices using ODK, a software package from OpenDataKit. A team of 14 data collectors carried out structured face-to-face household interviews and rapid spot-check observations. The supervisor, Red Cross officer, and researcher coordinated and monitored the interviews and accompanied the data collectors in the field during the entire data collection period.

Before the data collection, the interviewers attended 5 days of training, where they learned about the study, its goals, the theoretical background of the questionnaire, and the questionnaire itself. The data collectors practiced how to ask different types of questions and how to record data on the tablet device. Important do's, such as gaining entry, reading the answer categories if required for the psychometric questions and not reading the answers of open questions, and don'ts, such as not changing the sense of the question by changing the words, not suggesting answers, and not promoting a behavior, were discussed and trained with practical exercises and role plays. On the final day of the training, every interviewer practiced an interview in the field. This experience was discussed afterward as the last element in the training. The applicability of the questionnaire was verified with a pretest in the field (N = 16).

Ethics. All procedures conducted during the baseline survey were in accordance with the Declaration of Helsinki, and the research protocol was approved by the ethical committee in Malawi (National Committee on Research in the Social Sciences and Humanities; Ref No: NCST/RTT/2/6), and by the Ethics Committee of the University of Zürich in Switzerland. All study participants provided their informed consent.

Questionnaires and measures. The structured, face-to-face interviews were conducted in Chichewa, the local language of the study region. Each interview took around 1 hour. The questionnaire was structured in accordance with the behavioral factors of the RANAS model. Most of the questions were measured using five-point Likert scales (from "not at all" to "very much"). To identify mechanisms underlying behavior in our study population, we added specific questions on communication and hunger. We assumed that communication and hunger could influence people's behavior. We used additional questionnaires, such as for the measure of mental health (self-reporting questionnaire (SRQ-20)[9,10]; a validated 20-item Chichewa version of the SRQ, a brief screening measure for the detection of probable depression/mental distress) and the TFL questionnaire focusing on latrine construction, which include communicating expectations, follower development, intellectual stimulation, and personal recognition items.[11] We adapted the TFL to the rural Malawian context.

The quantitative questionnaire covered general information and socio- economic status, health status and awareness, latrine ownership, psychosocial factors of latrine construction, mental health, leadership and communication, and an index of wealth. Observational spot checks were recorded in the same file. All questionnaires used in the baseline survey were translated from English to Chichewa by local translators and then back-translated to ensure accuracy by other translators.

Statistical analysis of data. The data were directly transferred to computers (Excel files) and processed with IBM SPSS 23 statistics software. Means for owners and nonowners were compared using analysis of variance (ANOVA) to identify the most influential behavioral and context factors.

RESULTS

Frequencies of latrine construction. Around 86% of the interviewed households had a latrine for their own use (self-reported and observed). However, nearly all households without a latrine (92.5%; $N = 107$) reported that they planned to construct one within the next 12 months. These respondents reported a high average intention to construct their own latrines within the next year.

In our sample, the main reasons for not having built a latrine were lack of money (27.7%), just moved in (17.9%), will move soon (7.1%), heavy rains (8.9%), latrine collapsed (7.1%), busy (4.5%), and other (20.5%).

The self-reported, multiple reasons for the decision to construct a latrine were hygiene (65.6%), privacy (41.7%), ease of use (40.2%), security (22.2%), proximity to house (10%), and difficulty of finding a place for open defecation (2.3%).

Owners versus nonowners analysis: psychosocial factors. An ANOVA mean comparison analysis was carried out to answer the first research question: What are the differences in psychosocial factors between owners and nonowners of a latrine in the households of rural Malawi?

Statistical analysis revealed significant differences between owners and nonowners of latrines in several psychosocial factors (see Table 1). To identify the most important differences, we calculated the effect size, d. The related population effect sizes (from $d = 0.21$ to $d = 1.82$) lie in a range between small and large effects.[12] A large effect was found for the factor Others' behavior in the village ($d = -1.81$), meaning that Others' behavior in the village is rated higher by the nonowners ($M = 1.61$, SD = 0.30) than by the owners ($M = 2.48$, SD = 0.50). Medium effects were found in the factors Vulnerability ($d = 0.48$), Belief expensive ($d = 0.58$), Belief difficult money ($d = 0.63$), Belief time and effort ($d = 0.53$), and Communication ($d = -0.61$). **This means that nonowners rate it more probable that they will contract diarrhea than owners do (Vulnerability) that nonowners believe that latrine construction is more expensive than owners do (Belief expensive), that nonowners believe that finding money for latrine construction is more difficult than owners do (Belief difficult to find money), that nonowners believe that they need more time and effort for latrine building than owners do, (Belief time and effort), and that nonowners talk less about latrine construction and perceive less that other people talk about latrine construction than owners do (Communication).

Owners versus nonowners analysis: context factors. An ANOVA mean comparison was also calculated to answer the second research question: What are the differences in context factors (see Table 2 below) between owners and nonowners of a latrine in the households of rural Malawi?

Statistical analysis revealed that several contextual factors showed significant differences between owners and nonowners of latrines in the households of Kapelula (see Table 3 below): 1) Marital status: 87.5% of owners were married, compared with 68.1% of nonowners ; 2) Education in years: owners reported more years of education than nonowners (owners $M = 5.99$, SD = 3.62; nonowners $M = 4.92$, SD = 3.86); 3) Literacy: more owners were able to write and read than nonowners (owners 70.4%; nonowners 53.1%); owners' household size is bigger on average than nonowners' ($M = 5.47$, SD = 2.21; nonowners $M = 4.50$, SD = 2.27); wealth index is higher for owners ($M = 0.97$, SD = 1.00) than nonowners ($M = 0.52$, SD = 0.79); mental health is more impaired in

TABLE 1

Owners vs. nonowners RANAS psychosocial factors mean comparison with ANOVA

Factor group	Behavioral factors	Owners *M* (SD)	Non-owners *M* (SD)	Cohen's *d*
Risk factors	Vulnerability (factor)***	2.35 (1.23)	2.95 (1.30)	0.48
	Severity (factor)	4.44 (0.86)	4.38 (0.95)	n.s.
	Health knowledge (factor)	10.18 (1.83)	9.95 (2.06)	n.s.
Attitude factors	Belief expensive***	0.79 (0.54)	1.12 (0.72)	0.58
	Belief difficult money***	0.87 (0.59)	1.26 (0.77)	0.63
	Belief space	0.56 (0.27)	0.56 (0.24)	n.s.
	Belief time and effort***	0.57 (0.29)	0.75 (0.56)	0.53
	Feelings (proud)	2.13 (0.46)	2.20 (0.39)	n.s.
Norm factors	Other's behavior relatives**	4.11 (0.89)	3.83 (1.02)	–0.31
	Other's behavior village (factor) ***	2.48 (0.50)	1.61 (0.30)	–1.82
	Other's approval (factor)	4.08 (0.84)	3.96 (0.91)	n.s.
	Personal obligation*	2.41 (1.66)	2.75 (1.67)	0.21
Ability factors	Confidence in performance (flooding)**	4.04 (1.12)	3.70 (1.31)	–0.30
	Confidence in performance recovery (damaged)***	4.02 (1.14)	3.52 (1.17)	–0.44
	Confidence in performance maintenance (factor)***	3.95 (1.22)	3.54 (1.22)	–0.34
	Commitment	2.16 (1.62)	2.32 (1.59)	n.s.
Additional factor	Communication (factor)*	3.27 (1.14)	3.02 (1.23)	–0.61

* $P \leq 0.05$, ** $P \leq 0.01$, *** $P \leq 0.001$, n.s. = not significant. $N = 790–820$. Owner: $N = 706–708$; Nonowner: $N = 111–112$. All questions (excluding factor knowledge, which is sum score) included five-point Likert scales and response choices from "1 - not at all" to "5 - very much". Cohen's d, small: $d = 0.20$, medium: $d = 0.50$, large: $d = 0.80$.

TABLE 2
Context factors for latrine construction

Personal context	Gender
	Age in years
	Education
	Literacy
	Marital status
	Mental health
	Hunger
	House ownership
	Income
	Wealth index (radio, TV, electricity, mobile phone, and running water)
Social context	Household size
	Religion (not included in analysis because of the lack of variance—almost all respondents are Christians)
	Leadership
Physical context	Soil conditions

nonowners (49.1%) than in owners (30.1%); and leadership is perceived as more supportive (communicating expectations, follower development, intellectual stimulation, and personal recognition) by owners ($M = 0.85$, SD = 0.25) than by nonowners ($M = 0.76$, SD = 0.32).

DISCUSSION

Interpretation of results. The purpose of the present study was to identify the contextual and psychosocial factors relevant to latrine construction and the differences between owners and last nonowners of latrines in a rural Malawian population.

Our findings are in line with the theory of the diffusion of innovation postulated by Rogers.[5] Laggards, the last part of the population to adopt the innovation of latrine ownership, have limited economic resources, such as lower wealth. They also perceive latrine construction to be expensive, which may indeed reflect the reality they face that it is difficult to find money for latrine construction, and latrine construction needs a lot of time and effort. The last nonowners of a latrine live in smaller groups (household size is smaller), they communicate less with others about latrine construction, and they are less influenced by opinion leaders, meaning that they perceive the local leadership as less supportive.

In addtion, our results suggest that the last nonowners of latrines in our sample consist, in particular, of socially vulnerable households, which can be characterized as younger, less educated, and with more impaired mental health. They feel more vulnerable to contracting diseases, they are less aware of the latrine construction of others in the village, they feel less personally obliged to construct an own latrine, and they are less confident in their ability to rebuild a latrine after damage through flooding.

To our knowledge, few studies in developing countries explain the factors steering behavior and the characteristics of various types of adopters of a new innovation, including the laggards.[13,14] However, some findings in diffusion of innovation research are contradictory. For instance, a recent study in Bolivia[15] could not explain the agricultural practices of local farmers by adoption diffusion.

Our study in rural Malawi confirmed that even if the characteristics and situation of the final adopters of an innovation are very similar to other countries and other contexts, it is important to identify and access the specific mechanisms underlying the behavior with respect to innovation.

One clear limitation of this study is that these cross-sectional design survey results need confirmation from longitudinal research. We do not have exact data about the previous diffusion process in the study region, the CLTS that was triggered in 2008. Future research should take this limitation into account.

Practical implications. We aim to develop evidence-based behavior change interventions to alter latrine construction in rural Malawi for the last 14% of nonowners of a latrine.

After our study results and using the RANAS approach to systematic behavior change, including BCTs, we have developed population-tailored interventions in rural Malawi. We propose three intervention strategies to target latrine construction among final 14% of the population who have not yet built latrines: hardware promotion, social persuasion, and social support.

The aim of the first intervention strategy is to increase people's confidence in their abilities (confidence in performance) to construct their own latrine. This might involve, for instance, demonstrations in community meetings on how to build a latrine. This would also include triggering behavior practice, in that participants would actually start building latrines.

The second intervention strategy aims to change beliefs about the costs and benefits of latrine construction. This intervention strategy focuses on social persuasion, such as providing information about costs and benefits, for example,

TABLE 3
Mean comparison with ANOVA of contextual factors of the study participants on latrine construction

Variables	Scale	Owners M (SD) and %	Nonowners M (SD) and %
Gender	Male/female	Female 59.5%	Female 66.4%
Age in years		38.00 (15.19)	36.43 (16.62)
Marital status***	Yes/No (married = 1, others = 0)	Married 87.8%	Married 68.1%
Education in years**		5.99 (3.62)	4.92 (3.86)
Literacy***	Yes/No	Yes 70.4%	Yes 53.1%
Household size***		5.47 (2.21)	4.50 (2.27)
House ownership	Yes/No	Owners 96.2%	Owners 95.6%
Income		11,970.44 (n.a.)	8708.41 (n.a.)
Wealth index***	1–5	0.97 (1.00)	0.52 (0.79)
Mental health***	Yes/No (score 7 and more = Yes)	Yes = 30.1%	Yes = 49.1%
Hunger	1–5	3.50 (1.38)	3.72 (1.22)
Leadership***		0.85 (0.25)	0.76 (0.32)
Soil conditions	(sandy = 0, clay = 1, rocky = 0, other = 0)	clay 61.2%	clay 59.3%

n.a. = not applicable.
* $P \leq 0.05$, ** $P \leq 0.01$, *** $P \leq 0.001$. $N = 780$.

by conducting cost-benefit analyses. This would include not only financial costs and benefits but also health and social consequences and the effort that latrine building entails. During a household visit, the Red Cross volunteer (promoter) and the participant together calculate the costs and efforts of latrine building. The total monetary costs are compared with the monetary costs of medical treatment, and the effort is compared with the effort of taking someone to hospital or caring for a sick family member.

The third intervention strategy, social support, aims to increase communication with others and social support for latrine construction. This strategy includes help with latrine construction; for instance, local leaders prompt community mobilization at community meetings, which means prompting the help with building of low-cost latrines, helping to find material using locally available resources, and helping to construct latrines for vulnerable households.

CONCLUSIONS

People's thoughts and actions result from an interplay of psychosocial, contextual, and other factors such as time, new innovations, and interventions. These can result in either healthy or unhealthy behavior. The present study combined psychological theory to explain the health behavior of the last nonowners, the final adopters of the innovation of latrine building. Our findings suggest that the last nonowners of a latrine deserve specific attention by taking into account that they are isolated, have limited resources, live in smaller groups, and need help from other community members. Our study confirmed that the assumptions of the diffusion of innovations theory can be combined very effectively with the RANAS approach to behavior change to develop evidence-based behavior change strategies on WASH behaviors in developing countries.

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