Research Paper

Scaling up rural sanitation in Tanzania: evidence from the National Sanitation Campaign

Anyitike Mwakitalima, Khalid Massa, Amour Seleman and Telemu Kassile

ABSTRACT

Access to improved sanitation facilities has been a challenge, especially in developing countries. In 2012, Tanzania launched a rural-based National Sanitation Campaign to address the challenge of low coverage of improved sanitation and hygiene at household and school levels using a combination of approaches including Community-Led Total Sanitation (CLTS) and behavior change communication. In June 2016, a study that involved interviews with heads of households, complemented by observations of sanitation and hygiene facilities in 2,875 households from 289 villages, was carried out in campaign and non-campaign villages. Overall, 94.7% of the households had a basic toilet; whereas 7.0% of the households from non-campaign villages against 3.5% from the campaign villages had no toilet. Moreover, overall coverage of improved sanitation was found to be 52.6% and varied between campaign (62%) and non-campaign (43%) villages. Hand washing points were hardly observed in both campaign and non-campaign villages, although they differed significantly between the two areas: 42.7 vs. 26.7% for campaign and non-campaign villages, respectively. Factors associated with households' access to improved latrines include economic status of the household, education level of the head of household and geographical location of the household. Further studies are needed before drawing clear-cut conclusions about the impact of the campaign.

Key words | Community-Led Total Sanitation, National Sanitation Campaign, rural sanitation, Tanzania

Anyitike Mwakitalima
Khalid Massa
Amour Seleman
Ministry of Health, Community Development, Gender, Elderly and Children,
University of Dodoma, Faculty of Social Science in Community Development,
40478 Dodoma,
Tanzania

Telemu Kassile (corresponding author)
Department of Mathematics, Informatics and Computational Sciences, Solomon Mahlangu College of Science and Education,
Sokoine University of Agriculture,
Morogoro,
Tanzania
E-mail: *telemuk@yahoo.com*

INTRODUCTION

The link between access to improved sanitation and hygiene and health outcomes is well documented in literature (cf. WHO 2004; Andres *et al.* 2014; Benova *et al.* 2014; Stocks *et al.* 2014). Proper sanitation and hygiene are critical in suppressing the spread of water-borne diseases (Joshi & Amadi 2013; Zin *et al.* 2015). Evidence shows that improving sanitation can reduce diarrhea by 32%, whereas hygiene interventions such as education on best hygiene practices, including promotion of hand washing with soap, can result in a reduction of diarrhea cases by up to 45% (WHO 2004). Nevertheless, access to improved sanitation and hygiene has remained rather worrying, especially in developing countries. Global sanitation coverage in 2011 was 64% and by the end of 2011 there were 2.5 billion people who did not use an improved sanitation facility (WHO & UNICEF 2013).

In Tanzania, the rate of increase of coverage of improved sanitation and hygiene facilities has been observed to be relatively low. In 1990, 2000, and 2011 for example, only 7, 9, and 12% of the population were using an improved sanitation facility in the country, respectively (WHO & UNICEF 2013). Statistics for some countries in

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the East African Cooperation show that in the same period Kenya had 25, 27, and 29% of the total population using improved sanitation facilities, while Uganda had 27, 31, and 35% (WHO & UNICEF 2013). Disaggregated by rural and urban, statistics from the same report show that the proportions of the population which were reported to be using an improved sanitation facility in the same periods in Tanzania were 9, 16, and 24% in urban areas compared to 6, 7, and 7% in rural areas. On the other hand, 9, 11, and 12% of the total Tanzanian population in 1990, 2000, and 2011 were practicing open defecation, a significant proportion of which were from rural areas (10, 13, and 16%) as opposed to urban areas (2, 2, and 2%) (WHO & UNICEF 2013). According to the National Bureau of Statistics (NBS 2009), only 2.2 and 1.0% of rural households had access to VIP latrines and flush toilets, respectively. The high cost of meeting the desired improvement is among the factors that have been reported to affect the improvement of sanitation facilities in rural Tanzania (Sara & Graham 2014). According to UNICEF & WHO (2015), access rates of any type of toilet in rural and urban areas in Tanzania in 2015 were 83 and 98%, respectively. The national coverage of any type of toilets was 88%. On the other hand, access to improved toilets in rural and urban areas were 8 and 31%, respectively, while the national coverage was 16% (UNICEF & WHO 2015).

As a response to the challenge of low coverage of improved sanitation and hygiene, in 2012 Tanzania, through the then Ministry of Health and Social Welfare, launched the National Sanitation Campaign (NSC). The NSC was built on experience drawn from the *Mtu ni Afya* campaign that was implemented in Tanzania from 1973 to 1978. The key message of the campaign was (Kiswahili Language) '*Usafi ni ustaarabu unaanza na sisi*'; that is, cleanliness is civilization, it begins with us. Phase I of the campaign (2012–2015) aimed at improving rural households through adequate water and sanitation facilities, as well as providing schools with appropriate WASH facilities. The campaign used a combination of approaches including Community-Led Total Sanitation (CLTS), social marketing and behavior change communication. The CLTS approach was used to create demand and engage the rural communities in carrying out analysis of their practices related to sanitation and hygiene. It is a total engagement in the sense that everyone in the community has a role to play to ensure sanitation and hygiene is fully addressed and put as a key agenda for the community (Kar & Chambers 2008). That is, at the community level, the CLTS was used to trigger communal realization of the impact of open defecation and failure to wash hands with soap. Regarding social marketing, local artisans were trained on the construction of improved toilets and demonstration to the community on how to make low-cost hand washing points, commonly known as tippy taps. At least two artisans were trained in each campaign village. Promotional events on household sanitation and hygiene and school WASH were also conducted. In particular, the campaign capitalized on national and global sanitation and hygiene related commemorative events such as National Sanitation Week, Global Hand Washing Day and World Toilet Day. During the commemoration days, government officials and other influential people were invited to give key messages about the campaign. Other related events include road shows and open ground performance, media campaigns, as well as exhibitions at which information, education and communication materials were distributed to the community. Cleanliness competitions and assessment of NSC performance in councils were also conducted once a year and the best performing councils of the campaign were awarded certificates of recognition and other awards such as motorcycles and computers in order to promote effective implementation of the campaign. In addition, monitoring and evaluation were carried out to assess the progress of the campaign through various measures including supportive supervision and experience sharing meetings. The campaign was implemented in all 26 regions of mainland Tanzania involving 163 councils in which 6,428 villages and *mitaa* were reached.

In June 2016, the Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC) carried out an evaluation study of the NSC, the prime objective being to gain an understanding of the impact of the campaign. Issues assessed include availability of toilets, their types and usability status (used or not), availability and use of hand washing facilities, and presence of open defecation practices in the study areas. Key research questions that the evaluation aimed to address include: To what extent has the campaign contributed to the overall coverage of improved sanitation in relation to areas that are not under the campaign? The study adopted the

Joint Monitoring Programme's (JMP) definition of improved sanitation: that is, any toilet facility with a slab that hygienically separates feces from human contact. It includes a pit latrine with washable floor, ventilated improved pit latrine, Ecosan or composting latrine, and flush or pour flush (Reed 2011).

METHODS

Study areas

This cross-sectional study was conducted in 26 regions in Mainland Tanzania. In each region, all councils which were implementing the campaign were studied, resulting in a total of 148 councils. Moreover, in each council two villages were assessed: one village that was implementing the campaign (herein referred to as an intervention or treatment village) and one village that was not implementing the campaign (herein referred to as a control village). The latter village was included in the study primarily to allow a comparison of various aspects related to the study and hence to generate hypotheses for further studies. In total, 289 villages were studied. Figure 1 shows the regions in mainland Tanzania in which the study was conducted. For reasons of clarity, it was not feasible to include all councils and villages on the map. Figure 2 illustrates the location of control and treatment villages for one Mkuranga District Council in Pwani region.

In 2012, when the campaign began, coverage of improved sanitation in rural areas was 7% (WHO & UNICEF 2014). The entire rural area therefore qualified to be engaged in the campaign. For that reason, all villages had an equal chance of being involved in the campaign. However, due to financial constraints, few villages were included annually. The main criterion for early inclusion was the availability of an extension worker – Ward Health Officer – at the ward for close follow-up or monitoring of declaration, supervision of data collection and reporting of results. Since the campaign is part of the Water Sector Development Programme of which water supply started with 10 villages in each council, the same villages were engaged in the campaign for a complete WASH package. Other factors used for the selection of villages to be included in the campaign were incidences of cholera outbreak or high prevalence of diarrhea. Financial limitation also controlled the selection of villages for early inclusion in the campaign, whereby easy-to-reach villages were sometimes selected first to facilitate easy supervision and implementation of the campaign activities, rather than considering all villages within the district and, which might lead to ineffective implementation of the campaign.

Sample size

The reporting unit was an individual household. In each village (treatment and control), 10 households were expected to be selected to provide information for the study, making a total of 20 households in each council. However, because of non-response, not all the planned 20 households were studied in each council. Overall, a total of 2,875 households from 148 councils were studied.

Sampling procedure

In order to arrive at the household level, the study adopted a three-stage sampling strategy. The first stage of sampling involved the selection of one ward which was implementing the campaign in each council. After that, all villages which were implementing the campaign in the selected ward were listed. One village was then selected from the list. This resulted in the second stage of sampling. In each council, selection of the intervention village was carried out first followed by the control village. In contrast, selection of the control village was done purposefully. In particular, in each council, a control village was considered suitable if it was located at least 5 km from the intervention village. Accordingly, in some councils, selected control villages were located in the same ward as the intervention villages, while in some councils the two villages – intervention and control – were located in two different wards depending on the size of the wards. The third and final stage of sampling involved selection of households. In each village, households were selected using a systematic random sampling technique based on the available village registers of households.

Data collection

Data collection took place for 2 weeks and was carried out through structured face-to-face interviews with heads

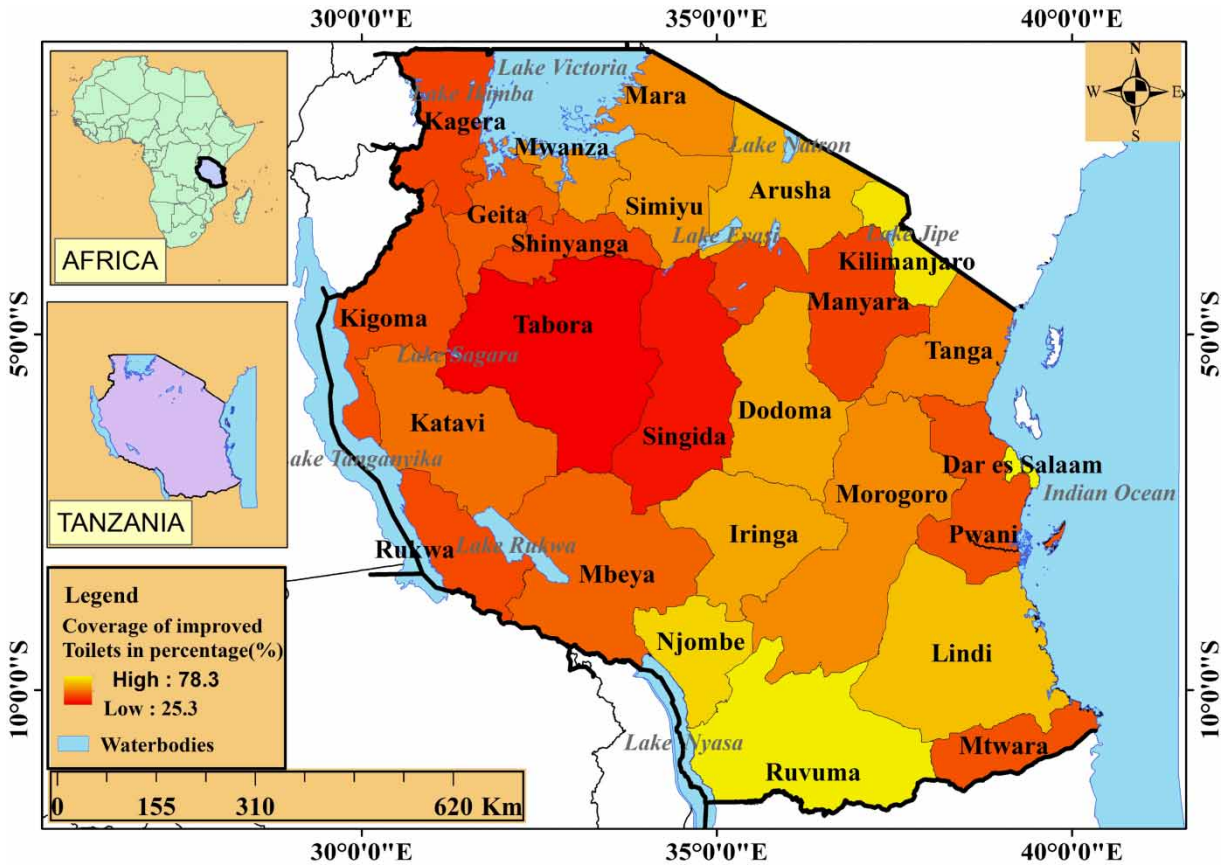

Figure 1 | Map of Tanzania showing regions in which the study was carried out.

of households, or any adult individuals at the household, using questionnaires. Five sets of questionnaires were designed to collect data for the study. These were at regional, council, village and household level, with one questionnaire that collected vital statistics. However, this paper analyzed data from the household survey questionnaire. At the household level, the questionnaire included items such as tenure status of the main household, main floor material, wall and roofing material, main source of drinking water during rainy and dry seasons, and measures taken by the household to ensure that the collected water was safe for drinking. At each selected household, interviews with the target respondents were complemented by observations of sanitation and hygiene facilities using a checklist that was appended at the end of each household level questionnaire. The questionnaires were designed in English while the interviews were conducted in Kiswahili. However, because of time constraints, no translation into Kiswahili was performed. Therefore, in order to ensure that the entire research team had a common understanding of the objectives and scope of the evaluation, a 1-day intensive training session that involved a question-by-question review was carried out at the Ministry's headquarters in Dar es Salaam.

Data collection was carried out by experienced personnel from various institutions in collaboration with regional and district health officers in each region and council, respectively. For example, participants were from the President's Office – Regional Administration and Local Government, Ministry of Water and Irrigation, Ministry of Education, Science and Technology and MoHCDGEC. Participants also came from higher learning institutions. At the village level, identification of selected households was carried out with the help of village health workers.

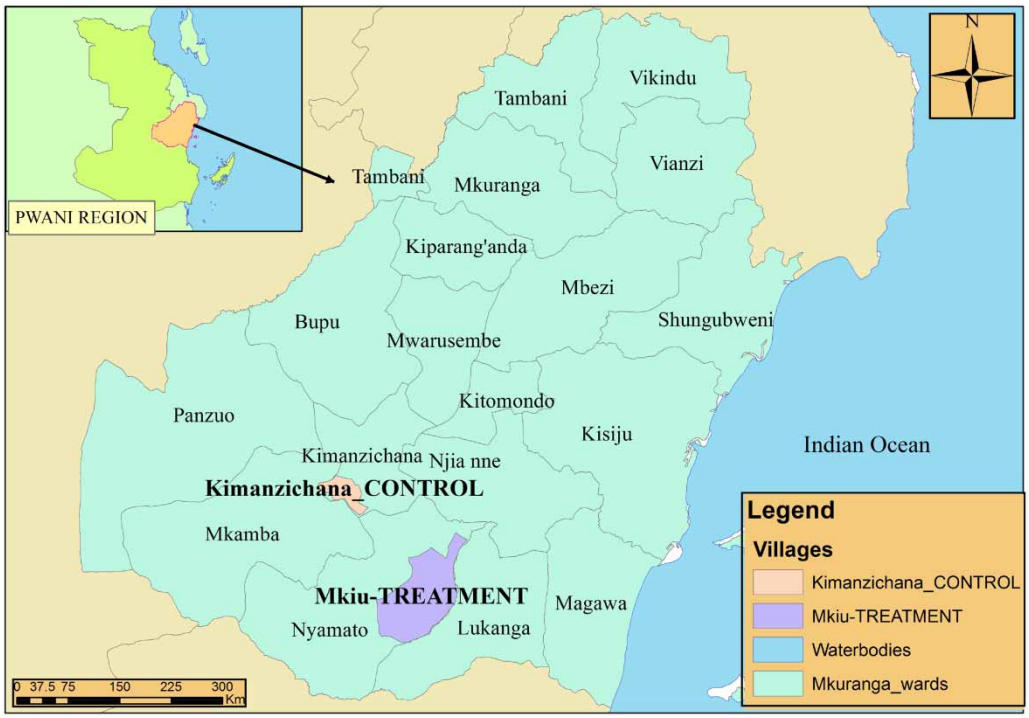

Figure 2 | Map of Mkuranga District Council in Pwani region showing control and treatment villages.

Ethical considerations

In each region, permission to conduct the study was sought through the Regional Administrative Secretariat who then informed the respective sub-regional authorities (councils, wards and villages). At the household level, each participant was informed about the objectives of the evaluation and the methods to be used for collection of the required data, that participation in the study was entirely voluntary, and that respondents were free to withdraw from the study at any time if they wished to do so for any reason. Moreover, respondents were told that the data would be treated confidentially and that no personal attributes would be revealed anywhere in any media. Respondents who freely chose to take part in the study gave oral informed consent.

Data management

The collected data were entered into the Statistical Package for the Social Sciences (SPSS) software version 16.0 by seven experienced data entry clerks for 6 days. Each data entry clerk entered data for specific regions, thereafter the separate files were merged. To check for accuracy of data entry, cross-tabulation of variables using the merged file was done.

Data analysis

The data were analyzed descriptively through estimation of frequencies and percentages as well as mean and standard deviation. According to the Tanzania Human Development Report (THDR 2015), gross domestic product (GDP) per capita represents the average resources available to each individual in the population. Therefore, in order to gain an understanding of the extent to which regional GDP per capita measured in Tanzania Shillings (TZS) was correlated with percentage coverage of improved toilets in each region, a correlation analysis was performed. However, five regions had no GDP per capita values. Accordingly, the correlation analysis involved only 21 regions which had complete information on both variables. Furthermore, the chi-square test of independence at the 5% levels of significance was carried out for certain variables.

In order to establish which variable(s) were associated with the presence of an improved latrine at the household, a model-based analytical approach was employed. The dependent variable was the presence of an improved latrine (equal to 1 if the latrine was improved based on JMP classification, and 0 if the latrine was a traditional pit latrine). Consequently, the analysis in this case considered a subsample of the total households in the study. That is, the analysis did not consider households which had no latrines. Since the outcome variable takes on only two values (0 and 1), a logistic regression model of the form $\text{logit}(\pi) = \alpha + \beta X + \varepsilon$ (cf. Maddala 1983; Agresti 1996; Hosmer & Lemeshow 2000) was fitted to the data. Where π is the probability of having an improved latrine given a set of explanatory variables represented by X, β is a vector of unknown regression parameters to be estimated and which measure the extent of association of different characteristics with the outcome variable, and ε is the error term. The dependent variable was modeled with a set of categorical variables, namely ownership of the house, floor material of the house, wall material of the house, and roofing material of the house. These were used as proxies of economic status of the household. Consistent with previous studies (e.g. Msisha *et al.* 2008), the educational attainment of the head of the household was categorized into three main groups: no education, primary education, secondary education and above. Since the social environment in which the individual lives is likely to affect his/her perception about something, as observed earlier by Subedi (1989), contextual variables such as years the respondent has lived in the village and whether he/she has heard about the campaign through community events were included in the model. Place of residence is often considered to be an important indicator of socio-economic status, especially in less developed economies (Msisha *et al.* 2008). To estimate geographic differentials in the possession of improved latrines, regions in Mainland Tanzania (as shown in Figure 1) were divided into eight geographic zones (regions) as follows: Western zone (Tabora, Kigoma); Northern zone (Kilimanjaro, Tanga, Arusha); Central zone (Dodoma, Singida, Manyara); Southern Highlands zone (Iringa, Njombe, Ruvuma); Southern zone (Lindi, Mtwara); South West Highlands zone (Mbeya, Rukwa, Katavi, Songwe); Lake zone (Kagera, Mwanza, Geita, Mara, Simiyu, Shinyanga); and Eastern zone (Dar es Salaam, Pwani, Morogoro).

RESULTS

Descriptive statistics of study areas

Of the total 289 villages studied, 146 (50.5%) were intervention while 143 (49.5%) were control villages, yielding a response rate of about 98% (289 out of the expected 296 villages from the total 148 councils visited). Meanwhile, of the total households (2,875) that were visited during the evaluation mission, 1,448 (50.4%) were from the campaign while the remaining 1,427 (49.6%) were not under the campaign at the time of execution of the evaluation study. Overall, approximately 111 households were visited in each region that was considered in the evaluation, while in each village an average of 10 households were visited during the course of the evaluation period. However, on average, there was no difference in the number of households visited between the intervention and control villages: 9.9 households in the intervention villages vs. 10.0 households in the control villages.

Table 1 presents descriptive statistics of the study villages (under campaign and not under campaign villages) at the time of execution of the study. As is evident from the table, generally the two categories of villages show similar characteristics. However, measures in place to ensure the quality of drinking water were highly significantly dependent on the status of the village ($p < 0.001$). In particular, households from the campaign villages were more likely to report having measures to ensure safety of drinking water than households from villages which were not under the campaign: 843 (58.2%) of the households in campaign villages against 645 (44.5%) of the households from non-campaign villages. The most frequently reported measure was boiling, which was reported by 706 (83.7%) of the households from the intervention villages and 533 (82.6%) of the households from the control villages (Table 1).

Coverage of toilets

Of the total households studied, 2,724 (94.7%) had a toilet of any form and the remaining households 151 (5.3%) had no form of a toilet. Households without any form of toilet were mostly from the control villages as compared to those from

Table 1 | Characteristics of study villages: selected variables

	Village status		
Variable	**Intervention *n* (%)**	**Control *n* (%)**	**Combined *n* (%)**
Tenure status of main house			
Owner	1,271 (87.8)	1,265 (88.6)	2,536 (88.2)
Employer-provided (subsidized)	2 (0.1)	4 (0.3)	6 (0.2)
Employer-provided (free)	5 (0.3)	10 (0.7)	15 (0.5)
Rented	143 (9.9)	119 (8.3)	262 (9.1)
Free of charge	25 (1.7)	28 (2.0)	53 (1.8)
Nomads	2 (0.1)	1 (0.1)	3 (0.1)
Floor material of main house			
Earth, sand, dung	493 (34.0)	723 (50.7)	1,216 (42.3)
Wood planks, bamboo	15 (1.0)	23 (1.6)	38 (1.3)
Parquet or polished wood	2 (0.1)	3 (0.2)	5 (0.2)
Vinyl or asphalt strips	6 (0.4)	2 (0.1)	8 (0.3)
Ceramic tiles, terrazzo	40 (2.8)	28 (2.0)	68 (2.4)
Cement	887 (61.3)	645 (45.2)	1,532 (53.3)
Carpet	2 (0.1)	1 (0.1)	3 (0.1)
Other	3 (0.2)	2 (0.1)	5 (0.2)
Wall material of main house			
Grass	12 (0.8)	10 (0.7)	22 (0.8)
Poles and mud	181 (12.5)	301 (21.1)	482 (16.8)
Sun-dried bricks	266 (18.4)	296 (20.7)	562 (19.5)
Baked/Burnt bricks	712 (49.2)	633 (44.4)	1,345 (46.8)
Cement blocks	256 (17.7)	172 (12.1)	428 (14.9)
Stones	11 (0.8)	4 (0.3)	15 (0.5)
Other	10 (0.7)	11 (0.8)	21 (0.7)
Main roofing material of main house			
Grass/Thatch/Mud	135 (9.3)	238 (16.7)	373 (13.0)
Iron sheet	1,305 (90.1)	1,184 (83.0)	2,489 (86.6)
Tiles	4 (0.3)	2 (0.1)	6 (0.2)
Concrete	1 (0.1)	0 (0.0)	1 (0.0)
Other	3 (0.2)	3 (0.2)	6 (0.2)
Households takes measures to ensure safety of drinking water			
Yes	843 (58.2)	645 (44.5)	1,488 (51.8)
No	597 (41.2)	768 (53.0)	1,365 (47.5)
Not sure	8 (0.6)	14 (1.0)	22 (0.8)
Measures taken to ensure safety of drinking water	$n = 843$	$n = 645$	$n = 1,488$
Boiling	706 (83.7)	533 (82.6)	1,239 (83.3)
Use water filter	26 (3.1)	29 (4.5)	55 (3.7)
Strain through a cloth	46 (5.5)	44 (6.8)	90 (6.0)
Treat with chemicals (e.g. water guard)	57 (6.8)	32 (5.0)	89 (6.0)
Use bottled water	1 (0.1)	4 (0.6)	5 (0.3)
Other	7 (0.8)	3 (0.5)	10 (0.7)

the intervention villages: 100 (7.0%) of the households from the control villages against 51 (3.5%) of the households from the intervention villages.

When the results on households without any form of toilet (combined for both intervention and control villages) were disaggregated by region, it was revealed that Morogoro, Manyara, Mara, Lindi and Arusha had the highest proportions of households without any form of toilet (Figure 3). This means that a great proportion of households in these regions either shared toilets with their neighbours or practiced open defecation. Then again, for the sample of households considered in both intervention and control villages, it was revealed that there were no households that were practicing open defecation in Dar es Salaam and Rukwa regions. Iringa, Njombe, Ruvama, Simiyu and Katavi had the lowest proportions of households without any form of toilet (Figure 3).

In terms of types of sanitation facilities observed in the villages, the results show that traditional pit latrines were predominant in most villages. As Figure 4 shows, traditional pit latrines accounted for more than one-third, 1,292 (47.4%), of the total households which had any form of toilet, followed by the pour flush type, which accounted for 593 (21.8%) of the total households with any form of toilet. Improved traditional pit latrines and ventilated improved pit latrines respectively were observed in 561 (20.6%) and 271 (9.9%) of the total households with a toilet in the study. The results show further that less than 1% (0.3%) of the households with a toilet were found to have an Ecosan type of toilet.

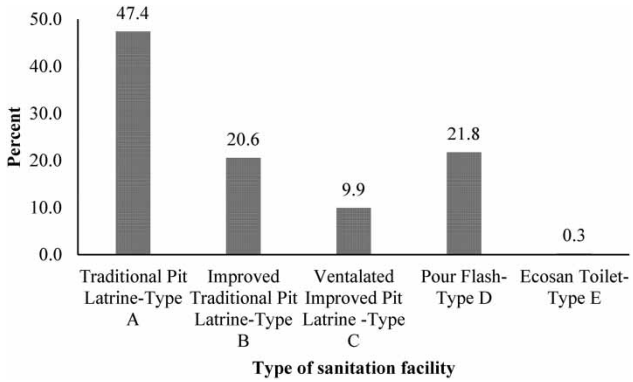

Figure 4 | Percentage coverage of toilets in the study.

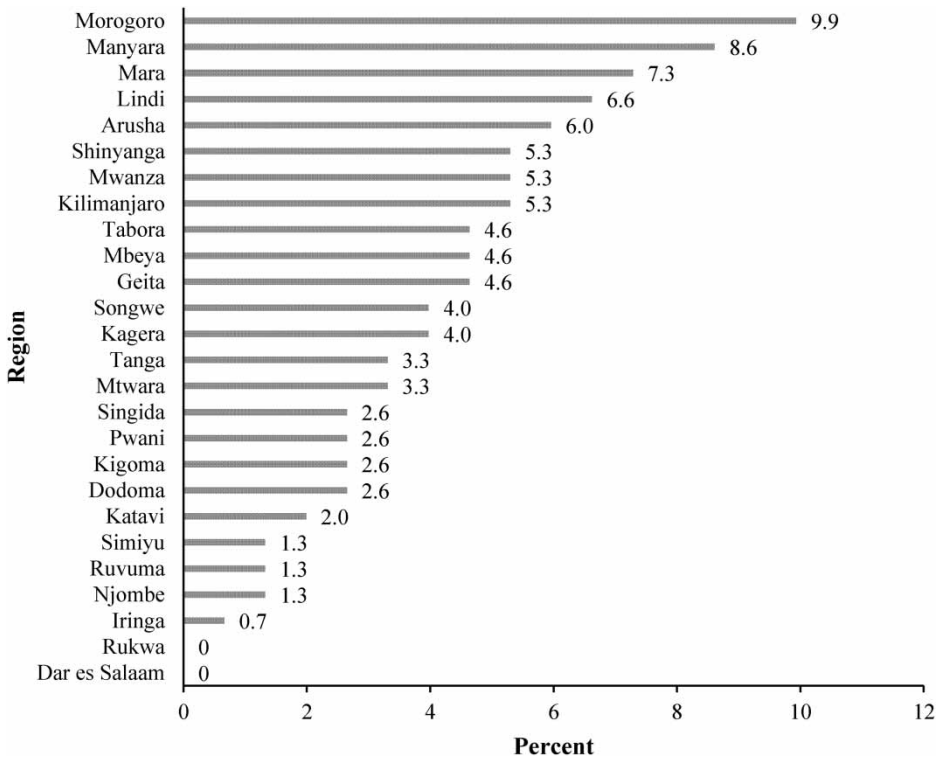

Figure 3 | Regional differentials in proportion of households without any form of toilet.

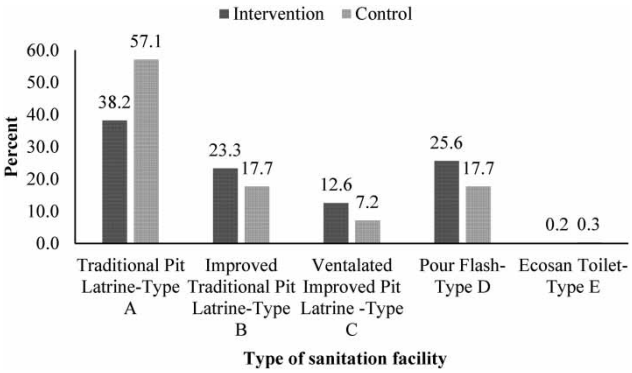

Figure 5 | Percentage coverage of sanitation facilities by village status.

Comparison of type of toilets in intervention and control villages

When the results on types of sanitation facilities were disaggregated by village status (intervention or control), some important differences were observed. For example, it was found that traditional pit latrines were more common in the control villages as compared to villages which were under the campaign: 758 (57.1%) for households in the control villages vs. 534 (38.2%) for households in the intervention villages (Figure 5). In terms of improved sanitation facilities, the findings reveal that the coverage of improved toilets was higher in the intervention villages compared to the control villages: 863 (62.0%) intervention villages against 569 (43.0%) control villages. Considering specific types of toilets, it was found that the coverage of sanitation facilities was consistently higher in the intervention villages than it was in the control villages except for the Ecosan type, which was found to be slightly less in the intervention villages (0.2%) compared to the control villages (0.3%). In particular, pour flush type of toilets, followed by improved pit latrines, were more frequently observed in the intervention villages than they were in the control villages (Figure 5).

A comparison of improved latrines by region was carried out. In this respect, the results show that there were also some notable regional differentials. As Figure 6 shows, Dar es Salaam, Ruvuma, Kilimanjaro, and Njombe ranked as the top four regions in terms of coverage of improved toilets with households in Dar es Salaam region being more likely to have improved latrines. On the other hand, Tabora, Singida, Kagera, and Manyara regions were the last four in terms of coverage of improved toilets with

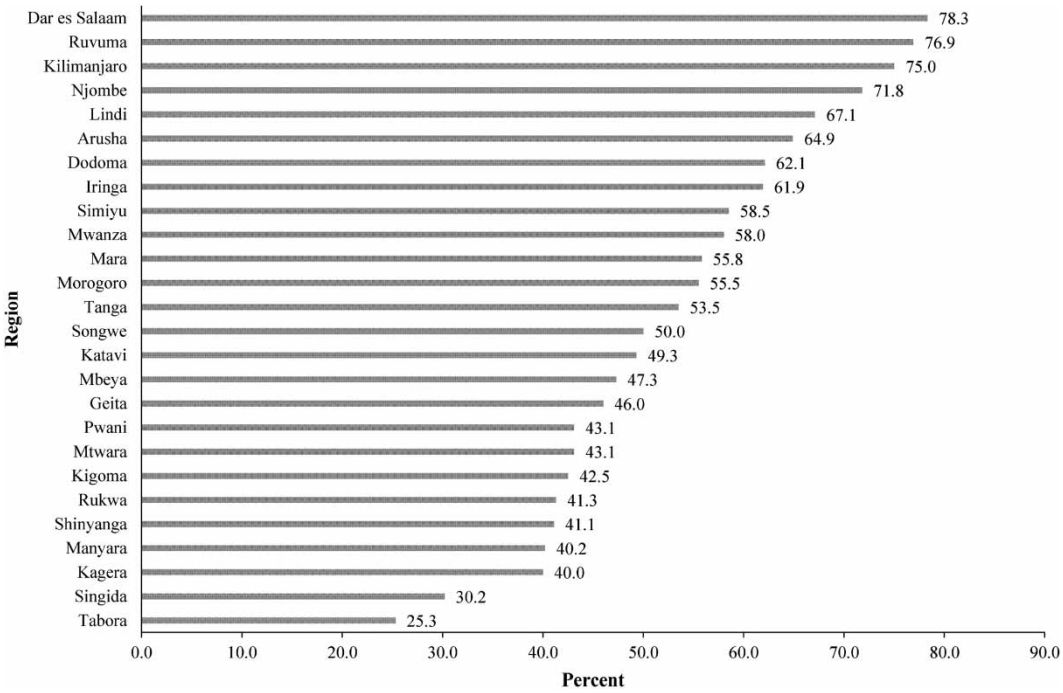

Figure 6 | Regional differences in coverage of improved toilets.

households in Tabora being less likely to have an improved type of toilet (Figure 6).

Factors associated with households' access to improved sanitation facility

Table 2 provides the results of testing for association between type of latrine and some individual, household and community attributes in the study. As seen from the table, ownership of a house, type of floor, wall and roofing materials used, education level of the head of household, and whether the respondent had heard about the campaign through community events and geographical position (zone) of the region in which the household was located were statistically significantly associated with the type of latrine ($p < 0.01$). Specifically, individuals in rented dwellings, houses built of permanent materials (floor, wall and roof) and in households in which the head had secondary and above level of education were more likely to have improved types of latrines than their counterparts. Furthermore, individuals who reported to have heard about the campaign through community events (such as triggering meetings), as well as those who lived in the southern highlands, northern and eastern parts of the country, were more likely to have improved type of latrines (Table 2).

Table 3 provides the logistic regression analysis results for the probability of improved latrine (that is, the event thinsp;= '1'). From the table, parameter estimates for most of the variables are statistically significant. The parameter estimates for proxies of households' economic status (measured by floor, wall and roof constructed using durable materials) are positive, suggesting that well-off individuals were more likely to improve their latrines than their poor counterparts, adjusting for the other variables in the model. The parameter estimate for education level is also positive, suggesting that highly educated heads of

Table 2 | Association between type of latrine and some variables across villages in the study

		Category of latrine				
Variable	**Response category**	**Improved; *n* (%) 1,432 (52.6)**	**Unimproved; *n* (%) 1,292 (47.4)**	**Combined ($n = 2,724$)**	**χ^2 value (DF)**	***P*-value**
Ownership of a house	Do not own the house	192 (59.6)	130 (40.4)	322	7.3 (1)	0.007***
	Owns the house	1,240 (51.6)	1,162 (48.4)	2,402		
Floor material of a house	Earth/sand/mud	313 (28.2)	795 (71.8)	1,108	443.1	0.000***
	Permanent material	1,119 (69.2)	497 (30.8)	1,616	(1)	
Wall material of a house	Grass/poles/mud	126 (27.5)	333 (72.5)	459	139.7	0.000***
	Permanent material	1,306 (57.7)	959 (42.3)	2,265	(1)	
Roofing material of a house	Grass/thatch/mud	73 (22.7)	248 (77.3)	321	129.8	0.000***
	Permanent material	1,359 (56.6)	1,044 (43.4)	2,403	(1)	
Years in the village	0–5 years	373 (55.2)	303 (44.8)	676	2.5 (1)	0.117
	6+ years	1,059 (51.7)	989 (48.3)	2,048		
Education level of head of household	No education	165 (33.5)	327 (66.5)	492	182.3	0.000***
	Primary education	879 (51.1)	840 (48.7)	1,719	(2)	
	Secondary and above	388 (75.6)	125 (24.4)	513		
Heard about the National Sanitation Campaign through community events	No	655 (48.2)	703 (51.8)	1,358	20.4	0.000***
	Yes	777 (56.9)	589 (43.1)	1,366	(1)	
Geographical location (zone)	Western	78 (35.9)	139 (64.1)	217		
	Northern	254 (63.8)	144 (36.2)	398		
	Central	119 (41.2)	170 (58.8)	289		
	Southern Highlands	199 (70.3)	84 (29.7)	283	102.9	0.000***
	Southern	78 (54.9)	64 (45.1)	142	(7)	
	South West Highlands	141 (46.7)	161 (53.3)	302		
	Lake	375 (49.8)	378 (50.2)	753		
	Eastern	188 (55.3)	152 (44.7)	340		

***Significant at <0.01.

Table 3 | Logistic regression model on household ownership of an improved latrine, $n = 2,724$

Parameter	Estimate (S.E)	Wald	DF	exp (β)	95% C.I. for exp (β)	*P*-value
Intercept	−3.074 (0.286)	115.849	1	0.046		0.000***
Ownership of a house						
Do not own the house	Ref.					
Owns the house	0.122 (0.141)	0.750	1	1.130	(0.857, 1.491)	0.386
Floor material of a house						
Earth/sand/dung	Ref.					
Permanent materials	1.252 (0.097)	166.129	1	3.496	(2.890, 4.228)	0.000***
Wall material of a house						
Grass/poles/mud	Ref.					
Permanent materials	0.910 (0.144)	39.853	1	2.484	(1.872, 3.294)	0.000***
Roofing material of a house						
Grass/thatch/mud	Ref.					
Permanent materials	0.514 (0.160)	10.277	1	1.671	(1.221, 2.288)	0.001***
Years in the village						
0–5 years	Ref.					
6+ years	–0.120 (0.110)	1.196	1	0.887	(0.715, 1.100)	0.274
Education level of respondent						
No education	Ref.					
Primary education	0.408 (0.119)	11.717	1	1.504	(1.190, 1.899)	0.001***
Secondary and above	1.210 (0.156)	60.163	1	3.355	(2.471, 4.556)	0.000***
Heard about the campaign						
No	Ref.					
Yes	0.298 (0.090)	11.105	1	1.348	(1.131, 1.606)	0.001***
Geographical location (zone)						
Western	Ref.					
Northern	1.287 (0.205)	39.246	1	3.623	(2.422, 5.419)	0.000***
Central	0.018 (0.203)	0.007	1	1.018	(0.683, 1.516)	0.931
Southern Highlands	1.018 (0.210)	23.600	1	2.769	(1.836, 4.175)	0.000***
Southern	0.588 (0.253)	5.394	1	1.801	(1.096, 2.959)	0.020**
South West Highlands	0.244 (0.202)	1.449	1	1.276	(0.858, 1.898)	0.229
Lake	0.414 (0.176)	5.555	1	1.513	(1.072, 2.134)	0.018**
Eastern	0.933 (0.205)	20.673	1	2.541	(1.700, 3.799)	0.000***

***Significant at <0.01, **significant at <0.05.

households were more likely to improve their latrines, adjusting for the other variables in the model. Furthermore, knowledge about the campaign and geographical location of the region in which the household was located within the country are positive, suggesting an increased probability of having an improved type of latrine after adjusting for other variables. Regarding geographical location, relative to individuals from the western zone, those from the northern, southern highlands and eastern zones were more likely to improve their latrines (Table 3).

Analysis of data on GDP revealed that regional GDP per capita (000 TZS) was on average (SD) about 995.27

(281.72), and ranged from 608.65 to 1,734.84 TZS. The top five regions (value) in terms of GDP per capita (000 TZS) were Dar es Salaam (1,734.84), Iringa (1,428.24), Arusha (1,258.33), Ruvuma (1,237.97), and Kilimanjaro (1,237.76). On the other hand, regions with the lowest values of GDP per capita were Kigoma (608.65), Singida (625.97), Dodoma (665.18), Kagera (716.21), and Pwani (752.19). Correlation analysis results show that regional GDP per capita and percentage of households with improved toilets were positively and significantly ($p = 0.001$) correlated as Figure 7 shows.

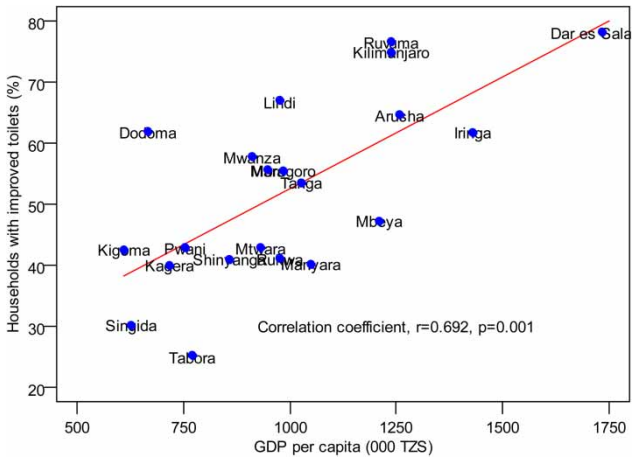

Figure 7 | Scatterplot matrix of proportion of households with improved type of toilet and regional GDP per capita.

Availability of hand washing facilities

On this aspect, the results show that of the total 2,724 households which were found to have a toilet, less than one-third, 864 (31.8%) were observed to have a designated place for hand washing with soap after use of a toilet. About two-thirds, 1,773 (65.1%) of the households which had a toilet were found to have no specific places for hand washing with soap. It was observed further that 386 (14.2%) of the households with a toilet had a mobile bucket or basin. About 10% ($n = 252$, 9.3%) of the households had a tippy tap while only 77 households had a sink with a tap (about 3.0%). Observation of the hand washing facility was not possible in about 3.2% of the total households with a toilet.

A comparison between intervention and control villages revealed that hand washing facilities were more likely to be found in the former villages than in the latter ones. This is depicted in Figure 8 in which it is shown that the proportions of households without hand washing facilities in the intervention and control villages were 57.3 and 73.3%, respectively. Moreover, the proportion of households which had a sink with a tap were 3.7% in the intervention villages against 2.0% in the control villages. Tippy taps were available in 14.1% of the households in the intervention villages compared to only 4.1% of those in the control villages. Additionally, fixed basins were found to be available more frequently in the intervention villages than was

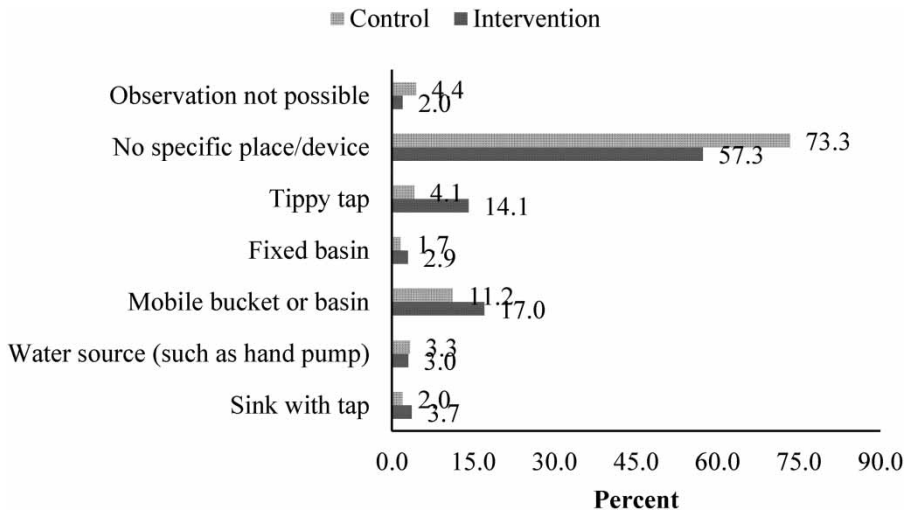

Figure 8 | Status of hand washing facilities between intervention and control villages.

the case in the control villages: 2.9% in the intervention villages against 1.7% in the control villages. Mobile buckets or basins were also more likely to be found in the intervention villages (17.0%) as compared to the control villages (11.2%). However, water sources such as hand pumps were somewhat more frequently available in the control villages than in the intervention villages: 3.3% in the control villages against 3.0% in the intervention villages (Figure 8).

Cross-tabulation of type of toilet against availability of hand washing facilities revealed the existence of a positive trend between the two attributes. For example, traditional pit latrines were more likely (76.5%) to have no specific places/devices for hand washing after use of a toilet compared to other types of toilets (Table 4). Individuals with an ecosan type of toilet were less likely to have no place for hand washing (14.3%). Mobile buckets or basins for hand washing after use of a toilet were available in 9.0% of the households with a traditional pit latrine type, 15.2% of the households with an improved traditional pit latrine, 19.9% of the households with a ventilated improved pit latrine, 21.8% of the households with pour flush toilet and 28.6% of the households with an ecosan type of toilet. Overall, households with better toilets appear to have better hand washing facilities (Table 4).

DISCUSSION

The purpose of analyzing the data in this paper was to establish whether or not households from villages which were implementing the campaign had a large proportion of coverage of improved toilets compared to households from villages which were not under the campaign. Furthermore, the analysis aimed at determining variables that are associated with improved sanitation facilities in the study areas. This study provides important evidence in the areas of sanitation and hygiene in Tanzania. It gives highlights on the achievements made in relation to the coverage of improved sanitation and hygiene facilities in the country. One issue is worth mentioning in this section. The study involved a cross-sectional sample design, having no randomization of the villages to either the intervention or control groups at the start of the campaign. It is therefore likely that the observed difference in coverage of improved latrine between the intervention and control villages is due to several unobserved factors that were not captured in the study. Therefore, because of the cross-sectional sample design used in the present study, cause-and-effect relationships between the observed coverage of improved latrines and the campaign were not estimated in this study. Notwithstanding this limitation, it is practical to discuss the results of this study in the light of a plethora of randomized controlled trials conducted in many settings (for example Patil *et al.* 2013; Clasen *et al.* 2014; Freeman *et al.* 2016), which have demonstrated the existence of significant impacts of rural sanitation promotion programmes in intervention areas relative to control groups.

In this study, households from the campaign and those from the control villages displayed similar general characteristics. However, households from the campaign villages

Table 4 | Association between availability of hand washing facility and type of toilet

	Type of toilet					
Hand-washing facility	**Traditional pit latrine – Type A**	**Improved traditional pit latrine – Type B**	**Ventilated improved pit latrine – Type C**	**Pour flash – Type D**	**Ecosan toilet – Type E**	**Total**
Sink with tap	3	13	4	53	4	77
Water source (such as hand pump)	34	16	21	15	0	86
Mobile bucket or basin	116	85	54	129	2	386
Fixed basin	14	12	9	28	0	63
Tippy tap	79	63	42	68	0	252
No specific place/device	989	354	140	289	1	1,773
Observation not possible	57	18	1	11	0	87
Total	**1,292**	**561**	**271**	**593**	**7**	**2,724**

were observed to perform somewhat better in many aspects related to water, sanitation and hygiene, including the practice of treating drinking water. Households from the campaign villages and those not from the campaign villages were observed to have similar sources of drinking water, but individuals from the former villages were more likely to treat their drinking water compared to individuals in households from the latter villages. This could be one of the consequential benefits of the campaign. This is consistent with similar studies such as Freeman *et al.* (2016) who found households in the intervention group were about 3.4 times likely to practice safe disposal of child feces than households in the control group.

Findings from the present study show some improvements from the results obtained from other nationally representative studies. For example, results from the 2012 Population and Housing Census show that 89.2% of the total rural population in Tanzania Mainland had a form of toilet facility (NBS & OCGS 2014). This value is smaller than the one obtained in our study (94.7%). The difference in coverage demonstrates that the need for improved sanitation facilities is on the increase in rural areas.

In terms of access to improved sanitation facilities, the situation reported in 2012 is significantly different from that reported in the present study whereby it has been demonstrated that the overall coverage of improved sanitation is found to be 52.6%. The impact of the campaign is apparent as a great proportion of households in the intervention villages (62%) seemed to have improved forms of toilets compared to those in the control villages (43%). The pour flush type of toilets appear to be more common, probably due to increased access to water. The 2011–2012 household budget survey showed, for example, that 84 and 71% of the households were within 1 km to drinking water sources during rainy and dry seasons, respectively (NBS 2013).

In 2012 when the campaign began, access rates for any type of a toilet in rural and urban areas were 84 and 97%, respectively, while the national coverage was 87%. On the other hand, the coverage of improved forms of toilets was 7% in the rural area and 25% in the urban area while the national coverage of improved form of toilets was 12% (WHO & UNICEF 2014). These statistics show that even before the campaign in 2012, the access rate for any form of a toilet in the rural area was high (over 80%). The challenge was creating access to improved toilet facilities, which was as low as 7%. Other studies conducted in rural Tanzania in the period 2011–2012 found a coverage of over 90% for any type of toilet. For example, a study conducted in rural Morogoro found an access rate of 96% (Seleman & Bhat 2016). The high access rate (43.0%) of improved toilets in the control villages found in the present study may be due to a spillover effect because some actions such as advocacy or sensitization that were taken by leaders at the council and ward levels in the campaign areas and nationwide events possibly reached leaders at the ward level in the non-campaign villages.

The findings on hand washing facilities observed in our study are not contrary to our prior expectation as other studies have also made similar findings. For example, Karn *et al.* (2012) found that 90% of the respondents had high sanitation knowledge, but less than two-thirds of them were using soap water for hand washing. Similar findings were reported in rural Tanzania by Briceño *et al.* (2015) who found minimal changes in hand washing behavior related to food preparation and no improvement in other important hand washing aspects.

Correlation analysis between regional GDP per capita and regional rate of improved toilets revealed a fairly moderate positive correlation between the two variables. This suggests that individuals who live in more affluent regions are more likely to improve their sanitation facilities than those who live in poor regions. THDR (2015) shows that regions with the highest GDP per capita are also the ones with the highest level of human development. This demonstrates further that income growth is indeed an essential means for development.

Logistic regression analysis of the data in the present study confirmed this evidence as economic status of the household; education level and geographical location of the household were among the most important correlates of improved sanitation facility. Results from process evaluation of the National Sanitation Campaign that was conducted in 14 regions in 2014 found similar evidence of regional disparities in coverage of improved latrines. According to SHARE (n.d), the estimates of improved sanitation facilities ranged from a minimum of 4.2% (95% CI: 1.3–12.9) in Newala district (Southern zone) to a maximum of 89.6% (95% CI: 78.0–95.4) in Njombe district (Southern

Highland zone). A study conducted to provide an understanding of factors affecting the utilization of ventilated improved pit latrines among communities in Mtwara Rural District, Tanzania, found that 50.5% of the households had a ventilated improved pit latrine (Kema *et al.* 2012). Factors associated with access to an improved ventilated latrine include income, whereby households with earnings of more than TZS 50,000 were two times more likely to own an improved latrine than their counterparts who earned less than that amount. The sex of the head of household was also associated with access to an improved ventilated latrine, whereby the probability of possessing an improved latrine was reduced by more than 60% for female-headed households.

Studies conducted in other countries show similar findings. For example, a study conducted to estimate determinants and inequalities in access to improved water sources and sanitation among the Zambian households found that access to improved water and sanitation was high among the better-off individuals and increased with increasing wealth quintile in both rural and urban areas (Mulenga *et al.* 2017). Moreover, Mulenga *et al.* (2017) found a positive association between access to improved sanitation and each of the variables wealth index, gender of household head, region and type of place of residence. Similar findings were observed in a study about socioeconomic factors affecting households' sanitation preferences in Akure, Nigeria (Rotowa *et al.* 2015). Specifically, Rotowa *et al.* (2015) found that all socioeconomic factors, except gender of head of household, were significantly associated with the type of sanitation facilities used by households in the study area. Abubakar (2017) conducted a study on access to sanitation facilities among Nigerian households focusing on determinants and implications for sustainability. The author revealed the existence of significant associations between type of sanitation facility households used and several variables including place of residence, geopolitical zone, ethnicity, educational attainment and wealth. A study in one region in Vietnam found that individuals in the highest wealth quintile were about 42 times more likely to have access to both improved water and sanitation facilities than their poor counterparts (Tuyet-Hanh *et al.* 2016).

In the present study, villages which were enrolled in the campaign had similar characteristics to those which were not enrolled. Key features include lowest sanitation coverage and high prevalence of diarrheal diseases including cholera. Also, the possibility of the village having a water scheme in the near future was an added value in the selection of the village. The consideration of the possibility of a water scheme was due to the fact that sanitation helps to make the environment clean, therefore the chances of polluting water sources whenever villages have attained open-defecation free status are minimized. Besides factors that are distributed along the socio-economic hierarchy, the coverage of improved toilets observed in the present study is likely to have been facilitated by the use of CLTS under the campaign to create demand for improved sanitation facilities, but also to ensure supply of sanitation and hygiene materials through sanitation marketing, which involved training of artisans on the construction of improved toilets and ensuring the supply of materials.

Although there appears to be a positive correlation between GDP per capita and regional rate of improved toilets, it has been noted that in matters of health not all socioeconomic status-related inequalities in health favor individuals of the higher socioeconomic status strata (Victora 2007). In the present study, despite high rates of ownership of improved latrines, relatively low rates of good practice such as availability of hand washing facilities are reported. The low practices may not necessarily be due to failure of CLTS to elicit behavior change on hand washing, but a critical shortage of water in some villages. Access to water supply is a key determinant to hand washing practices. In Tanzania, access to water supply in rural areas stands at 56% (NBS & OCGS 2015). These data show that water scarcity is not uncommon in most parts of Tanzania. Therefore, despite efforts taken to trigger a change of behavior and practices regarding hand washing, the shortage of water would explain the low levels of hand washing.

CONCLUSIONS

The need for construction of improved sanitation facilities is on the increase in rural areas in Tanzania with the majority of households opting for pour flush latrines. Evidence from the current study shows the potential for Tanzania to increase the improvement of sanitation and hygiene

facilities in rural areas in line with national and global targets, including addressing SDGs 3 and 6. However, more strategic approaches and investments are required to ensure that the extent of increase in the proportion of households with improved toilets matches with that of accessibility and use of hand washing facilities in rural Tanzania. Further studies are needed to ascertain the impact of the observed coverage of improved toilets in terms of reduction of morbidity and mortality among vulnerable groups. Further studies that would allow estimation of cause-and-effect relationships and hence draw definite conclusions about the impact of the National Sanitation Campaign on scaling up rural sanitation in Tanzania are also needed.

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