

Original Research Article

Predictors of the resurgence and sustainability of open defecation-free status among adult residents in Kibwezi East Sub County, Makueni County, Kenya

Joshua M. Mutuku*, Joseph Juma, Bibianne W. Aidi

Department of Epidemiology and Biostatistics, Mount Kenya University, Kenya

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*Correspondence:

Joshua M. Mutuku,

E-mail: joshuamutuku45@gmail.com

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ABSTRACT

Background: Worldwide, 2.4 billion persons lack improved sanitation and practice open defecation. In Kenya, about 14% of its population defecates in the open and the country loses over \$324 million a year due to poor sanitation. The study focused on establishing infrastructural factors influencing the resurgence and sustainability of open-defecation-free status among adult residents in Kibwezi East Sub-County of Makueni County, Kenya.

Methods: The study employed purposeful, cluster, proportionate, simple random sampling and descriptive cross-sectional design. Participants included residents aged 18 or older, who lived in the area at least two years. Chi-square tests at $p \leq 0.05$ examined relationships between independent and dependent variables.

Results: Majority of respondents were Christian (98.8%), with 52.9% completing primary education. Most were female (68.6%), married (89.1%), and averaged 48.40 years. Education at or below primary level increased the likelihood of not sustaining ODF practices ($uOR=1.567$, 95% CI: 1.061-2.315, $p=0.024$). Sanitary facilities were often within 10-50 m (59.5%), with a median walk time of 3.0 min. ODF sustainability was less likely without user-friendly facilities ($uOR=2.47$, $p<0.001$) and with roofless toilets ($uOR=0.355$, $p<0.001$). Longer walking times (>3 min) reduced ODF sustainability ($uOR=0.341$, $p<0.001$). Absence of designated open defecation sites increased ODF odds by 1.669 times ($UOR=1.669$, $p<0.001$), and odor-free toilets enhanced sustainability ($UOR=1.287$, $p=0.030$).

Conclusions: The results highlight the significance of socio-demographic factors, including education levels, and infrastructural in maintaining ODF status.

Key words: Resurgence, Sustainability, Open defecation, Open defecation free, Adult residents

INTRODUCTION

Reduced soil worms, cholera, diarrhea, trachoma, and malnutrition are some public health advantages associated with increased sanitation access.¹ Despite its well-known advantages, effective excreta disposal remains a challenge, particularly in attaining universal coverage of the dispersed rural populations that characterize most people in middle- and low- income countries.² Worldwide, 2.4 billion inhabitants have limited access to better sanitation, thus posing a

challenge to sustaining open defecation-free status in villages.³ Eliminating open defecation and providing safe, affordable, and accessible sanitation for everyone everywhere are central tenets of Sustainable Development goal 6 (SDG 6).⁴ Research shows that adding latrines is not sufficient to reduce fecal-oral disease. Paramount indicators of ODF, such as toilet privacy, aperture covers, availability of facilities for handwashing with soap and water, and the absence of defecation sites, are non-negotiable in the effort to lowering the burden of these diseases. In Kenya, the

estimated open defecation rate is 14%. Some counties, such as Turkana, Wajir, and Samburu, have open defecation rates exceeding 70% (MoH, 2017). Out of the 3643 villages in Makueni County, 860, or 23.6%, are open-defecation-free. Most of the open-defecation-free villages (488) are located in Kibwezi East Sub-County. The sanitation data from a records review indicates that 48% of certified villages (235 out of 488) had reverted to an open defecation state.

Despite these concerning trends, it is noteworthy that no published study has documented them or attempted to describe the factors associated with this state in Makueni County. Therefore this study sought to determine the infrastructural factors influencing the resurgence and sustainability of open defecation free status among adult residents in Kibwezi East Sub County.

METHODS

The researcher used descriptive cross-sectional method for this investigation. This method works well for obtaining data to determine the relationship between independent and dependent variables. The participants in this study were adult residents of Kibwezi East Sub County, Makueni County, Kenya. The four wards that make up the Sub-County Mtito/Andei, Thange, Ivingoni/Nzambani and Masongaleni. Participants meeting the inclusion criteria were individuals aged 18 and above, residents in the area for over two years, and community health volunteers (CHVs) with a completed Form IV. Exclusion criteria comprised individuals under 18, non-residents, those residing in the area for less than two years, participants with mental illness, and household heads or participants who did not provide consent to the study.

There are 3643 villages in Makueni County and 18142 households in Kibwezi East Sub County. Due to the high number of ODF villages (57%, 488 out 860) in Makueni County and increased reversion rates to open defecation (48%, 235 out of 488), Kibwezi East Sub County was purposively sampled. Cluster sampling by considering each ward as a cluster was employed to get study villages, proportionate sampling was utilized to get study units (households), and a simple random by use of rafts was employed to select and gather information from 423 household heads from a population of 18,142 households.

Background characteristics (age, gender, marital status, religion and education level) and infrastructure factors were included as independent variables. The resurgence and sustainability of open defecation free status amongst Kibwezi East Sub County residents, Makueni County, Kenya, was the dependent variable. A questionnaire and observation checklists were utilized to collect information on background characteristics and factors linked with the resurgence and sustainability of open defecation free status amongst community members. A

pre-test was conducted among the residents of Kibwezi West Sub County to confirm its reliability. Data collection occurred during August 2023, spanning one month. The Chi-square test was used to look into the links between categorical variables (background and infrastructural factors) and the resurgence and sustainability of open defecation free status.

RESULTS

Background characteristics of the respondents

A total of 423 household heads were surveyed with a response rate of 100%. The socio-demographic profile of the participants is shown in the (Table 1).

Table 1: Socio-demographic characteristics of the residents.

Characteristics		N	%
Religion	Christian	418	98.8
	Muslim	3	0.7
	Hindu	0	0.0
	Others	2	0.5
	Total	423	100.0
Education level	None	23	5.4
	Primary	226	52.9
	Secondary	151	35.4
	College	27	6.3
	Total	427	100.0
Gender	Female	269	68.6
	Male	123	31.4
	Total	392	100.0
Marital status	Married	383	89.1
	Single	38	8.8
	Divorc.	2	0.5
	Separ.	2	0.5
	Cohab	1	0.2
	Others	4	0.9
	Total	430	100.0
Age; Min=20, Max=84, Range=64, Mean=48.40, Median=48, SD=13.35			
Outcome variables			
ODF sustainable	No	243	56.8
	Yes	185	43.2
	Total	428	100.0

Most respondents were Christians (98.8%), had completed primary education (52.9%), were female (68.6%), married (89.1%), and had an average age of 48.40 years. A Chi-square analysis was applied to examine the relationship of background features and the sustainability of open defecation free status among the residents. Further, the unadjusted odds of the outcome occurring given the dependent variable were also computed. As shown in Table 2, individuals with education levels at or below primary education had higher odds of not sustaining ODF practices (uOR=1.567, 95% CI:1.061-2.315, p=0.024).

Table 2: Association of selected socio-demographic characteristics with sustainability of open defecation free status.

Characteristics		ODF Sustainable						P value	uOR (95% CI)
		No (Reference)		Yes		Total			
		N	%	N	%	N	%		
Religion	Others	2	0.8	3	1.7	5	1.2	$\chi^2=0.615$, df=1, p=0.433	0.494 (0.082- 2.986), Ref
	Christian	239	99.2	177	98.3	416	98.8		
	Total	241	100.0	180	100.0	421	100.0		
Education level	≤Primary	152	63.3	97	52.4	249	58.6	$\chi^2=5.117$, df=1. p=.024	1.567 (1.061- 2.315), Ref
	≥Secondary	88	36.7	88	47.6	176	41.4		
	Total	240	100.0	185	100.0	425	100.0		
Marital status	Others	26	10.7	20	10.8	46	10.7	$\chi^2=.001$, df=1, p=0.971	0.988 (0.533- 1.832), Ref
	Married	217	89.3	165	89.2	382	89.3		
	Total	243	100.0	185	100.0	428	100.0		
Gender	Female	144	66.1	125	72.7	269	69.0	$\chi^2=1.969$, df=1, p=0.161	0.732 (0.473- 1.133), Ref
	Male	74	33.9	47	27.3	121	31.0		
	Total	218	100.0	172	100.0	390	100.0		
Age (years) (SD)		48.46 (13.6)		48.41 (13.1)		48.44		t (418)=-0.034, p=0.973 (Equal variances were assumed)	

uOR=Unadjusted Odds Ratio, Dependent Variable (DV): “ODF Sustainability”. Reference Category: “NO”

Table 3: Infrastructural factors.

Parameters	N	%
Accessibility of the facilities		
Distance to sanitary facility (miles)	10-50	59.5
	<10	33.5
	>50-100	6.3
	>100	0.5
	I don't have a sanitary facility	0.2
	Total	100.0
Walking time to/from the facility (Minutes) (N=201); 25 th Percentile =2.50 th Percentile =3.75 th Percentile=5		
Walking time (minutes)	Long (>3)	33.3
	Short (≤3)	66.7
	Total	100.0
Sanitary facility accessibility for all ages	No	8.30
	Yes	91.70
	Total	100.00
Open defecation sites in the community	No	67.10
	Yes	32.90
	Total	100.00
Privacy and facility management		
Lavatory wall material	Iron sheets	6.9
	Tree branches walling	7.4
	Cement	8.1
	Cement bricks	35.4
	Mud Bricks	42.3
	Total	100.0
Lavatory floor material	Tiles	3.1
	Mud floor	37.1
	Sand & Cement Screed	59.9
	Total	100.0
Roof presence in the lavatory	No	11.4
	Yes	88.6
	Total	100.0
Privacy and facility management		
Latrine privacy adequate	No	6.3
	Yes	93.8

Continued.

Parameters		N	%
	Total	416	100.0
Unpleasant odors from the toilet	Yes	169	40.4
	No	249	59.6
	Total	418	100.0
Often encounter insects in the lavatory	Yes	176	42.4
	No	239	57.6
	Total	415	100.0

Infrastructural factors influencing the resurgence and sustainability of open defecation free status

The (Table 3) summarizes key infrastructural factors related to facility accessibility, privacy, and management.

Most sanitary facilities (59.5%) were located within 10-50 meters, with a median walking time of 3.0 minutes. A majority of 91.7% (N=388) were accessible to people of all ages. Most respondents, 67.1% (N=275), reported no open defecation sites in their community.

Table 4: Infrastructural characteristics and ODF sustainability.

Infrastructural factors		ODF Sustainable						P value	uOR (95%CI)
		No		Yes (Ref)		Total			
		N	%	N	%	N	%		
Distance to sanitary facility (miles)	>10	150	62.50	132	71.40	282	66.40	3.666	1.263 (0.986- 1.617), Ref
	<10	90	37.50	53	28.60	143	33.60		
	Total	240	100.00	185	100.00	425	100.00		
Walking time (minutes)	Long (>3)	27	23.3	40	47.1	67	33.3	12.486, df=1 p=0	0.341 (0.186- 0.625), Ref
	Short (≤3)	89	76.7	45	52.9	134	66.7		
	Total	116	100.0	85	100.0	201	100.0		
Sanitary facility accessibility for all ages	No	31	13.00	4	2.20	35	8.30	15.85, df=1, p=0	0.247(0.098- 0.625), Ref
	Yes	208	87.00	179	97.80	387	91.70		
	Total	239	100.00	183	100.00	422	100.00		
Open defecation Sites in community	No	139	59.40	136	77.30	275	67.10	14.526, df=1 p=0	1.669 (1.254- 2.222), Ref
	Yes	95	40.60	40	22.70	135	32.90		
	Total	234	100.00	176	100.00	410	100.00		
Lavatory wall material	Cement	22	9.20	12	6.60	34	8.10	5.767, df=4, p=0.217	-
	Cement bricks	76	31.80	73	40.10	149	35.40		
	Mud bricks	101	42.30	77	42.30	178	42.30		
Lavatory floor material	Tiles	5	2.10	8	4.30	13	3.10	3.978, df=2 p=0.137	-
	Sand & Cement Screed	136	57.40	116	63.00	252	59.90		
	Mud floor	96	40.50	60	32.60	156	37.10		
	Total	237	100.00	184	100.00	421	100.00	15.837, df=1 p=0	0.355 (0.187- 0.675)
	No	40	16.80	8	4.40	48	11.40		
	Yes	198	83.20	175	95.60	373	88.60		
Latrine privacy adequate	Total	238	100.00	183	100.00	421	100.00	3.142, df=1, p=0.076	0.602 (0.316- 1.145)
	No	19	8.10	7	3.90	26	6.30		
	Yes	215	91.90	174	96.10	389	93.70		
Unpleasant odors from the toilet	Total	234	100.00	181	100.00	415	100.00	4.684, df=1, p=0.030	1.287 (1.018- 1.628)
	No	129	54.90	119	65.40	248	59.50		
	Yes	106	45.10	63	34.60	169	40.50		
Often encounter insects in lavatory	Total	235	100.00	182	100.00	417	100.00	1.851, df=1, p=0.174	1.167 (0.932- 1.460)
	No	126	54.50	112	61.20	238	57.50		
	Yes	105	45.50	71	38.80	176	42.50		

uOR=Unadjusted Odds Ratio, Dependent Variable (DV):“ODF Sustainability. “Reference Category: “Yes”

Concerning lavatory wall materials, mud bricks were the predominant choice at 42.3%, while sand and cement screed dominated lavatory floors at 59.9%. A significant majority, 88.6% (N=373), had a roof in their lavatory, and 93.8% (N=390) were considered to have adequate privacy. However, 40.4% (N=169) encountered unpleasant odors from the toilet, and 42.4% (N=176) frequently encountered insects in the lavatory.

Association between infrastructural factors and the resurgence and sustainability of open defecation free status

In the (Table 4) below, ODF sustainability was less likely in households without user-friendly sanitary facilities (uOR=2.47, $p<0.001$) and roofless toilets (uOR=0.355, $p<0.001$). Longer walking times (>3 minutes) were associated with reduced ODF sustainability (uOR=0.341, $p<0.001$). Conversely, the absence of designated open defecation sites increased the odds of ODF sustainability by 1.669 times (uOR=1.669, $p<0.001$), and households with toilets emitting no unpleasant odors were more likely to sustain ODF (uOR=1.287, $p=0.030$).

DISCUSSION

Most of the respondents (98.8%, N=418) were Christians. This reveals the dominance of Christianity in the study area. In regards to education, most of the participants (52.9%, N=226) reported to have completed primary education. Studies have consistently shown that educational attainment has a strong effect on health behaviors and attitudes towards sanitation adoption and use. In the study, females (68.6%, N=269) dominated the sample. It is a clear indication that women and young girls may suffer a lot when a household lacks a decent sanitary facility for use by the members. This is in line with a study in Kenya by Njuguna, whose findings revealed that women and young girls in school are particularly at risk of violence and rape when searching open defecation sites, especially during late hours.⁶ The study further revealed that individuals with education levels at or below primary education had higher odds of not sustaining ODF practices.

The findings concur with the studies by Delaire et al where they reported a significant relationship between the mother's level of education, the presence of secondary school students, the frequency of latrine construction, latrine sanitation, and the use of latrines.⁷ The study further revealed that most of the sanitary facilities (59.5%) were located within 10–50 meters, with a median walking time of 3.0 minutes, and the longer walking times (>3 minutes) were associated with reduced ODF sustainability. The results are in line with WHO's recommendations that the pits be built at a reasonable distance from the house, ideally balancing easy access against smell.³ Additionally, the findings concur with those of Tessama et al who reported a significant relationship between the distance from the household to

the toilet and ODF sustainability.⁸ In this study, ODF sustainability was less likely in households without user-friendly sanitary facilities. This result agrees with Delaire et al report that, in order to maintain the status of ODF, all sanitary facilities, including school toilets, should be suitable for the elderly and children of all ages and sizes.⁷

Further analysis from qualitative data revealed that, user-friendliness of sanitary facilities especially for the elderly population in the study area was a public health concern if we were to sustain ODF. Additionally, reports from qualitative analysis indicated that, common challenge was the lack of water in areas where SATO-PAN toilets were in use.

The reasons why households return to open defecation are likely to vary among contexts, according to Odagiri's report, which supports these conclusions.⁹ Many people who practice the open defecation method in some places may own toilets, but they may not use them because of poor construction, a lack of privacy, the availability of designated OD sites, or an offensive odour from the toilets.

Limitations

Challenges included long distances between sampled villages and households, compounded by limited resources. To address this, researcher used own savings. In quantitative data collection, biases were acknowledged and mitigated by employing an observation checklist. Monetary demands from study subjects were addressed by clarifying the study's educational nature, emphasizing voluntary participation.

CONCLUSION

This study achieved a high response rate. The findings indicate that socio-demographic factors, such as education levels and infrastructural factors such as time taken to access sanitary facility, absence of designated open defecation sites in the community and having a toilet that did not emit unpleasant odors are crucial for sustaining ODF status. Since education has been linked to better sustainability of ODF, the study recommends that the ministry of education continue with the efforts of 100% transition of pupils to secondary and higher education levels. Also, the community members should enhance infrastructural factors such as the provision of vent pipes, toilet roofing, construction of permanent toilets, latrine aperture covers, and hand washing facilities with running water and soap through subsidized government intervention. Further, the study recommends additional research to uncover more influencers to ODF sustainability.

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