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# Latrine Structure, Design, and Conditions, and the Practice of Open Defecation in Lodwar Town, Turkana County, Kenya: A Quantitative Methods Research

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## ABSTRACT

**BACKGROUND:** Poor latrine conditions, structure, and design may deter latrine use and provoke reversion to open defecation (OD). Statistics show that only 18% of the households in Turkana County, Kenya, have access to a latrine facility with most of these facilities in poor structural designs and poor hygienic conditions, which encourages rampant OD practices.

**AIM:** This article reports on quantitative aspects of a larger cross-sectional survey to assess latrine structure, design, and conditions, and the practice of OD in Lodwar.

**METHODS:** An observational study was carried out to examine latrine conditions, structure, and design in Lodwar, Kenya. A standardized questionnaire was also used to collect quantitative data. Stratified random sampling technique was employed to select respondents for this study with the sample drawn from 4 administrative units of Lodwar town covering the low-, medium-, and high-income households. Data were managed using Statistical Packages for Social Science (SPSS) software.

**RESULTS:** Nineteen percent of the sampled households did not possess a latrine facility at their homesteads with 73% of the latrines constructed using poor materials (mud, mats, polythene bags, and grass). Twenty percent of the respondents were scared of using a latrine with the main reason being loose soils that do not support strong constructions. Eighty-seven percent of the respondents agreed that the presence of feces on the latrine floor encouraged the practice of OD and 321 (80%) respondents stated that the latrine construction materials influenced latrine ownership and its subsequent use.

**CONCLUSIONS:** Respondents attributed rampant OD practices to poor latrine structure, design, and conditions. In addition, rampant cases of latrine sharing result in latrine filthiness, which eventually encourages OD practice. Inequality in sanitation, among counties, should be addressed in Kenya. The government should take charge of provision of good-quality communal latrines to the less-privileged societies like Turkana. Community empowerment and introduction of a small fee for cleaning and maintenance of these facilities will also improve their conditions. Ending the practice of OD will lead to increased positive public health and environmental outcomes in the study area.

**KEYWORDS:** Latrine structure and design, latrine condition, open defecation, improved sanitation, sanitation access

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## Introduction

Access to improved sanitation is an important component of human health.<sup>1</sup> At a household level, improved sanitation entails having a sanitation facility, for instance, a covered latrine for safe disposal of human feces.<sup>2</sup> Lack of access to improved sanitation facilities results to use of unimproved sources. Open defecation (OD), a common type of unimproved sanitation is the act of defecating in fields, forests, bushes, bodies of water, or other open spaces.<sup>3</sup> Even with a presence of a latrine facility, the few households who can afford to construct the facility face latrine-sharing challenges that still encourage latrine filthiness. Often, such latrines are constructed using poor materials with less safety and privacy thus deterring their usage.

There is need to end the practice of OD due to its negative impacts on both human beings and the environment.<sup>4</sup> Such impacts include, but not limited to, environmental pollution

due to widespread scattering of human feces even in public utilities, loss of income and productive time including missed school hours and days by school-aged children, and finally lack of privacy, dignity, and threat to human safety.<sup>4</sup> Rampant outbreak of water-related diseases caused by these negative impacts such as cholera, typhoid, and trachoma have highly been associated with poor sanitation practices such as OD.<sup>5,6</sup>

Similarly, owning a latrine has been described as a source of comfort as it prevents one from being exposed to elements such as thorns or dirt.<sup>7</sup> It is also provides privacy, especially for women and girls, as it prevents them from exposing their body parts. Therefore, lack of access to a latrine presents a great challenge, particularly to these special group of people, because they have to look for a more private place to relieve themselves. The situation is even worse during their menstrual periods as girls even tend to miss school and sometimes this could lead to



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ultimate dropout. Finally, lack of a latrine facility can be seen as a form of shame, humiliation, and embarrassment, especially in the presence of visitors.<sup>7</sup> Owning a latrine can be described as one of the influencers to the household's social status and a source of respect for its owners.

Access to adequate sanitation was declared by the United Nation as a basic human right and subsection 6.2 of the Sustainable Development Goals (SDGs) emphasizes on the need to end the practice of OD by the year 2030.<sup>8</sup> Various organizations such as the World Bank, World Health Organization (WHO), United Nations Children's Fund (UNICEF), other bodies such public health practitioners, and environmentalists have emphasized the need to end the practice of OD in developing countries.<sup>9</sup> Indeed, by the year 2015, the proportion of the population practicing OD globally decreased from 26% to 12%. However, Sub-Saharan Africa (SSA) still has a large proportion of the population practicing OD.<sup>10</sup> Access to improved sanitation facilities is still very low and the region shoulders the highest sanitation challenge with most of the population using unimproved sources.<sup>11</sup>

Kenya, being a developing country, faces major sanitation challenges. The statistics shows that 39% of the Kenyans use unimproved sanitation facilities.<sup>12</sup> These majorly involves the use of uncovered pit latrines often in poor structural designs and conditions such as poor flooring material, stagnant water on the latrine floors, presence of human feces on such floors, or tattered latrine walls. Such conditions make latrines unpleasant to clean and may revoke reversion to OD.<sup>13</sup> Similarly, latrine conditions, structure, and design may influence latrine usage in many ways. Odor, filled-up latrines, lack of a latrine roof, and incomplete latrines are some of the reported deterrents to latrine nonuse.<sup>14,15</sup> For instance, a study by O'Reilly to assess OD and latrine use in India reported that good latrine flooring materials and superstructure lead to their increased usage.<sup>16</sup>

Lodwar town is located within Arid and Semi-Arid Land (ASAL) Turkana County. According to the international poverty line of US\$1.90 a day, this County has a poverty index of 94.3%, a hygiene poverty index of 66.2%, and sanitation poverty index of 59.1%.<sup>12</sup> The region is characterized by households living in low socioeconomic status and cannot afford improved sanitation facilities such as ventilated improved pit (VIP) latrines, covered pit latrines, connection to a septic tank, or a sewer. This forces them to depend on unimproved sanitation facilities.<sup>17</sup> OD is often a last resort because most of the residents cannot even afford to construct a simple pit latrine.

The nomadic pastoralist kind of life and scarcity of rainfall experienced in Turkana has also resulted in little sanitation demand. Water is very essential for a latrine to function.<sup>16</sup> Poor latrine conditions experienced in such areas may be linked to inadequate amounts of water to perform daily good sanitation and hygiene practices. To back up this, a study to explore the remote and rural OD and latrine use in Uttarakhand, India, in 2017 reported that the cost of tapping water to the residential

homes for latrine flushing and postanal cleansing was described by the residents as being very high and therefore discouraged them from constructing a latrine.<sup>16</sup> In addition, there is illegal dumping of fecal waste including babies' feces coupled with inadequate household containment.<sup>18</sup> Such affects the ability of these communities to empty their waste disposal facilities.

As at the year 2013, only 8% of the households in Turkana County had access to improved sanitation facilities.<sup>12</sup> There is inadequate latrine coverage with low-quality pits dominating the area.<sup>18</sup> This poses a significant challenge to the public health. Several studies have researched the factors that are associated with OD practice globally.<sup>4,10,16,19-21</sup> However, there is no county-level study to determine latrine-related factors associated with the practice of OD in Turkana despite being the leading county with the use of unimproved sanitation facilities. In particular, there is limited research that has been done to exploit whether latrine structure, design, conditions have an association with the practice of OD in Lodwar. Therefore, to add on to the growing literature on OD and to address this knowledge gap, this study was conceived to assess whether latrine conditions, structure, and design has in some way contributed to the rampant OD practices in Lodwar, Kenya.

This article is very important because understanding how latrine structure, design, and its condition influence the practice of OD could assist in designing of good latrines and interventions that could lead to their improved conditions. In addition, it will also help in the achievement of SDG 6.2. This article also underscores some public health implications of OD and recommends ways of curbing the practice in Kenya.

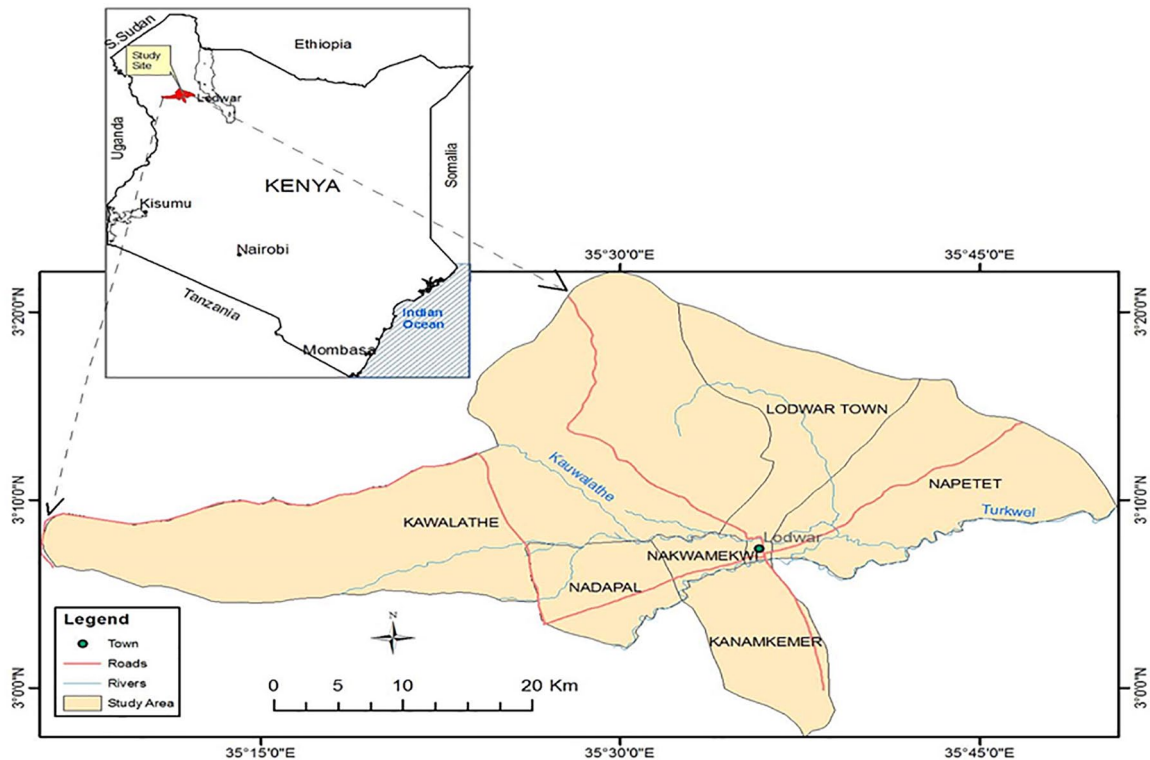
## Methods

### *Study area*

This study was part of a larger cross-sectional survey that was conducted in 4 human settlements in Lodwar town, that is, Kanamkemer, Napetet, Nakwamekwi, and Kawalathe (Figure 1). These were the 4 out of the 5 settlements that surrounded the town. A pilot study was conducted in one of the remaining settlements, referred to as Nadapal. Lodwar is a major town in Turkana County. Thickets and shrubs are the major type of vegetation that dominates the area. The region has a gently sloping terrain. Lodwar lies within the GPS coordinates 3°07'8.80" North and 35°35'17" East. Most households in the region cannot afford improved sanitation facilities such as VIP latrines, covered pit latrines, connection to a septic tank, or a sewer.<sup>17</sup> The population here lead a nomadic pastoralist kind of life and cases of OD are very rampant.<sup>18</sup>

### *Research design*

This specific cross-sectional study examining latrine conditions, structure, and design employed a purely quantitative study design through the use of a standardized questionnaire and an observation checklist.<sup>22</sup>



**Figure 1.** Map of the study area from topographic map of Kenya; scale 1:100 000, field survey.

### *Target population, sample size, and sampling*

Households formed the study sample. In each household, a household head, aged 18 years and above or their designated representatives formed the study respondent. This sample was calculated using the Kish 1965 formula for determining sample size for approximating population proportions,  $n = Z^2 \times P(1-P) / d^2$ , where  $n$  is the required sample size;  $Z$  is statistic for a level of interval (at 95%,  $Z = 1.96$ );  $P$  is the population proportion, that is, the percentage of the population with no access to a latrine facility in the study area; and  $d$  is precision which is 0.05.<sup>18</sup>

A minimum sample size of 310 households was estimated, and anticipating a 30% nonresponse rate, 403 households were selected for the study.<sup>23</sup> Household listing was done, and the total number of households in the study area were 41 120. Stratified random sampling technique was employed to select 101 households from each stratum. Kawalathe being the smallest stratum had 100 households sampled. Kanamkemmer and Kawalathe settlements were the high- to middle-income areas, whereas Napetet and Nakwamekwi were the low-income settlements. The sample included both households who have or do not have a latrine facility.<sup>18</sup>

### *Research instruments and data collection*

Four research assistants who had obtained a bachelor's degree in environmental science and had prior experience in data collection were recruited.<sup>18</sup> Five days before data collection, the

research assistants were trained by the student researcher and the supervisor. A pilot study was conducted during the last 2 days of the training to test the reliability and validity of data collection instruments.<sup>18</sup>

Data collection took place from October 2017 to February 2018. A standardized questionnaire and observation checklist whereby all the respondents were exposed to the same nature of questions and the same system of coding their responses were used to collect quantitative data. Based on prior studies that focused on factors that contribute to OD, the independent variables included latrine conditions, structure, and design. The dependent variable was OD practice.<sup>24-28</sup>

There were 45 closed-ended questions concerning the respondent's details; fecal disposal practices; and the knowledge, attitude, and perception (KAP) questions on latrines and general household fecal disposal practices in the questionnaires.<sup>18</sup> Due to high illiteracy levels in the study area, in-person interview procedure was employed to administer and retrieve the questionnaires as this was considered less burdensome to those respondents who could not write down their responses. It also provides a high response rate and an opportunity to observe the household sanitation conditions thus providing a room to fill the observation checklist. Respondents were free to answer or not to answer any question they felt was inappropriate.<sup>18</sup>

### *Data management and analysis*

The data collected were coded then entered into the SPSS database. The data were then checked for completeness or any

**Table 1.** Characteristics of study participants.<sup>18</sup>

CHARACTERISTIC	N	%	CHARACTERISTIC	N	%
Administrative unit			Family size		
Kanamkemer	101	25	0-4 members	137	34
Napetet	101	25	5-9 members	203	50
Nakwamekwi	101	25	10-14 members	57	14
Kawalathe	100	25	15 members and above	6	2
Sex			Occupation of household head		
Male	151	38	Employed	53	13
Female	252	62	Unemployed	192	48
Age			Casual labor	75	19
18-28 years	124	31	Business	83	21
29-39 years	152	38	Household head's education level		
40-50 years	76	19	Primary	129	32
51-61 years	37	9	Secondary	86	21
62-72 years	13	3	Tertiary colleges	36	9
73 years and above	1	0	University	17	4
			Illiterate	135	34

missing values. Frequencies and valid percentages were employed to analyze descriptive data. After all the analysis had been done, quantitative data obtained were represented in the form of tables. Plates were used to present photographic data on latrine structure, design, and conditions.

### *Ethical issues*

For ethical reasons, a research permit from Egerton University Research and Ethics Committee and the National Council of Science, Technology, and Innovation (NACOSTI) (NACOSTI/P/18/77199/25718) was obtained prior to the commencement of the study. Additional approval was sought from the community leaders in the study area and the local authorities before the study began. All the respondents for the questionnaires were asked for their permission to participate in the study, and a written consent form was signed.

## **Results**

### *Characteristics of respondents*

Forty-eight percent of household heads were unemployed (no work completely) and 13% were employed (contractual or permanent employment). In addition, 34% of the household heads were illiterate with only 4% of household heads who had obtained a university-level education (Table 1).

### *Latrine structure, design, and conditions*

A total of 77 (19%) households had a latrine facility and this consisted mainly of simple pit latrines (86%) with only 4 (5%) being a flush toilet (Table 2). Forty-five percent of the latrines had their floors made of sand or mud and 38% were without any form of roofing material. Sixty-seven percent of the latrines present had their walls fully covered and 27% were almost filled up with feces visible inside the latrine. Twelve percent of the latrines had stagnant water on their floors. Sixty-five percent of the latrines were being shared by more than 1 household, and 51% had human feces scattered all over the floor. Only 17% of the latrines had a water supply present in or near the latrine.

On the basis of cleanliness, 10% of the latrines identified (mostly the shared ones) were never cleaned at all. Thirty-eight percent of the latrines had a cleaning material present inside or around the latrine, and these were mostly brooms. The county government and the community facilitated the construction of 4% and 5% of the latrines, respectively (Table 2). Fifty-four percent of the households had their latrine located between 20 and 39 meters from their houses. On the basis of latrine distribution, each household was sampled to provide an estimate distance to the nearest latrine facility, and 72% of the households had their nearest latrine located more than 100 meters away (Table 2).

**Table 2.** Latrine conditions, structure, and design in various human settlements of Lodwar.

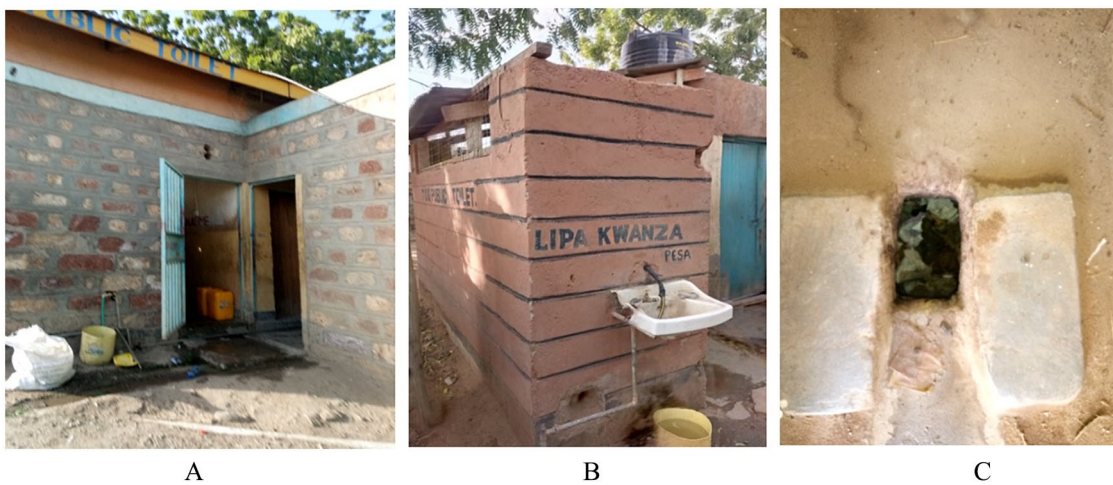
CHARACTERISTIC	N	%	CHARACTERISTIC	N	%
Latrine presence			Latrine type		
Yes	77	19	Pit latrine (3 from government and 4 from the community)	66	86
No	326	81	VIP latrine (2 from NGOs)	7	9
			Flush toilet	4	5
Latrine wall construction material			Latrine roofing material		
Cement	21	27	Iron sheets	40	52
Iron sheets	10	13	Wood	1	1
Wood	12	16	Mats	1	1
Mud	11	14	Grass material	6	8
Mats and polythene materials	7	9	None	29	38
Stones	2	3			
Grass material	14	18	Stagnant water present in the latrine		
			Yes	9	12
Latrine flooring material			No	68	88
Cement	35	45			
Wood	6	8	Human feces on latrine floor		
Mud or sand	35	45	Yes	39	51
Stones and wood	1	1	No	38	49
Latrine walls covered			Water supply present around the latrine		
Yes	52	67	Yes	13	17
No	25	33	No	64	83
Feces visible inside the latrine			Latrine sharing		
Yes	21	27	Yes	50	65
No	56	73	No	27	35
Latrines shared by households			Latrine cleaning time		
2-4 Households	8	10	Daily	15	19
5-9 Households	10	13	2-5 days	24	31
10-15 Households	12	16	Weekly	23	30
16 Households and more	47	61	Monthly	7	9
			No cleaning	8	10
			Latrine construction contributors		
Cleaning material present in the latrine			Government	3	4
Yes	29	38	Joint community	4	5
No	48	62	Individual households	68	88
			NGOs	2	3

(Continued)

**Table 2.** (Continued)

CHARACTERISTIC	N	%	CHARACTERISTIC	N	%
The distance of the latrine from the household (77 households)			Distance from each household to the nearest latrine (all households)		
0-19m	15	19	0-19m	21	5
20-39m	42	54	20-39m	10	3
40-59m	10	13	40-59m	10	3
60-79m	6	8	60-79m	19	5
80m and beyond	4	5	80-99m	53	13
			100m and beyond	290	72

Abbreviations: VIP, ventilated improved pit; NGO, nongovernmental organization.



**Plate 1.** (A, B) Conditions of the only 2 public toilets in Lodwar and (C) the only available latrine present in the Nataparkakono IDP camp (146 households).<sup>18</sup>

In Lodwar town center, there are only 2 public latrines that reports less than 30 individuals using it per day (Plate 1(A) and (B)). There is limited latrine coverage in upper Nakwamekwi settlements as compared with other parts of the study area with most of the population here using the nearby bushes and along R. Kawalathe for defecation. Latrine coverage was even worse in one of the Internally Displaced Persons (IDP) Camp (Nataparkakono) where there were 146 households with only 1 latrine that was completely filled up (Plate 1(C)). Residents here used the nearby bushes and thickets that were adjacent R. Kawalathe to defecate.

In Kanan IDP camp located in Kanamkemer settlements, there were 610 households with only 6 latrines that were constructed by the individual households. These mostly consisted of simple pit latrines that were constructed using mud, grass material, wood, polythene bags, and mats (Plate 2(A)-(C)). The rest of the households that lack access to a latrine facility used the nearest bushes and excavations to defecate.

### *Socioeconomic factors associated with OD*

A total of 20% of the respondents feared using a latrine with the 74% of the reasons being loose soils that do not support good-quality pits. A total of 321 (80%) respondents stated that latrine construction materials influenced latrine use (Table 3).

### *The KAP relating to latrines and OD*

Privacy was a major concern for most respondents, and 86% of these respondents agreed that tattered latrine walls and poor roofing materials encouraged the practice of OD. Safety was also a major concern for most respondents, and 84% of the agreed that poor flooring material, for instance, loose soils instilled fear to the users thus encouraging the practice of OD. Finally, most respondents were concerned about the cleanliness of the latrine with 87% of the respondents agreeing that the presence of feces on the latrine floor encouraged the practice of OD with only 3% of the respondents strongly disagreed with the statement (Table 4).



Plate 2. (A), (B), and (C) Nature of the latrines in the study area.<sup>18</sup>

Table 3. Socioeconomic factors associated with open defecation.<sup>18</sup>

CHARACTERISTIC	N	%
<i>Factors associated with latrine ownership</i>		
Fear of using a latrine		
No	321	80
Yes	82	20
Why fear using a latrine		
One can fall inside	61	74
For some, one has to pay to use them	10	12
One has to clean the latrine when it is dirty	6	7
Its maintenance is costly	5	6
Do construction material influence latrine use		
Yes	321	80
No	82	20

### Discussion

Access to an improved sanitation facility remains a great challenge, especially in poor and growing urban areas.<sup>3</sup> Only 19% of the households in the study area had access to a latrine facility, and this has majorly been attributed to low income and low education levels in the region.<sup>18</sup> Furthermore, 74% of the population with access to a sanitation facility in the study area use simple pit latrines with 48% using covered pit latrines, 5% using VIP latrines, and 21% using uncovered pit latrines. A study done by Kenya National Bureau of Statistics (KNBS) and Society for International Development (SID) shows that approximately 39% of Kenya’s population does not have access to an improved sanitation facility with about 18% of the population practicing OD.<sup>12</sup>

Even with the availability of a few latrines, unimproved sanitation facilities such as uncovered pit latrines are less likely

Table 4. Presentation of KAP questions on latrines and OD.<sup>18</sup>

CHARACTERISTIC	AGREE (%)	UNDECIDED (%)	DISAGREE (%)
Flies encourage OD	11	7	82
Odor encourages OD	10	10	80
Tattered latrine walls encourage OD	86	12	5
Poor flooring materials encourage OD	84	11	5
Almost/filled up latrines encourages OD	92	5	3
Feces on latrine floor encourages OD	87	10	3

Abbreviations: KAP, knowledge, attitude, and perception; OD, open defecation.

to be used as compared with improved sanitation facilities.<sup>29</sup> The reasons behind this association are latrine-related factors such as poor latrine designs, structure, and conditions. A similar study to assess latrine coverage and its use in a rural village of Eastern Nepal in 2017 reported that flush latrines were more likely to be used as compared with the pit latrines.<sup>29</sup> However, there were no preference over latrines (both pit and flush latrines) reported by the respondents in the study area.

The few available latrines present in the study area were constructed using poor materials such as mud, wood, grass materials, mats, and polythene bags. Due to poor structural designs, respondents stated that some of the latrines did not offer enough privacy. A good latrine facility should provide enough privacy for its users.<sup>18</sup> A similar study to assess factors influencing latrine ownership points out that it is very important to have a latrine with all its walls enclosed.<sup>7,30</sup> O’Connell<sup>7</sup> in his study also found out that latrine privacy was a crucial factor, especially for women. Women do not like exposing their body parts, and this was the main reason why people were constructing latrines rather than defecating in the open. Another



study done to assess OD and latrine use in Uttarakhand, India, highlights that a good latrine should provide enough privacy and safety for its users.<sup>16</sup> This safeguards human dignity, fear of animal attacks, and rape cases, especially at night.<sup>31</sup> Failing latrines, inability to repair and maintain them are some of the factors that have been associated with OD practices.<sup>9,32</sup>

The inability to purchase strong building materials by the residents of Lodwar has resulted into use of weak and cheap materials that could collapse easily. According to the respondents, this scares away some of its users. Some of the construction materials such as wood used may also rot and the latrine may sink after some few years. These were considered some of the strong motivators to the rampant cases of OD. Poor latrine structure and design provoke communities to practice OD which exposes the public to acute excreta-related diseases, more so a leading cause of diarrheal diseases in the world today.<sup>33</sup> A similar systematic review and meta-analysis to quantitatively characterize how sanitation interventions impact on latrine coverage and use suggests that good latrine structure and design are associated with higher latrine use thus accelerating the progress toward OD elimination.<sup>30</sup> A similar study to determine latrine use and determining factors in 2016 in Southwest Ethiopia also reported that those latrines that were not in use were in poor states and needed repair.<sup>24</sup>

Poor designs such as large squatting holes and safe floors have also been associated with latrine nonuse. A study to assess latrine utilization and associated factors in Ethiopia reported that 54.4% and 19.4% of the respondents attributed latrine nonuse to large squatting holes and unsafe floors to stand especially for children.<sup>14</sup> In Lodwar town center, there were only 2 public latrines with the very low turnout of users. However, respondents did not attribute this to latrine structural designs. There were no cases of latrine nonuse as a result of latrine designs such as large squatting holes in the study area.

Increased access and usage of improved sanitation facilities that can hygienically separate human excreta brings improved public health outcomes.<sup>34</sup> Latrine filthiness may be a notorious disincentive from using such facilities. Being a dry area and with limited amount of water to perform daily sanitation and hygiene practice, three-quarters of these latrines were not cleaned regularly or at all. Presence of flies was reported in most of the latrines. Such poor conditions were reported to influence latrine usage. A similar study conducted to understand successful sanitation in rural India in 2014 reported that unavailability of water was an extreme challenge that such that the residents could not even use their latrines.<sup>35</sup> Another study to assess the long-term sustainability of improved sanitation in Bangladesh found out that the distance to the water source was significantly related to latrine cleanliness.<sup>36</sup>

In addition, KAP survey questions administered to all the respondents concluded that most respondents agreed that human feces on latrine floors and filled/almost filled up latrines encouraged the practice of OD. A systematic review to assess

what determines OD and latrine ownership reported that few latrine users would use a latrine with human feces on its floor.<sup>7</sup> A similar study to assess latrine utilization and associated factors in Denbia District, Northwest Ethiopia, in 2014 also reported that households who did not clean their latrines on a regular basis were 5.5% likely to use their latrine as compared with households who cleaned their latrines on a regular basis.<sup>14</sup> The same study also reports that households which had hygienic latrines were 4.327 times more likely to use them as compared with unhygienic latrines.<sup>14</sup> Another systematic review and meta-analysis to quantitatively characterize how sanitation interventions impact on latrine coverage also concluded that latrine cleanliness was frequently associated with its increased use, whereas poorer latrine conditions were associated with lower use.<sup>30</sup>

However, odor was reported as one of the deterrents to latrine use in the study area. Bad latrine odor is an overlooked barrier to latrine ownership.<sup>13,14</sup> A similar study to assess factors influencing OD and latrine ownership in Meghalaya, India, reported that 56% of the population stated that bad smell in latrines was the reason for its nonuse. Thus, poor latrine conditions may have deterred latrine usage in Lodwar.

Latrine sharing goes hand in hand with latrine filthiness.<sup>22</sup> Queuing and congestion are expected with shared latrines. This was a common practice in Lodwar with more than half of the latrines being shared by more than 1 household. The more serious scenario was an IDP camp in Kanan with 610 households sharing 6 latrines, and 21 latrines each shared by more than 16 households. Latrine sharing result from the inability of most respondents to construct their latrines and only depend on those who can afford to construct a simple latrine. Most of these shared latrines were not cleaned regularly and therefore in bad hygienic conditions. O'Connell and Devine<sup>37</sup> found out in their study that the perception of the latrine users toward the use of dirty latrines, which in this case a shared facility, is negative and thus may opt for OD.

Owing to high poverty levels experienced in the region, users were not charged for the use of shared latrines. This might have accelerated their poor conditions. Social interventions to make sanitation facilities more hygienic may increase usage.<sup>25</sup> A similar study to examine patterns and determinants of communal latrine usage in Bhopal, India, reported that the introduction of household subscription fee from cleaning was a proxy indicator of good latrine conditions and it had a 24-hour access.<sup>27</sup>

Constructing latrines, both by individual households and the community as well as the government, is essential toward catering of daily sanitation needs and ending the practice of OD.<sup>9</sup> Although most of the governments have taken initiatives to construct latrines for its citizen, the poor, especially those living in rural areas, have often been neglected.<sup>15</sup> Being a marginalized area, Turkana still lags behind in some of the developmental projects.<sup>12</sup> Despite this, some communities in Lodwar have taken an initiative to contribute toward the construction of joint

community latrines. The county government has also provided few communal mobile toilets in the region. However, these facilities are still not enough for the entire population. With high demand, these facilities become decrepit shortly after they are commissioned. Nonfunctional latrines that result from such situations will force populations to practice OD.

Similar studies have highlighted the importance of communal latrines in catering for daily defecation needs for some of the low-income areas,<sup>27</sup> for instance, a large-scale randomized trial research on promoting hand-washing and sanitation in 2015 in rural Tanzania observed that sanitation promotion including provision of latrines increased latrine ownership rates from 38.6% to 51% thus reducing OD practice.<sup>38</sup> However, such public latrines provided by the governments are limited compared with their demand.<sup>9</sup> Due to high demand, a study to examine patterns and determinants of communal latrine usage in Bhopal, India, indicates that provision of communal latrines does not reduce OD in low-income areas.<sup>27</sup>

However, in as much as latrine presence is considered essential, there are still reported cases of nonuse in Lodwar. Other factors, for instance, culture, contribute to latrine nonuse.<sup>18</sup> A similar study conducted in Ghanaian peri-urban to understand the factors influencing the use of household and communal latrines in 2015 reported that provision of public latrines does not guarantee its regular use.<sup>25</sup>

Pit latrines eventually fill up and need to be emptied or replaced. As a result of rampant cases of latrine sharing reported in the region, latrine fill-up rates of such becomes similarly faster. High poverty levels experienced in the region slowdown the replacement or emptying of such facilities hence encouraging OD. A study to examine adaptation strategies to address limitations of pit latrines in 2016 in Malawi reported that communities adopted improved sanitation facilities when there are no barriers (such as cost) preventing them<sup>26</sup> and the perception of people toward filled-up latrines may further dissuade them from using it.<sup>36</sup>

Loose sand in Lodwar makes it even worse to dig new pits when the existing ones get filled up. The sand cannot support the construction of strong pit latrines. This has resulted into construction of poor-quality pits in the study area. Construction of deep pits that do not fill up faster encourages latrine use for a long period of time. However, sandy soils present in the study area limit construction of such pits. In addition, the sandy soils cannot withstand periodic flooding commonly experienced in the region. Respondents stated that the sand is so loose that most latrines would collapse during the rainy season. Respondents, most elderly, also stated that they were scared of using such latrines and preferred OD. These conditions have accelerated OD practices as the situation becomes more marked with time. A similar study is carried out to understand latrine adoption in a representative panel of rural Indian households in 2017 and associated soil porosity and ecology to positively impact on latrine ownership and use.<sup>19</sup>

Distance to a latrine facility may have an important role in influencing OD cases.<sup>33</sup> Almost a quarter of the study respondents had a latrine located 100 meters and beyond from their homestead. This was majorly because a large number of these facilities were shared. Access to a latrine facility located far from the household, especially during the night may have been one of the contributing factors to rampant cases of OD in the study area. A study to examine patterns and determinants of communal latrine usage in Bhopal, India, reported that households who did not have a latrine facility near their homesteads had greater odds of practicing OD compared with households who were closer to a latrine facility.<sup>27</sup> Another cross-sectional survey to study latrine coverage and associated factors in Bahir Dar Zuria, Ethiopia, in 2013 also reported that latrine use was affected by its distance from the household.<sup>39</sup>

Distance to a common OD site may also be an important determinant of latrine use.<sup>27</sup> Even with the availability of 2 public toilets in Lodwar town and 1 latrine in the stadium, residents still defecated in the proposed arboretum and the stadium, respectively. Major hotspots identified were bushes, along rivers, along the roads, Lodwar's proposed arboretum, and Lodwar stadium. This presents a serious health concern especially during the rainy season as the runoff water carries along this fecal matter and deposit them into the rivers which are the main sources of domestic water. As a result, it leads to widespread cases of water-related diseases in the region.

## Recommendations

OD is a worst type of unimproved sanitation that has been linked to rising cases of water-related diseases such as diarrhea in the world today. The practice has also been linked with various negative impacts such as environmental degradation and negative public health outcomes. There are a lot of inequalities when it comes to sanitation issues, especially in marginalized areas such as Turkana.<sup>4</sup> Addressing such inequalities is required to achieve meaningful sanitation coverage. A similar study done in SSA to explore changes in OD prevalence concluded that most of the sanitation investments were mostly being done in the affluent societies, and this was considered a major barrier toward ending the practice of OD.<sup>40</sup> Efforts to end the practice of OD will provide numerous environmental and public health outcomes that include reduction in widespread outbreaks of water-related diseases.

For instance, the inability of such communities to afford improved sanitation facilities should force the government to take charge of providing at least 1 community latrine for 5 number of households. This intervention can be considered as being more feasible. In as much as shared facilities was associated with latrine filthiness in the study area, introducing a small fee for daily maintenance and cleaning can improve their conditions. Such facilities should possess good structural designs such as appropriate squatting holes, should always be in good hygienic conditions, and be located in a central location where

it is accessible even during the night. Strengthening the supply of these latrines to cater for the demand of the population is very important in achieving this.

However, there are still households that can afford to construct a latrine facility but does not possess one. In such cases, perhaps empowering them to build and manage these facilities could lead to construction of a large number of latrines, an initiative that is urgently required in the study area. Real-time tracking of these facilities by the responsible bodies, for instance, public health, may also ensure the construction of quality pits and improved latrine conditions. Finally, extensive triggering and community mobilization using media tools may improve the general sanitation issues in Lodwar.

### Study limitations

This study is, however, only generalizable to the peri-urban population of 4 settlements in Lodwar and does not include the rural populations.

### Conclusions

Provision of safe and adequate sanitation facilities in a region brings various positive outcomes both to the environment and the general public health. Open defecation is influenced by various factors such as poverty, poor latrine characteristics and conditions, low levels of education, among others.

This article tries to establish whether there is an association between latrine structure and design (roofing, wall, flooring material, and design) and condition (presence of feces or stagnant water on the floor, odor, flies, or almost/filled up latrines), and the practice of OD.

Significant study findings indicate that at least a quarter of the population possesses a latrine facility with most of the population practicing OD. The few available latrines are constructed using poor materials such as grass, polythene bags, mud, and mats. Such materials have been reported to accelerate the practice of OD. The reasons behind this include the fear of latrines collapsing, other safety and privacy issues. Latrine odor, presence of flies, feces, and stagnant water on latrine floors were observed in most of the latrines. Latrine filthiness as a result of latrine sharing among various households was also reported as common issue. All these conditions were reported as major deterrents to latrine use and have pushed the residents to defecate in the open. Bushes, river banks, and along the paths have been used as some of the OD hotspots in the study area.

This article is important as it assesses various latrine characteristics that influence OD practice, which may have been researched by other scholars when coming up with interventions to end the practice in the study area. It also contributes toward the achievement of SDG 6.2 on OD elimination by highlighting more factors that contribute to the practice. This becomes easy for policy makers, nongovernmental organizations (NGOs), and other sanitation practitioners in placing priorities on these factors other than guessing.

Future research is needed to design other feasible interventions on how to address the issue of loose soils which limit the construction of strong latrines in Lodwar. Ending the practice of OD will lead to increased and positive public health and environmental outcomes in the study area.

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### Author Contributions

GMO, MAM, and PJB conceptualized and planned the study; agreed with the results and conclusions; and came up with arguments for this manuscript. PJB analyzed the data and wrote the first draft of the paper. GMO, MAM, and PJB revised and approved the final manuscript.

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