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Open defecation among Kenyan households: an analysis of demographic and health survey 2022 and census report of 2019

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Abstract

Background Open defecation (OD) is the disposal of human excreta in the fields, bushes, water bodies and other open spaces. It poses a public health risk as it can lead to the spread of diarrhoea, cholera, soil-transmitted helminths and trachoma. Kenya aims to achieve 100% open defecation free status by 2030 in line with Sustainable development goal number 6. This study sought to determine factors influencing OD at the household level as well as quantify the number of households practicing OD in each of the 47 Kenyan counties.

Methods Data from the household questionnaire of the Kenya Demographic and Health Survey, 2022 was analysed. Bivariate logistic regression was done with open defecation status as the dependent variable. Independent variables were poverty status, place of residence, ownership of farm animals, gender and educational level of household head. The number of households practicing OD per county were determined using the Kenya Census report of 2019.

Results Poverty was the strongest predictor of a household practicing OD (OR 43.8 95% CI 26.1–73.8) followed by educational status of the household head (OR 3.3 95% CI 2.3–4.6) and the household not owning livestock (OR 0.7 95% CI 0.6–0.9). An estimated 7.4% of households practice OD. These are estimated to be 814,223 households. Out of these, 686,051 households (84.3%) are found in the 15 counties ranked as having a high population practicing OD. Five counties have managed to eliminate OD and another nine have OD rates of less than 0.5%.

Conclusion Kenya has made commendable progress in eliminating OD. Poverty is a significant predictor of OD at the household level. To eliminate OD, it is advised that more efforts be targeted towards poor households as well as the 15 counties having a high number of OD-practicing households.

Keywords Open defecation, Kenya, Sustainable development goals

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Background

Open defecation (OD) is defined as 'disposal of human faeces in fields, forests, open bodies of water, beaches and open spaces or with solid waste' [1]. One of the targets of Sustainable Development Goal 6 is to eliminate open defecation by 2030. Globally, OD has been on a decline. Between 2000 and 2022, the number of households practicing OD declined from 1.3 billion to 419 million [1]. This is a decline from 10.3 to 5.2% of the global population. In spite of this, in 2022 there were 36 countries with OD rates of between 5% and 25% [2]. In sub-Saharan Africa the number of households practicing OD reduced from 207 million in 2015 to 193 million in 2022 [1]. This means that 46% of households classified as OD are located in sub-Saharan Africa. Open defecation in Kenya declined from 16.2% in 2003 to 7% in 2022 [2]. This means that Kenya is one of the 36 countries with high OD rates.

Open defecation has both health and social impacts [3]. Health impacts include adverse pregnancy outcomes e.g., low birth rates. There are also the infectious diseases associated with poor sanitation. These include diarrhoeal diseases, neglected tropical diseases like trachoma, schistosomiasis, soil -transmitted helminths and vector-borne diseases like lymphatic filariasis [2]. Faecal contamination of the environment through OD has been shown to cause environmental enteric dysfunction (EED). This condition may cause gut inflammation, intestinal leakiness and malabsorption of nutrients. This may contribute to stunting, especially in children [4]. Open defecation also contributes to antimicrobial resistance through spread of excreted resistant microbes in the environment as a result of poor disposal of wastewater and sludge [2]. Women who practiced OD were more at risk of non-partner sexual violence and were also more likely to have their privacy and dignity violated [3]. There are also psychosocial stressors associated with OD. These include environmental stressors e.g., animal bites and discomfort at OD site [3].

Sanitation is the safe disposal of human excreta [2]. Human excreta include faeces, urine and menstrual blood. Sanitation plays a key role in securing public health by preventing a wide range of diseases associated with poor sanitation including OD. In 2019, the World Health Organization estimated that poor sanitation caused 564,000 deaths attributed to diarrhoeal diseases in low- and middle-income countries [5]. Sanitation is a human right. Everyone should be able to easily access sanitation services that provide privacy, dignity and safety. Sanitation is also a public good as improved sanitation benefits the whole community by safeguarding their health and promoting socio-economic development [2]. Poor sanitation will adversely affect even those who have good sanitation. An example is an outbreak of diarrhoea or cholera due to lack of sanitary facilities. There is a likelihood that even those with good sanitary facilities may contract the disease e.g. through food [2]. Poor sanitation causes economic losses with these estimated to be 3.2% of the Gross Domestic Product (GDP) among countries in sub-Saharan Africa [2].

Sanitation contributes to sustainable development and is an integral part of Sustainable Development Goals (SDG's) targets 3.9, 6.1 and 6.2. The WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP) monitors progress in attaining sanitation-related SDG goals at the national, regional and global levels [1]. A sanitation service ladder is normally used to monitor progress. This ladder has 5 steps and it begins with the worst-case scenario and gradually progresses to the ideal one. At the bottom rung is OD. The Kenyan government aims to achieve universal access to improved sanitation by 2030. One way of achieving this is through the construction and proper use of clean latrines [6]. To achieve this the government has devised a modified sanitation service ladder with 3 targets. The first is to attain an OD free environment [6]. In 2010, Kenya enacted a new constitution which led to the creation of 47 semi-autonomous County governments. These are mandated to provide sanitation services to all their residents. The bill of rights in the Kenyan constitution includes the right to sanitation thus entrenching sanitation as a human right. The government estimates that 83% of the population practicing OD in Kenya is found in 15 counties which are mostly classified as arid and semi-arid [6]. National population census and demographic and health surveys have been used by JMP to provide estimates on OD levels among the population [1]. This study determined factors associated with OD at the household level and also estimated the number of households practicing OD per each county. This would indicate the number of households that need to move or be moved up the sanitation service ladder.

Methods

Study setting

The 2022 Kenya Demographic and Health Survey (KDHS) was carried out by the Kenya National Bureau of Statistics (KNBS) and its partners. Data was collected from 37,911 households across all the 47 counties beginning on 17th February and ending on 31st July 2022. Its objective was to provide estimates of nutrition, health and sociodemographic indicators. The survey methodology including institutional review board approval is described elsewhere [7]. Eight questionnaires were used in KDHS 2022. One of these was the household questionnaire and this was administered to eligible men aged between 15 and 54 years and women aged 15–49 years. It collected a wide range of household characteristics

including water and sanitation; and asset ownership [10]. The 2019 Kenya population census report on population per each county was downloaded from the website of the Kenya National Bureau of Statistics [8].

Statistical analysis

The data files for the household questionnaire were accessed with permission from DHS Program (https://dhsprogram.com/). Stata data files were downloaded from the DHS website. The variable indicating type of toilet facility a household has was the dependent variable. This was recoded into two categories. These are households having a toilet/latrine and those without. The former is termed as open defecation free (ODF) and the latter as open defecation (OD). The responses recoded as households with a toilet facility were flush toilet, flush to piped sewer system, flush to septic, flush to pit latrine, flush to somewhere else, flush to an unknown place, pit latrine, ventilated improved pit latrine, pit latrine with slab, composting toilet, hanging toilet and other. The responses recoded as households without toilet facility were no facility, bush or field. The independent variables were place of residence i.e., rural or urban, wealth index of household, sex and educational level of household head, and ownership of livestock. The independent variables were recoded into binary variables. The DHS wealth index categorizes households into 5 wealth quintiles. The poorest and poorer households were recoded as poor while middle, richer and richest were as non-poor. The highest education level of the household head was recoded into two categories. The first was no education or pre-school. The second comprised of primary, secondary and tertiary levels.

The survey data analysis section in Stata was used to account for the sampling methods used as well as do binary logistic regression reporting odds ratio. Estimation of OD levels among counties was also done. The number of households per each county were derived from the national census report of 2019 [8]. This was multiplied by the percentage of households practicing OD to give the number of households practicing OD in a county. The number of households practicing OD among the 15 counties cited as having a high percentage of population practicing OD was calculated. These counties are Baringo, Garissa, Homa Bay, Isiolo, Kajiado, Kilifi, Kwale, Mandera, Marsabit, Narok, Samburu, Tana River, Turkana, Wajir and West Pokot [6].

Results

Preliminary analysis showed that a household was likely to practice OD if it was poor, located in a rural area and owned livestock. It was likely to practice OD if its head was a male and had no formal education. Of households practicing OD, 94.6% are rural-based, 81.2% owned livestock and 87.8% have their wealth status classified as poorest (Table 1).

Binary regression indicated that poverty was the strongest predictor of a household practicing OD (OR 43.8 95% CI 26.1–73.8) followed by educational status of the household head (OR 3.3 95% CI 2.3–4.6) and the household not owning livestock (OR 0.7 95% CI 0.6–0.9). Living in an urban area and a female- household head influenced a household to be OD free, though not significantly.

An estimated 7.4% of Kenyan households practice OD. Out of the 47 counties, five have managed to eliminate OD (Table 2). These are Nairobi, Muranga, Nyandarua,

Table 1 Socio-demographics of households practicing open defecation

Socio-demographic	Category	Percentage of Households practicing Open Defecation	Proportion of households practicing Open Defecation (%)
Gender of household head	Male	4.2%	56.8
	Female	3.2%	43.2
Educational status of household head	No education	4.5%	60.8
	Primary education	2.3%	31.1
	Secondary school	0.5%	6.8
	Higher education	0.1%	1.4
Place of residence	Urban area	0.4%	5.4
	Rural area	7.0%	94.6
Household owns livestock, herds or farm animals	Yes	6.0%	81.1
	No	1.4%	18.9
Wealth status of household	Poorest	6.5%	87.8
	Poorer	0.7%	9.5
	Middle	0.2	2.7
	Richer	0.0	
	Richest	0.0	

Table 2 Factors influencing open defecation at the household level

Factor	Odds ratio	*P*>|t|	95% CI
Poverty status according to households ranked poorest and poorer.	43.8	0.00	26.1–73.8
Living in an urban area	0.6	0.4	0.2–1.8
Household head is a female	0.9	0.2	0.7–1.1
Household owns no livestock, herds or farm animals	0.7	0.01	0.6–0.9
Household head has not completed primary school education	3.3	0.00	2.3–4.6

Kericho and Nakuru. Another nine counties have OD rates of 0.5% or less. The total number of households practicing OD was estimated to be 814,223. Out of these, 686,051 households (84.3%) are found in the 15 counties ranked as having a high population practicing OD. Of these, two counties have OD rates of over 50%. These are Tana River and Turkana at 55.2% and 70.8% respectively (table 3).

Discussion

Poverty status of a household was found to strongly influence OD. The preliminary analysis showed that poorest households comprise of 87.8% of households categorized as practicing OD (Table 1). The odds of a poor household practicing OD compared to a non-poor one was also shown to be high (Table 2). Belay and his colleagues analysed determinants of OD among 33 sub-Saharan Africa. They found that poverty influenced OD with poor households being seven times more likely to be classified as OD compared to rich households [9]. An estimated 34.7% of households in Kenya are classified as poor. Another 4.9% or 625,000 households are further classified as hardcore poor [10]. These live in abject poverty and even if they were to spend all their earnings on food, they would still not meet the minimum required nutritional needs as stipulated in the minimum food consumption basket [10]. These households may not be able to afford a sanitary facility as they have no disposable income and are unable to save. Some of these households receive social assistance from the government e.g. cash transfers for the elderly, food aid and health insurance [7]. There is no assistance tailored specifically towards acquiring a sanitary facility among poor households. It has been argued that poor households are likely to be marginalized and not benefit much from public investments in sanitation e.g. sewer lines compared to non-poor households [2]. Poor households have also been shown to be at a higher risk of being affected by disability compared to non-poor households [11]. They may need to invest more funds in disability-friendly sanitation facilities. When they lack resources, the disabled are predisposed to practice OD for lack of an alternative [2]. The GLAAS 2021/22 country survey showed that households in sub-Saharan Africa meet 70% of the costs of sanitation either through out-of-pocket expenses or tariffs [12]. This means that the cost of providing sanitation is borne by the household.

Households whose head did not attend formal school were likely to practice OD compared to those whose heads had attended formal school. Educated people may earn more income as some may be in formal employment or engage in business and can afford to construct a toilet or rent a house with one. In Kenya, poverty levels in urban areas were found to be highest in households headed by an individual with no formal education [10]. A study in sub-Saharan Africa found that the odds of a household practicing OD decreases by 43% when the household head has completed primary school [9]. Owning animals influenced whether a household was classified as OD. This may be a poxy of a pastoralist household. Pastoralists in Kenya are mainly confined to arid and semi-arid counties which have high OD rates [6]. This could be due to the pastoralists being highly mobile as they move with their animals in search of pasture and water. Though not statistically significant, being located in a rural area and having a male head, had some influence on practice of OD. A plausible reason could be that females are more inconvenienced by OD. This may lead to female headed households prioritizing a latrine more compared to their male counterparts. A study in Ethiopia also found that males were more likely to practice OD compared to females [13]. Urban areas tend to be more densely populated with little privacy provided to practice OD e.g., presence of bushes. They also tend to be more developed with water-borne sanitation systems coupled with stricter enforcement of public health. Poverty levels are also relatively lower in urban areas e.g. 1.3% of urban households in Kenya are hardcore poor compared to 7.3% among rural-based households [10].

An estimated 7.4% of households in Kenya practice OD. In 2000, OD in Kenya was 18.4% [1]. This means that a reduction of 11% has been attained over a period of 22 years. This translates to an average reduction of 0.5% per year. At this pace, eliminating OD by 2030 may not be attained. It has been shown that progress in eliminating OD in Africa is slow. To eliminate OD in Africa, it has been suggested that the rate of progress needs to be tripled [2]. Applying this to Kenya would lead to annual decrease of 1.5% resulting in elimination of OD by 2030. Pooled prevalence of OD among households in sub-Saharan Africa was recently estimated to be 22.5% with a range of 0.8% in Comoros to 72.8% in Niger [9]. Kenya has lower OD levels than some of her neighbours e.g., Ethiopia with 18%. The reverse is also true with some of her neighbours e.g., Rwanda having lower OD levels at 2% [9].

Table 3 Estimate of households practicing Open Defecation in Kenya

Name of County	Number of households as per the 2019 census	Percentage of households practicing open defecation as per KDHS 2022	Number of households practicing open defecation
Mombasa	378,422	0.7	2,649
Kwale	173,176	26.4	45,718
Kilifi	298,472	21.0	62,679
Tana River	68,242	55.2	37,670
Lamu	37,963	15.8	5,998
Taita Taveta	96,429	0.4	386
Garissa	141,394	17.5	24,744
Wajir	127,932	40	51,173
Mandera	125,763	27.1	34,082
Marsabit	77,495	41.8	32,393
Isiolo	58,072	20.8	12,079
Meru	426,360	0.6	2,558
Tharaka Nithi	109,860	1.1	1,208
Embu	182,743	0.3	548
Kitui	262,942	5.1	13,410
Machakos	402,466	0.5	2,012
Makueni	244,669	1.5	3,670
Nyandarua	179,686	0	0
Nyeri	248,050	0.4	992
Kirinyaga	204,188	0.1	204
Muranga	318,105	0	0
Kiambu	795,241	0.1	795
Turkana	164,519	70.8	116,479
West Pokot	116,182	36.2	42,058
Samburu	65,910	52.6	34,669
Trans Nzoia	223,808	1.0	2,238
Uasin Gishu	304,943	0.6	1,830
Elgeyo Marakwet	99,861	4.7	4,693
Nandi	199,426	2.0	3,989
Baringo	142,518	33.6	47,886
Laikipia	149,271	7	10,449
Nakuru	616,046	0	0
Narok	241,125	24.7	59,558
Kajiado	316,179	17.3	54,699
Kericho	206,036	0	0
Bomet	187,641	0.5	938
Kakamega	433,207	0.2	866
Vihiga	143,365	0.6	860
Bungoma	358,796	1.3	4,664
Busia	198,152	0.8	1,585
Siaya	250,698	6.2	15,543
Kisumu	300,745	4.8	14,436
Homa Bay	262,036	11.5	30,134
Migori	240,168	13.0	31,222
Kisii	308,054	0.1	308
Nyamira	150,669	0.1	151
Nairobi	1,506,888	0	0
Total	12,143,913		814,223

This study found that 0.8 million households practice OD in Kenya. Five counties have eliminated OD. This include Nairobi which is the most urbanized as it is also Kenya's capital city. Previously, the Ministry of health had declared Busia, Kitui and Siaya counties as OD free [14]. This study shows these counties have OD rates of 0.7%, 5% and 6.1% respectively. Other than Busia, it can be inferred that Kitui and Siaya counties have significant slippage to OD as each has over 10,000 households practicing OD. Over 80% of counties with high OD levels are located in 15 counties which are characterized by under-development and high levels of poverty [6, 15]. A large proportion of their population are herders and these are highly mobile as they move with their animals in search of pasture and water. Turkana county has the highest number of households practicing OD. It also has the highest proportion of poor people with 77.7% of its population being poor [10]. The 2010 Kenyan constitution was cognizant of this and it established an Equalization fund. This was aimed at helping marginalized counties improve their basic services. Access to improved sanitation is one of the criteria used when allocating these funds [15]. It can be argued that the equalization fund has not improved sanitation at the household level. A plausible reason could be that equalization funds are hardly used to improve sanitation at the household level. They are mostly used to improve basic services like water, roads, health services and electricity [16]. The Kenyan government is addressing this issue through the formation of the Kenya Sanitation Alliance in 2021 [17]. This comprises of the 15 county governments, ministries of health, water and sanitation at the national level ; non-governmental organizations and donors. The aim is to eliminate OD by 2025 in these 15 counties with the highest OD rates. In 2022, the alliance had achieved a 20% increase in people living in OD free communities. This is commendable but more needs to be done if the 2030 target is to be met. A major challenge is inadequate funding. The alliance required each county government to commit at least 10 million Kenya shillings or 67,000 US Dollars per year. Counties like Mandera, Wajir and Isiolo are yet to make any financial commitments. Only Kajiado, Turkana, Kilifi and Kwale have spent some of the funds they had committed. These are estimated to have spent 32,000 US Dollars [17]. These counties should be encouraged to eliminate OD at the household level as eliminating OD in rural areas has been shown to have six-fold returns of the cost [18]. They may need to invest more including in innovative sanitation facilities. These may include provision of subsidized infrastructure like latrine slabs or culturally acceptable portable latrines which can easily be dismantled and carried using animals e.g. donkeys for their highly mobile population.

A limitation of this study is that information collected by DHS is liable to reporting and recall biases [19]. Open Defecation is also influenced by other factors which may not be captured by a standard DHS survey. A key example is socio- cultural factors [6]. The DHS uses the JMP definition of OD. The ministry of health, Kenya uses a different definition when it comes to certifying households as OD free. This includes the use of fly proof and clean toilet, presence of handwashing facility with soap and water; having no exposed human excreta and safely managed child excreta and diapers [6]. The DHS household questionnaire does not collect this type of data. Using the JMP definition could underestimate the number of households practicing OD. The national census was done in 2019, and the population has increased and by extension the number of households. This means that the number of households classified as OD may be higher than estimated.

Conclusion

It is estimated that 7.4% of households in Kenya lack sanitary facilities. These households are poor, and the head has little or no formal education and are mostly concentrated within 15 counties. It is imperative that sanitation interventions target these households for Kenya to attain SDG target 6. One way would be for counties with high OD levels to invest more in pro-poor sanitation programs.

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JN designed the paper, analysed the data, wrote and reviewed the manuscript.

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Data availability
The data that support the findings of this study are available from the DHS Program https://www.dhsprogram.com/data/available-datasets.cfm.

Declarations

Ethics approval and consent to participate
The study utilized secondary data accessed with permission from the DHS program. Ethical approval by an institutional board was done prior to the actual research being done as described in https://dhsprogram.com/pubs/pdf/PR143/PR143.pdf.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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