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Factors Associated with the Access and Use of Improved Latrine Facilities in Tanzania

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Access to improved latrine facilities is a basic human right and fundamental to good health. Inadequate sanitation practices cause serious health problems especially transmission of diarrhea. The study aimed to determine associated factors with access to and use of improved latrine facilities in Tanzania. The data for this study was obtained from the 2022 Tanzania Demographic and Health Survey and Malaria Indicator Survey (2022 TDHS-MIS) by visiting <https://www.dhsprogram.com>. Data were analyzed using STATA Version 16, whereby a multilevel logistic regression model was chosen as the statistical approach. The study revealed that overall 67.76% of the households had access to improved latrines. The study revealed that head of households with higher education, rich 55+ years and with television had higher odds of using improved toilets compared to others. The study concludes that more than half of the households in Tanzania had access to an improved latrine which is not common in most developing countries, especially in sub-Saharan Africa, and thus can be used as a reference for learning. This implies the government and stakeholders' interventions have brought positive changes. Hence, the need of policy enforcement in specific areas as well as government and stakeholders creating awareness campaigns to enable more households' access to improved latrine in both rural and urban areas.

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INTRODUCTION

The use of improved latrine facilities is fundamental to good health, and the United Nations recognizes that improved latrines ensure dignity at the household level and in the entire community (Mondal, 2022). In this context, improved latrine facilities include flush or pour-flush to piped sewer systems, ventilated-improved pit latrines, pit latrines with slab, or septic tank pit latrines, or composting toilets (Tamene and Afework 2021; WHO, 2023). The use of improved latrine facilities has become an increasing international agenda under the Sustainable Development Goals (SDGs) whereby the United Nations in Goal 6 specifically target 6.2 challenges the global community to achieve universal, sustainable, and equitable access to safe Water, Sanitation, and Hygiene (WASH), intending to end open defecation worldwide by 2030 (González-Rodrigo et al., 2022; Apanga et al., 2022; Golla et al., 2023; Paul, 2023). Despite this target, over 1.5 billion people still do not have basic sanitation services, such as private toilets or latrines, among these people, 419 million still defecate in the open, for example in street gutters, behind bushes, or into open bodies of water (WHO, 2023). The majority of people using unimproved latrines live in developing countries and the majority of them live in rural areas (Mshida et al., 2020; Legge et al., 2021; Mondal, 2022; Ali and Khan, 2023).

Poor use of improved latrines causes a serious health problem that affects billions of people around the world, predominantly the developing countries (Asrate et al., 2022). It reduces human well-being, and social and economic development due to impacts such as the risk of sexual assault, anxiety, and lost opportunities for education and work. Also, is linked to the transmission of diarrheal diseases such as cholera and dysentery, as well as typhoid, intestinal worm infections, and polio (Le and Makarchev, 2020; Mondal, 2022; Tamilarasan et al., 2022; Basinda et al., 2023;

Golla et al., 2023; Paul, 2023; Fagunwa et al., 2023). Sub-Sahara Africa has remained behind in access to improved latrine facilities, whereby the population with access to improved sanitation services increased from 8% in 2000 to 31% in 2017 (Asrate et al., 2022). The situation is worse in rural areas with an estimated 35% of rural households, in contrast to 8% of urban households (Ntaro et al., 2022; Basinda et al., 2023; Golla et al., 2023; Paul, 2023). Poor sanitation expenses were estimated to be 222.9 Billion Dollars in 2015, this included health care expenditure for treating sanitation-correlated diseases, time lost to access sanitation facilities, and output lost due to illness (Tamene & Afework, 2021).

Given the importance of sanitation to public health, it has been given focus by the government of Tanzania through various programs. Improving access to improved latrines has been a priority of the government as part of efforts to reduce global inequalities in WASH (González-Rodrigo et al., 2022). The estimated 31,000 deaths each year due to inadequate WASH services are over 10% of preventable deaths in Tanzania, and cost the economy more than \$2.4 billion each year in excess medical costs and lost productivity (World Bank, 2023). The situation of poor latrines is more common in rural areas compared to urban areas. As such, the government of Tanzania has taken various interventions to ensure all households have access to improved latrines. These interventions include 'Mtu ni Afya' (Health is Life), Health through Sanitation and Water (HESAWA) (Mwesongo and Mwakipesile, 2023), National Sanitation Campaign (NSC) since 2012 to increase the proportion of households and schools with improved sanitation and hygiene conditions as well as 'nyumba ni choo' (a house is not complete without a proper toilet). The campaign used a mixture of approaches including Social Marketing; Community-Led Total Sanitation (CLTS), Behavior Change Campaign (BCC), rehabilitation or construction of appropriate WASH facilities in schools, and

Artisan Training (Safari et al., 2023). Despite these efforts taken by the government, still 32.24% of households use unimproved latrines and only 67.76% of households use improved latrines (DHS, 2022). These percentages vary from one region to another, which underscores the need for this study.

Recent studies on the use of improved latrine facilities in various countries have showed that there are substantial factors for geographical variations in latrine use across countries and regions in specific countries. In India, Mondal (2022) and Ali and Khan (2023) found age, income, water availability, social category, education, occupation, socio-religious affiliation, access to information, and economic status, are significant factors in access to improved latrines. In Vietnam, a study by Le and Makarchev (2020) showed the only hygienic latrine use predictors with statistical significance are neighbors' behavior, health-benefit beliefs, and user preference. In Indonesia, Yolanda et al., (2022) found that predisposing factors that influence the use of improved latrines include occupation, education, attitudes, knowledge, economic status, and habits. In Haiti, Paul (2023) found factors such as education, media, and income determine the use of improved latrines. In Ethiopia, access to improved latrines is still a big problem and is determined by water access, availability of sanitation hardware stores, and knowledge (Omer et al., 2022; Asrate et al., 2022). Another study by Tamene and Afework (2021) found adoption and use of improved latrine facilities were determined by contextual factors (e.g. the status of land ownership, population density, limited space, personal preference for using the field, educational status, and gender), psychosocial factors (attitudes, beliefs, culture, and perceptions of minimal health threat from children's feces), and technological factors (cost of constructing a latrine and inconveniences in acquiring materials).

In addition, In Rwanda, Muhimpundu and Rutayisire (2022) found people with tertiary education and high monthly income were more likely to have improved latrines. In Kenya, Legge

et al., (2021) found households with a head with at least secondary school education, higher local sanitation coverage, and level of coarse soil fragments used improved latrines. In Uganda, Ntaro et al., (2022) found contextual factors associated with the use of improved latrines include financial constraints, a perceived health risk for typhoid disease, and negative attitude of less value attached to open defecation-free components. There have been many studies on factors associated with the use of improved latrine facilities in developing countries, but there is still no specific study that discusses these factors broadly and in-depth in the context of Tanzania. Therefore, the aim of this study is to determine associated factors with access to and use of improved latrine facilities in Tanzania.

This study is important to address and understand current status of latrine use and improve sanitation practices and public health in the country. This study will be used by other countries which experience low use of latrines as reference to learn how to improve sanitation practices and contribute to the achievement of Sustainable Development Goal number 6 specifically target 6.2. The findings of this study show the practices of Tanzania and thus can be used as a reference to other countries especially Sub-Saharan Africa where the majority lags in using improved latrines. The findings of this study contribute to the empirical evidence base in aspects related to sanitation and thus contribute to the intellectual discourse as well as stimulating further studies.

This paper is structured as follows, section two describes methods and materials and section three presents the results. The findings are discussed in section four while the conclusion and recommendations are discussed in section five.

Methods and Materials

Data Source

The data source for this study is the 2022 Tanzania Demographic and Health Survey and Malaria Indicator Survey (2022 TDHS-MIS) by visiting <https://www.dhsprogram.com> which is the 7th DHS survey in Tanzania to be conducted through

the DHS program. The DHS is a nationally representative survey conducted periodically to collect demographic and health information from households across Tanzania. This comprehensive survey covers a wide range of health indicators, including sanitation practices, making it particularly suitable for our study.

Sampling

The Tanzania DHS employed a multistage cluster sampling design to sample 15,540 respondents. Clusters are selected in the first stage, followed by systematically sampling households within each cluster. The sampling strategy ensures the representation of both urban and rural areas and covers diverse regions of Tanzania.

The study sample is drawn from the households included in the most recent wave of the DHS. The inclusion criteria for households are based on their availability in the survey dataset and the completeness of relevant variables. Only households with complete information on the dependent variable ("Use of Improved Toilets") and key independent variables (e.g., socioeconomic status, education) are included in the analysis to ensure the reliability of the results.

Variables

Dependent Variable: "Use of Improved Toilets" Binary variable indicating whether a household uses an improved toilet. This variable was coded as "1" when households responded that "Flush Toilet", "Flush to piped sewer system", "Flush to septic tank", "Flush to pit latrine", "Flush to somewhere else", "Flush, don't know where", "Pit Toilet Latrine", "Ventilated Improved Pit latrine (VIP)", "Pit latrine with slab (washable)", "Pit latrine without slab/open pit", and "Composting toilet" and term as improved toilets while "0" when they responded "Pit latrine with slab (not washable)", "NO FACILITY", "No facility/bush/field", "Bucket toilet", "Hanging toilet/latrine" or "Other" and we term as unimproved toilets.

List of the independent variables used in the analysis, including but not limited to Socioeconomic Status (SES), education level of

household head, urban/rural residence, access to clean water, sanitation facilities, household size, awareness of hygiene practices, distance to healthcare facilities, presence of children under 5 years old, and knowledge about improved toilets.

Data analysis

In this study data, we analyzed data using STATA Version 16. We started by analyzing descriptive statistics through frequency and percentage due to our variables being categorical. For inferential analysis, a multilevel logistic regression model was chosen as the statistical approach. The choice was driven by the hierarchical nature of the data, where individuals (level 1) are nested within households (level 2), and households are further nested within regions (level 3). This multilevel structure allows us to account for the potential clustering of observations within households and regions, addressing the correlated nature of the data. The decision to use logistic regression is motivated by the binary nature of the dependent variable, "Use of Improved Toilets," which is coded as 1 if a household uses an improved toilet and 0 otherwise. Logistic regression is well-suited for modeling binary outcomes, providing probabilities and odds ratios that facilitate the interpretation of the effects of independent variables on the likelihood of using improved toilets. Random Effects; the inclusion of random effects in the model is crucial to capture and account for unobserved variability at both the household and regional levels. By allowing for random intercepts at these levels, the study acknowledge that there might be unmeasured factors specific to households and regions that influence toilet access and use. This is particularly relevant in the context of sanitation practices, where local and regional variations play a significant role.

Data Cleaning and Preparation

The dataset undergoes a thorough cleaning process to handle missing values, outliers, and inconsistencies. Variables are recorded and transformed as needed for the analysis. Descriptive statistics are calculated to gain insights into the distribution of key variables.

Results

Figure 1 shows the types of toilets used by households. The majority of households (21.9%) used pit latrines with slabs (not washable), followed by 20.57% of households that used flush-to-pit latrines while the least (0.05%) of households used composting toilets and flush (don't know where) toilets. Consequently, Figure 2 shows the distribution of improved toilets, more than two-thirds (67.76%) of households used improved toilets while 32.24% of households did

not use improved toilets. Moreover, Table 1 shows the profile of the households, the majority (58.28) of heads of households had primary education, half of the households (52.32%) had 1-5 children, 43.85% of households were rich, 44.16% of heads of households aged between 35 and 54 years, nearly three-quarters of head of households were males, 41.71% of household size were 4-6 people, 70.35% of head of households were married, more than half (56.09%) of households had no radios, more than two thirds (71.72%) of households had no televisions.

Table 1: Profile of the households

Variable	Category	Frequency	Proportion (%)
Education	Education, preschool/early Childhood	3,068	19.74
	Primary	9,056	58.28
	Secondary	3,024	19.46
	Higher	392	2.52
Number of living children	0	7,372	47.44
	1-5.	8,131	52.32
	6+	37	0.24
Wealth index	Poor	5,497	35.37
	Middle	3,228	20.77
	Rich	6,815	43.85
Age of household head (years)	15-34	3,821	24.59
	35-54	6,863	44.16
	55+	4,856	31.25
Sex of household head	Male	11,040	71.04
	Female	4,500	28.96
Household size	1-3	5,768	37.12
	4--6	6,482	41.71
	6+	3,290	21.17
Marital status	Never married	749	4.82
	Married	10,933	70.35
	Widowed	1,952	12.56
	Divorced	1,906	12.27
Has radio	No	8,717	56.09
	Yes	6,823	43.91
Has television	No	11,145	71.72
	Yes	4,395	28.28

Figure 1: Types of toilets facility used by households

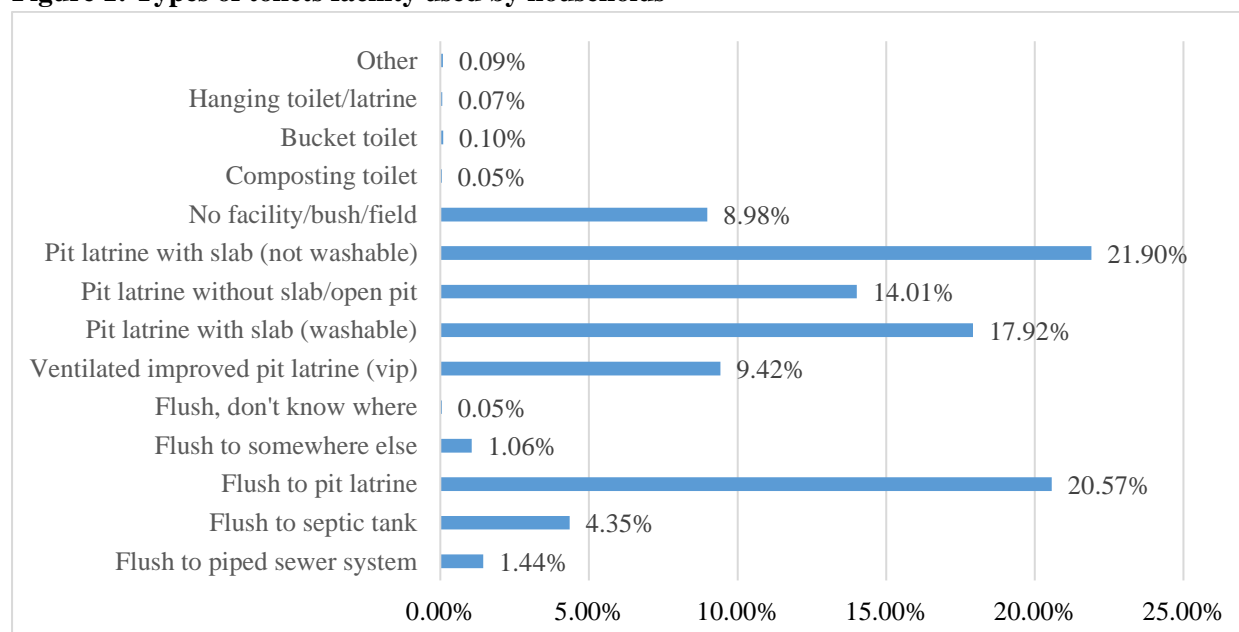
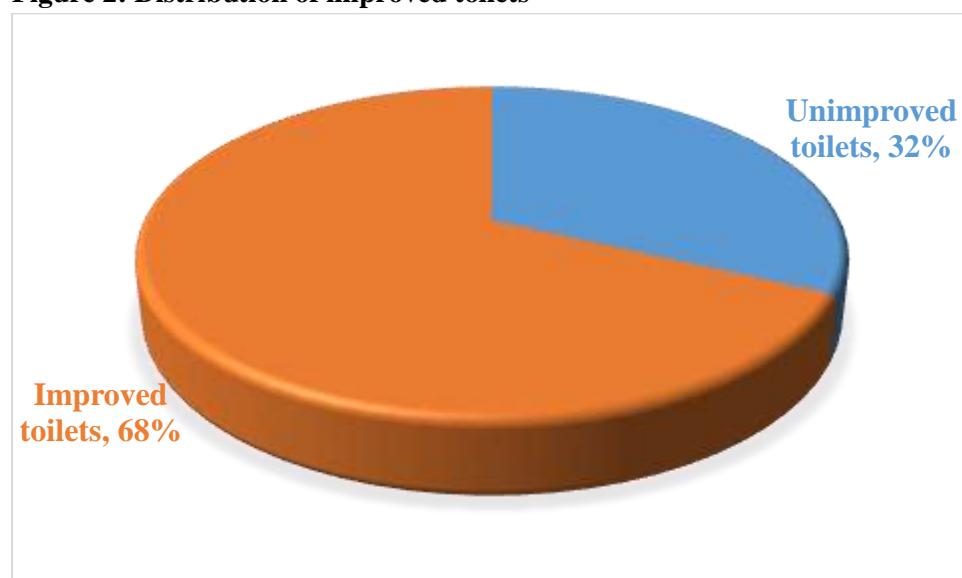


Figure 2: Distribution of improved toilets



The results of multilevel logistic regression for the fixed effects of the predictors on the use of improved toilets are as follows, Head of households with primary (OR=1.23, 95% CI: 1.077-1.41, $p<0.002$), secondary (OR=1.45, 95% CI: 1.25-1.69, $p<0.00$), and higher education (OR=1.88, 95% CI: 1.25-2.82, $p<0.002$) had higher odds of using improved toilets compared to those with no education. Concerning wealth, households with middle (OR=2.48, 95% CI: 2.01-3.07, $p<0.00$) and rich (OR=12.46, 95% CI: 9.44-16.46, $p<0.00$) had higher odds of using improved toilets compared with poor, head of household

with 55+ years (OR=1.21, 95% CI: 1.05-1.39, $p<0.007$) had higher odds of using improved toilets compared to 15-34 years, households with radio (OR=0.87, 95% CI: 0.78-0.97, $p<0.02$) had lower odds of using improved toilets compared with no radio, households with television (OR=1.25, 95% CI: 0.99-1.55, $p<0.025$) had higher odds of using improved toilets compared to those with no television. For the random effects, the estimated variance of the random effects ($\sigma^2=0.4827729$) represents the variability of the random effects across regions, it suggests that there are notable differences in the use of

improved toilets between regions. The low correlation coefficient between random effects ($p=0.066$) suggests that households within the same region are less correlated in terms of their use of improved toilets. This implies that regional

factors have a moderate impact on household behavior regarding improved toilet use, but individual households within the same region can vary more independently (See Table 2).

Table 2: A Multilevel logistic regression for the predictor of the use of improved sanitation

Variable	Odds Ratio	Std. Err.	Z	p-value	95% confidence interval	
Education						
No education, preschool/early childhood	Reference					
Primary	1.23231	0.084385	3.05	0.002	1.077538	1.409314
Secondary	1.456961	0.112846	4.86	<0.000	1.251756	1.695806
Higher	1.884567	0.390102	3.06	0.002	1.256071	2.82754
Number of living children						
0	Reference					
1-5.	0.996169	0.055718	-0.07	0.945	0.892738	1.111584
6+	1.158791	0.333878	0.51	0.609	0.658797	2.038256
Wealth index						
Poor	Reference					
Middle	2.483963	0.268656	8.41	0	2.009474	3.070492
Rich	12.46931	1.768821	17.79	0	9.442697	16.46602
Age of household head (yrs)						
15-34	Reference					
35-54	1.143979	0.083401	1.85	0.065	0.991657	1.319698
55+	1.212427	0.08654	2.7	0.007	1.054141	1.39448
Sex of head of household						
Male	Reference					
Female	1.056477	0.049861	1.16	0.244	0.963134	1.158866
Household size						
1—5	Reference					
4—6	1.019329	0.070282	0.28	0.781	0.89048	1.166821
6+	0.976162	0.083968	-0.28	0.779	0.824713	1.155424
Marital status						
Never married						
Married	0.860919	0.139862	-0.92	0.357	0.626151	1.18371
Widowed	0.986849	0.151617	-0.09	0.931	0.730254	1.333606
Divorced	0.744802	0.115039	-1.91	0.056	0.55026	1.008125
Has radio						

No	Reference					
Yes	0.875583	0.05008	-2.32	0.02	0.782729	0.979451

Has television						
No	Reference					
Yes	1.243776	0.139796	1.94	0.025	0.997861	1.550295
_Cons	0.662705	0.131018	-2.08	0.037	0.449817	0.976349

Discussions

Findings show that 67.76% of households used improved toilets while 32.24% of households did not use improved toilets in Tanzania, which is higher than the African average of 31% (UNICEF and WHO, 2022). The reasons for using improved toilets are the results of a national sanitation campaign known as Nyumba ni Choo (which roughly translates as ‘a house is not complete without a proper toilet) implemented by the Government through the Ministry of Health. According to Aunger et al. (2023) 97% of Tanzanians had heard of Nyumba ni Choo likewise, 44% of households surveyed said they built an improved toilet because they heard or saw a campaign about improving toilets (direct effect), or visited officials (an indirect effect). Countries with a higher percentage of the population using at least basic sanitation in Africa include Algeria (86%), Botswana (81%), Cape Verde (83%) and Seychelles (100%) (WHO, 2024). Also, this proportion of access to improved latrines found in this study was lower than in other studies done in India and Vietnam in which 73% and 74% of the households had improved latrines in respective order (Asrate et al., 2022). These variations might be due to the economic characteristics variation and socio-demographics from one country to another (Golla et al., 2023).

Findings show that heads of households with primary, secondary, and higher education were likely to use improved toilets compared to those with no education. This is consistent with a study conducted in Ethiopia on Magnitude and determinants of improved household latrine utilization (Tesfaw et al., 2023). Also, consistent with a study conducted in India on the Transition in the availability of improved sanitation facilities and its effect (Brahmanandam and Bharambe,

2023). Likewise, the results of this study are consistent with a study done in Rwanda on improved latrine coverage and associated factors among rural communities (Muhimpundu and Rutayisire, 2022). This is because as heads of households are educated it enables them to understand different matters of hygiene and health and thus know the importance of good sanitation and hygiene practices and risks of using traditional toilets. Also, educated households area easily find information and make informed choices. Educated individuals have better access to information. This supports the Health Belief Model (HBM) which suggest that individuals’ decisions to use improved latrines are influenced by their perceptions of the severity of health risks associated with open defecation and the benefits of using improved facilities.

Households with middle income and rich had higher odds of using improved toilets compared with the poor. This is consistent with a study conducted in Benin on Household access to basic drinking water, sanitation, and hygiene facilities (Gaffan, et al., 2022). Also, in Bangladesh on equity in access to safely managed sanitation and the prevalence of diarrheal diseases (Akter, et al., 2022). This is because as heads of households, their incomes increase also their ability to construct and install improved toilets increases. Also, households with middle-income and rich families can afford to upgrade their toilets, buy cleaning facilities, and well as do regular maintenance when needed. This is linked with the cost-benefit analysis that households perform when deciding whether to invest in improved latrines, factors such as the cost of construction materials, and long-term economic benefits of improved health are considered.

Head of households with 55+ years had higher odds of using improved toilets compared to 15-34 years. This is consistent with a study conducted in Ghana on the Effects of Socioeconomic and Housing Characteristics on the Choice of Toilet Facilities (Adzawla, et al., 2020). People with 55+ years had higher odds of using improved toilets because improvement could be beneficial, highlighting its potential for improving comfort, accessibility, and dignity (Balaceanu et al., 2019). Also, heads of households with 55+ years had higher odds of using improved toilets because they are more sensitive to health-related factors than young ones.

In addition, households with radio had lower odds of using improved toilets compared with no radio, and households with television had higher odds of using improved toilets compared to those with no television. This is consistent with a study done in Ethiopia on the analysis of improved drinking water sources and sanitation facilities (Xu, et al., 2023). The reason can be most of the sensitization campaigns are advertised through televisions and people can easily observe how improved toilets look which is different when using radio.

Conclusion

More than half of the households had access to an improved latrine which is not common in most developing countries, especially in sub-Saharan Africa, and thus can be used as a reference for learning. This implies the government and stakeholders' interventions have brought positive changes. Households with higher education, households with middle income and rich, heads of households with 55+ years, and households with television were found using improved latrines. The study found Health Belief Model (HBM) and cost benefit analysis used in decision of using improved latrines, these helps in designing effective interventions to improve latrine access and use in Tanzania.

Key practical applications of the study involve combination of community-driven initiatives, policy interventions, and technological innovations. Mobilizing communities to eliminate open defecation through collective behavior

change is important by fostering a sense of ownership and responsibility, communities are more likely to build and maintain their own latrines. Promoting the benefits of improved latrines through targeted marketing campaigns through educating people about health benefits, convenience, and social status associated with using improved facilities increases use of improved latrines. Developing latrine designs that are affordable, easy to construct, and suitable for local environmental conditions can increase adoption. Enforcing regulations that require the construction of latrines in new buildings and public spaces can ensure widespread access. Policies that support sanitation infrastructure development and maintenance are also crucial. Establishing systems to monitor the use and maintenance of latrines can help identify issues and improve interventions. By implementing these practical applications, Tanzania can make significant strides in improving sanitation, reducing disease, and enhancing the overall quality of life for its citizens. Therefore, these efforts will increase the number of households using improved latrines in the country and thus contribute to the achievement of sustainable goal 6 specifically target 6.2.

Study limitation

The major limitation of the study was based on the fact that DHS data is nationally representative, it may not capture all regional variations and specific local contexts. In addressing this limitation the study considered use of complementary studies to provide a more complete picture.

Data availability statement

<https://www.dhsprogram.com>

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