

Research Title: Prevalence and Factors associated with unimproved sanitation in Kirehe district, Rwanda

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Abstract

Worldwide, the disease burden associated with poor water, sanitation, and hygiene is estimated to account for 4.0% of all deaths and 5.7% of the total disease burden in disability-adjusted life year. This study aimed at determining the prevalence of unimproved sanitation and associated factors among community households in Kirehe district. The findings will add to the growing body of knowledge needed for improved sanitation and prevention of infectious disease like cholera and diarrhea especially by the Ministry of Health and Rwanda Biomedical Center (RBC) and showed the prevalence of unimproved sanitation in rural community households in order to know how far the problem is and plan for intervention. Furthermore, this study provided baseline information regarding prevalence of unimproved sanitation and associated factors which may be used for further researchers. A cross-sectional study was employed using mixed methods with quantitative and qualitative data collection approaches. The quantitative approach of data collection method has been conducted and then qualitative approach has been followed. A structured questionnaire has been used to collect quantitative data and Focus Group Discussions (FGDs) has been conducted to collect the qualitative data. The study population consisted of household heads or their representatives and key informants from the study area of Kirehe district. For quantitative the total sample size was 271 households while for qualitative data, a total of three FGDs with eight (8) participants has been conducted among twenty-four (24) rural community members of Kirehe district. Multistage and simple random sampling methods have been used for quantitative part while for qualitative method; purposive sampling method has been used. Raw data from the questionnaire have been entered into EPI data and transported into SPSS version 22 for analysis. Descriptive statistics has been used to tabulate and describe the data and Bivariate analysis to assess the association between independent and dependent categorical variables were carried out using Chi square (X^2). The strengths of the associations have been determined with multiple logistic regressions. Inference has been made using a 95% confidence interval and a p-value < 0.05 . The results have been presented in frequency, cross tabulation tables, and pie charts and qualitative data have been analyzed using manual. The results showed that 64.6% of respondents were male household heads. The results showed that only 16.2% were below 30 years old, most of the respondent's equivalent to 40.6% were between 40-50 years and 12.2% were aged between 30-40 years whereas 31% are above 50 years old. The findings from the study revealed that more households (68.3%) responded that they had improved sanitation whereas 31.7% responded that they did not have improved sanitation. The prevalence of unimproved sanitation in Kirehe District is 31.7%. Findings revealed that households headed by male are more likely to have improved sanitation facilities (AOR=1.66, 95% CI :1.168-3.447, P=0.009). Respondents who completed secondary education and above

were 3.40 times more likely to have improved sanitation compared to those who did primary education. Households with respondents aged 30 to 40 were 62% more likely to have improved sanitation. The findings revealed that households with four and more members were less likely to have improved sanitation (AOR=0.57, 95%CI: 0.145-0.803, P=0.002) Respondents with average monthly income Between 50,000 and 100,000 Rwfs are 2.72 times more likely to have improved sanitation. Since the level improved sanitation in rural areas of KIREHE was found to be less than the national level, there is a need of continued mobilization the community members about the importance of improved sanitation facilities.

Keywords: Improved sanitation; Unimproved sanitation; Household sanitation; Water, Sanitation and Hygiene (WASH); Associated factors; Rural households; Kirehe District; Rwanda.

1. Background

Despite encouraging progress on sanitation, most of Sub-Saharan Africa did not meet the MDG sanitation target. Globally, it was estimated that billions of people still use unimproved sanitation facilities, and a significant proportion of the world population continues to practice open defecation (World Health Organization [WHO] & United Nations Children's Fund [UNICEF], 2023). These figures indicate that sanitation remains a major global public health challenge, particularly in low- and middle-income countries. Globally, a considerable proportion of the population does not use improved latrine facilities, forcing many people to resort to unsafe sanitation practices. Earlier global estimates showed that sanitation coverage was insufficient to meet international targets, suggesting that the world was unlikely to achieve the sanitation-related Millennium Development Goals (MDGs) on time if the prevailing trends continued (UNICEF, 2013). This demonstrates that inadequate sanitation has remained a persistent global development issue over time.

From a global perspective, sanitation inequality is also reflected in the fact that rural populations are disproportionately affected compared to urban populations. Many rural communities continue to experience limited access to improved sanitation services due to poverty, weak infrastructure, and low levels of awareness (United Nations, 2023). In addition, poor sanitation practices contribute significantly to environmental contamination and the spread of infectious diseases, including diarrhea, cholera, and typhoid fever (WHO, 2022).

Regionally, Sub-Saharan Africa remains the farthest behind in progress toward universal access to improved sanitation facilities. Regional estimates indicate that a large proportion of the population still relies on unimproved sanitation facilities, while open defecation remains common in many countries due to lack of adequate sanitation infrastructure (UNICEF, 2022). This situation is driven by multiple factors, including rapid population growth, poverty, limited government investment in sanitation, and insufficient behavioral change interventions.

In developing countries, a large proportion of the population continues to live in unhygienic environments compared to developed countries. Sanitation coverage remains significantly lower in rural areas compared to urban settings, where access to improved sanitation facilities is more available (Bartram & Cairncross, 2010). Globally, the majority of people using unimproved sanitation facilities and those practicing open defecation are concentrated in rural areas, highlighting a strong rural–urban disparity in sanitation access (Central Statistical Agency [CSA], 2014).

Sanitation is a critical determinant of public health, environmental sustainability, and socio-economic development. Access to improved sanitation facilities significantly reduces the transmission of communica

ble diseases such as diarrhea, cholera, typhoid fever, and parasitic infections, which continue to pose major public health challenges in low- and middle-income countries (WHO & UNICEF, 2023). Poor sanitation is particularly detrimental to children under five years of age, contributing to high morbidity, mortality, and impaired physical and cognitive development.

Globally, progress in sanitation coverage has been uneven, with rural populations lagging behind urban areas. Sub-Saharan Africa remains the region with the lowest access to improved sanitation, largely due to poverty, rapid population growth, weak infrastructure, and limited behavioral change interventions (UNICEF, 2022). Inadequate sanitation also exacerbates environmental contamination and undermines human dignity and safety, especially for women and girls.

In Rwanda, the government has made commendable progress in improving water, sanitation, and hygiene (WASH) services through national policies such as Community-Led Total Sanitation (CLTS) and the National Sanitation Policy. These interventions have contributed to increased latrine coverage and improved awareness of hygiene practices. However, despite these achievements, significant disparities persist between urban and rural settings. Rural districts continue to experience higher levels of unimproved sanitation facilities, including traditional pit latrines and shared sanitation facilities.

Kirehe District, located in the Eastern Province of Rwanda, is predominantly rural and characterized by low household income, limited access to improved infrastructure, and environmental conditions that may hinder the construction of durable sanitation facilities. These challenges increase the likelihood of households relying on unimproved sanitation facilities, thereby exposing communities to sanitation-related diseases and environmental risks.

Whereas most studies conducted have focused on establishing latrine coverage levels, there is a clear gap in the investigation of the underlying factors leading to unimproved sanitation, especially in marginalized areas like Kirehe District. National and regional reports provide general sanitation coverage data but do not sufficiently explore the prevalence of unimproved sanitation and the associated household and community-level factors. Therefore, this study seeks to determine the prevalence of unimproved sanitation and associated factors among community households in Kirehe District, Rwanda.

2. Research Methodology

A cross-sectional study design has been conducted using both quantitative and qualitative approaches. The study design has taken small geographical area in a short period of time. The quantitative approach of data collection method has been conducted and then qualitative approach has been followed in order to get richly information. A structured questionnaire has been used to collect quantitative data and Focus group discussions (FGDs) have been conducted to collect the qualitative data.

3. Study area

The study has been undertaken in KIREHE district, Rwanda. the study location has 12 sectors: Kirehe, Kigina, Nyamugali, Nasho, Mpanga, Mushikiri, Gatore, Musaza, Gahara, Mahama, Nyarubuye and Kigarama.

Kirehe District is located in the Eastern Province of Rwanda, bordered by Tanzania and Burundi. Its geographical coordinates are approximately 30°45'E and 2°13'S. The district is characterized by savanna vegetation and features notable geographical landmarks such as Rusumo Falls on the Akagera River.

Kirehe District population is predominantly by rural area 93.7% while urban represents 6.3%. The sectors of Kirehe District which are entirely rural are Gahara, Gatore, Kigarama, Mpanga, Musaza, Mushikiri and

Nyarubuye are entirely while the remaining are somehow urban.

SECTORS	NUMBER HOUSE HOLDS	CORRESPONDING POPULATION	AVERAGE SIZE OF HOUSEHOLD
RWANDA	3,312,743	13,100,600	4.0
EASTERN PROVINCE	886,132	3,521,227	4.0
KIREHE DISTRICT	113,886	459,566	4.0
GAHARA	11,038	44,429	4.0
GATORE	7,856	31,656	4.0
KIGARAMA	9,423	37,115	3.9
KIGINA	8,911	34,557	3.9
KIREHE	7,621	29,448	3.9
MAHAMA	18,892	80,851	4.3
MPANGA	9,840	39,743	4.0
MUSAZA	7,603	30,067	4.0
MUSHIKIRI	8,244	32,819	4.0
NASHO	8,400	33,645	4.0
NYAMUGALI	10,540	42,635	4.0
NYARUBUYE	5,518	22,601	4.1

Target Population

Population and Housing Census (PHC5) has enumerated 460,860 residents in Kirehe District, which represent 12.9% % of the total population of the Eastern Province (3,563,145 residents). The population of Kirehe District is predominantly female: 239,097 are women corresponding to 51.9 % of the total population of Kirehe District. Females are predominant in all sectors of the district. Mahama (81,014 population) is the most populated sector. Its population represents 17.6% of the total population of Kirehe District. The two less populated sectors are Nyarubuye (22,660 inhabitants) and Kirehe (29,547 inhabitants). They represent 4.9 and % 6.4% of the total resident population of Kirehe District

The study population consists of household heads or their representatives and FGDs from the study area of Kirehe district. Kirehe district has a total population of 460,860 and 113.886 households based on the Fifth Rwanda Population and Housing Census, 2022 (NISR)

3.1: Distribution of households and their corresponding size

Source: Fifth Rwanda Population and Housing Census, 2022 (NISR)

3.3.1 Inclusion criteria

Every household with head or member over 18 years selected randomly has been visited and FGDs participants within the 3 selected sectors.

3.3.2 Exclusion criteria

Households without family members that have not been present for at least six months

3.3 Sample Design

This includes sample size and sampling techniques that will be used.

3.3.1 Sample Size

Quantitative

The sample size for the study is determined using the sample size calculation designed by Fisher et al. (1998) because the target population is greater than 10,000 as detailed below:

$$n = z^2 pq / d^2$$

Where;

n= Expected sample size

z= Degree of confidence at 95% that corresponds to 1.96

p= Expected prevalence (0.19) of sanitation coverage in Rwanda was 19%

d= Acceptance error at 0.05 (5% precision)

$$n = (1.96)^2 \times (0.19 \times 0.81) / 0.05^2$$

$$n = 236$$

The total sample size was 236 households

No response rate of 15% was added to estimated sample, therefore the final sample size is 271 households.

Qualitative

A total of three FGDs with eight participants in each has been conducted among 24 rural community members of Kirehe district.

3.3.2 Sampling Techniques

Multistage sampling method has been used for quantitative part. In the first step 3 sectors have been selected using convenience sampling methods. In the second stage, 1 cell from each sector was randomly selected and again 2 villages from each selected cell have been selected randomly using Statistical Packages of Social Sciences software (SPSS) after the list of villages entered into the software. In the third stage, households have also been selected randomly using SPSS as the code and list of households have been obtained from the sector administration and then households have been distributed according to proportionate to the number of households in each sector.

3.4 Data Collection Methods

This explains quantitative and qualitative data collection methods, administration of data collection instruments and validity as well as reliability of data collection tools.

Quantitative

For quantitative, data have been collected using a pretested semi-structured questionnaire which was in English and then translated into Kinyarwanda. It has been administered to the study participants with the help of 2 trained research assistants and the principal investigator. It took approximately 30 minutes to administer the questionnaire. In this study, unimproved sanitation has been determined through the proportion of households having ownership of unimproved sanitation facility (latrine), or shared one whether improved or unimproved or total absence of latrine (open defecation).

Qualitative

For qualitative, data have been collected using FGDs (appendix 4 for community member). The FGDs members have been interviewed on perception of community members regarding improved sanitation/unimproved sanitation. The discussions have been recorded by using telephone recorder and the interviews lasted between 30-40 minutes.

3.4.2 Administration of data collection instruments

For quantitative, questionnaire has been administered by trained assistants after receiving consent from each study participants. Participants have been recruited after consent is sought and obtained from each individual. At the end of each day the researcher has cross checked the questionnaire for completeness. Only completed questionnaires have been considered for data entry.

For qualitative, FGDs guide have been used in collecting data and moderator has been the researcher himself. Qualitative data have been done using telephone recorder.

3.4.3 Validity and Reliability

Validity and reliability are the major criteria for measuring the instrument quality and adequacy. Validity refers to the extent to which a measurement instrument actually measures what it is meant to measure. To ensure the validity of the research instrument, the researcher designed the questionnaire by reviewing relevant literature and studies in the area of interest.

Reliability is the degree of similarity of the results obtained when the measurement is repeated on the same subject or the same group. The tools have been pretested by administering the questionnaire to ten (10) study participants at KIREHE district and the tools have been modified where necessary. The research assistants have also been trained on how to administer the tools. Adjustments were made accordingly, in case required, with the guidance of the supervisor. The Cochrane's coefficient has been calculated to measure the percentage agreement between the responses from the two tests. A coefficient of 0.7 and above has been considered adequate for field testing of the tool. Research assistants have also been trained on how to collect data and the overall study objectives.

3.5 Data Analysis Procedures

Data analysis procedures show how quantitative and qualitative data have been analyzed

3.5.1 Quantitative data analysis

Raw data from the questionnaire have been entered into EPI data and transported into SPSS version 20 for analysis. Descriptive statistics have been used to tabulate and describe the data, score assessment of all variables related to improved sanitation were done in order to find sanitation coverage and Bivariate analysis to assess the association between independent and dependent categorical variables were carried out using Chi square (X^2). The strengths of the associations have been determined with multiple logistic regressions. Inference has been made using a 95% confidence interval and a p-value < 0.05. The results have been presented in frequency, cross tabulation tables, and pie charts.

3.5.2 Qualitative data analysis

The qualitative data have been analyzed thematically. Each interview transcript has been assigned a unique key informant identifier. The transcripts have sent back to the key informants for validation purposes. The key issues in all the transcripts have been coded and grouped into similar concepts. The concepts have been then be categorized into themes and a short report was produced for each discussion topic. The qualitative data have been presented in form of quotes.

3.6 Ethical Consideration

The consent of the respondents has been sought and obtained before the administration of the questionnaire (Appendix 1). The participants have been informed that their participation is voluntarily and they could withdraw from the study at any time without giving any reason. The findings have been treated with utmost confidentiality and it is for the purpose of this research only. The objective and result of the study have been explained to the subjects of research participants. Then, the participants have been informed that the procedure used will not pose any potential risk and their identities and personal particulars will be kept strictly confidential.

Approval to carry out the study has been sought and obtained from Mount Kenya University (MKU), School of Post Graduate studies and the permission to conduct the study has been obtained from Kirehe district. All the information collected from study participants were kept confidential and only used for

research purposes. The questionnaire did not bear names but had a number thus participants identity have not been revealed. The names have not been used in any report of this study or in any publication or presentations.

4. RESEARCH FINDINGS AND DISCUSSION

4.1 Socio demographic characteristics of Respondents

This section examines the demographic information of respondents that include Gender of household head, occupation, level of education, Age, Average monthly income and number of household members. Descriptive statistics of each demographic variable is describes in the following table (Table 4.1), this information is useful to comprehensively gain the background information of respondents, thereafter each variable were compared with outcome variable of interest which is sanitation status.

Table 4 1: Socio-demographic characteristics of respondents

Characteristics	Frequency (N=271)	Percent (%)
Gender of household head		
Male	175	64.6
Female	96	35.4
Age		
< 30	44	16.2
30-40	33	12.2
40-50	110	40.6
Above 50	84	31.0
Occupation		
Employment (Salaried)	69	25.5
Informal employment (Casual)	56	20.7
Business/Trading	98	36.2
Farming	48	17.6
Level of Education		
Primary Education	57	21.0
Secondary and above	214	79.0
Average Monthly Income		
Less than 50,000 Rwf	36	13.3
Between 50,000 and 100,000 Rwf	112	41.3
Between 100,001 and 200,000 Rwf	88	32.5
Above 200,000 Rwf	35	12.9
Number of Household members		
Six or more	32	11.8
Four or five	113	41.7
Three	72	26.6
Two	39	14.4
One	15	5.5

Source: Primary Data

The table above (Table 4.1) displays the information on demographic characteristics of respondents. The results shows that 64.6% of respondents who reported that they were household heads were male while 35.4% were females.

The Age of respondents was reviewed and the results showed that only 16.2% were below 30 years old, most of the respondents equivalent to 40.6% were between 40-50 years and 12.2% were aged between 30-40 years whereas 31% are above 50 years old.

The research further more sought to find out the occupation status of respondents and categorized into Formal employment (25.5%), Informal employment (20.5%) , Business/Trading (36.2%) , and farming (17.6%).

To get the information on school-learnt skills, education of respondent was asked and 21.0% of respondents had primary education and less whereas 79% completed Secondary education and above.

To understand the earnings of respondents, the average monthly income of respondents were asked and most of respondents (41.3%) said that their monthly income ranges between 50,000 and 100,000 Rwfs, only 5.9% of respondents earn less than 50,000Rwfs, 14.8% earn between 50,000 and 100,000 Rwfs and 32.5% of respondents had income which is between 100,000 Rwf and 200,000 Rwfs monthly.

And lastly, the research wanted to know the size of household in terms of number of people living in, asked the respondents about the number of household members and 41.7% respondents that there were four or five household members, 26.6% said that there three members in their household, and 14.4% responded that there were two household members.

1. Age (Approximate)

Using the following midpoint assumptions:

Age Category	Midpoint	Frequency
< 30	25	44
30–40	35	33
40–50	45	110
Above 50	55	84

2. Number of Household Members (Approximate)

Using midpoint assumptions:

Household Size Category	Midpoint	Frequency
One	1	15
Two	2	39
Three	3	72
Four or five	4.5	113
Six or more	6.5	32

4.2 Presentation of Findings

The overall objective of this study was to determine the prevalence of unimproved sanitation and associated factors among rural community in Kirehe district, Rwanda. The findings are presented according to specific objectives of the study.

4.2.1 Prevalence of unimproved sanitation in community households in Kirehe district

The study further established the prevalence of unimproved sanitation in rural area of Kirehe district, having improved sanitation such as latrine was to facilitate for the safe disposal of human faeces and urine without slab and to also know the proportion of households having ownership of an improved latrine facility among community under the study.

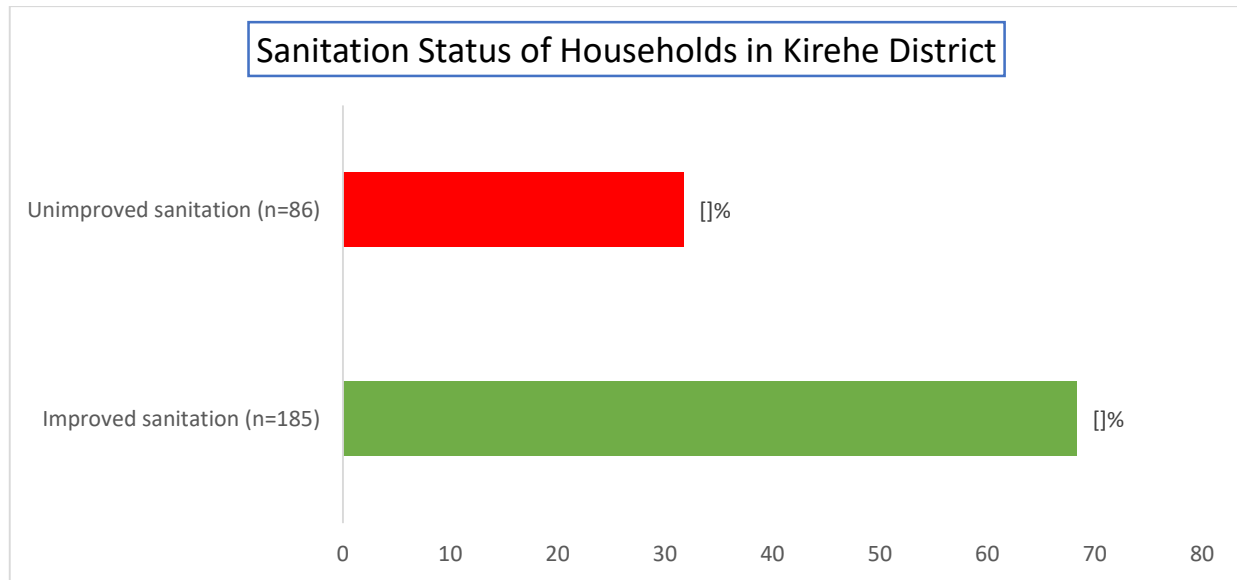


Figure 4. 1 Sanitation status of households in rural area of Kirehe district

As shown by the figure 4.1 above, the results from the study revealed that more households (68.3%) responded that they had improved sanitation whereas 31.7% responded that they did not have improved sanitation. Therefore, the prevalence of unimproved sanitation in Kirehe District is 31.7%. From this discrepancy in the ownership of improved sanitation, researcher sought to know the related factors that may hinder or influence the possession of improved sanitation in the household under study.

4.2.2 Factors associated with improved sanitation among rural households in Kirehe district

To sort out the factors associated with improved sanitation in rural households of Kirehe district, Bivariate analysis was conducted through a chi-square test in SPSS to find out the interdependence among independent variables and the outcome variable of interest which is the possession of unimproved sanitation. Chi-square test statistic was observed and P-Value was viewed to compare it to significance level (0.05) so as to take the decision against the null hypothesis (there is no association between any independent variable and the possession of unimproved sanitation).

Table 4 2: Bivariate Analysis: Factors associated with improved Sanitation

Variables	Have improved sanitation		P-Value
	Yes n(%)	No n(%)	
Gender of household head			0.041
Male	125(67.5)	50(26.7)	
Female	60(32.5)	36(8.1)	
Occupation			0.264
Formal employment (Salaried)	48(26.0)	21(24.4)	

Informal employment (Casual)	42(22.7)	14(12.3)	
Business/Trading	32(17.3)	16(23.6)	
Farming	63(34.0)	35(40.7)	
Level of Education			0.019
Primary	49(26.5)	8(9.3)	
Secondary and above	136(73.5)	78(90.7)	
Age			0.041
<30	23(12.4)	21(24.4)	
30-40	7(3.8)	26(30.2)	
40-50	86(46.5)	24(27.9)	
Above 50	69(37.3)	15(17.4)	
Average Monthly Income			0.006
Less than 50,000 Rwfs	29(15.6)	7(8.1)	
Between 50,000 and 100,000 Rwfs	101(54.6)	11(12.8)	
Between 100,001 and 200,000 Rwfs	40(21.6)	48(55.8)	
Above 200,000 Rwfs	15(8.2)	20(23.3)	
Number of Household members			0.038
3 and less	99(53.5)	30(34.8)	
Four and above	86(46.5)	56(65.2)	
Having necessary skills for constructing latrine			0.038
Yes	153(82.7)	79(91.8)	
No	32(17.3)	7(8.2)	
Who is responsible for ensuring availability of sanitary facility			0.073
Men	134(72.4)	66(76.7)	
Women	51(27.6)	20(23.3)	

Source: Primary Data, 2026

The table above (Table 4.2) shows the results from a bivariate analysis between socio-economic characteristics of respondents and the improved sanitation, chi-square test of independence was used to test the relationship, P-Value ($p < 0.05$) was considered significant.

Gender of the household head was significantly associated with improved sanitation ($p = 0.041$), although households with males as the household heads 127(67.5%) tend to have improved sanitation. There is no significant association between occupation of respondents and improved sanitation, although more respondents with farming activities 63(34.0%) have improved sanitation. A significant association was observed between education level of the respondents and improved sanitation (P-Value = 0.019). It was observed that respondents with secondary education and above tend to have improved sanitation 136(73.5%).

The Age of respondent was found significantly associated with improved sanitation in Kirehe district (P-Value = 0.041), respondents aged between 40 and 50, 86(46.5%) tend to have improved sanitation comparing to older and younger respondents. There is a significant relationship between average monthly income and improved sanitation ($p = 0.006$), respondents who earn 50,000 to 100,000Rwf per month

101(54.6%) have improved sanitation. In contrast, the findings revealed that household with monthly income of 100,000 to 200,000 Rwf tend to have unimproved sanitation 48 (55.8%).

Significant relationship was observed between number of household members and improved sanitation ($P=0.038$), where household with three and less members tend to have improved sanitation 99(53.5%). Out of 86 households with unimproved sanitation, 56 (65.2%) had more than four household members. The findings revealed that having necessary skills for constructing latrine influence the ownership of improved sanitation ($p= 0.038$), the research also found no significant relationship between whoever is responsible for ensuring the availability of improved sanitation with ($p=0.073$).

Results from bivariate analysis showed that gender of head of household head, age, education level, monthly income, number of households members and having skills to construct a latrine were significantly associated with improved sanitation with the P-Values less than 0.05.

Multivariate analysis estimates the logistic model with independent variables significantly associated with outcome variable and the outcome variable (Improved, Unimproved sanitation), the results from Binary logistic regression are shown in the table 4.3 below.

Table 4 3: Multivariate analysis of Factors associated with the improved sanitation in Kirehe District

Variables	Description	AOR	95% CI	P-Value
Gender				
	Female	Ref		
	Male	1.66	(1.168 - 3.447)	0.009
Education Level				
	Primary and less	Ref.		
	Secondary and above	3.40	(1.270 - 7.032)	0.005
Age				
	< 30	Ref		
	30-40	1.62	(1.001 - 3.061)	0.019
	40-50	2.55	(1.211 - 4.238)	0.012
	Above 50	0.49	(0.525 - 1.061)	0.075
Number of Household members				
	3 and less	Ref.		
	Four and more	0.57	(0.145-0.803)	0.002
Average Monthly Income				
	Less than 50,000 Rwfs	Ref		
	Between 50,000 and 100,000 Rwfs	2.72	(1.309 - 4.120)	0.022
	Between 100,001 and 200,000 Rwfs	6.51	(1.920 - 12.294)	<0.001
	Above 200,000 Rwfs	4.74	(1.122 - 6.720)	0.005
Having necessary skills for constructing latrine				
	Yes	Ref		
	No	0.36	(0.09 - 0.71)	0.006

Source: Primary Data, 2026

Results from multivariate analysis presented in **Table 4.3** revealed that households headed by male are more likely to have improved sanitation facilities (AOR=1.66, 95% CI :1.168-3.447, P=0.009). Respondents who completed secondary education and above were 3.40 times more likely to have improved sanitation compared to those who did primary education (AOR=3.40, 95% CI:1.270-7.032, P=0.005).

Households with respondents aged 30 to 40 were 62% more likely to have improved sanitation (AOR=1.62, 95%CI (1.001-3.061), P=0.019), the same trends were observed for household with respondents aged 40 to 50 where they were more than two times more likely to have improved sanitation (AOR= 2.55, 95%CI: 1.211-4.238, P=0.012). The findings revealed that households with four and more members were less likely to have improved sanitation (AOR=0.57, 95%CI: 0.145-0.803, P=0.002).

Respondents with average monthly income Between 50,000 and 100,000 Rwfs are 2.72 times more likely to have improved sanitation compared to those who earn on average less than 50,000 Rwf (AOR=2.72 95% CI :1.309-4.120, P=0.022). Earning on average between 100,001 and 200,000 Rwfs per month increase by 6.51 times the likelihood of having improved sanitation (AOR=6.51, 95%CI: 1.920-12.294, P<0.001) and respondents who on average earn above 200,000 Rwfs per month are 4.74 times more likely to have improved sanitation compared with those who earn less than 50,000Rwf per month (AOR=4.74, 95% CI:1.122-6.720, P=0.005).

Respondents who did not have skills for constructing latrine were 0.36 times less likely to have improved sanitation as compared to those who had skills for constructing the latrine (AOR=0.36, CI at 95%: 0.09-0.71, P=0.006).

4.2.3 Community Perception about sanitation status in Kirehe District

There are households without proper sanitation in Kirehe District, and the main reasons has been reported. *“Some households do not have latrine and water because of poverty and ignorance”.*

Some of the reasons behind the lack of proper sanitation among the community members of Kirehe district as described below by one key informant: *“We have in our community some people.....few among us who not use latrines when they are drunk and sometimes use to defecate on the road other when they are in the firm just defecate and urinate around or near the firm, the reason behind is that of ignorance, or just misbehaving in a such way because they are drunk. Another group of people are mentally unstable who always don't care about diseases contamination and shamed about defecating in any way”*

People in this community have the capacity necessary to construct latrine facilities (skills, ability, materials, funds etc) because with a willing to have a latrine building it is somehow possible. A member of the community said: *“Yes, I think and agree that community members of here have capacity to construct because digging a hole is easily done, materials we use are locally found here, the ability I judge like it is a self-motivation which is needed. There are also funded latrines constructed in public area and a few numbers of latrines constructed to very poor and vulnerable group of people”*

Some problems could be attributed to lack of sanitation facilities in the community and problems differ per households. Attribution of lacking a latrine is not the same to all households. One said: *“Poverty and ignorance is the main problems and really we have poor households missing likely all mean to survive at a point that they cannot build latrines or other sanitation facilities themselves”.*

Having a neighbor who is not clean or not using good latrine may be a source of contamination of many diseases. If a neighbor use open defecation this can causes a serious number of problems. A key informant said: *“Having a neighbor without toilet of course diarrhea will affect family members of both families. Even if they borrow from your side either you can refuse or just, they use without cleaning it as it should be done because they don't feel responsible”*

“If someone doesn’t build his own latrine it means that he is careless, we cannot admit them using ours”
One household member said *“the leaders obliged us to dig a long hole of more than 6 meters while feces are good source for farming. Go and tell me that we can’t miss these resources unless they show us how to have an improved latrine and use these feces in farming”*.

During household visits, research observed that some latrines have very nice super structure but the pit is very short to facilitate them to recuperate feces manually. And this has been observed as a bad habit that can contribute to the contamination of diseases.

“Generally, we use the toilet which are seen as ordinal toilet which doesn’t need water just you go in. washing hand after using it is when water is available. Many among the toilet don’t have even a cement in.”

How do you clean them?? *“we just use to clean without water because we can’t put water on mad and the one with cement we use to clean with water and soap, some of us had very good and high quality of latrine I may say Euhh.. those one in white”*

People in the community always had the same ideas about use of latrines but they can’t differentiate improved and unimproved sanitation. Some member on focus group said *“I cannot say that I know about ehuhu..... about others views or ideas on perception of using toilet because I may confirm that I know few information on how my neighbors are in terms of using improved latrines ”*

The benefits of using an improved latrine or motivation for constructing one has been discussed within the interview. The informants admit that there are benefits of having a latrine being improved or not. Benefits are many mainly hygiene and diseases prevention and some one said: *“community members having small children are motivated to construct because of maintaining hygiene and prevention of diseases. We used to have health education session at the health center and at the community level”*

Open defecation is perceived as harmful and disliked by community member. Some reasons for open defecation have been discussed. One community member said: *“Off course open defecation is harmful. Contamination of food for example like vegetables and fruits which easily get contaminated and need a special attention while preparing them.”*

Handling children’s feces is perceived as an hygiene manner that is used in many houses and is a family habit, they don’t attribute it on cause of diarrhea but admit that if not well-handled diarrhea may follow. A informant said: *“The children’s feces after being handled must be followed with a hand washing with clean water and soap otherwise diarrhea and other related diseases may follow”*

Discussion

The present study found that the prevalence of unimproved sanitation among rural households in Kirehe District was 31.7%, indicating that although most households had improved sanitation facilities, a substantial proportion still lacked access to adequate sanitation. This finding is consistent with the WHO/UNICEF Joint Monitoring Programme (2023), which reported that rural populations in Sub-Saharan Africa continue to experience lower access to improved sanitation than urban populations. Similarly, a study conducted in rural Ethiopia reported that nearly one-third of households used unimproved sanitation facilities, reflecting challenges related to infrastructure, poverty, and limited sanitation services (Al-emu et al., 2021). However, the prevalence observed in this study is lower than that reported in some rural areas of Tanzania and Uganda, where more than 40% of households lacked improved sanitation (Moshi et al., 2020). The relatively lower prevalence in Kirehe District may be attributed to Rwanda's continued

investment in community-based sanitation programmes, hygiene promotion, and Community Health Worker initiatives that have improved sanitation coverage over recent years.

The study further established that education level, household income, age, household size, and skills for latrine construction were significant predictors of improved sanitation. Households with higher educational attainment were more likely to have improved sanitation, which is consistent with findings from Ethiopia and Kenya showing that education enhances awareness of sanitation benefits and promotes healthier hygiene practices (Asnake et al., 2020; Tumwebaze & Orach, 2018). Similarly, higher household income significantly increased the likelihood of owning improved sanitation facilities, supporting evidence from the World Bank (2022), which emphasized that financial resources enable households to afford improved sanitation infrastructure and maintenance. The finding that larger households were less likely to have improved sanitation agrees with previous studies that reported increased household size often places greater pressure on available financial and physical resources, reducing investment in sanitation facilities (Graham & Polizzotto, 2019). Furthermore, respondents without the necessary skills to construct latrines were significantly less likely to own improved sanitation, highlighting the importance of technical knowledge in promoting sanitation uptake.

The qualitative findings reinforced the quantitative results by identifying poverty, inadequate knowledge, limited technical skills, and poor sanitation practices as key barriers to improved sanitation. Community members reported that financial constraints prevented some households from constructing improved latrines, while ignorance and misconceptions about sanitation contributed to open defecation and poor hygiene behaviours. Similar findings have been reported in studies across Sub-Saharan Africa, where poverty and inadequate sanitation awareness remain major barriers to achieving universal sanitation coverage (UNICEF, 2022; WaterAid, 2021). The study also found that community members recognized the health benefits of improved sanitation, particularly in preventing diarrhoeal diseases, although some lacked adequate knowledge regarding improved sanitation standards. These findings suggest that interventions should combine financial support for vulnerable households with continuous health education, behaviour change communication, and practical training on affordable latrine construction to improve sanitation coverage and contribute to achieving Sustainable Development Goal 6 (WHO, 2022).

Conclusion

This study assessed the prevalence of unimproved sanitation and the factors associated with improved sanitation among rural households in Kirehe District, Rwanda. The findings revealed that the prevalence of unimproved sanitation was 31.7%, indicating that although the majority of households had access to improved sanitation facilities, a considerable proportion still lacked adequate sanitation. This suggests that achieving universal access to improved sanitation remains a challenge in the district.

The study identified several significant factors associated with improved sanitation, including education level, age, household income, household size, and having the necessary skills for latrine construction. Households with higher educational attainment, higher monthly income, and respondents aged 30–50 years were more likely to have improved sanitation facilities, whereas larger households and those lacking latrine construction skills were less likely to have improved sanitation. These findings demonstrate that both socioeconomic and technical factors influence sanitation outcomes in rural communities.

The qualitative findings complemented the quantitative results by showing that poverty, inadequate sanitation knowledge, limited technical skills, and poor sanitation practices remain major barriers to improved sanitation. Therefore, improving sanitation coverage in Kirehe District requires integrated

interventions that strengthen community health education, promote behaviour change, enhance technical capacity for constructing improved latrines, and provide financial or material support to vulnerable households. Such interventions would contribute to reducing the burden of sanitation-related diseases and support Rwanda's efforts toward achieving Sustainable Development Goal 6 on universal access to adequate and equitable sanitation.

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