Original Article

Prevalence and Factors Associated With Diarrhoea among Children under Five in Murambi Sector, Gatsibo District, Rwanda

Alex Manzi[1*2], Monica Mochama[3], Rosemary Okova[4]

[1]*Public Health, College of Health Sciences, Mount Kenya University, Thika 1000, Kenya*
[2]*Rwanda Biomedical Center, Kigali, Rwanda*
[3]*Public Health, Mount Kenya University, Kigali, Rwanda*
[4]*School of Health Sciences, Mount Kenya University, Thika, Central, Kenya*

***Corresponding author:** Alex Manzi. Public Health, College of Health Sciences, Mount Kenya University, Thika 1000, Kenya. Email: adamanzi2000@yahoo.com, manzialex86@gmail.com. ORCID: https://orcid.org/0009-0003-0196-8910

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Abstract

Background
Diarrhoea remains a major public health concern among children under five in developing countries due to inadequate sanitation and limited access to clean water. Evidence on specific factors contributing to diarrhoea in Murambi Sector, Gatsibo District, Rwanda, is limited. This study assessed the prevalence of diarrhoea and its associated factors among children under five.

Methods
A cross-sectional study was conducted with 339 children under five. Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 21.0, applying bivariate and multivariable logistic regression. Statistical significance was set at $p < 0.05$.

Results
Among the participants, 56.6% were female. The prevalence of diarrhoea was 14%. Factors significantly associated with diarrhoea included having an improved toilet, presence of a handwashing facility, and washing hands before feeding a child ($p < 0.05$).

Conclusion
Improved sanitation and hand hygiene practices are essential to reduce diarrhoea among children under five in Murambi Sector. These findings support interventions aimed at promoting household hygiene and enhancing access to sanitation facilities.

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Keywords: Diarrhoea, Children under Five, Factor Associated with Diarrhoea, Prevalence of diarrhea

Introduction

Diarrhoea remains a major public health concern globally, particularly among children under five, due to inadequate sanitation, limited access to clean water, and poor hygiene practices. Worldwide, diarrhoea is responsible for an estimated 2.5 billion cases annually among children under five, with approximately 1,400 deaths every day, making it the second leading cause of mortality in this age group.[1,2] The most common pathogens include viruses, bacteria, and parasites, with cholera caused specifically by the bacterium Vibrio cholerae.[3] The burden of diarrhoea is disproportionately higher in low- and middle-income countries, where access to safe water and sanitation remains limited.[1,2]

In sub-Saharan Africa, diarrhoea continues to be a leading cause of morbidity and mortality among children under five. Countries in southern and eastern Africa, such as Ethiopia, Uganda, and Tanzania, report high diarrhoea prevalence rates due to poor water quality, inadequate sanitation, and limited health infrastructure.[4,5] In Ethiopian suburban areas, the incidence of acute diarrhoea among children under five was reported at 11%, with higher risk among children aged 12–23 months, poor household waste management, and unsafe water sources.[6] Similarly, slum populations in East Africa face compounded risks related to poverty, overcrowding, and insufficient hygiene practices.[7]

At the national level, Rwanda continues to face challenges related to diarrhoel disease. The Rwanda Demographic and Health Survey (RDHS) reported a national diarrhoea prevalence of 13.1%, slightly lower than neighboring Tanzania (13.9%) but lower than Burundi (24.8%).[8] Contributing factors include maternal illiteracy, low household wealth, young maternal age, and seasonal variations such as the rainy season.[8,9] Improved interventions, such as health education for mothers, promotion of personal hygiene, proper waste disposal, and scaling up oral rehydration therapy, have been shown to reduce diarrhoea incidence.[10] Despite these efforts, Rwanda still reports significant gaps in sanitation and hygiene infrastructure, with 44% of the population relying on unimproved water sources and only 14% practicing handwashing after visiting toilets.[11]

At the district level, data for Eastern Province, particularly Gatsibo District, indicated a reduction in diarrhoea prevalence from 12% in 2019 to 11% in 2020, with Murambi Sector reporting a prevalence of approximately 5%.[12] However, limited research exists on the specific determinants of diarrhoea in this area, including household sanitation, hygiene practices, and water sources. Known risk factors globally and regionally include unimproved toilet facilities, lack of handwashing practices, inadequate water treatment, and early introduction of complementary foods before six months of age.[3,6,10] Consequences of diarrhoea include dehydration, malnutrition, increased healthcare costs, and high infant morbidity and mortality, placing a burden on families and the health system.[1,7]

Evidence from other countries demonstrates that improvements in water, sanitation, and hygiene (WASH) practices, combined with oral rehydration therapy and health education, can significantly reduce diarrhoea incidence and associated mortality.[5,10,13] In Rwanda, similar strategies targeting mothers' education, household hygiene, and community awareness are crucial to further reducing diarrhoel disease burden. Despite Rwanda's national efforts, no research has specifically examined the prevalence and factors associated with diarrhoea among children under five in Murambi Sector, Gatsibo District. This study sought to fill this gap by assessing the local burden of diarrhoea and identifying associated risk factors to inform targeted interventions and policy decisions.[12]

Methods

Research design and population

A cross-sectional design was employed. The target population included children under five in Murambi Sector, Gatsibo District, with each household represented by a parent or caregiver. The study considered 2,232 households, identified from records at Murambi Health Centre, the primary facility serving all deliveries and child health services in the sector. Murambi Sector comprises 4 cells and 34 villages, and all households with children under five were included in the sampling frame.

Sample size estimation and sampling techniques

A total of 339 children under five were selected from 2,232 households using Yamane's formula.[13] Stratified sampling was applied across the four cells of Murambi Sector (Rwimitereri, Murambi, Nyamiyaga, and Rwankuba), with households proportionally selected from all 34 villages using simple random sampling. If a household had more than one child under five, one child was randomly chosen. Only female parents/caregivers were included as primary child caretakers. Inclusion criteria: children under five residing in the sector with caregiver consent; exclusion criteria: children severely ill or without caregiver consent.

Data collection tool

A structured questionnaire was developed and adapted from WHO core health questions,[14] and modified for cultural relevance to the Rwandan context. The tool was drafted in English, then translated into Kinyarwanda. Content validation was done by public health experts, and it was pretested on 20 households outside the study area for clarity and reliability.[15] The questionnaire had four sections: (1) caregiver demographics, (2) environmental factors, (3) sociodemographic factors, and (4) behavioural factors. Diarrhoea was defined as the passage of three or more loose or watery stools within 24 hours.[16] Prevalence was calculated as the proportion of children experiencing at least one diarrhoea episode in the two weeks prior to data collection, among the sampled children, representing the sector-level burden.

Data collection procedures

Data were collected by trained enumerators through face-to-face interviews with household caregivers.

The questionnaire was developed based on WHO core health questions,[14] and adapted to the Rwandan context. To ensure clarity and reliability, a pilot study was conducted on 10% of the calculated sample (34 households) in Rwimbogo Sector, which was excluded from the main study. The pilot tested internal consistency of the questionnaire sections (sociodemographic, environmental, and behavioural factors) using Cronbach's alpha, which yielded 0.908, indicating excellent reliability.[17]

For validity, questions were reviewed by public health experts and revised based on feedback to ensure cultural relevance and clarity. Some items were adapted from Degabasa's study in Yaya Gulele District, Ethiopia.[18] While others were newly formulated to align with WHO standards. The tool assessed caregivers' demographic characteristics, household sanitation and hygiene practices, sociodemographic, and child health behaviours. This approach ensured both content validity and scientific rigor in measuring factors associated with diarrhoea among children under five.

Data analysis

After data collection, raw data were entered into SPSS version 21.0 for cleaning, editing, and verification. Descriptive statistics, including frequencies and percentages, were computed. Chi-square tests were used to assess associations between the dependent variable (diarrhoea) and categorical independent variables (socio-demographic and environmental factors). For variables with more than two categories, all categories were included in the Chi-square test, and no reference category was specified.

For further quantification of associations, logistic regression was performed using odds ratios (ORs) with 95% confidence intervals (CIs), where one category of each categorical independent variable was set as the reference. Variables with $p < 0.05$ in bivariate analysis were included in the multivariable logistic regression to identify factors independently associated with diarrhoea.

Ethical considerations

The researcher received ethical approval from Mount Kenya University Rwanda (Reference Number: MKU04/PGS&R/0814/2023) as well as the letter from Gatsibo District (Reference Number:2269/07.05.03/01/ JADF). Ethical approval was obtained from the Rwanda National Ethics Committee (Approval No.:226/07.05.03). Written informed consent was obtained from all participants; if a caregiver was unable to sign, consent was witnessed and documented by an impartial third party. Explanation about research was given to participants and ensured that they understand, obtain their informed consent to participate in research, findings collected were confidential and identity of participant was not disclosed, there are no risk and no monitory or benefits except the results were useful to the community of Murambi sector, Gatsibo District by putting strategies in place to prevent diarrhoea and for academic achievement.

Results

Demographics characteristics of the caregivers

A total of 339 caregivers participated, with the majority (95.9%) being mothers, highlighting their central role in child care. Most caregivers were aged 25–34 years. Children included in the study were aged under five, with ages categorized for analysis; 3–5 years refers to the age group of the children, not caregivers. These demographic findings contextualize the factors influencing diarrhoea prevalence and help interpret associations with sociodemographic, environmental, and behavioral determinants in the community.

Prevalence of diarrhoea among children under five

The study revealed that 14% of children had encountered episodes of diarrhoea in two weeks before the research while a majority of 290 (86%) did not experience diarrhoea, this suggests a relatively lower rate of diarrhoea within surveyed population. Figure 1

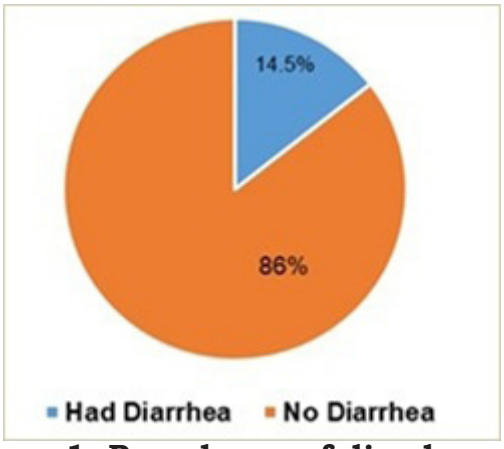

Figure 1. Prevalence of diarrhoea among children under five

Source: Primary Data, 2023

Sociodemographic factors associated with prevalence of diarrhoea among children five

The researcher studied sociodemographic information of the caregivers. In this study 140(41.2%) children were male and 199(58.8%) were female. Among them 54(15.9%) were aged <12 months, 113(33.4%) aged between 12 to 36 months and 173(50.7%) aged from 37 to 59 months. The majority of parents/caretakers 325(95.9%) were biological mothers to the children.

The results from the chi-square test indicated that the type of caretaker did not demonstrate a strong association with diarrhoea prevalence. In terms of primary caregivers, the vast majority of cases had the biological mother as the caretaker, accounting for approximately 96% of diarrhoea cases. Regarding the age of the caregiver, no significant association with diarrhoea the prevalence was observed. Similarly, household size did not exhibit a significant impact of diarrhoea prevalence, as the proportion of cases remained fairly uniform across various household sizes. Table 1

Table 1. Bivariate analysis of sociodemographic factors to test for association with diarrhoea among children under five

Variable	Category	Diarrhoea		Chi-Square	P-Value
		Yes	No		
		n (%)	n (%)		
Child Gender	Male	14 (28.6)	126 (43.5)	9.898	0.125
	Female	35 (71.4)	164 (56.5)		
Age of Child (months)	<12	9 (18.4)	45 (16.2)	5.008	0.286
	12–36	20 (40.8)	93 (32.1)		
	37–59	20 (40.8)	150 (51.7)		
Parent/ Caregiver	Biological mother	47 (95.9)	278 (95.9)	0.0003	0.985
	Caretaker	2 (4.1)	12 (4.1)		
Caregiver Age (years)	15–19	2 (4.1)	16 (5.5)	1.989	0.570
	≥20	47 (95.9)	274 (94.5)		
Household Size	2–4	22 (44.9)	111 (38.3)	1.567	0.710
	5–7	22 (44.9)	134 (46.2)		
	8+	5 (10.2)	45 (15.5)		
Caregiver Education	No education	5 (10.2)	17 (5.9)	2.107	0.498
	Primary	41 (83.7)	248 (85.5)		
	Secondary	3 (6.1)	30 (8.6)		
Caregiver Religion	Christian	35 (71.4)	164 (56.5)	15.293	0.226
	Others	14 (28.6)	126 (43.5)		
Household Income (RWF)	<50,000	47 (95.9)	275 (94.8)	0.670	0.891
	≥50,000	2 (4.1)	15 (5.2)		

Source: Primary Data, 2023

Environmental factors associated with diarrhoea among children under five

Table 2. Bivariate analysis of environmental factors associated with diarrhoea among children under five

Variable	Category	Diarrhoea		Chi-Square	P-Value
		Yes	No		
		n (%)	n (%)		
Water Source Protected	Yes	45 (91.8)	253 (87.2)	0.833	0.362
	No	4 (8.2)	37 (12.8)		
Time Taken to Fetch Water	>30 minutes	24 (49.0)	128 (44.1)	0.397	0.528
	<30 minutes	25 (51.0)	162 (55.9)		
Pets in the House	Yes	2 (4.1)	9 (3.1)	0.128	0.721
	No	47 (95.9)	281 (96.9)		
Toilet Cleanliness	Yes	42 (85.7)	251 (86.6)		0.874
	No	7 (14.3)	39 (13.4)		
Improved Toilet	Yes	14 (28.6)	137 (47.2)	5.915	0.015
	No	35 (71.4)	153 (52.8)		
Handwashing Facility	Yes	3 (6.1)	69 (23.8)	7.825	0.005
	No	46 (93.9)	221 (76.2)		
Toilet Near Kitchen	Yes	6 (12.2)	63 (21.7)	2.323	0.127
	No	43 (87.8)	227 (78.3)		
Cover Toilet Hole	Yes	17 (34.7)	124 (42.8)	1.122	0.289
	No	32 (65.3)	166 (57.2)		

Source: Primary Data, 2023

The participants were asked about water source protection, living with animals, cleanliness of the toilet, the improved latrine and so on. The findings evidenced that 298(87.9%) said that the water source was protected and 11(3.2%) participants were living with the animals. Having improved latrine found among 151(44.5%) participants, 69(20.4%) participants had the latrine near the kitchen and 141(41.6%) used to cover their latrine holes.

The results indicate significant associations of diarrhoea with the presence of hand washing facilities and improved toilets demonstrated significant associations with diarrhoea prevalence. Only 6.12% of children with diarrhoea had access to hand washing facilities, whereas 23.79% of those without diarrhoea had such access (chi-square = 7.825, p = 0.005). Similarly, 28.57% of children with diarrhoea had improved toilets, while 47.24% of those without diarrhoea had access to improved sanitation (chi-square = 5.915, p = 0.015). Table 2

Behavioral factors associated with diarrhoea among children under five

The results showed that 176(51.9%) participants used to boil water for drinking, 305(90%) participants said that they wash hands after changing baby's diapers and 6(1.8%) participants agreed that they dispose child's feces in the compound. Notably, washing hands before feeding the baby demonstrated a significant association (chi-square = 4.663, p = 0.031). A higher proportion of children without diarrhoea (98.62%) had hands washed before feeding compared to those with diarrhoea (93.88%).

Table 3. Bivariate analysis of behavioural factors for association with diarrhoea among children under five

Variable	Category	Diarrhoea		Chi-Square / Fisher's	P-Value
		Yes	No		
		n (%)	n (%)		
Boil Drinking Water	Yes	25 (51.0)	151 (52.1)	0.019	0.892
	No	24 (49.0)	139 (47.9)		
Child Fed with Bottle	Yes	9 (18.4)	83 (28.6)	2.229	0.135
	No	40 (81.6)	207 (71.4)		
Wash Hands After Changing Diapers	Yes	42 (85.7)	263 (90.7)	1.150	0.284
	No	7 (14.3)	27 (9.3)		
Wash Hands After Visiting Toilet	Yes	36 (73.5)	220 (75.9)	0.130	0.719
	No	13 (26.5)	70 (24.1)		
Wash Hands Before & After Cooking	Yes	46 (93.9)	281 (96.9)	1.119	0.290
	No	3 (6.1)	9 (3.1)		
Wash Hands Before Feeding Baby	Yes	46 (93.9)	286 (98.6)	4.663	0.031
	No	3 (6.1)	4 (1.4)		
Wash Breast Before Feeding Baby	Yes	0 (0.0)	4 (1.4)	0.684	0.408
	No	49 (100.0)	286 (98.6)		
Dispose Child's Feces in Toilet	Yes	49 (100.0)	288 (99.3)	0.340	0.560
	No	0 (0.0)	2 (0.7)		
Dispose Child's Feces in Compound	Yes	2 (4.1)	4 (1.4)	1.761	0.185
	No	47 (95.9)	286 (98.6)		

Source: Primary Data, 2023

Table 4. Multivariable analysis of factors associated with diarrhoea disease among children under five in Murambi sector of Gatsibo District

Factors	Crude OR (95% CI)	Adjusted OR (AOR) (95% CI)	PValue
Improved Toilet	0.45 (0.23–0.97)	0.60 (0.30–0.93)	<0.001
Handwashing Facility	0.21 (0.06–0.69)	0.24 (0.08–0.55)	0.041
Wash Hands Before Feeding Baby	0.37 (0.02–0.89)	0.33 (0.06–0.76)	0.006

Source: Primary Data, 2023

Table 4 shows the multivariable logistic regression analysis of factors associated with diarrhoea among children under five. Variables with significant crude associations (COR) in bivariate analysis were entered into the multivariable model. Findings are presented as adjusted odds ratios (AOR) with 95% confidence intervals (CI) and P-values. Improved toilet facilities, having a handwashing facility, and washing hands before feeding the child were independently associated with lower odds of diarrhoea, (Table 4).

Discussion

The study examined diarrhoea prevalence and its associated factors among children under five in Murambi sector, Gatsibo District, Rwanda. The study found a 14.5% prevalence of diarrhoea among children under five in Murambi Sector, Gatsibo District. Having an improved toilet, the presence of a hand wash facility and washing hands before feeding a child were found to be statistically significantly associated with reduced diarrhoea among study participants.

The found prevalence rate is notably lower than that observed in a community-based study among under-five children in Northwest Ethiopia, which reported a prevalence of 29.0%%.[1] The substantial difference in prevalence rates suggests varying levels of risk and exposure to diarrhoeal illnesses between the two regions, likely influenced by differences in sanitation, hygiene practices, and household conditions. The disparity in diarrhoea prevalence between study areas may be explained by differences in access to basic amenities and environmental conditions. Regions with improved sanitation, safe water supply, and better healthcare infrastructure tend to report lower diarrhoea rates, whereas areas lacking these amenities show higher prevalence. Climatic variations, such as rainy seasons or high temperatures, can increase water contamination and favor the spread of diarrhoeal pathogens. Thus, both infrastructural amenities and climatic factors interact, influencing the observed differences in diarrhoea burden across the regions.

Access to improved toilet facilities was found to have an adjusted odd ratio (AOR) of 0.60 (95% CI: 0.30-0.93), indicating a significant 40% of reduction in likelihood of diarrhoea among children with access to improved toilets compared to those without such facilities. Similarly, the presence of handwashing facilities revealed an AOR of 0.24 (95% CI: 0.08-0.55), signifying 76% reduction in the odds of diarrhoea. Additionally, the practice of washing hands before feeding the baby showed an AOR of 0.33 (95% CI:06-0.76), showing a notable 67% reduction in odds of diarrhoea among caregivers who practiced this behaviour.[1] The study conducted in selected slum areas of Wakiso District, Uganda reported a strikingly high diarrhoea prevalence of 62.4%.[20] This contrasts sharply with the 14% prevalence observed in Murambi Sector, Gatsibo District, Rwanda. A key difference is the study setting: The Ugandan research focused on densely populated slum settlements, where limited sanitation, overcrowding, and poor access to safe water exacerbate diarrhoea risk, whereas the Rwandan study was conducted in a non-slum community. Both studies highlight the role of environmental and hygiene factors in diarrhoea prevalence,

but the specific determinants differ: in Rwanda, improved sanitation, handwashing facilities, and hygiene before feeding were significant, whereas in Uganda, factors included protected water sources and suitable sanitation infrastructure.[20]

A research conducted in Somaliland revealed a significantly higher prevalence of diarrhoea among children under five compared to this research conducted in Murambi Sector, Rwanda. While rate of diarrhoea contamination was 51% in Somaliland, it was only 14% in the Rwandan context. The factors related to diarrhoea differed between two studies. In Somaliland, children older than one year, not exclusively breastfed, not given colostrum milk, those drinking water stored in jerrycans, and those with poor hand washing practices are identified as more likely to develop diarrhoea. In contrast, the Rwandan study emphasized that access to improved sanitation infrastructure, presence of handwashing facilities, and practicing hand hygiene before feeding children were significantly associated with lower diarrhoea prevalence.[21] Unlike the Ugandan slum study, where high population density and limited access to protected water were dominant factors, the Rwandan context showed that even when water sources were relatively safe, behavioral practices and household sanitation played a more critical role in reducing diarrhoea risk. This suggests that in non-slum communities, hygiene behavior and proper sanitation use may be more influential in determining diarrhoea burden than mere access to water. Comparing the research conducted in Ethiopia.[22] With the study conducted in Murambi Sector, Gatsibo District, Rwanda, reveals some notable similarities and differences. In Dale District, Ethiopia, the reported 2-week diarrhoea rate of contamination was 13.6%. Similarly, in Murambi Sector, Rwanda, the proportion was 14.5%. In Uganda's slum settlements, the prevalence reached 62.4%, reflecting extreme vulnerability due to overcrowding and poor sanitation.[20] whereas in the non-slum Rwandan community, the prevalence was lower at 14%, yet still indicates a significant public health concern.[21] Children with access to improved toilets exhibited lower odds of diarrhoea prevalence, with changed odds ratio in Rwanda and in Ethiopia. Additionally, both studies identified the presence of hand washing facilities as another significant factor associated with reduced odds of diarrhoea among children. Access to hand washing facilities was associated with lower odds of diarrhoea occurrence, in Rwanda and in Ethiopia.The study conducted in Kenya found significant similarities in the importance of certain environmental factors.[24] Similarly, in Rwandan study, accessibility to adequate toilet infrastructure as well as hand washing facilities are discovered as statistically correlated with reduced odds of diarrhoea.

Strengths and limitations of the study

This study provides important insights into the prevalence of diarrhoea and its associated factors among children under five in Murambi Sector, Gatsibo District. By collecting primary data directly from households, it effectively links caregiver hygiene behaviors and household sanitation conditions with diarrhoea risk, offering actionable evidence for targeted interventions. However, the cross-sectional design limits the ability to establish causal relationships, and the focus on a single sector restricts generalizability to other regions. Additionally, because the study was conducted during one season, it may not capture seasonal variations in diarrhoea prevalence. Despite these limitations, the findings offer valuable guidance for interventions aimed at reducing diarrhoea among children under five in this community.

Conclusion

This study determined the prevalence of diarrhoea and its associated factors among children under five in Murambi Sector, Gatsibo District, Rwanda. The prevalence of diarrhoea indicated a moderate but significant public health concern in the community. Key factors significantly associated with diarrhoea included the lack of improved toilets, the absence of

handwashing facilities, and not practicing hand hygiene before feeding children. These findings highlight that household sanitation and caregiver hygiene behaviors are critical determinants of diarrhoea risk among young children.Interventions promoting improved sanitation infrastructure and consistent handwashing practices before feeding are essential to reduce diarrhoea prevalence in this community. Future research should explore the effectiveness of community-based sanitation and hygiene interventions, as well as behavioral change strategies targeting caregivers, to further reduce diarrhoea incidence among children under five in similar rural settings.

Authors' contribution

MA, RO, MM contributed to the conception, development of the manuscript and will work on reviewers comment until its publication.

Conflict of interest

No conflict of interest was declared.

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