

Exploring Handwashing Practices and Awareness Among Primary School Children in Karongi District, Rwanda: A Cross-Sectional Study

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Abstract

Child mortality is a major concern in Africa, particularly due to diarrhoea and respiratory tract infections, which are the leading causes. These diseases are often transmitted through poor handwashing practices. This study aimed to examine the factors that influence handwashing practices, as well as the knowledge, awareness, and actual practices of handwashing among primary school students in the Karongi district, Rwanda. A mixed methods approach was utilized, combining quantitative data gathered through an online questionnaire with qualitative data obtained from semi-structured interviews. Interviews were conducted with teachers and students to gain insight into the existing hygiene practices and support systems in place. The sample size consisted of 583 students and 120 teachers. Quantitative data was analyzed using SPSS version 25.0, incorporating Fisher's exact, Chi-square, correlation, and multiple regression tests. Qualitative data was analyzed using NVivo version 14.0. The correlation ($r=0.75$; $p<0.001$) and multiple regression analyses demonstrated that knowledge of handwashing practices significantly influenced awareness ($r=0.612$; $p<0.001$), the availability of hygiene facilities ($r=0.665$; $p<0.001$), and the implementation of hygiene practices. The students and teachers in Karongi possess a certain level of knowledge regarding handwashing techniques. Teachers in all primary schools supported the practice of handwashing. Students were washing their hands with soap and water as a means of reducing the transmission of diseases. However, more emphasis on instilling proper handwashing practices is required. Handwashing campaigns should be utilized to encourage good hygiene practices among children, as the primary schools already have adequate facilities in place.

Keywords: Awareness, Handwashing Behaviours, Hygiene Education, Effective Practices, Primary School Children.

Introduction

Research Background

Handwashing practices have been proven to be the most effective and cost-efficient method for disease control [1]. To protect the health and well-being of their populations, both developed and developing nations have been promoting hand hygiene campaigns over the past few

decades [2]. Often referred to as the "father of hand hygiene," Hungarian doctor Ignaz Semmelweis played a pivotal role in advancing this practice [3]. Despite numerous initiatives and strategies aimed at curbing the spread of infectious diseases, Curtis and Cairncross argue that there are still significant numbers of severe diseases leading to high rates of mortality and morbidity worldwide [4]. For instance,

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diarrhoea and respiratory tract infections (RTIs) are prevalent among children and account for approximately half of all child deaths globally each year [4, 5]. The issue of disease transmission remains a pressing concern in many countries and regions, with children being particularly vulnerable [3].

Most developing nations are still in their infancy stages when it comes to sanitation and efficient vaccination coverage in controlling the spread of diseases like COVID-19. People are not practising basic hygiene behaviours such as handwashing. Handwashing is considered the most common form of hygiene in many developing nations because it effectively controls the spread of infectious diseases. Using alcohol-based hand sanitizers has been proven to be an effective solution, as it takes less time to use and causes less skin irritation compared to traditional handwashing methods with just water and soap. Additionally, basic handwashing practices have significantly reduced mortality rates by about 50% worldwide [3, 6]. It has also been argued that school-going children are particularly affected by transmissible diseases, so it is the responsibility of schools to promote handwashing practices among children. Collaborating in groups like the Global Handwashing Partnership and conducting further research on the effects of hand hygiene practices are both necessary [3]. Therefore, this study aims to explore and determine the level of awareness regarding handwashing practices among school-going children.

The rationale of the Study

Despite the presence of various health and well-being programs in Rwanda, especially for children [7, 8], there is a need for stronger and more strategic approaches to promote handwashing practices in the country. Specifically, most schools in Rwanda lack basic hygiene and water supply facilities. Moreover, primary schools in Karongi District face a lack of adequate handwashing facilities and require

continuous monitoring of handwashing practices to prevent the spread of infectious diseases. Additionally, there are a limited number of studies that focus on handwashing among primary school children in this demographic. Therefore, the author conducted this study to explore and assess the awareness level of handwashing practices among primary schools in Karongi District, Rwanda.

Significance of Handwashing in Primary Schools

Handwashing practices have been recommended as an effective way to prevent the misuse of antibiotics, especially among children. Schools are an ideal setting to promote healthcare initiatives and programs. In schools, children can learn and take proactive actions related to handwashing and other hygiene practices [9, 10]. ALBashtawy [11] argued that many schools in developing countries either lack sufficient handwashing facilities or are unaware of how to use them properly. Most schools already promote handwashing practices as the most basic and cost-effective method of controlling the spread of diseases. Furthermore, the attitudes of teachers, parents, and peers towards hygiene and handwashing behaviours can significantly influence children's attitudes towards handwashing practices, both at school and at home. However, there are significant variations in the knowledge, attitudes, and behaviours of handwashing practices among students [12]. On the other hand, handwashing and other hygienic practices can significantly reduce the number of diarrhoea cases among school children, thereby improving school attendance rates. Promoting handwashing practices in schools has proven to be the most successful program for enhancing knowledge and practices among primary school children. Handwashing, particularly after using the toilets, significantly reduces disease transmission, which is particularly important for school children who are more susceptible to

illnesses in many countries [13].

Aim and Objectives

The purpose of this study was to examine the handwashing practices and awareness of primary school children in the Karongi District, Rwanda. The study aimed to achieve two specific objectives:

1. To investigate handwashing practices and their predictors among primary school children in Karongi District.
2. To determine the current state of knowledge, awareness, and practice of handwashing techniques among primary school-going children in Karongi District.

Methodology

Selection of the Area

A descriptive cross-sectional research design was used to collect data on handwashing practices and awareness from a large number of participants within a short time frame. The data were gathered through surveys, interviews, and observations.

The study focused on primary school children and their teachers in Karongi District. The case group consisted of 2,176 students from designated schools, while the control group included 9,969 students from other schools. A total of 120 teachers participated, with 60 from the case group schools and 60 from the control group schools. Primary school children were selected using simple random sampling, and teachers were chosen through convenience sampling.

The participants included primary school children aged 6 to 12 years who regularly attended school and had parental consent. The teachers included in the study were employed at the sampled schools and had at least one year of experience. Children with chronic illnesses, irregular attendance, or lacking parental consent were excluded, as were teachers who were not currently employed, had less than one year of experience, or were unwilling to provide consent.

Sample Size Determination

The sample size was determined using a widely accepted method in statistical research [14]. In our study, we considered the population dynamics of primary school-aged children, with a total population of 40,660 individuals. Out of these, 12,144 were actively attending school during the study. Among the active students, 2,175 belonged to the case group schools, while 9,969 were in the control group.

Cuemath [14] emphasizes that for populations under 10,000, the standard formula is appropriate due to its simplicity and ease of use. This approach is particularly effective for small to moderately-sized populations.

$$n = \frac{N * z^2 * p(1 - p)}{e^2(N - 1) + z^2 * p(1 - p)}$$

With a margin of error (e) of 5%, a confidence level of 95% (corresponding to a Z-score of 1.96), and a response distribution (p) of 50%, the initially calculated sample sizes were 306 for the control group (N = 9,969) and 277 for the experimental group (N = 2,175). However, for the study, the final sample size was determined to be 583 students. Furthermore, 15 teachers from each selected school were conveniently chosen to participate in the study.

Sampling Technique

In this study, two sampling techniques were used to obtain a representative and manageable participant group from a total population of 583 students and 120 teachers.

Simple Random Sampling: This method was used to select the 583 primary school children, ensuring that each student had an equal chance of inclusion. This approach aimed to enhance the representativeness of the study and provide an unbiased sample of the student population.

Convenience Sampling: This technique was applied to select the 120 teachers based on their availability and willingness to participate. This practical method facilitated the inclusion of teachers within the study's timeframe.

Data Collection

Both quantitative and qualitative data were collected for this study. Quantitative data were gathered from primary school students using a 30-item closed-ended questionnaire (Questionnaire A). Teachers completed a separate 20-item questionnaire (Questionnaire B), which included both closed-ended and open-ended questions. Closed-ended questions provided quantitative data, while open-ended questions offered qualitative insights. Responses were recorded using a 5-point Likert scale (1 = Strongly disagree to 5 = Strongly agree), chosen for its clarity and ease of use.

Additionally, semi-structured face-to-face interviews were conducted with teachers, and direct observations of handwashing practices and facilities were carried out in school settings.

Data Analysis

Quantitative data were analyzed using SPSS version 25, applying descriptive statistics such as frequencies, percentages, means, and standard deviations. Qualitative data from open-ended questions, interviews, and observations were thematically analyzed. Interview transcripts were coded and categorized into themes such as handwashing behaviours, hygiene education, facility availability, and cultural factors. Observational data helped identify patterns in handwashing practices and facility conditions. Thematic analysis of both data sources provided comprehensive insights into factors influencing handwashing behaviours among primary school children.

Results

This section presents the findings from

Table 1. Sample Characteristics of Students and Teachers in Karongi District Primary Schools

Variables	Students(N=583)	Teachers (N=120)
School Category		
Control group	309 (53.0%)	60 (50.0%)
Experimental group	274 (47.0%)	60 (50.0%)

surveys, interviews, and observations. Quantitative data, including handwashing frequency and facility availability, were analyzed statistically to identify patterns and trends. Qualitative data from interviews with students and teachers were thematically analyzed to explore attitudes and perceptions regarding hand hygiene.

Quantitative Data Findings

Quantitative data were analyzed using IBM SPSS 25.0 to address research objectives on handwashing knowledge, awareness, and influencing factors. The analysis included cross-tabulation, Fisher's Exact test, Chi-square test, correlation, and multiple regression. These tests assessed knowledge and awareness levels, identified differences in behavioural determinants, examined relationships between hygiene factors and handwashing awareness, and explored the impact of knowledge on hygiene facilities and practices.

Sample Characteristics

The characteristics of the study sample were evaluated using frequency and percentage analysis (Table 1). A total of 583 students and 120 teachers participated in the survey. Of these, 309 students (53%) and 60 teachers (50%) were in the control group, while 274 students (47%) and 60 teachers (50%) were in the experimental group. The highest number of students were from Bwishyura (80; 13.7%), followed by Murambi (78; 13.4%), Gishyita (76; 13%), and Mutuntu (76; 13%). Gashari and Gitesi had an equal number of students (70; 12%), with Murundi having the fewest (68; 11.7%). An equal number of teachers (15; 12.5%) participated from each school sector (Figure 1, 2).

School Sector		
Bwishyura	80 (13.7%)	15 (12.5%)
Gaspari	70 (12.0%)	15 (12.5%)
Gishyita	76 (13.0%)	15 (12.5%)
Gitesi	70 (12.0%)	15 (12.5%)
Murambi	78 (13.4%)	15 (12.5%)
Murundi	68 (11.7%)	15 (12.5%)
Mutuntu	76 (13.0%)	15 (12.5%)
Ruganda	65 (11.1%)	15 (12.5%)

Source: Field Survey 2024

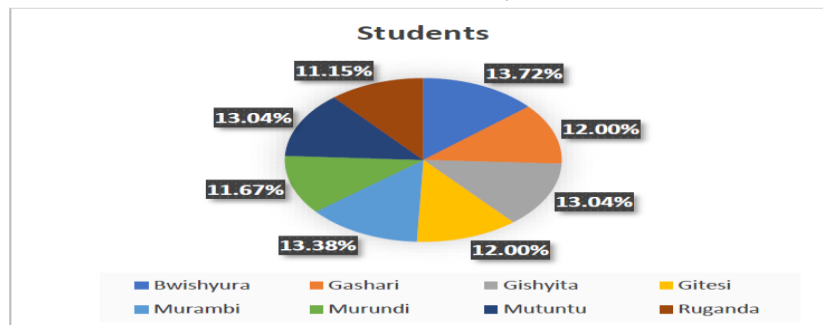


Figure 1. Students Selected from Each School Sector

Source: Field Survey 2024

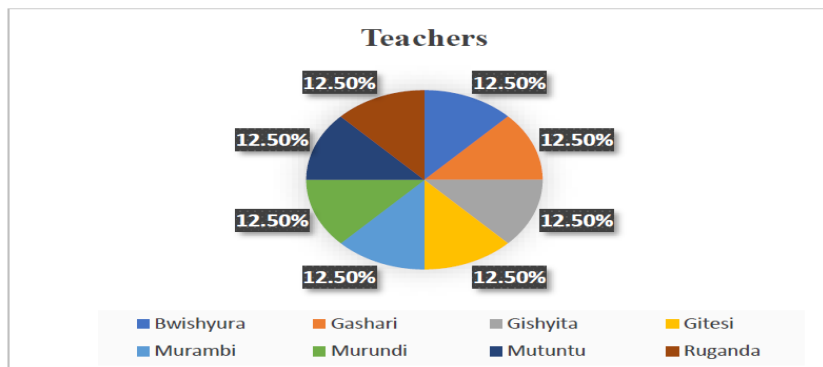


Figure 2. Teachers Selected from Each School Sector

Source: Field Survey 2024

Knowledge and Awareness About Handwashing Practices Among Teachers

All teachers (60, 100%) emphasized the importance of implementing handwashing practices, particularly post-COVID-19, in both the control and experimental groups.

In the experimental group, 59 (98.3%) of teachers monitored students after meals, and 55 (91.7%) did so after toilet use (Table 2). In comparison, in the control group, 57 (95%) of

teachers monitored students after meals, and 54 (90%) did so after toilet use. This indicates that teachers in the experimental group were more vigilant in ensuring handwashing after eating and using the toilet. Additionally, 52 (86.7%) of teachers in the experimental group and 47 (78.3%) in the control group paid attention to handwashing activities at their schools.

Furthermore, 51 (85%) of teachers in the experimental group and 44 (73.3%) in the control group monitored students during sneezing or coughing (Figure 3). However,

factors such as the importance of handwashing post-COVID-19 ($p=0.1$), monitoring after meals ($p=0.309$), monitoring after toilet use ($p=0.5$), attention to school handwashing activities ($p=0.168$), and monitoring during coughing or sneezing ($p=0.088$) were not significantly associated with teachers' attitudes towards WASH practices (Table 2).

Knowledge and Awareness of Handwash Practices Among Students

Understanding the students' knowledge of handwashing, as well as how aware they are of proper handwashing techniques, has been crucial in promoting effective handwashing behaviours in schools.

A significant proportion of respondents from both the experimental group (231; 84.3%) and the control group (161; 52.1%) mentioned that handwashing is supported by their teachers (Table 3). Out of them, 9 (2.9%) from the control group strongly disagreed that the teachers support handwashing. The majority of students, including 161 (58.8%) from the experimental group and 127 (41.1%) from the control group, opined that water is sufficient for handwashing. Regarding the spread of germs, improper handwashing is believed to cause the spread of diseases by 211 (77%) and 178 (57.6%) respondents from the experimental and control groups, respectively.

Table 2. Knowledge and Awareness of Handwashing Practices Among Primary School Teachers of Karongi District

Variable		Frequency (N = 120)	Control Group (N = 60)	Experimental Group (N=60)	p-value
Importance of Implementing WASH Practices as COVID-19 is not a trending issue	No	0 (0%)	0 (0%)	0 (0%)	0.1
	Yes	120 (100%)	60 (100%)	60 (100%)	
Paying attention to students after they eat food	No	4 (3.3%)	3 (5.0%)	1 (1.7%)	0.3
	Yes	116 (96.7%)	57 (95.0%)	59 (98.3%)	
Paying attention to students after they use the toilet	No	11 (9.2%)	6 (10.0%)	5 (8.3%)	0.5
	Yes	109 (90.8%)	54 (90.0%)	55 (91.7%)	
Paying attention to the wash activities in school	No	21 (17.5%)	13 (21.7%)	8 (13.3%)	0.2
	Yes	99 (82.5%)	47 (78.3%)	52 (86.7%)	
Paying attention to the students' coughing or sneezing	No	25 (20.8%)	16 (26.7%)	9 (15.0%)	0.1
	Yes	95 (79.2%)	44 (73.3%)	51 (85.0%)	
Schools took hygiene actions to handle the COVID-19 pandemic	No	5 (4.2%)	4 (6.7%)	1 (1.7%)	0.2
	Yes	115 (95.8%)	56 (93.3%)	59 (98.3%)	
Kids need to be close to the sinks	No	3 (2.5%)	1 (1.7%)	2 (3.3%)	0.5
	Yes	117 (97.5%)	59 (98.3%)	58 (96.7%)	
Students think that washing their hands takes a lot of time	No	52 (43.3%)	17 (28.3%)	35 (58.3%)	0.001*
	Yes	68 (56.7%)	43 (71.7%)	25 (41.7%)	
Receiving forms for handwash practices	No	59 (49.2%)	30 (50.0%)	29 (48.3%)	0.5
	Yes	61 (50.8%)	30 (50.0%)	31 (51.7%)	
Perform visual cues and practices for handwashing	No	16 (13.3%)	14 (23.3%)	2 (3.3%)	0.001*
	Yes	104 (86.7%)	46 (76.7%)	58 (96.7%)	
Students should get prizes and rewards for handwashing	No	40 (33.3%)	17 (28.3%)	23 (38.3%)	0.2
	Yes	80 (66.7%)	43 (71.7%)	37 (61.7%)	

Handwashing practice should be monitored among students	No	10 (8.3%)	4 (6.7%)	6 (10.0%)	0.4
	Yes	110 (91.7%)	56 (93.3%)	54 (90.0%)	
Your school provides soaps, towels, etc.	No	19 (15.8%)	8 (13.3%)	11 (18.3%)	0.3
	Yes	101 (84.2%)	52 (86.7%)	49 (81.7%)	
Students should wash their hands ten times per day	No	73 (60.8%)	34 (56.7%)	39 (65.0%)	0.2
	Yes	47 (39.2%)	26 (43.3%)	21 (35.0%)	
Sinks are provided at washing facilities	No	23 (19.2%)	6 (10.0%)	17 (28.3%)	0.010*
	Yes	97 (80.8%)	54 (90.0%)	43 (71.7%)	
Handwashing practices include hand drier options	No	13 (10.8%)	3 (5.0%)	10 (16.7%)	0.037*
	Yes	107 (89.2%)	57 (95.0%)	50 (83.3%)	
Handwashing practices are vital among children	No	1 (0.8%)	0 (0.0%)	1 (1.7%)	0.5
	Yes	119 (99.2%)	60 (100.0%)	59 (98.3%)	
Aware of wash practices at the schools	No	8 (6.7%)	6 (10.0%)	2 (3.3%)	0.1
	Yes	112 (93.3%)	54 (90.0%)	58 (96.7%)	
Received handwashing practices in schools	No	35 (29.2%)	17 (28.3%)	18 (30.0%)	0.5
	Yes	85 (70.8%)	43 (71.7%)	42 (70.0%)	
Schools should support handwashing practices	No	5 (4.2%)	2 (3.3%)	3 (5.0%)	0.5
	Yes	115 (95.8%)	58 (96.7%)	57 (95.0%)	

***Denotes Statistical Significance at p<0.05 (Fisher's Exact Test Used)**

Source: Field Survey 2024

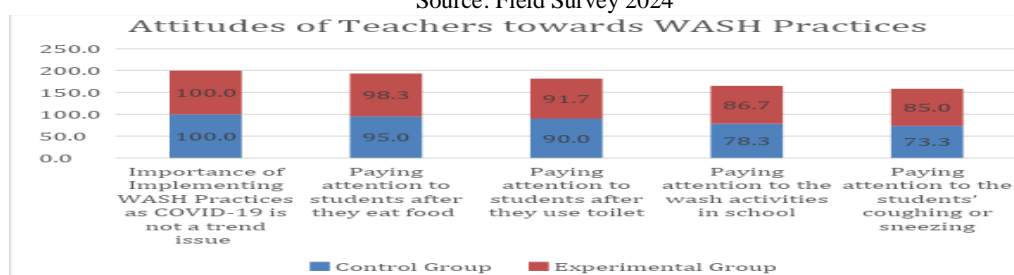


Figure 3. Attitudes of Teachers Towards WASH Practices

Source: Field Survey 2024

On the other hand, 217 (79.2%) respondents in the experimental group and 139 (45%) in the control group washed their hands with soap and water after coughing. Approximately 158 (57.7%) and 135 (49.3%) respondents from the experimental group were more evident that other students washed their hands after eating food and using the toilet as well, respectively. In the case of the control group, 129 (41.7%) and 117 (37.9%) respondents strongly agreed that other students washed their hands after having food and using the toilet, respectively. Additionally, 186 (67.9%) and 152 (49.2%) from the experimental and control groups, respectively, mentioned that their teachers reminded them about washing after eating food.

Furthermore, 190 (69.3%) and 141 (45.6%) respondents from the experimental and control groups strongly agreed that their teachers reminded them about washing their hands after using the toilets. Overall, the highest frequency of responses was reported for supporting handwashing by teachers and washing hands with soap and water after coughing, i.e., 392 (67.2%) and 389 (66.7%), respectively. Thus, the knowledge and awareness about handwashing practices among students in the experimental group were more effective than the control group. The support of handwashing behaviour by teachers ($p<0.001$), water is sufficient for handwashing ($p<0.001$), spreading of germs when desks are touched

($p < 0.001$), causing the spread of diseases with improper handwashing ($p < 0.001$), washing hands with soap and water after coughing ($p < 0.001$), other students washing their hands after having food and using the toilet ($p < 0.001$), reminding of washing hands after having food ($p < 0.001$), and using the toilet ($p < 0.001$) by teachers are significantly associated with the knowledge and awareness of handwashing techniques among students in Rwandan schools (Table 3).

Hygiene Education in Rwanda Schools

The current state of hygiene education in Karongi district explores the curriculum,

resources available for promoting hygiene education, and the negative side effects of improper handwashing to understand the impact of handwashing on students' health and behaviour. Regarding knowledge or awareness about hygiene practices among students, the majority of respondents, specifically 203 (74.1%) from the experimental group and 170 (55%) from the control group, reported that hygiene practices are vital in reducing disease transmission. Out of these respondents, 164 (59.9%) in the experimental group and 123 (39.8%) in the control group expressed fear of inadequate handwashing (Table 4).

Table 3. Knowledge and Awareness of Handwashing Practices Among Students in Karongi District

Statements		Frequency (N=583)	Control Group (N=309)	Experimental Group (N=274)	p-value
Teachers Support Handwashing	Agree	101 (17.3%)	62 (20.1%)	39 (14.2%)	<0.001*
	Disagree	48 (8.2%)	46 (14.9%)	2 (0.7%)	
	Neither Agree nor Disagree	31 (5.3%)	31 (10.0%)	0 (0%)	
	Strongly Agree	392 (67.2%)	161 (52.1%)	231 (84.3%)	
	Strongly Disagree	11 (1.9%)	9 (2.9%)	2 (0.7%)	
Water is Sufficient for Hand Washing	Agree	103 (17.7%)	60 (19.4%)	43 (15.7%)	<0.001*
	Disagree	66 (11.3%)	53 (17.2%)	13 (4.7%)	
	Neither Agree nor Disagree	67 (11.5%)	56 (18.1%)	11 (4.0%)	
	Strongly Agree	288 (49.4%)	127 (41.1%)	161 (58.8%)	
	Strongly Disagree	59 (10.1%)	13 (4.2%)	46 (16.8%)	
Germs can be Spread When Desks are Touched.	Agree	99 (17.0%)	54 (17.5%)	45 (16.4%)	<0.001*
	Disagree	60 (10.3%)	49 (15.9%)	11 (4.0%)	
	Neither Agree	45 (7.7%)	29 (9.4%)	16 (5.8%)	

	nor Disagree				
	Strongly Agree	366 (62.8%)	171 (55.3%)	195 (71.2%)	
	Strongly Disagree	13 (2.2%)	6 (1.9%)	7 (2.6%)	
Improper Handwash Causes the Spread of Diseases	Agree	98 (16.8%)	47 (15.2%)	51 (18.6%)	<0.001*
	Disagree	51 (8.7%)	49 (15.9%)	2 (0.7%)	
	Neither Agree nor Disagree	38 (6.5%)	31 (10.0%)	7 (2.6%)	
	Strongly Agree	389 (66.7%)	178 (57.6%)	211 (77.0%)	
	Strongly Disagree	7 (1.2%)	4 (1.3%)	3 (1.1%)	
After Coughing Wash with Soap and Water	Agree	104 (17.8%)	58 (18.8%)	46 (16.8%)	<0.001*
	Disagree	50 (8.6%)	45 (14.6%)	5 (1.8%)	
	Neither Agree nor Disagree	67 (11.5%)	62 (20.1%)	5 (1.8%)	
	Strongly Agree	356 (61.1%)	139 (45.0%)	217 (79.2%)	
	Strongly Disagree	6 (1.0%)	5 (1.6%)	1 (0.4%)	
Other Students Washed Their Hands After Eating Foods	Agree	136 (23.3%)	65 (21.0%)	71 (25.9%)	<0.001*
	Disagree	57 (9.8%)	46 (14.9%)	11 (4.0%)	
	Neither Agree nor Disagree	91 (15.6%)	66 (21.4%)	25 (9.1%)	
	Strongly Agree	287 (49.2%)	129 (41.7%)	158 (57.7%)	
	Strongly Disagree	12 (2.1%)	3 (1.0%)	9 (3.3%)	
Other Students Wash Their Hands After Using the Toilet	Agree	158 (27.1%)	77 (24.9%)	81 (29.6%)	<0.001*
	Disagree	60 (10.3%)	45 (14.6%)	15 (5.5%)	
	Neither Agree nor Disagree	93 (16.0%)	66 (21.4%)	27 (9.9%)	

	Strongly Agree	252 (43.2%)	117 (37.9%)	135 (49.3%)	
	Strongly Disagree	20 (3.4%)	4 (1.3%)	16 (5.8%)	
Teachers Remind me About Washing After Eating Food	Agree	119 (20.4%)	63 (20.4%)	56 (20.4%)	<0.001*
	Disagree	60 (10.3%)	52 (16.8%)	8 (2.9%)	
	Neither Agree nor Disagree	57 (9.8%)	36 (11.7%)	21 (7.7%)	
	Strongly Agree	338 (58.0%)	152 (49.2%)	186 (67.9%)	
	Strongly Disagree	9 (1.5%)	6 (1.9%)	3 (1.1%)	
Teachers Remind me About Washing After Using Toilet	Agree	125 (21.4%)	69 (22.3%)	56 (20.4%)	<0.001*
	Disagree	60 (10.3%)	49 (15.9%)	11 (4.0%)	
	Neither Agree nor Disagree	53 (9.1%)	42 (13.6%)	11 (4.0%)	
	Strongly Agree	331 (56.8%)	141 (45.6%)	190 (69.3%)	
	Strongly Disagree	14 (2.4%)	8 (2.6%)	6 (2.2%)	

***Denotes Statistical Significance at 0.05 (Chi-square test used)**

Source: Field Survey 2024

Table 4. Hygiene Education Among Students in the Karongi District

Statements		Frequency (N=583)	Control Group (N= 309)	Experimental Group (N=274)	p-value
It is vital to reduce the disease transmission	Agree	103 (17.7%)	46 (14.9%)	57 (20.8%)	<0.001*
	Disagree	59 (10.1%)	55 (17.8%)	4 (1.5%)	
	Neither Agree nor Disagree	43 (7.4%)	33 (10.7%)	10 (3.6%)	
	Strongly Agree	373 (64.0%)	170 (55.0%)	203 (74.1%)	
	Strongly Disagree	5 (0.9%)	5 (1.6%)	0 (0.0%)	
Fear of getting improper handwashing	Agree	123 (21.1%)	47 (15.2%)	76 (27.7%)	<0.001*
	Disagree	82 (14.1%)	72 (23.3%)	10 (3.6%)	
	Neither Agree nor Disagree	75 (12.9%)	60 (19.4%)	15 (5.5%)	
	Strongly Agree	287 (49.2%)	123 (39.8%)	164 (59.9%)	
	Strongly Disagree	16 (2.7%)	7 (2.3%)	9 (3.3%)	

	Disagree				
It is uncommon at important moments	Agree	154 (26.4%)	64 (20.7%)	90 (32.8%)	<0.001*
	Disagree	98 (16.8%)	60 (19.4%)	38 (13.9%)	
	Neither Agree nor Disagree	142 (24.4%)	100 (32.4%)	42 (15.3%)	
	Strongly Agree	142 (24.4%)	66 (21.4%)	76 (27.7%)	
	Strongly Disagree	47 (8.1%)	19 (6.1%)	28 (10.2%)	
Irregular handwashing caused stomach-ache & vomiting	Agree	109 (18.7%)	34 (11.0%)	75 (27.4%)	<0.001*
	Disagree	75 (12.9%)	65 (21.0%)	10 (3.6%)	
	Neither Agree nor Disagree	51 (8.7%)	43 (13.9%)	8 (2.9%)	
	Strongly Agree	344 (59.0%)	165 (53.4%)	179 (65.3%)	
	Strongly Disagree	4 (0.7%)	2 (0.6%)	2 (0.7%)	
Unwashed hands are considered disgusting	Agree	163 (28.0%)	76 (24.6%)	87 (31.8%)	<0.001*
	Disagree	70 (12.0%)	61 (19.7%)	9 (3.3%)	
	Neither Agree nor Disagree	54 (9.3%)	35 (11.3%)	19 (6.9%)	
	Strongly Agree	284 (48.7%)	132 (42.7%)	152 (55.5%)	
	Strongly Disagree	12 (2.1%)	5 (1.6%)	7 (2.6%)	
Perceiving diarrhoea and serious consequences	Agree	117 (20.1%)	43 (13.9%)	74 (27.0%)	<0.001*
	Disagree	65 (11.1%)	57 (18.4%)	8 (2.9%)	
	Neither Agree nor Disagree	42 (7.2%)	36 (11.7%)	6 (2.2%)	
	Strongly Agree	355 (60.9%)	172 (55.7%)	183 (66.8%)	
	Strongly Disagree	4 (0.7%)	1 (0.3%)	3 (1.1%)	
Visual notices have been observed	Agree	174 (29.8%)	57 (18.4%)	117 (42.7%)	<0.001*
	Disagree	64 (11.0%)	61 (19.7%)	3 (1.1%)	
	Neither Agree nor Disagree	82 (14.1%)	66 (21.4%)	16 (5.8%)	
	Strongly Agree	258 (44.3%)	122 (39.5%)	136 (49.6%)	
	Strongly Disagree	5 (0.9%)	3 (1.0%)	2 (0.7%)	
*Denotes statistical significance at 0.05 (Chi-square test is used)					

Source: Field Survey 2024

Maintaining hygiene at important moments is uncommon, according to the perspective of 76 (27.7%) respondents from the experimental group and 66 (21.4%) respondents from the control group. Moreover, 179 (65.3%) respondents in the experimental group and 165

(53.4%) in the control group expressed the opinion that irregular handwashing caused stomachache and vomiting. A total of 152 (55.5%) respondents in the experimental group considered unwashed hands disgusting, whereas in the control group, 132 (42.7%)

reported the same (Table 4). Importantly, the majority of respondents, including 183 (66.8%) in the experimental group and 172 (55.7%) in the control group, considered the risk of perceived diarrhoea and serious consequences under unhygienic conditions. Approximately 136 (49.6%) respondents from the experimental group and 122 (39.5%) from the control group observed hygiene practices through visual notices. The positive attitudes towards hygiene education were observed among students in the experimental group more than in the control group. Overall, 373 (64%) and 355 (60.9%) respondents highly considered that hygiene practices are important in reducing disease transmission and the risk of perceived diarrhoea and severe consequences under unhygienic conditions. The vital role of hygiene practices in reducing disease transmission ($p < 0.001$), fear of improper handwashing ($p < 0.001$), uncommon moments of importance ($p < 0.001$), stomach ache and vomiting caused by irregular handwashing ($p < 0.001$), unwashed hands as disgusting ($p < 0.001$), risk of perceived diarrhoea and serious consequences ($p < 0.001$), and observing hygiene practices through visual notices ($p < 0.001$) are significantly associated with the knowledge or awareness level of WASH practices among students (Table 4).

Correlation Between Knowledge of Handwashing Practices, Awareness of Hygiene Practices, Provided Facilities for Hygiene, and Implementation of Hygiene Practices among Students

Pearson's correlation test was performed to determine the correlation between variables of knowledge of handwashing practices (KHP), awareness of hygiene practices (AHP), provision of hygiene facilities (PHF), and implementation of hygiene practices (IHP). This data analysis showed that KHP was positively and significantly correlated with AHP, PHF, and IHP, as their correlation coefficients ranged from 0.489 to 0.75 (Table 5). This indicates that there is a significant

correlation between knowledge of handwashing practices, AHP, PHF, and IHP.

Effects of Behavioural Determinants of Handwashing on Hygiene Practices

A multiple regression analysis was performed to examine the relationship between behavioural determinants of handwashing and hygiene practices. The model demonstrated strong explanatory power with an R-squared value of 0.55 (> 0.5) and an F-ratio of 141.059 (> 1) (Table 6). The results indicated a statistically significant effect of handwashing practices on hygiene awareness, facility provision, and implementation of hygiene practices, with all p-values being less than 0.05. Thus, knowledge of handwashing practices significantly influences awareness, the provision of hygiene facilities, and the implementation of hygiene practices among students in Karongi District, Western Province, Rwanda.

Qualitative Data Findings

Semi-structured interviews were conducted to investigate the importance of handwashing practices, challenges faced by students, and strategies for promoting hygiene in schools. Data were analyzed using NVivo 14.0 software and thematic analysis techniques. This analysis identified key themes highlighting the essential role of handwashing practices in enhancing school hygiene. The significance of handwashing, especially post-COVID-19, was underscored by the need to increase awareness among students and teachers.

Interviewees highlighted several factors critical to effective handwashing, including hygiene, disease transmission reduction, handwashing campaigns, availability of soap and water, good habits, promotion, monitoring, and adequate washing facilities (Figure 4). Most respondents emphasized that hygiene and disease prevention were the primary reasons for encouraging handwashing. Despite the implementation of handwashing facilities in

schools within Karongi District, further efforts are needed to promote these practices through targeted campaigns and to enhance awareness about proper hygiene for maintaining health.

Discussion

The knowledge of teachers and their reported handwashing practices was vital after

the COVID-19 pandemic (100%) and should be promoted among children (99.2%). These findings suggest that teachers need to encourage children to implement handwashing practices at their schools. In alignment with the study of Raji et al. [15], primary school teachers should be.

Table 5. Correlation Analysis Between KHP, AHP, PHF, and IHP

Correlations (Pearson)					
Variables		KHP	AHP	PHF	IHP
KHP	Pearson Correlation	1	0.75**	0.612**	0.665**
	Sig. (2-tailed)	<0.001	<0.001	<0.001	<0.001
	N	583	583	583	583
AHP	Pearson Correlation	0.75**	1	0.622**	0.649**
	Sig. (2-tailed)	<0.001	<0.001	<0.001	<0.001
	N	583	583	583	583
PHF	Pearson Correlation	0.612**	0.622**	1	0.489**
	Sig. (2-tailed)	<0.001	<0.001	<0.001	<0.001
	N	583	583	583	583
IHP	Pearson Correlation	0.665**	0.649**	0.489**	1
	Sig. (2-tailed)	<0.001	<0.001	<0.001	<0.001
	N	583	583	583	583
**Correlation is significant at 0.05 level (2-tailed)					

Source: Field Survey 2024

Table 6. Regression Analysis to Determine the Effects of Handwashing Behaviours on Hygiene Practices

Overall Model Fit					Value	
Multiple R					0.742	
Coefficient of Determination (R^2)					0.550	
Adjusted R^2					0.546	
Standard Error of the Estimate					0.696	
Analysis of variance						
	Sum of squares		Df	Mean square	F	Sig.
Regression	341.939		5	68.388	141.059	0.000*
Residual	279.739		577	0.485		
Total	621.678		582			
Regression Coefficients						
Variables	Regression Coefficients			Statistical Significance		
	B	Std. Error	Beta	T	Sig.	
(Constant)	-0.051	0.080		-0.637	0.524	
AHP	0.337	0.048	0.337	6.950	<0.001**	

which was implemented based on self-reported design among teachers in Ethiopian schools. Another survey by Liyanage et al. [22] was carried out among medical students to understand the behavioural patterns of handwashing practices. The data findings disclosed that interventions aimed to improve knowledge and practices of handwashing among participants. It indicated that self-reported data could be much more credible if the consent process establishes trust among participants appropriately. Therefore, the results of this study could be utilized as a baseline for the institution of handwash and hygiene intervention programs in the Karongi district, Western Province, Rwanda.

In this study, it was found that schoolteachers opined that it is important to wash their hands after the COVID-19 pandemic (100%), and most of them pay attention to the students' handwashing practices after they eat food (96.7%) and after they use the toilet (90.8%). These data findings were supported by the study of Klar et al. [17], which depicted the importance of hand hygiene practices after using the toilet because it might have accounted for the higher perceived risks of contaminating hands with bacteria due to the open toilets in school settings. The study of Simanjuntak et al. [18] also confirmed that faecal bacteria mostly contaminate hands. This study reported a higher level of handwashing practices than the study of Almoslem et al. [23] among medical students after toilet use. In summary, the above discussions noted the importance of continuous hand hygiene education and the provision of adequate facilities in schools. The presence of sufficient washing facilities supports the promotion of handwashing practices and overall hygiene among students.

Conclusion

The handwashing behaviours of students were found to be influenced by their knowledge and attitude toward handwashing facilities, behavioural determinants, and perceived

severity of disease transmission. The main goal of the study is to promote hygiene practices among students. Therefore, based on the first objective, it can be concluded that the students and teachers in Karongi possess a certain level of knowledge regarding handwashing techniques. However, more emphasis on instilling proper handwashing practices is required.

Research has shown that promoting hand hygiene interventions and campaigns among students leads to an improvement in their understanding. The proportion of students was lower regarding the implementation of proper handwashing practices at their schools in the Karongi district. The mixed method study design depicted those teachers in all primary schools supported handwash practices and the students washed their hands with soap and water to reduce disease transmission. Although the schools provided sufficient facilities mostly, they should have focused on promoting hygiene practices and hand-washing interventions among children.

Recommendations

Based on the main study findings, the following recommendations have been made to enhance hygiene education and handwashing practices among school children:

1. Schools should prioritize water, sanitation, and hygiene (WASH) programs to keep students healthy by providing hygiene education along with WASH materials and facilities.
2. The government of Rwanda and other stakeholders such as UNICEF and UNESCO, should work together to provide appropriate hygiene education and resources that are needed for schools to promote effective hand hygiene practices.
3. Schools should integrate age-appropriate and location-specific hygiene education programs to address the diverse needs of students based on their age, class level, and regional context.

4. Teachers should receive ongoing training on the importance of hand hygiene and effective methods to encourage and monitor students' handwashing practices.
5. Community awareness campaigns should emphasize the importance of hand hygiene, involving local government, healthcare providers, and community leaders to reinforce the message.
6. Regular monitoring and evaluation of WASH facilities and hygiene practices in schools should be conducted to ensure continuous improvement and promptly address any emerging issues.
7. Partnerships with private organizations should be encouraged to support WASH initiatives, providing additional resources and expertise to enhance hygiene practices in schools.
8. Schools should implement reward and recognition programs to motivate students to consistently practice good hand hygiene, thereby creating a culture of cleanliness and health awareness among students.
9. To effectively reduce disease transmission and enhance overall hygiene, it is strongly recommended that schools in the Karongi district of Rwanda intensify their initiatives to encourage regular handwashing practices among students.

Contribution to Knowledge

The study offers insights into the handwashing habits and hygiene awareness of primary school students in the Karongi district, Rwanda. By using quantitative analysis, the study demonstrates the effectiveness of promoting handwashing among students in reducing illness and absenteeism, thus underscoring the impact of school-based hygiene promotion. Qualitative findings reveal challenges related to hygiene infrastructure in primary schools, such as water shortages and insufficient resources. These findings provide a valuable understanding of the obstacles to

effective hygiene practices. The study highlights the importance of promoting handwashing through educational campaigns and addressing resource limitations in primary schools. By doing so, health outcomes for school children in Rwanda can be enhanced. The study concludes with actionable policy recommendations for improving hygiene practices.

Limitations of Study

Limitations were identified in the study's narrow focus on handwashing habits alone, without considering broader hygiene practices. Furthermore, the study did not sufficiently explore cultural and socioeconomic factors that may influence handwashing. Additionally, the assessment of the long-term sustainability of hygiene interventions was lacking, emphasizing the need for further research.

Suggestions for Future Research

Further research in the Karongi district, Rwanda, could focus on investigating broader hygiene practices among primary school students. In-depth studies are also important to understand how cultural and socioeconomic factors influence handwashing behaviours. Additionally, longitudinal studies will help assess the long-term effects of hygiene interventions.

Strength of the Research

The study excels in its comprehensive examination of handwashing habits among primary school students. It employs a combination of methods, providing valuable insights and presenting practical policy suggestions.

Weakness of the Study

The study's limited focus on handwashing overlooks broader hygiene practices and does not sufficiently explore cultural influences.

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Conflicts of Interest

The author declares no conflict of interest.

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