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Evaluation of Impact of Bilharzia Storytelling on Community Awareness of schistosomiasis among primary school-aged children in Bugesera District, Rwanda, 2024

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ABSTRACT

INTRODUCTION: Schistosomiasis remains a significant public health concern in low- and middle-income countries, particularly in Rwanda. This study aimed to assess the effectiveness of storytelling based educational intervention in improving knowledge, attitudes, and practices (KAP) related to schistosomiasis prevention among school-aged children in Bugesera District.

METHODS: This was a cross-sectional interventional study conducted in Bugesera District, Rwanda. Baseline data were collected through surveys from 341 students, while the end line was collected from 303 students aged 7-15 years. SPSS version 25 was used to analyze the frequencies of the demographic variables and the distribution of the knowledge, attitude, and practice variables of the participants. Pearson Chi-square tests were performed to determine the association between sociodemographic characteristics and the level of knowledge, attitude, and practice at a 95% confidence level.

RESULTS: Disease awareness increased from 14.7% to 98.3%, with parents emerging as the primary information source (96.0%). Understanding of transmission routes improved substantially, with recognition of water contact risks increasing from 3.8% to 92.1%. Risk perception increased (52.0% to 72.1%) while fear levels decreased (82.0% to 71.5%). Behavioral changes were significant: swimming in water bodies decreased from 35.8% to 7.3%, regular toilet use increased from 76.5% to 89.8%, and lake water usage for drinking dropped from 33.7% to 15.5%.

CONCLUSION: The storytelling-based intervention demonstrated exceptional effectiveness in improving schistosomiasis-related KAP among school children in Rwanda, surpassing outcomes reported in comparable African studies.

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INTRODUCTION

Schistosomiasis, or Bilharzia, is a significant global public health issue, particularly in tropical and subtropical regions where poverty and limited access to clean water and sanitation perpetuate its transmission [1,2]. Caused by parasitic worms released from freshwater snails, the disease infects humans through skin contact with contaminated water. Over 250 million people worldwide require preventative treatment, with the vast majority of cases and the greatest burden occurring in Africa [3].School-aged children are disproportionately affected, constituting a large portion of the over 123 million infected children [4-6]. Consequently, the primary global control strategy for the past two decades has been preventive chemotherapy, using drugs like Praziquantel, targeted at this age group [7,8].

In Rwanda, a tropical nation where schistosomiasis is endemic, the disease remains a persistent challenge. It is a recognized contributor to anemia and hospitalization, with recent mapping indicating an infection rate of approximately 36% for the prevalent Schistosoma mansoni species [8,9]. As one of Rwanda's key Neglected Tropical Diseases, the national response has included mass drug administration in schools [10]. However, despite achieving high treatment coverage, re-infections among children continue. This persistence could highlight a critical gap: chemotherapy alone is insufficient if children continue to engage in high-risk water-contact behaviors due to a lack of knowledge [10-12].

This gap underscores the need for complementary strategies, such as community education and awareness campaigns, to instill lasting behavioral change. While Rwanda has employed various methods, including community health worker programs and One Health initiatives, awareness levels among children and teachers remain critically low, at around 3%. This knowledge deficit is a major obstacle to elimination [10-12].
It is within this context that the *"Bilharzia Storytelling Lab*" emerged as an innovative Behavior Change Communication program. Recognizing that traditional methods had not sufficiently increased awareness, this initiative aimed to leverage the engaging power of storytelling and comics to educate school-aged children. The project involved distributing over 2,500 illustrated notebooks with prevention messages and hosting storytelling contests in three schools in the Bugesera District. Therefore, this study was designed to evaluate the impact of this novel storytelling-based educational program on the knowledge, attitudes, and practices regarding schistosomiasis among its primary targets: school-aged children in a high-risk area of Rwanda.

METHODS

Study Design and Setting

This study involved the evaluation of the impact of the storytelling program using a pre-test and post-test cross-sectional study design. Data collection was carried out using a semi-structured survey questionnaire. The study was conducted in Bugesera district, one of the seven districts in the Eastern province of Rwanda. This district was selected due to its high susceptibility to schistosomiasis infections, attributed to the presence of numerous freshwater bodies, particularly Lake Rweru.

Study Population and Sample

The study population comprised 2,549 school-aged children from the three selected schools [Groupe Scolaire (GS) Nyiragiseke, Ecole Primaire (EP) Kivusha, and Ecole Primaire (EP) Mugina] in Bugesera District. A random sampling method was employed, with the sample proportionally distributed among the three schools. The inclusion criteria specified students aged between 8 and 22 years.

Data Collection Procedures

A baseline study was initially conducted on students' knowledge, attitude, and perception of Bilharzia in October 2023. Following this, project activities, comprising teachings and competitions, were implemented, and the post-interventional data were collected from June 16 to June 17, 2024, to evaluate their impacts.
Data collection was conducted by a trained research team using a paper-based, administered-assisted questionnaire with multiple-choice questions. The questionnaire was available in both English and Kinyarwanda to accommodate participant preferences. The study measured three key dependent variables: knowledge, attitudes, and practices of the students regarding Bilharzia. Pre and post-intervention results were compared to

evaluate the impact of the educational activities.

KAP scaling and scoring.
The knowledge, attitude, and practice were scored 1 for the correct response and 0 for the false response. The total scores were summed and categorized as poor and good for the scores below and above the average, respectively [13,14].

Data Analysis
Data was entered into Microsoft Excel for cleaning and subsequently analyzed using SPSS. Descriptive statistics were used to summarize participant characteristics. Knowledge levels, attitude groups, and practice levels were determined by calculating the overall scores of correct and specific answers. Bivariate analysis with Pearson Chi-square ($\chi 2$) tests was used to compare knowledge, attitude, and practice across the socio-demographic characteristics. A pre-specified alpha significance level (two-tailed p-value) of 0.05 was used, and 95% confidence intervals were reported.

Ethical Considerations
The study's ethical clearance was obtained from Kepler College, Rwanda. Additional approval was sought from the National Health Research Committee with reference number: NHRC/2023/PROT/037. Participation was voluntary, and responses were treated as anonymous and confidential. Written informed consent forms were obtained from parents/guardians of each participant under the age of 18 years.

RESULTS

Baseline characteristics of participants: The evaluation of the study encompassed a total of 303 participants, revealing demographic patterns across age, gender, education, location, and socioeconomic status. Age distribution showed 86.5% were 15 years or younger, while 13.2% were 16 or above, aligning with the focus on school-aged children. Gender distribution demonstrated remarkable balance and represents both sexes to be adequately represented in the research findings. The socioeconomic status of participants, measured through the Ubudehe categories, revealed interesting patterns (Table 1). Among the three schools that participated, GS Nyaragiseke, EP Kivusha, and EP Mugina represented with 47.5%, 30% and 22.4% respectively.

Table 1: *Socio-demographic characteristics of participants*

		Post Intervention	
Variables		**n**	**%**
Age category	≤ 15	262	86.5
	> 16	40	13.2
Gender	male	148	48.8
	female	155	51.2
Educational level	primary 4	117	38.6
	primary 5	101	33.3
	primary 6	85	28.1
School name	GS Nyiragiseke	144	47.5
	EP Mugina	68	22.4
	EP Kivusha	91	30.0
Sector	Gashora	2	0.7
	Rweru	301	99.3
Ubudehe category	Category 1	23	7.6
	Category 2	68	22.4
	Category 3	151	49.8
	Category 4	1	0.3
	Do not know	60	19.8
	Total	303	100

Comparison of the knowledge in the baseline vs. and post-intervention evaluation: A remarkable transformation in knowledge and awareness about schistosomiasis was observed between the pre-intervention and post-intervention periods of the study. Initially, only 14.7% of participants

Table 2: *Comparative knowledge distribution on the signs and symptoms, transmission, and prevention*

		Baseline		Post-Intervention	
Variables		**n**	**%**	**n**	**%**
Have heard about Bilharzia before	No	29	85.3%	5	1.7%
	Yes	50	14.7%	298	98.3%
The source of information about Bilharzia	Parent	11	3.2%	291	96.0%
	School	18	5.3%	2	0.7%
	Friends	5	1.5%	8	2.6%
	Community health workers	11	3.2%	3	1.0%
	Radio	14	4.1%	5	1.7%
	Others	1	0.3%	5	1.7%
Have you been infected with bilharzia	No	45	90.0%	289	97.0%
	Yes	5	10.0%	9	3.0%
Family members have been infected	No	40	81.6%	288	96.6%
	Yes	9	18.4%	10	3.4%
Mode of transmission	Playing in waterbodies	13	3.8%	279	92.1%
	Drinking rainwater	22	6.5%	183	60.4%
	Eating too much salt	7	2.1%	54	17.8%
	Water snake bite	11	3.2%	225	74.3%
	Going to the toilet barefoot	15	4.4%	240	79.2%
	Stepping in urine	14	4.1%	242	79.9%
	Eating raw mangoes	6	1.8%	43	14.2%
	Praying in fire	4	1.2%	43	14.2%
	Not wearing shoes	14	4.1%	265	87.5%
	Urinating in water bodies	12	3.5%	238	78.5%
	Others	20	5.9%	6	2.0%
Activities that lead to being infected	Fishing in lake	21	6.2%	254	83.8%
	Cultivating rice	18	5.3%	279	92.1%
	Drawing lake water	22	6.5%	252	83.2%
	Swimming in a lake	19	5.6%	267	88.1%
	Washing in the lake	21	6.2%	252	83.2%
	Others	7	2.1%	7	2.3%
Treatment	Taking medications	25	7.3%	251	82.8%
	Consulting a health center	42	12.3%	286	94.4%
	Traditional medicines	8	2.3%	57	18.8%
	Traditional healers	5	1.5%	28	9.2%
	Roosted roots	4	1.2%	24	7.9%
	Others	1	0.3%	2	0.7%
Prevention	Avoiding open defecation	20	5.9%	252	83.2%
	Avoiding stepping into water bodies	30	8.8%	291	96.0%
	Others	16	4.7%	7	2.3%

had heard about Bilharzia, but this awareness underwent a dramatic shift post-intervention, with 98.3% of participants becoming familiar with the disease. This substantial increase indicates the intervention's effectiveness in raising basic awareness about Bilharzia among the target population.

Parents have emerged as the primary information source, increasing dramatically from 3.2% (n=11) to 96.0% (n=291). Other information sources, including schools, community health workers, and radio, showed decreased relative importance post-intervention, though this may reflect the overwhelming shift toward parental information sharing.

Regarding personal experience with the disease, both direct infection and family member infection rates showed notable changes. Self-reported Bilharzia infections decreased from 10.0% (n=5) to 3.0% (n=9), while reported family member infections declined from 18.4% (n=9) to 3.4% (n=10). This reduction might indicate either improved prevention practices or enhanced diagnostic accuracy in identifying the disease.

Knowledge about transmission modes showed remarkable improvement across multiple categories. Understanding of key transmission routes increased substantially: recognition of playing in water bodies as a risk factor rose from 3.8% (n=13) to 92.1% (n=279), and awareness of risks from not wearing shoes increased from 4.1% (n=14) to 87.5% (n=265). Importantly, participants also showed increased awareness of other legitimate transmission risks, such as urinating in water bodies (from 3.5% to 78.5%) and going barefoot to toilets (from 4.4% to 79.2%).

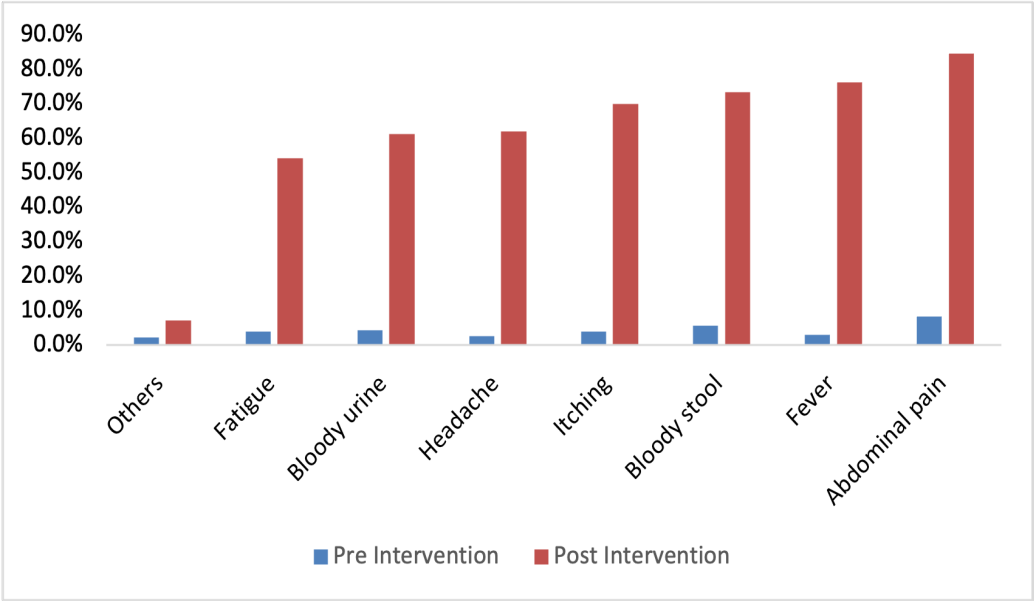

Figure 1: *Trend in the knowledge of the signs and symptoms of schistosomiasis*

Table 3: *Analysis of perceptions and attitudes towards schistosomiasis*

		Baseline		Post Intervention	
Variables		**n**	**%**	**n**	**%**
Easy to get infected	yes	26	52.00%	215	72.10%
Getting treated	yes	50	100.00%	289	97.00%
Discuss	yes	48	96.00%	288	96.60%
Hard to change behavior	yes	19	38.00%	107	35.90%
Fear of getting infected	yes	41	82.00%	213	71.50%
Many children get infected	yes	3	6.00%	10	3.40%
Infection is not age-dependent	yes	16	32.00%	223	74.80%

Awareness of high-risk activities demonstrated similar improvements. Recognition of risky behaviors increased significantly across all categories: rice cultivation awareness rose from 5.3% to 92.1%, swimming in lakes from 5.6% to 88.1%, and fishing activities from 6.2% to 83.8%. This comprehensive improvement suggests successful education about practical risk factors in daily activities.

Regarding treatment knowledge, awareness of appropriate interventions has improved significantly. Recognition of the importance of consulting health centers increased from 12.3% to 94.4%, and knowledge about medication-based treatment rose from 7.3% to 82.8%. Interestingly, awareness of traditional treatment methods also increased, though to a lesser extent, with traditional medicine awareness rising from 2.3% to 18.8%.

Prevention knowledge showed substantial improvement, particularly in two key areas: avoiding stepping in water bodies increased from 8.8% to 96.0%, and awareness of avoiding open defecation rose from 5.9% to 83.2% (Table 2).

Signs and symptoms of schistosomiasis: Understanding of signs and symptoms showed substantial enhancement post-intervention. Recognition of key symptoms increased

Table 3: *Practice pre- and post-storytelling program*

		Baseline		Post Intervention	
Variables		**n**	**%**	**n**	**%**
Do you work in swamps and stagnant water bodies	No	135	39.6%	170	56.1%
	Yes	206	60.4%	133	43.9%
How often do you wear shoes when walking in swamps and stagnant water bodies	Never	103	30.2%	30	9.9%
	Sometimes	45	13.2%	59	19.5%
	Always	59	17.3%	44	14.5%
How often do you defecate in a toilet	Always	261	76.5%	272	89.8%
	Sometime	150	44.0%	40	13.2%
Swim in water bodies	No	219	64.2%	280	92.7%
	Never	19	5.6%	9	3.0%
	Sometimes	103	30.2%	13	4.3%
	Always	0	0.0%	0	0.0%
Source of water for respondents' drinks	Swamps	45	13.2%	22	7.3%
	Lakes	115	33.7%	47	15.5%
	Rivers	16	4.7%	7	2.3%
	Community water access point	144	42.2%	153	50.5%
	Natural water retrieval point	16	4.7%	4	1.3%
	Household/Neighbor water supply latrine	77	22.6%	83	27.4%
	Other sources	14	4.1%	1	0.3%
Source of water respondents use at home	Swamps	85	24.9%	48	15.8%
	Lakes	256	75.1%	178	58.7%
	Rivers	12	3.5%	13	4.3%
	Community water access point	34	10.0%	52	17.2%
	Natural water retrieval point	8	2.3%	2	0.7%
	Household/neighbor water supply latrine	20	5.9%	33	10.9%
	Other sources	17	5.0%	2	0.7%

dramatically: abdominal pain awareness rose from 8.2% to 84.5%, fever from 2.9% to 76.2%, and bloody stool from 5.6% to 73.3%. This improved symptom recognition could facilitate earlier detection and treatment seeking (Figure 1).

Pre- and post-storytelling program participants' attitudes: The study revealed significant shifts in participants' perceptions and attitudes toward Bilharzia between the pre-and post-intervention periods. The proportion of participants who believed it was easy to get infected increased from 52.0% (n=26) to 72.1% (n=215). This substantial increase suggests enhanced awareness of transmission risks and vulnerability to the disease following the intervention.

Regarding treatment accessibility and attitudes, there was a slight shift in perspectives. Initially, all participants (100%, n=50) believed they could get treated for Bilharzia, while this percentage showed a marginal decrease to 97.0% (n=289) post-intervention (Table 3)

The willingness to discuss Bilharzia remained consistently high throughout both periods, with 96.0% (n=48) of participants initially willing to discuss the disease, and this openness was maintained at 96.6% (n=288) post-intervention. Perceptions about behavioral change showed minimal variation between the two periods. Initially, 62.0% (n=31) of participants did not consider it hard to change behavior related to Bilharzia prevention, which slightly increased to 64.1% (n=191) post-intervention. Fear of infection showed an interesting shift, with the proportion of participants expressing fear decreasing from 82.0% (n=41) to 71.5% (n=213). Understanding of infection patterns across age groups showed substantial changes. The belief that many children get infected decreased markedly, with those who disagreed increasing from 52.0% (n=26) to 67.4% (n=201). Notably, uncertainty about this aspect decreased from 42.0% (n=21) to 29.2% (n=87). The most dramatic shift was observed in the understanding of age-dependent infection patterns, with recognition that infection is not age-dependent, increasing from 32.0% (n=16) to 74.8% (n=223).

Practice pre- and post-storytelling program: The study revealed significant changes in risk-related behaviors and water usage patterns between the pre-and post-intervention periods. One of the most notable shifts occurred in exposure to high-risk environments, with participants reporting reduced engagement in activities involving swamps and stagnant water bodies, decreasing from 60.4% (n=206) to 43.9% (n=133).

Footwear habits showed meaningful changes in post-intervention. The proportion of participants who never wore shoes decreased dramatically from 30.2% (n=103) to 9.9% (n=30), indicating improved protective behavior. However, the percentage of those always wearing shoes remained relatively stable, slightly decreasing from 17.3% (n=59) to 14.5% (n=44), while occasional shoe-wearing increased from 13.2% (n=45) to 19.5%

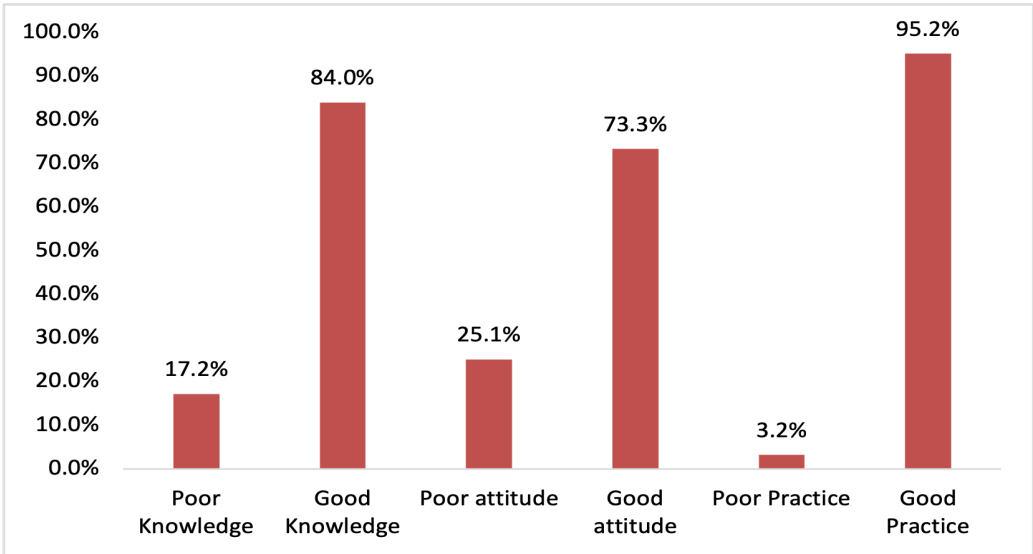

Figure 2: *Post-intervention levels of knowledge, attitude and practice*

Table 5: *Association between socio-demographic characteristics and the knowledge about schistosomiasis*

Demographics		Knowledge level		Total	X^2	OR (95%CI)	P-value
		Poor knowledge	Good knowledge				
Age	≤15	31	231	262	0.015	0.93(0.342-2.577)	0.536
		86.1%	86.8%	86.8%			
	>16	5	35	40			
		13.9%	13.2%	13.2%			
Gender	Male	20	128	148	0.458	1.26(0.636-2.528)	0.308
		54.1%	48.1%	48.8%			
	Female	17	138	155			
		45.9%	51.9%	51.2%			
Educational level	Primary 4	21	96	117	7.313	0.610(0.271-1.372)	0.26
		56.8%	36.1%	38.6%			
	Primary 5	6	95	101			
		16.2%	35.7%	33.3%			
	Primary 6	10	75	85			
		27.0%	28.2%	28.1%			
Ubudehe category	Category 1	3	20	23	0.41	1.026(0.247-4.258)	0.98
		8.1%	7.5%	7.6%			
	Category 2	9	59	68			
		24.3%	22.2%	22.4%			
	Category 3	17	134	151			
		45.9%	50.4%	49.8%			
	Category 4	0	1	1			
		0.0%	0.4%	0.3%			
	Don't know	8	52	60			
		21.6%	19.5%	19.8%			
School	GS.	18	126	144	0.205	0.728(0.380-1.966)	0.9
	Nyiragiseke	48.6%	47.4%	47.5%			
	EP Mugina	9	59	68			
		24.3%	22.2%	22.4%			
	EP Kivusha	10	81	91			
		27.0%	30.5%	30.0%			
Sector	Gashora	2	0	2	14.47	8.6(6.29-11.74)	0.015*
		5.4%	0.0%	0.7%			
	Rweru	35	266	301			
		94.6%	100.0%	99.3%			

**Statistically significant at p<0.05, OR: Odd ratio, CI: Confidence interval, X^2: Value of the chi-square test statistics*

(n=59).

Sanitation practices demonstrated substantial improvement. The proportion of participants always using toilets for defecation increased from 76.5% (n=261) to 89.8% (n=272), while occasional toilet use decreased significantly from 44.0% (n=150) to 13.2% (n=40).

Recreational water contact behaviors showed remarkable changes. Swimming in water bodies decreased substantially, with those avoiding such activities increasing from 64.2% (n=219) to 92.7% (n=280).

Perhaps most significantly, water sourcing patterns showed a shift toward safer options. For drinking water, reliance on high-risk sources decreased substantially: lake water usage dropped from

Table 6: *Association between socio-demographic characteristics and attitude about schistosomiasis*

		Attitude level		Total	X^2	OR (95%CI)
		Poor attitude	Good attitude			
Age Category	≤15	189	68	257	0.75	0.695(0.305-1.582)
		85.5%	89.5%	86.5%		
	>16	32	8	40		
		14.5%	10.5%	13.5%		
Gender	Male	103	42	145	1.78	0.701(0.415-1.183)
		46.4%	55.3%	48.7%		
	Female	119	34	153		
		53.6%	44.7%	51.3%		
Educational level	Primary 4	90	23	113	2.58	0.613 (0.319-1.179)
		40.5%	30.3%	37.9%		
	Primary 5	72	28	100		
		32.4%	36.8%	33.6%		
	Primary 6	60	25	85		
		27.0%	32.9%	28.5%		
Ubudehe category	Category 1	16	7	23	1.59	0.361(0.718-2.485)
		7.2%	9.2%	7.7%		
	Category 2	50	16	66		
		22.5%	21.1%	22.1%		
	Category 3	113	35	148		
		50.9%	46.1%	49.7%		
	Category 4	1	0	1		
		0.5%	0.0%	0.3%		
	Don't know	42	18	60		
		18.9%	23.7%	20.1%		
School	GS. Nyiragiseke	101	38	139	0.88	1.33(0.718-2.485)
		45.5%	50.0%	46.6%		
	EP Mugina	50	18	68		
		22.5%	23.7%	22.8%		
	EP Kivusha	71	20	91		
		32.0%	26.3%	30.5%		
Sector	Gashora	1	1	2	0.63	0.33(0.021-5.493)
		0.5%	1.3%	0.7%		
	Rweru	221	75	296		
		99.5%	98.7%	99.3%		

OR: Odd ratio, CI: Confidence interval, X^2: Value of the chi-square test statistics

33.7% (n=115) to 15.5% (n=47), and swamp water usage decreased from 13.2% (n=45) to 7.3% (n=22). Conversely, use of community water access points increased from 42.2% (n=144) to 50.5% (n=153).

Household water sourcing patterns similarly showed positive changes. Lake water usage for household purposes decreased from 75.1% (n=256) to 58.7% (n=178), while utilization of community water access points increased from 10.0% (n=34) to 17.2% (n=52). Usage of household/neighbor water supply systems also showed an increase from 5.9% (n=20) to 10.9% (Table 4).

Table 7: *Association between socio-demographic characteristics and practice about schistosomiasis*

		Practice level		Total	X^2	OR (95%CI)	P-value
		Poor practice	Good practice				
Age Category	<=15	3	259	262	0.463	0.976(0.976-1.002)	0.652
		100.0%	86.6%	86.8%			
	>16	0	40	40			
		0.0%	13.4%	13.2%			
Gender	male	3	145	148	3.173	0.98(0.957-1.003)	0.115
		100.0%	48.3%	48.8%			
	female	0	155	155			
		0.0%	51.7%	51.2%			
Educational level	primary 4	1	116	117	2.642	2.795(0.249-31.338)	0.267
		33.3%	38.7%	38.6%			
	primary 5	0	101	101			
		0.0%	33.7%	33.3%			
	primary 6	2	83	85			
		66.7%	27.7%	28.1%			
Ubudehe category	category 1	0	23	23	10.471	1(0.0001-1.00)	0.033*
		0.0%	7.7%	7.6%			
	category 2	3	65	68			
		100.0%	21.7%	22.4%			
	category 3	0	151	151			
		0.0%	50.3%	49.8%			
	category 4	0	1	1			
		0.0%	0.3%	0.3%			
	don't know	0	60	60			
		0.0%	20.0%	19.8%			
School	GS. Nyiragiseke	2	142	144	1.304	0.944(0.084-10.591)	0.521
		66.7%	47.3%	47.5%			
	EP Mugina	1	67	68			
		33.3%	22.3%	22.4%			
	EP Kivusha	0	91	91			
		0.0%	30.3%	30.0%			

**Statistically significant at p<0.05, OR: Odd ratio, CI: Confidence interval, X^2: Value of the chi-square test statistics*

The KAP scores: Post-intervention, the mean scores of the participants on the knowledge about the transmission, signs and symptoms, treatment, and prevention of schistosomiasis were 13.5 +3, with a minimum of 5 and a maximum of 17. The participants' mean scores on attitudes about schistosomiasis were 5.3 +1.7, with a minimum of 1 and a maximum of 9. The mean scores of the participants on the practice regarding schistosomiasis prevention were 10.2 +1.17, with a minimum of 5 and a maximum of 13.

The study population demonstrated a robust understanding, with 87.8% of participants exhibiting good knowledge levels, while only 12.2% showed poor knowledge. A significant majority of participants (73.3%) displayed good attitudes toward schistosomiasis, with only 25.1% showing poor attitudes. This stark contrast between knowledge and attitude levels indicates a potential disconnect between understanding the disease and developing positive attitudes towards prevention and control measures. Perhaps most surprisingly, the practice component showed exceptionally positive results, with an overwhelming 99% of

participants demonstrating good practices, and merely 1% showing poor practices (Figure 2).

Association between the socio-demographic characteristics and the knowledge, attitude, and practice of schistosomiasis: Most participants (86.8%) were aged 15 years or younger. Age showed no significant association with knowledge (X^2=0.015, OR=0.93, p=0.536), attitudes (X^2=0.75, OR=0.695, p=0.254), or practices (X^2=0.463, OR=0.976, p=0.652). Gender distribution, educational level, and all of these sociodemographic characteristics showed no association with KAP domains. Socioeconomic status showed a significant association only with practices (X^2=10.471, OR=1.00, p=0.033). Participants attended GS. Nyiragiseke (47.5%), EP Kivusha (30.0%), and EP Mugina (22.4%), with no significant associations across KAP domains. The geographical sector showed significant associations in knowledge (X^2=14.47, OR=8.6, p=0.015) and practices (X^2=201.33, OR=3001, p=0.001), with 99.3% of participants from the Rweru sector, though showing no significant association with attitudes (X^2=0.63, OR=0.33, p=0.446) (Tables 5, 6 and 7).

DISCUSSION

School-based interventions for schistosomiasis control have gained increasing attention worldwide, with storytelling emerging as an innovative educational approach. This study, conducted in three schools demonstrates remarkable success in transforming knowledge, attitudes, and practices (KAP) regarding schistosomiasis through storytelling interventions.

The baseline survey indicated a generally low level of awareness, poor attitude, and poor practice; the results were almost similar to Botswana, Tanzania, and many other sub-Saharan African countries [15–17]. The intervention achieved extraordinary improvements in disease awareness, from 14.7% to 98.3%, surpassing results from similar studies in Tanzania, where awareness increased to 85.6% [18]. Notably, the emergence of parents as primary information sources (3.2% to 96.0%) reflects a unique aspect of the Rwandan intervention, contrasting with studies in Uganda, where school-based education remained the primary information channel [19]. However, the study conducted in Ethiopia about schistosomiasis prevalence, a systematic review showed that certain regions in the south experience high rates of 25.9%, suggesting that targeted treatment and control strategies remain essential for further reduction of the disease burden.

Another major difference between articles on schistosomiasis, especially in low-resource settings, was that one of the major challenges was to specifically predict if the reduction in prevalence rate was attributed to the education strategies or other implemented strategies nationally. Furthermore, the comprehensive improvement in understanding transmission routes (water contact risks increasing from 3.8% to 92.1%) parallels findings were reported by Anyolitho et al., where 98.% of the participants knew the modes of transmission [20] Similarly, symptom recognition improvements (abdominal pain awareness: 8.2% to 84.5%) contrast with results from Bostwana, where a big number of children didn't know that bloody urine is a symptom of this disease [15].

The study revealed interesting attitude shifts, with increased risk perception (52.0% to 72.1%) accompanied by decreased fear levels (82.0% to 71.5%), indicating good attitude levels. This balanced outcome contrasts with the findings of Alemu [21]. The maintained high willingness to discuss the disease (96.0% to 96.6%) reflects successful destigmatization, similar to results from Ethiopian school-based programs [22]

The intervention's impact on practices was particularly noteworthy. The reduction in high-risk water contact (swimming decreased from 35.8% to 7.3%). Previous theories from Tanzania [18] and Uganda [20] also showed some similarities. Sanitation practices showed remarkable improvement, with regular toilet use increasing from 76.5% to 89.8%, comparable to WASH intervention outcomes in Swaziland [14].

The study's finding of significant associations between socioeconomic status (Ubudehe category) and practices (p=0.033), but not with knowledge or attitudes, contrary to observation by Alemu et al., where the male gender was also associated with the awareness level [21] The lack of gender-based differences contrasts with findings from Swaziland schools, where gender significantly influenced both knowledge and practices [14].

This study also has limitations. One major limitation is that some variables in practice rely on self-reporting responses, which are subject to social desirability bias. The lack of objective

verification methods limits the reliability of these practice-related findings. Secondly, the study experiences an attrition rate of approximately 11%, with 38 participants lost to follow-up between baseline and endline. This can raise concern about potential selection bias, particularly if those who dropped out differed systematically from those who remained. Such limitations should be considered when interpreting the study's conclusions and generalizability. The behavioral findings should be understood within the Rwandan context, where these reported results could normally be expected as positive behavior changes due to other health-promoting initiatives, such as campaigns encouraging shoe-wearing, which were not explored in this study.

CONCLUSION

This study demonstrates that storytelling-based interventions can be remarkably effective in improving schistosomiasis-related knowledge, attitudes, and practices among school children in Rwanda. The intervention achieved exceptional results across multiple dimensions, with knowledge improvements. This psychological equilibrium, combined with maintained high levels of disease discussion willingness, suggests that storytelling can effectively address both educational and emotional aspects of disease prevention.

Behavioral changes were particularly impressive, with substantial reductions in high-risk water contact and improved sanitation practices exceeding outcomes from conventional educational approaches. While socioeconomic status showed significant correlation with practices, the intervention's effectiveness across gender groups suggests its potential for broad-based implementation. Future research should explore the long-term sustainability of these behavioral changes and the potential for scaling this approach to other endemic regions.

Availability of data and materials: Obtained from the corresponding author upon reasonable request.

Author contributions: BB and NY conducted the study proposal development, BB, NY and EN collected the data. BB, DN and ET participated in the data analysis. All the authors contributed to the manuscript writing and review under the guidance of LN and DN.

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