Factors associated with perceived health of school-aged children in rural Rwanda: An opportunity to leverage community health workers to enhance primary healthcare systems linkages

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Abstract

Background:

Public schools have considerable potential to reach a significant portion of a given population and can play a central role in improving health across the lifespan. However, little is known about the current health needs of children at schools in rural and limited-resource settings. We sought to assess the perceived health of children and the role of community health workers (CHWs) at public schools in rural Rwanda.

Methods:

We conducted a convergent mixed methods study among teachers and community members to assess the factors associated with the perceived health of students in rural areas of Musanze, Rwanda. Data collection instruments were adapted from the World Health Organization's Health Promoting School (HPS) framework and the literature. Semi-structured interviews and focus group discussions were conducted to explore participants' perceptions of children's health. We performed a logistic regression analysis to examine the factors associated with perceived health. Thematic analysis was used to analyze the qualitative data.

Results:

A total of 479 individuals participated in this survey. Of these, 425 (89%) were community members, while 54 (11%) were employed as teachers at Nyabirehe or Rwinzovu public schools. Almost half of respondents 221 (46%) described the overall children's health as poor. Many factors were associated with perceived children's health, including having an established leadership team for school-based health promotion (OR = 1.97, 95%CI: 1.01,3,84), and being familiar with school-based health promotion (OR = 4.77, 95%CI: 2.27,10.0). The lack of access to primary care was associated with negative perceptions of children's health (OR:0.54,95%CI:0.31,0.95). Qualitative results described the CHW as a bridge between communities, schools, and primary healthcare centers. Further, qualitative findings highlighted the structural barriers and needs to be addressed for effective implementation of school-based health promotion.

Conclusion:

This study's findings revealed gaps in children's health in rural areas of Musanze. The strong association between school-based CHWs and children's health reflects the vital role CHWs play in linking communities and primary healthcare facilities. This study provides evidence to inform the development of innovative strategies for effectively implementing school-driven interventions to strengthen health promotion in rural and low-resource settings.

Background

The interrelationship between education, health, and economic productivity at the individual and societal level is well documented in literature (1,2). Children who are sick are more likely to be absent from school, which can result in grade repetition or dropouts, reducing graduation rates and overall educational achievement(1). Investing in measures to improve child health and wellness is crucial for developing capacity building and ensuring economic prosperity(3). Schools can be leveraged to reach a significant portion of the population (children, parents, and community members), playing a central role in improving health and educational achievement across the lifespan (4,5). A number of studies have shown that school-based interventions are cost-effective, scalable, and sustainable approaches for advancing national health agendas and improving health outcomes (5,6). This approach is particularly important in low- and middle-income countries (LMICs), such as Rwanda, with limited access to healthcare facilities and a high percentage of school-aged children(7).

The World Health Organization's Health Promoting School (HPS) framework was developed to promote health and learning and improve health outcomes among students, staff, and community members through community participation and intersectional collaboration(4,6). The HPS model (whole-school approach) aligns with the Social Ecological Model framework, as it employs a multifaceted approach (individual, organizational, community, and structural) to promote sustainable behavior change rather than focusing solely on individual factors that influence behaviors(4). The framework highlights the need to implement healthy school policies, provide health education, and school health programs and services such as nutrition and food safety, counseling, social and mental health support, and recreation. This is coupled with school and community-based projects through the active involvement of staff, parents, students, and community members(8).

While the HPS framework shows promise in improving health outcomes, inconsistency in implementing the components of the framework prevents a comprehensive assessment to determine the overall effectiveness of the model. For example, the family and community components are sometimes minimally or not addressed(6,9). The need for more evidence related to outcomes such as sexual health, substance use, violence, and mental health has also been documented(6).

Efforts to achieve Sustainable Development Goal (SDG) 3—to ensure healthy lives and promote well-being for all ages—have typically focused on health facility-based interventions with limited involvement of community schools and learning centers. Globally, non-communicable and infectious diseases kill 41 million and 17 million people, respectively, each year(10). While health promotion and education could prevent risk factors associated with these diseases, the paucity of health workers, among other resources, limits access to timely education and prevention(11).

Rwanda is one of the few countries to have achieved most health-related millennium development goals to significantly increase life expectancy, reduce premature mortality, and improve a wide range of health indicators(12). However, communicable diseases such as lower respiratory infections, tuberculosis, diarrheal diseases, malaria, and HIV/AIDS remain the leading causes of morbidity and mortality in Rwanda(13). Intestinal worms constitute a significant public health challenge affecting over 40% of the

Rwandan population(14). Further, an increase in the incidence of non-communicable diseases (NCDs) weighs a heavy burden, accounting for 35% of disability-adjusted life years in 2016 compared to 16% in 1990. Recent reports highlighted high rates of obesity among children and the school-aged population in Rwanda, suggesting more proactive interventions to supplement health facility-based health promotion efforts(15). The World Health Organization (WHO) and the United Nations Educational, Scientific and Cultural Organization (UNESCO) launched the Health Promoting School (HPS) model as a strategic vehicle to promote positive development and healthy behaviors, with the potential to improve health and well-being. The HPS model, a whole-school approach, aligns with the Social Ecological Model framework, as it employs a multifaceted approach to promote sustainable behavior change rather than focusing solely on individual factors that influence behaviors.

The HPS framework consists of three interrelated components, including:

1) Curriculum, teaching, and learning, providing students with the knowledge, skills, and attitudes that enable them to make healthy choices and adopt healthy behaviors. It also involves training teachers and other staff to deliver effective health education and promote a positive learning environment;

2) School policies, practices, and environment involve developing and implementing that support health and well-being in the school setting, such as ensuring safe water and sanitation, preventing violence and bullying, promoting physical activity and nutrition, and providing health services and referrals; and

Partnerships and services capitalizing on the involvement of parents, families, community members, health professionals, and other stakeholders in planning, implementing, and evaluating health-promoting activities in the school. This also involves linking the school with external resources and services to enhance its capacity to address health issues(10).

In 1995, the Global School Health Initiative was initiated as a strategy to mobilize and strengthen health promotion and education activities at the local, national, regional, and global levels. The initiative is designed to enhance the initial goal of HPS to improve the health of students, school personnel, families, and other community members (16).

Countries that have successfully implemented the HPS framework found remarkable success in various dimensions. In Thailand, the HPS approach has been integrated into the national education policy since 1997, reaching over 30,000 schools nationwide. The method approach has resulted in improved health knowledge, attitudes, and behaviors among students, as well as reduced absenteeism, dropout rates, substance use, violence, and teenage pregnancy(17). In Chile, the HPS approach has been implemented in over 2,000 schools since 1998, with support from the Ministry of Education and Health. The approach has increased physical activity, fruit and vegetable consumption, self-esteem, academic achievement, and civic participation among students and reduced obesity, tobacco use, violence, and sexual risk behaviors(18).

In South Africa, the HPS approach has been implemented in over 1,000 schools since 2003, with support from various partners such as the United Nations Children's Funds (UNICEF), UNESCO, and Save the Children(11). The approach has improved access to water, sanitation, and hygiene (WASH), nutrition, HIV prevention, and care services for students. It has also enhanced their life skills, resilience, peer support, and participation in school governance.

The implementation of HPS was supported by its clear goals to improve the health and well-being of students, staff, and community members, improve academic performance, reduce health inequities and disparities, increase social cohesion and empowerment of students, staff, and community members, and accelerate the pace towards achieving SDG 3 and national health and education priorities.

WHO published a new implementation guide to facilitate national implementation of HPS, with the ultimate goal of every school adopting HPS as a model to ensure the health and wellness of children and families(11). Despite clearly defined goals, a few countries have successfully implemented the HPS framework. A systematic review of 67 studies from 16 countries in the region found that most studies focused on single health topics such as HIV, oral health, or nutrition rather than the comprehensive HPS approach(19). WHO currently supports and advocates for HPS strategies in over 32 African countries, but the scarce funding and limited political will hindered the implementation of HPS(8).

In Rwanda, a school-based oral health program that focused on health promotion of brushing one's teeth and handwashing saw improvements in oral health practices and attitudes, decreases in oral health problems two years following the program compared to baseline level, and also slight increases in school attendance and academic performance compared to control schools(20). Similarly, a retrospective cohort study conducted in Malaysia measured the effectiveness of HPS strategies on the quality of life, but only oral health indicators were used. This study reported a statistically significant decrease in bleeding gums and plaque in teeth(21). Another systematic review of 25 studies from 12 countries in the region found that most studies reported positive effects of the HPS approach on health knowledge and behaviors among students. Still, few studies measured its impact on health status or academic achievement. The review also found that most studies did not report on the implementation process or the contextual factors influencing the HPS approach. In the United States, Stormacq *et al*. assessed the effectiveness of health literacy interventions in socioeconomically disadvantaged communities. They observed that cultural appropriateness, tailoring, skills building, and goal setting were important factors in creating an effective health literacy plan(22).

While schools can be leveraged to reach a significant portion of the population (children, parents, and community members) and play a central role in improving health across the lifespan in addition to educational achievement, little is known about the current status of children's health and the potential role of community health workers (CHWs) to address public health challenges at public schools and surrounding communities.

We sought to conduct a baseline assessment of perceived health and describe the role of school-based CHWs at rural public schools in Rwanda. The results of this study will inform strategies for effective

implementation of the HPS framework and guide the integration of school-based CHWs to improve universal health coverage in rural and resource-limited settings.

Methods

Study design and setting

This cross-sectional study was conducted among 479 participants (teachers, education and health administrators, and community members) who reside in Musanze district, Rwanda. We partnered with three schools to conduct this study: 1) Nyabirehe K-9, which has a population of 1,229 students and 25 teachers; 2) Rwinzovu Primary, which has a population of 1,013 students and 26 teachers; and 3) Rwinzovu High School which has a population of 21 teachers and 587 students. Participants who were eligible for this study were Rwandans aged at least 18 years of age, employed by either Nyabirehe or Rwinzovu schools in Musanze district (teachers and administrators), or a community member who resides in Musanze district for at least one year and has at least one child attending either Nyabirehe or Rwinzovu in their household. A five-member Rwandan study team (3 three study coordinators and two interviewers) was trained to implement the study in Rwanda. Team members promoted the study within the schools and Musanze community, including school administration, community members during home visits, and distribution of study flyers at schools, churches, and homes.

Data collection

All participants were Rwandans who were at least 18 years old, employed by either Nyabirehe or Rwinzovu public schools in Musanze district (teachers and members of staff), or community members who were residents of Musanze district for at least one year. To participate in the study, community members were required to have at least one child in their household attending either Nyabirehe or Rwinzovu public schools. This measure ensured that all study participants had sufficient knowledge of the school and community needs and other contextual information about the scope of the study.

Participants who were eligible to take part in the study were invited to complete an interviewer-administered questionnaire. The key variables included sociodemographic characteristics, participants' perceptions of HPS, students' health, school health problems, and strategies for implementing the HPS framework. The questionnaire was developed in English, translated, and administered in Kinyarwanda. Two Rwandan interviewers administered the questionnaire by reading the questions and entering verbal responses to Beta CommScreen via a tablet. To explore participants' perceptions of the current health and the role of the school-based CHW, we organized in-depth interviews (IDIs) with principals and school administrators and focus group discussions (FGDs) with teachers and community members. FGDs included three groups of ten participants, each representing a balance of teachers and parents from all grade bands and genders in both schools. The questionnaires were administered in a private room at school. The data was collected between October 2022 and August 2023.

Data analysis

Study measures

Outcome variable

The perceived health of children was measured by asking a single question: How would you describe the health of the children attending school in general? The response options included excellent, very good, good, fair, poor, and don't know/not sure. Participants who reported excellent, very good, and good were assigned a score of 1, while those who reported fair or poor were assigned 0.

Explanatory variables

Health-promoting school components

We adopted questions from the WHO's HPS assessment guidelines to measure participants' perceptions related to health promotion at local schools. Specifically, we assessed 16 domains in the HPS: (1) promotion of a hygienic environment; (2) school's physical environment; (3) provision of a healthy eating environment; (4) addressing the needs of students and staff; (5) basic health care services for students; (6) creating an environment of friendliness and care in school; (7) establishment of an inclusive environment of value and mutual respect; (8) comprehensive curriculum with health-related issues for students to acquire health skills; (9) infectious disease control; (10) proactive linkage with other community bodies; (11) proactive linkage with other community bodies; (12) family involvement in school affairs; (13) related health skills for family members and the community (all participants); (14) staff are well-equipped to promote health; and (15) strategic approaches for students to acquire health skills. Response options for all questions included were yes, no, and don't know.

Perceived health problems at schools

Participants were asked to rate 18 common health problems (e.g., infectious diseases, chronic diseases, sanitation, mental health, violence, injuries, helminth infections, etc.) based on their perceptions of the seriousness of each condition at the schools. Each condition was rated using a 5-point scale where 0 = don't know, 1 = not a problem, 2 = a fairly small problem, 3 = somewhat of a problem, 4 = a serious problem, and 5 = a very serious problem. We converted this Likert scale into a binary variable (*no* for not a problem and *yes* for a perceived problem) prior to the analysis.

Background factors

Participants were asked questions about their age, gender, marital status, residence, level of education, employment, and household income.

Data analyses

Descriptive statistics were used to characterize the study sample stratified by the outcome (perception of students' health). Categorical variables were assessed using Chi-square or Fisher's exact test while continuous variables were assessed using Student's T-test if normally distributed or the Mann-Whitney

Wilcoxon test if not normally distributed. Bivariate analyses were used to identify the factors associated with the outcome. The multivariable logistic regression model included measures with a two-sided p-value <0.05 in the unadjusted logistic regression model. Odds ratios (ORs) and 95% confidence intervals were computed and presented, except for age, which was considered a potential confounder. We analyzed the data using Stata v15.1 (College Station, TX: StataCorp LP). We performed a rapid qualitative data analysis using a grounded theory approach. Emerging themes were compared and contrasted with the quantitative findings.

Results

A total of 479 individuals participated in this survey. Of these, 425 (89%) were community members, while 54 (11%) were employed as teachers at Nyabirehe or Rwinzovu public schools. Almost half of the respondents (46%) reported poor overall quality of the children's health. In bivariate analysis, several variables were related to perceived children's health, including the level of education ($p = 0.01$), residence being remote versus local ($p = 0.016$), familiarity with health promotion ($p < 0.001$), having an established leadership for health promotion ($p = 0.002$), having a good perception of children's future ($p = 0.023$), better quality of life ($p < 0.001$), and access to care ($p < 0.001$). Furthermore, perceived children's health was strongly related to various areas of health promotion needs, including HIV/AIDS prevention ($p < 0.001$), malaria ($p < 0.001$), unintended teenage pregnancy ($p < 0.001$), unsafe water ($p = 0.002$), and smoking ($p < 0.057$) (Table 1).

Table 1
Bivariate relationships between demographics, school and community characteristics, and perceived health of children

Characteristics	N	%	OR	95%CI		P-value
Age						0.579
< 30	84	18	1			
30–39	185	39	1.05	[0.62	1.77]	
40–49	114	24	0.87	[0.49	1.54]	
> 50	92	19	0.75	[0.41	1.36]	
Residence						0.016
Nearby villages	393	82	1.00			
Remote villages	86	18	1.77	[1.10	2.86]	
Level of education						0.010
≤Primary	393	82	1.00			
≥Secondary	86	18	1.87	[1.15	3.06]	
Marital status						0.433
Married	252	53	1.00			
Not married	227	47	0.86	[0.6	1.24]	
Primary Work Language						0.006
Kinyarwanda	429	89	1.00			
English	50	11	2.75	[1.26	5.98]	
Employment status						0.074
Unemployed	403	84	1.00			
Employed	76	16	1.57	[0.95	2.61]	
Employed as teachers						1.010
No	425	89	1.00			
Yes	54	11	1.79	[3.17	0.04]	
Gender						0.557
Male	144	30	1.00			
Female	330	69	0.88	[0.59	1.31]	

Characteristics	N	%	OR	95%CI		P-value
Prefer not to say	4	1	Omitted			
Monthly income						0.156
≤50,000 RWF	420	88	1.00			
50,000-100,000 RWF	26	5	1.05	[0.47	2.32]	
> 100,000 RWF	33	7	2.07	[0.96	4.46]	
Children under 18 in household						0.872
None	19	4	1.00			
1–3 children	331	69	1.02	[0.40	2.58]	
≥4 children	129	27	1.14	[0.43	2.98]	
Perceived future, health and quality of life						
Perceived future of children						0.023
Not good	68	14	1.00			
Good	411	86	1.82	[1.08	3.06]	
Perceived quality of life						
Not good	353	74	1.00			<0.001
Better	126	26	6.54	[3.91	10.92]	
Common and serious health problems and perceived health						
Alcohol and other substances						0.320
No	325	58	1.00			
Yes	154	32	1.22	[0.83	1.79]	
Injuries						0.789
No	403	84	1.00			
Yes	76	16	1.07	[0.65	1.75]	
Helminth (worm) infections						
No	141	29	1.00			0.026
Yes	338	71	0.64	[0.43	0.95]	
HIV/AIDS and STIs						<0.001

Characteristics	N	%	OR	95%CI		P-value
No	297	62	1.00			
Yes	182	38	2.07	[1.41	3.02]	
Malaria						
No	320	67	1.00			< 0.001
Yes	159	33	2.20	[1.49	3.28]	
Mental health problems						0.944
No	433	90	1.00			
Yes	46	10	1.02	[0.56	1.88]	
Oral health problems						0.100
No	433	90	1.00			
Yes	46	10	1.68	[0.89	3.18]	
Protein energy malnutrition						0.010
No	162	34	1.00			
Yes	317	66	0.59	[0.40	0.87]	
Respiratory infections						0.922
No	432	90	1.00			
Yes	47	10	0.97	[0.53	1.77]	
Unsafe/inadequate sanitation						0.234
No	321	67	1.00			
Yes	158	33	0.79	[0.54	1.16]	
Tobacco						0.084
No	413	86	1.00			
Yes	66	14	1.60	[0.93	2.73]	
Unintended pregnancies						
No	323	67	1.00			0.001
Yes	156	33	1.86	[1.26	2.76]	
Unsafe water						

Characteristics	N	%	OR	95%CI		P-value
No	81	17	1.00			0.002
Yes	398	83	0.46	[0.28	0.77]	
Violence						0.135
No	399	83	1.00			
Yes	80	17	0.69	[0.43	1.12]	
Immune diseases						0.067
No	400	84	1.00			
Yes	79	16	0.12	[0.23	0.00]	
Vision and hearing						0.546
No	454	95	1.00			
Yes	25	5	0.78	[0.35	1.75]	
Harmful behaviors and perceived health						
Alcohol abuse						0.892
No	265	55	1.00			
Yes	214	45	1.03	[0.71	1.47]	
Dropping out of school						0.241
No	156	33	1.00			
Yes	323	67	0.79	[0.54	1.17]	
Drug abuse						0.705
No	169	35	1.00			
Yes	310	64	0.93	[0.64	1.35]	
Lack of exercise						0.050
No	85	18	1.00			
Yes	394	82	0.62	[0.38	1.00]	
Poor eating/feeding practices						0.040
No	221	46	1.00			
Yes	258	54	1.45	[1.01	2.09]	

Characteristics	N	%	OR	95%CI		P-value
No immunization						0.094
No	89	19	1.00			
Yes	390	81	0.67	[0.42	1.08]	
Marijuana use						0.057
No	129	27	1.00			
Yes	350	73	0.17	[0.02	1.45]	
Unsafe sex						0.433
No	178	37	1.00			
Yes	301	63	0.86	[0.59	1.25]	
Health promotion policy, health literacy						
Health education sessions per month						0.242
≤ 10 hours	16	29.63	1.00			
> 10 hours	38	70.37	2.25	[0.54	9.35]	
Main Source of Drinking Water						< 0.001
Open Water Sources	295	61	1.00			
Rainwater catchment	90	19	1.64	[1.02	2.65]	
Tap water	94	20	3.93	[2.32	6.68]	
Familiarity health promotion model						
No	397	83	1.00			< 0.001
Yes	82	17	5.30	[2.88	9.72]	
Leadership for health promotion						0.002
No	221	46	1.00			
Yes	258	54	2.30	[1.32	4.01]	
Children receive health care when needed						< 0.001
Yes	221	46	1.00			
No	258	54	0.41	[0.26	0.65]	

After controlling for confounders, several factors remained associated with the perceived health of the children, including having an established leadership or team for school-based health promotion (OR = 1.97, 95%CI: 1.01,3,84), and being familiar with school-based health promotion (OR = 4.77, 95%CI: 2.27,10.0). Unsurprisingly, positive perceptions of a child's future and better quality of life were associated with perceived children's health (OR = 2.28,95%CI:1.18,4.37) and (OR = 6.77,95%CI:3.75,12.20), respectively (Table 2). However, participants who responded that children had no access to health care were less likely to admit a positive perception of children's health (OR:0.54, 95%CI:0.31,0.95).

Table 2
Multivariate logistic regression model with odds ratios, confidence intervals, and P-value for perceived health at public schools and local communities in rural Rwanda

Characteristics	OR	95%CI		p-value
Age				
< 30				
30–39	1.28	[0.66	2.48]	0.468
40–49	0.85	[0.41	1.77]	0.670
> 50	1.08	[0.50	2.31]	0.847
Residence				
Nearby villages	1.00			
Remote villages	1.48	[0.81	2.72]	0.205
Level of education				
≤Primary	1.00			
≥Secondary	1.52	[0.82	2.84]	0.183
Primary Work Language				
Kinyarwanda	1.00			
English	1.02	[0.38	2.77]	0.969
Unsafe water				
No	1.00			
Yes	0.55	[0.27	1.12]	0.100
Main Source of Drinking Water				
Open Water Sources	1.00			
Rainwater catchment	1.03	[0.56	1.89]	0.920
Tap water	2.24	[1.19	4.18]	0.010
Poor eating/feeding practices				
No	1.00			
Yes	1.17	[0.74	1.86]	0.500
Helminth (worm) infections				
No	1.00			

Characteristics	OR	95%CI		p-value
Yes	0.95	[0.55	1.63]	0.840
HIV/AIDS and STIs				
No	1.00			
Yes	1.56	[0.65	3.79]	0.650
Malaria				
No	1.00			
Yes	0.92	[0.37	2.31]	0.870
Protein energy malnutrition (availability)				
No	1.00			
Yes	0.74	[0.43	1.26]	0.270
Unintended pregnancies (education)				
No	1.00			
Yes	1.32	[0.79	2.21]	0.280
Lack of exercise				
No	1.00			
Yes	0.86	[0.45	1.62]	0.640
Marijuana use				
No	1.00			
Yes	0.08	[0.01	0.88]	0.040
Familiarity health promotion model				
No	1.00			
Yes	4.77	[2.27	10.00]	< 0.001
Leadership for health promotion				
No	1.00			
Yes	1.97	[1.01	3.84]	0.050
Children receive health care when needed				
Yes	1.00			
No	0.54	[0.31	0.95]	0.030

Characteristics	OR	95%CI		p-value
Perceived quality of life				
Not good	1.00			
Good	6.77	[3.75	12.20]	< 0.001
Perceived future of children				
Not good	1.00			
Good	.2.28	[1.18	4.37]	0.010

In our qualitative analysis, four themes emerged from IDIs and FGDs: 1) health as stability, 2) CHWs as a bridge between communities, schools, and primary healthcare centers, 3) teachers as community health assets, and 4) structural barriers as major hindrances.

1) Health as stability

According to WHO, health is "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity." The teachers' responses focus on the absence of disease or pain, the ability to function and meet basic needs, and the quality of family and social relationships. Participants emphasized the absence of disease and the ability to afford primary needs such as housing and schooling. When asked about their own definition of health, one FGD participant, supported the peers and said:

Health means that you are not sick, that you have the ability to educate your child or treat yourself, and that you have a known place of residence.

Another teacher described health as:

Living without worry and illness at home in a person's family.

While these are essential components of health, respondents did not capture the full scope of well-being that the WHO definition implies. For example, the participants did not mention the emotional, psychological, or spiritual dimensions of health, nor did they consider the impact of environmental, political, or economic factors on health. However, their definitions and perceptions of health are consistent with the standard definition of health. A more comprehensive and holistic understanding of health would encompass the multiple and interrelated dimensions of human existence and the challenges and opportunities that affect health outcomes.

2) CHWs as a bridge between communities, schools, and primary healthcare centers

The respondents' views reflected the important role of community health workers in promoting child health and well-being. They described how CHWs act as a bridge or interface between the communities, schools, and primary healthcare centers, providing regular monitoring, reporting, and advice on child health issues. One school administrator said:

Community health workers monitor how children grow, and if there is a problem, they report to the village chief and the health center. When there is a problem with these children, the village's leader reports to his superiors and gives advice to those parents on what to do to make his life healthy. Community health workers work with community leaders to make children healthy.

Respondents also highlighted the responsiveness and support of CHWs, who visit the children at home and help them address any problems they face. The respondents portrayed CHWs as valued and trusted members of their communities who contribute to improving the health outcomes and quality of life of the children and their families. A teacher and participant of the FGD said:

When we need him, we call to tell him what the problem is and how it is. He follows up on the child at home because it is his duty, then identifies some problems at the child's house, informs us on time, and helps us fix it.

As they expanded on this, respondents described CHWS as protectors of the community. In their response, one community leader participant of the FGD said:

Community health workers have a heavy responsibility to make children have a healthy life. This means they must know how a child grows up in the village. The children they look after are the ones we have as our students, so if a child shows signs of malnutrition, they give advice and tell the parent to feed the child using health advice. When a child feels good, we see him back to school.

To highlight this statement, a teacher reiterated:

The community health worker's job is to protect people's lives, from children, reports he [the CHW] shares to make the village he represents have better life conditions.

Participants repeatedly evoked the fact that the CHWs collaborate with teachers and parents in the community. Teachers explained the unique ability of the CHWs to reach households and have a thorough follow-up of children in need. One teacher said:

If they see a child who looks bad, they seem like a teacher who sees a child and sends a message to the parent to take care of the child's health. If a teacher teaches a child to clean himself, he will not go to the house to give soap or fetch water; what should he do? He would send the message to the community health workers so they go and tell the people to clean themselves and the children we teach.

In addition to school-based health promotion activities, a parent emphasized the essential role that CHWs play in community sensitization. She said:

“...community health workers, [he] sensitizes us on how to build smaller farms. If they taught you, you should not throw them away like that, but you should change the vegetables if they are old and life continues.”

Respondents explained that CHWs facilitate learning. They help teachers to translate theoretical knowledge into practice. They also help communities get the necessary resources so that the children are in safe conditions. The respondents commended such hands-on health promotion.

A teacher from one of the schools said:

Both theory and practice are important; if we teach about sanitation, there must be sanitary papers in the toilet; if not, it would be like we did the theory only without practice. Better both theory and practice.

Further, participants highlighted the fact that having a CHW grants them access to care. A school administrator said:

When the government distributes medications for worm infections to people, the community health worker does it too to students so they can have a healthy life.

3) Teachers as community health assets

While reflecting on the high workload and limited availability of CHWs, participants highlighted the possibility of teachers serving as an extended workforce for community health. To expand on this rationale, one teacher, a member of the FGDs, stated:

Teachers are the second parents. They must combine educators and parents in changing students' behavior so that students consider teachers as parents. That is why they are very well respected in the community. Because of the respect of the teachers, the teachers will do the same load that the parents are supposed to do. The teacher will try to solve it in the same way that the parent would like to do.

Schools are perceived as safe places for children. As such, parents rely on school to take care of their children. One school administrator said:

Parents just send children to schools and let the teachers do what they can do. It is a kind of security because they do not want to keep children at home, so they feel secure that they are not at home but at school.

4) Structural barriers as the major hindrances to school-based CHWs

Persistent structural barriers constitute a major setback to the school-based community health system. Respondents described the need for more communication between schools and stakeholders working to improve community health. One school administrator said:

The problem is that there isn't a mechanism for formal collaboration among stakeholders. Each one is helping in his own way, but that help should be coordinated among the stakeholders.

One teacher said:

The community health worker must have an official position at the school. There is no rule that he works at the school; he only does it out of a feeling of duty. It is not mentioned that the CHW will come to school except when we ask for help. But saying he will mingle himself with the school is written nowhere.

Another school administrator said:

The community health worker must have a room in the school that would be important, and they can replace each other in villages, and then they can exchange time or rotate at school. They should also have first aid medications if a child has a problem before the situation gets complicated.

Although health education is necessary, the National Curriculum does not emphasize it as a stand-alone subject. For example, Comprehensive Sexuality Education is integrated into the curriculum as a cross-cutting theme in all grades(23). As such, sexuality education is an add-on to required subjects, such as Social Studies. General health topics (nutrition and hygiene) are included but less as a directive than an aspiration. According to our FGD participants, teachers and families expressed the need for education in hygiene, sexual and reproductive health, and disease prevention. One teacher from Nyabirehe said:

For students to increase their success rate, we as teachers need the training to improve our skill level, know how to care for those children, and raise them to where we want them to be.

Discussion

This study shed light on the perceived health of children and the overall need for health promotion in rural Rwanda. Almost half of the study population's health was poor, reflecting the need to invest in strategies to reach children and families through decentralized, community, and school-based interventions. Rwanda is one of the leading countries in promoting access to community-based health insurance schemes (CBHI) (24). Such uptake has contributed to increased universal health coverage. However, Nyandekwe *et al.* reported poverty as a major barrier limiting access to CBHI; as such, families with financial hardship fail to afford the health insurance and the user fee required to obtain primary health services(25). The majority of our study population lives under the poverty line. The inability to afford the essential services for their children may explain their perception of the children's health and other responses provided. This suggests that interventions to improve the health of children should focus on multiple dimensions, including the social and economic conditions of families in rural and low-resource settings.

Unsurprisingly, school-based CHWs were regarded as important for the health of children. These findings highlight the role of CHWs in advancing universal health coverage (UHC). However, our study's findings

suggest that the role of CHWs is beyond the conventional role of detecting and managing cases at the community level or referring sick children. CHWs are regarded as community leaders who play the role at the intersection between the community, schools, and health facilities. Further, they were referred to as agents for family health promotion. This reputation affirms the rationale to leverage CHWs as change agents in strengthening community health systems.

This study's findings depict the intersectionality between health education and community engagement as an essential consideration for the effective implementation of HPS interventions in resource-limited settings. As such, in addition to formalizing the role of the school-based CHWs, schools should be equipped with essential supplies and tools to address health needs. Further, referral pathways should be developed to streamline the collaboration between schools and health facilities.

Despite the common desire to adopt integrated approaches to improve health and educational outcomes, only some countries have successfully implemented HPS, especially in resource-constrained settings(4). This may be partly due to the fact that the model has yet to be adapted to local contexts in many cases. Expanding the scope of CHWs to include school-based screening and care management could bring about remarkable improvements in school health and overall population health outcomes in resource-limited settings.

This study's findings are consistent with previous evaluations, highlighting the importance of strong leadership, clear goals and objectives, and effective stakeholder communication and collaboration. Community stakeholders, including parents and teachers, should have an equal voice in implementing and monitoring HPS programs. Creating a network of active champions of this information will help to disseminate information throughout the community more effectively and efficiently than attempting to reach every community member with direct education.

Further, efforts to adapt or streamline HPS should address structural and system bottlenecks. This is consistent with prior evaluations, which noted that tackling organizational and structural changes was key to ensuring the success of the HPS model(26). This study's findings highlighted that having a school-based CHW was not an official appointment, which they did not even have an office or room at school, limiting their motivation and visibility. All structural and administrative challenges should be addressed in order to leverage CHWs in school-based interventions to increase UHC.

While the Rwandan Ministry of Education and Rwanda Education Board have produced a high-quality national competence-based curriculum(27), its implementation depends on getting students to attend and stay in school. This challenge depends, in turn, on resolving several impediments to consistent school attendance, including sickness, water and sanitation, and school supplies among vulnerable children. Implementing the HPS framework will transform schools into one-stop centers to address the identified needs while improving academic and health outcomes.

There was a modest association between the primary work language and the perceived health of children. Educators, health workers, and parents use different language when communicating various

health topics. It is hard to come to an agreed-upon language to present the information to constituents productively and effectively. It was appreciated that the translated version of the surveys was administered in accordance with the native language of the participants. This challenge can be easily avoided by using CHWs and teachers who use the local language to tackle health promotion and other health-related needs.

This study has a number of limitations. First, any community members, teachers, and parents who participated in the study may aspire for improvements in their health and education system. This may have subconsciously led to expectation bias whereby study participants could have been influenced by the need to have a school-based CHW, possibly leading to biased perceptions. However, this confounding effect might have been minimal as data collectors were instructed to provide ample information on the study's objectives.

Further, data collection instruments were adapted from the WHO's HPS framework, a new concept for most participants. A limited understanding of a typical HPS framework may have affected their perceptions and accuracy of provided responses. However, data collectors used WHO's definition to explain the concept and checked their understanding before formal data collection.

Finally, this study occurred in a non-controlled environment. Like any observational study, this may have affected the study's external validity. Therefore, the interpretation and generalizability of these findings should be assessed with caution. However, a methodological rigor was adopted to control potential confounding. These findings inform the needs and best practices for practical implementations of HPS. Further studies are needed to use experimental design to assess the impact of school-based CHWs on academic and population health outcomes in resource-limited settings.

Conclusion

This study's findings highlight the importance of school-based CHWs in promoting health and overall UHC. In rural and remote areas where access to health services remains very low, CHWs constitute an opportunity to ensure the timely detection of life-threatening conditions among children and families. The partnership between teachers and CHWs enables the effective prevention and timely detection and management of illnesses among children. This study revealed that CHWs can be crucial in delivering health services and education and facilitating collaboration between schools and health facilities, especially in rural and remote areas. Further, this study provides valuable insights and recommendations for policymakers, practitioners, and researchers interested in developing and implementing school-based and CHW-driven interventions in similar contexts.

In low- and limited-resource settings with a persistent shortage of health workers, efforts to accelerate the pace toward achieving UHC should leverage the school-based CHW as a strategy to build linkage between community health systems. Further studies are needed to assess the impact of such a downstream strategy to enhance the prevention, detection, and management of common illnesses among the school-aged population.

Abbreviations

CHW
Community Health Workers
HPS
Health Promoting Schools
WHO
World Health Organization
UNICEF
United Nations International Children's Emergency Fund
WASH
Water, Sanitation, and Hygiene
STH
Soil-transmitted Helminths
UHC
Universal Health Coverage

Declarations

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Authors' contributions

AM and EB conceived the study. TN, TS, ON, and JN participated in data collection. AM, DN, BK, and LRH participated in the data analysis and interpretation. AM, DN, BK, CAM, JN, TN, TS, JN, ON, NBB, TT, and LRH participated in the manuscript preparation. All authors read and approved the final manuscript.

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Availability of data and materials

The datasets analyzed during the current study are available from the corresponding author upon reasonable request.

Ethics approval and consent to participate

The Rwanda National Ethics Committee approved this study (N°302/RNEC/2022). We obtained informed consent from all study participants. Names and other personal identifiers were excluded from datasets extracted for the analyses.

Consent for publication

Not applicable

Competing interests

The authors declare that they have no competing interests

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