HIGHLIGHTS

1. Utilization of Antenatal Care among Women in Rwamagana District, Rwanda

2. The Role of Community Health Workers in Influencing Family Planning Decisions

3. Predictors of Adolescent Pregnancy among 13-19 Years Old Girls in Karongi District

4. Caregivers' Knowledge, Attitudes, and Practices of Intestinal Parasite Prevention in Children

5. Concurring the Silent Killer: Hypertension management through Innovations

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Public Health Bulletin

General Information

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This will allow more and effective communication between policy makers, researchers and health practitioners.

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CONTENT

Dear readers,

It is with great pleasure that I introduce Volume 5, Issue 2 of the Rwanda Public Health Bulletin (RPHB), a dedicated issue focusing on the critical aspects of maternal and child health.
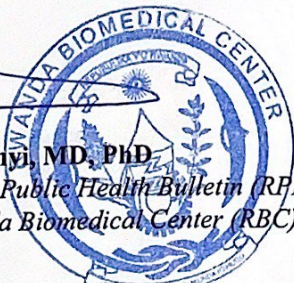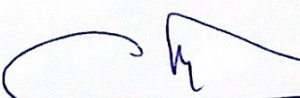
This issue presents a comprehensive evaluation of various facets essential to improving the health and well-being of mothers and children in Rwanda, highlighting both challenges and innovative solutions that our healthcare system could implement. Maternal and child health remains a cornerstone of our national health agenda, and we have made significant strides in enhancing the quality and accessibility of healthcare services. However, there is still much work to be done to ensure that every mother and child in Rwanda can thrive.

This issue explores the current state of Antenatal care (ANC) utilization, which is crucial for monitoring and promoting the health of both the mother and the developing fetus. Identified influencing factors could inform strategies to improve attendance and quality of care. This issue also shows how community health workers (CHWs) influence family planning decisions and highlights areas of improvement since CHWs play an indispensable role in our healthcare system, particularly in promoting family planning and reproductive health services. Strengthening the capacity and support for CHWs is essential for sustaining and promoting family planning and reproductive health services, which also would help combat adolescent pregnancies. Adolescent pregnancy poses serious health risks to young mothers and their infants and can have long-lasting socio-economic consequences. By reading this publication, you will learn the contributing factors to adolescent pregnancy and gain insights into interventions that can help mitigate this challenge. Addressing the root causes of adolescent pregnancy is critical to improving the life prospects of our youth.

Intestinal parasites remain a significant public health issue affecting young children in Rwanda. You will learn from an article on caregivers' knowledge, attitudes, and practices, the importance of educating caregivers on effective prevention measures, and the role of sanitation and hygiene in combating these infections. Empowering caregivers with the right knowledge and practices is key to protecting children from these preventable conditions.

Additionally, this issue features a policy brief on hypertension management using innovations as one of the outcomes of Data to Policy (D2P) Progarm conducted by the Rwanda Biomedical Centre (RBC) in collaboration of Center for Disease Control and Prevention (CDC), Vital Strategies, and Bloomberg Philanthropies. Hypertension is a growing concern in Rwanda, contributing to the burden of non-communicable diseases. This brief explores innovative approaches to managing hypertension and reducing its prevalence and impact on our population.

The current issue of the RPHB underscores our commitment to advancing maternal and child health through evidence-based research, community engagement, and innovative solutions. Therefore, I extend my heartfelt gratitude to all the contributors, researchers, and health professionals who have shared their valuable insights and findings. Together, we can continue to build a healthier future for all Rwandans.

Prof. Claude Mambo Muvunyi, MD, PhD
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Utilization of Antenatal Care among Women in Rwamagana District, Rwanda: A Cross-sectional Study Conducted at Health Centers in 2023

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ABSTRACT

INTRODUCTION: Optimal utilization of antenatal care (ANC) has been challenging in Rwamagana District. One of the causes is the limited availability of multifaceted information regarding ANC. Therefore, this study aimed to determine the rate of antenatal care utilization in Rwamagana District and the possible influencing factors.

METHODS: A descriptive, cross-sectional study and through a convenient sampling method, three hundred fifty-three (353) women were selected to participate. A structured questionnaire with multiple-choice questions was used for data collection.

RESULTS: The majority (79.6% of women) began having ANC early in pregnancy, while 20.1% started having ANC in the second or third trimester. After initiation, 94.4% of the women attended ANC for the remaining trimester(s). Dropout was 3.0%, while the women who skipped the second trimester were 1.7%. Subsequently, 0.4% of the women had no ANC at all from conception up to delivery. Overall, 24.1% had <4 ANC contacts, 66.2% of women received 4 – 7 ANC contacts, and only 9.7% of women had ≥ 8 ANC contacts. The household size (P=0.035), socioeconomic status (P=0.016), place of delivery (P=0.033), and source of ANC information (P=0.013) had a significant association with ANC utilization.

CONCLUSION: Utilization of ANC has relatively been improved; it was found to be significantly influenced by household size, socioeconomic status, place of delivery, and sources of ANC information.

INTRODUCTION

To ensure safety during pregnancy, coordination of efforts by every pregnant woman, her family, the community, and healthcare providers is a key to success. The main platform that provides pregnant women with regular contacts with healthcare providers is the antenatal care (ANC) program [1]. This is a healthcare practice in which pregnant women are followed up until delivery, enhancing fetal and maternal well-being. This is achieved by providing curative, preventive, and promotive health interventions to pregnant women during ANC visits. Curative health interventions involve

the management of possible pre-existing or newly diagnosed pathologies and abnormal body changes associated with pregnancy. Those interventions, for example, include the management of high blood pressure (BP), gestational diabetes (GD), HIV/AIDS, urinary tract infections (UTIs), and sexually transmitted infections (STIs). Preventive health care aims to protect the health of both the fetus and the mother, and involves screening fetal and maternal abnormalities, immunization against tetanus, deworming, supplementation of iron and folic acid, and provision of mosquito nets. Lastly, health promotion during pregnancy is achieved by providing health education and counseling or advice about healthy nutritional and lifestyle practices, family planning, and formulation of delivery plans [1,2,3]. The optimum attendance of ANC is paramount in pregnancy to ensure that the pregnant woman and fetus are in good health.

On the other hand, having poor ANC utilization is associated with the risk of missing or late recognition of danger signs of urgent obstetrical conditions, which can occur at any stage of pregnancy and ultimately result in adverse pregnancy outcomes [4,5,6]. For possible pre-existing maternal conditions, poor ANC utilization would contribute to inappropriate management coupled with an increased risk of adverse pregnancy outcomes, though these abnormalities could be preventable and treatable [7].

Since the first decade of the 21st century, maternal health issues have been prioritized, essentially in Millennium Development Goal 5 (MDG 5) and sustainable development goals (SDGs) frameworks [8]. However, the desired ANC utilization remains low. Worldwide, it was reported that among five women, only three fully attended ANC as recommended by the WHO [9]. In Sub-Sahara Africa (SSA), only 53% of pregnant women had 4 ANC visits or more in 2021 [9]. Such inadequacy of ANC utilization is unfavorable as it can be associated with potential health threats as well as undesirable pregnancy outcomes, and in most cases, 99% of them occur in developing and middle-income countries, with more than half of that mortality and morbidity burden being recorded in the SSA region [5,9,10,11]. Previous studies showed that accessibility to ANC visits is influenced by factors such as distance to health facilities, cost and availability of transport, and time to reach the facility. Women's attitudes and experiences, such as negative experiences, limited understanding of ANC procedures, and concerns about pregnancy disclosure, were found to contribute to low attendance [12,13]. Interpersonal factors like family support, advice from others, and attitudes of health workers also contribute to attendance [12], in addition to health system factors like the cost of ANC services, availability of health workers, and mandatory testing procedures performed [12,14].

According to the 2019–2020 Rwanda Demographic and Health Survey (RDHS), 98% of women received ANC at least once from skilled providers, but only 47% of the pregnant women had at least 4 ANC contacts [15], indicating that adherence the recommended ANC visits is still low in Rwanda. Additionally, the rates of ANC visits are different depending on the district. In the Rwamagana District, only 35.8% of pregnant women achieved at least 4 ANC visits from 2013 to 2018 [16], below the average national rate. This highlights the need to explore this health problem further and address the low ANC attendance in the Rwamagana District. A recent previous study showed that the prevalence of delayed ANC in Rwanda was 41%, and it was influenced by the number of children the women have, coverage by health insurance, women´s education level, and woman´s occupation [17]. To our knowledge, no previous study has been conducted in the Rwamagana District to explore poor adherence to ANC. Therefore, this study aimed to determine the rate of ANC utilization in Rwamagana District and identify influencing factors. The findings would guide healthcare providers, partners, beneficiaries, and decision-makers in addressing issues hindering optimal ANC utilization. They would also inform interventions to improve the ANC experience, motivating women to attend as recommended, and promoting healthy pregnancies and positive motherhood.

METHODS

Study Design: This study employed a descriptive, health center-based cross-sectional research design, and was conducted in September 2023 in Rwamagana District, Eastern Province, Rwanda. Eligible women were selected by the convenient sampling method from four Health Centers (HCs) located in Rwamagana District,

namely; Rwamagana, Karenge, Nyagasambu, and Muyumbu HCs. Rwamagana District, one of Rwanda's 30 districts, is located in the Eastern Province with a surface area of approximately 682 km² [16,18,19]. The health centers were randomly selected from the total number of 16 HCs in the district.

Eligibility Criteria: This study included women aged 15 to 49 who exclusively attended ANC in Rwamagana District during pregnancy. Each woman was either pregnant or had delivered within the last 15 months and voluntarily agreed and consented to participate in the study. On the other hand, women who either had ANC from outside of the district or refused to consent to participation in the study were excluded.

Sampling: By using the Kish Leslie's formula 1965, the sample size was calculated as follows [7]:

$n = (p(1-p) z^2)/d^2$

Where; n = desired sample, p = proportion of pregnant women already known not to attend ANC as recommended, given as: p = 100% - 35.8%, p = 64.2%, which is equivalent to 0.642, z = standard normal deviation usually set as 1.96 corresponding to 95%, and d = the degree of error set at a range of 0.05 – 0.1. $n = (0.642 \times (1-0.642) \times 1.96^2)/0.05^2 = 353$

To account for potential non-response, a margin of 10% (35 women) was anticipated, resulting in an overall target sample size of 388 women.

Study Tool: A structured questionnaire with multiple-choice questions, designed by referencing [3,6,20,21], was administered to each individual respondent. The questionnaire comprised four sections: socio-demographic characteristics, pregnancy-related factors, factors related to healthcare providers, and ANC service cost and satisfaction. Initially designed in English, the questionnaire was later translated into Kinyarwanda, the local language. To pretest the tool, 15 pregnant women and 15 mothers with babies aged ≤15 months at Rwamagana Health Center were randomly selected and asked to complete the questionnaire. The results of this pretest helped identify any ambiguities or confusion in certain questions. Misunderstood

questions were rephrased to ensure clarity for all study participants, and the order of questions was also restructured for better flow.

Data Analysis: After data collection, every questionnaire was verified for clarity of responses. Thereafter, data were coded and entered into Microsoft Excel 2019, then imported into IBM™ SPSS V.21 (IBM Corporation, Chicago, U.S.) for statistical analysis. Descriptive statistics were used to summarize study variables such as frequencies, percentages, mode, and mean. Also, the data collected were analyzed using statistical methods to determine the odds ratios (OR) and 95% confidence intervals (CI) for various factors influencing ANC utilization. Logistic regression analysis was employed to calculate the odds ratios, which indicate the likelihood of ANC utilization associated with specific factors. Confidence intervals were calculated to provide a range within which the true odds ratio is expected to fall, with 95% certainty. Statistical significance was assessed using p-values, with a threshold of $p < 0.05$, indicating that the observed associations were unlikely to have occurred by chance.

Ethical considerations: The study received ethical clearance from the Institutional Review Board at the University of Rwanda, College of Medicine and Health Sciences (CMCH/IRB/429/2023), and permission to collect data from selected HCs from Rwamagana Level II Teaching Hospital (14/346/ Hop/Rgna/2023). Participants were informed of the study's content, voluntary participation, and confidentiality. They were assured of their physical and social safety. Participants were allowed to read the details of the informed consent form, and illiterate participants were allowed to choose someone to read for them out loud before providing and signing informed consent.

RESULTS

Socio-demographic and reproductive health-related characteristics: Table 1 below presents the sociodemographic and reproductive health-related characteristics of all study participants. The majority of participants were between 20 and 29 years old (175 women, 49.6%), had only attended primary school (212 women, 60.1%), and had households with no more than 3 members (154 women, 43.6%).

Table 1: *Socio-demographic Characteristics*

Characteristics	N	%
Age		
15-19	30	8.5
20-29	175	49.6
30-49	148	41.9
Religion		
None	3	0.8
Muslim	11	3.1
Catholic	104	29.5
ADEPR	133	37.7
Methodist	15	4.2
Adventist	39	11.0
Other	48	13.6
Woman's level of education		
None	9	2.5
Primary	212	60.1
Secondary	115	32.6
Tertiary	17	4.8
Husband's level of education		
None	20	5.7
Primary	188	53.3
Secondary	112	31.7
Tertiary	33	9.3
Household size		
1-3 members	154	43.6
4-5 members	131	37.1
>5 members	68	19.3
Woman's occupation		
None	83	23.5
Housemaid	4	1.1
Peasant/ farmer	125	35.4
Businesswoman	39	11.0
Civil servant	88	24.9
Employee	14	4.0
Husband's occupation		
None	29	8.2
Houseman	0	0.0
Peasant/ farmer	97	27.5
Businessman	47	13.3
Civil servant	121	34.3
Employee	59	16.7
Socioeconomic status (Ubudehe Category)		
None	27	7.6
Category 1	23	6.5
Category 2	179	50.7
Category 3	124	35.1
Category 4	0	0.0
Financial support		
Yes	224	63.5
No	129	36.5
Health insurance		
Yes	328	92.9
No	25	7.1
Marital status		
Single	24	6.8
Married	134	38.0
Cohabitating	179	50.7
Separated	14	4.0
Widowed	2	0.6
Household conflict/ violence		
Yes	49	13.9
No	304	86.1
Autonomy		
Yes	318	90.1
No	35	9.9
Residential area		
Rural	321	90.9
Urban	32	9.1
Main mode of HF access for ANC visit		
Walking	287	81.3
Vehicle	66	18.7
Walking time (in hours) to HF (if the main mode of HF access is by walking)		
≤ 0.5	79	27.5
> 0.5 – 1	118	41.1
> 1	90	31.4
Affordable transportation cost (if the main mode of HF access is by a vehicle)		
Yes	32	47.1
No	36	52.9
Reproductive health-related characteristics		
knowledge of pregnancy manifestations		
Yes	287	81.3
No	66	18.7
Pregnant or delivered		
Delivered	237	67.1
Pregnant	116	32.9
Gravidity		
Primigravida	97	27.5

To be continued on the next page...

Multigravida	216	61.2
Grand-multigravida	40	11.3
Parity		
Nulli- and primipara	145	41.1
Multipara	182	51.6
Grand-multipara	26	7.4
Number of living children		
≤ 3 children	306	86.7
4 children and more	47	13.3
Family planning		
Yes	207	58.6
No	146	41.4
Pregnancy planning		
Yes	250	70.8
No	103	29.2
ANC Knowledge		
Yes	324	91.8
No	29	8.2

ADEPR: Associations des Eglises de Pentecote au Rwanda; HF: Health facility

Additionally, most participants belonged to the second category of socioeconomic status (Ubudehe Category 2), (n=179, 50.7%), received financial support from their partners (n=224, 63.5%), had health insurance (n=328, 92.9%), lived in rural areas (n=321, 90.9%), and accessed health facilities by walking (n=287, 81.3%). Regarding reproductive health-related characteristics, most participants had some

knowledge of pregnancy manifestations (n=287, 81.3%), had given birth (n=237, 67.1%), had had multiple pregnancies (n=216, 61.2%), had given birth to multiple live babies (n=182, 51.6%), had planned their last pregnancy (n=250, 70.8%), and had some information about ANC (n=324, 91.8%).

Trimester of Pregnancy (Gestational Age) for Initiation of Antenatal Care Contacts: Table 2 below shows the trimester of pregnancy at which ANC was first accessed. Women who began ANC visits during the first trimester were considered to have early initiation of ANC contact. It was found that 79.6% (n=281) had early initiation. This rate was highest among women from Rwamagana Health Center (n=84, 82.3%) and lowest among women from Nyagasambu Health Center (n=52, 74.3%).

Conversely, late ANC initiation was defined as having the first contact beyond the first trimester, and one-fifth of the women (n=71, 20.1%) started attending ANC during the second or third trimester. A higher proportion of late initiators were from Nyagasambu Health Center (n=18, 25.7%), while the lowest proportion was from Rwamagana Health Center (n=18, 17.7%). Only one woman (0.3%) did not attend ANC at any point during her pregnancy.

Sequence of Antenatal Care Contacts after Initiation: We also determined the progression of ANC contact from initiation to delivery, involving only women who had completed their gestation

Table 2: *Trimester of pregnancy for initiation of ANC visits*

Trimester for initiation of ANC	Rwamagana HC (n=102) f (%)	Karenge HC (n=85) f (%)	Nyagasambu HC (n=70) f (%)	Muyumbu HC (n=96) f (%)	Total (n=353) f (%)
No initiation (No visit among all trimesters)	0 (0.0)	1 (1.2)	0 (0.0)	0 (0.0)	1 (0.3)
Early initiation (1st trimester)	84 (82.3)	67 (78.8)	52 (74.3)	78 (81.2)	281 (79.6)
Late initiation (2nd or 3rd trimester)	18 (17.7)	17 (20.0)	18 (25.7)	18 (18.8)	71 (20.1)
Total	102 (100)	85 (100)	70 (100)	96 (100)	353 (100)

n: number of respondents; HC: health center

Table 3: *Sequence of ANC visits throughout pregnancy period*

Sequence of ANC	Rwamagana HC (n=76)	Karenge HC (n=61)	Nyagasambu HC (n=29)	Muyumbu HC (n=71)	Total (n=237)
	f (%)	f (%)	f (%)	f (%)	f (%)
No ANC contact throughout pregnancy	0 (0.0)	1 (1.6)	0 (0.0)	0 (0.0)	1 (0.4)
Continuous ANC contact after initiation	71 (93.4)	59 (96.7)	28 (96.5)	67 (94.4)	225 (94.9)
ANC dropout (no attendance in 3rd trimester)	3 (4.0)	1 (1.6)	1 (3.5)	2 (2.8)	7 (3.0)
Irregular ANC contact (2nd trimester skipped)	2 (2.6)	0 (0.0)	0 (0.0)	2 (2.8)	4 (1.7)
Total	76 (100)	61 (100)	29 (100)	71 (100)	237(100)

n: number of respondents; HC: health center; f: frequency; %: percentages

period (n=237). The majority of women (n=225, 94.9%) continued to attend ANC in the subsequent trimesters following initiation. The highest continuation rate was observed at Karenge Health Center (n=59, 96.7%), while the lowest was at Rwamagana Health Center (n=71, 93.4%).

Some women discontinued ANC attendance after the second or third trimester following initiation

Table 4: *Frequency of ANC visits for each and all trimesters of pregnancy*

Frequency of ANC contacts per trimester		Rwamagana HC (n=76)	Karenge HC (n=61)	Nyagasambu HC (n=29)	Muyumbu HC (n=71)	Total (n=237)
		f (%)	f (%)	f (%)	f (%)	f (%)
Trimester 1	0 visit	12 (15.8)	12 (19.7)	6 (20.7)	14 (19.7)	44 (18.6)
	1 visit	43 (56.6)	32 (52.5)	20 (69.0)	44 (62.0)	139 (58.6)
	2 visits	13 (17.1)	9 (14.8)	2 (6.9)	10 (14.1)	34 (14.3)
	≥3 visits	8 (10.5)	8 (13.1)	1 (3.4)	3 (4.4)	20 (8.4)
Trimester 2	0 visit	5 (6.6)	5 (8.2)	2 (6.9)	4 (5.6)	16 (6.8)
	1 visit	40 (52.6)	25 (41.0)	16 (55.2)	34 (47.9)	115 (48.5)
	2 visits	22 (28.9)	21 (34.4)	9 (31.0)	24 (33.8)	76 (32.1)
	3 visits	4 (5.3)	7 (11.5)	2 (6.9)	7 (9.9)	20 (8.4)
	≥4 visits	5 (6.6)	3 (4.9)	0 (0.0)	2 (2.8)	10 (4.2)
Trimester 3	0 visit	3 (3.9)	2 (3.3)	1 (3.4)	2 (2.8)	8 (3.4)
	1 visit	29 (38.2)	17 (27.9)	9 (31.0)	31 (43.7)	86 (36.3)
	2 visits	32 (42.1)	26 (42.6)	17 (58.6)	23 (32.4)	98 (41.4)
	3 visits	5 (6.6)	7 (11.5)	1 3.4)	8 (11.3)	21 (8.9)
	4 visits	3 (3.9)	2 (3.3)	1 (3.4)	6 (8.5)	12 (5.1)
	≥5 visits	4 (5.3)	7 (11.5)	0 (0.0)	1 (1.4)	12 (5.1)
Overall number of ANC contacts	0-3 visits	26 (34.2)	10 (16.4)	8 (27.6)	13 (18.3)	57 (24.1)
	4-7 visits	42 (55.3)	42 (68.8)	21 (72.4)	52 (73.2)	157 (66.2)
	≥8 visits	8 (10.5)	9 (14.8)	0 (0.0)	6 (8.5)	23 (9.7)
Total		76 (100)	61 (100)	29 (100)	71 (100)	237 (100)

n: represents number of respondents; HC: health canter; f: frequency; %: percentages

Table 5: *Description of overall number of ANC visits*

Overall number of ANC contacts		
Mean		4.58
95% Confidence Interval for the Mean	Lower Bound	4.32
	Upper Bound	4.84
Mode		4
Median		4.00
Std. Deviation		2.039

ANC: Antenatal care; Std: Standard deviation

(dropouts). The overall dropout rate was 3.0% (7 women). Additionally, a small number of women attended ANC only in the first and third trimesters, skipping the second trimester (irregular ANC visits). Specifically, 4 women (1.7%) initiated ANC in the first trimester, skipped the second trimester, and resumed in the third trimester. Furthermore, 1 woman (0.4%) did not attend ANC at any point during her pregnancy. Table 3 below represents the progression of ANC contact after initiation.

Frequency of antenatal care visit by each trimester during pregnancy: This study assessed the number of ANC visits made per trimester and the total number of ANC visits in general, among 237 women who had completed their pregnancies. The study categorized the women based on the number of ANC visits they had: less than or equal to 3 visits, 4 to 7 visits, and 8 or more visits.

In the first trimester, 139 women (58.6%) had a single ANC visit; in the second trimester, 115 women (48.5%) had one ANC visit, and in the third trimester, 98 women (41.4%) had two ANC visits. Muyumbu Health Center had the highest number of women with a single ANC visit in both the first and second trimesters, while Karenge Health Center had the fewest. In contrast, during the third trimester, a large number of women (n=98, 41.4%)

reported having two ANC visits.

Overall, 157 women (66.2%) had 4 to 7 ANC visits, with the highest proportion from Muyumbu Health Center (n=52, 73.2%) and the lowest from Rwamagana Health Center (n=42, 55.3%). Additionally, 57 women (24.1%) had fewer than 3 ANC visits, and 23 women (9.7%) had 8 or more ANC visits throughout their pregnancies. Table 4 below illustrates the frequency of ANC visits for each trimester and the overall number of visits.

Table 5 describes the overall number of ANC visits among all study participants who had delivered (237 mothers). The average number of ANC visits was 4.58 (S.D = 2.039, 95% C.I = 4.32 – 4.84), and the most common number of ANC visits throughout the pregnancy period was 4.

Factors influencing ANC utilization among mothers in Rwamagana District: As shown in the Supplementary Table 1, a binary Logistic Regression Analysis was conducted to evaluate the impact of socio-demographic characteristics, pregnancy-related factors, healthcare provider factors, and ANC service cost and satisfaction on ANC utilization. The analysis aimed to predict whether these factors were associated with suboptimal ANC visits (<4 visits) or optimal ANC

Table 6: *Simple Linear Regression analysis for the association between means of age categories, family size, gravidity, parity and living children, and the overall number of ANC visits*

Influencing factors						95%CI for b	
	R	R²	P-value	a	b	LL	UL
Means of age categories	0.036	0.001	0.579	4.287	0.010	-0.027	0.047
Family size	0.020	0.000	0.759	4.691	-0.024	-0.181	0.132
Gravidity	0.010	0.000	0.880	4.613	-0.012	-0.166	0.143
Parity	0.046	0.002	0.479	4.726	-0.059	-0.223	0.105
Number of living children	0.007	0.000	0.918	4.560	0.009	-0.170	0.188

R: coefficient of correlation; R2: coefficient of determination; a: intercept for regression equation; b: slope for regression equation; CI: confidence interval; LL: lower limit; UL: upper limit

visits (≥4 visits). Women with a household size of 4-5 members were significantly more likely to have optimal ANC visits (P = 0.035). Women with no definite socioeconomic class were the most likely to attend the recommended ANC visits (16 women, 88.9%), while those in the third category were the least likely (59 women, 67.8%) (p=0.016). Women who delivered at the health facilities were significantly more likely to have attended 4 ANC visits than those who delivered at home (P = 0.033). The source of ANC information significantly impacted ANC utilization (p=0.013), with women who received information from health facilities alone being the most to attend the recommended ANC visits, followed by those who received ANC-related information from health facilities, friends and relatives, and the radio.

Simple linear regression analysis in Table 6 showed that age, family size, gravidity, parity, and number of living children showed no significant relationships with the overall number of ANC visits. The coefficients of correlation (r) of 0.19), and their corresponding p>0.05 indicate a negligible relationship. Additionally, the coefficients of determination (r²) were 0, suggesting that age, family size, gravidity, parity, and number of living children have no influence on the total number of ANC visits among women in Rwamagana District.

DISCUSSION

ANC is a suitable approach for decentralized reproductive health care for pregnant women. This program remains indispensable in monitoring universal fetal and maternal well-being during pregnancy and is useful when various vital prerequisites are taken into consideration. This study evaluated ANC utilization and some influencing factors, such as the time of ANC initiation, the flow of ANC visits concerning gestational age, the total number of ANC visits, and the factors of ANC utilization in Rwamagana District.

The findings showed that 4 out of 5 women (79.6%) in Rwamagana District started attending ANC as early as in the first trimester (<12 weeks of amenorrhea). The findings align with a previous study by Rustagi et al. conducted in 2021 [22], recent 2019-2020 RDHS [15], and Demographic and Health Surveys (DHS) and Multiple Indicator Cluster Surveys (MICS) of 81 Countdown to 2030 priority countries [21] which, respectively, reported that 69.3%, 59%, and 49.9% of women commenced ANC contacts within their first trimester of pregnancy. This can be attributed to the integrated system in Rwanda, with decentralized services at the community level, and the role of Community health workers (CHWs) in the early identification of conceived women, encouraging them to attend the ANC program as required. However, one-fifth (20.1%) of women began having ANC later in pregnancy (in the second or third trimester). Similarly, but higher, the 2019-2020 RDHS observed that 37% of women started having ANC other than in the first trimester [15]. According to the current study, failure of early ANC initiation slightly decreased. Enforcement of established measures or incentives put in place, such as rewarding health facilities with higher early ANC initiation [9] and allocation of most ANC services to the primary healthcare (PHC) level, could explain this decrease [9,16]. Worse are the findings of DHS in 81 other low and middle income countries, which revealed that 11.2% of women had no ANC during pregnancy [21].

Regular ANC visits are important because every trimester of pregnancy is associated with unique body changes that require different assessments and health interventions. We found that the majority of women continued to attend after the experience from prior visits, with 94.5% returning to health facilities for ANC. This might suggest that the initial ANC visit motivates women to return for the next visit. However, a few of them did not comply with the recommended attendance, although they initiated ANC. This highlights the need for continuously encouraging women to consistently adhere to the ANC program, emphasizing its benefits. The more the ANC visits, the more benefits are achieved from ANC, as regular ANC visits are essential for preventing complications, improving health outcomes, and fostering healthy fetal development [23]. They enable early detection and management of potential health problems, reducing maternal and neonatal risks. ANC also promotes healthy practices, educates mothers on self-care, and provides essential medical interventions, such as pregnancy tests, medical consulting, and screening for infections [20,23]. According to WHO's 2016 ANC Model [11], the recommended number of ANC contacts is at least 8. However, the new 2016 WHO model began in

March 202, and consequently, during this study (September 2023), women who were thought to have benefited from the 2016 WHO ANC mode of 8 contacts were still pregnant, and had not delivered so as to be considered to have complied to the new ANC recommended visits. So, referring to the 2002 ANC model, the recommended number of ANC visits was at least 4 [24]. In general, this study observed that around 99.6% of pregnant women in the Rwamagana district had at least 1 ANC visit during their pregnancy. This agrees with the RDHS 2019/2020 Eastern Province District Profile, which showed that in Rwamagana District, 99% of women received at least 1 ANC from skilled personnel [25]. Similarly, RDHS 2029-2020 also reported that 98% of women in Rwanda aged 15-49 received ANC from a professional for the last pregnancy [15]. By the time of the study, it was revealed that every delivered woman had 4.58 total number of ANC contacts (mean 4.58, S.D = 2.039). However, 24.1% of participants received inadequate ANC (< 4 visits). This is contrary to the 81.9% of women in El-Beheira Governorate, Egypt, who had < 4 ANC visits [6]. On the other hand, three-quarters of women (75.9%) had ANC as intended, while 66.2% of women had 4 to 7 total ANC contacts, and 9.7% had ≥ 8 ANC contacts. This shows improvement in the utilization of ANC compared to only 35.8% of women who had ≥ 4 ANC in the Rwamagana District, as reported by a 2016 study [16]. These are higher than the findings about women who had ≥ 4 ANC visits reported in the rural Northwest of Rwanda (34.7%) [9], and in 2019-2020 RDHS (47%) [15]. They are also higher than what were reported in Egypt (18.1%) [6], and India (53%) [22] .

Regarding the factors that influence ANC utilization in Rwamagana District, women who lived with many household members (> 5 members) were the least to attend ANC adequately (63.0% versus 77.0 % and 82.3% for women who lived with 1-3 and 4-5 members, respectively). Similar findings were reported in the SSA by Okedo-alex et al. in 2019 [3]. As the household size increases, women struggle to search for subsistence needs or become busy with domestic chores, which ultimately limit ANC attendance, explaining the negative association between household size and ANC attendance. On the other hand, one study contrasts this finding by showing that household members can positively contribute to the likelihood of attending ANC by encouraging and supporting pregnancy women to comply [9]. The socioeconomic status of the study participants was also found to play a role in ANC utilization. Women who were not classified in any socioeconomic category (88.9%) were the most likely to seek ANC, followed by those in the first category (78.6%). Women who had the least ANC contacts were mostly in the third category (67.8%). Obviously, as the socioeconomic status (SES) (Ubudehe category) of the study participants improved, the number of ANC visits decreased. This is possibly due to the fact that women with no socioeconomic classification (unclassified due to errors in their identity papers, immigration status, etc.) or with low SES were largely concerned with their health and paid medical attention to even subtle health conditions more than those with high SES due to fear of incurring expensive healthcare bills they cannot afford in case of delayed diagnosis of any complications. Moreover, women with high SES have busy schedules due to businesses or other chores, and sparing time for ANC can be challenging. They probably feel the urge to attend ANC when they are encouraged or face major health problems. Contrasting our findings, studies conducted by The World Bank [20], Tawfik et al. in El-Beheira Governorate, Egypt [6], and Okedo-alex et al. in sub-Saharan Africa [3] found that high wealth index of a woman was associated with appropriate attendance of ANC of women. The better the SES of women, the higher the attendance of ANC. The reason might be attributed to regional differences and different characteristics of participants between studies in Rwanda and elsewhere. Our findings of low ANC attendance among women with higher SES highlight the need for more efforts tailored to this group of women to raise ANC awareness and encourage them to attend. Different systems already in place, such involvement of local authorities, CHWs, Community Based Health Insurance (CBHI) [9], [15,16], and decentralization of ANC services closer to the community [9] should be engaged to focus on women with higher SES, who they might have considered too knowledgeable to be sencitized.

We found that ANC utilization in Rwamagana District is influenced by the place of delivery. Apart from two women who delivered at home, the rest delivered at formal health facilities (HC, hospital, or private clinic). This agrees with the

2019/2020 RDHS, which showed that 97% of pregnant women who received ≥4 ANC contacts delivered at health facilities) [15]. Giving birth at formal health facilities is important to ANC utilization because women can be provided with comprehensive health care, leading to better care experience and health education (such as awareness of pregnancy danger signs) given to pregnant mothers, which later contribute to the subsequent ANC attendance. Lastly, the source of ANC information was found to be a significantly influential criterion for optimal ANC utilization. The majority of the study participants obtained information related to ANC from health facilities, friends and relatives, and radio. This may be because, at health facilities, healthcare providers provide accurate and convincing health information to women, whereas friends/ colleagues and relatives, and radio conveniently and instantly communicate ANC information, which can also convince and remind them, when they are at home, to attend ANC as required. The literature supports our findings by showing that mass media can help disseminate information about maternal health and care and inform women about good practices during pregnancy [25].

The study's geographical scope, and convenience sampling methodology may limit the generalizability of results to the entire target population. The representative sample and study settings may not fully capture the specific contexts influencing ANC utilization for every individual across the entire district and country in general. Moreover, participants might have experienced recall bias or social desirability bias, potentially affecting the accuracy of reported ANC visits and other variables. Furthermore, the study's cross-sectional design restricts its ability to establish causal relationships between variables. Conducting longitudinal or time-lagged designs, employing case-control or cohort studies, acknowledging limitations, and addressing biases would provide a more comprehensive understanding of the dynamic factors that impact ANC utilization over time.

CONCLUSION

This study showed overall good ANC utilization in Rwamagana District. However, it also showed some areas of improvement, such as ensuring early initiation of ANC, regular attendance throughout

pregnancy, achieving the recommended number of ANC visits, and ensuring equitable access and consistent utilization of ANC services. Factors such as household size, socioeconomic status, place of delivery, and source of ANC information significantly influence ANC utilization. Therefore, efforts should focus on targeted interventions that address socioeconomic disparities, improve health education, and enhance accessibility of ANC services to further promote maternal and fetal well-being in the district.

Author Contributions
All authors contributed to data analysis, drafting, or revising the article, have agreed on the journal to which the article will be submitted, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

REFERENCES

[1] A. A. Rurangirwa, I. Mogren, J. Ntaganira, K. Govender, and G. Krantz, "Quality of antenatal care services in Rwanda : assessing practices of health care providers," vol. 5, pp. 1–10, 2018.

[2] D. Worku, D. Teshome, C. Tiruneh, A. Teshome, and G. Berihun, "Antenatal care dropout and associated factors among mothers delivering in public health facilities of Dire Dawa Town , Eastern Ethiopia," vol. 7, pp. 1–8, 2021.

[3] I. N. Okedo-alex, I. C. Akamike, O. B. Ezeanosike, and C. J. Uneke, "Determinants of antenatal care utilisation in sub-Saharan Africa : a systematic review," 2019, doi: 10.1136/ bmjopen-2019-031890.

[4] N. I. of S. of R. (NISR), "Beyond coverage: Improving the quality of antenatal care delivery through integrated mentorship and quality improvement at health centers in rural Rwanda," BMC Health Serv. Res., vol. 18, no. 1, pp. 1–8, 2018, doi: 10.1186/s12913-018-2939-7.

[5] Y. A. Bekele, T. E. Tafere, A. A. Emiru, and H. B. Netsere, "Determinants of antenatal care dropout among mothers who gave birth in the last six months in BAHIR Dar ZURIA WOREDA

community ; mixed designs," vol. 9, pp. 1–9, 2020.

[6] E. H. Tawfik, W. Abd, E.-H. Arafat, and V. N. Ghattas, "Factors Associated with Pregnant Women ' s Dropout from Antenatal Care Visits in Primary Health Care Facilities," pp. 301–316, 2023, doi: 10.21608/ASNJ.2023.188772.1500.

[7] M. Apiso, "Assessment of Factors Affecting Attendance of Antenatal Care in Kagote Health Center III, Kabarole District, Uganda," Stud. J. Health Res. Afr., vol. 2, no. 3, pp. 1–15, 2021, doi: 10.51168/sjhrafrica.v2i3.

[8] D. R. Singh and T. Jha, "Exploring Factors Influencing Antenatal Care Visit Dropout at Government Health Facilities of Dhanusha District, Nepal," Am. J. Public Health Res., vol. 4, no. 5, pp. 170–175, 2016, doi: 10.12691/ajphr-4-5-2.

[9] T. Dusingizimana et al., "Predictors for achieving adequate antenatal care visits during pregnancy: a cross-sectional study in rural Northwest Rwanda," BMC Pregnancy Childbirth, vol. 23, no. 1, pp. 1–10, 2023, doi: 10.1186/s12884-023-05384-0.

[10] F. Sayinzoga, M. Tetui, K. Van Der Velden, J. Van Dillen, and L. Bijlmakers, "Understanding variation in health service coverage and maternal health outcomes among districts in Rwanda - A qualitative study of local health workers' perceptions," PLoS ONE, vol. 14, no. 10, 2019, doi: 10.1371/journal.pone.0223357.

[11] World Health Organization (WHO), "WHO Recommendations on Antenatal Care for a Positive Pregnancy Experience: Summary," vol. 10, no. January, pp. 1–10, 2018, doi: 10.1186/1742-4755-10-19.5.

[12] W. Acup et al., "Factors associated with first antenatal care (ANC) attendance within 12 weeks of pregnancy among women in Lira City, Northern Uganda: a facility-based cross-sectional study," BMJ Open, vol. 13, no. 7, p. e071165, Jul. 2023, doi: 10.1136/bmjopen-2022-071165.

[13] E. V. W. Andrew et al., "Factors Affecting Attendance at and Timing of Formal Antenatal Care: Results from a Qualitative Study in Madang, Papua New Guinea," PLoS ONE, vol. 9, no. 5, p. e93025, May 2014, doi: 10.1371/journal.pone.0093025.

[14] L. Mason et al., "Barriers and facilitators to antenatal and delivery care in western Kenya: a qualitative study," BMC Pregnancy Childbirth, vol. 15, no. 1, p. 26, Dec. 2015, doi: 10.1186/s12884-015-0453-z.

[15] National Institute of Statistics of Rwanda (NISR) [Rwanda], Ministry of Health (MOH) [Rwanda], U. Rwanda Demographic and Health Survey 2019-20 Final Report. Kigali, Rwanda, and Rockville, Maryland, and N. and ICF., Rwanda Demographic Health Survey, 2019-20. Kigali, Rwanda, and Rockville, Maryland, USA: NISR and ICF, 2021.

[16] T. De Bruyn and J. Wets, "The Republic of Rwanda," pp. 53–70, 2023, doi: 10.18356/2ceb351a-en.

[17] A. Mulungi, J. Mukamurigo, S. Rwunganira, K. Njunwa, and J. Ntaganira, "Prevalence and risk factors for delayed antenatal care visits in Rwanda: an analysis of secondary data from Rwanda demographic health survey 2019-2020," Pan Afr. Med. J., vol. 44, p. 74, 2023, doi: 10.11604/pamj.2023.44.74.37570.

[18] National Institute of Statistics of Rwanda (NISR), "Map of Rwamagana District Rwanda." 2019.

[19] Rwamagana District, Environmental and Social Management Plan (ESMP). Kigali, Rwanda: Rwanda Information Society Authority (RISA), 2019.

[20] K. M. Alibhai, B. R. Ziegler, L. Meddings, E. Batung, and I. Luginaah, "Factors impacting antenatal care utilization: a systematic review of 37 fragile and conflict-affected situations," Confl. Health, vol. 16, no. 1, pp. 1–16, 2022, doi: 10.1186/s13031-022-00459-9.

[21] S. S. Jiwani et al., "Timing and number of antenatal care contacts in low-and middle-income countries: Analysis in the Countdown to 2030 priority countries," J. Glob. Health, vol. 10, no. 1, 2020, doi: 10.7189/jogh.10.010502.

[22] R. Rustagi, S. Basu, S. Garg, M. M. Singh, and Y. M. Mala, "Utilization of antenatal care services and its sociodemographic correlates in urban and rural areas in Delhi , India," pp. 1–5, 2021.

[23] H. Ahmed and I. Manzoor, "Knowledge about the importance of antenatal care among females of child bearing age living in a suburban community of Lahore," Pak. J. Med. Sci., vol. 35, no. 5, pp. 1344–1348, 2019, doi: 10.12669/pjms.35.5.1256.

[24] D. Kpienbaareh et al., "Social Science & Medicine Spatio-temporal disparities in maternal health service utilization in Rwanda : What next for SDGs ?," Soc. Sci. Med., vol. 226, no. December 2018, pp. 164–175, 2019, doi: 10.1016/j.socscimed.2019.02.040.

[25] National Institute of Statistics of Rwanda.

Ministry of health, Rwanda Demographic and Rwanda Health Survey 2019-20: North Province. Kigali,

Supplementary Table 1: *Factors influencing ANC utilization among mothers in Rwamagana District*

	ANC utilization						
	<4 ANC		≥4 ANC		Total		
Influencing factors	n	%	n	%	(n)	P	OR
Socio-demographic characteristics							
Age							
15-19	4	18.2	18	81.8	22	0.322	0.816
20-29	25	21.5	91	78.5	116		
30-49	28	28.3	71	71.7	99		
Religion							
None	1	100	0	0.0	1	0.904	0.984
Muslim	0	0.0	7	100	7		
Catholic	17	23	57	77.0	74		
ADEPR	24	28.6	60	71.4	84		
Methodist	5	50.0	5	50.0	10		
Adventist	6	20.7	23	79.3	29		
Other	4	12.5	28	87.5	32		
Woman's level of education							
None	4	50.0	4	50.0	8	0.982	1.010
Primary	36	26.1	102	73.9	138		
Secondary	15	19	64	81.0	79		
Tertiary	2	16.7	10	83.3	12		
Husband's educational level							
None	4	30.8	9	69.2	13	0.648	1.180
Primary	30	24.8	91	75.2	121		
Secondary	17	21	64	79.0	81		
Tertiary	6	27.3	16	72.7	22		
Household size							
1-3 members	20	23.0	67	77.0	87	**0.035***	0.743
4-5 members	17	17.7	79	82.3	96		
>5 members	20	37.0	34	63.0	54		
Woman's occupation							
None	14	25.0	42	75.0	56	0.084	1.281
Housemaid	1	100	0	0.0	1		
Peasant/ farmer	21	25.3	62	74.7	83		
Businesswoman	7	29.2	17	70.8	24		
Civil servant	13	20.6	50	79.4	63		
Employee	1	10.0	9	90.0	10		

Husband's occupation							
None	5	25.0	15	75.0	20	0.227	0.847
Houseman	0	0.0	0	0.0	0		
Peasant/ farmer	18	30.0	42	70.0	60		
Businessman	5	14.7	29	85.3	34		
Civil servant	16	19.0	68	81	84		
Employee	13	33.3	26	66.7	39		
Socioeconomic status (Ubudehe Category)							
None (unclassified)	2	11.1	16	88.9	18	**0.016***	0.517
Category 1	3	21.4	11	78.6	14		
Category 2	24	20.3	94	79.7	118		
Category 3	28	32.2	59	67.8	87		
Category 4	0	0.0	0	0.0	0		
Financial support							
Yes	36	24.8	109	75.2	145	0.296	1.509
No	21	22.8	71	77.2	92		
Health insurance							
Yes	49	22.5	169	77.5	218	0.090	0.341
No	8	42.1	11	57.9	19		
Marital status							
Single	4	23.5	13	76.5	17	0.053	0.570
Married	18	20.0	72	80.0	90		
Cohabitating	29	24.4	90	75.6	119		
Separated	5	55.6	4	44.4	9		
Widowed	1	50.0	1	50.0	2		
Household conflict/ violence							
Yes	11	30.6	25	69.4	36	0.461	1.451
No	46	22.9	155	77.1	201		
Autonomy							
Yes	51	23.8	163	76.2	214	0.526	0.659
No	6	26.1	17	73.9	23		
Residential area							
Rural	49	22.7	167	77.3	216	0.057	0.289
Urban	8	38.1	13	61.9	21		
Main mode of HF access for ANC visit							
Walking	49	26.8	134	73.2	183	0.911	0.858
Vehicle	8	14.8	46	85.2	54		

Walking time to HF (If the main mode of HF access is walking)							
≤ 30 minutes	11	23.4	36	76.6	47	0.647	0.886
30 minutes – 1 hour	22	27.5	58	72.5	80		
> 1 hour	16	28.6	40	71.4	56		
Affordable transportation cost (If the main mode of HF access is by vehicle)							
Yes	5	19.2	21	80.8	26	0.567	1.620
No	3	10.7	25	89.3	28		
Pregnancy-related factors							
knowledge of pregnancy manifestations							
Yes	44	23.8	141	76.2	185	0.602	0.778
No	13	25.0	39	75.0	52		
Place of delivery (for the most recent birth)							
Institutional (Health facility)	56	23.8	179	76.2	235	**0.033***	0.026
Non-institutional	1	50.0	1	50.0	2		
Mode of Delivery (for the most recent birth)							
Normal delivery	39	23.4	128	76.6	167	0.699	0.855
Cesarean section	18	25.7	52	74.3	70		
Gravidity							
Primigravida	16	24.6	49	75.4	65	0.748	1.143
Multigravida	32	22.4	111	77.6	143		
Grand-multigravida	9	31.0	20	67.0	29		
Parity							
Primipara	19	25.3	56	74.7	75	0.608	0.754
Multipara	29	20.7	111	79.3	140		
Grand-multipara	9	40.9	13	59.1	22		
Number of living children							
1 – 3 children	41	20.9	155	79.1	196	0.411	1.472
4 children and more	16	39.0	25	61.0	41		
Family planning							
Yes	33	24.1	104	75.9	137	0.523	0.746
No	24	24.0	76	76.0	100		
Pregnancy planning							
Yes	36	20.9	136	79.1	172	0.166	0.533
No	21	32.3	44	67.7	65		
ANC Knowledge							
Yes	54	24.8	164	75.2	218	0.092	4.668
No	3	15.8	16	84.2	19		

Sources of ANC information

Not applicable (if no ANC knowledge)	3	15.8	16	84.2	19	**0.013***	1.134
Health facility	18	30.0	42	70	60		
Friends and relatives	7	43.7	9	56.3	16		
Radio	3	27.3	8	72.7	11		
Other sources	0	0.0	3	100	3		
Health facility and Radio	4	15.4	22	84.6	26		
Health facility, Friends and relatives and Radio	15	25.9	43	74.1	58		
Health facility, Friends and relatives, Radio, Television and social media	1	16.7	5	83.3	6		
Health facility and Friends and relatives	4	17.4	19	82.6	23		
Health facility, Friends and relatives, Radio and Television	2	28.6	5	71.4	7		
Health facility, Radio and Television	0	0.0	2	100	2		
Friends and relatives and Radio	0	0.0	5	100	5		
Health facility, Friends and relatives, Radio, Television, social media and Newspapers	0	0.0	1	100	1		

Type of HF of ANC contacts

Public HF	55	25.1	164	74.9	219	0.173	4.978
Private HF	1	11.1	8	88.9	9		
Both public and private HF	0	0.0	8	100	8		

ANC follow-up during the last pregnancy

Yes	27	24.8	82	75.2	109	0.442	1.329
No	29	22.8	98	77.2	127		

Complications on pregnancies

Yes	11	20.8	42	79.2	53	0.708	0.835
No	46	25.0	138	75.0	184		

Factors related to healthcare providers

Waiting time for receiving ANC services

< 1 hour	23	23.5	75	76.5	98	0.778	1.073
1 – 2 hours	20	26.7	55	73.3	75		
> 2 hours	13	20.6	50	79.4	63		

Good/respectable manner by ANC cadre

	n	%	n	%	n	P	OR
Yes	53	23.4	173	76.6	226	0.652	0.628
No	3	30.0	7	70.0	10		

Health Education or advice during ANC visit

Yes	52	24.5	160	75.5	212	0.353	2.032
No	4	16.7	20	83.3	24		

ANC service cost and satisfaction

Expensive cost of ANC services

Yes	17	24.3	53	75.7	70	0.757	1.132
No	39	23.5	127	76.5	166		

ANC service satisfaction

Yes	53	23.7	171	76.3	224	0.955	1.064
No	3	25.0	9	75.0	12		

n: number of study participants; %: percentage; P: P-value; *: significant P-value; OR: odd ratio; ADEPR: Associations des Eglises de Pentecote au Rwanda; HF: Health facility; ANC: antenatal care; %: percentages

The Role of Community Health Workers in Influencing Family Planning Decisions among Users: A Case Study in the Ndera Sector of Gasabo District, Rwanda

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ABSTRACT

INTRODUCTION: Community health workers (CHWs) play a critical role in promoting contraceptive knowledge and usage, thereby impacting fertility rates in developing nations. Understanding their contribution to family planning (FP) decisions in specific contexts, such as the Ndera sector of Gasabo District, Rwanda, is essential.

METHODS: This was a cross-sectional quantitative study of 445 randomly selected family planning users that used a structured questionnaire.

RESULTS: Ninety-one percent of respondents were female, 53% were aged 25-34 years, and 75% were married. Educational levels ranged from primary to secondary. While CHWs were acknowledged by 97% of respondents, only 41% reported receiving adequate FP information. Statistically significant associations ($p<0.001$) were found between various demographic and FP-related variables, including age, marital status, FP preferences, access to FP information, satisfaction with information, educational level, and perceived barriers, and CHW's Contribution on Family Planning Decisions.

CONCLUSION: The study highlights a lack of male involvement in FP services in Rwanda, with only 9.1% of participants reporting male involvement and suboptimal provision of family planning information by community health workers

INTRODUCTION

Community health workers (CHWs) have emerged as crucial components of healthcare systems worldwide, particularly in addressing the needs of rural and underserved populations in developing countries [1]. Originating in Ding Xian, China in the 1920s, CHW programs began to proliferate globally in the 1960s, recognizing the limitations of the traditional Western medical model in meeting the healthcare needs of these populations [2, 3]. CHWs are defined by the US Department of Labor as individuals who assist communities in adopting healthy behaviors, conducting outreach, and advocating for individual and community health needs, CHWs play diverse roles in promoting health and well-being [3].

In developed nations such as the USA, CHWs

are integral members of healthcare teams, particularly in addressing social determinants of health within disadvantaged communities [4]. Throughout Africa, CHWs have played pivotal roles in advancing health-related Millennium Development Goals, notably in reducing child mortality, improving maternal health, and combating HIV/AIDS, malaria, and other diseases [5]. In Rwanda, the establishment of CHW programs by the Ministry of Health in 1995 was a response to healthcare access challenges and a shortage of medical professionals exacerbated by the 1994 genocide against Tutsi [6].

CHWs in Rwanda operate within various settings, including workplaces, neighborhoods, and households, with the objective of providing both therapeutic and preventive healthcare services [6]. With approximately 45,000 CHWs serving communities, their responsibilities range from offering medical care to children, pregnant and nursing women, to facilitating access to contraception [7]. Specifically regarding family planning services, CHWs provide a range of options including short-acting methods like injectable, tablets, condoms, and standard day techniques; which allows women to track their menstrual cycle in-order to identify when they are likely to become pregnant, given the complexity of implant insertion requiring medical expertise and sterile environments [8].

The aftermath of the 1994 genocide significantly impacted fertility patterns in Rwanda, prompting government initiatives to promote family planning as a means of poverty reduction and national development [7]. "Vision 2020," launched in 2000, aimed to elevate Rwanda to a middle-income country, with a concerted effort to reduce the fertility rate from 6.5 to 4.5 total births per woman by 2020. CHWs, along with other stakeholders, were trained to disseminate information about contraception and address societal barriers hindering family planning uptake [7].

Through routine community engagement activities such as the monthly umuganda community service day (A traditional Rwandan practice of community service, held on the last Saturday of each month), CHWs and officials actively discussed reproductive health issues, including family planning, with community members [9]. These concerted efforts bore fruit, as Rwanda's fertility rate plummeted below the target to 4.1 total births per woman by 2020, with a substantial increase in contraceptive usage among married women from 17% to 64% during the same period [8,10].

Despite these achievements, there remains a paucity of published literature elucidating the specific contribution of CHWs to family planning promotion in Rwanda. Therefore, this study aims to assess the role of CHWs in promoting family planning utilization among the community of Ndera sector in Gasabo district, Rwanda. By filling this gap, the study seeks to provide valuable insights into the effectiveness of CHW-led interventions in advancing reproductive health outcomes in Rwanda.

METHODS

Study Design: This study used a descriptive cross-sectional design to investigate family planning (FP) users attending the 4 health posts in the Ndera Sector of Gasabo District, Kigali city, during mid-September to early-October 2023.

The Ndera Sector, covering 50 square kilometers, has a total population of 95,000 people, with a population density of 1,890 per square kilometer. It comprises 6 cells and 42 villages, with 214 CHWs operating under Rubungo Health Center supervision. Additionally, apart from the health center, Ndera has 4 health posts that provide FP services among their offerings.

To determine the sample size, Yamane's formula was employed, taking into account the average number of FP users per year in the Ndera sector, which is 31,780. According to Yamane's formula: n= N/1+N (e) 2

Sample size (n) = 31780/ [(1+31780(0.05)2)] = 395 (+ allowance for non-response ~10%). Hence (n) is superior or equal to 434.5= 445.

Participants: Participants eligible for inclusion in this study were women and men aged between 18 and 45 years residing in the Ndera sector who were actively using family planning options, while individuals with mental disabilities and new residents were excluded.

Study Tool: A survey was conducted at all four health posts in the Ndera Sector, employing a simple random sampling technique to select participants from among family planning users. Data collection occurred at each health post, where FP users were categorized by their respective villages. Participants were provided with pieces

of paper marked with "yes" or "no," and those selecting "yes" were invited to participate in the study. Priority was given to male participants during data collection due to their perceived underutilization of contraception. Each village was represented by nine FP users in the study sample. Data were collected using a structured questionnaire administered through face-to-face interviews. The questionnaire, initially prepared in English, was translated into the local language (Kinyarwanda).

Data Analysis: Analysis was conducted using the Statistical Package for Social Science (SPSS), where frequency distribution and percentages were utilized to determine the socio-demographic characteristics of family planning (FP) users. Descriptive statistics tools such as frequency and percentage were employed to assess the attitudes, practices, and level of knowledge of FP users. Tables were utilized for visual representation of the data. To identify factors associated with CHWs contribution to FP decisions among users, the Chi-square test was employed, with significance set at a P value of less than 0.001.

Ethical considerations: Numerous ethical considerations were addressed during the study.

Ethical clearance was obtained from the Institutional Review Board (IRB) of the University of Rwanda, College of Medicine and Health Sciences (Ref: CMHS/IRB/430/2023).

Oral authorization was also obtained from the Sector Executive Secretary of the Ndera sector, along with a consent letter from Kibagabaga District Hospital. Written informed consent was obtained from all study participants after providing them with comprehensive information about the study's purpose, benefits, and risks. Participants were given the freedom to decide whether or not to participate, without any intervention or consequences for declining or leaving the study early. Participant information was kept confidential and anonymous to ensure privacy. The study did not cause any physical or psychological harm to participants, and no financial compensation was provided for participation, as it was voluntary.

RESULTS

Socio-demographic Characteristics of Participants: Table 1 summarizes the sociodemographic characteristics of the 395 participants included in this study.

Table 1: *Socio-Demographic Characteristics of Participants*

Socio-demographics	n	%
Gender		
Male	36	9.1
Female	359	90.9
Age (years)		
18-24	33	8.4
25-34	211	53.4
35-45	151	38.2
Marital status		
Single	84	21.3
Married	298	75.4
Divorced	7	1.8
Widowed	6	1.5
Education level		
None	4	1.0
Primary	165	41.8
Secondary	199	50.4
University/tertiary	27	6.8

The sample predominantly consists of females, with only 9.1% (n=36) being male. Regarding age distribution, 8.4% (n=33) of participants fall within the 18–24 age range, 53.4% (n=211) within the 25–34 age group, and 38.2% (n=151) within the 35–45 age group. Marital status varies, with 1.8% (n=7) divorced, 1.5% (n=6) widowed, 75.4% (n=298) married, and 21.3% (n=84) single. In terms of educational attainment, 1.0% have never attended formal schooling, 41.8% (n=165) have completed elementary education, 50.4% (n=199) have completed secondary education, and 6.8% have completed university or higher education; only 1% (n=4) reported being uneducated.

Perceptions of Family Planning Users towards Services Offered by Community Health Workers in Family Planning: The findings presented in Table 2 demonstrate a high awareness of CHWs among respondents, with 97% (n=383) confirming their presence in the study area. Only a minority, comprising 3% (n=12) of participants, reported unawareness of CHWs. Among those aware, 41% (n=162) indicated receipt of sufficient FP information from CHWs and expressed comfort in discussing FP matters with them, while 59% (n=233) reported insufficient information or discomfort in such discussions.

Table 2: *Perceptions of Family Planning Users towards Services Offered by Community Health Workers (CHWs) in Family Planning (FP)*

Variable(s)	n	%
CHWs presence in your area		
Yes	383	97.0
No	12	3.0
Enough information about FP from CHW		
Yes	162	41.0
No	233	59.0
Satisfied by information provided by CHW about FP		
Yes	155	39.2
No	7	1.8
Not applicable	233	59.0
Feel comfortable discussing FP issues with CHW		
Yes	162	41.0
No	31	7.8
Did not have the chance to discuss with CHWs	202	51.1
CHWs contribution in FP decision		
Yes	147	37.2
No	248	62.8
Can recommend FP services offered by CHWs		
Yes	155	39.2
No	7	1.8
Not applicable	233	59.0
Family planning method		
Condom	40	10.1
Birth control pills	66	16.7
Intrauterine Device	13	3.3
Injectable	162	41.0
Implant	110	27.8
Natural methods	4	1.0

Furthermore, 39.2% (n=155) expressed satisfaction with the FP information provided by CHWs and endorsed the FP services offered by them. Notably, 37.2% (n=147) acknowledged CHWs' contribution to their FP decisions and method selection, with injectables being the most preferred (41%, n=162),

followed by implants (27.8%, n=110), condoms (10.1%, n=40), birth control pills (16.7%, n=66), intrauterine devices (IUDs) (3.3%, n=13), and natural methods (1%, n=4).

Factors Associated with CHW's Contribution on Family Planning Decisions among FP Users: Table 3 displays the results of the chi-square test examining the relationship between various factors and participants' decisions regarding family planning. Among the variables analyzed in the multivariate model, seven demonstrated statistical significance ($p < 0.01$) in relation to the contribution of Community Health Workers to family planning decisions. These variables encompassed age, marital status, education level, preference for FP methods, access to sufficient FP information, satisfaction with provided information, and perceived barriers. However, gender did not show statistical significance ($p = 0.11$) in this analysis.

DISCUSSION

This study delved into the pivotal role of Community Health Workers (CHWs) in influencing family planning decisions among FP users within the Ndera sector of Gasabo District, Rwanda. Our investigation encompassed an examination of demographic characteristics, provision of adequate information, and FP users' perceptions regarding the services offered by CHWs. While our research builds upon existing literature, which has touched upon the general impact of CHWs on FP promotion in Rwanda, it uniquely focuses on elucidating the specific roles of CHWs in this domain.

In terms of FP users' perceptions, our findings underscored a high level of awareness among FP users regarding the presence of CHWs in their community, with 97% of participants acknowledging their existence. However, only 41% reported receiving sufficient information about FP from CHWs, a discrepancy from findings reported by Mazzei et al. in 2019, which highlighted regular household visits by CHWs as a significant factor contributing to increased contraceptive use [11]. Nevertheless, FP users who received adequate information from CHWs expressed high levels of satisfaction and were inclined to recommend these services to others, corroborating similar positive attitudes reported in a study conducted in rural Ghana by Maya J. Stephens et al. in 2020 [12]. Regarding FP practices, our study revealed that

Table 3: *Factors Associated with CHW's Contribution on Family Planning Decisions among FP*

	No n (%)	Yes n (%)	Total n	Chi^2	P-Value
Age				16.30	<0.001
18-24	24(72.7)	9(27.3)	33		
25-34	148(70.1)	63(29.9)	211		
35-45	76(50.3)	75(49.7)	151		
Total	248(62.8)	147(37.2)	395		
Gender				2.53	0.110
Female	221(61.6)	138(38.4)	359		
Male	27(75.0)	9(25.0)	36		
Total	248(62.8)	147(37.2)	395		
Marital status				23.68	<0.001
Divorced	3(42.9)	4(57.1)	7		
Married	172(57.7)	126(42.3)	298		
Single	71(84.5)	13(15.5)	84		
Widowed	2(33.3)	4(66.7)	6		
Total	248(62.8)	147(37.2)	395		
Educational level				16.09	<0.001
None	0(0.0)	4(100.0)	4		
Primary level	91(55.2)	74(44.8)	165		
Secondary level	136(68.3)	63(31.7)	199		
University/ tertiary level	21(77.8)	6(22.2)	27		
Total	248(62.8)	147(37.2)	395		
FP method				26.93	<0.001
Birth control pills	37(46.2)	43(53.8)	80		
Condom	29(72.5)	11(27.5)	40		
Implant	80(74.1)	28(25.9)	108		
Injectable	88(58.6)	62(41.4)	150		
Intrauterine devices	12(92.3)	1(7.7)	13		
Natural methods	2(50.0)	2(50.0)	4		
Total	248(62.8)	147(37.2)	395		
Enough FP Information			299		0.00
No	228(97.9)	5(2.1)	233		
Yes	20(12.3)	142(87.7)	162		
Total	248(62.8)	147(37.2)	395		

a majority of FP users who had health contact with CHWs opted to use FP methods endorsed by CHWs. For instance, injectables emerged as the preferred choice among 162 participants, aligning with findings from a study by Jane Wickstrom et al. in 2015, which emphasized the popularity of injectable contraceptives among FP users in sub-Saharan Africa, including Rwanda [13].

Moreover, our research identified certain sociodemographic factors, such as age, level of education, and marital status, as influential determinants in shaping FP users' decisions in relation to CHW involvement. Specifically, age, marital status, and education level exhibited a strong association with the extent of CHW contribution to FP decisions, echoing similar findings from studies conducted both within and outside Rwanda. For instance, A. Juma's study in Western Kenya highlighted the role of education in influencing attitudes towards CHW services, with less educated women expressing higher approval rates for CHW services compared to their more educated counterparts [14].

Interestingly, while our study found no significant correlation between gender and CHW contribution to FP decisions, factors such as adequate information provision, satisfaction levels, and overcoming perceived barriers emerged as key drivers for FP uptake, with FP users predominantly opting for methods provided by CHWs. These findings align with those of B. Solanke et al. from Nigeria, which demonstrated a positive association between interaction with CHWs and modern contraceptive use [15].

In this case, the cross-sectional design restricted the researchers from examining the dynamic nature of the relationship between community health workers and family planning decisions among users in the Ndera sector of Gasabo District, Rwanda. Therefore, prospective longitudinal studies are recommended to better explore this relationship.

CONCLUSION

The study underscores a significant gap in male involvement (9.1%) and suboptimal provision of FP information by CHWs, despite their potential impact on FP uptake. However, among those who had contact with CHWs, 91% acknowledge their significant contribution to FP decision-making.

To maximize their influence, extending CHWs' reach to a larger population segment is crucial. Efforts to enhance awareness about CHWs' roles are imperative, given that nearly half of those who never had contact with CHWs cited lack of awareness about FP services.

Therefore, the community health workers in collaboration with other health professionals, community leaders and related government agencies needs to address the gaps in male involvement in FP services and improving awareness about CHWs' roles in providing FP services. These are essential steps in advancing FP uptake and reproductive health outcomes in Rwanda.

REFERENCES

[1] R. Muremyi, "Contribution of community health workers in the prevention of disease caused by malnutrition in Rwanda", doi: 10.21203/rs.3.rs-41252/v1.

[2] H. Perry, "A Brief History of Community Health Worker Programs," no. September, 2013.

[3] H. B. Perry, R. Zulliger, and M. M. Rogers, "Community health workers in low-, middle-, and high-income countries: An overview of their history, recent evolution, and current effectiveness," in Annual Review of Public Health, Annual Reviews Inc., 2014, pp. 399–421. doi: 10.1146/annurev-publhealth-032013-182354.

[4] S. Sabo, C. G. Allen, K. Sutkowi, and A. Wennerstrom, "Community Health Workers in the United States : Challenges in Identifying , Surveying , and Supporting the Workforce," vol. 107, no. 12, pp. 1964–1969, 2017, doi: 10.2105/AJPH.2017.304096.

[5] C. Health and W. Programmes, Community health worker programmes in the who African region : evidence and options policy brief community health worker programmes in

the who African region: Evidence. [Online]. Available: https://www.afro.who.int/publications/community-health-worker-programmes-who-african-region-policy-brief

[6] H. Perry and R. Zulliger, "How effective are community health workers?," 2012. [Online]. Available: http://www.mdgha.org/

[7] D. N. Muhoza, D. S. Ruturwa, and I. H. Kabano, "Socio-economic factors associated with the choice of community health workers as contraceptive providers in Rwanda," 2022, doi: 10.21203/rs.3.rs-1330958/v1.

[8] C. S. Program, "Community-Based Family Planning Breaking Barriers to Access and Increasing Choices for Women and Families," pp. 1–12, 2019, [Online]. Available: https://www.mcsprogram.org/wp-content/uploads/2020/05/5_-MCSP-CBFP-Brief.pdf

[9] J. Corey et al., "Family planning demand generation in Rwanda : Government efforts at the national and community level impact interpersonal," no. April, 2022, doi: 10.1371/journal.pone.0266520.

[10] D. N. Muhoza, C. Rutayisire, and A. Umubyeyi, "decomposition analysis," J. Popul. Res., no. February 2019, 2016, doi: 10.1007/s12546-016-9177-9.

[11] A. Mazzei et al., "Community health worker promotions increase uptake of long-acting reversible contraception in Rwanda," pp. 1–11, 2019, doi: 10.1186/s12978-019-0739-0.

[12] M. J. Stephens et al., "' I have a lot of faith in her ': Value of community health workers in addressing family planning in rural Ghana," Glob. Public Health, vol. 0, no. 0, pp. 1–13, 2020, doi: 10.1080/17441692.2020.1762238.

[13] J. Wickstrom, R. Jacobstein, J. Wickstrom, and R. Jacobstein, "Commentary Contraceptive Without Incomplete Methods Permanent Security : and Long-Acting of Family Planning," vol. 42, no. 4, pp. 291–298, 2015, [Online]. Available: http://www.jstor.org/stable/23339380

[14] P. A. Juma, N. Mutombo, and C. Mukiira, "Women ' s attitudes towards receiving family planning services from community health workers in rural Western Kenya .," no. March, 2015, doi: 10.4314/ahs.v15i1.22.

[15] B. L. Solanke, O. O. Oyediran, and A. F. Awoleye, "Do health service contacts with community health workers influence the intention to use modern contraceptives among non - users in rural communities ? Findings from a cross - sectional study in Nigeria," BMC Health Serv. Res., pp. 1–14, 2023, doi: 10.1186/s12913-023-09032-3.

Predictors of Adolescent Pregnancy among 13-19 Years Old Girls in Karongi District: unmatched case-control study, 2021

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ABASTRACT

INTRODUCTION: Adolescent pregnancy is a global public health challenge, and in Rwanda, though the percentage of adolescent girls experiencing pregnancy has decreased slightly, it remains a concern, particularly in Karongi District, with high incidences. This study aims to identify the risk factors associated with adolescent pregnancy in Karongi district.

METHODS: A case-control study design with a 1:2 ratio of adolescent girls aged 13-19 years was carried out in Karongi District, Western Province, Rwanda. The data were collected using a structured questionnaire and face-to-face interviews. Multivariate logistic regression analysis was performed to identify factors independently associated with adolescent pregnancy. The findings were presented as adjusted odds ratios (aORs) with 95% confidence intervals (CIs).

RESULTS: A total of 522 adolescent girls participated in the study. In bivariate analysis, the majority of variables were significantly associated with adolescent pregnancy. In multivariable analyses, significant factors independently associated with adolescent pregnancy were low socioeconomic status [Ubudehe category 1 (aOR = 4.6, CI = 1.47-14.28), and Ubudehe category 2 (aOR = 5.6, CI = 2.06-14.61)], lack of sexual education from parents/guardians [aOR = 4.5, CI = 1.71-11.82], peer pressure to engage in sexual intercourse (aOR = 3, CI = 1.23-7.32), first sexual intercourse at $\geq$ 16 years old (aOR = 32, CI = 5.98-88.52).

CONCLUSION: Low socioeconomic status, lack of sexual education from parents/guardians, peer pressure, and first-sex intercourse at $\geq$ 16 years old were found to be positively associated with adolescent pregnancy. Interventions focusing on increasing parental involvement in sexual health education, supporting low-income families, and addressing peer influence may play a vital role in preventing adolescent pregnancy.

INTRODUCTION

Adolescent pregnancy is an important public health challenge. An estimated 16 million girls aged 15 to 19 years and two million girls under the age of 15 give birth every year, and this makes up 11% of all births worldwide. The low- and middle-income countries have the highest proportion, nearly 95% of adolescent pregnancies [1,2]. An estimated 21 million girls aged 15 to 19 years in

developing regions become pregnant every year, and among them, 12 million give birth. Estimates also demonstrate that 2.5 million girls aged under 16 years give birth every year [3,4].

Various factors, including behavior, culture, and religion, influence adolescent pregnancy. Risk factors include multiple sexual partners, lack of contraception, peer pressure, early marriage, sexual abuse, and community violence [5,6]. Family dynamics, economic status, education, and knowledge gaps also contribute to adolescent pregnancy [7]. Restrictive laws, limited access, and gender inequality further compound the issue [8].

In Sub-Saharan Africa, an estimated 45% of pregnancies among young women aged 15-19 are unwanted pregnancies, leading to unwanted births and unsafe abortions [3]. The rate of adolescent pregnancy in the eastern African region is high, varying from 18% of adolescents in Kenya to 29% in both Malawi and Zambia [9]. In addition, children who are born to adolescent mothers have a higher risk of dying and are more vulnerable to other life-threatening conditions [10]. Complications of pregnancy among adolescents during delivery are the most important contributors to mortality among 15-19-year-old adolescents and young women [2]. Adolescent girls are still experiencing the disproportionately high burden of sexual and reproductive ill health, mostly in sub-Saharan Africa, with the prevalence of adolescent pregnancy of 19.3% [11,12].

According to the World Health Organization (WHO), the majority of pregnancies and childbirth are not planned and wanted [13]. Adolescent pregnancy is associated with high maternal and child morbidity and mortality, and it affects the socioeconomic development of a country. It is related to an increased risk of adverse pregnancy and childbirth outcomes compared to older women [14,15].

Although the Government of Rwanda (GoR) has put efforts into most aspects of health and the fight against Gender-Based Violence (GBV) among its priorities, in the last 5 years, there was a reduction of only 1% in adolescent pregnancy. From 6% in 2014/2015 to 5% in 2019/2020 [16,17]. The Rwanda Demographic and Health Survey (RDHS) 2019-2020 report, 5% of adolescent women aged 15-19 have begun childbearing, 4% have given birth, and 1% are pregnant with their first child. There is a slight decline in adolescent pregnancy

of 2% since 2014-2015. The percentage of female adolescents who have begun childbearing is highest in the East and South, at 6% each, and in the West and the city of Kigali, it is 4% [16]. However, Karongi district has a higher proportion of adolescent pregnancy (9.3%) [18], highlighting the need to explore further this public health issue. Therefore, this study assessed the predictors of adolescent pregnancy in Karongi district, Rwanda. Understanding these predictors will inform policies and strategies to effectively combat adolescent pregnancy, ultimately improving the health and socioeconomic outcomes for adolescents and their communities.

METHODS

Study design: An unmatched case-control study with a 1:2 ratio (case/control) was conducted from January 1 to December 31, 2021, in Karongi district, Western Province, Rwanda.

Study population: The study targeted adolescent girls (cases and controls) between the ages of 13 and 19 years who are residents of Karongi District and who gave birth in healthcare facilities. In Karongi District, 87% of adolescent pregnant girls gave birth at the hospital level, and 13% gave birth at health centers. A case was defined as any female adolescent girl aged 13-19 years, who was pregnant or had given birth to at least one child, who resided and attended any of the catchment areas of three hospitals (Kirinda, Mugonero, and Kibuye hospitals) in Karongi district. Controls were defined as adolescent girls who had never been pregnant and resided in the closest neighboring households of cases.

Households where parents/guardians or adolescent girls refused to participate were disqualified, and alternative households were selected randomly. The study excluded the ones who did not consent to participate.

Sample size and sampling technique: Considering a 95% confidence, power of 80%, and 9.3% prevalence of adolescent pregnancy in Karongi district [18] as exposure, the minimum case sample was 158. After adding 10% to compensate for dropout and non-responses, we recruited 174 cases and a subsequent 348 controls. The list of cases (adolescent girls) with names, age, residential sector, cell, village and phone numbers

were retrieved from medical records of the health facilities and were used to find respondents. The controls (adolescent girls who have never been pregnant) were identified and selected from the closest neighboring households using a simple random sampling technique.

Data collection tools and methods: We used a questionnaire adapted from similar previous studies conducted on adolescent pregnant girls [4,6,9-15]. The questionnaire consisted of participants' socio-demographics such as age, residence, mother and father's educational status, and adolescent education level. Other items, such as behavior and familial factors related to pregnancy within respondents, were assessed, and they answered with a binary response (e.g., Yes or No). The respondents were interviewed to get information about demographic factors, and familial factors such as having living parents, divorced parents, and siblings with a history of adolescent pregnancy. Socioeconomic status was identified using Ubudehe categorization, which is the categorization of all households based on economic status into one of 4 categories (from 1: the poorest to 4: the richest). Behavior factors, such as age at first sex, multiple sex partners, alcohol use, and contraceptive knowledge, and societal factors such as peer influence to engage in sexual intercourse, were also identified through interviews.

Data collectors were trained for three days on data collection tools, interview techniques, and recruitment of study participants. The questionnaire was designed in English and later translated into Kinyarwanda which is the first language of respondents. Data collectors visited eligible participants at home, and they explained the purpose of the study and got consent before starting data collection.

Data analysis: Data was collected using Epi-info software, cleaned in Excel, and entered into STATA version 14.0 for analysis. Descriptive characteristics of participants were presented as frequencies and percentages. Bivariate analysis using a chi-square test of independence was initially performed between the dependent variable (pregnancy status) and each of the independent variables (demographic, behavioral, familial, and socioeconomic factors) to identify the independent variables that show statistically significant

associations with the dependent variable. Statistically significant associations of variables at $p < 0.05$ with chi-square analysis allowed the selection of variables that were further moved to a multiple regression model to assess the odds of the factors associated with adolescent pregnancy, and adjust the effect of possible confounders. Results were expressed in terms of the Adjusted Odds Ratio (AOR) and their corresponding 95% confidence intervals (CI).

Ethics approval to conduct this study was obtained from the College of Medicine and Health Sciences (CMHS), University of Rwanda (UR) Institutional Review Board (IRB) (Ref: CMHS/IRB/124/2023). Before starting data collection, participants were briefed, and informed consent was obtained. The data were kept secret, were only accessible by investigators, and were used solely for the purpose of this study. Parents/guardians signed a consent form to authorize the participation of under 18 years old participants (minors), and the minor participants gave their assent. Participation was voluntary, and participants had the right to withdraw from the study whenever they felt uncomfortable. Autonomy, respect, and confidentiality were maintained at all stages of the data collection process by not mentioning any personal identifiers, such as names from the questionnaire.

RESULTS

Socio-demographic characteristics of the study participants: Overall, 174 cases and 384 controls were included. The mean age of the cases and controls was 17.4 years and 16.3 years, respectively. Over 78% were between the ages of 16 and 19, and there were cases (94.8%). Most participants attended primary and secondary school, with the higher proportion of cases attending primary (51.7%), while among controls, the proportion was higher in secondary school (59.2%). Most of the parents were alive (62.3%) and were farmers (39.7% and 51.3% for fathers and mothers, respectively). Ubudehe category 3 had the highest proportion (44%) (Table 1).

Familial characteristics of participants: Among study participants, the proportion of parental separation was 38.9%, and 16.1% of participants had siblings with a history of adolescent pregnancy.

Table 1: *Socio-demographic characteristics of the study participants*

Variables	Cases (n=174) Frequency (%)	Control (n=348) Frequency (%)	Total (n=522) Frequency (%)
Age group (years)			
13-15	9 (5.2)	101 (29.0)	110 (21.1)
16-19	165 (94.8)	247 (71.0)	412 (78.9)
Residence			
Kibuye catchment area	80 (46.0)	160 (46.0)	240 (46.0)
Kirinda catchment area	51 (29.3)	102 (29.3)	153 (29.3)
Mugonero catchment area	43 (24.7)	86 (24.7)	129 (24.7)
Adolescent's education			
No formal education	6 (3.5)	3 (0.9)	9 (1.7)
Primary	90 (51.7)	139 (39.9)	229 (43.9)
Secondary	78 (44.8)	206 (59.2)	284 (54.4)
Parents alive			
Both are alive	64 (36.8)	261 (75.0)	325 (62.3)
None is alive	37 (21.3)	15 (4.3)	52 (9.9)
Only father is alive	23 (13.2)	14 (4.0)	37 (7.1)
Only mother is alive	50 (28.7)	58 (16.7)	108 (20.7)
Father's education			
No formal education	62 (35.6)	59 (17.0)	121 (22.8)
Primary	100 (57.5)	180 (51.7)	280 (53.6)
Secondary and post-secondary	12 (6.9)	109 (31.3)	121 (23.2)
Mother's education			
No formal education	43 (24.7)	76 (21.8)	119 (22.8)
Primary	121 (69.5)	173 (49.7)	294 (56.3)
Secondary and post-secondary	10 (5.8)	99 (28.5)	109 (20.9)
Father's occupation			
Farmer	74 (42.5)	133 (38.2)	207 (39.7)
Business	11 (6.3)	84 (24.1)	95 (18.2)
Government/non-government organization	5 (2.9)	51 (14.7)	56 (10.7)
Unemployed	84 (48.3)	80 (23.0)	164 (31.4)
Mother's occupation			
Farmer	97 (55.7)	171 (49.2)	268 (51.3)
Business	8 (4.6)	87 (25.0)	95 (18.2)
Government/non-government organization	8 (4.6)	44 (12.6)	52 (10.0)
Unemployed	61 (35.1)	46 (13.2)	107 (20.5)
Socioeconomic status (Ubudehe category)			
Category 1	85 (48.9)	52 (15.0)	137 (26.2)
Category 2	62 (35.6)	94 (27.0)	156 (29.9)
Category 3	27 (15.5)	202 (58.0)	229 (43.9)

Around 51% of participants received sexual health education from parents, and the proportion of alcohol abuse in the family was 36.8% (Table 2).

Behavior and societal characteristics of participants: Among study participants, around 57% received condom education, while 29.5%

Table 2: *Familial characteristics of participants*

Variables	Cases (n=174) Frequency (%)	Control (n=348) Frequency (%)	Total (n=522) Frequency (%)
Parental separation/divorce			
No	64 (36.8)	225 (73.3)	319 (61.1)
Yes	110 (63.2)	93 (26.7)	203 (38.9)
Sibling with a history of adolescent pregnancy			
No	135 (77.6)	303 (87.1)	438 (83.9)
Yes	39 (22.4)	45 (12.9)	84 (16.1)
Received sexual education from parents			
Yes	51 (29.3)	221 (63.5)	272 (52.1)
No	123 (70.7)	127 (36.5)	250 (47.9)
Alcohol abuse in the family			
No	107 (61.5)	223 (64.1)	330 (63.2)
Yes	67 (38.5)	125 (35.9)	192 (36.8)

Table 3: *Behavior and societal characteristics of participants*

Variables	Cases (n=174) Frequency (%)	Control (n=348) Frequency (%)	Total (n=522) Frequency (%)
Received education on condom use			
Yes	104 (59.8)	193 (55.5)	297 (56.9)
No	70 (40.2)	155 (44.5)	225 (43.1)
Involved in alcohol consumption			
No	113 (64.9)	255 (73.3)	368 (70.5)
Yes	61 (35.1)	93 (26.7)	154 (29.5)
Peer pressure to engage in sexual intercourse			
No	49 (28.2)	261 (75.0)	310 (59.4)
Yes	125 (71.8)	87 (25.0)	212 (40.6)
Lived in Kigali			
No	52 (29.9)	280 (80.5)	332 (63.6)
Yes	122 (70.1)	68 (19.5)	190 (36.4)
Age at first sexual intercourse (n=222)			
≥ 16 years	121 (72.9)	12 (21.4)	133 (60.0)
13-15 years	39 (23.5)	29 (51.8)	68 (30.6)
≤ 12 years	6 (3.6)	15 (26.8)	21 (9.4)
Multiple sex partners (n=222)			
No	112 (67.5)	20 (35.7)	132 (59.5)
Yes	54 (32.5)	36 (64.3)	90 (40.5)
Condoms use (n=222)			
Often use	49 (29.5)	28 (50.0)	77 (34.7)
Never	117 (70.5)	28 (50.0)	145 (65.3)

were involved in alcohol consumption. About 60% of participants had peer influence to engage in sexual intercourse, and of 222 participants who had sexual intercourse, 60% had their first sex

Table 4: *Bivariate analysis of socio-demographic and economic factors associated with adolescent pregnancy*

Variables	Cases (n=174) Frequency (%)	Control (n=348) Frequency (%)	OR (95% CI)	P-value
Age group (years)				
13-15	9 (8.2)	101 (91.8)	reference	
16-19	165 (40.0)	247 (60.0)	7.5 (3.68-15.24)	< 0.001
Adolescent's education				
Secondary	71 (26.5)	197 (73.5)	reference	
Primary	86 (38.0)	140 (62.0)	1.7 (1.16-2.49)	0.006
No formal education	17 (60.7)	11 (39.3)	4.3 (1.91-9.59)	< 0.001
Parents alive				
Both are alive	66 (20.2)	261 (79.8)	reference	
None is alive	36 (70.6)	15 (29.4)	9.5 (4.90-18.36)	< 0.001
Only father is alive	23 (62.2)	14 (37.8)	6.5 (3.17-13.31)	< 0.001
Only mother is alive	49 (45.8)	58 (54.2)	3.3 (2.09-5.32)	< 0.001
Father's education				
secondary and post-secondary	12 (10.0)	109 (90.0)	reference	
Primary	100 (35.7)	180 (64.3)	5 (2.65-9.61)	< 0.001
No formal education	62 (51.2)	59 (48.8)	9.5 (4.76-19.12)	< 0.001
Mother's education				
Secondary and post-secondary	10 (9.2)	99 (90.8)	reference	
Primary	121 (41.2)	173 (58.8)	7.0 (3.47-13.81)	< 0.001
No formal education	43 (36.1)	76 (63.9)	5.6 (2.64-11.86)	< 0.001
Father's occupation				
Business	11 (11.6)	84 (88.4)	reference	
Farmer	85 (36.3)	149 (63.7)	4.3 (2.2-8.6)	< 0.001
Government/non-government organization	5 (8.9)	51 (91.1)	0.7 (0.25-2.28)	0.610
Unemployed	73 (53.3)	64 (46.7)	8.7 (4.27-17.76)	< 0.001
Mother's occupation				
Business	8 (8.4)	87 (91.6)	reference	
Farmer	106 (37.3)	178 (62.3)	6.5 (3.02-13.89)	< 0.001
Government/non-government organization	8 (15.4)	44 (84.6)	1.9 (0.69-5.62)	0.201
Unemployed	52 (57.1)	39 (42.9)	14.5 (6.29-33.40)	< 0.001
Socioeconomic status (Ubudehe category)				
Category 3	27 (11.8)	202 (88.2)	reference	
Category 2	62 (39.7)	94 (60.3)	2.14 (1.39-3.30)	< 0.001
Category 1	85 (62.0)	52 (38.0)	12.2 (7.2-20.76)	< 0.001

CI: Confidence internal, AOR: Adjusted Odd ratio, p<0.05: Statistically significant

intercourse at 16 years old and above, 59.5% had sexual intercourse with more than one partner, and 34.7% often used condoms (Table 3).

Bivariate analysis of socio-demographic and economic factors associated with adolescent pregnancy: The bivariate analysis showed that adolescent pregnancy was significantly associated

Table 5: *Bivariate analysis of familial, behavior, and societal factors associated with adolescent pregnancy*

Variables	Cases (n=174) Frequency (%)	Control (n=348) Frequency (%)	OR (95% CI)	P-value
Parental separation/divorce				
No	64 (20.0)	255 (80.0)	reference	
Yes	110 (54.2)	93 (45.8)	4.7 (3.19-6.95)	< 0.001
Sibling with a history of adolescent pregnancy				
No	135 (30.8)	303 (69.2)	reference	
Yes	39 (46.4)	45 (53.6)	1.9 (1.21-3.12)	0.006
Received sexual education from parents				
Yes	51 (18.7)	221 (81.3)	reference	
No	123 (49.2)	127 (50.8)	4.2 (2.83-6.21)	< 0.001
Alcohol abuse in the family				
No	107 (32.4)	223 (67.6)	reference	
Yes	67 (34.9)	125 (65.1)	1.12 (0.77-1.63)	0.564
Received education on the use of condoms				
Yes	104 (35.0)	193 (65.0)	reference	
No	70 (31.1)	155 (68.9)	0.8 (0.58-1.21)	0.349
Involved in alcohol consumption				
No	113 (30.7)	255 (69.3)	reference	
Yes	61 (39.6)	93 (60.4)	1.5 (1.00-2.19	0.050
Peer pressure to engage in sexual intercourse				
No	49 (15.8)	261 (84.2)	reference	
Yes	125 (59.0)	87 (41.0)	7.6 (5.08-11.53)	< 0.001
Lived in Kigali				
No	52 (15.7)	280 (84.3)	reference	
Yes	122 (64.2)	68 (35.8)	9.7 (6.35-14.69)	< 0.001
Age at first sexual intercourse (n =222)				
≤ 12 years	6 (28.6)	15 (71.4)	reference	
13-15 years	39 (57.4)	29 (42.6)	3.4 (1.16-9.72)	0.025
≥ 16 years	121 (91.0)	12 (9.0)	25.2 (8.25-77.05)	< 0.001
Multiple sex partners (n=222)				
No	112 (84.8)	20 (15.2)	reference	
Yes	54 (60.0)	36 (40.0)	0.3 (0.14-0.50)	< 0.001
Condoms use (n=222)				
Never	117 (80.7)	28 (19.3)	reference	
Often use	49 (63.6)	28 (36.4)	0.4 (0.22-0.78)	0.006

CI: Confidence internal, AOR: Adjusted Odd ratio, p<0.05: Statistically significant

with age (P<0.001), lack of formal education (P<0.001) and having only primary education (P=0.006), losing parents (P<0.001), lack of formal education and primary education of parents (P<0.001), employment of the parents (P<0.001), and Ubudehe category (P<0.001) (Table 4).

Bivariate analysis of familial, behavior, and societal factors associated with adolescent pregnancy: The analysis has shown adolescent pregnancy was significantly associated with parent's separation (P<0.001), having a sibling with a history of adolescent pregnancy (P=0.006), not receiving sexual education from parents

Table 6: *Multivariate analysis of the risk factors associated with adolescent pregnancy*

Risk factor	aOR	95% CI		P-value
		Lower	Upper	
Age group (Years)				
13-15	reference			
16-19	3.1	0.53	18.6	0.206
Adolescent's education				
Secondary	reference			
Primary	1.3	0.46	3.9	0.586
No formal education	1.8	0.14	24.1	0.638
Parents alive				
Both are alive	reference			
None is alive	1	0.23	3.7	0.911
Only father is alive	3.8	0.67	21.97	0.128
Only mother is alive	1.7	0.55	5.47	0.352
Father's education				
secondary and post-secondary	reference			
Primary	0.8	0.13	4.64	0.794
No formal education	1.15	0.16	8.40	0.888
Mother's education				
Secondary and post-secondary	reference			
Primary	0.4	0.14	5.28	0.864
No formal education	0.8	0.05	3.32	0.406
Father's occupation				
Business	reference			
Farmer	0.9	0.21	4.32	0.958
Government/non-government organization	0.3	0.02	3.13	0.291
Unemployed	4.6	0.38	56.03	0.225
Mother's occupation				
Business	reference			
Farmer	0.9	0.16	5.13	0.918
Government/non-government organization	1.3	0.08	19.75	0.855
Unemployed	6.1	0.43	86.80	0.181
Socioeconomic status (Ubudehe category)				

Continued on the next page....

Category 3	reference			
Category 2	5.6	2.06	14.61	0.001
Category 1	4.6	1.47	14.28	0.008
Parental separation/divorce				
No	reference			
Yes	1.9	0.48	7.64	0.359
Sibling with a history of adolescent pregnancy				
No	reference			
Yes	0.4	0.12	1.35	0.145
Received sexual education from parents				
Yes	reference			
No	4.5	1.71	11.82	0.002
Peer pressure to engage in sexual intercourse				
No	reference			
Yes	3	1.23	7.32	0.016
Lived in Kigali				
No	reference			
Yes	2.2	0.90	5.56	0.082
Age at first sexual intercourse (n =222)				
≤ 12 years	reference			
13-15 years	2.5	0.69	9.02	0.163
≥ 16 years	23	5.98	88.52	< 0.001
Multiple sex partners (n=222)				
Yes	reference			
No	0.4	0.12	1.43	0.166
Condoms use (n=222)				
Never	reference			
Often use	0.4	0.13	1.05	0.062

CI: Confidence internal, AOR: Adjusted Odd ratio, p<0.05: Statistically significant

(P<0.001), peer pressure to engage in sexual intercourse and live in Kigali (P<0.001), age at first sexual intercourse and multiple sex partners (P<0.001), and never using condoms (P=0.006) (Table 5)

Multivariable analysis of the risk factors associated with adolescent pregnancy: Multivariable analysis showed that these factors were independently and significantly associated with adolescent pregnancy: Ubudehe category 1 (Adjusted Odds Ratio [aOR] = 4.6, 95% confidence interval [CI] = 1.47-14.28, P=0.008),

Ubudehe category 2 (aOR = 5.6, 95%CI = 2.06-14.61, P<0.001); Not receiving sexual education from parents (aOR = 4.5, 95%CI = 1.71-11.82, P = 0.002), peer pressure to engage in sexual intercourse (aOR = 3, 95%CI = 1.23-7.32, P=0.016); age at first sexual intercourse (aOR = 23, 95%CI = 5.98-88.52, P<0.001) (Table 6).

DISCUSSION

This study aimed to identify predictors of adolescent pregnancy in the Karongi District of Western Province, Rwanda. Key findings indicated

that low socioeconomic status, inadequate sexual health education, peer influence, age at first sexual intercourse, and parental marital status were significantly associated with adolescent pregnancy. These findings resonate with previous studies and provide a comprehensive understanding of the factors influencing adolescent pregnancy in Karongi District and in Rwanda in general and would inform policies and strategies to solve this persisting, though decreasing, public health issue with devasting consequences on Rwandan youth [19].

This study found that adolescents from financially unstable families (Ubudehe categories 1 and 2) were significantly more likely to experience pregnancy compared to those from financially stable families (Ubudehe category 3). This finding aligns with a previous study that reported that low socioeconomic status was a significant predictor of adolescent pregnancy across African countries [20,21]. Similarly, studies in Ghana reported that adolescents from low-income families were at higher risk of being pregnant due to socioeconomic pressures [22,23]. These findings suggest that financial instability may expose adolescents to exploitation and risky behaviors due to the need to meet their basic needs. This might be attributed to the fact that adults with ill behaviors are more likely to take advantage of adolescents from families with poor financial status, and girls get into risks trying to satisfy their needs. Moreover, girls from low-income families are at high risk of substance and alcohol abuse, which increases their likelihood of unwanted pregnancy [24,25]. Thus, interventions aimed at improving the socioeconomic status of families in low-income communities are necessary to reduce the incidence of adolescent pregnancy.

Inadequate sexual health education was another significant predictor of adolescent pregnancy in this study. Adolescents who did not receive sexual health education were at a higher risk of becoming pregnant, a finding consistent with a study in Nigeria that emphasized the importance of sex education in preventing unwanted pregnancies [26]. Conversely, a study in the United States found that abstinence-only education was associated with higher rates of teen pregnancy, highlighting the importance of comprehensive sex education over restrictive educational approaches [27]. These findings underscore the critical role of sexual health education in equipping adolescents with the knowledge to make informed decisions about their

sexual health. It was found that comprehensive sexual health education, including information on contraception and safe sex practices, can significantly reduce the rates of adolescent pregnancy compared to abstinence-only education [28,29].

Peer pressure to engage in sexual intercourse was also identified as a significant risk factor for adolescent pregnancy. This finding is supported by another study that highlighted the influential role of peers in adolescent behavior, including engagement in risky sexual activities [30]. If an adolescent's friends are sexually active, they are prone to engage in unprotected sexual activity themselves and subsequently become pregnant [31]. A study on barriers to adolescent girls' access to sexual and reproductive health services further indicated that peer acceptance often leads adolescents to engage in risky behaviors, such as unprotected sex and substance abuse [30]. The consistency across these studies points to the need for interventions that address peer dynamics and promote healthy peer relationships. Targeted programs that address peer pressure and promote positive peer influences would decrease risky sexual behaviors and subsequent adolescent pregnancies.

This study also found that engaging in sexual intercourse at an older age (16 years and above) was associated with a higher risk of pregnancy. This may be due to societal pressures and peer mockery faced by older adolescents who have not yet had sexual experiences, leading them to engage in sexual activities without adequate knowledge or preparation [22,31]. This contrasts with findings from other studies where early sexual initiation was more commonly linked to higher pregnancy rates [32,33]. For instance, studies in Ethiopia reported that girls who initiated sexual activity at a younger age were more likely to experience pregnancy [32,34]. This discrepancy suggests that cultural and social contexts may play a crucial role in how age at first sexual intercourse influences pregnancy risk among adolescents. Age-specific and tailored sexual health interventions that address the specific needs and pressures faced by adolescents based on their age categories would reduce the incidence of pregnancy. This is supported by a systematic review showing that tailored interventions lead to fewer adolescent pregnancy incidences than untailored interventions [35].

Adolescents from separated or divorced parents

were found to be more likely to become pregnant compared to those from intact families. This finding is in line with studies from Ethiopia [36], Malaysia [37], and South Africa [38], which reported similar associations between parental marital status and adolescent pregnancy. It was found that adolescents from single-parent families are more likely to be insecurely attached and are more likely to get pregnant [39]. The stability provided by married parents may offer a protective effect by ensuring better supervision and communication about sexual health matters between adolescents and parents, reducing the risks of pregnancy. This highlights the importance of family dynamics in shaping adolescent behaviors and outcomes. Additionally, adolescents raised by single mothers were more likely to become pregnant than those raised by single fathers. This may be due to the perception that male parents are generally stricter with their daughters than female parents. Furthermore, in accordance with the cultural perspective in Rwanda, a household with a male presence might instill more fear and discipline compared to a household with only female figures. This cultural perspective might lead to single mothers imposing more unhealthy restrictive controls on their girls, which further exposes them to risky behaviors. A study done on single mother parenting and adolescent psychopathology indicated single mothers can exhibit more controlling behaviors, negatively affecting the development of a healthy sense of autonomy in their children, whereas a mother who engages in a less negative controlling behavior, allows their children to achieve developmentally appropriate levels of independence [40]. Moreover, single mothers and their families are at higher risk of financial instability, stress, and other mental health disorders than single fathers, which further exposes adolescent girls in those families to higher risks of pregnancy [39,41]. Moreover, girls with single mothers are more likely to drop out of school, increasing the risk of pregnancy [42]. These findings indicate that support programs for families undergoing separation or divorce are essential and would mitigate the increased risk of adolescent pregnancy.

This study provides a baseline knowledge of risk factors associated with pregnancy among adolescents in Karongi District. It could also inform policies to set preventive measures aimed at reducing adolescent pregnancies through evidence-based prevention programs in Karongi District. However, this study has some limitations for consideration. The case-control design was unmatched and prone to recall and selection bias. Furthermore, the generalizability of the results to other districts is limited since it was conducted in one district. Therefore, we recommend an extensive longitudinal study that includes the whole country with larger samples.

CONCLUSION

The research reveals that adolescent pregnancy is positively influenced by factors, such as low socioeconomic status, lack of sexual education from parents/guardians, peer pressure, and first sex intercourse at ≥ 16 years old. To prevent adolescent pregnancy, support for low-income families can help reduce the likelihood of adolescent pregnancy. Comprehensive sexual education that includes information on contraception, and safe sex practices can be prioritized. Poverty reduction programs are also essential to empower families, especially families of single mothers. Parents can play a crucial role by providing sexual health education and discussing risks with their children and should be engaged and educated to step up and educate their children. Peer pressure can also be reduced through mentoring programs and after-school activities. By addressing these risk factors, the number of adolescents who become pregnant can be reduced, promoting a healthy life.

REFERENCES

[1] "WHO. Preventing early pregnancy and poor reproductive outcomes among adolescents in developing countries. Geneva: WHO; 2011.". https://www.who.int/publications/i/item/9789241502214

[2] "UNFPA. (2013). Motherhood in childhood: facing the challenge of adolescent pregnancy. Paris: UNFPA." https://www.unfpa.org/press/state-world-population-2013-motherhood-childhood

[3] J. E. Darroch, V. Woog, and A. Bankole, "Adding it up : Costs and Benefits of Meeting the Contraceptive Needs of Adolescents," New York: Guttmacher Institute, no. May, pp. 1–16, 2016.

[4] S. Neal, Z. Matthews, M. Frost, H. Fogstad, A. V Camacho, and L. Laski, "Childbearing in adolescents aged 12-15 years in low resource countries: a neglected issue. New estimates

from demographic and household surveys in 42 countries.," Acta obstetricia et gynecologica Scandinavica, vol. 91, no. 9, pp. 1114–1118, Sep. 2012, doi: 10.1111/j.1600-0412.2012.01467.x.

[5] S. F. Wallington, "Akella, Devi and Jordan, Melissa (2014) 'Impact of Social and Cultural Factors on Adolescent Pregnancy,' Journal of Health Disparities Research and Practice: Vol. 8 : Iss. 1 , Article 3.," The Routledge Handbook of Language and Health Communication, vol. 8, no. 1, 2015, doi: 10.4324/9781315856971.ch11.

[6] O. V Panova, A. M. Kulikov, A. Berchtold, and J. C. Suris, "Factors Associated with Unwanted Pregnancy among Adolescents in Russia.," Journal of pediatric and adolescent gynecology, vol. 29, no. 5, pp. 501–505, Oct. 2016, doi: 10.1016/j.jpag.2016.04.004.

[7] H. Mezmur, N. Assefa, and T. Alemayehu, "Adolescent pregnancy and its associated factors in eastern ethiopia: A community-based study," International Journal of Women's Health, vol. 13, pp. 267–278, 2021, doi: 10.2147/IJWH.S287715.

[8] S. Caffe et al., "Looking back and moving forward: Can we accelerate progress on adolescent pregnancy in the Americas?," Reproductive Health, vol. 14, no. 1, pp. 1–8, 2017, doi: 10.1186/s12978-017-0345-y.

[9] Y. D. Wado, E. A. Sully, and J. N. Mumah, "Pregnancy and early motherhood among adolescents in five East African countries: A multi-level analysis of risk and protective factors," BMC Pregnancy and Childbirth, vol. 19, no. 1, pp. 1–11, 2019, doi: 10.1186/s12884-019-2204-z.

[10] T. Ganchimeg et al., "Maternal and perinatal outcomes among nulliparous adolescents in low- and middle-income countries: A multi-country study," BJOG: An International Journal of Obstetrics and Gynaecology, vol. 120, no. 13, pp. 1622–1630, 2013, doi: 10.1111/1471-0528.12391.

[11] S. J. Phillips and M. T. Mbizvo, "Empowering adolescent girls in Sub-Saharan Africa to prevent unintended pregnancy and HIV: A critical research gap.," International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics, vol. 132, no. 1, pp. 1–3, Jan. 2016, doi: 10.1016/j.ijgo.2015.10.005.

[12] G. M. Kassa, A. O. Arowojolu, A. A. Odukogbe, and A. W. Yalew, "Prevalence and determinants of adolescent pregnancy in Africa: A systematic review and Meta-analysis 11 Medical and Health Sciences 1117 Public Health and Health

Services," Reproductive Health, vol. 15, no. 1, pp. 1–18, 2018, doi: 10.1186/s12978-018-0640-2.

[13] M. Najafian, K. B. Karami, M. Cheraghi, and R. Mohammad Jafari, "Prevalence of and Some Factors Relating with Unwanted Pregnancy, in Ahwaz City, Iran, 2010," ISRN Obstetrics and Gynecology, vol. 2011, pp. 1–4, 2011, doi: 10.5402/2011/523430.

[14] World Health Organization (WHO), "WHO Recommendations on Adolescent Health: Guidelines Approved by the WHO Guidelines Review Committee," World Health Organization, no. August, pp. 1–30, 2017.

[15] A. Kirbas, H. C. Gulerman, and K. Daglar, "Pregnancy in Adolescence: Is It an Obstetrical Risk?," Journal of Pediatric and Adolescent Gynecology, vol. 29, no. 4, pp. 367–371, 2016, doi: https://doi.org/10.1016/j.jpag.2015.12.010.

[16] National Institute of Statistics of Rwanda and Rwanda Ministry of Health, Rwanda Demographic Health Survey, 2019-20. 2021.

[17] NISR, Ministry of Health (MOH) [Rwanda], and ICF International, Rwanda Demographic and Health Survey 2014-2015. 2015.

[18] D. SE. Theogene M, David HO, Vedaste N, "Theogene M, David HO, Vedaste N, Dieudonné SE. Prevalence and associated factors to adolescent pregnancies in Mugonero hospital catchment area.," vol. 1473, no. March, pp. 8–10, 2019.

[19] D. Uwizeye, R. Muhayiteto, E. Kantarama, S. Wiehler, and Y. Murangwa, "Prevalence of adolescent pregnancy and the associated contextual correlates in Rwanda," Heliyon, vol. 6, no. 10, p. e05037, Oct. 2020, doi: 10.1016/j.heliyon.2020.e05037.

[20] I. Yakubu and W. J. Salisu, "Determinants of adolescent pregnancy in sub-Saharan Africa: a systematic review," Reprod Health, vol. 15, no. 1, p. 15, Dec. 2018, doi: 10.1186/s12978-018-0460-4.

[21] C. Odimegwu and S. Mkwananzi, "Factors Associated with Teen Pregnancy in sub-Saharan Africa: A Multi-Country Cross-Sectional Study," Afr J Reprod Health, vol. 20, no. 3, pp. 94–107, Sep. 2016, doi: 10.29063/ajrh2016/v20i3.14.

[22] M. Amoadu et al., "Socio-cultural factors influencing adolescent pregnancy in Ghana: a scoping review," BMC Pregnancy Childbirth, vol. 22, no. 1, p. 834, Nov. 2022, doi: 10.1186/s12884-022-05172-2.

[23] B. Y. A. Asare, D. Baafi, B. Dwumfour-Asare, and A.-R. Adam, "Factors associated with

adolescent pregnancy in the Sunyani Municipality of Ghana," International Journal of Africa Nursing Sciences, vol. 10, pp. 87–91, 2019, doi: 10.1016/j.ijans.2019.02.001.

[24] H. S. Connery, B. B. Albright, and J. M. Rodolico, "Adolescent substance use and unplanned pregnancy: strategies for risk reduction," Obstet Gynecol Clin North Am, vol. 41, no. 2, pp. 191–203, Jun. 2014, doi: 10.1016/j.ogc.2014.02.011.

[25] M. Namukisa, O. Kamacooko, J. F. Lunkuse, E. Ruzagira, M. A. Price, and Y. Mayanja, "Incidence of unintended pregnancy and associated factors among adolescent girls and young women at risk of HIV infection in Kampala, Uganda," Front Reprod Health, vol. 5, p. 1089104, 2023, doi: 10.3389/frph.2023.1089104.

[26] U. E. Osadolor, E. O. Amoo, D. E. Azuh, I. Mfonido-Abasi, C. P. Washington, and O. Ugbenu, "Exposure to Sex Education and Its Effects on Adolescent Sexual Behavior in Nigeria," Journal of Environmental and Public Health, vol. 2022, pp. 1–10, Jun. 2022, doi: 10.1155/2022/3962011.

[27] K. F. Stanger-Hall and D. W. Hall, "Abstinence-Only Education and Teen Pregnancy Rates: Why We Need Comprehensive Sex Education in the U.S," PLoS ONE, vol. 6, no. 10, p. e24658, Oct. 2011, doi: 10.1371/journal.pone.0024658.

[28] A. Cheedalla, C. Moreau, and A. E. Burke, "Sex education and contraceptive use of adolescent and young adult females in the United States: an analysis of the National Survey of Family Growth 2011-2017," Contracept X, vol. 2, p. 100048, 2020, doi: 10.1016/j.conx.2020.100048.

[29] M. T. Mbizvo et al., "Comprehensive sexuality education linked to sexual and reproductive health services reduces early and unintended pregnancies among in-school adolescent girls in Zambia," BMC Public Health, vol. 23, no. 1, p. 348, Feb. 2023, doi: 10.1186/s12889-023-15023-0.

[30] M. Janighorban, Z. Boroumandfar, R. Pourkazemi, and F. Mostafavi, "Barriers to vulnerable adolescent girls' access to sexual and reproductive health," BMC Public Health, vol. 22, no. 1, p. 2212, Nov. 2022, doi: 10.1186/s12889-022-14687-4.

[31] L. Widman, S. Choukas-Bradley, S. W. Helms, and M. J. Prinstein, "Adolescent Susceptibility to Peer Influence in Sexual Situations," J Adolesc Health, vol. 58, no. 3, pp. 323–329, Mar. 2016, doi: 10.1016/j.jadohealth.2015.10.253.

[32] S. D. Kebede et al., "Spatial distribution and determinants of Early sexual initiation in Ethiopia," BMC Public Health, vol. 24, no. 1, p. 1536, Jun. 2024, doi: 10.1186/s12889-024-19057-w.

[33] M. Arefaynie, M. Yalew, Y. Damtie, and B. Kefale, "Determinants of early sexual initiation among female youth in Ethiopia: a multilevel analysis of 2016 Ethiopian Demographic and Health Survey," BMC Womens Health, vol. 20, no. 1, p. 205, Sep. 2020, doi: 10.1186/s12905-020-01069-4.

[34] B. E. Birhanu, D. L. Kebede, A. B. Kahsay, and A. B. Belachew, "Predictors of adolescent pregnancy in Ethiopia: a multilevel analysis," BMC Public Health, vol. 19, no. 1, p. 601, Dec. 2019, doi: 10.1186/s12889-019-6845-7.

[35] E. Brown et al., "Improving the Sexual Health of Young People (under 25) in High-Risk Populations: A Systematic Review of Behavioural and Psychosocial Interventions," Int J Environ Res Public Health, vol. 18, no. 17, p. 9063, Aug. 2021, doi: 10.3390/ijerph18179063.

[36] Y. Ayanaw Habitu, A. Yalew, and T. Azale Bisetegn, "Prevalence and Factors Associated with Adolescent Pregnancy, Northeast Ethiopia, 2017: A Cross-Sectional Study," Journal of Pregnancy, vol. 2018, pp. 1–7, Nov. 2018, doi: 10.1155/2018/1714527.

[37] S. Abdullah, S. Abd. Ghani, S. S. S. M. S. Akil, and N. M. Faudzi, "Relationship of Parent and Peer Attachment with Coping Strategy among Adolescentrs Pregnancy," Procedia - Social and Behavioral Sciences, vol. 114, pp. 334–338, Feb. 2014, doi: 10.1016/j.sbspro.2013.12.707.

[38] C. Odimegwu and S. Mkwananzi, "Family structure and community connectedness: Their association with adolescent pregnancy in South Africa," Journal of Psychology in Africa, vol. 28, no. 6, pp. 479–484, Nov. 2018, doi: 10.1080/14330237.2018.1544390.

[39] K. Chavda and V. Nisarga, "Single Parenting: Impact on Child's Development," Journal of Indian Association for Child and Adolescent Mental Health, vol. 19, no. 1, pp. 14–20, Jan. 2023, doi: 10.1177/09731342231179017.

[40] I. Daryanani, J. L. Hamilton, L. Y. Abramson, and L. B. Alloy, "Single Mother Parenting and Adolescent Psychopathology," J Abnorm Child Psychol, vol. 44, no. 7, pp. 1411–1423, Oct. 2016, doi: 10.1007/s10802-016-0128-x.

[41] R. J. Stack and A. Meredith, "The Impact of Financial Hardship on Single Parents: An Exploration of the Journey From Social Distress

to Seeking Help," J Fam Econ Iss, vol. 39, no. 2, pp. 233–242, Jun. 2018, doi: 10.1007/s10834-017-9551-6.

[42] J. L. Sobngwi-Tambekou, M. Tsague-Agnoux, L. K. Fezeu, and F. Ndonko, "Adolescent childbearing and school dropout in a sample of 18,791 single mothers in Cameroon," Reprod Health, vol. 19, no. 1, p. 10, Dec. 2022, doi: 10.1186/s12978-021-01323-4.

Caregivers' Knowledge, Attitudes, and Practices Regarding Intestinal Parasite Prevention in Children Under 5 Years of Age in Masaka Sector, Kigali, Rwanda

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ABSTRACT

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INTRODUCTION: Intestinal parasitic infections pose a significant health burden globally, particularly in developing nations. This study aims to assess the knowledge, attitudes, and practices (KAP) of caregivers regarding the prevention of intestinal parasites among children under 5 years of age in Masaka sector of Kigali, Rwanda.

METHODS: A descriptive cross-sectional study was conducted using multistage sampling, incorporating purposive and simple random sampling methods to recruit 383 participants.

RESULTS: This study indicated a high level of awareness among participants regarding symptoms associated with intestinal parasites, with 86.1% recognizing vomiting and 83% acknowledging diarrhea. However, only 26.1% were aware of weight loss as a symptom. Factors such as symptom intensity, cultural differences, and educational backgrounds influenced awareness levels. Notably, 61.1% of caregivers rated preventing infections as "very important," while 26.9% considered it "extremely important," reflecting a strong consensus on safeguarding child health. Furthermore, over 70% emphasized the significance of handwashing, clean water, and sanitation in preventing intestinal parasites.

CONCLUSION: While caregivers demonstrate understanding of common symptoms and sources of intestinal parasite infection, knowledge gaps persist regarding prevention strategies. Nonetheless, a significant majority of caregivers exhibit commendable preventive practices.
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INTRODUCTION

Intestinal parasitic infections (IPIs) affect a significant portion of the global population, however; the prevalence of disease varies from one country to another [1]. The prevalence of parasitic infections is 50% in developed countries while it reaches around 95% in most of the developing countries [2]. According to the World Health Organization (WHO), around 3.5 billion people worldwide are affected by the IPIs, and over 450 million of these people develop clinical morbidity, many of whom are children of the developing countries [3]. Around 300 million people worldwide are severely ill with these worms and of those, 50% are school-age children [4].

Despite the fact that IPIs rarely result in mortality, the problem's scope results in a sizable number of linked deaths worldwide, for example, about 39 million disability adjusted life years (DALYs) are attributed to IPIs and these thus represent a substantial economic burden [5].

Africa is considered as a high-burden regions for intestinal parasites with prevalence rates which could be as high as 80% or even more [6]. Especially in Sub-Saharan Africa like Ethiopia, Nigeria, and Somalia, IPIs are among public health issues and the majority of the affected are children. According to the estimates, in certain areas IPIs cause between 25 and 75% of all childhood illnesses, account for about 14% of outpatient visits and 16% of hospital admissions, and this causes an average of 35 days of illness per year in children under the age of five and below [7]. Infection, poverty, poor productivity, and insufficient socioeconomic development are all exacerbated by the morbidity brought on by these infections, which places a heavy strain on the health system [6]. Areas with inadequate sanitation facilities, poor hygiene practices, and limited access to healthcare are more susceptible to increased infection rates [8,9].

IPIs continue to be a major cause of children's morbidity and mortality in underdeveloped counties including Rwanda [8,9]. Ascaris lumbricoides, Entamoeba histolytica and Giardia lamblia are the most prevalent IPIs causative agents respectively [10]. According to the 2019-2020 Rwanda Demographic Health survey, IPIs were more prevalent in children aged 6 months and above with 23% and 25% rates among those aged 6-11 months and 12-23 months respectively [8]. In addition, a high number of IPIs was seen in rural areas compared to urban areas of residence [8], which showed that children above six months of age were more likely to have IPIs than the children less than 6 months (children between ths (23%) and those between 12-23 months (25%) in comparison to urban areas rural areas has high prevalence [8].

IPIs in Masaka sector are among the top 5 diseases received at Masaka Health Centre(HC) and little is known about the genesis of these ailment, therefore, this study aims to assess Knowledge, Attitude, and practice of caretakers towards prevention of intestinal parasites among under 5 aged children of Masaka sector.

METHODS

Study Design: This descriptive cross-sectional study was conducted in Masaka sector, one of the sectors of Kicukiro District, located in Kigali city, Rwanda. Masaka sector encompasses an area of 52.71 km2 and is subdivided into 6 cells. According to the population census conducted in August 2022, Masaka had a population of 78,788, with an estimated 10,069 children under the age of 5. The sector is served by two health centers, Masaka HC and Kabuga HC.

The study targeted caregivers of children under 5 years of age, including mothers, fathers, or hired assistants residing in Masaka sector. The sample size was determined using Cochran's formula [11]:

$$n_0 = \frac{Z^2 pq}{e^2}$$

Where: n is the required sample size; Z is the Z-score associated with the desired level of confidence. For a 95% confidence level, Z would be 1.96; P is the estimated proportion of caregivers with the desired knowledge, attitude, and practices (KAP) toward preventive measures of Intestinal Parasitic Infections (IPIs). In the absence of an estimate, a conservative estimate of 0.5 was utilized; E is the desired margin of error, representing the maximum acceptable difference between the true population proportion and the estimated proportion from the sample.

Applying the above formula, the study determined a sample size of 383 children.

Participants: Eligibility criteria for participation in this study included caregivers with children aged between 6 months and 5 years residing in or around the study area, with only one caregiver per household eligible. Caregivers with children under 6 months old, those who refused to participate, or did not sign the consent form were excluded.

Study Tool: A multistage sampling approach was employed, incorporating purposive sampling and simple random sampling techniques. The questionnaire, administered in the local language (Kinyarwanda), was completed by caregivers under the guidance of the investigators.

The data collection tool consisted of a questionnaire translated into the local language to enhance community engagement. The questionnaire was customized in kobo toolbox electronic software

to facilitate the data collection processes. Participation was contingent upon individuals agreeing to sign the consent form, with collected data promptly stored on the cloud account and managed exclusively by the investigators.

Data analysis: Data analysis was conducted using Statistical Package for Social Science (SPSS) version 28, with descriptive statistical analysis employed to generate and present findings through histograms, tables, and bar graphs.

Prior to commencement, ethical clearance was obtained from the Institutional Review Board (IRB) of the University of Rwanda, College of Medicine and Health Sciences (Ref: CMHS/ IRB/434/2023). Additionally, permission was granted by the director of corporate services of Masaka Sector, Kicukiro District in Kigali city, and the Executive Secretary of Masaka sector to conduct the research within the community.

Participation in the study was voluntary, with no financial incentives offered. Informed consent was obtained from each participant following a brief explanation of the research aims.

Ethical clearance was obtained from the Institutional Review Board (IRB) of the University of Rwanda,

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RESULTS

General Characteristics of Study Participants

Table 1 presents the demographic characteristics of the 383 caregivers who participated in the study in Masaka sector. Of these, 42% (163) were male, while 57.4% (220) were female. Regarding age, 71.8% (275) fell between 15 and 30 years, with the remaining 28.2% (108) between 31 and 60 years. In terms of the caregiver-child relationship, 77.3% (296) were parents, 16% (61) were guardians, and 6.2% (26) were classified as "others" (such as babysitters, siblings, or other relatives).

Table 1: *Characteristics of Respondents*

Variable	Frequency	Percentages
Gender		
Male	163	42.5%
Female	220	57.5%
Age		
15-30	275	71.8%
31-60	108	28.2%
Relationship with the child		
Parent	296	77.28%
Guardian	61	15.92%
Others	26	6.7%
Education level		
Non formal education	61	15.93%
Primary level	106	27.68%
Secondary level	179	46.74%
Higher education	37	9.66%
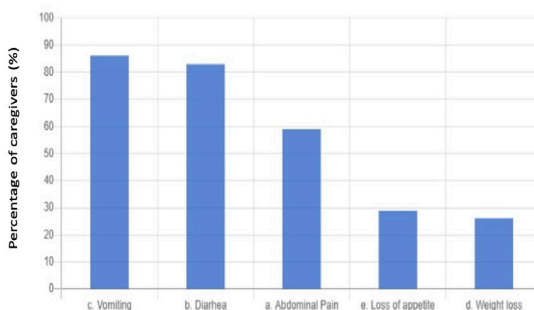
Figure 1: *Knowledge of Caregivers towards Intestinal Parasites infestation*
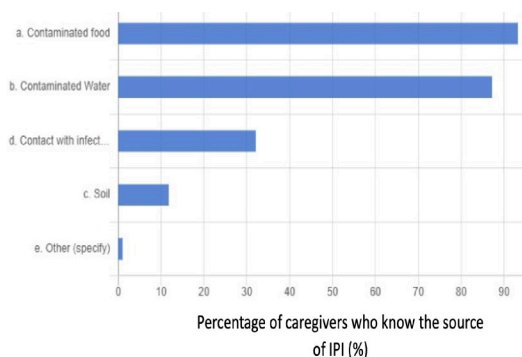
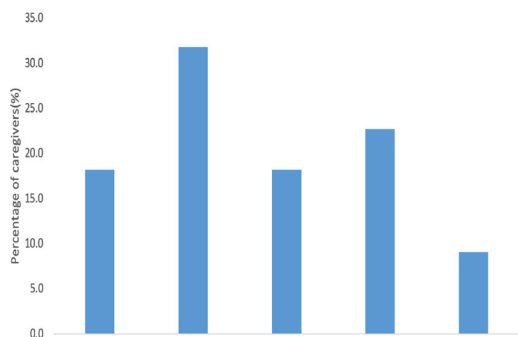**Figure 2:** *Knowledge of an individuals about the source of intestinal parasitic infection*

Figure 3: *Effects of Health education on the Attitudes of Caregivers towards Prevention of Intestinal Parasitic Infections*

Furthermore, 16% (61) of the respondents had no formal education, while 27.7% (106), 46.7% (179), and 9.6% (37) had attended primary, secondary, and university education levels, respectively.

The study revealed a notable level of awareness among participants, with 86.1% recognizing vomiting and 83% identifying diarrhea as symptoms of intestinal parasites (see Figure 1). Additional-ly, 59% are aware of abdominal pain, while 28.9% recognize loss of appetite.
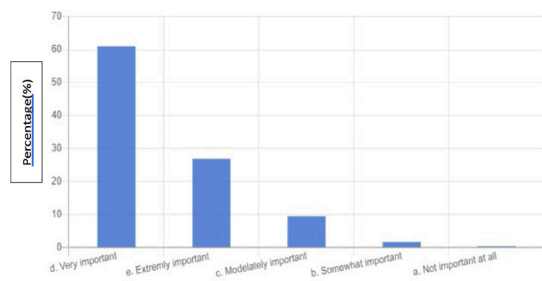
Figure 4: *Attitude of caregivers about the Importance of taking preventive measures*
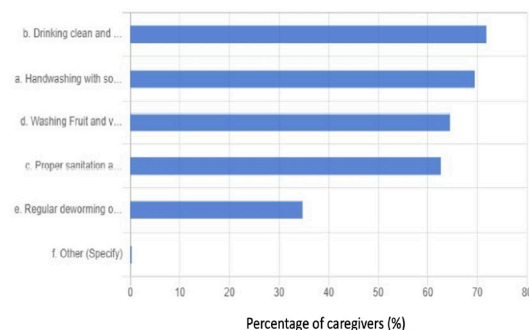
Figure 5a: *Practice applied by individuals in community for preventing Intestinal parasite infections*

However, aware-ness decreases for symptoms such as weight loss, with only 26.1% recognizing it as a potential sign of intestinal parasites (Figure

1). The majority, comprising 93.2%, recognize contaminated food as a primary mode of transmission, while 87.2% identify contaminated water as a significant route (Figure 2).

Additionally, a notable 32.1% acknowledge contact with infected individuals as a mode of transmission. How-ever, there is comparatively lower awareness, with only 11.7% associating soil with transmission (Figure2).

The attitudes of respondents towards preventing intestinal parasitic infections indicate a generally positive stance on the effectiveness of health education in reducing their prevalence. A significant portion, comprising 53%, strongly agree, demonstrating robust support for the notion that health education is a powerful strategy. Additionally, 29.7% express agreement, further con-tributing to a majority perspective favoring the role of health education. While 12.8% remain neutral, suggesting an opportunity for targeted educational initiatives to enhance understanding. Relatively low percentages of disagreement (3.1%) and strongly disagree (0.2%) (Figure 3).
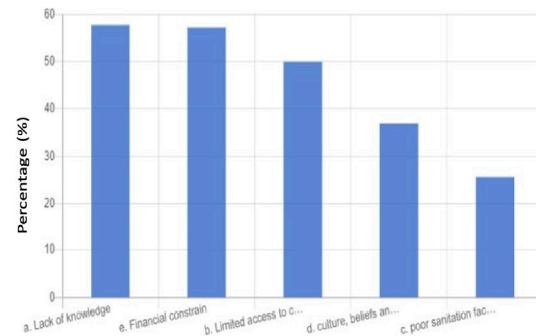
Figure 5b: *Challenges that affected the implementation of preventive measures against Intestinal parasite infections*

A notable 61.1% of respondents express the view that preventing such infections is "very important," highlighting widespread recognition of the importance of safeguarding young children's health from these preventable illnesses.

Furthermore, 26.9% of respondents consider preventing intestinal parasite infections in young children to be "extremely important," indicating a strong collective commitment to child health. Meanwhile, 9.4% find it "moderately important," suggesting varying degrees of importance among respondents. Lower percentages of "somewhat important" (1.5%) and "not important" (0.2%) indicate a prevailing consensus among respondents

regarding the critical importance of preventing intestinal parasitic infections in children (Figure 4).

Practices aimed at preventing intestinal parasitic infections in children reveal several positive trends in preventive behaviors. The majority of respondents prioritize key practices, with 71.8% emphasizing the importance of drinking clean water, 69.4% advocating for handwashing with soap and water, 64.5% stressing the washing of fruits and vegetables, and 62.6% recognizing the significance of proper sanitation and waste disposal (Figure 5a). However, the study also identifies challenges encountered in implementing these practices. The most prevalent challenges include a lack of knowledge (57.7%) and financial constraints (57.2%), highlighting the need for targeted educational campaigns and potential economic support to address these barriers. Additionally, limited access to clean water (49.9%), cultural beliefs and practices (36.9%), and inadequate sanitation facilities (25.6%) contribute to the challenges faced (Figure 5b).

DISCUSSION

Caregiver Knowledge on Intestinal Parasitic Infections

This study reveals that our targeted population possesses some knowledge concerning the signs and symptoms of intestinal parasite infections, with unanimous agreement on common indicators such as diarrhea, vomiting, and abdominal pain. Additionally, the majority of the population recognizes contaminated water and food as the primary sources of intestinal parasitic infections. However, despite this awareness, caregivers demonstrate insufficient knowledge regarding the prevention of intestinal parasitic infections in children under five years of age. Given the crucial role of knowledge in both recognition and prevention, these findings underscore a concerning gap.

These findings align with those of a study done in Uganda, where less than one-quarter of caregivers exhibited adequate knowledge about intestinal parasitic infections [12]. Furthermore, more than half of the caregivers surveyed were unable to identify more than two correct methods of preventing such infections.

However, McLennan's study [13] suggests that there may not necessarily be a correlation between biomedical knowledge and preventative actions. McLennan found that some caregivers with limited expertise still practiced appropriate preventive measures. This discrepancy may be attributed to different geographic contexts; for instance, McLennan's study was conducted in a poor Santo Domingo slum district, whereas ours took place in Masaka Sector, Kigali.

Caregiver Attitudes towards Preventing Intestinal Parasitic Infections

This study on caregiver attitudes towards preventing intestinal parasitic infections in young children unveils overwhelmingly positive sentiments among respondents. A substantial 61.1% express that preventing such infections is "very important," while 26.9% consider it "extremely important." These responses underscore a collective commitment to child health, reflecting widespread acknowledgment of the significance of safeguarding young children from preventable illnesses. The overall tone of attitudes is positive, highlighting a strong sense of responsibility towards child health [14].

However, despite this positive attitude towards intestinal parasites, less than half of the respondents are convinced that sickness can spread to other family members and result in growth retardation if left untreated. This suggests that respondents may not prioritize receiving treatment for the infection, possibly due to ignorance. Some caregivers may dismiss symptoms, especially if they do not cause significant discomfort to the children. These findings underscore the necessity for targeted public health interventions and educational campaigns to reinforce and support these positive attitudes [15].

Similarly, a study conducted among 120 pupils in two primary schools in Igbeagu community, Nigeria, revealed overwhelmingly positive attitudes of caregivers towards the prevention and treatment of intestinal parasitic infections among the respondents. An impressive 97.5% of participants expressed generally positive attitudes on this aspect [16].

Caregivers Practices toward Prevention of Intestinal Parasite Infection

To explore caregivers' basic hygiene practices concerning intestinal parasitic (IP) infections, they were queried about their hand hygiene habits, fruit washing practices, consumption of clean water, sanitation and hygiene practices, and proper deworming. As expected, the majority of respondents exhibited positive preventive

practices against intestinal parasites in this study. The high level of adherence to good practices can be attributed to respondents' strong understanding of the primary sources of intestinal parasites. This suggests that the knowledge possessed by these caregivers effectively translates into favorable practices [17]. This achievement is noteworthy, as not all knowledge necessarily leads to action. Reports have highlighted instances of inadequate preventive practices despite individuals possessing sound knowledge of various conditions. For example, a community-based study conducted in Ethiopia revealed that although 94.4% of participants exhibited good knowledge, 35.9% demonstrated poor practices regarding intestinal parasites [18].

Lack of knowledge and financial constraints were observed among most of the participants as a challenge in implementing these practices. Highlighting the necessity of focused educational initiatives and possible financial assistance to remove these obstacles. 96.6% of the respondents agreed that health education or training would be highly appreciated and might help them in preventing intestinal parasites infection [19].

CONCLUSION

The study findings highlight that while caregivers generally possess some knowledge about the signs and sources of intestinal parasitic infections (IPIs), there are notable gaps in understanding preventive measures, particularly for children under five years old. Despite positive attitudes toward prevention, a significant portion lacks awareness of the consequences of untreated infections. However, a commendable majority demonstrates good preventive practices, aligning with their solid knowledge of infection sources. Challenges such as financial constraints hinder full implementation of preventive measures. Therefore, targeted educational interventions are crucial to bridge knowledge gaps, dispel misconceptions, and bolster positive attitudes, while addressing identified challenges can enhance effective preventive practices in the community.

REFERENCES

[1] M. Seid, T. Yohanes, Y. Goshu, K. Jemal, and M. Siraj, "The effect of compliance to Hand hygiene during COVID-19 on intestinal parasitic infection and intensity of soil transmitted helminthes, among patients attending general hospital, southern Ethiopia: Observational study," PLoS ONE, vol. 17, no. 6 June, pp. 1–23, 2022, doi: 10.1371/journal.pone.0270378.

[2] N. Nkenfou, C. T. Nana, and V. K. Payne, "Intestinal Parasitic Infections in HIV Infected and Non- Infected Patients in a Low HIV Prevalence Region , West- Cameroon," vol. 8, no. 2, pp. 1–6, 2013, doi: 10.1371/journal.pone.0057914.

[3] M. Sackey, M. M. Weigel, and R. X. Armijos, "Predictors and Nutritional Consequences of Intestinal Parasitic Infections in Rural Ecuadorian Children," vol. 49, no. February, pp. 17–23, 2003.

[4] C. Izere, L. Agarwal, and C. Point, "ASSESSMENT AND MAPPING OF INTESTINAL PARASITIC INFECTIONS AND ITS," vol. 9, no. 2, pp. 19–32, 2021.

[5] V. Mehraj, J. Hatcher, S. Akhtar, G. Rafique, and M. A. Beg, "Prevalence and Factors Associated with Intestinal Parasitic Infection among Children in an Urban Slum of Karachi," vol. 3, no. 11, 2008, doi: 10.1371/journal.pone.0003680.

[6] S. Lustigman et al., "A research agenda for helminth diseases of humans: The problem of helminthiases," PLoS Negl. Trop. Dis., vol. 6, no. 4, 2012, doi: 10.1371/journal.pntd.0001582.

[7] C. Izere, "Assessment and Mapping of Intestinal Parasitic Infections and Associated Risk Factors from Different Northern Health Centers in Rwanda," no. December 2020, 2023, doi: 10.32474/CTBM.2020.02.000133.

[8] H. Survey, Rwanda. 2019.

[9] H. Survey, Rwanda. 2014.

[10] B. K. Niyizurugero E, Ndayanze JB, "prevalence of intestinal parasitic infections and associated risk factors among kigali institute of education kigali, Rwanda," Trop Biomed, vol. 30(4), no. prevalence of intestinal parasitic infections and associated risk factors among Kigali institute of education students in Kigali, Rwanda, pp. 718–726, 2013.

[11] W. G. Cochran, Sampling Techniques, Third Edition, Page 75 read with 51. 1963.

[12] K. Joseph, "Caregivers ' Knowledge , Attitudes , and Practices on Prevention of Diarrhoea in Children Under Five Years in Soweto Namuwongo an Undergraduate Research Paper Presented To the School ...," no. December 2012, 2014, doi: 10.13140/2.1.3186.8803.

[13] F. Curtale et al., "Knowledge, perceptions and behaviour of mothers toward intestinal helminths in Upper Egypt: Implications for control," Health Policy Plan., vol. 13, no. 4, pp. 423–432, 1998, doi: 10.1093/heapol/13.4.423.

[14] D. Chambers, A. Cantrell, and A. Booth, "Recognition of risk and prevention in safeguarding of children and young people: a mapping review and component analysis of service development interventions aimed at health and social care professionals," BMC Health Serv. Res., vol. 21, no. 1, pp. 1–11, 2021, doi: 10.1186/s12913-021-07257-8.

[15] K. B. Mukara, P. Waiswa, R. Lilford, and D. L. Tucci, "Knowledge and care seeking practices for ear infections among parents of under five children in Kigali, Rwanda: A cross-sectional study," BMC Ear Nose Throat Disord., vol. 17, no. 1, pp. 1–9, 2017, doi: 10.1186/s12901-017-0040-1.

[16] U. Mathiazhakan, "A Study To Assess The Knowledge , Attitude And Practice Of Caregiver Of Children Admitted With Diarrhoea At KMCH Hospital Coimbatore A Study To Assess The Knowledge , Attitude And Practice Of Caregiver Of Children Admitted With Diarrhoea At Kmch Hospital ," Int. J. Pharm. Biol. Sci., vol. 6, no. 1, pp. 16–22, 2016.

[17] A. Yoseph, A. Tamiso, and A. Ejeso, "Knowledge, attitudes, and practices related to COVID-19 pandemic among adult population in Sidama Regional State, Southern Ethiopia: A community based cross-sectional study," PLoS ONE, vol. 16, no. 1 January, pp. 1–19, 2021, doi: 10.1371/journal.pone.0246283.

[18] B. Galal, A. El-Aal, S. E. Nady, E. A. Shokr, and M. W. Shokry, "Awareness And Practices Of Preventive Behaviors Toward Intestinal Parasitic Infection Among Mothers Of Preschool Children," J. Posit. Sch. Psychol., vol. 6, no. 8, pp. 6290–6305, 2022.

[19] A. G. Azene, M. S. Workie, and A. M. Aragaw, "Knowledge, Attitude, and Prevention Practices Toward Coronavirus Disease 2019 in Ethiopia: A Systematic Review and Meta-Analysis," Curr. Ther. Res. - Clin. Exp., vol. 94, p. 100633, 2021, doi: 10.1016/j.curtheres.2021.100633.

Concurring the Silent Killer: How to improve hypertension management through Innovative Knowledge Systems in Nyamasheke District, Rwanda

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KEY MESSAGE

16.8% of the Rwandan population have hypertension, with the middle-aged being mostly affected.

In 2019, the World Health Organization (WHO) ranked Rwanda as the first country with the lowest hypertension treatment rate 10.5%.

Controlled hypertension can reduce premature death through complications such as Cardiovascular diseases, Kidney failures, and Stroke.

When the healthcare Providers are continuously exposed to refresher trainings, it will raise the Hypertension control rate from 37.8 to 50.1%

Increasing community NCDs Knowledge will be an innovative way for increasing Hypertension control rate from 37.8 to 48.7%.

Figure 1. *Health providers taking blood pressure measurements during the Healthy Heart Africa project launch in Kigali, Rwanda, in 2022 (Adapted from PATH.Org/Charles Wanga)*

PROBLEM STATEMENT

Globally, the growing burden of non-communicable diseases (NCDs), particularly hypertension, poses a significant challenge to public health and socio-economic development [1,2]. The World Health Organization (WHO) estimates that NCDs account for 41 million deaths worldwide every

year, with cardiovascular diseases contributing to approximately 17.9 million deaths annually [2], [3]. Hypertension as a major cause of premature death worldwide is estimated in 1.28 billion adults aged 30–79 years worldwide, most (two-thirds) living in low- and middle-income countries, and more than half of adults (58%) with hypertension remain undiagnosed and untreated. The prevalence of hypertension varies across regions and country income groups. The WHO African Region has the highest prevalence of hypertension (27%) compared to that of the WHO Region of the Americas 18% which is the lowest in the world [2].

In Rwanda, NCDs are responsible for an estimated 36% of total deaths, with cardiovascular diseases constituting a substantial portion of this figure [4], [5]. It is estimated that 16.8% of Rwandans have hypertension ; however, that figure jumps to 27.7% among those over 45 [6]. A situation where the middle-aged population experiences the highest prevalence of hypertension can negatively impact the overall progress of a community because it is the middle-aged population that has more stable job security that helps them to care for the older and younger generations. It is also this same age group that provides payment for medical services for the older generation and education for the younger generations in their families. In 2019, WHO ranked Rwanda as the first country with the lowest hypertension treatment rate (10.5%), which is not different from Rwanda's STEP survey 2022 findings, which found that 89.2% of people with hypertension were not on medication [7,8].

A significant proportion of the Rwandan population faces inadequate access to hypertension-related NCD services, which exacerbates the extent of the problem. This issue is primarily driven by two factors: 1) a widespread lack of knowledge and awareness about hypertension, its risk factors, and prevention strategies among the general population, and 2) low involvement of Healthcare providers in refresher courses and inability to comply with the NCDs Management guidelines. The consequences of these barriers include delayed diagnosis, poor management of hypertension, and increased morbidity and mortality rates, which in turn contribute to a rising disease burden on the healthcare system.

Since 2015, Rwanda has decentralized NCD management from the District hospital level to the Health center level, thereby enhancing access to care for all in need. In 2022, Rwanda initiated a community NCDs screening model by Community Healthcare Providers, which was being piloted in 3 districts [9]. One of those districts is Nyamasheke District, which is one of the largest and most populated districts in Rwanda about half a million [10]. Rwanda HMIS data showed that Nyamasheke District reported the highest number of hypertensive patients in the last quarter of the fiscal year 2022-2023. We believe that tackling the problem of lack of knowledge and awareness about hypertension in the population will increase the treatment rate, which will increase the hypertension control rate.

This policy brief will address the root causes of high rates of hypertension at both patient and health provider level. From the patient level, the policy brief will address the root causes that include poor medication adherence, patients having less knowledge on where and how to notify a healthcare provider of a medication side effect, lack of judgment regarding the various side effects
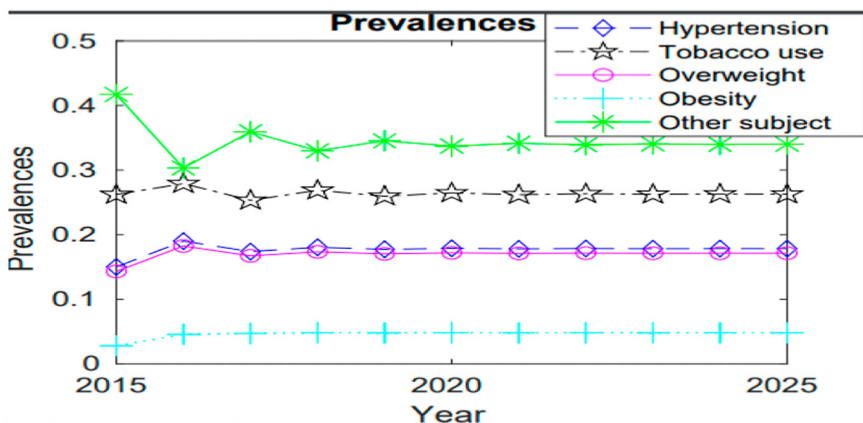

Figure 1: *Prevalence of NCDs, including hypertension from 2015-2025 (Source: Dukunde et al. [12])*
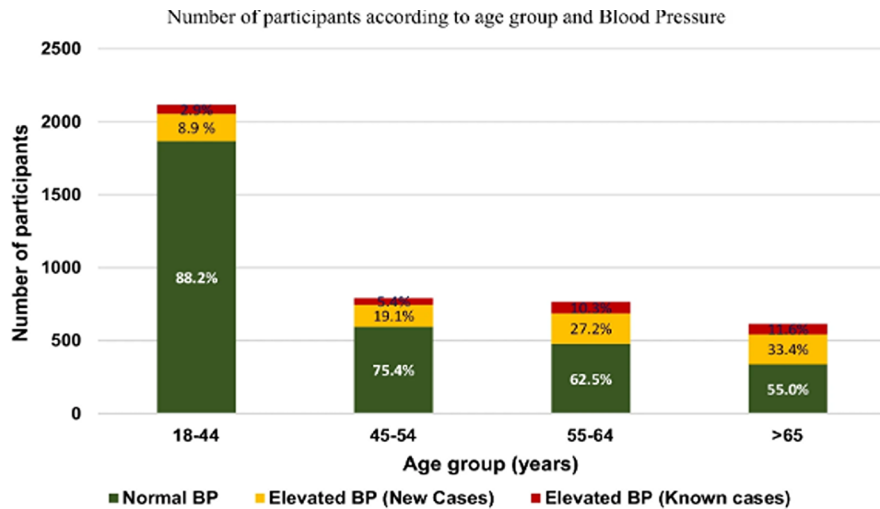
Figure 2: *Number of participants according to age group and blood pressure (Source: Ntanganda et al. [13])*

and management with other patients, and lack of follow-ups on medical checkups. At a healthcare provider level, the policy brief seeks to address the root causes of lack of appropriate hypertension management skills, workload overload, and staff shortage, lack of clarity about the side effects of medicine, and undetailed note-taking from patient files.

Some of the current actions that have been taken to address the root causes are the hypertension refresher courses for healthcare providers and involving community health workers (CHWs) to test community members for hypertension. However, the enrollment rates of hypertension refresher courses for healthcare providers remain low, and community knowledge about the NCD should be improved [11].

Figure 1 shows a projected steady prevalence of hypertension from 2015-2025, especially among people who are overweight. There is also a higher amount of tobacco use, which can also have an impact on hypertension management. Both smoking and exposure to secondhand smoke increase the risk for the buildup of plaque inside the arteries (atherosclerosis), a process that high blood pressure is known to accelerate [12].

Figure 2 shows higher blood pressure cases among the 55–64-year age group [13]. This is the age group that is normally financially responsible for family structures in Rwanda. Therefore, poorly managed hypertension within this age group can affect education support for younger generations and

overall support for the elderly population groups in Rwanda communities. It is in this case that it is important to improve hypertension management at both healthcare provider and community levels.

POLICY OPTIONS

Policy Options 1. Status Quo:
What: The conventional model of refresher courses is offered, but enrollment in HCP is low, and hypertensive patients meet HCP once a month at the health facility.
Why: The WHO recommends that refresher courses and clinical guidelines for hypertension be offered to HCPs for all regions.

Policy Option 2
What: increase the enrollment of Health care providers in refresher courses by adopting online continuous learning models.
Why: It is a strategy to ensure that healthcare providers are continuously learning and retaining knowledge from refresher courses.
It will enable Healthcare providers to manage Hypertension by complying with guidelines and evidence-based interventions.
This will increase the Hypertension control rate among people with Hypertension.
Feasibility is Moderate: because it will involve hiring developers of the system, hiring staff to maintain the system and address the challenges of the system, and also developing and shooting instruction videos.

Table 1: *Cost-effectiveness analysis of the policy options*

Uncontrolled cases of hypertension		**Status Quo**	**Policy2**	**Policy3**
	Outcome	45374	8834	9841
	Incremental outcome	-	36540	35533
	Cost of intervention	$24,278.65	$51,454.62	$238,631.71
	Cost per case reduction	-	$1.46	$6.72
	Incremental Cost	-	$27,175.97	$187,177.08
	ICER	-	$0.8	$5.21
	Political Feasibility	High	Moderate	High
	Operational Feasibility	High	High	High

ICER: Incremental cost-effectiveness ratio

Policy Option 3

What: Increase community NCD knowledge through Village NCDs Ambassadors

Why: This will increase knowledge of people with hypertension and create a network of support among people with Hypertension in the village.

It will prevent the dropout of patients into the NCDs Program, which will bring good adherence to medication.

It will also help to address challenges that patients are facing regarding doing follow-up at Health Facilities and adherence to medication.

Feasibility is High: because it has been tried in an HIV program and it is showing positive results, and it will involve hypertensive patients.

The overall objective of the policy options is to decrease the prevalence rate of hypertension through proper management at both clinical and community levels. Policy option 2 tends to the low enrollment of hypertension refresher courses by healthcare providers by promoting the e-learning module of the course as a means to give healthcare providers the flexibility of enrolling for the course at a place of their own convenience. This eliminates burdensome expenses such as transport, accommodation, and physical learning materials. It would also allow the flexibility of healthcare providers working in understaffed healthcare facilities adequate time to enroll and facilitate the refresher courses [14]. This policy option would set an example of how to embrace technological advancements in Rwanda's hypertension refresher courses by providing personalized, engaging, and accessible e-learning opportunities that would be tailored to meet the needs of healthcare providers attending to hypertension patients in Rwanda. The adoption of this policy option is especially befitting

at this time in Rwanda, where the E-learning Africa conference will be held in Kigali in 2024 under the theme, "Education fuels innovation, Investment Amplifies Skills: Africa's vibrant leap forward."

Policy option 3 seeks to decrease hypertension prevalence by engaging community members as part of the solution to the problem. This option would equip hypertension ambassadors through multidisciplinary team workshops so that they can effectively guide community members towards adopting healthier ways of living that would contribute to their better management of hypertension at home. The ambassadors would be trained to guide different population groups about how to properly manage hypertension based on their food consumption patterns, their coping mechanisms regarding stress, and overall health-seeking behaviors that are influenced by their culture and religion. With this policy option, it has been identified that men tend to abuse alcohol and tobacco as a way of coping with stress because of gender norms where men are expected to not express their negative emotions [6].

Thus, it is essential that community-level training workshops for NCD ambassadors include experts in alcohol and tobacco abuse to teach the ambassadors about the link between alcohol and tobacco abuse and hypertension. The community-level workshops will also include nutritionists who will teach about healthier eating patterns that are essential for hypertension management at the community level. In this case, the nutritionist would address the issue of the gendered consumption of fruits and vegetables, where cultural and religious norms have prescriptions about how men and women should consume fruits and vegetables. For example, the association of meat consumption

Table 2: *Breakdown of what should happen to implement the intervention*

Policy Option 2	Policy Option 3
Continue with conventional method of providing refresher courses to healthcare providers	Organize workshops to increase knowledge of Non-Communicable Diseases (NCDs) ambassadors about living with hypertension in the community
Develop E-learning materials for the refresher course	These workshops should consist of multidisciplinary facilitators that are inclusive of:
Develop instruction videos to be included in the online module	-nutritionists
	-Alcohol and tobacco abuse specialists
	-NCD specialists
	These facilitators will collectively develop a tool to train the community NCD ambassadors
Hire a developer to develop the system of E-learning	Select 15 Sectors NCD ambassadors, and 1176 village NCD ambassadors
Tend to the monthly fee for maintaining the system domain	Communication fee for ambassadors to keep contact with Hypertension patients

with masculinity and the association of fruit and vegetable consumption with femininity [15,16,17].

The economic evaluation results for improving hypertension control in Rwanda, more specifically Nyamasheke District, involves three interventions: (i) Status quo; (ii) increase the enrollment of Health care providers in refresher courses by adopting online continuous learning models, and (iii) Increase community NCDs Knowledge through Village NCDs Ambassadors

Among these, increasing the enrollment of health care providers in refresher courses by adopting online continuous learning models is the most cost-effective policy with a cost of $51,454.62 with the improvement of 12.3% of controlled hypertensive patients, translating to ICER of $0.8 (Table 1). Increasing community NCD knowledge through Village NCD ambassadors also improves the Control rate at 10.9%, but it does so at a higher cost compared to our policy option 2. However, implementing each intervention is far below the ICER threshold for a lower-income country such as Rwanda. In this case, we favor adopting both policy options to improve controlled hypertension cases in the Nyamasheke District.

Combining political and operational feasibility assessments, the results emphasize that increasing the enrollment of health care providers in refresher courses by adopting online continuous learning models can contribute highly to addressing the problem of high uncontrolled rates among hypertensive patients in Rwanda.

RECOMMENDATIONS AND NEXT STEPS

We recommend the intervention of combining policy options 2 and 3 as this will contribute towards controlling hypertension cases by 12.3% and 10.9%, respectively, in the district. This will assist with keeping people healthier in the most cost-effective way, which also translates to securing the livelihoods and upkeep of the young and elderly who are under the care of the population group affected mainly by hypertension. Table 2 shows the breakdown of implementation procedures of these policy options.

In implementing these policy options, we take lessons from the successes in Brazil, where the Agita Sao Paulo Program successfully increased community awareness about hypertension and promoted healthy lifestyles by organizing community workers who encouraged physical activity and a balanced diet [18].

With our policy option 3, we take lessons from the adoption of the e-learning refresher courses in the United States of America (USA), where the combination of the e-learning and conventional modules assisted health workers with remembering course materials over longer periods of time and helped them perform an average of 3.4 more skills

compared to the control group that only did the conventional refresher course [14].

It is needed to take actions to increase the control rate of hypertension in Rwanda to avoid further complications that may lead to premature death and hinder the health progress that Rwanda has made so far.

REFERENCES

[1] S. Ramesh and K. Kosalram, "The burden of non-communicable diseases: A scoping review focus on the context of India," J. Educ. Health Promot., vol. 12, p. 41, 2023, doi: 10.4103/jehp.jehp_1113_22.

[2] WHO, "Noncommunicable diseases." [Online]. Available: https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases

[3] WHO, "Noncommunicable diseases." Accessed: Jun. 30, 2023. [Online]. Available: https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases

[4] C. M. Ruhara, S. Abdool Karim, A. Erzse, A.-M. Thow, S. Ntirampeba, and K. J. Hofman, "Strengthening prevention of nutrition-related non-communicable diseases through sugar-sweetened beverages tax in Rwanda: a policy landscape analysis," Glob. Health Action, vol. 14, no. 1, p. 1883911, Jan. 2021, doi: 10.1080/16549716.2021.1883911.

[5] J. B. Niyibizi et al., "Perceived cardiovascular disease risk and tailored communication strategies among rural and urban community dwellers in Rwanda: a qualitative study," BMC Public Health, vol. 22, no. 1, p. 920, Dec. 2022, doi: 10.1186/s12889-022-13330-6.

[6] M. R. Nahimana et al., "A population-based national estimate of the prevalence and risk factors associated with hypertension in Rwanda: implications for prevention and control," BMC Public Health, vol. 18, no. 1, p. 2, Dec. 2018, doi: 10.1186/s12889-017-4536-9.

[7] RBC, "Second Rwanda non-communicable diseases risk factors study (STEP 2022)," 2023. [Online]. Available: https://www.rbc.gov.rw/fileadmin/user_upload/report23/STEPS%20Booklet.pdf

[8] J. Uwimana Nicol, J. Nganabashaka, K. Tumusiime, T. Young, E. Rehfuess, and J. Burns, "Taking stock of population-level interventions targeting risk factors for hypertension and diabetes in Rwanda and South Africa: methodological reflections and lessons learnt from conducting a multi-component situational analysis," BMC Public Health, vol. 23, no. 1, p. 1630, Aug. 2023, doi: 10.1186/s12889-023-16537-3.

[9] J. B. Niyibizi et al., "Community Health Worker-Led Cardiovascular Disease Risk Screening and Referral for Care and Further Management in Rural and Urban Communities in Rwanda," Int. J. Environ. Res. Public. Health, vol. 20, no. 9, p. 5641, Apr. 2023, doi: 10.3390/ijerph20095641.

[10] "Menya Nyamasheke," Akarere ka Nyamasheke. [Online]. Available: https://www.nyamasheke.gov.rw/akarere

[11] A. A. Baumann et al., "Dissemination and Implementation Program in Hypertension in Rwanda: Report on Initial Training and Evaluation," Glob. Heart, vol. 14, no. 2, p. 135, Jun. 2019, doi: 10.1016/j.gheart.2019.06.001.

[12] A. Dukunde, J. M. Ntaganda, J. Kasozi, and J. Nzabanita, "Prediction of the Prevalence of Hypertension and Associated Risk Factors in Rwanda Using Gibbs Sampling Method," Dis. Basel Switz., vol. 11, no. 2, p. 87, Jun. 2023, doi: 10.3390/diseases11020087.

[13] E. Ntaganda et al., "High rates of undiagnosed and uncontrolled hypertension upon a screening campaign in rural Rwanda: a cross-sectional study," BMC Cardiovasc. Disord., vol. 22, no. 1, p. 197, Dec. 2022, doi: 10.1186/s12872-022-02606-9.

[14] T. M. Smith, "It works: E-learning module fills gaps in BP measurement training."

[15] R. Prattala, L. Paalanen, D. Grinberga, V. Helasoja, A. Kasmel, and J. Petkeviciene, "Gender differences in the consumption of meat, fruit and vegetables are similar in Finland and the Baltic countries," Eur. J. Public Health, vol. 17, no. 5, pp. 520–525, Oct. 2007, doi: 10.1093/eurpub/ckl265.

[16] S. K. Stanley, C. Day, and P. M. Brown, "Masculinity Matters for Meat Consumption: An Examination of Self-Rated Gender Typicality, Meat Consumption, and Veg*nism in Australian Men and Women," Sex Roles, vol. 88, no. 3–4, pp. 187–198, Feb. 2023, doi: 10.1007/s11199-023-01346-0.

[17] K. C. Sumpter, "Masculinity and Meat Consumption: An Analysis Through the Theoretical Lens of Hegemonic Masculinity and Alternative Masculinity Theories," Sociol. Compass, vol. 9, no. 2, pp. 104–114, Feb. 2015, doi: 10.1111/soc4.12241.

[18] S. M. Matsudo et al., "The Agita São Paulo

Program as a model for using physical activity to promote health," Rev. Panam. Salud Pública, vol. 14, no. 4, pp. 265–272, Oct. 2003, doi: 10.1590/S1020-49892003000900007.

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About the Rwanda Public Health Bulletin (RPHB)

The Rwanda Public Health Bulletin (RPHB) is a printed and open access, peer-reviewed journal, published as the flagship scientific and technical periodical publication. RPHB is a public health bulletin launched in March 2019 by the Rwandan Ministry of Health, through the Rwanda Biomedical Centre (RBC) in collaboration with the CDC Foundation and with support from Bloomberg Philanthropies Data for Health Initiative.

Mission

To serve as a scientific information dissemination platform of national and international significance, mainly in areas related to the Rwanda Ministry of Health's essential mission to strengthen national and local health systems and improve the health of the people of Rwanda. The Rwanda Public Health Bulletin publishes disease surveillance summaries, public health response guidelines, public health notices, case reports, outbreak reports, original research papers, and policy briefs among others. It generally features issues of importance to its targeted audience, which is health professionals, academic researchers, policymakers and anybody interested in health issues. Articles for publication are received from doctors, nurses, allied health professionals, students, policymakers, government bodies, non-governmental bodies and others.

Aim

To bridge the gap in public health information sharing between policymakers, researchers, health professionals and practitioners.

Publisher

RPHB is a publication of the Rwanda Health Communication Centre (RHCC) which is the communication arm of the Rwanda Ministry of Health and operating under the Rwanda Biomedical Centre (RBC).

Registration

INSTRUCTIONS TO AUTHORS

All works submitted to this bulletin will have to belong to the types of articles stated below:

1. ORIGINAL RESEARCH

Referred to as "Primary Research" pioneer in a determined domain. It can be from various aspects: Clinical features, pathophysiology, biochemistry, molecular biology, etc.

THE TITLE

The title of the article should be concise and informative. It should contain enough thoughts on the subject.

ABSTRACT

Abstract of 250 words maximum must accompany each manuscript and be divided into 4 paragraphs with the following headings and MeSH keywords:

Introduction: stating the purposes/aims of the work; the research undertaken, the hypothesis tested or the procedure evaluated.
Materials and methods: briefly stating what was done and what materials were used, including the number of subjects, the methods to assess the data and to control bias.
Results: Providing key findings of the study, including indicators of statistical significance, actual numbers, as well as percentages.
Conclusion: Summarizing in 1 or 2 sentences the work on the basis of the findings. It emphasizes new and important aspects of the study or observations.

THE MAIN TEXT

The text of observational and experimental articles is divided into sections with the following headings: Introduction: should always begin the text, and requires brevity and focuses. It conveys the nature and purpose of the work, and quotes the relevant literature. Only strictly pertinent background information is necessary for understanding why the topic is important. We suggest the final paragraph clearly states the hypothesis or purpose of the study.

METHODS

Details of clinical and technical procedures should follow the introduction. A clear description of the selection of the observational or experimental subjects should be given. The identification of all aspects of the study, its reasoning, and the related relevance should be explicitly justified. In case, the study was done in a particular way, the guiding principles should all be clarified. Exclusion and inclusion criteria or partial inclusion, the reliability index, the confidentiality index, the analysis step, and the data collection processes should be also carefully specified. This section should provide sufficient details on the methods, instrumentation, procedures, all drugs and chemicals used (including generic names, doses, routes of administration). It should allow other workers to reproduce the study if necessary.

This section should also state the self-evaluation of the study by: independent/consensus readings blinded or unblinded to other information and estimate the fluctuation of recall biases by random ordering of studies.

Be clear about the retrospective or prospective nature of the study. Finally, provide references to established methods, including statistical methods that have been published, forthcoming, or that may not be well known. New description or substantially modified methods may be used however, give reasons for the use of these techniques, and evaluate their limitations. Statistical methods should be described with enough details to enable a knowledgeable reader with access to the original data to verify the reported results. A general description of methods would be defined in the methods section, whereas a specific statistical method used into analysis would be summarized in the results section. Any general use of the computer program should be

specified, and more details have to be clarified about any randomization issues.

RESULTS

Logical sequence of presentation of results is required in the text; along with tables, and illustrations. Repetition of data from illustrations into the text should be avoided; however, emphasize or summary of only important observations would be helpful. Avoid the ''non-technical use'' of technical terms in statistics which should be defined and reserved for the right purpose. Moreover, define all those statistical terms aside with or including abbreviations and/or most used symbols. Any complication and/or unexpected finding should be reported and the more possibly explained and the author should report lost to follow up and dropouts from a clinical trial.

DISCUSSION

Use ample subheadings. Emphasize the new and important aspects of the study and the conclusions that follow from them. Avoid repetition of details included in other parts. This section requires the mention of the implication of the findings, and their limitations for future research, involving relating the observations to other relevant studies.

Finally, the conclusions should be linked to the goals of the study; though mostly avoiding:

Unqualified statement not completely supported by the data

Statement on economic benefits and costs unless the report includes economic data and analyses

Claim of priority and alluding to work that has not been completed.

Whereas new hypotheses could be suggested when warranted, but they should be clearly labeled as such and recommendations, when appropriate and needed, may be given.

2. CHECKLIST FOR SURVEILLANCE REPORTS

Disease surveillance summaries are reported following the checklist below:
Title: Compose a title that includes the name of the health condition, population, time and place.
Abstract: Provide a structured abstract including the following sub- headings: Background; Objectives; Methods; Results; and Conclusion.

INTRODUCTION

Context: Summarize the current situation regarding the health condition under surveillance and identify why it is important. Objectives: State the objective of the surveillance report.

METHODS

Setting: Describe the setting, locations and dates of the surveillance period.
Population: Describe the population under surveillance. Definitions: Provide definitions for each health event under surveillance, including

case definitions and any public health interventions. **Information sources**: Describe all data sources, including the objective of any surveillance systems, what data were collected and how data were gathered, transferred and stored. Supplementary data: If appropriate, note where to access supplemental material (e.g., www.opendata.gc.ca). **Data quality, missing data and reporting delays:** Describe how the data quality was assessed. Explain how missing data were addressed. If data is reported by date of diagnosis or symptom onset, include a statement about whether the data for the most recent periods may be revised.

DATA ANALYSIS

Describe any analytical methods used providing sufficient detail to enable a knowledgeable reader with access to the original data to judge its appropriateness and to assess the reported results.

RESULTS

Descriptive: Provide a summary of the descriptive data, including demographics.
Data Quality: Report on data quality (e.g., completeness, missing data, under reporting)
Analytic data: Provide a summary of the analysis including (when indicated) estimates of trends. When applicable, point estimates should include appropriate indicators of measurement error such as 95% confidence intervals (e.g., average annual percentage change used to describe trends or odds ratios used to describe subgroup differences).
Figures: Create the minimum number of figures to highlight key results. Create a title that includes person, time and place.

DISCUSSION

Key results: Summarize key results with reference to study objectives
Comparison: Consider these findings in relation to the current literature. Strengths and weaknesses: Discuss the strengths and weaknesses of the study (data quality, completeness, sources of

potential bias). Interpretation and generalizability: Provide a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies and other relevant evidence.
Conclusion: Ensure conclusions address objectives and follow from the results.

3. PUBLIC HEALTH NOTICES / OUTBREAK REPORTS

Following the Center for Disease Control recommendations, for public heath notices and outbreak reports to be published they need to cover all four components as stated below:

INTRODUCTION

Generally, the introductory paragraph should begin with 1 to 3 sentences establishing the existence of the outbreak or underlying public health problem. E.g., "On January 2, 2008, the Nevada State Health Division contacted CDC concerning surveillance reports received regarding two persons recently diagnosed with acute hepatitis C." The introductory paragraph also usually contains: a) a statement that an investigation was conducted, when and by whom; b) the most important finding(s); c) the actions taken to stem the outbreak; and d) a statement of the public health implications and actions that should be taken in response to the investigation. Investigation and results: First, present the initial investigation and its findings. This might include: 1) a description of the setting and a statement of how the outbreak came to the attention of health authorities; 2) a clinical description of the index case or initial cases; 3) initial key test results; and 4) hypothesis generation activities and results. Next, summarize the full investigation, including: case definition, case-finding activities, method of investigation, and results. Cases should be counted and described by clinical characteristics, treatment, and outcome, as well as time, place, and person descriptive results. Next, present the methods and results of any analytic epidemiologic studies (e.g.,

cohort or case-control studies). Finally, provide the results of any relevant microbiologic, genetic, or toxicologic results, followed by the results of any testing of environmental samples. Public health response: When appropriate, a brief description summarizing any public health interventions taken and the results of the interventions follows.

DISCUSSION

Same as for a Full Report, except that a Limitations paragraph might not be required for an Outbreak Report.

4. POLICY BRIEFS

This bulletin will use guidelines on reporting/ publishing policy notes as they are suggested by the Center for Disease Control (CDC). As the CDC defines them; Policy Notes are intended to announce new official policies or recommendations (e.g., from ACIP or CDC). These reports can be thought of as briefs. Maximum word count at submission is 1,400 words. Up to three tables, figures, or boxes may be included. Policy Notes contain no Discussion or Limitations, and a summary box is not required. Although policy notes or brief might vary, following is a rough guide of what basic notes should have: Introduction: The introductory paragraph should be limited to 150–200 words. It might contain all or some of the following components: a brief introductory statement orienting the reader to the topic and placing it in context, a brief description of the public health problem, a brief statement of the rationale for the policy or recommendation, mention of the most important parts of the policy or recommendations, and one or two sentences stating the conclusions and the public health implications of the new policy or recommendations.

BACKGROUND

The Policy Note should include a paragraph after the introduction that summarizes background information relevant to the policy or recommendation that can help the reader understand the context and need for the policy or recommendation.

Methods: Should include a summary of the methods used to establish the policy or recommendation, including answers to some or all of these questions: Who was involved in the production of the guidelines or recommendations, and how? What evidence base was considered? What was the rationale for considering this evidence base? Was other evidence excluded from consideration and, if so, why? Rationale and evidence: The Policy Note should provide a concise review of the rationale for the policy or recommendation and a descriptive review of the scientific evidence used to establish it. It should include an explanation of how the policy or recommendation adds to, or differs from, relevant policies or recommendations established previously. Presentation of the policy or recommendation: The policy or recommendation should state clearly when it takes effect and to whom and under what circumstances it applies.

DISCUSSION OR COMMENT

The Policy Note should comment on the likely impact of the new policy or recommendation and plans for assessment of the policy or recommendation

5. CASE REPORTS

These are reports of an individual patient on their symptoms, treatment reactions on a disease or condition of interest. These reports normally focus on unusual reactions or occurrences. Similar cases to other research reports, case reports might include a literature review of previous similar. Case reports might also address positive patient outcome on particular treatment guidelines or individual impact of a particular intervention. These are mainly used for educational and decision-making purposes. Case reports are normally reported following a checklist found at the CARE Guidelines.

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6. CASE STUDIES

We recommend authors to follow the "EQUATOR Network" for ample explanations and guidelines in the writing of such articles. They have to be well-described case studies on health care interventions of public health concern. These could be:

Rigorous assessments of processes and program interventions.

Recommendations on possible health interventions.

Never on individual patient (= case report)

7. COMMENTARIES / OPINION / METHODOLOGY ARTICLES

We recommend authors to follow the "EQUATOR Network" for ample explanations and guidelines in the writing of such articles. Though these articles are moderated, they should be:

Short, focused, opinionated to previous articles or any subject related to the journal entirely. Contemporary and focusing on specific issues. Normally up to 800 words.

Frank critics to the journal are bravely motivated and would be as much as possible published.

8. FORMATTING THE MANUSCRIPT

Please note that articles which are not correctly formatted will be returned to the authors

Format text: Style: No Spacing, Single column, Single Spacing
Font: Single Spacing, Times New Roman - size 12
Titles: Capitals and bold, size 14
Format tables: Times New Roman, Font size 9
No vertical lines. Horizontal lines in the table can be removed. No table should be larger than a single A4 page. Footnote should be size 9 and italic

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