Original Article

Knowledge, Attitude, and Practices of Antibiotic Usage and Resistance among People Attending Primary Healthcare in Rwanda

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Abstract

Background
Antimicrobial resistance (AMR) poses a global threat to public health with sub-Saharan Africa facing a substantial burden. Our study assessed the knowledge, attitude, and practices of antibiotic usage and resistance among people attending primary healthcare facilities in Rwanda.

Methods
The cross-sectional study was conducted at three health centres in Kigali, and it involved 246 individuals. We used a close-ended questionnaire for data collection. The levels of knowledge, attitudes and practices were calculated as proportions of correct answers, with high, good, or positive being greater or equal to 70%. The chi-square test was used to find the association between demographic characteristics and knowledge, attitudes and practices.

Results
Among 246 participants, 8 (3.2%) and 51 (20.7%) had high knowledge of antibiotic usage and antimicrobial resistance respectively. In addition, 81 (32.9%) had a positive attitude and 97 (39.4%) had good practices. Attitudes were significantly positive in males (p = 0.003) and among individuals with a university education (p = 0.007). Knowledge of antimicrobial resistance was significantly high in males (p-value = 0.047).

Conclusion
Limited levels of knowledge, attitude and practices on antibiotic usage and resistance were found, with women having lower levels in multiple aspects. Strategies to promote rational use of antibiotics ought to address social inequities.

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Keywords: antimicrobial resistance, antibiotics, Rwanda, primary healthcare, knowledge

Background

Antimicrobial resistance (AMR) continues to pose an increasing global threat to human, animal, and environmental health. [1] Antimicrobial resistance (AMR) enables the bacteria to withstand the effects of antibiotics, resulting in increased morbidity, mortality, and prolonged hospital stays, contributing to high costs for individual health care and health systems globally. [2] The latest global study on AMR in 2019 reported that resistance in bacteria was associated with 4.95 million deaths, with the highest direct attributable rate in the West and East Sub-Saharan Africa (SSA), which had 27.3 and 21.4 deaths per 100,000 people respectively.[3] There is a steady increase in the number of microorganisms resistant to antimicrobial agents due to the emergence, spread, and persistence of multidrug-resistant microorganisms. [4,5] A high rate of AMR was reported in one Rwandan referral hospital with 75.9% isolates resistant to ceftriaxone and 71.7% isolates producing extended-spectrum beta-lactamase (ESBL).[6]

Limited knowledge and poor attitude towards antibiotic usage result in irrational consumption of antibiotics, which contribute to the AMR problem.[7,8] Patient expectations can influence the decision of physicians to prescribe antibiotics, and irrational prescriptions can lead to antibiotic resistance.[9,10] Worldwide, studies found that some patients expect antibiotics to treat the flu or common cold, despite the ineffectiveness of antibiotics to treat viral diseases.[11,12] Poor attitudes and practices toward antibiotic usage have been highlighted in Low- and Middle-Income Countries (LMICs) where individuals self-prescribe, share, and use leftover antibiotics. [13–15] A study that assessed knowledge and attitude toward antibiotic usage and resistance among healthcare students in Rwanda reported a moderate knowledge of antimicrobial resistance and the likelihood of students purchasing antibiotics without a prescription.[16]

In Africa, low levels of knowledge of the appropriate use of antibiotics have been reported in different target audiences, and context-specific antibiotic awareness campaigns have been suggested as interventions to improve outpatient antibiotic use.[14,17,18]

The Rwanda Ministry of Health, along with the Ministry of Agriculture and Ministry of Environment, have developed a National Action Plan on Anti-Microbial Resistance 2022-2024 including interventions such as public education on the prevention of AMR.[19] The health system in Rwanda is becoming much stronger and stable, and healthcare professionals can help to engage communities in infection control programs.[20] The effectiveness of national-level educational interventions including education campaigns for healthcare professionals and the general public to reduce inappropriate antibiotic consumption has been documented, though many studies were conducted in high- and upper-middle-income countries.[21]

The majority of antibiotic consumption is driven by awareness regarding the appropriate use of antibiotics in the community.[8,15] In Rwanda, a study conducted to assess knowledge and attitudes towards antibiotic usage and resistance was reported in 2020; however it recruited only students who had a medical background, who did not represent the general population.[16] Exploring the level of knowledge according to the educational categories can help to understand the state of awareness in the general population. People attending primary healthcare facilities are potential consumers of antibiotics and can contribute to the control of AMR.[22] Therefore, this study aimed to assess the knowledge, attitude, and practice of antibiotic usage and resistance among people attending primary healthcare facilities in Rwanda.

Methods

Study design and setting

The study was cross-sectional and recruited 246 participants among outpatients attending three health centres in Kigali City, Rwanda in October 2023. Health centres provide primary health care in Rwanda. Random sampling was used to select one health centre in every three districts of Kigali city, by assigning and choosing from their numbers. Selected health centres were Remera Health Centre in the Gasabo district, Gikondo Health Centre in Kicukiro district, and Nyarurenzi Health Centre in Nyarugenge district.

Study population and eligibility criteria

Participants were adults aged 18 years or above who attended any of the selected health centres, and were able to answer the study questions in Kinyarwanda or English. Only people who were not exhibiting distress, willing, and consented to participate were selected.

Sampling procedures

A proportionate stratified sampling strategy based on education level was used to guide the selection of study participants at each health centre. Four strata were developed based on educational level: People with no primary education (participants who did not attend or complete formal primary education), people with primary education (participants who completed formal primary education only), people with secondary education (participants who completed secondary education only or equivalent) and people with university education (people who attended higher education or university). A convenient sampling strategy was used to select participants in each stratum.

Data collection instruments, procedures, and quality control

Data were collected using a close-ended questionnaire, which was guided by existing literature.[23–28) It was originally developed in English and later translated into Kinyarwanda by a professional translator. The questionnaire was reviewed by an expert in microbiology who has a good knowledge of antimicrobial resistance and the local context of study areas. The questionnaire was validated in a pilot study that was conducted on eight individuals by asking them to respond to the study questions. Content validity was observed as the participants were able to get the meaning of the questions. The questionnaire consisted of questions to assess knowledge, attitude, and practices for the use of antibiotics. To assess whether participants could correctly identify antibiotics, they selected antibiotics from the list of six drugs where three were not antibiotics (paracetamol, seloken, and alvedon), and the other three were antibiotics (amoxicillin, ampicillin, and chloramphenicol). The three antibiotics assessed are on the WHO list of antibiotics recommended for empirical treatment of most common infection and promoted to be widely available and found on the Rwanda national list of essential medicines for adults and paediatrics.[29–31]

To assess knowledge, attitude and practices, data collectors asked the study participants to indicate whether they agreed, did not agree, or did not know the given statements.They responded to ten questions for knowledge of antibiotic usage, eleven questions for knowledge of antibiotic resistance, six questions for attitudes toward antibiotic accessibility, and 14 questions for practices regarding patient-prescriber relationship and infection prevention. The questionnaire also collected information regarding demographic characteristics (age, education level, being a healthcare worker or not, and the country of completing most of education), and history of antibiotic use for themselves or in the family. Data were collected by trained data collectors by requesting participants to respond to the items on the study questionnaire. Participants were approached after receiving the clinical service or fulfilling the reason for their visit to the health facility, and it took average of 20 minutes to complete the questionnaire.

After data collection, the trained data collector discussed the expected answers with the participants to enhance the participants' learning.

Data analysis

Frequencies for demographic characteristics of the total sample were determined. Participants were then grouped according to gender, age, and educational categories. Frequencies of answers for each group of participants were found for every statement. The number of correct answers for every participant was divided by the total number of answers and multiplied by 100 to find the total score of knowledge of antibiotic usage, knowledge of antimicrobial resistance, attitudes regarding antibiotic accessibility, and practices regarding patient-prescriber relationship and infection prevention. Participants were classified into three categories based on the total score they obtained. For the knowledge of antibiotic usage and antimicrobial resistance, the proportion of expected answers below 40%, from 40% and less than 70%, and 70% and above were classified as poor, moderate and high respectively. For the attitudes regarding antibiotic accessibility, the proportion of expected answers below 40%, from 40% and less than 70%, and 70% and above were classified as negative, mixed, and positive, respectively. For the practices regarding patient-prescriber relationship and infection control, the proportion of expected answers below 40%, from 40% and less than 70%, and 70%and above were classified as poor, moderate and good respectively. Stata version 18 software was used for data analysis, and a chi-square test was used to find the association between demographic characteristics and level of knowledge, attitudes, and practices.

Ethical considerations

This study obtained ethical clearance from the Institutional Review Board (IRB) of the University of Rwanda, College of Medicine and Health Sciences (UR/CMHS) with Reference number: CMHS/IRB/436/2023. All participants signed informed consent before participating in the study. The respondents were not given any incentive to participate in the study.

Results

Characteristics of study participants

The study recruited a total of 246 people, whereby 60 (24.39%) did not attend or complete primary school, 64 (26.02%) completed primary school, 62 (25,20%) completed secondary school, and 60 (24.39%) attended university or higher education (Table 1). An equal number of participants (82) were recruited at each health facility. Of the 246 participants, 140 (56.91%) and 106 (43.09%) were females and males, respectively. By age groups, 96 (39.02%) were older than 30 years, 80 (32.52%) were between 25-30 years, and 70 (28.46%) were between 18-24 years. Most participants (91.06%) were not healthcare workers.

Table1. Participants recruited from each selected centre and education level

	Education strata				
Health Centres	**No primary Education**	**Primary Education**	**Secondary Education**	**University Education**	**Total**
Remera health centre	20	22	20	20	82
Nyarurenzi health centre	20	21	21	20	82
Gikondo health centre	20	21	21	20	82
Total samples	**60**	**64**	**62**	**60**	**246**

Table 2. Demographic information and history of antibiotic usage

Variables	Frequency n	Percentages %
Gender		
Female	140	56.91
Male	106	43.09
Age group		
18 – 24 Years	70	28.46
25 – 30 Years	80	32.52
>40 Years	96	39.02
Level of Education		
Not completed primary School	60	24.39
Primary School (or equivalent)	64	26.02
Secondary School (or equivalent)	62	25.20
University (or equivalent)	60	24.39
Profession		
Health care worker	22	8.94
Non-health care worker	224	91.06
Have you ever taken antibiotics?		
Don't know	7	2.85
No	19	7.72
Yes	220	89.43
How many times have you consumed antibiotics during the past 12 months?		
Never	71	28.86
Once	64	26.02
2-5 times	83	33.74
More than 5 times	28	11.38
How many times have another adult in your household (over 18 years old) received antibiotics during the past 12 months?		
Never	70	36.08
Don't know	15	7.73
There are no other adults in the house	1	0.52
Once	25	12.89
2-5 times	60	30.93
More than 5 times	23	11.86
How many times have children in your household received antibiotics during the past 12 months (in total)?		
Never	112	46.09
Don't know	14	5.76
There are no other adults in the house	6	2.47
Once	27	11.11
2-5 times	65	26.75
More than 5 times	19	7.82
Is anyone in your household taking antibiotics at the moment?		
Yes	52	21.31
No	192	78.69

Most participants (89.43%) reported having taken antibiotics, and only 28.86% reported not having taken antibiotics within the last 12 months (Table 2). Participants who identified antibiotics correctly were 215 (87.40%) for amoxicillin, 103 (41.87%) for ampicillin, and 40 (16.26%) for chloramphenicol. Paracetamol, alvedon, and seloken were misidentified as antibiotics by 142 (57.72%), 3 (1.22%), and 1 (0.41%) participants respectively.

Knowledge of antibiotic usage

Most participants (72.36%) were aware that the body could clear mild infections without taking antibiotics, and an average (50.00%) expressed a belief that antibiotics can be used to treat the common cold (Figure 1). However, the majority expressed poor knowledge of most of the statements on when to use antibiotics. Many participants (70.33) wrongly agreed that a persistent cough continuing for over a week always necessitates antibiotic treatment, and 65.04% supported antibiotic use always when the mucous becomes coloured during a cold. Few participants (30.49%) accurately disagreed that antibiotics could prevent complications associated with a sore throat and a cold, and more than average (53.25%) did not know the right answer.

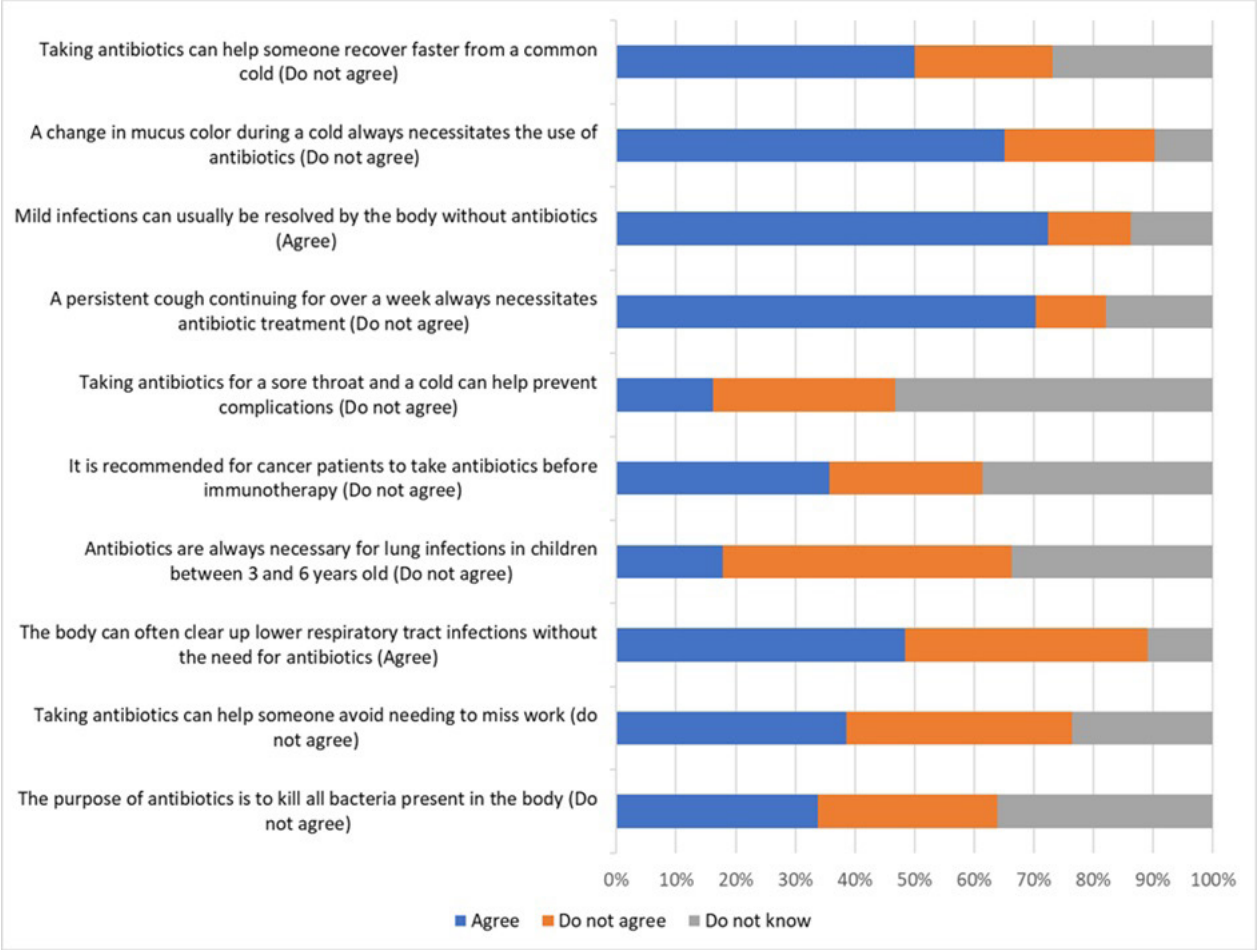

Figure 1. Answers to the statements regarding knowledge of antibiotic usage

Participants who had high, moderate, and low levels of knowledge of antibiotic usage were 3.2%, 29.3%, and 67.5% respectively. On average, all the participantshad levels of knowledge of antibiotic usage of 29.0%. No significant association was found between knowledge about antibioticusage andeducation level, gender, or age at a P-value less than 0.05 (Table 3).

Females who had a high level of knowledge of antibiotic usage were 2.9%, while males were slightly more (3.8%). According to the age category and education level,most people with a high level of knowledge of antibiotic usage were found in the category aged between 25-30 years old (3.8%), and people with a university education (8.3%).

Table 3. Level of knowledge of antibiotic usage and antimicrobial resistance (N=246)

	Knowledge of study participants on antibiotic usage						Knowledge of study participants on antimicrobial resistance					
Variables	**Low** (<40%)	**Moderate** (40-70%)	**High** (>70%)	**Average (%)**	**Chi-square**	**P-Value**	**Low** (<40%)	**Moderate** (40-70%)	**High** (>70%)	**Average (%)**	**Chi-square**	**P-Value**
Gender												
Female	98(70.0%)	38(27.1%)	4(2.9%)	28.29%	0.974	0.614	55(39.3%)	60(42.8%)	25(17.9%)	45.65%	6.136	0.047
Male	68(64.2%)	34(32.1%)	4(3.8%)	30.00%			26(24.5%)	54(51.0%)	26(24.5%)	52.66%		
Age												
18-24	47(67.1%)	21(30.0%)	2(2.9%)	27.29%	2.634	0.621	21(30.0%)	35(50.0%)	14(34.3%)	50.78%	1.486	0.829
25-30	53(66.3%)	24(30.0%)	3(3.8%)	30.63%			30(37.5%)	35(43.7%)	15(18.8%)	46.36%		
31-40	41(65.1%)	20(31.7%)	2(3.2%)	31.27%			21(33.3%)	31(49.2%)	11(17.5%)	47.47%		
>41	25(75.8%)	7(21.2%)	1(3.0%)	24.55%			9(27.3%)	13(39.4%)	11(33.3%)	52.07%		
Education												
No primary	41(68.3%)	18(30.0%)	1(1.7%)	26.00%	5.369	0.497	24(40.0%)	26(43.3%)	10(16.7%)	43.48%	5.036	0.539
Primary	52(81.2%)	12(18.8%)	0(0%)	23.91%			23(35.9%)	31(48.5%)	10(15.6%)	47.87%		
Secondary	39(62.9%)	21(33.9%)	2(3.2%)	30.81%			16(25.8%)	30(48.4%)	16(25.8%)	52.64%		
University	34(56.7%)	21(35.0%)	5(8.3%)	35.67%			18(30.0%)	27(45.0%)	15(25.0%)	50.61%		
Total	166(67.5%)	72(29.3%)	8(3.2%)	29.02%			81(32.9%)	114(46.4%)	51(20.7%)	48.67%		

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Knowledge of antimicrobial resistance

Overall, 57.32% of the participants were aware that increased use of antibiotics in a society increases risks for emerging and spreading antimicrobial resistance and 56.50% agreed that resistance can spread from person to person (Figure 2). Also, 79.67% and 60.16% of participants knew that AMR is a big problem in the world and Rwanda respectively.

Majority of participants (62.60%) agreed that a person can terminate antibiotic treatment when feeling better after partial consummation of the treatment course while67.89% disagreed that antibiotics can negatively affect the body's bacterial flora. Only 44.72% agreed that antibiotic use for animal and agricultural activities can reduce the effectiveness of antibiotic treatment for humans.

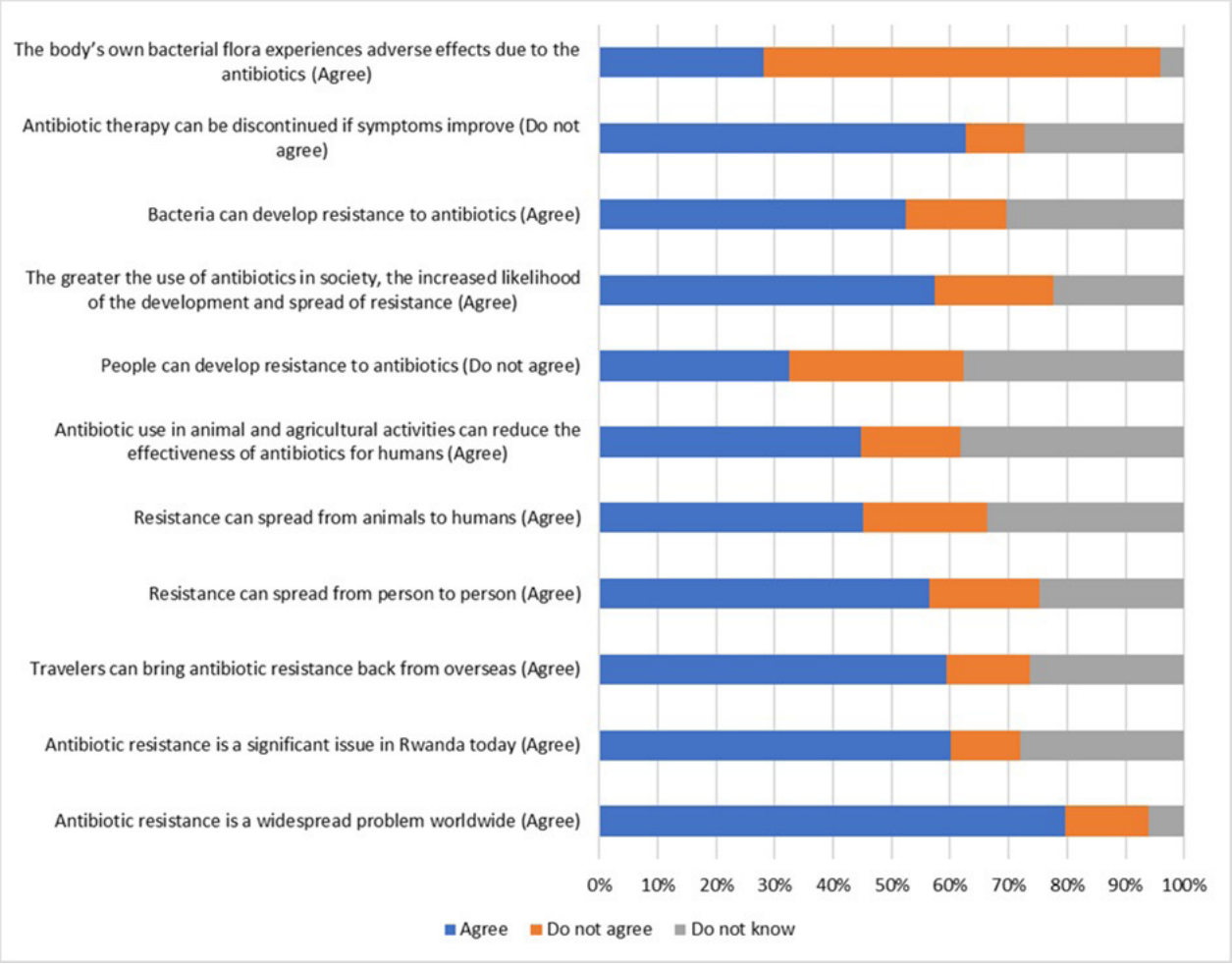

Figure 2. Answers to the statements regarding knowledge of antimicrobial resistance

Total scores regarding knowledge of antimicrobial resistance showed a mean of 48.7%. Participants that had high, moderate, and low levels of knowledge of antimicrobial resistance were 20.7%, 46.4%, and 32.9% respectively (Table 3). Level of knowledge of antimicrobial resistance was significantly associated with gender (p-value= 0.047), where 24.5% of males and 17.9% of females had a high level of knowledge of antimicrobial resistance. In terms of age categories and education levels, the highest percentage of participants with high knowledge were found in the age group of 18-24 years (34.3%), and people with secondary-level education (25.8%). No significant association were found between the level of knowledge of antimicrobial resistance and age or education level.

Attitudes toward accessibility of antibiotics

The majority of the study participants (76.42%) knew about the need for a prescription to buy antibiotics from the pharmacy while 61.38% reported that

antibiotics should not be preserved for future use (Figure 3). The majority of participants (64.63%) believed that it is not good to buy antibiotics online without doctor's examination while74.39% did not support to obtain antibiotics from relatives. However, only 10.16% were aware that leftover antibiotics should be taken back to the pharmacy.

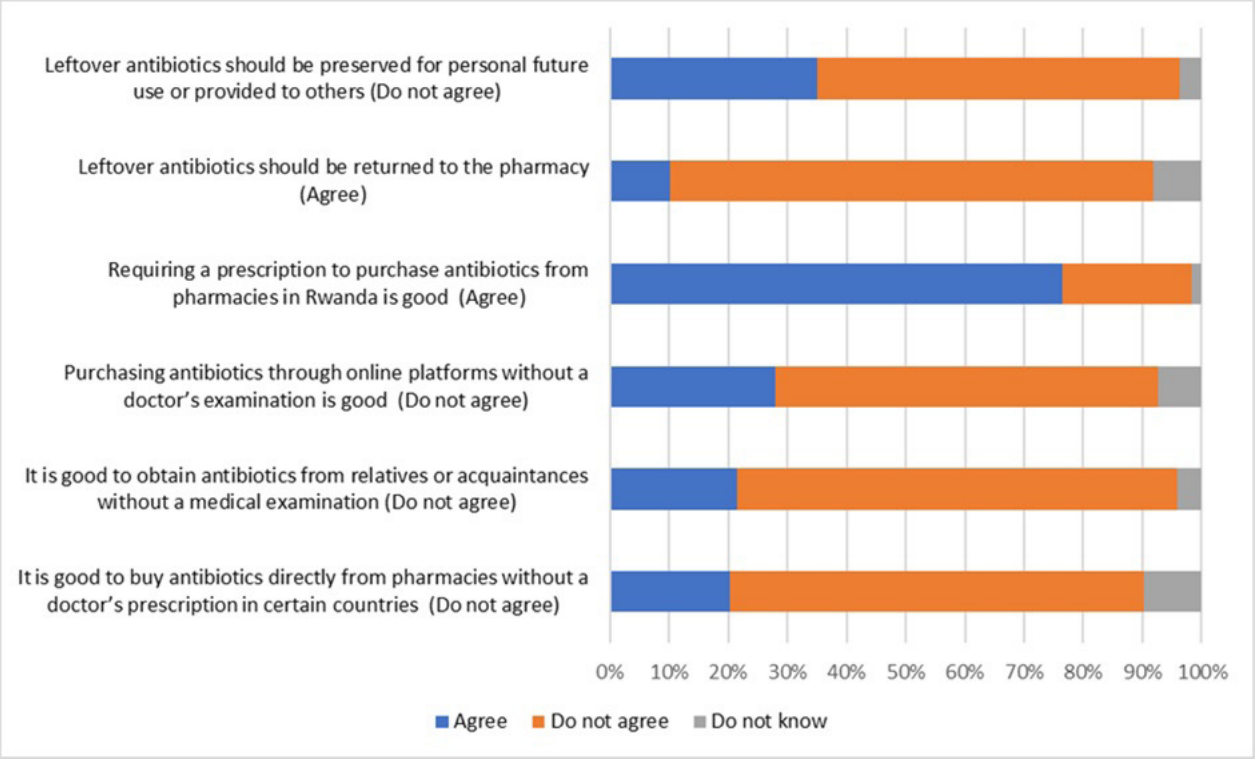

Figure 3. Answers to the statements regarding attitudes toward antibiotic accessibility

Total scores regarding attitudes toward antibiotic accessibility showed an average of 59.5% (Table 4). Participants who had positive, mixed, and negative attitudes toward antibiotic accessibility were 32.9%, 43.5%, and 23.6% respectively. The level of attitude was significantly associated with gender ($p = 0.003$) and education level ($p = 0.007$), whereby 44.3% of males and 24.3% of females had high levels of positive attitude.

The number of those with positive attitude varied with the level education as follows: university 50.0%, secondary 32.2%, primary 18.7%, and no primary education 31.6%. According to the age groups, the highest percentage of participants that had positive attitude were aged more than 40 years (36.7%).

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Table 4. Level of attitudes toward antibiotic accessibility and practices regarding patient-prescriber relationship and infection control

Variables	Attitudes of participants toward antibiotic accessibility						Practices on patient-prescriber relationship & infection control					
	Poor (<40%)	Moderate (40-70%)	Positive (>70%)	Average (%)	Chi-square	P-Value	Poor (<40%)	Moderate (40-70%)	Good (>70%)	Average (%)	Chi-square	P-value
Gender												
Female	39(27.9%)	67(47.8%)	34(24.3%)	55.36%	11.313	**0.003**	8(5.7%)	77(55.0%)	55(39.3%)	62.45%	1.328	0.515
Male	19(17.9%)	40(37.8%)	47(44.3%)	64.94%			10(9.4%)	54(50.9%)	42(39.6%)	61.39%		
Age												
18-24	21(30.0%)	25(35.7%)	24(34.3%)	56.90%	3.542	0.471	2(2.9%)	42(60.0%)	26(37.1%)	63.37%	5.685	0.224
25-30	17(21.2%)	39(48.8%)	24(30.0%)	60.83%			5(6.2%)	40(50.0%)	35(43.8%)	63.39%		
31-40	12(19.0%)	30(47.6%)	21(33.3%)	61.38%			8(12.7%)	28(44.4%)	27(42.9%)	59.86%		
>41	8(24.2%)	13(39.4%)	12(36.7%)	58.08%			3(9.1%)	21(63.6%)	9(27.3%)	59.74%		
Education												
No primary	19(31.7%)	22(36.7%)	19(31.6%)	54.72%	17.845	**0.007**	4(6.6%)	34(56.7%)	22(36.7%)	62.26%	9.477	0.148
Primary	19(29.7%)	33(51.6%)	12(18.7%)	54.69%			2(3.1%)	38(59.4%)	24(37.5%)	62.95%		
Secondary	13(21.0%)	29(46.8%)	20(32.2%)	58.87%			3(4.8%)	34(54.8%)	25(40.3%)	64.40%		
University	7(11.7%)	23(38.3%)	30(50.0%)	70.00%			9(15.0%)	25(41.7%)	26(43.3%)	58.21%		
Total	**58(23.6%)**	**107(43.5%)**	**81(32.9%)**	**59.49%**			**18(7.3%)**	**131(53.3%)**	**97(39.4%)**	**61.99%**		

Practices regarding patient-prescriber relationship and infection control

The majority of participants (91.87%) supported that hand hygiene reduces the risk of spreading antimicrobial resistance, and 51.22% reported that if they get infected, they wait and see if the infection will be cleared on its own (Figure 4). While most participants (89.43%) expressed that they were confident in the prescriber's decision if antibiotics were prescribed, 54.47% expressed that they were not confident in a prescriber's decision if antibiotics were not prescribed. Likewise, 51.63% did not agree that prescribers always examined thoroughly whether patients needed antibiotics or not, and 50.41% did not agree that prescribers provided enough information on how antibiotics should be used when prescribed. Majority of the participants (82.52%) reported having received antibiotic prescriptions for their own or their kin's use, and 77.64% reported knowing often whether they needed antibiotics or not before visiting a prescriber. Total scores for practices regarding patient-prescriber relationship and infection control showed a mean of 62.0% (Table 4). Participants that had good, moderate, and poor practices were 39.4%, 53.3%, and 7.3%, respectively. Practices regarding patient-prescriber relationship and infection control showed no significant association with education level, age, or gender. Females and males that showed good practices were 39.3% and 39.6%, respectively. According to the age groups, participants with good practices were aged 25-30 years (43.8%), while for education, the majority with good practice had a university education (43.3%).

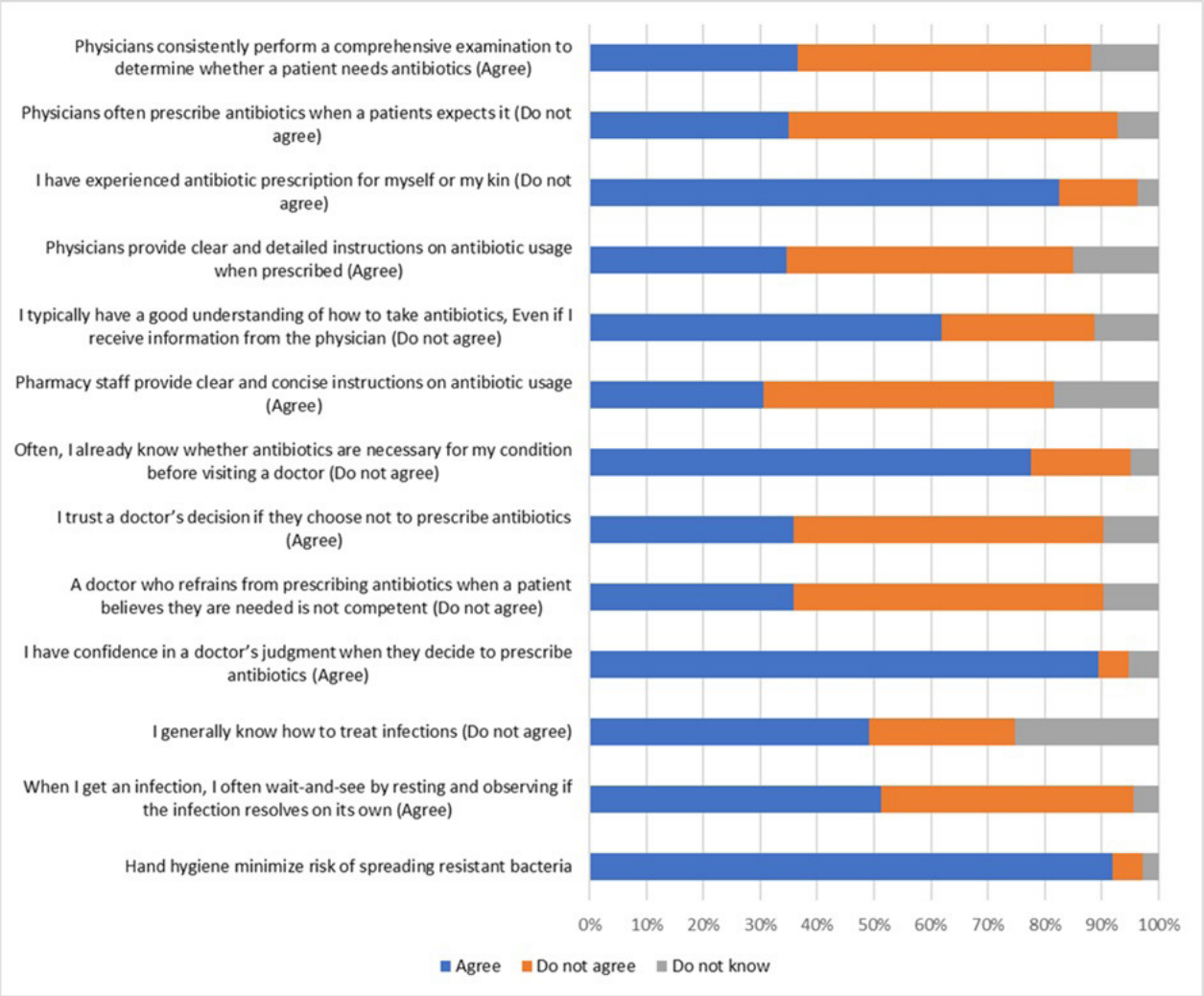

Figure 4. Answers to the statements regarding practices on patient-prescriber relationship and infection prevention

Discussion

Our study reported the knowledge, attitudes, and practices regarding antibiotic usage and resistance among people attending primary health facilities in Rwanda. The study found limited knowledge of antibiotic usage and resistance, positive attitudes toward antibiotic accessibility, and related practices. Education was significantly associated with attitudes while gender was significantly associated with both attitudes and knowledge of antibiotic resistance. Men and individuals with university or secondary education level were likely to express a high level of knowledge. The influence of gender on the level of awareness of antimicrobial resistance might reflect gender-based inequities in having access to knowledge and primary health care. Exploring gender differences in social-economic factors like internet literacy, which is drawing high attention in Rwanda, could help to understand inequities in awareness of antibiotic usage and resistance.

Participants reported receiving only limited information on how to consume antibiotics after getting a prescription, which can improve adherence and reduce inequities if context-specific factors are considered. Since the community should receive accurate information on antibiotic usage and resistance from the health system, the quality of primary care needs to be strengthened to improve health literacy. The issue of not providing enough information on antibiotic prescription had been reported also in a study conducted in Ghana, another country that has resource limitations, [26] Both Rwanda and Ghana have a low ratio of healthcare workers to the general population, which may minimize the time and quality of interaction between physician and patient.[32] Moreover, our findings have similarities to a study conducted in Ethiopia, which found that being female and having no primary education was significantly associated with having a lower level of knowledge, but age also showed a strong association.[33]

The influence of age in this study conducted in Ethiopia could be explained by prior access to education, as most of their participants (62.7%] had received a university education, which is higher than the 24.39% who participated in our study.[28]

People attending primary health care in Rwanda had different levels of knowledge of antibiotic usage and resistance. The lowest level of awareness was found in knowledge of antibiotic usage, where participants had an average of 29.02%, and only 3.2% of those participants had a high level of knowledge. Participants reported believing that antibiotics can be used to treat the common cold, and persistent cough, and taking antibiotics as a way of continuing to work. Our findings are comparable to a study conducted in India, where 49% of the general public claimed that antibiotics destroy viruses, and 45% of the respondents used antibiotics to treat their colds.[15] Both Rwanda and India have limited accessibility to primary healthcare, and poor knowledge is associated with fewer health promotion campaigns to promote rational antibiotic usage in the general population. Moreover, we found a lower average of knowledge of antibiotic usage (29.02%) compared with 45% reported in public sector from a study conducted in South Africa.[34] A relatively higher knowledge of antibiotic usage in South Africa could be linked to its strategic framework to control AMR since 2015, which prioritizes the appropriate use of antimicrobials in human and animal health. [34,35]

This study found a low level of knowledge regarding mechanisms that can lead to antimicrobial resistance. Only 20.7% of participants had a high level of knowledge and the average score for all participants was 48.67%. People were aware that antimicrobial resistance is a big problem in Rwanda and the world, which could facilitate the likelihood of community participation in prevention and control measures related to antimicrobial resistance. However, they are unaware of routine activities and behaviours that potentially increase antimicrobial

resistance; for instance, 62.60% think that it is safe to terminate antibiotic therapy when feeling improvement after partial consumption. In a study conducted in Columbia, 84.4% acknowledged that antimicrobial resistance was a significant problem in the country, and 36.9% reported that antibiotics could be stopped if symptoms improved.[27] A study conducted in Qatar among people attending primary healthcare centres found a high level of awareness, where 69.9% of the participants were aware of the importance of completing the full course of antibiotic treatment.[36] Resistant strains have been reported to increase in people who recently used antibiotics, which could be explained by selective pressure and inappropriate use.[37,38] False beliefs about antimicrobial resistance were found in our study, as 29.67% believe that people cannot be resistant to antibiotics, which is lower than the level of awareness reported in Singapore, where 62.5% of participants believed that resistance develops when our bodies get resistant to antibiotics.[39]

Accessibility to safe and quality antibiotics is essential for infection prevention and control. This study assessed the attitudes of people about different ways of assessing antibiotics. Only 32.9% of participants had a positive level of attitude toward antibiotic accessibility, and the overall average attitude was 59.49%. A high tendency to purchase antibiotics without a prescription can be linked to a low level of trust in prescribers, where confidence increases when patients' expectations are met, which is an extra issue as many participants reported expecting antibiotics to treat non-bacterial infections like the common cold. Our study found that 23.6% of study participants had negative attitudes toward antibiotic accessibility, which is comparable to 20.12% reported in a study conducted in Bangladesh.[24] A study conducted in Tanzania reported that 42.3% of participants were willing to use the same antibiotics if used by a friend or family member or friend to treat similar manifestations.[28] Returning leftover antibiotics to the pharmacy is good practice not only to prevent irrational use, but also to avoid environmental contamination with medical products; however, only a little public attention was found with only 10.16% showing the attitude of returning leftover antibiotics to the pharmacy. A study conducted in Jordan found that only 6.4% of unneeded antibiotics were returned to the pharmacy, and most participants who kept them reported potential future consummation.[40]

Practices regarding relationships with antibiotic prescribers and infection control were limited, with only 39.4% of participants showing a high level of effective practices, and the average for all participants was 61.99%. The level of practice is comparable to the findings of a study conducted in Ethiopia, which found that 40.7% of the participants had a level of practice in the range of 60-80% with the rest having a level below 60%.[33] Many participants reported knowing whether they needed antibiotics before visiting a prescriber, which could influence the prescriber's decision. This study found a low level of public trust for antibiotic prescribers on multiple parameters, which necessitated community involvement in primary healthcare activities. More than average participants do not believe that prescribers examine the need for antibiotics, and they merely get enough information on how antibiotics could be used, which are fundamental principles for antibiotic prescription. Mistrusting of antibiotic prescribers has been also reported in Qatar, as 12.3% of participants argued with doctors to obtain antibiotic prescriptions, and 20.4% were pressured for a specific antibiotic.[36] The findings are evidence of the need to refine antibiotic stewardship programs in Rwanda's health system.

Strengths and Limitations

This study has both strengths and limitations. To the best of our knowledge, it is the first study to be conducted in Rwanda and recruit the general population to explore awareness of antibiotic resistance. However, it was conducted in an urban setting among three health facilities and thus is not generalizable to the whole country.

The sample was balanced in terms of age, gender and education. However, it consisted of individuals who were attending healthcare facilities. The results might not reflect the perspectives of those who do not seek healthcare services provided by the national health system. Moreover, the assessment was done by asking the participants to answer the questions, which might have resulted in recall or social desirability bias, with participants providing only the information they could remember or thought was socially acceptable.

Conclusion

While gender and education level showed a strong association with attitude and knowledge of antimicrobial resistance, most of the participants in all categories of people attending primary health care facilities in Rwanda expressed poor to moderate levels in all aspects of awareness. Interventions to improve public awareness of antibiotic usage and resistance could target all people and address the existing inequities. Moreover, The role of the health system and primary healthcare providers needs to be strengthened to build public trust and improve literacy on antibiotic use and antimicrobial resistance, which could be the source of reliable information. Our study recruited only people attending primary health facilities, and large studies should be conducted in communities to promote diversity of participants.Further research is needed to explore social factors associated with antibiotic usage and determinants of effective relationships between antibiotic prescribers and end consumers.

Authors' contributions

J.N., O.T., and O.S. conceived the project. O.T. and O.S. participated in the field data collection. J.N., P.K., H.N., and F.H. analyzed and interpreted data. M.I.F. reviewed the study protocol and contributed to the data analysis, and interpretation. J.N. and O.T. drafted the original manuscript. M.I.F. critically reviewed the manuscript. All authors read and approved the final manuscript.

Availability of data and materials

The datasets generated and/or analysed during the current study are not publicly available due to the possibility of identifying participants but are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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