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Understanding Public Knowledge and Misconceptions About Antibiotic Usage and Resistance

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ABSTRACT

Antimicrobial resistance (AMR) is a significant public health threat worldwide; inappropriate use of antibiotics is a factor in the emergence and spread of resistant microorganisms. Although people are now more aware of AMR, there are still misunderstandings about the use and resistance of antibiotics. The objective of this study was to assess the knowledge, attitudes and practices of surveyed respondents on antibiotic use and antibiotic resistance, especially the common misconceptions and practices regarding inappropriate antibiotic use. A cross-sectional, questionnaire-based quantitative survey was carried out among 106 respondents across the age categories shown in Figure 1. The questionnaire used was structured to determine the knowledge of antibiotics, awareness of antibiotic resistance, antibiotic-use practices, attitudes towards treatment, non-prescription purchasing, antibiotic sharing, and retention of leftover medication. Other factors such as demographic characteristics and previous antibiotic use were also explored. The results revealed that there were gaps in knowledge within this sample. While most participants had some prior experience with antibiotics and reported seeking advice from health care providers, 37.7% incorrectly linked antibiotics to viral infections. In addition, 69.8% of respondents misinterpreted antibiotic resistance as resistance of the human body to antibiotics. Regarding practices, 57.6% reported having purchased antibiotics from a pharmacy without a prescription, and 42.5% said they would give their family member with similar symptoms their own prescription antibiotics. Also, 28.3% said they kept or gave away unused antibiotics. The aggregate results suggest an incongruity between general awareness and responsible behaviour regarding antibiotic use. The findings suggest potential value in antibiotic-literacy education, communication from health care providers and attention to prescription-only dispensing practices for populations similar to this sample; they do not establish population-wide needs or intervention effectiveness.

Keywords: *antibiotic use, antimicrobial resistance, public knowledge, misconceptions, antibiotic practices, self-medication, antibiotic stewardship*

INTRODUCTION

Antibiotics are today one of the most commonly used therapeutic agents globally (WHO, 2023). The use of antibiotics has risen significantly since 2000, especially in low- and middle-income countries, with India being one of the biggest users of antibiotics in the world (Klein et al., 2018). But overuse and misuse of antibiotics has been driving the development of antimicrobial resistance (AMR). AMR is when microorganisms, including bacteria, are able to survive exposure to antimicrobial agents that would otherwise kill them or stop them from growing (WHO, 2023).

Today, antimicrobial resistance is known to be one of the greatest challenges to global public health (WHO, 2023; Rather et al., 2017). The World Health Organization estimates that in 2019, about 1.27 million people died directly due to bacterial AMR, and nearly 4.95 million people died as a result of AMR (WHO, 2023). Resistant infections are linked to longer illness, more hospitalizations, higher healthcare costs, less effectiveness of treatment, and higher mortality rates (Centers for Disease Control and Prevention [CDC], 2024). Additionally, AMR compromises the success of critical medical interventions such as surgeries, organ transplants, chemotherapy, and intensive care (ICU) care (CDC, 2024).

Antibiotic resistance is heavily dependent on human behavior. Self-medication, not taking antibiotics as prescribed, sharing antibiotics with others and taking antibiotics for viral diseases like cold and flu (which antibiotics cannot cure) are practices that contribute to this (WHO, 2017). These behaviors are frequently related to lack of awareness, misconceptions about the effectiveness of antibiotics, easy availability of antibiotics, and the need for quick symptom relief (Ayukekbong et al., 2017; Rather et al., 2017).

New research still shows significant lack of understanding of the public on antibiotic use and antimicrobial resistance. Despite the growing awareness campaigns, misconceptions about the efficacy of antibiotics in treating viral infections and self-medication are still prevalent in several countries (Alrasheedy et al., 2020). A systematic review conducted by McCullough et al. (2016) found that many people are aware of antimicrobial resistance as a significant public health problem but have misconceptions about the correct use of antibiotics. More recently, Gualano et al. (2023) found that the lack of adequate knowledge about the use of antibiotics remains a problem worldwide and highlighted the importance of continuing public education and antimicrobial stewardship programs. Likewise, Dyar et al. (2018) found that there was a lack of knowledge and inappropriate attitudes of antibiotic use among healthcare and university students, thus emphasizing the need to reinforce educational interventions at an early stage of professional training. In summary, these studies show that misconceptions about antibiotic use are still a public health problem and the need for assessing current public knowledge and practices in various populations (Alrasheedy et al., 2020; Dyar et al., 2018; Gualano et al., 2023; McCullough et al., 2016).

Over-the-counter availability of antibiotics, lax regulations, and high prevalence of self-medication in developing countries also play a role in the spread of antimicrobial resistance (Ayukekbong et al., 2017; Rather et al., 2017). Although there are continuing antimicrobial stewardship programs and public health awareness campaigns, there are still misconceptions about antibiotic use in many populations (WHO, 2015). Poor public awareness of antibiotics and AMR is a significant challenge, especially in low- and middle-income countries (LMICs) (WHO, 2015). Thus, it is important to evaluate the knowledge, attitudes and practices of the public on the use of antibiotics to design efficient educational interventions and evidence-based strategies to promote rational antibiotic use and curb the spread of antimicrobial resistance. The aim of this study is to describe the surveyed respondents' knowledge, misconceptions and self-reported practices concerning antibiotics and antibiotic resistance; demographic associations were not tested.

2. METHODOLOGY

2.1 Study Design

This study was conducted by a cross-sectional survey with questionnaires. Participants were asked to provide data at one time. It was a quantitative observational study of respondents' knowledge, misconceptions and practices regarding use of antibiotics and antibiotic resistance. The design was based on a similar cross-sectional interview survey conducted in Sweden to evaluate the public knowledge of antibiotics and awareness of resistance (André et al., 2010).

This enabled the study of knowledge, misconceptions and self-reported habits together in one round of data collection. The study of public understanding of antimicrobial resistance is relevant due to the high number of deaths caused by antimicrobial resistance worldwide each year (Antimicrobial Resistance Collaborators, 2022). A quantitative approach is also the most common method used in this area of research (McCullough et al., 2016).

The data were collected during a designated study period, providing a snapshot of people's knowledge, beliefs and reports regarding antibiotics at that time.

2.2 Study Population and Sampling Strategy

The intended target population was people aged 18–60 years. However, Figure 1 reports 106 respondents across five age categories, including Under 18 and Over 60. The reported sample therefore cannot be described as consisting solely of adults aged 18–60 years. The available age distribution corresponds to 18 respondents under 18, 5 aged 18–25, 17 aged 26–40, 58 aged 41–60 and 8 over 60 (counts inferred from the displayed percentages and total).

The original inclusion criteria specified ages 18–60, understanding the survey language and ability to provide informed consent; incomplete and duplicate submissions were stated to be excluded. The supplied aggregate results do not document how these criteria were applied, and Figure 1 shows responses outside the intended age range. Individual responses and an exclusion log are unavailable for verifying screening or recalculating an eligible-only sample. The existing aggregate results are therefore reported for all 106 respondents, with this discrepancy acknowledged as a limitation rather than treated as a verified eligible sample.

The survey was disseminated online via a Google Form, and respondents participated voluntarily. Recruitment is described as non-probability voluntary-response sampling rather than random sampling, because no sampling frame or random participant-selection procedure is documented. The specific distribution channels, recruitment dates and participants' country or region are not recorded in the available study materials. The sample is therefore limited to respondents reached through the online survey and should not be considered representative of a defined geographic or general population.

2.3 Questionnaire Development

The questionnaire was described as informed by published literature, antimicrobial stewardship guidelines and Knowledge-Attitude-Practice (KAP) surveys on antibiotic use, including the Eurobarometer survey and André et al. (2010). This source basis does not establish validation of the questionnaire used in the present study.

The questionnaire included questions on antibiotic knowledge and its proper use, antibiotic use practices, common misconceptions, and awareness of antibiotic resistance and responsible use. A misconception that was highlighted was the notion that antibiotics are effective against viral infections such as the common cold, which was mentioned frequently in previous studies (McCullough et al., 2016).

The questionnaire consisted of multiple-choice, Yes/No, True/False and Likert scale items to assess factual knowledge and attitudes.

The available results classify knowledge at the item level: responses stating that antibiotics treat viral infections or both bacterial and viral infections were treated as misconceptions, as were responses identifying antibiotic resistance as the human body becoming resistant to medication. Practices and attitudes are reported by response category. No composite knowledge score or validated cut-off is reported. The complete original questionnaire, an item-by-item adaptation record and documentation of pilot testing, reliability or validity assessment are unavailable; no such procedures are claimed. Consequently, an exact full-questionnaire appendix cannot be supplied from these materials. Antibiotic resistance concerns bacteria becoming resistant to antibiotics; AMR is the broader term covering resistance of microorganisms to antimicrobial medicines. The present survey concerns antibiotics and bacterial resistance.

2.4 Study Variables

Previous antibiotic use, age, gender, education and occupation were recorded as descriptive characteristics. These factors have been associated with variations in antibiotic knowledge and behaviour in previous studies; education level is one factor identified in the literature (McCullough et al., 2016). Their associations with knowledge or behaviour were not tested in this study.

The outcome variables were knowledge about antibiotics, prevalence of common misconceptions, awareness about antibiotic resistance, and self-reported antibiotic use. These variables provide a snapshot of people's knowledge, misconceptions, and behaviors regarding antibiotics.

2.5 Statistical Analysis

The analysis is descriptive, using frequencies and percentages from the supplied aggregate survey results. Reported percentages are presented to one decimal place where available. The figures report 106 responses; individual records are unavailable to audit item-level missingness, duplicate removal or

age-based exclusions. No inferential tests, confidence intervals, regression analyses or comparisons across age, education, gender or previous antibiotic use are reported. Differences in this manuscript describe the sample only and do not indicate statistical significance or demographic associations.

2.6 Ethical Considerations

All participants were informed and volunteered to participate. No personally identifiable data was gathered, and all responses were kept confidential. The data were only used for academic and research purposes.

No school or institutional ethics approval, exemption decision, reviewing body or reference number is documented in the available study materials. Formal oversight status therefore cannot be confirmed. Because Figure 1 includes respondents under 18, parental permission and assent arrangements also cannot be verified from the aggregate information. Voluntary participation and confidentiality should not be interpreted as evidence of formal ethical approval.

3. RESULTS

The survey of antibiotic use and antibiotic-resistance awareness, perceptions and practices involved 106 respondents. Antibiotic knowledge, awareness of the need for prescription, awareness of ‘superbugs', attitudes towards the course of an antibiotic, the ability to buy antibiotics without prescription, sharing of antibiotics, handling of unused medicine and previous antibiotic use were all assessed with the questionnaire. It also evaluated sources of health information, attitude towards the necessity of antibiotics and antibiotic resistance amongst participants.

3.1 Demographic characteristics and antibiotic-use background

The demographic profile indicated that there were more females (72) than males (32) participants, and 2 chose not to disclose their gender. The age distribution was not even, with 58 respondents aged 41-60 years (Figure 1), with fewer respondents in the younger age group (18-25 years). Participants of different education levels, such as undergraduate, postgraduate, professional and high school level, were also included in the survey.

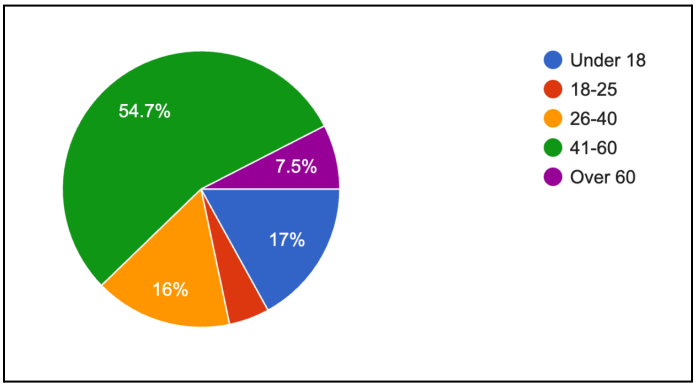


Figure 1. Age distribution of survey respondents.

Regarding antibiotic use during the previous year, 64 respondents reported taking antibiotics 1–2 times, while 33 had not taken antibiotics, 7 had taken them 3–5 times, and 2 reported more than five courses (figure 2). General practitioners/doctors were the most commonly reported source of infection-related health advice, selected by 75 respondents, followed by family or friends, Google/AI-based searches, and social media.

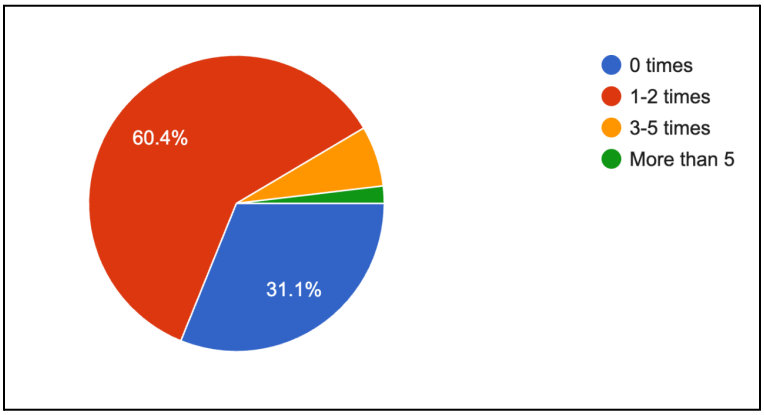


Figure 2. Frequency of antibiotic use among respondents during the previous year

3.2 Knowledge and awareness of antibiotics and antibiotic resistance

Despite relatively high educational attainment among respondents, important knowledge gaps were identified. When asked what antibiotics treat, 32 respondents (30.2%) incorrectly selected both bacterial and viral infections, while 8 (7.5%) believed that antibiotics exclusively treat viral infections such as the common cold or flu. Thus, 37.7% of respondents incorrectly linked antibiotics to viral infections. This

percentage combines the viral-only and combined bacterial/viral response categories; it excludes the separate "I don't know" category shown in Figure 3.

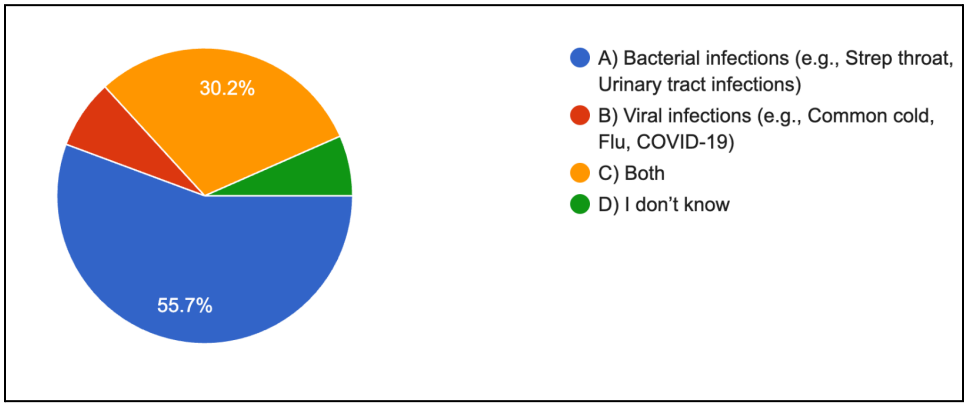


Figure 3. Respondents' understanding of what antibiotics are used to treat

One of the most frequent misunderstandings was about the concept of antibiotic resistance. 74 respondents (69.8%) misinterpreted the term "antibiotic resistance" as the body becoming immune or resistant to the medicine, instead of the bacteria becoming resistant to antibiotic treatment (Figure 4). The questionnaire also assessed understanding of "superbugs", with response options distinguishing antibiotic-resistant bacteria from unrelated concepts or lack of awareness.

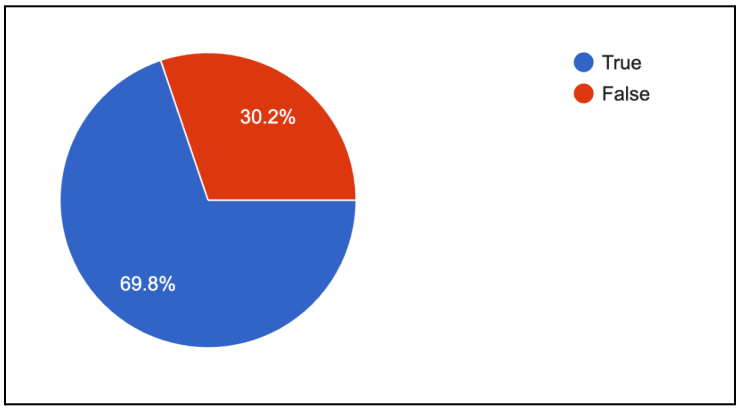


Figure 4. Respondents' understanding of the meaning of antibiotic resistance.

Awareness of prescription-control indicators was similarly limited. 56 respondents (52.8%) reported that they did not know what the "Red Line" on a medicine strip indicates, despite the indicator being associated with prescription-only medicines. These findings indicate that gaps in fundamental antibiotic and antibiotic resistance knowledge persisted even within a sample that was relatively well educated.

3.3 Attitudes toward antibiotic treatment and completion of therapy

The questionnaire explored whether participants considered antibiotics necessary for common illnesses and whether they understood the importance of completing a prescribed course. The responses indicated a generally positive attitude toward completing treatment: 56.6% reported completing their antibiotic course without retaining leftover medication. However, this appropriate behaviour was accompanied by concerning practices among a substantial minority.

Approximately 25.5% reported keeping leftover antibiotics for future illnesses, while 2.8% reported giving leftover antibiotics to another person who was sick (Figure 5) . The retention or redistribution of antibiotics indicates that a considerable proportion of respondents may regard antibiotics as reusable medicines rather than treatments intended for a specific illness and prescription.

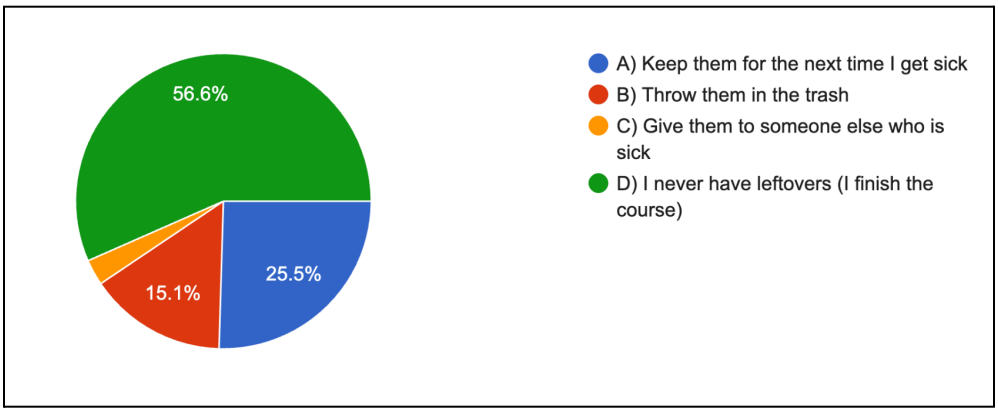


Figure 5. Respondents' actions regarding leftover antibiotics.

The survey also assessed whether respondents would stop treatment after feeling better, as well as their level of concern about "superbugs". The questions were formulated to assess awareness and attitudes towards appropriate antibiotic use and not just factual knowledge.

3.4 Non-prescription antibiotic purchase and antibiotic sharing

A major behavioural concern was the reported ability to obtain antibiotics without medical consultation. 57.6% of respondents reported having purchased antibiotics from a local pharmacy without showing a doctor's prescription. Among the total sample, 30.2% had done so once or twice, whereas 27.4% reported doing so frequently (Figure 6).

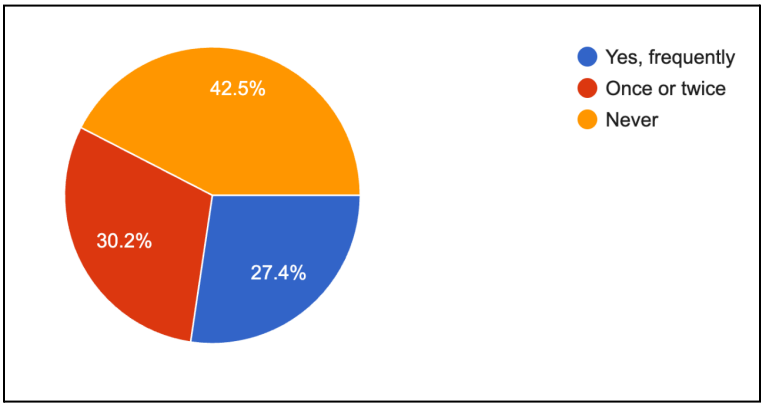


Figure 6. Respondents' reported purchase of antibiotics without a doctor's prescription

The willingness to share antibiotics with family members was another important finding. 45 respondents (42.5%) indicated that they would share their prescribed antibiotics with a family member experiencing similar symptoms, such as a sore throat, while 61 (57.5%) would not (Figure 7). Together, these findings identify self-reported non-prescription purchasing and willingness to share prescribed medicines within this sample; the sharing question did not establish that a transfer had occurred.

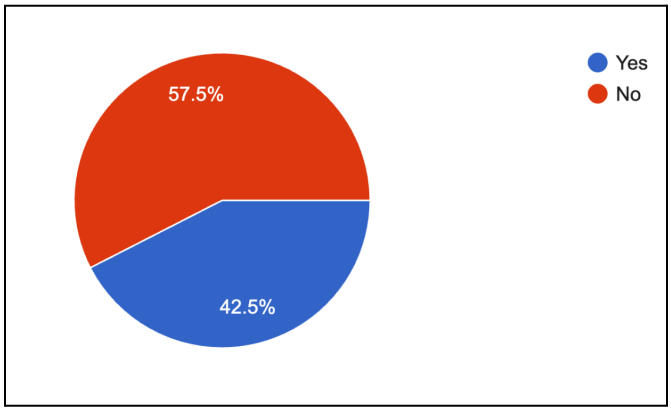


Figure 7. Respondents' willingness to share prescribed antibiotics with a family member

4. DISCUSSION

The results show a gap between the general knowledge about antibiotics and the knowledge needed for prudent antibiotic use. While many respondents seemed to have some knowledge of antibiotics and stated that they would seek advice from health care workers, there were still frequent misconceptions about the organisms that antibiotics work against, the concept of antibiotic resistance and the requirements for antibiotic prescription. This is noteworthy because of the relatively high educational level of the population surveyed.

The fact that 37.7% of respondents incorrectly linked antibiotics to viral infections indicates that a substantial proportion of respondents still view antibiotic use as a treatment for common infectious symptoms. The questionnaire also asked about antibiotic use for fever and cold, but corresponding response distributions are not reported here and cannot provide additional quantitative support for this interpretation.

The largest gap in knowledge was in relation to antibiotic resistance. Almost 70% of respondents mistakenly believed that antibiotic resistance was resistance of the human body, not resistance developed by the bacteria. This is not just a terminological issue, as it can make a person less likely to understand the importance of not using an antibiotic unnecessarily or inappropriately as a public health problem. This finding is noteworthy in light of the reported self-medication, sharing of antibiotics and the retention of unused drugs.

Another key behavioural issue is the 42.5% willingness to share prescribed antibiotics. This is likely a "symptom-matching" approach, where similar symptoms are thought to need the same antibiotic. This does not mean, however, that the symptoms are the same and that the same antibiotic, dosage, or length of treatment is suitable. Medication sharing can then lead to inappropriate medication and avoid professional evaluation. This behaviour was directly explored with the question: Would you share antibiotics with a family member who has similar symptoms?

Likewise, it is troubling that 28.3% of respondents kept leftover antibiotics for themselves or gave them to someone else. Storing antibiotics means that they can be used later without a clinical evaluation, and sharing them with someone else increases the risk of exposing another individual to an illness, dosage, or treatment that is different. These self-reported behaviours suggest possible topics for antibiotic education among populations similar to this sample.

This reported prevalence of purchasing non-prescription antibiotics is especially noteworthy at 57.6%. Over half of the respondents had purchased antibiotics at a local pharmacy without a doctor's prescription, with 27.4% saying that they did so often. This implies that inappropriate antibiotic use can be promoted by individual knowledge and attitudes as well as by the availability of antibiotics without formal consultation. These self-reports suggest that education and prescription-only dispensing practices merit further investigation in similar populations; this survey does not establish their effectiveness or justify population-wide enforcement conclusions.

Meanwhile, the results show some positive practices. Over half of respondents said they took their full course of antibiotics without keeping any leftovers, and 75 respondents said they got their health advice for infections from their GP. The results indicate that healthcare professionals are still a key pathway to reinforce antibiotic stewardship messages. Physicians and pharmacists might thus have a greater opportunity to educate about the need for antibiotics, the lack of effectiveness in treating viral illnesses, the importance of taking prescribed medicines as directed, and the need to not share or store antibiotics for future illnesses.

In general, the findings show that the problem is not just one of awareness but one of the gap between knowledge, perception and behaviour. High levels of antibiotic resistance misconceptions and non-prescription purchases, sharing of antibiotics and leftover retention suggest topics for further study and possible interventions among similar respondents. The findings suggest potential value in antibiotic education and communication about antibiotic resistance during healthcare consultations. Concurrently, the monitoring and auditing of the dispensing of prescription-only antibiotics in community pharmacies could be evaluated as a way to limit inappropriate access; this survey did not assess the effectiveness of such measures.

These results should be interpreted with several caveats. The sample was relatively small and not evenly distributed among demographic groups, with more females than males and a high number of respondents in the age group 41-60 years. There was a relative lack of older adults. The sample also had a relatively highly educated population, which may restrict the generalizability of the results to the broader population and may be noteworthy due to the observed knowledge and behavioural gaps. Additionally, the survey was self-reported, which can be subject to recall or social-desirability bias. The results should therefore be taken as a proxy for reported knowledge and practices and not as a direct measure of antibiotic use or AMR outcomes.

Additional limitations are voluntary-response sampling, undocumented geographic coverage, unavailable questionnaire validation records and the unresolved discrepancy between the intended age criteria and the reported sample. The aggregate data cannot establish whether the same individuals expressed positive treatment attitudes and reported sharing or retaining antibiotics. No demographic associations or population prevalence estimates can be inferred from these results.

Even with these drawbacks, the survey offers some evidence of ongoing misconceptions and possibly hazardous antibiotic use among the surveyed population. The findings suggest possible priorities for education, healthcare communication and dispensing practices in populations similar to this sample; larger, representative studies are needed to assess broader implications.

5. CONCLUSION

The aim of this study was to assess awareness among surveyed respondents, attitudes and practices on the use of antibiotics and antibiotic resistance. In general, the results suggest descriptive conclusions limited to this sample.

Firstly, there was a lack of awareness of antibiotics and antibiotic resistance. A substantial proportion of respondents were not sure that antibiotics are used to treat bacterial infections but not viral infections. In addition, even more thought that resistance meant that the human body developed resistance to medicine, not bacteria. Interestingly, these gaps remained even in a relatively well-educated sample, suggesting that general educational attainment may not ensure correct understanding of antibiotics in this sample; this association was not tested. Moreover, non-prescription antibiotic buying and sharing continue to be problematic behaviours. Over half of respondents were able to pick up antibiotics from a pharmacy

without a prescription, and a substantial proportion would be happy to give their prescribed antibiotics to a family member. They both bypass the professional assessment and increase the likelihood of wrong dosage and wrong treatment.

Meanwhile, positive treatment attitudes, leftover retention and willingness to share antibiotics were reported at the sample level. The aggregate results cannot establish that the same individuals reported these attitudes and practices, or determine how knowledge relates to behaviour. With this in mind, healthcare professionals can be a vital part of increasing antibiotic literacy. Consultations provide a natural opportunity to reinforce correct use and reduce misconceptions since GPs were the most common source of health advice in this study. These findings suggest potential value in education and review of prescription-dispensing practices among similar populations. The survey does not measure intervention effectiveness or establish a need for population-wide regulatory enforcement.

Last but not least, larger and more varied studies are suggested to confirm these results. The sample size in this study was small and had a skewed distribution of gender (more females than males and a predominance of respondents aged 41–60). More comprehensive and representative research would be useful to validate these trends and determine which interventions are most likely to be effective in the future.

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