Migration Letters

Volume: 20, No: S10 (2023), pp. 1450-1459

ISSN: 1741-8984 (Print) ISSN: 1741-8992 (Online)

www.migrationletters.com

Inappropriate Use of Antibiotics in The General Population

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ABSTRACT

Background: *Antibiotic resistance is a significant and growing threat to global health. While the vast majority of antimicrobial use occurs in communities where antibiotics are available without a prescription, we were unable to locate any studies examining community-level factors that influence the inappropriate use of antibiotics in settings where nonprescription antibiotic use is common.* ***Methods:*** *This qualitative study was conducted from 1 April to 5 May 2019 and consisted of in- depth, semi-structured interviews with adult household heads recruited via purposive and snowball sampling techniques. Participants with diverse educational and medical backgrounds were chosen. We utilized a thematic analysis methodology to investigate the community's knowledge and usage of antibiotics in the sampled population.*

Results: *Interviews were conducted with 18 participants with a median age of 35 years. The majority were female (77.7%), had completed at least secondary school (83.4%), and were unemployed (61.1%). We discovered that participants were familiar with the term "antibiotics" but had limited understanding of the indications and hazards of antibiotics, including the risk of antibiotic resistance. Antibiotic misuse was prevalent, as was self-medication with non-prescribed medications for a variety of non-indicated conditions, such as menstruation. The most frequently reported reason for not visiting a health facility for appropriate health care was limited income.* ***Conclusion:*** *Lack of adequate knowledge of antibiotic use, indications, and risks, prevalent self- medication, and financial barriers to accessing appropriate health care all contribute to pervasive inappropriate antibiotic use. To reduce the inappropriate use of antibiotics, both community education and structural interventions addressing poverty are required.*

KEYWORDS: *Antibiotic resistance, antimicrobial, inappropriate, Antibiotic misuse.*

INTRODUCTION

Antimicrobial resistance is recognized as one of the major global health challenges of the 21st century, causing over 700,000 fatalities annually [1]. Antimicrobial resistance will cost approximately 10 million lives and approximately $100 trillion by 2050 if no action is taken to curtail its spread [1]. S[1]ustainable development goals [2, 3] and numerous global initiatives of the World Health Organization (WHO) to enhance antimicrobial resistance surveillance include antimicrobial resistance. These include WHONET [4], the Advisory Group on Integrated Surveillance of Antimicrobial Resistance (AGISAR), and the Global Antimicrobial

Resistance Surveillance System (GLASS) [5]. The inappropriate use of antimicrobials, such as self-medication, suboptimal dosage, and overuse of antibiotics, is regarded as a significant contributor to the emergence and spread of antimicrobial resistance [6–8]. Antibiotic resistance is a subset of antimicrobial resistance, and improper

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use of antimicrobial agents, also known as antibiotics, is one of the major causes. Antibiotic misuse is contingent upon both supply and demand factors. Supply factors include the absence of antibiotic regulation, excessive prescription, and uncontrolled or unequal access to antimicrobials [9–11], whereas demand factors are associated with a lack of consumer knowledge regarding appropriate antibiotic use and
its implications, as well as beliefs, expectations, and personal experiences with antibiotics [12–16]. Numerous studies indicate that the vast majority of antimicrobials are used in the community, where they are readily accessible and can be obtained even without a prescription [17, 18]. A recent study
[19] estimated that community antibacterial consumption accounted for 85 to 95 percent of total antibacterial consumption in all countries for which data was available. This implies that patients administer their own antibiotics at home. They alone determine whether or not to adhere to the prescribed treatment, what to do with any remaining medications, and how to store or dispose of them. Recent research conducted in Ghana revealed that 86.6% of antibiotics were used improperly, either because they were obtained without a prescription or because the full course of treatment was not followed [20]. Increasing evidence suggests that in low-income countries, antimicrobial resistance occurs in microorganisms that are likely to be transmitted in the community (e.g., pathogens that cause pneumonia, diarrheal diseases, tuberculosis, sexually transmitted diseases, and malaria) [21]. Some nations have passed legislation regulating the prescription and sale of pharmaceutical products in recent years. The law restricts antibiotic prescribing to qualified health professionals, such as medical physicians, and prohibits the sale of antibiotics by nonpharmacists [22]. In spite of this, over-the-counter sales of antibiotics continue to be common and are frequently handled by unqualified personnel. Antibiotics are readily available in retail pharmacy stores (commonly known as "pharmacies") and even on the street [22]. Access to antibiotics, including broad-spectrum antibiotics, over-the- counter poses a challenge to controlling inappropriate antibiotic use and increases the risk of antibiotic resistance. Moreover, access to health care is primarily self-funded (90 percent of health care expenditures) in both the public and private health sectors [23]. This in turn encourages self- medication practices as a means of avoiding health care costs [22]. There is a need for research on community-level factors likely to influence antibiotic access, efficacy, and use. Information regarding the community use of antibiotics in contexts with limited resources is extremely scarce, and there are no studies of this nature on record. The present study sought to fill this gap in the literature by investigating community residents' knowledge of antibiotics and practices regarding the use and storage of antibiotics.

METHODS

This was a qualitative study conducted between 1 April and 5 May 2019. No official reports or published studies currently describe the social structure and health care facilities in. Some cities in the world are well-known for their lack of access to clean water and appropriate sanitation, making them cholera epicenters [24]. The prevalence of commercial sex work may contribute to the spread of sexually transmitted diseases among the population. Assuming a high prevalence of infectious diseases and antibiotic use among the population, we purposefully chose a random location as the study's setting. The research population consisted of adults (at least 18 years old) with the authority to make health-related decisions for their households. Participants were recruited on purpose using the snowball and maximum variation sampling methods. Maximum variation sampling was utilized to ensure that a broad variety of potential factors relevant to the study objectives were adequately represented in the study population. These variables included education level, employment status, household size, and medical history. Using a semi-structured interview framework, data were collected through in-depth interviews. The authors created the interview protocol specifically for this study after reviewing the scientific literature on PubMed, cairn, and Google Scholar. The research team evaluated the interview guide to ensure that it explored topics related to antibiotic knowledge (antibiotic indications, antibiotic risks), methods of procurement, antibiotic sources, and practices related to the use and storage of antibiotics (including leftover drugs) in the home. Throughout the duration of the research, the interview guide was modified based on emerging themes from the interviews. The interviews (one interview per participant) were conducted in the

residences of the participants and lasted an average of 45 minutes. The interviews were conducted in location A, where the most prevalent language is spoken. Photographic documentation of a visual inspection of household medications and their storage conditions was also conducted by researchers. All interviews were smartphone-recorded digitally, transcribed verbatim, and translated. All transcripts were examined for veracity by comparing them to the original recordings. We utilized a thematic analysis methodology to examine the data. This analytical approach, as described by Braun & Clarke (2006) [25], entails becoming familiar with the data through an iterative process of reading the transcripts, generating initial codes, arranging codes into larger categories, and drawing connections between codes and categories until a thematic map of the analysis is produced [25]. The initial data coding was performed by the principal investigator (AKPS), and the emergent themes were revised and refined through regular meetings with research team members PMM and OD in the first phase. Coding discrepancies were discussed and resolved by consensus, and codes were categorized into larger groups. For the purposes of this paper, participant quotes were translated into English and mildly edited for clarity. This research was ethically approved by the National Health Ethics Committee of the Ministry of Health. Prior to conducting interviews, we obtained written consent from all participants after they had been fully informed. All participants were informed of the objectives of the study, the confidentiality of their responses, their right to answer or not answer any question, and their right to withdraw from the study at any time without consequence. Eight prospective participants refused to sign the written consents and were therefore excluded from the study. Results Description of individuals 18 participants were evaluated in total. 35 was the median age of participants. The preponderance were women (77.7%), high school graduates (83.4%), and unemployed (61.1%). Four of the participants had a medical background (Table 1): three nurses and one pharmacist. We present results based on the identified major themes: (i) Knowledge, indications, and use of antibiotics; (ii) Prescription of antibiotics; (iii) Dosage and duration of treatment; (iv) Storage of antibiotics in the home; (v) Antibiotic risks; (vi) Perceived quality of antibiotics available on the market; and (vii) Unreliable sources of information. Antibiotic knowledge, indications, and usage All respondents were familiar with the term "antibiotics," and the majority described them as medications used to treat infections.

Table 1. Sample characteristics.

Variable	**N (18)**	**(%)**
Age		
Median (Min-Max)	35	33-50
Gender		
Male	4	22.22
Female	14	77.7
Education level		
Primary	3	16.6
Secondary	6	33.3
High school/Professional training	5	27.7
University	4	22.2
Profession		
Unemployed	11	61.1
Employed	7	38.9
Household size		
Median (Min-Max)	4.5	3-5

Participants were able to identify antibiotics (amoxicillin, ampicillin, clamoxyl, ciprofloxacin, etc.), though a few participants listed non-antibiotic drugs. All participants reported personally administering or administering antibiotics to a household member.

"Antibiotics are medicines. ..Medications that treat diseases. ..For instance, amoxicillins are antibiotics" (Female respondent #6) The participants listed a variety of infection-related signs and symptoms for which they used antibiotics. This included fever; itching and pimples; cough; profuse perspiration; ringworm; malaria (combined with antimalarial medications); and a change in urine color and pain during urination. Several participants attributed the prevalent use of antibiotics to their unsanitary living conditions, which exposed them to a variety of infections. Several households, for instance, shared latrines and bathing buckets, and the entire community lacked access to pure water. "By merely observing the environment in which we exist, it is clear that there are many germs; furthermore, the environment, the water we drink, foul odors, and garbage are everywhere.

..When I find myself incessantly scratching my skin and lesions begin to appear on my skin. I convince myself that antibiotics can make it all go away." (Male respondent #1) It was interesting to learn that some female participants frequently used antibiotics during menstruation to prevent infection or when they experienced a burning or tingling sensation in the genital region. Some participants said: ". ..In addition, as a woman, I experience extreme discomfort, tingling, and agony during my period. ..I disinfect the water with Detol (antiseptic) and take amoxicillin when this occurs. I am unaware of what others do, but this is what I do. "During my period, I take antibiotics to prevent infections" (Female respondent #7). ..I am not like the others who take them on a monthly basis. I do this sporadically every month or two. It depends. ..It is intuitive. ..I learnt this from my brother's wife, my sister-in-law. She told me that it helps get rid of all the "dirt." Since I dislike taking medication, I would prefer not to do it every month. " (Female respondent #12) "... I use amoxicillin during my period. Towards the end of my period, I buy a sleeve of amoxicillin and take one pill in the morning and another in the evening... mostly to protect myself. You see the environment we live in, and on top of that I have very painful periods.

Prescription, purchase, and use of antibiotics Based on participant responses; we identified several sources advising use of antibiotics. These included in order of importance: self-medication or advisement from non-medical family members, pharmacist or pharmacy salesperson, nurses, and doctors. Self-medication was very common. Several participants mentioned that they relied on their personal medical experience for antibiotic use. The knowledge was based on previous experience (e.g. previous antibiotic prescriptions from health care providers), or their educational training (for those with a medical background). In a few instances, they relied on advice from family members or friends. “By going to the hospital with the kids, I got a handle on the routine checkups that are ordered and the medications that doctors prescribe. Another thing, I jealously guard the medical prescriptions and use when I need them, especially when I don’t have the money. When I encounter the same problem, I buy the same medicines and it works.” (Female respondent #16) “I am not a health professional but for several years I ran a pharmacy. When people came to buy products for this or that pathology, I often remembered what the doctors prescribed. In addition, I have often fallen ill: even now I am sick but I just cannot afford to go to the hospital. I have a fever, my eyes hurt,. . . I’m just going to use my knowledge to buy products in pharmacies.” (Female respondent #9) Other participants sought advice from pharmacists or pharmacy outlet salespersons for treatment of symptoms or for alternative treatments when the treatments initiated at home did not work. “I don’t waste my money in the hospital. For frequent pathologies such as malaria and typhoid fever I refer to old prescriptions or I discuss with the pharmacy salesperson.” (Female respondent #8) “. . . There is a gentleman who ran a drugstore not far from here, who had

a reputation of being a good prescriber. . . " (Female respondent #2) Nurses were also cited as important players in the prescription of antibiotics in the community. Two of the three nurses included in this study reported prescribing antibiotics to individuals who sought their advice. One of them stated, "I believe in antibiotics. ..especially beta lactam antibiotics and amoxicillin. ..I use these antibiotics frequently. ..because I believe in them. ..When I use them, I have excellent results with my patients and even with those I treat at home when they are sick." (Male respondent #1) For some participants, visiting a doctor was routine when feeling ill, whereas for others, it was a last resort when other solutions failed. The lack of financial resources was the most frequently cited reason for not visiting a medical facility when ill. The majority of respondents stated that they could not afford to visit the hospital whenever a health issue arose. Therefore, they relied on self-medication, relatives, and non-clinical healthcare providers.
"The hospital is extremely costly, and we lack sufficient funds. To treat a pathology like malaria in a local clinic can cost up to 80 US dollars, whereas for 10 dollars you can buy Lutter Injectable (antimalarial drug) and get the same results." (Male respondent #10) "The hospital is the ultimate level. When you feel that your body is not doing well despite everything you've taken, you must go to the hospital to find out more." (Female respondent #16) "... Due to a lack of money Many participants relied on the advice of prescribers for dosage and duration of treatment. Those who self- medicated relied on the package leaflet for the dosage and duration of treatment, while others referred to previous medical prescriptions: "I used to give it [to my child] once a day, but when I visit the hospital for more severe cases, they always give it three times a day. So I began administering it three times per day..... " (Female respondent #2) Age, weight, and severity of illness were also cited as factors that would determine dosage and duration of treatment: "By the way, you must consider the age, the weight, and the severity of the illness." ..You must consider the individual's general condition. By observing a person of a certain age, for instance, we can determine that two amoxicillin tablets will be too much for them, so we should start with one and see how they respond. " (Female respondent #1) "I give according to age. Under the age of four, I administer half of a 500 mg tablet in the morning and the remaining half in the evening. If I miss the morning dose, I give one 500 mg tablet to make up for it. Typically, 12 pills. If there is no improvement, I will purchase a second carton of antibiotics." (Male respondent #10) Storage of antibiotics in the household We asked participants to show us where they stored their medications and to provide a sample of the medications available in the home to assess medication storage. Antibiotics (including residual antibiotics) and other medications were commonly stored in the homes of the participants. Numerous participants resided in shacks made of sheet metal, a material that conducts heat and humidity, especially in a country with year-round high temperatures. Observed antibiotics were affected by humidity and exhibited dubious coloring. A few participants stored their medication in a dry and sanitary location, whereas others did not store their medication at home due to limited financial resources. Antibiotic risks Participants' knowledge of antibiotic hazards was limited. Many were unaware of the hazards associated with antibiotic use, while others acknowledged that antibiotics could be dangerous but were unable to elaborate. Participants were more cognizant of the benefits of antibiotics than they were of the term "antibacterial resistance." Some participants mentioned the following: " I'd like to know the real risks of antibiotics. What happens when you don't finish your treatment. My own negligence frequently causes me to discontinue treatment." (Female respondent No. 3) "When antibiotics are taken too frequently, i.e., for the slightest discomfort, a resistance develops and the antibiotic loses its efficacy," (Female respondent #11) During interviews, participants mentioned possible indications of antibiotic resistance, though they did not necessarily recognize it as such. "I don't take amoxicillin when I'm sick because it doesn't work for me," said one participant. There is no effect from taking it. I prefer Ciprofloxacin or Clamoxyl tablets, or even penicillin, because they have an effect on me. I was taking amoxicillin and it was working well, but I began to observe that it wasn't working as well as it had in the past. I no longer take it myself and only give it to the children." (Male respondent #13) Perceived quality of antibiotics that are commercially available Participants were concerned about the integrity of commercially available medications. Some respondents had purchased antibiotics with altered expiration

dates or used medications that they perceived to be less effective because of a low concentration of the active pharmaceutical ingredient. A participant stated, "Once, my spouse bought expired medication..."They modified the expiration date on the packaging, and upon opening the package, the medication's pigment had already altered. When I inspected the packaging, I discovered that the product had expired. (Female respondent #11)

Informational resource Participants were aware of their limited health knowledge and lack of financial resources to visit a hospital, so they sought "good information" from health professionals, particularly nurses and pharmacy salespeople. However, the care and information they received were not always adequate. Some participants said: " My

sibling was administered a double dose of Norfen (norfloxacin) by a nurse. Once we realized the error, we halted the treatment, but she continues to suffer from gastritis." (Male respondent #10) The individuals who sell in pharmacies are not always pharmacists or health professionals. (Female respondent #11) Discussion This is the first qualitative investigation into the community's knowledge of antibiotics and practices regarding antibiotic use. This study demonstrated that the inappropriate use of antibiotics is a result of the interaction of multiple factors, such as limited knowledge of antibiotic risks and indications, easier access to antibiotics, self-medication of non-prescribed medicines or prescriptions made by unqualified people (e.g., relatives, pharmacy outlet salespeople), and participant perceptions of their high risk for infection (due to living conditions and unsanitary environments). Although the majority of participants in this study were familiar with the term "antibiotic," they possessed limited knowledge regarding the indications and hazards associated with the use of antibiotics. The participants were unaware of the ineffectiveness of antibiotics against viral infection. The reported indications for which they used antibiotics (e.g., cough; fever; etc.) were not justified, considering, for instance, that "cough" is a symptom of conditions and may be due to a viral infection that is resistant to antibiotics [26]. In addition, dyspnea and fever in a tuberculosis-endemic area may delay the correct diagnosis and treatment of tuberculosis [26, 27]. Although prescribing antibiotics is a medical procedure, we discovered that, for our study population, the antibiotic prescriber is determined by the sector the patient uses first. In general, participants relied on their own knowledge or the knowledge of those close to them (self- medication or advice from family members and acquaintances) prior to consulting with health professionals of any qualification. They had limited knowledge regarding the dosage of antibiotics and the duration of treatment, which was typically determined by the improvement of symptoms. The law prohibits over-the-counter sales of antibiotics without a prescription, but this prohibition has been weakly enforced. This has fostered an atmosphere conducive to self- medication [22]. A prior study documented a self-medication prevalence of 59.6%, with antimicrobials constituting 32.9% of self-medicated medications [28]. The retail pharmaceutical industry is primarily dominated by unregistered drug stores that are generally not operated by completely qualified pharmacists [29]. This circumstance exacerbates the risk of antibiotics being inappropriately prescribed in the United States. The current law regulating pharmaceutical practices dates back to 1993 and has not been accompanied by accompanying regulations that explicitly define the framework of drug prescription in the country [22]. Consequently, it is of the utmost importance to update the current law with new regulations and to establish mechanisms for enforcing the law and regulations regarding prescriptions and retail sales of antibiotics. Previous research has also found that self-medication with non-prescribed medications is a widespread practice in many nations, fuelled by easier access to antibiotics without a prescription [12, 20, 26, 28, 30–35]. For instance, in a recent survey conducted in Ghana, 64.3% of antibiotics were used without a prescription (489 out of 761) [20]. Horumpende et al. [26] discovered a high proportion (75%) of over-the-counter antibiotics prescribed for congestion in Tanzania. Lack of knowledge regarding antibiotics contributes to their misuse [36, 37]. In Ghana, Afari-Asiedu et al. discovered that antibiotics were used to alleviate stomachache and wounds [36]. In our study population, awareness of the hazards of antibiotics was low, and the majority of participants were unaware that improper use of antibiotics can contribute to antibacterial resistance. There was a high perception of infection risk, which was one of the motivating factors for the inappropriate use of antibiotics. Due to

the unsanitary conditions of their living environment and other hazardous behaviors, such as the sharing of toilets and containers, female participants in this study used antibiotics as a preventative measure to lower their risk of infection.. Interestingly, menstruation was perceived as a vulnerable period for which the use of antibiotics was justified in order to deter the risk of infection. There were other misconceptions such as antibiotics can "get rid of all the dirt," or relieve menstrual pain. It is critical to conduct large- scale quantitative research to assess the extent of such risky practices in this place and other similar resource-constrained settings. We found that poverty was a significant structural barrier that contributed to the misuse of antibiotics among the participants. The lack of financial resources deterred visits to health facilities and seeking professional treatment was perceived as more expensive than self-medication or seeking medical advice from relatives or salespersons at pharmacy outlets. , health care is mostly paid out of pocket (up to 90% of health care expenditure) in both public and private health facilities [23]. In support of our findings, Afari-Asiedu et al. in Ghana found that people who paid for health care without the benefit of health insurance and those who did not seek health care from health centers were over two times more likely to use antibiotics inappropriately [20]. In addition, financial constraints were cited as a factor that influenced community demand of antibiotics in Ghana [38]. In our study, the lack of financial means resulted in the purchase of less than the recommended quantity of medicines just to make the symptoms disappear. In addition, the precarious living conditions which favor sex work and unfavorable hygienic conditions (such as the use of toilets by several households; the exchange of buckets for the shower, etc.) increased the risk of infection, which in turn, led to extensive use of antibiotics among the residents of this community. The role of poverty in the misuse of antibiotics and emergence of antimicrobial resistance has been shown in previous research and reports [39, 40]. A recent qualitative study in rural South Africa has shown that although people have knowledge of where to receive professional healthcare, financial constraints, cultural norms, or habit often guided their choice of whether to actually seek out professional care [41]. In this regard, while community education is an important facet in addressing the inappropriate use of antibiotics, failure to address structural barriers such a poverty and financial insecurity as well as the lack of health insurance and financial risk protection (through universal health coverage) may negatively impact of the benefit of community education [41]. Storage of antibiotics for future use is a common practice in low- and middle-income settings, and it has been shown to be associated with inappropriate use of antibiotics [42, 43]. In a recent study from Angola, 53.92% of the surveyed households (55/102) was found to store antimicrobials [17]. Most participants in our study stored antibiotics. However, the storage conditions did not meet the standards required for storing medicines safely to ensure drug stability (humidity, temperature, light, oxygen, acidity, presence of catalysts and microbial contamination) [44]. The quality of antibiotics available in the marketplace was another theme that emerged from our study. There were accounts of tampering with drug expiry dates or suspected counterfeit antibiotics in the Congolese medicines market. Counterfeit drugs pose a serious threat for the delivery of quality health care. An estimated 40–45% of medicines sold are counterfeit according to the "Office Fe´de´ral des Migrations 2014" [45]. Counterfeit and substandard medicines represent 10% of medicines in low-income and middle-income countries [46]. This situation is due limited capacity and infrastructure for regulation, quality control, and law enforcement of drugs in many low- and middle-income countries. This study has a few limitations. Firstly, the interview guide was developed, but the in-depth interviews were conducted without a formal procedure and guidelines for translation to ensure accuracy of translation. The interview guide was not pilot tested. However, the principal investigator, using the flexibility of in- depth interviews, ensured that participants understood the topics for discussion. Secondly, it is unclear to what extent the findings of our study can be applied to other similar settings. This study has, however, the merit of being the first to explore the inappropriate use of antibiotic use in the household. More research is needed to increase the evidence base regarding inappropriate use of antibiotics.

CONCLUSION

A lack of understanding of the risks and indications of antibiotic use, beliefs that infection risk

is high, the prevalence of self-medication, and structural factors like poverty and inadequate regulatory systems for quality control of medications all contribute to the inappropriate use of antibiotics. In light of these findings, interventions for the proper use of antibiotics should focus on structural obstacles like poverty, financial insecurity, and inadequate regulatory systems for the quality control of medicines as well as community education to increase awareness of the risks of antibiotics and best practices for their use.

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