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Research Article

Antibiotic Use, Antimicrobial Resistance Awareness and Knowledge–Practice Gaps in Magharibi A, Zanzibar: A Bayesian Estimation and Posterior Predictive Analysis

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Abstract

Antimicrobial resistance (AMR) is driven partly by inappropriate antibiotic use, including premature treatment discontinuation, antibiotic sharing, and inappropriate treatment decisions. This study assessed antibiotic-use practices, AMR awareness, and the knowledge–practice gap among community inhabitants and community health workers in Magharibi A District, Zanzibar, while applying Bayesian analysis to project the persistence of inappropriate antibiotic-use behaviours under comparable conditions. A cross-sectional study was conducted from 16 December 2025 to 24 June 2026 among 60 respondents, comprising 44 community inhabitants and 16 community health workers. Data were collected using a structured questionnaire and analysed using descriptive statistics, Bayesian estimation, and posterior predictive analysis to quantify uncertainty and estimate the likely occurrence of selected antibiotic-use behaviours in comparable populations. All community inhabitants (44/44, 100%) reported previous antibiotic use, and none reported obtaining antibiotics without a prescription. However, all (44/44, 100%) reported discontinuing antibiotic treatment before completing the prescribed course. Economic constraints were the leading reported reason for discontinuation (22/44, 50.0%), while 7/22 (31.8%) of those reporting economic constraints also reported antibiotic sharing. Traditional or herbal remedies were subsequently used by 25/44 (56.8%) inhabitants, including 7/44 (15.9%) following hospital discharge. AMR awareness was lower among community inhabitants (29/44, 65.0%) than among community health workers (16/16, 100%), highlighting a substantial knowledge–practice gap. Bayesian posterior predictive analysis indicated that inappropriate antibiotic-use behaviours may remain prevalent in comparable communities if underlying social, economic, and behavioural conditions remain unchanged. These findings highlight the need to strengthen community-based AMR education, antibiotic-use counselling, and socioeconomic support, with active involvement of community health workers, to promote rational antibiotic use and strengthen antimicrobial stewardship in Zanzibar.

Keywords

Antimicrobial Resistance, Antibiotic Use, Antibiotic Sharing, Treatment Adherence, Traditional Medicine, Community Health Workers, Bayesian Statistics, Zanzibar

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1. Introduction

Antimicrobial resistance (AMR) has emerged as one of the most important global public health threats, compromising the effectiveness of medicines used to treat infectious diseases and increasing the risks of treatment failure, prolonged illness, disability and death. The World Health Organization (WHO) identifies the misuse and overuse of antimicrobials as major drivers of the emergence and spread of drug-resistant micro-organisms. In 2023, approximately one in six laboratory-confirmed bacterial infections causing common infections globally was resistant to antibiotic treatment, highlighting the continuing and growing threat posed by antibiotic resistance [25]. The problem is particularly concerning in low- and middle-income countries, where limited access to appropriate healthcare, diagnostics and medicines may coexist with inappropriate antimicrobial use and weak enforcement of regulatory measures [24].

Antibiotics remain essential for the treatment of bacterial infections; however, their effectiveness depends on rational use by prescribers, dispensers and patients. Inappropriate antibiotic use includes unnecessary treatment, use of antibiotics for conditions that do not require them, self-medication, acquisition without a prescription, sharing of medicines, incorrect dosing and premature discontinuation of treatment [16]. Such practices may increase unnecessary antibiotic exposure and create selective pressure that favours resistant organisms. Evidence from across Africa indicates that antibiotic self-medication is widespread and is influenced by multiple factors, including previous treatment experience, perceived severity of illness, healthcare accessibility, cost and ease of obtaining medicines outside formal healthcare facilities [4]. A systematic review of antibiotic self-medication in Africa similarly identified substantial variation between countries but confirmed that non-prescription antibiotic use remains an important public health concern [5].

The problem is also well documented in Tanzania. A cross-sectional study conducted among residents of Siha District reported that 58% of participants practiced antibiotic self-medication, with amoxicillin being among the most frequently used antibiotics. Cough, fever or malaria-related symptoms and diarrhea were common conditions associated with self-medication [8]. Importantly, studies also identified healthcare costs, accessibility of pharmacies and difficulties accessing formal healthcare as factors influencing antibiotic self-medication [5, 8]. These findings suggest that inappropriate antibiotic use cannot be understood solely in terms of individual knowledge; socioeconomic circumstances and accessibility of healthcare may also influence antibiotic-use decisions.

Access to antibiotics without a prescription represents an additional concern. Although Tanzania has regulations requiring prescription-only dispensing of antibiotics, evidence indicates persistent non-compliance within community pharmacies and accredited drug dispensing outlets [6]. A simulated-client study conducted in Mwanza, Mbeya and Kilimanjaro found that 88.2% of outlets dispensed amoxicillin without a prescription, while most outlets were also willing to sell incomplete courses of the antibiotic. The findings indicate a substantial gap between existing regulations and actual dispensing practices and underscore the need for stronger enforcement, surveillance and continuing professional education [1]. Similar findings have been reported in Moshi Municipality, where more than 90% of pharmacies dispensed antibiotics without prescriptions and incomplete antibiotic doses were frequently accepted by retailers [8].

Community knowledge of AMR is another important component of antibiotic-use behaviour. However, knowledge does not necessarily translate into appropriate practice. A study involving 828 community members from Ilala, Kilosa and Kibaha districts of Tanzania found that 98.6% of participants were aware of antimicrobials, while 62.5% demonstrated moderate knowledge of AMR [20]. Nevertheless, inappropriate antimicrobial-use practices remained evident, with antimicrobials being used for conditions such as cough, diarrhea and wounds. Education level and age were significantly associated with knowledge and antimicrobial-use scores [19]. These findings demonstrate that relatively high awareness of antimicrobials may coexist with behaviours that are inconsistent with rational antibiotic use.

Further evidence from Dar es Salaam demonstrates similar inconsistencies between knowledge and antibiotic-use behaviour [6]. Among 960 antibiotic consumers, only 20.4% demonstrated good knowledge of rational antibiotic use, while 52.4% demonstrated good knowledge of conditions that can be treated with antibiotics. Nevertheless, substantial proportions reported behaviours suggesting reliance on previous treatment experiences or advice from family and friends when deciding whether to use antibiotics [21]. Such findings highlight the importance of distinguishing between general awareness of antibiotics or AMR and the practical knowledge required to support rational antibiotic-use decisions.

Healthcare workers are equally important within the antimicrobial-use pathway because their prescribing, dispensing and patient-counselling practices directly influence antibiotic exposure within communities [9]. Although healthcare workers may possess relatively high levels of knowledge concerning AMR and prescription regulations, knowledge may not always translate into appropriate practice. A national study among pharmacists in Tanzania found that 77.7% demonstrated excellent knowledge of legal requirements governing antibiotic dispensing and the AMR challenge, yet 72.6% acknowledged dispensing antibiotics without prescriptions [18]. Reported reasons included pressure from patients, commercial considerations and inadequate regulatory inspection. This finding illustrates that inappropriate antibiotic use may persist even where knowledge is relatively high, indicating the influence of institutional, economic and regulatory factors.

The persistence of inappropriate antibiotic use despite increasing awareness suggests the existence of a broader knowledge–practice gap. This gap is important because interventions based exclusively on community education may have limited effectiveness when individuals face financial barriers to healthcare, limited access to diagnostic services, inadequate counselling, or easy access to antibiotics through informal or poorly regulated channels. Similarly, healthcare-worker training may not be sufficient in the absence of effective prescription enforcement, adequate supervision and functional antimicrobial stewardship programmes. Evidence from Tanzania therefore supports a multidimensional approach combining community education, regulatory enforcement, professional training and antimicrobial stewardship [15].

Despite the growing body of evidence on AMR and antibiotic use in Tanzania, important contextual gaps remain. Existing studies have largely examined community members, antibiotic consumers, pharmacies or healthcare professionals as separate populations [10]. Consequently, there is limited district-level evidence directly comparing AMR awareness among community members with antibiotic-use practices and healthcare-worker knowledge within the same setting. Furthermore, the extent to which awareness of AMR corresponds with actual behaviours such as obtaining antibiotics without prescriptions, sharing antibiotics and prematurely discontinuing treatment remains insufficiently characterized in many local communities. Understanding this relationship is particularly important in socioeconomically disadvantaged settings, where healthcare accessibility, cost and established treatment-seeking practices may influence antibiotic-use decisions.

Therefore, the present study assessed antibiotic-use practices and awareness of antimicrobial resistance among community members and healthcare workers in Magharibi A district. Specifically, the study examined patterns of antibiotic use, access to antibiotics without prescriptions, antibiotic sharing, adherence to prescribed treatment, knowledge of appropriate antibiotic indications, and awareness of AMR among the two population groups. The study further sought to determine whether a gap exists between knowledge of AMR and actual antibiotic-use practices and to generate evidence for strengthening community-based AMR education, prescription regulation and antimicrobial stewardship interventions in the district.

2. Materials and Methods

2.1. Study Design

A cross-sectional descriptive study was conducted to assess antibiotic-use practices and awareness of antimicrobial resistance (AMR) among community inhabitants and community health workers in Magharibi A District, Zanzibar. The study employed a quantitative approach, using a structured questionnaire to collect information on antibiotic-use behaviours, access to antibiotics, treatment practices, and knowledge of antimicrobial resistance.

2.1.1. Study Area

The study was conducted in Magharibi A District, Zanzibar, Tanzania. Magharibi A is one of the administrative districts of Unguja and comprises communities with varying socioeconomic and educational characteristics. The district was selected as the study setting because community members frequently interact with community-level health services and medicine outlets, making it an appropriate setting for assessing antibiotic-use practices and AMR awareness.

2.1.2. Study Period

The study was conducted from 16 December 2025 to 24 June 2026. The study period included preparation of research instruments, recruitment of participants, data collection, data processing and analysis.

2.1.3. Study Population

The study population consisted of two groups: community inhabitants residing in Magharibi A District and community health workers providing health-related services within the study area. A total of 60 respondents participated in the study, comprising 44 community inhabitants (73.3%) and 16 community health workers (26.7%). Community inhabitants were included to assess antibiotic-use practices at the household and community level, while community health workers were included to assess AMR awareness and their role in promoting appropriate antibiotic use.

2.2. Inclusion and Exclusion Criteria

Community inhabitants were eligible to participate if they were adults residing in Magharibi A District during the study period and were willing to provide informed consent. Community health workers were eligible if they were actively providing community-level health services in the study area during the study period and consented to participate. Individuals who were unavailable during the data-collection period, unable to provide informed responses, or declined to participate were excluded from the study.

2.3. Sampling Procedure and Sample Size

A total of 60 respondents participated in the study, comprising 44 community inhabitants (73.3%) and 16 community health workers (26.7%) from Magharibi A District, Zanzibar.

For the community inhabitants, random sampling was used to provide an opportunity for eligible members of the target community to participate in the study. Eligible inhabitants were identified within the selected study locations, and participants were randomly selected until the required number of 44 respondents was reached.

For community health workers, convenience sampling was

employed. Community health workers who met the eligibility criteria and were available during the data-collection period were approached and invited to participate. A total of 16 community health workers who consented to participate were included in the study.

The final sample therefore consisted of 60 respondents, representing both community-level antibiotic-use practices and the perspectives of community health workers. The combination of random sampling among community inhabitants and convenience sampling among community health workers was adopted in consideration of the accessibility of the study population and the availability of eligible respondents during the study period.

Participation was voluntary, and only individuals who met the predefined eligibility criteria and provided informed consent were included in the study.

2.4. Data Collection Instrument

Data were collected using a structured questionnaire developed from previously published literature on antibiotic use, antimicrobial resistance awareness and antimicrobial stewardship. The questionnaire was adapted to the local context of Magharibi A District. The questionnaire consisted of sections addressing:

1) *Socio-demographic characteristics*, including age, sex, educational level and occupation;
2) *Antibiotic-use history*, including previous antibiotic use and reasons for antibiotic use;
3) *Access to antibiotics*, including whether antibiotics were obtained with or without a prescription and the source of the medicines;
4) *Antibiotic-use practices*, including self-medication, antibiotic sharing, adherence to prescribed treatment and premature discontinuation;
5) *Knowledge and awareness of AMR*, including understanding of antibiotic resistance and its consequences;
6) *Knowledge concerning antibiotic indications*, particularly whether antibiotics are appropriate for bacterial and viral infections;
7) *Factors influencing antibiotic-use practices*, including healthcare accessibility, financial considerations, advice from relatives or medicine sellers, symptom improvement and use of traditional or herbal remedies; and
8) *AMR-related knowledge and practices among community health workers*, including antibiotic counselling, prescription practices and antimicrobial stewardship.

2.5. Measurement of Amr Awareness and Knowledge

Awareness of AMR was initially assessed by asking participants whether they had heard of antimicrobial resistance. Knowledge was subsequently assessed using a series of structured questions covering appropriate antibiotic use, the distinction between bacterial and viral infections, antibiotic resistance, antibiotic sharing, treatment adherence and the consequences of inappropriate antibiotic use. Each correct response was assigned one point, while incorrect and "don't know" responses were assigned zero points. Individual knowledge scores were converted into percentages. For interpretation, knowledge scores were categorized as follows: <50%: low knowledge; 50–74%: moderate knowledge; and ≥75%: high knowledge. This classification was defined before analysis and applied consistently to the study population.

2.6. Assessment of Antibiotic-Use Practices

Antibiotic-use practices were assessed using questions addressing whether respondents had ever used antibiotics, whether antibiotics had been obtained with a prescription, whether antibiotics had been shared with another person, whether treatment had been completed as prescribed, and whether antibiotics had been used without consultation with a qualified healthcare professional. For participants reporting antibiotic use, the following indicators were specifically assessed:

1) *Non-prescription antibiotic use:* obtaining or using antibiotics without a prescription from a qualified prescriber;
2) *Antibiotic sharing:* giving antibiotics obtained for oneself to another person or using antibiotics obtained for another person;
3) *Incomplete treatment:* discontinuing antibiotic treatment before completing the prescribed course or instructions;
4) *Self-medication:* using antibiotics without appropriate consultation with a qualified healthcare professional; and
5) *Inappropriate indication:* using antibiotics for conditions for which antibiotic treatment is generally not indicated, including viral infections.

The prevalence of each practice was calculated as the proportion of respondents reporting the specific behaviour.

2.7. Assessment of the Knowledge–Practice Gap

The knowledge–practice gap was assessed by comparing participants' AMR knowledge scores with their reported antibiotic-use behaviours. Particular attention was given to participants who demonstrated awareness or knowledge of AMR but simultaneously reported inappropriate antibiotic-use practices. The gap was assessed using indicators including non-prescription antibiotic acquisition, antibiotic sharing and incomplete treatment. This approach allowed the study to determine whether awareness of AMR was reflected in appropriate antibiotic-use behaviour.

2.8. Data Collection Procedure

Data were collected using interviewer-administered structured questionnaires. Before data collection, the research team

was oriented on the study objectives, questionnaire administration, informed consent procedures and confidentiality requirements. Potential participants were approached at their respective community settings or workplaces. The purpose of the study was explained to each participant, and informed consent was obtained before the interview. Interviews were conducted in a manner that maintained privacy and confidentiality. Completed questionnaires were reviewed daily for completeness and consistency before data entry and analysis.

2.9. Data Quality Control

To enhance data quality, the questionnaire was reviewed for clarity and relevance before administration. Where necessary, the instrument was translated into Swahili, if applicable and reviewed to ensure that the meaning of the questions was retained. Completed questionnaires were checked for completeness, consistency and accuracy. Data were coded before entry, and the dataset was checked for missing values and inconsistencies prior to statistical analysis.

2.10. Data Analysis

Data were entered, coded and analyzed using Excel. Descriptive statistics were used to summarize participants' characteristics and antibiotic-use practices. Categorical variables were presented as frequencies and percentages. AMR knowledge scores were summarized using percentages. The prevalence of antibiotic-use behaviours—including non-prescription acquisition, antibiotic sharing and incomplete treatment was calculated. Comparisons between community inhabitants and community health workers were performed using Fisher's exact test, as appropriate, for categorical variables. Associations between AMR knowledge and antibiotic-use practices were assessed using appropriate Chi-square statistical tests. Where sample size permitted, logistic regression analysis was considered to identify factors independently associated with inappropriate antibiotic-use practices. Statistical significance was set at $p < 0.05$. Given the relatively small sample size of 60 participants, inferential analyses were interpreted cautiously and emphasis was placed on effect estimates, confidence intervals and descriptive findings. The Bayesian posterior predictive analysis is employed for likely antibiotic-use behaviours.

3. Results

3.1. Socio-Demographic Characteristics of Study Participants

A total of 60 respondents participated in the study, comprising 44 community inhabitants (73.3%) and 16 community health workers (26.7%). The two groups were analyzed separately according to their respective roles in the study.

Among the 16 community health workers, 7 (43.8%) were aged 25–35 years, 6 (37.5%) were aged 35–44 years, 2 (12.5%) were below 25 years, and 1 (6.3%) was aged 45 years or above. Females constituted 9 (56.3%) of the community health workers, while males accounted for 7 (43.8%). All community health workers had attained at least diploma-level education, with 2 respondents holding bachelor's degrees in Public Health.

The 44 community inhabitants were aged between 18 and 65 years. Educational attainment varied considerably. Twenty-two respondents (50.0%) had post-secondary education, comprising 16 (36.4%) with diploma-level qualifications and 6 (13.6%) with university degrees. Fourteen respondents (31.8%) had secondary education, while 8 (18.2%) had no formal education. Among those without formal education, 5 (62.5%) were housewives. Out of 44, 30 were female while 4 men had primary education. Thus, the demographic composition displays a pronounced gender imbalance and a deeply polarized educational landscape with the educational background of the sampled community varies considerably, reflecting a distinct bifurcation between advanced qualifications and a lack of formal schooling.

3.2. Socioeconomic and Gender Intersectionality

Cross-referencing education levels with gender roles uncovers localized socioeconomic vulnerabilities, particularly among female residents. Out of the eight individuals who completely lack formal education, five (62.5%) are housewives. This strong correlation suggests that a lack of access to non-formal labour roles and basic education for women within this community.

3.3. Antibiotic Use Among Community Inhabitants

All 44 community inhabitants reported having used antibiotics, representing 100.0% of the respondents. This finding demonstrates widespread exposure to antibiotic treatment within the study population. Despite the universal history of antibiotic use, none of the 44 inhabitants reported purchasing antibiotics without a prescription. Thus, non-prescription antibiotic acquisition was reported by 0 (0.0%) of the respondents.

3.4. Antibiotic Sharing and Treatment Completion

Antibiotic sharing was reported by 7 of the 22 surveyed community inhabitants (≈ 32%), who gave away medication originally obtained for their own treatment. This practice extends antibiotic exposure beyond individual patients, facilitating inappropriate use within households and the wider com-

munity. Crucially, all 44 respondents (100.0%) failed to complete their prescribed antibiotic courses. This universal non-adherence represents a severe deviation from rational medicine use and presents a major challenge to antimicrobial resistance prevention. These problematic behaviours align closely with socioeconomic barriers, particularly low educational attainment—with eight respondents lacking formal education—and financial constraint.

3.5. Awareness and Understanding of Antimicrobial Resistance

Awareness of antimicrobial resistance (AMR) differed substantially between the two respondent groups. Among community inhabitants, 65.0% reported being aware of AMR, representing a moderate level of awareness according to the predefined classification adopted in this study. In contrast, all 16 community health workers (100.0%) demonstrated awareness of AMR, reflecting a high level of exposure to AMR-related information within the healthcare system.

3.6. Knowledge–Practice Gap

The findings demonstrate an important discrepancy between awareness of AMR and reported antibiotic-use practices among community inhabitants. Although 65.0% of inhabitants demonstrated awareness of antimicrobial resistance and none reported obtaining antibiotics without a prescription, inappropriate practices remained evident.

In particular, 7 respondents (≈ 32%) reported sharing antibiotics, while all respondents (100.0%) reported failure to complete their antibiotic treatment. These findings indicate that general awareness of AMR did not consistently translate into appropriate antibiotic-use behaviour.

The observed knowledge–practice gap suggests that factors other than awareness may influence antibiotic-use behaviour in the study community. These may include perceptions of illness, improvement of symptoms, treatment-related experiences, socioeconomic circumstances, health-seeking behaviour and the use of alternative or traditional remedies (Alison et al, 2025). However, these factors should only be interpreted as explanatory factors if they were directly assessed in the questionnaire.

3.7. Awareness Among Community Health Workers

All 16 community health workers (100.0%) demonstrated awareness of antimicrobial resistance. Their universal awareness indicates a high level of recognition of AMR as a public-health concern among community-based health personnel. Nevertheless, awareness of AMR should be distinguished from detailed knowledge of rational antibiotic use. The observed gaps concerning antibiotic use for viral infections and the consequences of incomplete treatment suggest the need for continued community-health-worker education focusing on practical antimicrobial stewardship and effective community counselling.

3.8. Antibiotic Treatment Completion and Reasons for Discontinuation

All respondents (100.0%) indicated that they had discontinued antibiotic treatment before completing the prescribed course. Economic constraints were the most frequently reported reason for discontinuation (18/44, 42.0%), followed by perceived allergic reactions (8/44, 18.2%), concerns related to urine smell (5/44, 11.4%), hallucinations (5/44, 11.4%), boredom with taking the medication (5/44, 11.4%), feeling well before completing treatment (4/44, 9.1%) and 4/44, and 9.1% discontinued because the initial dose provided did not combat their infection.

In addition to premature discontinuation, 25 respondents (56.8%) reported subsequently using traditional or herbal remedies as an alternative or complementary approach to treatment. Participants indicated that this practice was influenced by the belief that traditional or herbal remedies were more effective in eliminating the underlying disease. The use of herbal remedies was also reported among individuals who had previously been hospitalized; in seven documented cases, respondents reported seeking traditional or herbal treatment after discharge from hospital.

3.9. Antibiotic Access and Prescription Practices

Contrary to the initial expectation of widespread non-prescription antibiotic acquisition, none of the 44 community inhabitants (0.0%) reported purchasing antibiotics without a prescription. Thus, non-prescription acquisition was not identified as a common practice among the respondents in this study.

3.10. Bayesian Estimation and Posterior Predictive Projection of Antibiotic-Use Behaviours

A Bayesian beta-binomial framework using a Jeffreys prior, Beta (0.5, 0.5) is also applied to each binary outcome. The posterior distribution was estimated from the observed number of respondents reporting each behaviour. The posterior mean represents the Bayesian estimate of the underlying population proportion, while the 95% credible interval represents the range within which the underlying proportion lies with 95% posterior probability. Posterior predictive estimates were then used to project the expected number of individuals reporting each behaviour in a hypothetical future population of 100 individuals, assuming that the underlying behavioural pattern remains broadly unchanged.

Table 1. *Bayesian estimation and posterior predictive projection of antibiotic-use behaviours.*

Antibiotic-use indicator	Observed n/N	Observed (%)	Bayesian posterior estimate (%)	95% credible interval (%)	Expected per 100 future inhabitants	95% posterior predictive range per 100
Previous antibiotic use	44/44	100.0	98.9	94.5–100.0	99	94–100
Incomplete antibiotic treatment	44/44	100.0	98.9	94.5–100.0	99	94–100
Economic constraints	22/44	50.0	50.0	35.6–64.4	50	33–67
Perceived allergic reactions	8/44	18.2	18.9	9.0–31.4	19	7–34
Urine-smell concerns	5/44	11.4	12.2	4.5–23.1	12	3–25
Hallucinations	5/44	11.4	12.2	4.5–23.1	12	3–25
Boredom with medication	5/44	11.4	12.2	4.5–23.1	12	3–25
Initial dose perceived as ineffective	4/44	9.1	10.0	3.1–20.2	9	2–22
Feeling well before completion	4/44	9.1	10.0	3.1–20.2	9	2–22
Subsequent traditional/herbal remedy use	25/44	56.8	56.7	42.1–70.6	57	39–73
Traditional remedy use after hospital discharge	7/44	15.9	16.7	7.4–28.7	16	6–31
AMR awareness among inhabitants	29/44	65.9	65.6	51.2–78.6	66	48–81
Antibiotic sharing among those citing economic constraints	7/22	31.8	32.6	15.5–52.6	32	14–55

Note: The posterior estimates and credible intervals were obtained using a Jeffreys Beta (0.5, 0.5) prior. The posterior predictive projection assumes a future population comparable to the study population and no substantial change in the underlying behavioural environment. Multiple responses were permitted for reasons for treatment discontinuation; therefore, those categories should not be interpreted as mutually exclusive and their percentages are not expected to sum to 100%.

4. Discussion

4.1. Antimicrobial Resistance Awareness and Knowledge

Awareness of antimicrobial resistance was reported by 65.0% of community inhabitants, indicating a moderate level of awareness according to the predefined scoring criteria. In contrast, all 16 community health workers (100.0%) demonstrated awareness of AMR. Despite this level of awareness, important gaps were identified in specific aspects of antibiotic knowledge, particularly concerning the effectiveness of antibiotics against viral infections and the consequences of discontinuing treatment before completion.

The study identified concerns related to antibiotic dispensing practices in community pharmacies and drug outlets. Respondents reported that pharmacists or medicine dispensers do not always provide adequate counselling regarding simultaneous treatment of sexual partners, particularly in recurrent urinary tract infections (UTIs) and other communicable infections. Failure to treat all affected partners may result in reinfection, repeated antibiotic exposure, and increased opportunities for the development and selection of resistant organisms [14]. Such practices contribute to the overuse and repeated use of antibiotics, both of which are recognized risk factors for AMR. To add, most pharmacists also do provide half dose depending on the customer's pocket and the customer rarely turns back to purchase the remaining summing up to economic constraints. Thus, economic constrain emerges as the leading reported reason for premature discontinuation, followed by perceived allergic reactions or adverse effects, concerns related to urine smell, hallucinations, and the perception that treatment could be stopped once symptoms had improved.

The growth of use of herbal medicine too has taken the toll. Averagely, most patient do mix the conventional antibiotics drugs with the claimed herbal medicine to clear the microbes hence they do not finish the dispensed antibiotic drug.

Knowledge deficiencies were particularly evident in relation to appropriate indications for antibiotic use [22] and majority of the patients do not attempt to go back after treatment to see the nurse or doctor for follow-ups while some respondents unable to distinguish between bacterial and non-bacterial infections. Misconceptions regarding the effectiveness of antibiotics against viral illnesses, together with limited understanding of the long-term consequences of incomplete treatment, inappropriate self-medication, and repeated antibiotic exposure, suggest that current community awareness remains superficial rather than functional.

Most respondents associated AMR primarily with failure to complete prescribed doses or irregular drug intake, suggesting that their understanding was largely confined to patient adherence. However, knowledge of the broader ecological, microbiological, and public health drivers of AMR was limited as there are well known factors contributing to AMR. For example, Improper disposal of unused or expired household medications can release biologically active antimicrobial compounds into rivers, wastewater systems, and soils, where they exert selective pressure that promotes the survival and proliferation of resistant bacteria [13].; limited awareness of food-chain transmission [23], including the contribution of antibiotic use in agriculture and livestock production, which may contaminate meat, milk, water, and agricultural products with resistant organisms or resistance genes [23]. To add, understanding of poor infection prevention and control practices, inadequate sanitation, unsafe water supplies and the role of environmental contamination in spreading of resistant microorganisms [7]. Few participants were aware that resistance can arise through spontaneous genetic mutations and spread rapidly through horizontal gene transfer. Bacteria not only transmit resistance traits to their offspring during replication but can also exchange resistance genes with unrelated bacterial species through mobile genetic elements such as plasmids, transposons, and integrins [17]. This mechanism greatly accelerates the dissemination of resistance across bacterial populations and represents one of the principal reasons AMR has become a global health threat.

However, the findings indicate that awareness did not necessarily translate into comprehensive knowledge of the causes, transmission pathways, and prevention of AMR. Although general awareness of AMR was relatively high among both community members and health workers, critical knowledge gaps persist regarding the multifactorial causes and transmission dynamics of antimicrobial resistance [22]. The results highlight the need for comprehensive AMR education programs that extend beyond adherence messages to include environmental stewardship, food-chain contamination, infection prevention and control, sanitation and hygiene, rational antibiotic dispensing, and the biological mechanisms underlying bacterial resistance. Strengthening these components within community health promotion strategies may improve antibiotic-use behaviours and contribute to ongoing efforts to contain the spread of AMR.

4.2. Overall Knowledge–Practice Gap

Among the inhabitants, 66% are female with majority claiming recurring unitary tract infection has led them to the world of unfinish dose of antibiotic intake due to change of different antibiotic medicines in the desire of better medicine. Some are silent to their partners while to some their partners do not take the antibiotic drug prescribe and this leads to counter infection also. Furthermore, more than half of the inhabitants (56.8%) reported subsequently turning to traditional or herbal remedies, reflecting the influence of cultural beliefs and alternative treatment practices on antibiotic-use behaviour. These findings indicate that awareness of AMR alone may not be sufficient to achieve rational antibiotic use. Economic constraints, perceived adverse effects, symptom improvement and preference for traditional medicine may contribute to premature discontinuation of antibiotic therapy, thereby creating conditions that may undermine appropriate antibiotic use and potentially contribute to AMR.

4.3. Bayesian Estimation and Future Projection

The Bayesian analysis demonstrated a consistently high posterior probability of continued inappropriate antibiotic-use behaviours if the behavioural conditions observed in the study population remain unchanged. The strongest finding concerned incomplete antibiotic treatment. Although all 44 inhabitants (100.0%) reported discontinuing antibiotic treatment before completing the prescribed course, the Bayesian posterior estimate remained exceptionally high at 98.9% (95% credible interval [CrI]: 94.5–100.0%). Under the posterior predictive model, approximately 99 of every 100 comparable inhabitants would be expected to report incomplete antibiotic treatment in a future population, with a 95% posterior predictive range of approximately 94–100 individuals. This finding identifies premature discontinuation as the most persistent antibiotic-use behaviour observed in the study.

Economic constraints constituted the most frequently reported reason for discontinuation, being reported by 22 of 44 inhabitants (50.0%). The Bayesian posterior estimate remained 50.0% (95% CrI: 35.6–64.4%), suggesting that approximately half of a comparable future population could potentially experience economic barriers affecting antibiotic completion. The posterior predictive distribution correspondingly indicated an expected 50 individuals per 100, with a predictive range of approximately 33–67 individuals. This finding is particularly important because it suggests that inappropriate antibiotic use may not be attributable solely to insufficient knowledge or individual attitudes; structural and socioeconomic barriers may also contribute substantially to treatment interruption [11].

Among the other reported reasons for discontinuation, perceived allergic reactions were reported by 8 respondents (18.2%), producing a Bayesian posterior estimate of 18.9% (95% CrI: 9.0–31.4%). The posterior predictive model suggests that approximately 19 of every 100 comparable individuals could report this reason in a future population. Urine-smell concerns, hallucinations and boredom were each reported by five respondents (11.4%), with identical Bayesian posterior estimates of 12.2% (95% CrI: 4.5–23.1%). Each of these behaviours would therefore be expected to occur in approximately 12 of 100 comparable inhabitants, although the relatively broad credible intervals reflect the small number of observations.

The proportion reporting that the initial dose did not combat the infection was 4/44 (9.1%), as corrected, resulting in a Bayesian posterior estimate of 10.0% (95% CrI: 3.1–20.2%). Similarly, 4/44 (9.1%) reported discontinuing treatment because they felt well before completing the prescribed course, producing an identical posterior estimate of 10.0% (95% CrI: 3.1–20.2%). For each behaviour, the posterior predictive model suggests approximately 9 individuals per 100 in a comparable future population, although the corresponding predictive range remains relatively wide (2–22 per 100).

4.4. Traditional and Herbal Remedy Use

An important finding was the substantial use of traditional or herbal remedies following antibiotic treatment. Twenty-five inhabitants (56.8%) reported subsequently using traditional or herbal remedies, resulting in a Bayesian posterior estimate of 56.7% (95% CrI: 42.1–70.6%). The posterior predictive distribution suggests that approximately 57 of every 100 comparable inhabitants could engage in this behaviour in a future population, with a 95% predictive range of approximately 39–73 individuals.

This finding warrants particular attention because it suggests that the use of traditional or herbal remedies is not an isolated behaviour within the study population. Rather, if the underlying circumstances remain unchanged, it could remain relatively common. The finding should, however, be interpreted carefully: the use of traditional medicines itself does not demonstrate antimicrobial resistance, nor does it establish that traditional remedies cause resistance. Instead, it identifies a treatment-seeking behaviour that may complicate adherence to prescribed antimicrobial therapy and warrants further investigation.

Seven inhabitants (15.9%) specifically reported using traditional remedies following hospital discharge. The Bayesian posterior estimate was 16.7% (95% CrI: 7.4–28.7%), with approximately 16 of 100 comparable individuals predicted to exhibit this behaviour in the future. Although this proportion was substantially lower than overall traditional-remedy use, the finding indicates that treatment substitution or supplementation may persist beyond formal healthcare encounters.

4.5. Antibiotic Sharing and Economic Vulnerability

Among the 22 inhabitants who reported economic constraints as a reason for discontinuing treatment, seven (31.8%) reported sharing antimicrobial drugs with other people. Bayesian estimation produced a posterior proportion of 32.6% (95% CrI: 15.5–52.6%). In a comparable future population of 100 individuals experiencing economic constraints, approximately 32 individuals would therefore be expected to report antibiotic sharing, with a posterior predictive range of approximately 14–55 individuals.

This finding is particularly relevant from an antimicrobial stewardship perspective. Antibiotic sharing may result in inappropriate drug selection, inadequate dosing, incomplete treatment courses and exposure of individuals to antimicrobials without appropriate clinical assessment [12]. The association between economic constraints and sharing therefore suggests that interventions addressing antibiotic misuse should not focus exclusively on awareness campaigns but should also consider accessibility, affordability and continuity of treatment.

4.6. Amr Awareness Versus Antibiotic-Use Behaviour

AMR awareness among community inhabitants was observed in 29 of 44 respondents (65.9%), producing a Bayesian posterior estimate of 65.6% (95% CrI: 51.2–78.6%). The posterior predictive analysis suggests that approximately 66 of every 100 comparable inhabitants could demonstrate AMR awareness, with a predictive range of approximately 48–81 individuals.

However, the relatively high level of AMR awareness contrasts markedly with the reported antibiotic-use behaviours. Despite approximately two-thirds of inhabitants demonstrating awareness of AMR, all respondents reported incomplete antibiotic treatment, while half identified economic constraints as a reason for discontinuation and more than half reported subsequent use of traditional or herbal remedies.

This discrepancy is important because it indicates that knowledge alone may be insufficient to produce appropriate antibiotic-use behaviour. The findings support a broader interpretation in which antibiotic-use practices are influenced by a combination of knowledge, perceived adverse effects, economic circumstances, treatment response, cultural treatment preferences and access to healthcare [2, 3,].

4.7. Future Projection of Antibiotic-Use Behaviours and Associated Amr-Risk Indicators

The Bayesian projections indicate three particularly important areas of concern as reported in Table 2 below.

Table 2. Bayesian Projections.

Risk domain	Bayesian projection	Interpretation
Incomplete antibiotic treatment	~99/100	Very high projected behavioural risk
Traditional/herbal remedy use	~57/100	Substantial projected behavioural concern
Economic constraints	~50/100	Major structural risk factor
Antibiotic sharing among economically constrained respondents	~32/100	Important stewardship concern
AMR awareness	~66/100	Awareness relatively high, but behaviour remains problematic
Initial dose perceived as ineffective	~9/100	Moderate but potentially important treatment-related concern
Feeling well before completion	~9/100	Persistent adherence-related concern
Allergic reactions	~19/100	Potentially important contributor to discontinuation
Other concerns (urine smell, hallucinations, boredom)	~12/100 each	Secondary behavioural contributors

The particularly high posterior estimate for incomplete treatment (98.9%) and the substantial posterior estimates for traditional/herbal remedy use (56.7%) and economic barriers (50.0%) indicate that antibiotic stewardship challenges may remain considerable in the absence of targeted interventions. Importantly, these projections should not be interpreted as direct predictions of microbiologically confirmed antimicrobial resistance. Rather, they identify behaviours that may contribute to inappropriate antimicrobial exposure and therefore represent potential drivers of future AMR risk. Longitudinal surveillance incorporating antibiotic-use patterns, prescribing practices, treatment outcomes and microbiological susceptibility testing would be required to establish whether these behavioural patterns translate into measurable increases in antimicrobial resistance.

5. Conclusion

The study identified a substantial gap between awareness of antimicrobial resistance and appropriate antibiotic-use practices among community inhabitants in Magharibi A District, Zanzibar. Although none of the community inhabitants reported obtaining antibiotics without a prescription, all respondents reported discontinuing antibiotic treatment before completing the prescribed course, while approximately one-third which make vulnerable population reported sharing antibiotics with others. AMR awareness among community inhabitants was moderate (65%), despite universal antibiotic exposure, suggesting that awareness alone does not necessarily translate into appropriate antibiotic-use behaviour.

Economic constraints were the leading reported reason for treatment discontinuation, while perceived adverse effects, improvement of symptoms and other treatment-related concerns also influenced antibiotic-use decisions. The reported reliance on traditional or herbal remedies further highlights the influence of cultural and health-seeking practices on treatment decisions. Although all community health workers demonstrated awareness of AMR, the findings indicate a need to strengthen their capacity to translate general AMR awareness into effective community education and antimicrobial-stewardship activities.

The substitution of prescribed antibiotics with traditional or herbal remedies before completion of treatment may contribute to inappropriate antibiotic-use practices and potentially compromise effective management of bacterial infections.

Overall, the findings suggest that inappropriate antibiotic use in the study population is influenced by a combination of knowledge-related, socioeconomic, treatment-related and cultural factors. Addressing these factors requires interventions that extend beyond awareness creation to practical counselling, treatment support and culturally appropriate community engagement. Taken together, if these behaviours remain unchanged, the community could experience continued inappropriate antibiotic-use practices and an increased risk of conditions favouring antimicrobial resistance. The Bayesian posterior predictive analysis suggests that inappropriate antibiotic-use behaviours are likely to persist in a comparable community if the underlying social, economic and behavioural conditions remain unchanged.

6. Recommendations

Based on the findings of this study, the following recommendations are proposed:

6.1. Strengthen Community-Based Amr Education

Health authorities should intensify community education programs focusing on the correct use of antibiotics, the importance of completing prescribed treatment, the dangers of sharing antibiotics, and the limited effectiveness of antibiotics against viral infections.

6.2. Improve Counselling on Treatment Completion and Adverse Effects

Healthcare providers and community health workers should provide clear, understandable counselling on the expected duration of antibiotic treatment and what patients should do when adverse effects occur. Patients should be encouraged to consult a healthcare provider rather than independently discontinuing treatment.

6.3. Address Economic Barriers to Treatment Adherence

Since economic constraints were the most frequently reported reason for treatment discontinuation, health authorities should explore mechanisms for reducing the financial burden associated with completing prescribed treatment, particularly among economically vulnerable households.

6.4. Strengthen the Role of Community Health Workers in Antimicrobial Stewardship

Community health workers should receive regular training in AMR, rational antibiotic use, treatment adherence, recognition of common antibiotic-related adverse effects, and effective community counselling. They can serve as an important link between formal health services and households.

6.5. Address Antibiotic Sharing Through Targeted Education

Community education should explicitly discourage sharing antibiotics, emphasizing that antibiotics prescribed for one person may be inappropriate for another person because the illness, dose, duration and required medicine may differ.

6.6. Integrate Culturally Appropriate Approaches to Traditional Medicine

Because more than half of the community inhabitants reported turning to traditional or herbal remedies, AMR interventions should engage respectfully with existing cultural beliefs and treatment practices. Community leaders, traditional healers and community health workers could be engaged in culturally appropriate health-education initiatives that promote timely referral and discourage substitution or premature discontinuation of essential antibiotic treatment.

6.7. Strengthen Follow-Up After Treatment Initiation

Where feasible, community health workers should support follow-up of patients receiving antibiotics, particularly individuals at greater risk of discontinuing treatment because of financial difficulties, adverse effects or misconceptions about treatment.

6.8. Conduct Larger Studies

Further research involving larger and more representative samples across Magharibi A and other districts of Zanzibar is recommended to determine the prevalence and predictors of inappropriate antibiotic-use practices and to examine the relationship between socioeconomic factors, traditional medicine use, AMR knowledge and treatment adherence.

Abbreviations

AMR	Antimicrobial Resistance
Crl	Credible Interval
W. H. O	World Health Organization
UTI's	Urinary Tract Infections

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Author Contributions

Ochieng O Anthony: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Software, Validation, Visualization, Writing – original draft, Writing – review & editing

Sultan Khamis Muki: Project administration, Resources, Supervision

Data Availability Statement

The original contributions presented in the study are included in the article / supplementary materials further inquiries can be directed to the corresponding author. The questionnaire was developed from the study objectives and relevant

literature and was reviewed by experts in public health, antimicrobial resistance, and community health to establish content and face validity. The instrument was pretested among individuals with characteristics comparable to the study population who were not included in the final study. Feedback from the pretest was used to improve the clarity, wording, sequence, and comprehensibility of the items. Standardized administration procedures were used during data collection to minimize interviewer-related variation and enhance measurement consistency.

Conflicts of Interest

The author declare no conflicts of interest.

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