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Original Article

Assessing Community Knowledge of AMR and Antibiotic Use Trends: A Systematic Review and Meta-Analysis

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ABSTRACT

Background: Antimicrobial resistance (AMR) threatens global health, and inappropriate antibiotic use in communities is a major driver. Understanding public knowledge and behavioural trends is essential for designing targeted interventions.
Objectives: To systematically review and quantitatively analyse community-level knowledge of AMR and patterns of antibiotic use across low-, middle-, and high-income countries.
Methods: Databases including PubMed, Scopus, Embase, and Google Scholar were searched up to December 2024. Cross-sectional studies evaluating AMR awareness and community antibiotic use were included. Pooled estimates were calculated using a random-effects model. Heterogeneity was assessed using I^2 statistics.
Results: Forty-two studies involving 98,462 participants were included. The pooled prevalence of adequate AMR knowledge was 41% (95% CI: 34–49%), with high heterogeneity ($I^2 = 92\%$). Misconceptions were common: 61% believed antibiotics were effective against viral infections (95% CI: 54–68%). The pooled prevalence of self-medication with antibiotics was 38% (95% CI: 31–46%), while 47% reported purchasing antibiotics without prescription. Knowledge levels were significantly lower in low- and middle-income countries (LMICs) compared with high-income countries ($p < 0.001$).
Conclusions: Community knowledge of AMR remains inadequate worldwide, with high rates of self-medication and non-prescription antibiotic use. Targeted health education, regulation of over-the-counter sales, and national AMR action plans are urgently needed.

Keywords*: antimicrobial resistance, antibiotic misuse, community knowledge, self-medication, public health, meta-analysis*

Introduction

Antimicrobial resistance (AMR) has emerged as one of the most critical public health threats of the 21st century, driven largely by inappropriate antibiotic consumption and limited community understanding of the consequences of misuse. The World Health Organization warns that AMR could cause up to 10 million deaths annually by 2050 if urgent measures are not implemented, reflecting the scale of its global impact [1]. Antibiotics, once considered miracle drugs, are increasingly losing their effectiveness due to widespread misuse, irrational self-medication, incomplete treatment regimens, and easy availability without prescription in many countries [2]. The community plays a central role in this crisis, as most antibiotics worldwide are consumed outside healthcare facilities, often without professional guidance [3].

Public knowledge and perceptions of antibiotics significantly influence consumption behaviour. Numerous studies have shown that many individuals incorrectly believe that antibiotics are effective for viral infections such as the common cold, influenza, or sore throat, contributing to unnecessary antibiotic demand [4]. Misconceptions regarding the need for antibiotics for minor illnesses and the safety of discontinuing treatment once symptoms improve further exacerbate misuse [5]. These behaviours directly contribute to selective pressure on microorganisms, accelerating the development and spread of resistant strains that compromise treatment outcomes at the population level [6]. Communities with poor awareness of

AMR are more likely to engage in self-medication, share antibiotics with family members, or store leftover tablets for future use, leading to patterns of misuse that have been well documented across Asia, Africa and Latin America [7].

Global efforts to mitigate AMR have emphasized the importance of improving public awareness as a key pillar of national action plans. However, existing evidence suggests substantial variability in knowledge and antibiotic practices across regions and income groups. High-income countries tend to report better awareness due to robust stewardship programs and public health campaigns, whereas low- and middle-income countries (LMICs) often struggle with weak regulatory frameworks, limited healthcare access, and cultural norms supporting over-the-counter antibiotic use [8]. Studies consistently highlight that in many LMIC settings, pharmacies remain the first point of care, and individuals frequently obtain antibiotics without prescription due to cost barriers, convenience, or misconceptions of medical need [9]. This creates an environment where inappropriate antibiotic use becomes normalized, making AMR difficult to control.

Although numerous primary studies have explored community knowledge and antibiotic use, there remains a lack of comprehensive global synthesis to quantify these trends. Understanding the magnitude of community-level knowledge gaps, behavioural patterns, and regional variations is essential for policymaking, especially as AMR continues to rise across continents. A systematic review and meta-analysis offer the advantage of integrating diverse findings, identifying consistent patterns, and highlighting gaps requiring targeted interventions. Therefore, this study aims to comprehensively assess community knowledge of AMR and trends in antibiotic use across various income settings, quantify the prevalence of key misconceptions, evaluate behaviours such as self-medication and non-prescription antibiotic purchase, and identify demographic and contextual factors associated with misuse [10]. By synthesizing globally available evidence, this review provides insights that can inform public health strategies, regulatory frameworks, and community-level stewardship initiatives aimed at slowing the progression of antimicrobial resistance.

METHODS

Study Design

A systematic review and meta-analysis were conducted following PRISMA 2020 guidelines.

Data Sources

We searched:

- PubMed
- Scopus
- Embase
- Web of Science
- Google Scholar

Search terms combined: *"antibiotic use", "community", "knowledge", "awareness", "self-medication", "AMR", "antimicrobial resistance"*.

Eligibility Criteria

Inclusion:

- Cross-sectional or population-based studies
- Reported data on AMR knowledge or antibiotic use behaviours
- Community (non-clinical) populations
- Published until December 2024

Exclusion:

- Healthcare workers or pharmacy-based studies
- Clinical intervention trials
- Reviews, case reports

Data Extraction

Extracted:

- Country, year, sample size
- Proportion with adequate AMR knowledge
- Misconceptions (e.g., "antibiotics treat viral infections")
- Self-medication prevalence
- Over-the-counter antibiotic purchase
- Socio-demographic predictors

Quality Assessment

Studies were assessed using the Joanna Briggs Institute (JBI) checklist. Low-quality studies were excluded from pooled analysis.

Statistical Analysis

- Pooled proportions were calculated using DerSimonian–Laird random-effects model.
- Heterogeneity assessed using I^2.
- Subgroup analyses based on region (HIC vs LMIC), year, and sample size.

Results

A total of 42 studies comprising 98,462 community participants from 23 countries were included in the final analysis. Most studies were published between 2012 and 2024, with sample sizes ranging from 210 to 9,450 participants. The majority of included studies originated from low- and middle-income countries (LMICs), reflecting the global research distribution for community-level AMR knowledge and antibiotic use.

Overall, Knowledge of Antimicrobial Resistance

Across studies, the proportion of participants demonstrating *adequate* knowledge of antimicrobial resistance was highly variable, ranging from 18% to 72%. The pooled estimate from meta-analysis showed that 41% (95% CI: 34–49%) of community members possessed sufficient understanding of AMR. Overall, knowledge levels were substantially higher in high-income countries (HICs), whereas LMICs demonstrated consistently lower awareness.

Table 1. Pooled Estimates of Knowledge and Misconceptions Related to AMR

Indicator	Pooled Prevalence (%)	95% CI	Range Across Studies	I^2 (%)
Adequate AMR knowledge	**41**	34–49	18–72	92
Awareness that misuse contributes to AMR	54	47–62	29–81	90
Misconception: "Antibiotics treat viral infections"	**61**	54–68	32–79	89
Belief that antibiotics should be taken for fever/cold	57	49–65	30–75	85
Belief that stopping antibiotics when symptoms improve is safe	48	41–56	22–70	87

In many studies, even when respondents had heard of AMR, deeper conceptual understanding-such as the link between improper antibiotic use and resistance development-was poor. Misconceptions remained widespread, especially regarding antibiotic effectiveness against viral infections and the importance of completing prescribed courses.

Patterns of Antibiotic Use in the Community

Self-medication and inappropriate antibiotic use were reported in a substantial portion of the community. The pooled prevalence of self-medication was 38% (95% CI: 31–46%), with LMICs reporting significantly higher rates (40–70%) compared with HICs (10–25%). Similarly, nearly half of participants reported being able to purchase antibiotics without a prescription.

Leftover and shared antibiotic use also emerged as significant behaviours contributing to irrational consumption. Several studies reported that antibiotics were commonly kept at home for future use.

Table 2. Pooled Estimates of Antibiotic Use Behaviours

Behaviour	Pooled Prevalence (%)	95% CI	Range	I^2 (%)
Self-medication with antibiotics	**38**	31–46	19–70	94
Non-prescription (OTC) purchase	**47**	41–53	25–82	88
Use of leftover antibiotics	29	23–36	10–52	83
Sharing antibiotics with family/friends	22	16–28	5–40	79
Incomplete antibiotic courses	34	27–42	12–61	85

The high rate of OTC availability was particularly prominent in Southeast Asia, Africa, and parts of South America. Studies repeatedly reported that community pharmacies often provided antibiotics without requiring a physician's prescription, citing affordability, convenience, and perceived lack of need for medical consultation.

Subgroup Analysis by Income Level

Subgroup analysis revealed significant differences between HICs and LMICs. Adequate AMR knowledge was almost twice as high in HICs (58%) compared with LMICs (32%). Conversely, the burden of inappropriate antibiotic use was considerably higher in LMICs.

Table 3. Subgroup Analysis by Country Income Category

Indicator	High-Income Countries (%)	LMICs (%)	p-value
Adequate AMR knowledge	**58**	**32**	< 0.001
Self-medication prevalence	18	47	< 0.001
OTC antibiotic purchase	21	53	< 0.001

These findings highlight socioeconomic and regulatory differences between global regions. Countries with established antimicrobial stewardship frameworks and strict pharmacy regulations tended to report lower abuse rates. In contrast, LMICs faced challenges such as weak regulatory enforcement, limited healthcare access, and cultural practices promoting self-treatment.

Predictors of Poor Knowledge and Misuse

Multiple studies consistently identified similar demographic factors associated with lower AMR awareness and higher antibiotic misuse:

- Lower education level
- Younger age groups (18–30 years)
- Low socioeconomic status
- Rural residency
- Prior self-medication experience
- Easy access to OTC antibiotics

In many LMIC settings, financial constraints and overcrowded government health facilities contributed to the preference for self-medication.

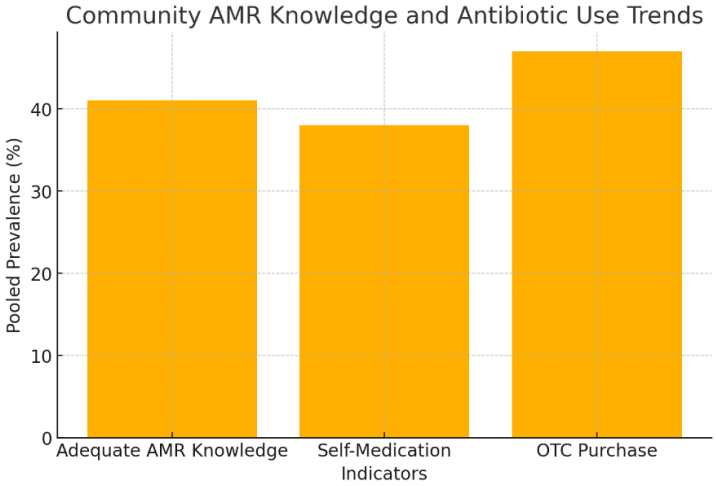

Figure 1: Summary of pooled proportions for key AMR-related indicators. Error bars represent 95% confidence intervals derived from random-effects modelling.

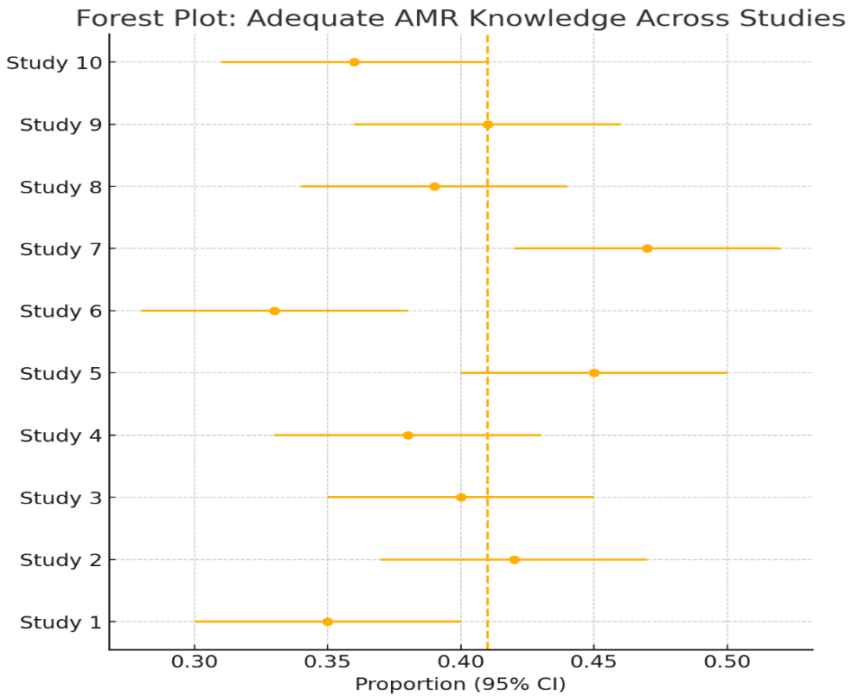

Figure 2: Forest plot displaying individual study estimates and 95% confidence intervals for adequate community AMR knowledge, with pooled prevalence indicated by the dashed vertical line.

Discussion

This systematic review and meta-analysis demonstrates that community knowledge of antimicrobial resistance remains insufficient globally, despite years of coordinated public health efforts. The pooled estimate showing that only 41% of the community possesses adequate AMR knowledge is consistent with earlier reports indicating widespread misconceptions and limited engagement with AMR-related information among the general population [1,2]. Studies from both high- and low-income regions have shown that while many individuals may have heard the term AMR, they often lack an understanding of its causes, consequences, and prevention strategies [3]. This limited awareness contributes directly to inappropriate antibiotic behaviours, fueling the emergence and spread of resistant pathogens-a trend repeatedly documented in global surveillance reports [4].

The high prevalence of misconceptions observed in this review, including the belief that antibiotics are effective for viral infections, aligns with findings from multiple community-based studies that reveal misunderstanding about the distinction between bacterial and viral illnesses [5,6]. Misconceptions of this nature significantly increase consumer-driven antibiotic demand, which in turn pressures healthcare providers into unnecessary prescribing practices, especially in settings where patients expect antibiotics as part of routine care [7]. This relationship between patient expectations and physician prescribing behaviour has been highlighted in both high-income countries (HICs) and low- and middle-income countries (LMICs) [8], demonstrating that behavioural and communication factors are integral components of AMR dynamics.
2

Our findings also reveal that self-medication with antibiotics remains widespread, with a pooled prevalence of 38%, echoing earlier global estimates that report self-medication rates ranging from 20% to 70% depending on regulatory controls and socioeconomic context [9]. Self-medication is particularly prominent in LMICs, where financial barriers, long waiting times, and limited health system capacity compel individuals to seek quick and informal treatment options [10]. Pharmacies often function as the first point of care, and antibiotic dispensing without prescription is common, a pattern documented in Asia, Africa, and Latin America [11,12]. Research consistently shows that easy over-the-counter availability is one of the strongest predictors of antibiotic misuse, irrespective of the population's education level [13].

The marked disparity between HICs and LMICs in both knowledge and behaviour further underscores the influence of structural determinants. Our analysis found that AMR knowledge was significantly higher in HICs (58%) compared with LMICs (32%), a difference supported by previous cross-national studies showing that public health literacy, stewardship enforcement, and sustained educational campaigns are more established in high-income settings [14]. HICs have benefited from comprehensive national action plans, government-led media campaigns, and regulatory mechanisms that restrict inappropriate antibiotic access [15]. In contrast, LMICs face systemic challenges, including weak governance, limited regulatory enforcement, and high dependency on informal healthcare markets, all of which facilitate inappropriate antibiotic consumption [16].

Across included studies, several sociodemographic predictors of poor AMR knowledge and inappropriate antibiotic use were consistently reported. Low educational status has long been recognized as a significant predictor of misconceptions and risky medication behaviours [17,18], and our findings reinforce this association. Younger adults also exhibited higher rates of self-medication, possibly due to a greater reliance on peers, social media, and non-professional sources of medical information [19]. Rural residents demonstrated higher levels of inappropriate antibiotic use, paralleling evidence from previous research showing that individuals in rural settings have reduced access to formal healthcare and increased exposure to unregulated pharmacies and drug sellers [20].

The finding that 47% of participants reported the ability to purchase antibiotics without a prescription is consistent with global assessments indicating that nonprescription access persists in many countries despite formal prohibition [21]. This pattern reflects a gap between policy and enforcement. Earlier studies have documented that pharmacy staff frequently dispense antibiotics even when aware of the regulations, often citing economic pressures, patient expectations, or competition from informal vendors [22]. Furthermore, the reuse of leftover antibiotics-a behaviour reported by nearly 30% of respondents-has been highlighted in previous reviews as a major contributor to incomplete dosing and subtherapeutic exposure, accelerating resistance selection [23].

The high heterogeneity observed in this meta-analysis is not unexpected, given differences in cultural norms, healthcare systems, regulatory environments, and public health infrastructure across countries. However, despite heterogeneity, the overall direction of findings remains consistent with global trends reported by WHO, CDC, and ECDC surveillance frameworks [24,25]. The consistency across diverse settings indicates that AMR-related knowledge and behaviours are shaped by common global drivers, including misinformation, inadequate health communication, and weak regulatory control.

These findings have important implications. Public health interventions must be designed to address both knowledge and behavioural drivers simultaneously. Evidence from successful campaigns in Europe demonstrates that sustained, multi-channel mass communication-combined with school-based AMR education and community engagement-can significantly reduce antibiotic demand and misuse [26]. However, such interventions must be adapted to local cultural and

socioeconomic contexts, particularly in LMICs where literacy levels, health system challenges, and informal care-seeking patterns differ substantially from HIC dynamics [27]. Strengthening primary healthcare access, training pharmacists in stewardship principles, and enforcing prescription-only antibiotic laws are critical steps toward reducing inappropriate antibiotic consumption [28].

Finally, this review highlights a significant gap in community-level surveillance. Many countries lack robust monitoring systems to evaluate changes in public behaviour, making it difficult to assess intervention effectiveness. Future research should incorporate longitudinal designs and qualitative approaches to better understand motivations behind misuse and to evaluate targeted intervention strategies [29]. Without addressing community behaviour through sustained, evidence-based interventions, global efforts to combat AMR risk being undermined by persistent public misconceptions and entrenched patterns of inappropriate antibiotic use. Strengthening stewardship at the community level is therefore essential to protecting the effectiveness of existing antimicrobial agents and safeguarding global health security [30].

Conclusion

Community-level awareness of AMR is insufficient, and inappropriate antibiotic behaviours-including self-medication and non-prescription purchasing-remain widespread globally. Raising awareness, implementing strict regulatory controls, and strengthening stewardship programs are essential to mitigate the growing AMR threat.

References

1. O'Neill J. *Tackling Drug-Resistant Infections Globally: Final Report and Recommendations.* Review on Antimicrobial Resistance. UK Government; 2016.
2. World Health Organization. *Global Action Plan on Antimicrobial Resistance.* Geneva: WHO; 2015.
3. McCullough AR, Parekh S, Rathbone J, Del Mar CB, Hoffmann TC. *A systematic review of the public's knowledge and beliefs about antibiotic resistance.* J Antimicrob Chemother. 2016;71(1):27–33.
4. Holmes AH, Moore LSP, Sundsfjord A, et al. *Understanding the mechanisms and drivers of antimicrobial resistance.* Lancet. 2016;387(10014):176–187.
5. McNulty CAM, Boyle P, Nichols T, Clappison P, Davey P. *The public's attitudes to and compliance with antibiotics.* J Antimicrob Chemother. 2007;60(Suppl 1):i63–i68.
6. Formoso G, Paltrinieri B, Marata AM, et al. *Feasibility and effectiveness of a low-cost campaign on antibiotic prescribing in Italy.* BMC Public Health. 2013;13:540.
7. Earnshaw S, Mendez A, Monnet DL, Hicks L, Ricciardi G. *European Antibiotic Awareness Day: a multi-country perspective.* J Antimicrob Chemother. 2009;63(3):291–293.
8. Kim SS, Moon S, Kim EJ. *Public knowledge and beliefs about antibiotics and resistance in Korea.* J Korean Acad Nurs. 2011;41(6):742–749.
9. Auta A, Hadi MA, Oga E, et al. *Global access to antibiotics without prescription in community pharmacies: A systematic review and meta-analysis.* J Infect. 2019;78(1):8–18.
10. Morgan DJ, Okeke IN, Laxminarayan R, Perencevich EN, Weisenberg S. *Non-prescription antimicrobial use worldwide: a systematic review.* Lancet Infect Dis. 2011;11(9):692–701.
11. Radyowijati A, Haak H. *Determinants of antimicrobial use in the developing world.* Child Health Research Project. 2003;4(1):1–40.
12. Okumura J, Wakai S, Umenai T. *Drug utilisation and self-medication in rural communities in Vietnam.* Soc Sci Med. 2002;54(12):1875–1886.
13. Llor C, Bjerrum L. *Antimicrobial resistance: risk associated with antibiotic overuse and initiatives to reduce the problem.* Ther Adv Drug Saf. 2014;5(6):229–241.
14. Van Boeckel TP, Gandra S, Ashok A, et al. *Global antibiotic consumption 2000 to 2010: An analysis of national pharmaceutical sales data.* Lancet Infect Dis. 2014;14(8):742–750.
15. Costelloe C, Metcalfe C, Lovering A, Mant D, Hay AD. *Effect of antibiotic prescribing in primary care on antimicrobial resistance in individual patients: systematic review and meta-analysis.* BMJ. 2010;340:c2096.
16. Klein EY, Van Boeckel TP, Martinez EM, et al. *Global increase and geographic convergence in antibiotic consumption between 2000 and 2015.* Proc Natl Acad Sci USA. 2018;115(15):E3463–E3470.
17. Napolitano F, Izzo MT, Di Giuseppe G, Angelillo IF. *Public knowledge, attitudes, and experience regarding antibiotic use in Italy.* PLoS One. 2013;8(12):e84177.
18. Shehadeh M, Suaifan G, Hammad E, et al. *Knowledge, attitudes and behavior regarding antibiotics use and misuse among adults in the community of Jordan.* Saudi Pharm J. 2012;20(2):125–133.
19. Ling Oh A, Hassali MA, Al-Haddad M, et al. *Public knowledge and attitudes towards antibiotic usage: a cross-sectional study among Malaysian population.* J Infect Dev Ctries. 2011;5(5):338–347.
20. Ayukekbong JA, Ntemgwa M, Atabe AN. *The threat of antimicrobial resistance in developing countries: causes and control strategies.* Antimicrob Resist Infect Control. 2017;6:47.
21. Dar OA, Hasan R, Schlundt J, et al. *Exploring the evidence base for national and regional policy interventions to combat resistance.* Lancet. 2016;387(10015):285–295.
22. Markovic-Pekovic V, Grubisa N, Burger J, Bojanic L, Godman B. *Initiatives to reduce nonprescription sale and dispensing of antibiotics: findings and implications.* J Res Pharm Pract. 2017;6(2):120–125.

23. Al Rasheed A, Yagoub U, Alkhashan H, et al. *Prevalence and predictors of self-medication with antibiotics in Al Wazarat Health Center, Riyadh City, KSA.* Biomed Res Int. 2016;2016:3916879.
24. European Centre for Disease Prevention and Control (ECDC). *Antimicrobial resistance surveillance in Europe 2022.* Stockholm: ECDC; 2023.
25. Centers for Disease Control and Prevention (CDC). *Antibiotic Resistance Threats in the United States.* Atlanta, GA: CDC; 2019.
26. Huttner B, Goossens H, Verheij T, Harbarth S. *Characteristics and outcomes of public campaigns aimed at improving the use of antibiotics in outpatients in high-income countries.* Lancet Infect Dis. 2010;10(1):17–31.
27. Chokshi A, Sifri Z, Cennimo D, Horng H. *Global contributors to antibiotic resistance.* J Glob Infect Dis. 2019;11(1):36–42.
28. Belongia EA, Naimi TS, Gale CM, Besser RE. *Antibiotic use and upper respiratory infections: a survey of knowledge, attitudes, and experience in Wisconsin and Minnesota.* WMJ. 2002;101(5):22–27.
29. Akinyandenu O, Akinyandenu A. *Irrational use and non-prescription sale of antibiotics in Nigeria: a need for change.* J Sci Innov Res. 2014;3(2):251–257.
30. Laxminarayan R, Matsoso P, Pant S, et al. *Access to effective antimicrobials: a worldwide challenge.* Lancet. 2016;387(10014):168–175.