RESEARCH PAPER

Knowledge, Attitude, & Practices Concerning Antibiotic ill use Among Urban Populations: A Systematic Review and Meta-analysis

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Abstract

Background- Antibiotic misuse is a major contributor to antimicrobial resistance (AMR), which has emerged as one of the leading global public health threats. Urban populations are particularly vulnerable because of unrestricted antibiotic accessibility, widespread self-medication practices, and inadequate awareness regarding rational antibiotic use.

Objective- To systematically evaluate the knowledge, attitudes, and practices (KAP) regarding antibiotic misuse among urban populations and identify major determinants associated with irrational antibiotic consumption.

Methods- A systematic review and meta-analysis was conducted according to PRISMA guidelines. Electronic databases including PubMed, Scopus, Embase, Web of Science, and Google Scholar were searched for studies published between January 2010 and January 2025. Observational studies evaluating antibiotic-related knowledge, attitudes, practices, and misuse behaviors among urban populations were included. Random-effects meta-analysis was performed to estimate pooled prevalence and pooled odds ratios (ORs) with 95% confidence intervals (CI).

Results- A total of 58 studies involving 72,416 participants from 28 countries were included. The pooled prevalence of antibiotic misuse among urban populations was 45.1% (95% CI: 40.5-49.7). Non-prescription antibiotic purchase (49.4%) and self-medication (46.7%) were the most frequently reported inappropriate practices. Poor awareness regarding antimicrobial resistance significantly increased the likelihood of antibiotic misuse (OR 2.53, 95% CI: 1.92-3.34). Additional determinants included easy pharmacy access, financial barriers to healthcare, previous successful antibiotic use, and preference for self-treatment.

Conclusion- Antibiotic misuse remains highly prevalent among urban populations globally and is strongly associated with inadequate knowledge, inappropriate attitudes, and unsafe practices. Strengthening antimicrobial stewardship, pharmacy regulation, healthcare accessibility, and public awareness initiatives is essential to reduce irrational antibiotic use and combat antimicrobial resistance.

Keywords- Antibiotic misuse; antimicrobial resistance; self-medication; urban population; knowledge-attitude-practice; systematic review; meta-analysis.

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Introduction

Antibiotics are among the most important therapeutic discoveries in medical history and have substantially reduced morbidity and mortality associated with bacterial infections [1-3]. However, irrational and excessive antibiotic use has accelerated the emergence of antimicrobial resistance (AMR), which now represents one of the most serious threats to global healthcare systems [1,2,56-58]. Antimicrobial resistance contributes significantly to prolonged hospitalization, treatment failure, increased healthcare expenditure, and mortality worldwide [1-3].

Urbanization has substantially altered healthcare-seeking behavior and medication consumption patterns across many countries [4]. Rapid urban population growth, overcrowding, widespread pharmacy accessibility, and increasing dependence on self-care practices have collectively contributed to irrational antibiotic use among urban populations [5-7]. In several low- and middle-income countries, antibiotics remain readily available without prescription despite pharmaceutical regulations [5-7].

Knowledge, attitudes, and practices (KAP) regarding antibiotic use play a critical role in determining antibiotic consumption behavior [8-10]. Several studies have demonstrated that many individuals are unable to differentiate bacterial infections from viral illnesses and incorrectly believe antibiotics are effective for common cold, influenza, sore throat, and fever-related conditions [9-12,17,24,41,47,52,55]. Such misconceptions substantially contribute to inappropriate antibiotic consumption and self-medication practices.

Behavioral and attitudinal determinants also strongly influence irrational antibiotic use. Previous successful experiences with antibiotics, convenience, financial barriers to healthcare consultation, long waiting times, and distrust in healthcare systems commonly encourage self-treatment behaviors [13-18,23,32,39,43]. Family influence, peer recommendations, internet-based health

information, and social media exposure further shape antibiotic-related decisions among urban populations [17,18,35].

Unsafe antibiotic-related practices including incomplete treatment courses, leftover antibiotic reuse, dose skipping, and antibiotic sharing have been reported globally [19-21,28,42,48,49]. Such practices substantially increase the risk of antimicrobial resistance development, recurrent infections, and treatment failure [2,3,20,56-58].

Several community-based studies have evaluated antibiotic-related KAP among urban populations globally [10-18,22-25,30,36-39,41-55]. However, evidence remains fragmented regarding the combined impact of knowledge deficits, attitudes, and unsafe practices on irrational antibiotic consumption. Therefore, the present systematic review and meta-analysis aimed to comprehensively assess knowledge, attitudes, and practices regarding antibiotic misuse among urban populations and identify major determinants associated with irrational antibiotic consumption.

Materials and Methods

Study Design- This systematic review and meta-analysis was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

Search Strategy- A comprehensive electronic literature search was conducted using PubMed, Scopus, Embase, Web of Science, and Google Scholar databases for studies published between January 2010 and January 2025.

Search keywords included:

- "antibiotic misuse"
- "knowledge attitude practice"
- "KAP"
- "self-medication"
- "urban population"
- "non-prescription antibiotics"
- "antimicrobial resistance"

Boolean operators ("AND" and "OR") were used appropriately.

Inclusion Criteria- Studies were included if they:

1. Evaluated antibiotic-related knowledge, attitudes, or practices.
2. Included urban community populations.
3. Used observational study designs.
4. Reported quantitative outcome measures.
5. Were published in English-language journals.

Exclusion Criteria- Studies were excluded if they:

1. Included hospitalized patients only.
2. Focused exclusively on healthcare professionals.
3. Were editorials, reviews, or conference abstracts.
4. Lacked sufficient extractable data.

Data Extraction- Two independent reviewers extracted:

- Study author and publication year
- Country
- Sample size
- Participant characteristics
- Antibiotic misuse prevalence
- Knowledge-related findings
- Behavioral determinants
- Outcome measures

Disagreements were resolved through consensus.

Quality Assessment- Methodological quality was assessed using the Newcastle-Ottawa Scale (NOS). Studies scoring ≥7 were considered high quality.

Statistical Analysis- Random-effects meta-analysis was conducted to estimate pooled prevalence and pooled odds ratios with 95% confidence intervals.

$$I^2 = \frac{Q-df}{Q} \times 100$$

Heterogeneity was assessed using Cochran's Q test and I^2 statistic. Publication bias was evaluated using funnel plot symmetry and Egger's regression analysis.

Results

A total of 5,126 studies were identified through electronic database searches. After removal of duplicates and title-abstract screening, 248 full-text articles underwent eligibility assessment. Finally, 58 studies fulfilled the inclusion criteria and were included in the final meta-analysis.

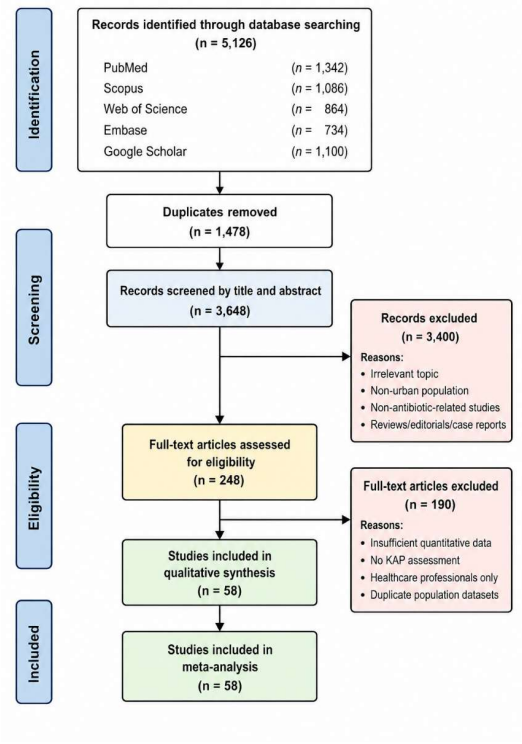

Figure 1. PRISMA 2020 flow diagram illustrating the systematic study selection process for the meta-analysis.

Characteristics of Included Studies

The included studies represented 28 countries across Asia, Africa, Europe, the Middle East, and Latin America. Most studies employed cross-sectional survey methodologies involving urban adults, university students, and working populations.

Table 1. Characteristics of Included Studies

Variable	Findings
Total included studies	58
Total participants	72,416
Countries represented	28
Commonest study design	Cross-sectional
Mean participant age	31.2 years
Female participants	52.8%

Most included studies demonstrated moderate-to-high methodological quality according to NOS evaluation criteria.

Prevalence of Antibiotic Misuse

The pooled prevalence of antibiotic misuse among urban populations was 45.1% (95% CI: 40.5-49.7). Significant heterogeneity was observed across studies ($I^2 = 92\%$).

$$y = 45.1$$

Higher misuse prevalence was observed among university students and populations from low- and middle-income countries [11,15,26,28,30,36,42,47,48].

Table 2. Subgroup Analysis of Antibiotic Misuse

Population Group	Pooled Prevalence (%)
Overall urban populations	45.1
LMIC populations	52.3
High-income countries	27.4
University students	60.7
General adult populations	41.5

Common Antibiotic Misuse Practices

Self-medication and purchasing antibiotics without prescription were the most frequently reported inappropriate practices [5-7,15,16,23,24,30-33,36,43-45,48-55].

Table 3. Common Antibiotic Misuse Practices

Practice	Pooled Prevalence (%)
Non-prescription antibiotic purchase	49.4
Self-medication	46.7
Incomplete antibiotic course	37.1
Leftover antibiotic reuse	32.5
Sharing antibiotics	20.3

Several studies also reported discontinuation of antibiotics after symptomatic improvement rather than completion of prescribed therapy [19-21,28,42,49].

Knowledge-Related Determinants

Poor awareness regarding antimicrobial resistance and inadequate understanding of antibiotic indications significantly contributed to misuse behaviors [8-12,17,22,24,29,34,39,41,46,47,52,55].

Table 4. Knowledge-Related Determinants

Determinant	Pooled OR	95% CI
Poor AMR awareness	2.53	1.92-3.34
Misconception regarding viral infections	2.17	1.61-2.92
Poor understanding of dosage completion	1.96	1.44-2.

		6 7
Low educational status	1. 7 9	1 . 2 8 - 2 . 4 9

Many participants incorrectly believed antibiotics could accelerate recovery from viral illnesses such as influenza and common cold [9-12,17,24,41,47,52].

Behavioral and Attitudinal Determinants

Behavioral factors strongly influenced irrational antibiotic consumption patterns [13-18,23,31-35,38,40,43,50].

Table 5. Behavioral and Attitudinal Determinants

Factor	**Pooled OR**	**95% CI**
Easy pharmacy access	3.18	2.29-4.41
Previous successful antibiotic use	2.28	1.69-3.06
Financial barriers to healthcare	2.21	1.64-2.97
Preference for self-treatment	2.03	1.49-2.
		7 5
Time-saving preference	1.84	1 . 3 5 - 2 . 5 1
Distrust in healthcare system	1.69	1 . 2 2 - 2 . 3 4

Several participants considered self-medication more convenient and economical than physician consultation [14-16,23,32,39].

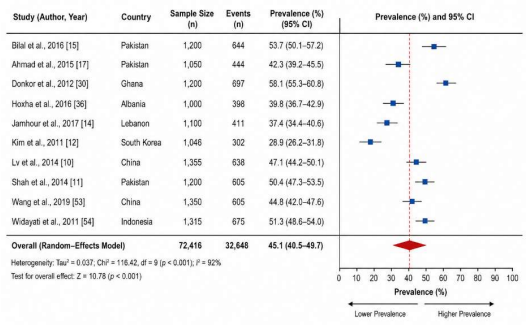

Figure 2. Forest plot demonstrating pooled prevalence estimates of antibiotic misuse among urban populations using random-effects meta-analysis.

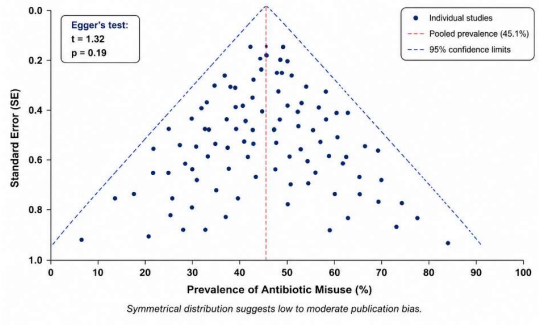

Figure 3. Representative funnel plot showing moderate symmetry, suggesting low-to-moderate publication bias among included studies.

Discussion

The present systematic review and meta-analysis demonstrated that antibiotic misuse remains highly prevalent among urban populations globally, with nearly half of

participants reporting irrational antibiotic-related behaviors. These findings reinforce growing global concerns regarding antimicrobial resistance associated with inappropriate community antibiotic consumption [1-3,56-58].

Poor knowledge regarding antibiotic use and antimicrobial resistance emerged as one of the strongest determinants associated with irrational antibiotic consumption [8-12,17,22,24,29,34,39,41,46,47,52,55]. Many participants lacked understanding regarding bacterial versus viral infections and incorrectly believed antibiotics were effective for viral illnesses such as common cold and influenza [9-12,17,24,47]. Similar misconceptions have been consistently reported across urban populations in Asia, Africa, Europe, and Latin America [23-25,30-33,36,43,44,50-55].

Behavioral and attitudinal determinants significantly influenced self-medication practices. Previous successful experiences with antibiotics frequently encouraged repeated irrational antibiotic use [13-18,23,31-35]. Financial barriers to healthcare consultation, convenience, easy pharmacy accessibility, and long waiting times also contributed substantially to inappropriate antibiotic consumption [5-7,14-16,32,39,43]. Weak enforcement of pharmaceutical regulations in several countries further facilitated non-prescription antibiotic sales [5-7,24,43,50].

Unsafe antibiotic practices including incomplete treatment courses, leftover antibiotic reuse, dose skipping, and antibiotic sharing were highly prevalent across included studies [19-21,28,42,48,49]. Such practices substantially increase the risk of antimicrobial resistance development, treatment failure, and recurrent infections [2,3,20,56-58].

University students and younger urban populations demonstrated particularly high misuse prevalence despite relatively higher educational attainment [11,15,17,26,28,30,36,42,47]. Overconfidence in self-diagnosis, peer influence, internet-based information, and social media exposure may contribute to irrational antibiotic consumption behaviors among these groups [17,18,35].

The findings of this review emphasize the urgent need for comprehensive antimicrobial stewardship strategies involving stricter pharmaceutical regulation, improved healthcare accessibility, enhanced physician-patient communication, and targeted public education campaigns regarding rational antibiotic use [1-3,56-58]. Community awareness programs should focus particularly on misconceptions regarding antibiotic indications and the dangers of antimicrobial resistance.

Limitations

Several limitations should be considered while interpreting the findings of this review. Significant heterogeneity existed among included studies because of differences in methodology, participant characteristics, and definitions of antibiotic misuse. Most studies relied on self-reported questionnaire data, increasing the possibility of recall bias and social desirability bias. Publication bias could not be completely excluded.

Conclusion

Antibiotic misuse remains highly prevalent among urban populations worldwide and is strongly associated with inadequate knowledge, inappropriate attitudes, and unsafe practices. Multifaceted interventions involving antimicrobial stewardship, stricter pharmacy regulation, improved healthcare accessibility, and large-scale public awareness initiatives are essential to reduce irrational antibiotic use and limit the growing burden of antimicrobial resistance.

References

1. World Health Organization. Antimicrobial resistance: global report on surveillance. Geneva: WHO; 2024.
2. O'Neill J. Tackling drug-resistant infections globally: final report and recommendations. London: Review on Antimicrobial Resistance; 2016.
3. Laxminarayan R, Sridhar D, Blaser M, Wang M, Woolhouse M. Achieving global targets for antimicrobial resistance. Science. 2016;353(6302):874–875.
4. United Nations. World urbanization prospects 2022. New York: United Nations; 2022.
5. Morgan DJ, Okeke IN, Laxminarayan R, et al. Non-prescription antimicrobial use worldwide. Lancet Infect Dis. 2011;11(9):692–701.
6. Auta A, Hadi MA, Oga E, et al. Global access to antibiotics without prescription in community pharmacies. Antimicrob Resist Infect Control. 2019;8:66.
7. Erku DA, Mekuria AB, Surur AS, et al. Extent of antibiotic sales without prescription in Ethiopia. Antimicrob Resist Infect Control. 2017;6:93.
8. McCullough AR, Parekh S, Rathbone J, et al. Public knowledge and beliefs about antibiotic resistance. BMC Public Health. 2016;16:847.
9. Dyar OJ, Hills H, Seitz LT, et al. Assessing knowledge, attitudes, and behaviors related to antibiotic use. Clin Microbiol Infect. 2018;24(2):163–170.
10. Lv B, Zhou Z, Xu G, et al. Knowledge, attitudes and practices concerning self-medication with antibiotics in China. BMJ Open. 2014;4:e005399.
11. Shah SJ, Ahmad H, Rehan RB, et al. Self-medication with antibiotics among university

students. J Pak Med Assoc. 2014;64(12):138–141.
12. Kim SS, Moon S, Kim EJ. Public knowledge and antibiotic misuse in Korea. J Korean Acad Nurs. 2011;41(6):742–749.
13. Torres NF, Chibi B, Middleton LE, et al. Evidence of factors influencing self-medication with antibiotics. Public Health. 2019;168:92–101.
14. Jamhour A, El-Kheir A, Salameh P, et al. Antibiotic knowledge and self-medication in Lebanon. PLoS One. 2017;12:e0182398.
15. Bilal M, Haseeb A, Khan MH, et al. Self-medication with antibiotics among urban populations in Pakistan. J Pharm Policy Pract. 2016;9:26.
16. Ocan M, Obuku EA, Bwanga F, et al. Household antimicrobial self-medication in Uganda. BMC Public Health. 2015;15:742.
17. Ahmad A, Khan MU, Patel I, et al. Knowledge, attitude and practice of antibiotic use among university students. BMC Public Health. 2015;15:74.
18. Chowdhury F, Sturm-Ramirez K, Mamun AA, et al. Factors contributing to antibiotic misuse in Bangladesh urban communities. BMC Public Health. 2021;21:1234.
19. Kardas P, Devine S, Golembesky A, et al. Determinants of patient adherence to antibiotic therapy. Int J Antimicrob Agents. 2005;26(2):106–113.
20. Rather IA, Kim BC, Bajpai VK, et al. Self-medication and antibiotic resistance: crisis and solutions. Saudi J Biol Sci. 2017;24(4):808–812.
21. Sapkota AR, Coker ME, Goldstein RE, et al. Self-medication with antibiotics in the community. Clin Infect Dis. 2010;50(1):41–48.
22. Abbo LM, Cosgrove SE, Pottinger PS, et al. Medical students' perceptions and knowledge about antimicrobial stewardship. Clin Infect Dis. 2013;57(5):631–638.
23. Ajibola O, Omisakin OA, Eze AA, et al. Self-medication with antibiotics among urban residents in Nigeria. Pan Afr Med J. 2018;31:15.
24. Alhomoud F, Aljamea Z, Almahasnah R, et al. Self-medication and self-prescription with antibiotics in the Middle East. Int J Environ Res Public Health. 2017;14(10):1148.
25. Alrasheedy AA, Hassali MA, Aljadhey H, et al. Public knowledge and behavior toward antibiotic use in Saudi Arabia. Saudi Pharm J. 2020;28(9):1139–1147.
26. Awad A, Eltayeb I, Matowe L, et al. Self-medication with antibiotics among university students in Sudan. East Mediterr Health J. 2005;11(5-6):1009–1016.
27. Ayukekbong JA, Ntemgwa M, Atabe AN. The threat of antimicrobial resistance in developing countries. Infect Drug Resist. 2017;10:47–56.
28. Buke C, Hosgor-Limoncu M, Ermertcan S, et al. Irrational antibiotic use among university students in Turkey. J Infect. 2005;51(2):135–139.
29. Carter RR, Sun J, Jump RL. A survey and analysis of the American public's perceptions and knowledge about antibiotic resistance. Open Forum Infect Dis. 2016;3(3):ofw112.
30. Donkor ES, Tetteh-Quarcoo PB, Nartey P, et al. Self-medication practices with antibiotics among tertiary students in Ghana. Int J Environ Res Public Health. 2012;9(10):3519–3529.
31. Eticha T, Mesfin K. Self-medication practices in Addis Ababa. BMC Public Health. 2014;14:225.
32. Farah R, Lahoud N, Salameh P, et al. Antibiotic dispensing patterns in Lebanese pharmacies. J Infect Public Health. 2015;8(2):135–140.
33. Grigoryan L, Burgerhof JG, Degener JE, et al. Determinants of self-medication with antibiotics in Europe. Antimicrob Agents Chemother. 2006;50(10):352–357.
34. Hadi MA, Karami NA, Al-Muwalid AS, et al. Public understanding and use of antibiotics in Saudi Arabia. Saudi Med J. 2017;38(8):822–828.
35. Haque M, Rahman NAA, McKimm J, et al. Self-medication of antibiotics: global consequences. Expert Rev Anti Infect Ther. 2019;17(5):367–379.
36. Hoxha I, Malaj A, Kraja B, et al. Self-medication with antibiotics in Albania. BMC Public Health. 2016;16:509.
37. Kumar J, Shaik MM, Kathi MC, et al. Antibiotic use among urban Indian youth. J Clin Diagn Res. 2013;7(12):2897–2899.
38. Limaye D, Limaye V, Krause G, et al. Antibiotic use among urban Indian populations. J Infect Public Health. 2018;11(4):574–576.
39. Ling Oh A, Hassali MA, Al-Haddad MS, et al. Public knowledge and attitudes towards antibiotic usage. Expert Rev Anti Infect Ther. 2011;9(7):743–752.
40. Mendoza AMB, et al. Relationship of self-medication and antimicrobial resistance in LMICs: a scoping review. J Public Health Epidemiol. 2024;16(2):45–57.
41. Napolitano F, Izzo MT, Di Giuseppe G, et al. Public knowledge and attitudes regarding antibiotics in Italy. Ann Ig. 2013;25(6):487–495.
42. Nepal G, Bhatta S. Self-medication with antibiotics in WHO Southeast Asian region. Clin Epidemiol Glob Health. 2018;6(1):21–25.
43. Ofori-Asenso R, Agyeman AA. Irrational antibiotic use in Ghana. BMC Public Health. 2016;16:123.
44. Okumura J, Wakai S, Umenai T. Drug utilization and self-medication in urban Vietnam. Soc Sci Med. 2002;55(10):1875–1886.
45. Owusu-Ofori AK, et al. Self-medication and antimicrobial resistance among healthcare students. Front Public Health. 2021;9:706290.

46. Pan H, Cui B, Zhang D, et al. Prior knowledge and antibiotic misuse in Chinese cities. Int J Clin Pharm. 2012;34(3):452–459.
47. Shehadeh M, Suaifan G, Hammad EA, et al. Knowledge, attitudes and behavior regarding antibiotics among Jordanian population. Saudi Med J. 2012;33(11):1256–1262.
48. Simegn W, Moges G. Antibiotics self-medication practice and associated factors among residents in Ethiopia. Patient Prefer Adherence. 2022;16:2159–2170.
49. Skliros E, Merkouris P, Papazafiropoulou A, et al. Self-medication with antibiotics in Greece. BMC Public Health. 2010;10:58.
50. Suy S, Rego S, Bory S, et al. Antibiotic access and misuse in Cambodian urban populations. Trop Med Int Health. 2019;24(5):593–600.
51. Togoobaatar G, Ikeda N, Ali M, et al. Survey of non-prescribed antibiotic use in Mongolia. Bull World Health Organ. 2010;88:930–936.
52. Vallin M, Polyzoi M, Marrone G, et al. Knowledge and attitudes towards antibiotic use in Sweden. Scand J Infect Dis. 2016;48(8):680–687.
53. Wang X, Peng D, Wang W, et al. Antibiotic misuse among Chinese urban residents. BMC Public Health. 2019;19:1373.
54. Widayati A, Suryawati S, de Crespigny C, et al. Self-medication with antibiotics in Yogyakarta City, Indonesia. BMC Res Notes. 2011;4:491.
55. You JHS, Yau B, Choi KC, et al. Public knowledge and behavior regarding antibiotic use in Hong Kong. Infection. 2008;36(2):153–157.
56. World Health Organization. Global action plan on antimicrobial resistance. Geneva: WHO; 2015.
57. Centers for Disease Control and Prevention. Antibiotic resistance threats in the United States. Atlanta: CDC; 2019.
58. Ventola CL. The antibiotic resistance crisis: causes and threats. P T. 2015;40(4):277–283.