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REVIEW

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Public knowledge and awareness of appropriate antibiotic use in Indonesia: A review of regional patterns and misconceptions

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Abstract: Inappropriate use of antibiotics is one of the major contributors to the rising incidence of antimicrobial resistance. Public knowledge plays a critical role in shaping appropriate antibiotic use behaviors. This review aims to assess the level of knowledge and awareness regarding antibiotics among communities across selected regions in Indonesia and identified persistent misconceptions. A literature search was conducted using PubMed and Google Scholar databases for studies published between 2020-2025. Cross-sectional studies examining public antibiotic knowledge in Indonesian populations were included. Quality assessment was performed using the CASP Checklist for cross-sectional studies. A total of ten articles met the eligibility criteria, each representing different provinces in Indonesia. All studies employed questionnaires as their primary data collection instruments. The review findings indicate that public knowledge and awareness of antibiotics remain moderate. Persistent misconceptions included beliefs that antibiotics treat viral infections, cold and cough symptoms, and fever. Non-prescription antibiotic procurement rates ranged from 40-52%, while 50-74% discontinued treatment when feeling better. To address these issues, targeted educational interventions are necessary, involving both active and passive dissemination strategies and engagement with healthcare professionals. Increasing public understanding of antibiotic use is expected to contribute to the reduction of antimicrobial resistance in Indonesia.

Keywords: antibiotic, knowledge, awareness, antimicrobial resistance

Introduction

Inappropriate antibiotic use is a major contributor to rising antimicrobial resistance (AMR) globally [1]. AMR remains a serious threat to global health, leading to increased morbidity, mortality, and economic burden in both developed and developing countries. The continued rise in antimicrobial resistance brings the world closer to a post-antibiotic era—a condition where antimicrobial agents become ineffective in preventing or treating infections [2]. In such a scenario, infections become difficult to treat, making many medical procedures including surgeries and cancer chemotherapy extremely risky.

Public knowledge and awareness regarding appropriate antibiotic use represent critical factors influencing antibiotic misuse patterns. The 2023 Indonesian Health Survey (*Survei Kesehatan Indonesia*) revealed that 22.1% of the population used oral antibiotics in the past year, with 41% obtaining antibiotics without a doctor's prescription. Furthermore, 18 provinces in Indonesia—primarily in the central and eastern regions—reported percentages above the national average [3]. These data highlight significant gaps in public knowledge about antibiotics and indicate weak regulatory controls over antibiotic distribution in communities.

Recognizing the growing threat of antimicrobial resistance, the Ministry of Health, in collaboration with the World Health Organization, has established various strategies to reduce AMR incidence [4]. A key strategy involves strengthening public education and awareness through intensive community outreach and educational campaigns. These initiatives aim to improve public understanding of antimicrobial resistance risks and promote positive behavioral changes in antibiotic use.

Several studies have examined public knowledge and awareness levels in specific Indonesian regions. However, few studies have analyzed public knowledge across diverse geographic areas, creating a gap in understanding regional variations and the effectiveness of existing interventions. A literature review is essential to comprehensively understand public knowledge and

awareness across various regions and social contexts within Indonesia.

This article aims to review and analyze previous research findings on public knowledge and awareness regarding antibiotics across different Indonesian regions. By examining various scientific sources, this study seeks to provide a scientific foundation for developing appropriate interventions and educational strategies for Indonesian communities. The findings are expected to inform targeted approaches for reducing AMR through improved public education programs.

Methods

Study design

This study employed a narrative literature review methodology to analyze scientific sources, primarily peer-reviewed journal articles, examining public knowledge and awareness regarding antibiotic use in Indonesia.

Search strategy

A literature search was conducted using two electronic databases: PubMed and Google Scholar. The search employed multiple keyword combinations including "knowledge and awareness of antibiotic in Indonesia," "knowledge of antibiotic in Indonesia," "awareness of antibiotic in Indonesia," and "pengetahuan tentang antibiotic" (Indonesian term for antibiotic knowledge).

The search strategy incorporated both English and Indonesian language terms to capture studies published in Indonesian journals that may not be indexed in international databases. Hand searching was performed to identify additional relevant articles from reference lists of included studies.

Study selection

Articles were initially screened based on titles and abstracts, followed by full-text review for potentially relevant studies. The inclusion criteria comprised articles written in Indonesian or English, observational studies using cross-sectional methodology, articles published between 2020 and 2025, studies specifically examining public knowledge and awareness regarding antibiotics, studies representing populations from specific Indonesian regions, and full-text articles available for review.

Studies were excluded if they were not available in full-text format, were literature reviews or systematic reviews, were not conducted in Indonesian populations, were conference abstracts or editorials, or focused solely on healthcare professionals' knowledge.

Quality assesment

Quality assessment was performed using the Critical Appraisal Skills Programme (CASP) Checklist for cross-sectional studies. The CASP Checklist evaluates multiple methodological aspects including study focus clarity, population recruitment appropriateness, data collection adequacy, study design suitability, sample representativeness, response rate adequacy, outcome measurement appropriateness, statistical analysis methods, results presentation clarity, and acknowledgment of study limitations. Several methodological limitations were commonly identified across the reviewed studies. Many studies did not report validity and reliability testing of questionnaires used, which represents a significant methodological concern in survey-based research.

Data extraction and analysis

Data extraction was performed systematically from articles meeting the quality assessment criteria. Extracted data included study characteristics such as year of publication, geographic location, sample size, and study population, along with outcome measures including knowledge and awareness levels and key findings about misconceptions regarding antibiotic use. Due to the heterogeneity of outcome measures and study populations across the included studies, a narrative synthesis approach was employed rather than quantitative meta-analysis. Results were categorized by geographic region and study population to identify patterns and regional variations in antibiotic knowledge and awareness.

Results

A total of 21 articles were identified through the literature search, of which 10 articles met the inclusion criteria and passed the CASP quality assessment. The general characteristics of these studies are presented in Table 1.

Study characteristics and publication trends

Analysis of publication trends reveals increasing research attention to antibiotic knowledge, with 40% of studies published in 2023 alone, suggesting growing

Table 1. Characteristic and quality assessment of included studies (n=10)

Study characteristics	Number of studies	Percentage (%)	Note
Publication year			
2020	3	30	Early Covid-19 period studies
2021	1	10	
2022	1	10	
2023	4	40	Peak research period
2024	1	10	
Journal type			
National	4	40	Local context
International	6	60	Higher visibility, English language
Sample range			
<100	2	20	Nuraini (96), Sugihantoro (96)
100 - 300	3	30	Kristina (268), Herwati (329), Zairina (236)
300 - 500	1	10	Karuniawati (573)
>500	4	40	Range 582-1,013
Geographic distribution			
Java island	7	70	East Java (5), Central Java (1), Yogyakarta (1)
Sulawesi island	1	10	Southeast Sulawesi
Bali island	1	10	Single village study
National/unspecified	1	10	Claims national representation
Study population type			
General public/community	4	40	Broader population representation
Health seekers/patients	3	30	Outpatients, pharmacy customers
Specific groups (parents/ women)	3	30	Targeted demographic studies
Data collection method			
Online questionnaire	4	40	Google forms, social media
Face-to-face interview	3	30	Direct community contact
Mixed/unspecified	3	30	Multiple methods

recognition of antibiotic resistance as a public health priority in Indonesia. The studies demonstrated considerable variation in sample sizes, ranging from 96 to 1,013 participants, with 40% of studies involving more than 500 respondents. This variation in sample sizes reflects different research capacities and target populations across institutions. Regarding publication venues, 60% of studies appeared in international journals while 40% were published in national Indonesian journals.

The geographic distribution of studies shows a pronounced bias toward Java Island, accounting for 70% of all included studies. Seven studies were conducted in various Java provinces (Yogyakarta, East Java, Central Java), while only one study each represented Sulawesi and Bali. One study claimed national representation but lacked clear geographic boundaries. This geographic concentration reflects both the density of research institutions and population centers in Java, but limits the generalizability of findings to Indonesia's more remote and culturally diverse regions.

Knowledge and awareness levels across studies

The review reveals consistently moderate levels of antibiotic knowledge across different populations and

regions. Knowledge levels varied significantly between studies, with some reporting high knowledge rates (71.6% in Surabaya communities) while others found predominantly low knowledge (58% in Yogyakarta). This variation appears partly related to study population characteristics, with urban populations and those with healthcare access generally showing better knowledge levels.

Parental knowledge patterns showed interesting variations. In East Java, parents demonstrated strong knowledge about antibiotic administration (87.5%) and definitions (94.8%), but weak understanding of antibiotic resistance (25.2%). Similarly, parents in Bangkalan showed diverse knowledge levels across different topics, with adequate understanding of usage rules and definitions but poor comprehension of resistance concepts.

Studies targeting general populations consistently revealed moderate knowledge levels. In Boyolali, Central Java, only 14.2% demonstrated high knowledge while 46.9% showed moderate levels. The Southeast Sulawesi study, representing the largest sample (1,013 respondents), found that 32.6% had good knowledge, 38.2% sufficient, and 29.1% poor knowledge, indicating a relatively normal distribution of knowledge levels.

Gender and demographic patterns emerged as significant factors. The Malang study focusing on women found that 82.7% were aware that antibiotics target bacteria, suggesting that targeted populations may show better baseline knowledge.

Persistent misconceptions and inappropriate behaviors

Despite moderate knowledge levels, critical misconceptions persist across all study populations. The most prevalent and concerning misconception involves the belief that antibiotics can treat viral infections, appearing in nearly every study that assessed this aspect. Specific rates varied: 78% in Yogyakarta, 73.12% in Boyolali, 87.5% in Malang, and 70.3% in Bali. This consistency across different regions and populations suggests a fundamental gap in public understanding of antibiotic mechanisms.

The misconception about antibiotics treating common cold and cough symptoms was equally persistent, reported by 75% of respondents in Yogyakarta and 56.8% in Bali. Related misconceptions included beliefs that antibiotics can reduce fever (63.35% in Boyolali) and treat sore throats (54.1% in Bali). These findings indicate confusion about the distinction between bacterial and viral infections among the general population.

Concerning behavioral patterns emerged across studies regarding antibiotic procurement and usage. Multiple studies documented high rates of non-prescription antibiotic purchases: 51.8% in Southeast Sulawesi and 40% in Boyolali obtained antibiotics without prescriptions. This behavior directly contradicts Indonesian regulations requiring prescriptions for antibiotic purchases.

Treatment adherence patterns revealed another area of concern. Studies consistently found high rates of treatment discontinuation when patients felt better, with 74% in Lamongan and 56.8% in Bali reporting this behavior. Only 51.7% of women in Malang reported completing full antibiotic regimens, indicating widespread non-adherence to prescribed treatment durations.

Antibiotic disposal practices showed uniformly poor patterns across studies. In Southeast Sulawesi, 54.1% disposed of unused antibiotics directly in household trash, while similar improper disposal methods were reported in other regions. This behavior poses environmental risks and contributes to antimicrobial resistance development.

Regional and population-specific patterns

Despite the geographic bias toward Java, some regional differences emerged from the available data. The single study from Southeast Sulawesi showed knowledge patterns similar to Java-based studies but revealed higher rates of non-prescription purchases (51.8% vs. approximately 40% in Java studies). The Bali study demonstrated comparable misconception rates to Java studies, suggesting that certain knowledge gaps may be consistent across Indonesian regions.

Urban versus rural differences, where reported, consistently favored urban populations. The Boyolali study specifically noted that rural residents were more prone to inappropriate antibiotic use, with lower education and income levels serving as additional risk factors.

Population-specific analyses revealed that healthcare-seeking populations (outpatients, pharmacy customers) generally demonstrated better knowledge than general community samples. However, even these populations maintained significant misconceptions, particularly regarding viral infections and treatment completion.

Table 2. Analysis of antibiotic knowledge and awaraness in Indonesia

Study details	Population & methods	Knowledge findings	Awareness/ attitude findings	Specific misconceptions	Behavioral patterns	Ref
• Kristina et al (2020) • Yogyakarta • n=268	• Outpatient clinics and pharmacies • Cross-sectional survey • Adapted WHO questionnaire	• Low knowledge: 58% • Adequate knowledge: 42% • 90,14% knew antibiotics kill bacteria	• Most participants (58%) had low awareness levels • Internet as major info source (71%) vs pharmacists (58%) and doctors (45%)	• Antibiotics treat cold/cough (75%) • Antibiotics treat viral infections (78%)	• Used antibiotics in last 6 months (76%) • Received from prescription (79%) • Completed full course (70%) • Only 32% became more cautious	[6]
• Herawati et al (2020) • East Java • n=329	• Parents of outpatient children at hospital • 14-items knowledge + 30-item perception questionnaire • Guttman + Likert scales	• Antibiotic definition: strong (94.8%) • Administration: strong (87.5%) • Healthcare role: average (68.4%) • Resistance: weak (25.2%)	• Perceptions mostly neutral category (3.5-3.7 on Likert scale) • Weak correlation between knowledge and perceptions	• AMR prevention by stopping early • Resistance = antibiotics successfully combating bacteria	• Parents deciding medication for children • Limited understanding of resistance concepts	[7]
• Sugihantoro et al (2020) • Lamongan, East Java • n=96	• Pharmacy patients and consumers • Purposive sampling	• High: 8% • Moderate: 35% • Low: 57% Majority female (64%), age 18-40 (75%)	• High attitude: 22% • Sufficient: 66% • Low: 12% Positive correlation (r=0.431, p<0.001)	74% did not know antibiotics should not be stopped when feeling better	• Most used antibiotic: amoxicillin (63%) • Strong correlation between knowledge and behavior	[8]
• Karuniawati et al. (2021) • Boyolali, Central Java • n=573	• General public • 51-question validated questionnaire • Demographics, KAP sections	• High: 14.2% • Moderate: 46.9% • Low: 38.9% Significant associations with gender, residence, education, income	• High: 20.6% • Moderate: 47.8% • Low: 31.6% 50% considered stopping when symptoms disappeared	• Viral infection treatment (73.12%) • Fever reduction (63.35%)	• Non-prescription purchase (40%) • Rural residents more prone to misuse • Lower education = higher misuse risk	[9]
• Yunita et al (2022) • Malang, East Java • n=583	• Female visitors at Community Health Center • Focus on women as primary caregivers • Multivariate logistic regression	• 82.7% aware antibiotics target bacteria • Higher education and previous experience = better knowledge • Urban residence = better knowledge	• Knowledge positively associated with treatment completion • Access to primary care improved awareness	• Viral/common cold treatment (87.5%) • Fever treatment requirement (72.2%)	• Self-medication: 38.4% • Completed regimens: 51.7% • Urban areas + limited doctor access = more self-medication	[10]
• Harris et al (2023) • Southeast Sulawesi • n=1,013	• General public • Online survey, snowball sampling • Dec 2020-Feb 2021	• Good: 32.6% • Sufficient: 38.2% • Poor: 29.1% Significant associations: age, education, occupation (p<0.005)	• Varied antibiotic use behaviors • Most received from pharmacies (67%) • Pharmacist information (28.3%)	• Immediate use for flu symptoms (30.6%) • Purchase without prescription (51.8%)	• Storage in closed containers (89%)< • Direct trash disposal (54.1%) • Most used: amoxicillin (45.7%)	[11]

Study details	Population & methods	Knowledge findings	Awareness/ attitude findings	Specific misconceptions	Behavioral patterns	Ref
• Sinuraya et al., (2023) • Indonesia/ unlimited regions • n=582	• General Indonesian population • Dec2019-Jun 2020	• Average score: 4.86±2.40/8 points 57.7% above population average • Variations by education and employment	• Average score: 5.29±1.85/7 points • 56.0% above population average • Employment status significant predictor	• Antibiotics kill viruses • Effective for any disease	• Trust in physicians = predictor of good behavior • Employment status influences behavior	[12]
• Nuraini et al. (2023) • Bangkalan, East Java • n=96	• Parents of pediatric patients Cross-sectional, closed questionnaire • Health Belief Model framework	• Very high: 3.1% • High: 31.3% • Sufficient: 36.5% • Low: 26% • Very low: 3.1%	Perception categories (sufficient levels): • Perceived benefit: 41.7% • Perceived barrier: 39.6% • Perceived threat: 66.7% • Perceived self-efficacy: 40.7%	Not specifically reported	• Focus on pediatric antibiotic use • Parents as decision-makers for children	[13]
• Zairina et al. (2023) • Surabaya, East Java • n=236	• Surabaya communities • Electronic questionnaire • Social media distribution	• Good: 71.6% • Moderate: 22.9% • Low: 5.5% Highest knowledge levels among all studies	• Positive: 97.9% • Negative: 2.1% Strong correlation: knowledge-practice (r=0.568, p<0.05)	Not specifically detailed	• Good practice levels (78%) • Focus on disposal practices included	[14]
• Dewi et al. (2024) • Bali • n=110	• Bali local community • Purposive interviews, Feb-Mar 2023	• Good: 24.5% • Moderate: 58.2% • Poor: 17.3% Moderate correlation: knowledge-AMR awareness (r=0.583)	• Good awareness: 20% • Adequate: 65.5% • Poor: 14.5% Moderate correlation: attitude-AMR awareness (r=0.427)	• Viral infection treatment (70.3%) • Cold/cough treatment (56.8%) • Sore throat cure (54.1%) • Stopping when feeling better (56.8%)	• 100% response rate • Focus on AMR awareness specifically	[15]

Discussion

This study presents an overview indicating that public knowledge and awareness regarding the proper use of antibiotics in Indonesia, mostly in Java, remain moderate or adequate. Many people of the Indonesian population still have low levels of knowledge and awareness regarding the rational use of antibiotics. The use of antibiotics can be influenced by several factors, including knowledge, expectations, interactions between the community and healthcare professionals, socioeconomic status, the health system, and other environmental factors. Indonesia, as a developing country, has a population with highly diverse demographic characteristics, which in turn affects the overall levels of public health and knowledge.

Misconceptions in the use of antibiotics are also still detected. Misconceptions, such as the belief that antibiotics can treat viral infections like the flu and common cold, are still prevalent among the general population. The misconception was also observed in a national survey in Thailand [16] and Malaysia [17] in 2019 where approximately half of respondents reported using antibiotics for the flu. In Saudi Arabia, only a small proportion of respondents stated that antibiotics are used for bacterial infections, while many still believed that antibiotics could treat illnesses caused by viruses [18]. A similar situation was also observed in Myanmar, only half of the participants knew antibiotics as a medicine and most believed that antibiotics could kill viruses and were effective against colds and flu [19].

Other factors that most significantly influence knowledge about antibiotics and antimicrobial resistance are the level of education and the frequency of internet use among the population [20]. Research has shown a significant association between individual's level of knowledge and antibiotic use behavior [21]. Therefore, low public knowledge about antibiotics may lead to inappropriate antibiotic use. In addition, direct exposure to information related to antibiotics can enhance individuals' knowledge levels, thereby increasing their motivation to adopt appropriate antibiotic use behaviors. A study suggests that providing social information about people's antibiotic intake may be effective in reducing the overuse of antibiotics [22].

Inappropriate use of antibiotics may include purchasing antibiotics without a prescription, taking antibiotics for viral or fungal infections, discontinuing antibiotic treatment before completion despite symptom improvement, storing unused antibiotics at home, and sharing prescribed antibiotics with others, among other behaviors [23]. Such practices may also indicate a low level of public awareness regarding appropriate antibiotic use. These inappropriate behaviors can contribute to bacterial resistance, making infections more difficult to treat [24].

Numerous factors contribute to the inappropriate use of antibiotics in the community. These include limited access to healthcare facilities, insufficient sources of information and technology, a shortage of healthcare professionals, economic constraints that hinder access to proper treatment, the perception that symptoms are mild, weak regulations on antibiotic distribution, and other related issues [25]. These factors often lead individuals to practice self-medication, sometimes excessively, thereby increasing the risk of inappropriate antibiotic use. Consequently, this may further exacerbate the rise of antimicrobial resistance.

In light of this, strategic educational approaches are necessary to improve public knowledge and awareness regarding the appropriate use of antibiotics. Health education delivered by healthcare professionals can be an effective method, depending on the type of intervention employed. Educational strategies may be implemented through either passive or active methods. Passive methods include antibiotic education campaigns, dissemination of leaflets, posters, educational videos, or combinations of these approaches. Educational videos have been proven to improve patient knowledge on the rational use of antibiotics in Indonesia [26,27]. Audiovisual activities have been proven to be more effective in improving patient knowledge compared to the use of posters or pamphlets [28]. This may be due to the fact that audiovisual activities stimulate more senses and are more engaging and attention-grabbing for patients.

However, studies have shown that active education methods—such as direct, individualized interventions involving active learning about antibiotics—have a more significant impact on individual behavior related to antibiotic use [29]. Directly involving patients through active discussions related to the illness they are experiencing can further enhance their awareness in using antibiotics. Healthcare professionals such as doctors, pharmacists, and nurses in hospitals need to collaborate or even develop specialized programs to support the implementation of active discussions with patients, in order to enhance patients' knowledge and awareness about antibiotics.

This study has some limitations. This study does not include a detailed analysis of the influence of respondents' sociodemographic factors on public knowledge and awareness regarding antibiotics. This information may be necessary to gain a more specific understanding of the factors influencing levels of knowledge and awareness, particularly within the Indonesian population. Such information would be valuable for the development and implementation of more accurate and targeted public education or awareness campaign programs.

Conclusion

The level of public knowledge and awareness regarding antibiotics in several provinces of Indonesia, mostly in Java, is categorized moderate or adequate. Consistent and continuous educational efforts are necessary to enhance public understanding and awareness of antibiotic use. These efforts are expected to contribute to the reduction of antimicrobial resistance in Indonesia. Future research should explore the effectiveness of various educational interventions in enhancing knowledge and promoting behavior change, particularly within rural and underserved communities.

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Declaration of interest

None.

Author contribution

YO contributed to the conception and design of the study, literature research and selection, data analysis, and the drafting and revision of the manuscript.

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