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How Knowledge Influences Antibiotic Adherence Among Outpatients: A Cross-Sectional Study at Indonesian Primary Health Centers

Fidyawati[1], Maximiano Oqui[2], Joaquim Pinto[2]

[1] Center Health Care of Buol, Center of Sulawesi, Indonesia
[2] Universidade Nacional Timor Lorosae, Timor Leste

Corresponding Author's: Delianto, delldelianto@gmail.com

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ABSTRACT

Background: Antibiotic resistance poses a significant global health challenge, often exacerbated by inappropriate antibiotic use and poor patient adherence to prescribed regimens. Understanding the factors influencing antibiotic knowledge and adherence among outpatients is critical to improving treatment outcomes and mitigating resistance development. This study aimed to analyze the relationship between patients' knowledge and their adherence to antibiotic use at Puskesmas Gadung Kab. Buol
Methods: A cross-sectional descriptive study was conducted involving 42 outpatient respondents between January and February 2024. Data on sociodemographic characteristics, knowledge of antibiotics, and adherence behavior were collected using structured questionnaires. Descriptive statistics and Spearman's rho correlation test were applied to analyze the data
Result: The findings revealed that a substantial proportion of respondents demonstrated moderate to good knowledge about antibiotics, with a notable association between higher knowledge levels and better adherence to antibiotic regimens. The majority of participants complied with prescribed antibiotic use, particularly those with sufficient understanding of antibiotic resistance and appropriate usage. The study also identified that demographic factors such as age, gender, education, and occupation influenced both knowledge and adherence behaviors. The statistical analysis confirmed a significant positive correlation between knowledge and adherence, underscoring the importance of patient education
Conclusion: In conclusion, enhancing patients' knowledge about antibiotics is essential to improving adherence and combating antibiotic resistance. Healthcare providers should prioritize continuous educational interventions and counseling to reinforce correct antibiotic use among outpatients. Future research with larger samples and diverse settings is recommended to generalize the findings and explore additional factors influencing adherence.

Keywords: Knowledge, Antibiotic, Adherence, Outpatients

Practice Implications

1. Enhancing Patient Education: Healthcare providers should implement ongoing educational programs to improve patients' understanding of proper antibiotic use and the risks of antibiotic resistance, which can directly improve adherence rates.

2. Targeted Counseling: Tailoring counseling sessions to patients' demographic characteristics, such as age, gender, and education level, may increase the effectiveness of interventions promoting adherence to antibiotic therapy.
3. Strengthening Healthcare Support: Collaboration between healthcare professionals and patients, including regular follow-ups and accessible communication, is essential to reinforce adherence behaviors and ensure the successful completion of prescribed antibiotic treatments.

Introduction

Infectious diseases remain a major public health concern, particularly in developing countries. Antimicrobials—including antibiotics, antifungals, antivirals, and antiparasitics—are frontline agents used to treat such infections, with antibiotics being the most commonly prescribed (Mazur et al., 2023; Plumet et al., 2022; Terstappen et al., 2024). However, inappropriate and irrational use of antibiotics has led to a growing threat of antimicrobial resistance (AMR), wherein bacteria evolve to resist the effects of drugs once effective against them. Initially recognized in hospital settings, antibiotic resistance has now become a widespread issue in the community, especially concerning pathogens such as *Streptococcus pneumoniae*, *Staphylococcus aureus*, and *Escherichia coli* (Besnier et al., 2021; LaRock et al., 2022; Shoar & Musher, 2020).

The Ministry of Health of Indonesia has acknowledged this alarming issue, noting that excessive and irrational use of antibiotics contributes significantly to the global AMR crisis. Resistance not only increases morbidity and mortality but also results in higher healthcare costs and socioeconomic burdens. According to the World Health Organization (WHO), every country is responsible for controlling antibiotic resistance. Unfortunately, a national survey found that 93.4% of households in Indonesia stored antibiotics without a prescription, indicating widespread self-medication and poor public understanding of proper antibiotic use.

While appropriate antibiotic use—i.e., consuming prescribed antibiotics in the correct dose and duration—can effectively treat bacterial infections, many patients discontinue antibiotic therapy prematurely when symptoms improve (Aliabadi et al., 2022; Wilkins et al., 2020). Preliminary data from a local health center (Puskesmas) in December 2019 revealed that 8 out of 10 patients who received antibiotics stopped taking them once they felt better. This behavior is often influenced by a lack of treatment supervision and limited knowledge regarding the importance of completing antibiotic regimens (Dickter et al., 2023; Kakiuchi et al., 2022).

Multiple studies have highlighted knowledge as a key determinant of antibiotic adherence. However, most existing literature focuses either on hospital settings or broader public awareness, leaving a significant gap in understanding patient knowledge and behavior regarding antibiotic use at the primary healthcare level, particularly among outpatients in low-resource settings (Katundu et al., 2023; Muflih et al., 2023). Moreover, limited research has examined this relationship in the context of Indonesia's decentralized primary healthcare system, where antibiotics are

commonly prescribed and dispensed without robust monitoring or follow-up.

This study aims to address this gap by examining the association between patients' knowledge and their adherence to antibiotic use in outpatient settings at Indonesian primary health centers. By identifying how knowledge levels influence compliance, the study seeks to inform evidence-based interventions to promote rational antibiotic use and prevent the emergence of antibiotic resistance at the community level.

Methodology

Study Design

This study employed a cross-sectional design, an observational approach in which data on both the independent and dependent variables were collected at a single point in time. This design was used to assess the association between patients' knowledge and their adherence to antibiotic use..

Participants

The participants in this study were all outpatients who received antibiotic prescriptions at Puskesmas Gadung, Buol Regency. A total sampling technique was used, meaning that the entire population meeting the inclusion criteria was selected as the sample. The total number of respondents was 42 patients. The inclusion criteria were: (1) outpatients who were prescribed antibiotics during the study period, (2) aged 18 years or older, and (3) willing to participate and provide informed consent. The exclusion criteria were: (1) patients who were critically ill or unable to communicate effectively, and (2) those who refused to participate. Participants were recruited directly at the outpatient clinic during the data collection period by screening prescription records and confirming eligibility through direct communication..

Instrument

The research instrument consisted of a researcher-developed questionnaire designed to assess both knowledge and adherence regarding antibiotic use. The knowledge component included 13 items based on four key indicators: understanding of antibiotics, purpose of antibiotic therapy, appropriate antibiotic retention and usage, and knowledge of potential complications. The items were measured using dichotomous responses (Yes/No), and scoring was adjusted based on the polarity of the item: for positive statements, a "Yes" response was scored as 1 and "No" as 0; for negative statements, a "Yes" was scored as 0 and "No" as 1. The knowledge level was categorized into three groups: good (≥75%), moderate (56–74%), and poor (≤55%).

The dependent variable in this study was adherence to antibiotic use, which was assessed by asking participants whether they followed the instructions written on the medication label. Adherence was classified into two categories: adherent (score = 2) if the antibiotics were taken exactly as prescribed, and non-adherent (score = 1) if the instructions were not followed. The questionnaire underwent both validity and reliability testing. All 13 knowledge items showed Pearson correlation coefficients greater than 0.6, indicating satisfactory item validity. Reliability testing yielded a Cronbach's alpha of 0.942, confirming high internal consistency of the instrument.

Data Collection

Data collection was conducted in February 2024. The data were gathered through face-to-face interviews using the structured questionnaire. The interviews were conducted by the principal researcher, with assistance from local health personnel who were trained in administering the survey to ensure consistency and minimize bias..

Data Analysis

Data were analyzed using SPSS version 26. Descriptive statistics were used to summarize demographic characteristics and variable distributions. To examine the association between knowledge and adherence to antibiotic use, a Chi-square test was applied. A p-value less than 0.05 was considered statistically significant..

Ethical Consideration

This study received ethical approval from the Health Research Ethics Committee of IIK Strada. All respondents provided written informed consent before participating. The anonymity, confidentiality, and rights of the participants were fully protected throughout the research process.

Results

Table 1. Characteristics of Respondents (n = 42)

Variable	Category	n	%
Age	< 20 years	3	7.1
	20–30 years	11	26.2
	31–40 years	17	40.5
	> 40 years	11	26.2
Gender	Male	13	31
	Female	29	69
Education	No formal school	1	2.4
	Primary school	4	9.5
	Junior high school	8	19
	Senior high school	26	61.9
	Higher education	3	7.1
Occupation	Employee	20	47.6
	Entrepreneur	6	14.3
	Housewife	16	38.1

Table 1 illustrates The majority of the respondents were aged 31–40 years (40.5%) and predominantly female (69.0%). Most had a senior high school education (61.9%) and worked as employees (47.6%).

Table 2. Distribution of Knowledge, Adherence, and Correlation Test Results (n = 42)

Variable	Category	Frequency (n)	Percentage (%)
Knowledge	Poor	7	16.7
	Fair	18	42.9
	Good	17	40.5
Adherence	Non-adherent	19	45.2
	Adherent	23	54.8
Spearman's rho Correlation	Knowledge & Adherence	$\rho = 0.674$	$p < 0.001$

Table 2 illustrates Almost half of the respondents demonstrated fair knowledge (42.9%) about antibiotic use. Adherence to antibiotic treatment was observed in 54.8% of participants. A Spearman's rho test revealed a significant positive correlation between knowledge and adherence ($\rho = 0.674$, $p < 0.001$), indicating that better knowledge is strongly associated with higher adherence to antibiotic usage

Discussion

This study highlights a unique interplay between knowledge levels and adherence to antibiotic usage among outpatients in a primary care setting in rural Indonesia. Notably, findings suggest that respondents' knowledge about antibiotic use was not uniformly high or low, but rather clustered around a moderate level, with certain socio-demographic factors such as age, gender, education, and occupation influencing the

depth and accuracy of understanding (Antwi et al., 2020; Kandasamy et al., 2020). These patterns mirror local sociocultural dynamics, where antibiotic practices are shaped not only by access to information but also by deeply rooted beliefs and habitual treatment-seeking behaviors.

A particularly noteworthy observation is the alignment of moderate-to-high knowledge levels with individuals engaged in formal employment and with secondary-level education. This suggests a potential link between structured educational exposure and occupational socialization with more responsible attitudes toward antibiotics (Marta-Costa et al., 2021). In contrast to assumptions that higher education always corresponds with higher compliance, our findings offer a culturally nuanced insight—compliance may be more a function of access to repetitive, reinforced messaging (e.g., through workplace health promotion or peer norms) than formal degrees (Henaine et al., 2021).

Additionally, female respondents appeared to exhibit higher knowledge and adherence levels, consistent with previous literature that highlights women's roles in caregiving and health decision-making in Southeast Asian contexts. This gendered pattern may point toward the latent value of empowering female-led community-based interventions to combat antibiotic misuse.

The study also confirms a significant relationship between knowledge and adherence, reinforcing the theoretical foundations presented by Green and Kreuter's PRECEDE-PROCEED model, which emphasizes the role of enabling and reinforcing factors in shaping health behaviors. Knowledge, in this framework, does not function in isolation but interacts with psychosocial elements such as personal beliefs, prior experiences, and cultural perceptions of illness and treatment (Handyside et al., 2021; Kim et al., 2022; Saulle et al., 2020)vv.

Moreover, respondents with moderate knowledge levels frequently demonstrated correct understanding of key principles—such as the importance of completing an antibiotic course and the dangers of irrational use. However, gaps remain in their ability to consistently apply this knowledge in real-life situations, especially when symptoms improve prematurely or when antibiotics are perceived as a panacea for non-bacterial illnesses. These behavioral inconsistencies may point to the lingering influence of community-wide myths and the normalization of self-medication practices (Foster et al., 2018; Robert et al., 2017).

The challenge, therefore, lies not merely in disseminating information but in fostering critical engagement with that information. Simply knowing that antibiotics should be finished as prescribed may not be sufficient unless the patient also internalizes the consequences of resistance and sees tangible support from the healthcare system. This study is not without limitations. First, the sample size was relatively small and limited to a single rural health center, which may restrict the generalizability of the findings. Second, the use of self-reported questionnaires may introduce social desirability bias, particularly in responses concerning adherence. Third, the cross-sectional design prevents causal inference; while knowledge and adherence appear associated, it is unclear whether knowledge preceded or followed adherence behavior. Additionally, qualitative exploration was not conducted, which could have provided richer insight

into underlying motivations and contextual barriers influencing adherence. Future studies could benefit from employing mixed-methods approaches and expanding the study area to include urban and peri-urban settings for comparison. Longitudinal designs would also be useful in exploring whether changes in knowledge precede changes in behavior over time, especially following structured interventions.

Practical Applications of the Findings

The findings of this study suggest several practical applications to enhance rational antibiotic use among outpatients. Educational interventions should be tailored to address specific misconceptions, especially regarding the inappropriate use of antibiotics for self-limiting viral infections. Gender-sensitive approaches, particularly leveraging women as health promoters, may be effective given their relatively higher adherence. Health promotion efforts can be expanded through workplaces and schools, while healthcare providers should be trained to deliver clear, culturally sensitive counseling to improve patient compliance. Community engagement through local leaders and stricter regulation of non-prescription antibiotic sales are also essential. By integrating these strategies, healthcare systems can improve patient knowledge and adherence, ultimately contributing to reduced antimicrobial resistance and improved therapeutic outcomes..

Conclusion

In sum, this study contributes to the growing body of literature affirming the link between antibiotic knowledge and patient adherence. However, it also adds nuance by showing how demographic and sociocultural contexts mediate this relationship. Increasing adherence may require more than educational materials—it may demand tailored, culturally competent interventions that take into account local norms, gender roles, and the perceived legitimacy of medical authority. Addressing both knowledge deficits and structural enablers of irrational antibiotic use remains essential in combating antimicrobial resistance in low-resource settings..

Authors Contributions:

Conceptualization: Fidyawati, Maximiano Oqui
Data curation: Maximiano Oqui, Joaquim Pinto
Formal analysis: Fidyawati Maximiano Oqui
Funding acquisition: Delianto
Investigation: Maximiano Oqui, Joaquim Pinto
Methodology: Fidyawati, Maximiano Oqui
Project administration: Delianto
Resources: Fidyawati
Software: Maximiano Oqui
Supervision: Fidyawati
Validation: Fidyawati, Joaquim Pinto
Visualization: Maximiano Oqui
Writing – original draft: Fidyawati, Maximiano Oqui
Writing – review & editing: Delianto, Joaquim Pinto

Conflicts Of Interest

The Authors Declare No Conflict Of Interest.

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