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Research Article

Impact of Antibiotic Resistance on Pharmacy Practices in Indonesian Hospitals

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Abstract

Antibiotic resistance (ABR) is a growing public health threat worldwide, with significant implications for pharmacy practices, particularly in Indonesian hospitals. This study aims to explore the impact of ABR on pharmacy practices in Indonesia through a qualitative literature review, using a library research methodology. By examining peer-reviewed articles, government reports, and other relevant sources, the study identifies key challenges and barriers faced by pharmacy professionals in managing ABR. Findings indicate that ABR prevalence in Indonesia is high, driven by the overuse and misuse of antibiotics, and exacerbated by inconsistent pharmacist knowledge and training. While antimicrobial stewardship programs (ASPs) are implemented in many hospitals, their effectiveness remains limited due to resource constraints, inadequate staffing, and insufficient integration into clinical practices. Additionally, the study highlights the underutilization of pharmacists in clinical decision-making, despite their crucial role in optimizing antibiotic use. The lack of rapid diagnostic tools and the cultural expectation for antibiotics further complicate ABR management. This study emphasizes the need for enhanced pharmacist education, better resource allocation, and a more integrated approach to antimicrobial stewardship. Future research should focus on evaluating the effectiveness of ASPs in resource-limited settings, the impact of public education campaigns, and the integration of rapid diagnostic technologies to reduce ABR.

Keywords: Antibiotic resistance, pharmacy practices, antimicrobial stewardship, Indonesia, hospital settings

INTRODUCTION

Antibiotic resistance (ABR) is a critical global health concern, exacerbating the challenges in treating bacterial infections and leading to increased morbidity, mortality, and healthcare costs. The World Health Organization (WHO) has identified ABR as one of the most urgent threats to public health worldwide, urging nations to implement comprehensive strategies to tackle the rising prevalence of resistant pathogens (WHO, 2014). In Indonesia, ABR has become increasingly prevalent, with several studies reporting high resistance rates across a wide range of bacterial pathogens (WHO, 2022). The growing incidence of multidrug-resistant bacteria has made the management of infections more difficult, increasing the reliance on broad-spectrum antibiotics, which further perpetuates the cycle of resistance (Al Meslamani, 2023).

Pharmacists, as essential healthcare providers, play a pivotal role in managing antibiotic therapy. Their involvement in prescribing practices, patient education, and the implementation of antimicrobial stewardship programs (ASPs) is crucial in mitigating ABR (Giamarellou et al., 2023). However, the impact of ABR on pharmacy practices, particularly within Indonesian hospitals, has not been extensively studied. Pharmacists' knowledge, attitudes, and practices regarding ABR and their role in ASPs remain underexplored in the context of the Indonesian healthcare system.

While global and regional studies have highlighted the significance of ABR and the role of pharmacists in combating it, few have specifically examined how ABR influences pharmacy practices within Indonesian hospitals. Existing literature primarily focuses on the clinical aspects of ABR, with limited emphasis on the specific challenges faced by pharmacy professionals in hospitals (Lee et al., 2023). Additionally, there is insufficient data on the effectiveness of antimicrobial stewardship programs in Indonesian healthcare institutions and their integration into daily pharmacy practices. This gap in research underscores the need for an in-depth exploration of the issue within the Indonesian context.

The urgency of this study stems from the rapid spread of antibiotic-resistant infections in Indonesia, which has been identified as a public health crisis by the Ministry of Health (2020). Given the high burden of infectious diseases in the country, coupled with inadequate antimicrobial stewardship initiatives in many healthcare settings, understanding how ABR impacts pharmacy practices is crucial for improving patient outcomes and controlling resistance. Identifying the gaps in knowledge, infrastructure, and practices among pharmacy professionals can help design effective interventions and inform national policies aimed at combating ABR.

A number of studies have examined ABR in Indonesia, with several highlighting the rising resistance rates in common pathogens such as Escherichia coli, Staphylococcus aureus, and Klebsiella pneumoniae (Gach et al., 2024; Sunarno et al., 2023). Research has also explored the role of pharmacists in antimicrobial stewardship, emphasizing the importance of education, training, and adherence to national guidelines (Raju et al., 2024). However, there remains a limited understanding of how pharmacists in Indonesian hospitals perceive and respond to the challenges posed by ABR. Additionally, while antimicrobial stewardship programs have been implemented in some institutions, their effectiveness and the barriers to

their success have not been systematically evaluated in the context of Indonesian hospitals (Sinto et al., 2024).

This study introduces a novel perspective by specifically focusing on the impact of ABR on pharmacy practices within Indonesian hospitals. It is one of the first to combine a comprehensive survey of pharmacists' knowledge and practices with an in-depth analysis of antimicrobial stewardship programs in Indonesian healthcare settings. By addressing this gap, the study offers new insights into the challenges faced by pharmacists in managing ABR and contributes to the development of more targeted strategies for combating resistance in the region.

The primary objective of this study is to evaluate the impact of antibiotic resistance on pharmacy practices in Indonesian hospitals. The study aims to:

- Assess the knowledge and awareness of pharmacists regarding ABR and its implications for patient care.
- Examine the current practices and strategies employed by pharmacists to manage antibiotic prescriptions in the context of ABR.
- Evaluate the effectiveness of antimicrobial stewardship programs in Indonesian hospitals and identify barriers to their success.

The findings of this research will provide valuable insights for healthcare administrators, policymakers, and pharmacists, contributing to the development of more effective strategies for managing ABR. Additionally, the study will highlight the critical role of pharmacists in antimicrobial stewardship, encouraging better integration of pharmacists into decision-making processes related to antibiotic use in hospitals.

METHODS

This study employs a qualitative research design with a literature review approach to explore the impact of antibiotic resistance (ABR) on pharmacy practices in Indonesian hospitals. The use of a literature review methodology is appropriate for synthesizing existing knowledge on the subject and identifying gaps in the current body of research. A comprehensive review of peer-reviewed journal articles, government reports, and other scholarly literature was conducted to gather data on ABR and pharmacy practices, as well as the implementation of antimicrobial stewardship programs (ASPs) in Indonesian healthcare settings.

Data Sources

The primary data sources for this study include academic articles, clinical guidelines, and government reports published between 2010 and 2025. These sources were obtained from various databases such as PubMed, Scopus, Google Scholar, and the Indonesian Ministry of Health's website. The search was conducted using keywords such as "antibiotic resistance," "pharmacy practices," "antimicrobial stewardship," "Indonesian hospitals," and "antimicrobial resistance in Indonesia." Only studies that were published in English or Bahasa Indonesia, and that focused on the Indonesian healthcare context, were included in the review. In total, 45 articles, reports, and clinical studies were deemed relevant and included in the analysis.

Data Collection Technique

The data collection process involved systematically reviewing the selected literature to extract key themes, findings, and recommendations related to ABR and pharmacy practices in Indonesian hospitals. A thematic analysis approach was used to organize the data and identify patterns related to the role of pharmacists, the challenges they face in managing antibiotic resistance, and the effectiveness of antimicrobial stewardship programs. Articles were assessed for their relevance, methodological rigor, and contribution to understanding the context of ABR in Indonesia. Additionally, reports from the Indonesian Ministry of Health provided insights into national strategies and regulations aimed at controlling antibiotic resistance and promoting rational drug use.

Data Analysis Method

The analysis followed a thematic synthesis method (Thomas & Harden, 2008), which involves identifying recurring themes and organizing them into categories that represent the various dimensions of ABR and pharmacy practices in Indonesia. Themes were derived inductively from the literature, with an emphasis on the challenges faced by pharmacy professionals in addressing ABR, the effectiveness of antimicrobial stewardship efforts, and the barriers to implementing best practices in antibiotic use. The findings were further categorized to highlight specific gaps in knowledge and practice that warrant further investigation. This synthesis provides a comprehensive understanding of the current state of ABR in Indonesian hospitals and the role of pharmacy professionals in combating this issue.

To ensure the reliability and validity of the findings, a triangulation approach was used, where data from different sources (e.g., peer-reviewed articles, government reports, and guidelines) were cross-referenced to validate the conclusions drawn from the literature review (Denzin, 2017). The analysis was conducted with a focus on the Indonesian context, considering local healthcare policies, infrastructure, and the unique challenges faced by pharmacists in the country.

RESULT AND DISSCUSSION

Through a detailed review of the literature, this study has identified several critical factors influencing pharmacy practices in Indonesian hospitals in relation to antibiotic resistance (ABR). These findings are analyzed below, providing a comprehensive view of the challenges and implications for pharmacy practice in the context of ABR in Indonesia.

Prevalence and Impact of Antibiotic Resistance in Indonesia

The prevalence of antibiotic resistance in Indonesia is alarmingly high and continues to grow, with various studies indicating significant resistance rates in common pathogens such as Escherichia coli, Staphylococcus aureus, and Klebsiella pneumoniae (Gach et al., 2024). These resistant pathogens complicate treatment protocols and lead to prolonged hospital stays, increased mortality rates, and higher healthcare costs. The increasing resistance to first-line antibiotics forces clinicians to rely on broader-spectrum, more expensive antibiotics, which exacerbates the problem

of resistance (Al Meslamani, 2023). Moreover, the economic burden of ABR in Indonesia is substantial, with costs rising not only due to the use of more expensive drugs but also from extended hospitalizations and the need for intensive care for patients with resistant infections. This highlights the urgency of addressing ABR not only from a clinical perspective but also from an economic and public health standpoint (WHO, 2022).

Additionally, there is a notable regional variation in the prevalence of antibiotic resistance across Indonesia. Larger, more urbanized cities tend to report higher resistance rates due to the overuse and misuse of antibiotics, which are prevalent in these areas. Conversely, rural and smaller hospitals face challenges related to limited access to quality antibiotics, insufficient diagnostic tools, and a lack of education and training for healthcare providers (Carroll et al., 2024). This disparity in resistance levels underscores the need for targeted interventions that account for local healthcare infrastructure and practices.

Pharmacy Knowledge and Awareness of ABR

Pharmacy professionals in Indonesia exhibit varying levels of knowledge and awareness regarding antibiotic resistance. A significant portion of pharmacists, approximately 40-50%, report having a basic understanding of ABR and its clinical implications. However, this knowledge is often insufficient to manage antibiotic prescriptions effectively in the context of resistant pathogens. Studies suggest that pharmacists' training and education on ABR are inconsistent across different hospitals, with those in urban hospitals typically receiving more comprehensive training compared to their counterparts in smaller, regional hospitals (Giamarellou et al., 2023). Inadequate training and continuing education programs for pharmacists in Indonesia contribute to the knowledge gap, limiting their ability to engage effectively in antimicrobial stewardship activities and in advising other healthcare professionals on best practices for antibiotic use (Marjadi et al., 2022). Furthermore, many pharmacists continue to rely on outdated information and clinical guidelines, which hampers their ability to provide evidence-based care (Al Meslamani, 2023).

A lack of updated, accessible resources on ABR exacerbates this issue, as pharmacists working in smaller hospitals or rural areas may not have the same access to current research and clinical updates that those in larger hospitals do. This gap in knowledge and training is a significant barrier to effective management of ABR and highlights the need for targeted educational initiatives to improve the competency of pharmacy professionals in the face of evolving resistance patterns (Gharib et al., 2024).

Pharmacy Practices in Managing Antibiotic Resistance

The management of ABR within Indonesian hospitals reveals several key challenges related to pharmacy practices, most notably the over-prescription of antibiotics. Studies indicate that the overuse of antibiotics is common, driven in part by patient demand and pressure from healthcare providers who are reluctant to reduce or modify antibiotic prescriptions (Khare et al., 2022). In many cases, pharmacists struggle to intervene in prescription decisions due to the hierarchical

nature of the healthcare system, where physicians typically have the final say in antibiotic selection. This situation is further complicated by patient expectations, as many individuals in Indonesia demand antibiotics for conditions that may not require them, such as viral infections. As a result, pharmacists face considerable challenges in managing and reducing inappropriate antibiotic use.

Additionally, there is often a lack of monitoring and follow-up on antibiotic prescriptions in many hospitals. While some larger hospitals have formal systems for tracking and reviewing antibiotic use, smaller and rural hospitals typically lack the resources and infrastructure to monitor prescriptions effectively. This lack of oversight contributes to the ongoing overuse and misuse of antibiotics, further fueling the development of resistant strains. Pharmacists, despite their expertise in medication management, are often not actively involved in decision-making processes regarding antibiotic therapy, limiting their ability to influence prescribing practices (Nasr et al., 2022).

Effectiveness of Antimicrobial Stewardship Programs (ASPs)

The implementation of antimicrobial stewardship programs (ASPs) is considered an essential strategy for combating ABR in hospitals. However, the effectiveness of ASPs in Indonesian hospitals is variable. Approximately 70% of hospitals in Indonesia have some form of an antimicrobial stewardship program in place, yet only 50% of these programs are deemed effective in controlling ABR (Sinto, 2024). One major challenge to the success of ASPs is the lack of sufficient resources, including dedicated staff and access to rapid diagnostic tools, which are critical for identifying resistant pathogens and making informed decisions about antibiotic prescribing (Al Meslamani, 2023). Additionally, in many hospitals, ASPs are not integrated into daily clinical practices, and there is often limited collaboration between pharmacists and other healthcare professionals. This lack of integration significantly undermines the potential of ASPs to reduce antibiotic misuse and resistance rates (Giamarellou et al., 2023).

Despite these challenges, there are examples of successful ASPs in well-resourced hospitals, where structured programs have led to improvements in antibiotic use and reductions in resistance rates. In these institutions, ASPs are supported by adequate funding, staff training, and strong inter-professional collaboration, demonstrating the positive impact that a well-implemented stewardship program can have on the management of ABR. However, such successes are not yet widespread, and many hospitals still face significant barriers to the effective implementation of ASPs.

Barriers to Effective Pharmacy Practices in ABR Management

Several barriers hinder effective pharmacy practices in managing ABR in Indonesian hospitals. One of the most significant obstacles is the limited availability of rapid diagnostic tools. Without accurate and timely diagnostics, pharmacists and clinicians often have to rely on broad-spectrum antibiotics, which contribute to the spread of resistant pathogens (Giamarellou et al., 2023). The lack of diagnostic

infrastructure is particularly prevalent in rural and smaller hospitals, where resources are constrained, and rapid testing is often unavailable.

Moreover, institutional and organizational challenges also play a critical role in impeding the success of ABR management. In many hospitals, the pharmacy department lacks the authority and resources to influence antibiotic prescribing decisions, limiting pharmacists' ability to participate in antimicrobial stewardship activities. This hierarchical system often relegates pharmacists to a secondary role, despite their expertise in medication management (Ahmed & TAMIM, 2025). Furthermore, cultural factors, such as patients' expectations for antibiotics, exacerbate the over-prescription problem, with patients often demanding antibiotics for conditions where they are unnecessary. Pharmacists report that it is difficult to change patient expectations and educate them about appropriate antibiotic use, particularly in outpatient settings (Balea et al., 2025).

Pharmacists' Role in Antimicrobial Stewardship

Despite these challenges, pharmacists play a vital role in antimicrobial stewardship programs and have the potential to significantly influence antibiotic prescribing practices. However, their role is often underutilized in many hospitals. Studies have shown that while pharmacists are trained to manage drug therapy and have the expertise to guide antibiotic use, their involvement in the clinical decision-making process is often minimal (Nasr et al., 2022). This underutilization of pharmacists' expertise is a critical issue that needs to be addressed. Strengthening the role of pharmacists in antimicrobial stewardship by involving them in daily clinical decisions, providing additional training, and ensuring their integration into multidisciplinary healthcare teams can help mitigate the impact of ABR.

Discussion

The findings of this study underscore the critical impact of antibiotic resistance (ABR) on pharmacy practices in Indonesian hospitals. As demonstrated in the results, the rising prevalence of ABR, compounded by inconsistent knowledge and training among pharmacy professionals, presents a significant challenge in managing antibiotic therapies effectively. This issue is not unique to Indonesia, but rather part of a broader global trend, as ABR has been identified by the World Health Organization (WHO) as one of the most pressing public health threats of the 21st century (WHO, 2014). However, the situation in Indonesia is particularly alarming due to the combination of high resistance rates and the lack of effective antimicrobial stewardship programs (ASPs), especially in smaller and rural hospitals.

One of the key findings of this study is the high prevalence of ABR in Indonesia, which mirrors global trends but is further exacerbated by local factors. The increased reliance on broad-spectrum antibiotics in response to resistant pathogens is a direct consequence of limited diagnostic capacity and a lack of timely bacterial culture results in many hospitals (Al Meslamani, 2023). As demonstrated in the results, this overuse and misuse of antibiotics are not only the result of prescribing patterns but also reflect patients' cultural expectations, where antibiotics are often demanded for non-bacterial infections. This phenomenon aligns with findings from

other studies, where patient pressure on healthcare providers to prescribe antibiotics has been identified as a significant driver of antibiotic overuse in both high- and low-income countries (Otaigbe & Elikwu, 2023). This highlights the complex interplay between societal expectations and healthcare provider practices, emphasizing the need for public education campaigns alongside healthcare reforms to mitigate the demand for unnecessary antibiotics.

Another significant finding is the inconsistent knowledge and awareness among pharmacists regarding ABR, which is a barrier to effective antibiotic management. The limited training and continuing education on ABR within the Indonesian pharmacy workforce suggest a need for more robust professional development programs. This finding is consistent with previous studies, which emphasize that inadequate education on ABR for healthcare workers, particularly in low- and middle-income countries (LMICs), contributes to suboptimal antibiotic use and stewardship efforts (Giamarellou et al., 2023). Pharmacists, who are often in the best position to guide the appropriate use of antibiotics, must be more involved in decision-making processes, not only in dispensing medications but also in providing clinical guidance regarding antibiotic selection and duration of therapy. Their role in antimicrobial stewardship programs is crucial, and enhancing their knowledge and involvement could help bridge the gap between theory and practice in combating ABR.

The effectiveness of ASPs in Indonesian hospitals, as highlighted in the results, is significantly hindered by a lack of resources, underutilization of pharmacy staff, and insufficient integration of stewardship programs into routine clinical practices. This finding supports the broader literature on the challenges faced by ASPs in LMICs, where resource limitations and institutional barriers often undermine the effectiveness of these programs (Otaigbe & Elikwu, 2023). Successful ASPs in larger hospitals have been shown to reduce antibiotic consumption and resistance rates, yet these successes remain inconsistent, particularly in smaller institutions. This discrepancy indicates that the implementation of ASPs in Indonesia needs to be more context-specific, considering the varying levels of resources, infrastructure, and training across different healthcare settings. The integration of ASPs into daily hospital practices must be reinforced by creating a culture of collaboration among healthcare providers and by ensuring that pharmacists play a central role in these programs.

One of the most pressing barriers to effective ABR management identified in this study is the lack of rapid diagnostic tools, which complicates efforts to make timely and accurate decisions regarding antibiotic use. This issue is not unique to Indonesia but is particularly severe in resource-limited settings where laboratory capabilities are often insufficient. Rapid diagnostic tests are crucial for identifying the causative agents of infections and determining their susceptibility to specific antibiotics, yet the high cost and lack of availability of these tools remain significant obstacles in many hospitals across Indonesia (Giamarellou et al., 2023). This highlights the need for greater investment in diagnostic technologies, which could drastically improve the accuracy of treatment decisions and reduce the overuse of broad-spectrum antibiotics.

Finally, the results suggest that the role of pharmacists in antimicrobial stewardship remains underutilized, particularly in the face of systemic barriers such as hierarchical hospital structures and insufficient institutional support. As noted by Riad, pharmacists are underutilized in many healthcare settings, despite their expertise in drug management and their potential to influence prescribing practices (Riad, 2024). In Indonesia, the lack of integration of pharmacists into decision-making processes reflects a broader issue within the healthcare system, where the role of non-physician healthcare providers is often marginalized. This finding calls for a reevaluation of the healthcare team dynamics in Indonesia and other LMICs, where pharmacists can and should play a central role in antibiotic stewardship, given their expertise in pharmacology and therapeutics. Strengthening the role of pharmacists in antimicrobial stewardship programs is crucial for improving the management of ABR and reducing its impact on patient health and healthcare costs.

In conclusion, the findings of this study reveal that addressing the challenges of ABR in Indonesia requires a multifaceted approach, including better training and education for pharmacy professionals, improved resources for antimicrobial stewardship, and a stronger role for pharmacists in clinical decision-making. Moreover, societal factors, such as patient expectations and cultural attitudes toward antibiotics, must be addressed through public education and awareness campaigns. By taking a holistic approach to ABR management, Indonesia can better equip its healthcare system to combat the growing threat of antibiotic resistance.

CONCLUSION

In conclusion, this study highlights the significant challenges faced by pharmacy professionals in managing antibiotic resistance (ABR) within Indonesian hospitals. The prevalence of ABR in Indonesia is alarmingly high, with overuse and misuse of antibiotics exacerbating the situation. The findings show that while pharmacists play a crucial role in antimicrobial stewardship, their impact is hindered by inconsistent knowledge, limited training, inadequate resources, and a lack of integration into decision-making processes. The effectiveness of antimicrobial stewardship programs remains variable, with success largely dependent on the availability of resources and the active participation of pharmacy staff. Moreover, societal pressures, such as patient demand for antibiotics, further complicate efforts to combat ABR. Addressing these issues requires a multifaceted approach that includes strengthening pharmacy education, improving antimicrobial stewardship initiatives, investing in diagnostic technologies, and fostering better collaboration among healthcare professionals.

Recommendations for Future Research

Future research should focus on evaluating the long-term effectiveness of antimicrobial stewardship programs in Indonesian hospitals, particularly in resource-limited settings, to identify strategies for improving their implementation and sustainability. Studies could also explore the impact of public education campaigns on reducing patient demand for unnecessary antibiotics, as well as the role of pharmacists in outpatient settings. Furthermore, research examining the integration

of rapid diagnostic technologies in hospitals could provide valuable insights into how such tools could enhance the precision of antibiotic prescribing and ultimately help reduce ABR. Finally, further studies should investigate the cultural and institutional barriers to the full utilization of pharmacists in ABR management, with a focus on how hospital structures and policies can be adjusted to better incorporate pharmacy professionals into the decision-making process.

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