Antimicrobial Resistance As A Global Health Threat: A Review Of Antibiotic Use Patterns, Policies, And Cross-Country Impacts

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Abstract.

Antimicrobial resistance (AMR) is a global health challenge that threatens the effectiveness of infection treatment and the success of modern medical procedures. Inappropriate use of antibiotics, both in healthcare facilities and in the community, has accelerated the emergence of resistance. Irregular distribution, access without prescription, and the use of antibiotics for non-medical purposes such as agriculture have exacerbated the situation. Global policies, such as the Global Action Plan on AMR initiated by the WHO in 2015, aim to harmonize cross-border efforts to control AMR through a multisectoral One Health approach. However, its implementation still faces various challenges, particularly in low- and middle-income countries due to resource constraints, weak surveillance systems, and inadequate regulations. The cross-border impact of AMR is very real, including increased global health costs, the spread of resistant strains through human mobility, and inequalities in access to the latest generation of antibiotics. Therefore, global synergy is needed to improve antibiotic governance, strengthen surveillance systems, and educate the public and health workers. This article reviews the latest literature and policies on AMR to understand the dynamics of antibiotic use, global policy challenges, and the direction of cross-border solutions.

Keywords: *Antibiotics; global policy; cross-border health; One Health and antimicrobial resistance.*

I. INTRODUCTION

Antimicrobial resistance (AMR) is one of the ten major threats to global health identified by the World Health Organization (WHO) [1]. AMR occurs when microorganisms such as bacteria, viruses, fungi, and parasites mutate or adapt to become resistant to antimicrobial drugs that were previously effective. This condition makes infections more difficult to treat, increasing the risk of complications, length of hospital stays, treatment costs, and mortality rates [2].According to the Global Research on Antimicrobial Resistance (GRAM) report, in 2019, approximately 4.95 million deaths worldwide were related to antibiotic-resistant bacterial infections, with around 1.27 million of these deaths directly caused by resistance [3]. This phenomenon is not only a clinical issue but also has widespread social and economic impacts, particularly in countries with weak healthcare systems. AMR is projected to cause 10 million deaths per year by 2050 if no serious interventions are implemented [4]. This projection indicates that AMR could surpass the number of deaths caused by cancer, making it one of the most serious future health crises.The primary cause of the rise in AMR is the irrational use of antibiotics. In many countries, antibiotics are still available over the counter without a doctor's prescription. Additionally, the excessive use of antibiotics in the agricultural and livestock sectors further exacerbates the resistance issue [5]. In this context, low- and middle-income countries (LMICs) face significant challenges in managing antibiotic distribution and monitoring their use.

he lack of effective regulatory systems, limited access to quality healthcare services, and insufficient laboratory facilities and expertise are major obstacles in controlling AMR [6].Meanwhile, developed countries are not immune to this threat. Globalization, cross-border mobility, international trade, and climate change have facilitated the faster and wider spread of resistant microorganisms. AMR is a cross-sectoral and cross-border issue that requires a coordinated and sustainable global approach. In this regard, the WHO, together with the Food and Agriculture Organization (FAO) and the World Organisation for Animal Health (WOAH), is promoting the One Health approach, which is a cross-sectoral collaboration between human, animal, and environmental health to comprehensively address AMR [7].In Indonesia, the challenges of AMR are increasingly complex due to low public awareness of the dangers of resistance, weak oversight of antibiotic use in healthcare facilities and the veterinary sector, and limited microbiological surveillance at

the regional level. Therefore, efforts to address AMR require strong policies, massive public education, and cross-sectoral data integration. This article aims to examine patterns of antibiotic use that contribute to resistance, review global and national policies in addressing AMR, and evaluate the cross-border impact of this crisis from a public health perspective [12].

II. METHODS

This research is a narrative literature review study that aims to evaluate and synthesize literature discussing antimicrobial resistance (AMR) from various perspectives, particularly patterns of antibiotic use, global policies, and cross-border impacts. This literature review employs a qualitative approach based on secondary data obtained from international scientific journals, global policy reports, and official documents from global health organizations such as the World Health Organization (WHO), the Food and Agriculture Organization (FAO), and the World Organisation for Animal Health (WOAH) [19].Data collection was conducted systematically through searches of articles and documents in several scientific databases, including Google Scholar, PubMed, Scopus, and the WHO Institutional Repository for Information Sharing (WHO IRIS). The keywords used in the search process included: “antimicrobial resistance,” “antibiotic use,” “global health policy,” and “cross-border impact,” either separately or combined using Boolean operators (AND/OR).

Additionally, manual searches were conducted to ensure no important sources were overlooked.The inclusion criteria used in the literature selection were: (1) articles or documents published between 2020 and 2024, (2) available in English or Indonesian, (3) directly related to the topic of antimicrobial resistance and the scope of this article, and (4) published by a reputable institution or peer-reviewed journal. Exclusion criteria included opinion articles, editorials, or documents that did not cite clear primary or secondary data sources [13].The data obtained were analyzed thematically, grouping the information into three main focuses, namely: (1) patterns of antibiotic use that contribute to resistance, (2) global policies and strategies for controlling AMR, and (3) the cross-border impact of antimicrobial resistance on public health systems. The results of the analysis were used to develop a problem mapping and recommendations in the context of global health.

III. RESULTS AND DISCUSSION

Antimicrobial resistance (AMR) is a rapidly growing phenomenon and a complex global health challenge involving interactions between antibiotic use patterns, international policies, cross-border movements, and social, economic, and environmental factors. This discussion presents findings from various studies and policy reports highlighting global trends in antibiotic use, the development of international policies based on the One Health approach, the cross-border impact of AMR, the role of interprofessional collaboration (IPE) in prevention, and the latest global initiatives such as the 1–10–100 goal to mobilize collective action. Through this review, it is hoped that readers will gain a comprehensive understanding of the current situation of AMR and the cross-sectoral strategies that can be implemented to address this threat in a sustainable manner.

1. Global Antibiotic Use Patterns

Antibiotic use increased by 65% between 2000 and 2015, predominantly in developing countries [4]. In Asia and Africa, >60% of antibiotics are consumed without a prescription [6,19]. The COVID-19 pandemic caused a temporary decline in antibiotic consumption in developed countries in 2020, but it increased again in 2021, including in Indonesia (22.8%) [20]. Use in the agricultural sector as a growth promoter for animals also contributes to resistance [7,21]. Driving factors include easy access at pharmacies, lack of oversight, and insufficient public education about the dangers of AMR.

During the pandemic, antibiotic consumption dropped sharply in 2020, especially in high-income countries. This decline was not directly related to successful antibiotic control but was also influenced by social interaction restrictions. However, in 2021, there was an increase in antibiotic consumption in middle-income countries, particularly in Indonesia, reaching 22.8% [20].

On the other hand, the agricultural and livestock sectors also contribute to resistance through the use of antibiotics as growth promoters. This increases human exposure to resistant bacteria through the food chain [5]. This practice is still common, especially in countries with weak veterinary oversight [13,14].

2. Global Policies and the One Health Approach

The WHO launched the Global Action Plan on AMR in 2015 with five strategic pillars: raising awareness, strengthening surveillance, preventing infections, optimizing antimicrobial use, and innovation [1,9]. Although more than 130 countries have developed National Action Plans (NAPs), only a small fraction have been implemented with adequate budgetary support [10,22]. Technical capacity limitations, weak inter-sectoral coordination, and low political priority are barriers to the effective implementation of NAPs [23].

The One Health approach is built on three core principles: communication, coordination, and collaboration. The goal of One Health is to achieve optimal health for humans, animals, and the environment [29]. In the context of AMR prevention, One Health has a significant contribution to preventing AMR. One Health efforts in AMR prevention include awareness campaigns, educational initiatives on antibiotic use, advocacy for political support, and the implementation of antimicrobial stewardship programs [30].

3. Cross-border Impact of Antimicrobial Resistance

AMR is a cross-border threat. Human mobility and international trade cause the spread of resistant strains between countries [8,24]. Hospitals in destination countries face challenges in treating resistant infections, increasing treatment costs and prolonging hospital stays [7].

Economically, the WHO estimates that AMR could cause losses of up to 100 trillion US dollars globally by 2050 if no serious interventions are taken [5,8]. Additionally, low-income countries are at higher risk of losing access to expensive and unaffordable new antibiotics, exacerbating disparities in infection management [12,25].

4. Interprofessional Collaboration (IPE) in combating antibiotic resistance in addressing the global health crisis

Interprofessional collaboration among healthcare professions begins during higher education through Interprofessional Education (IPE). It is hoped that the habit of collaborating will continue and develop during practice in healthcare services. IPE activities include opportunities for mutual meetings, joint courses, case studies, web-based discussions, community service learning, case-based conferences, student-led clinics, interaction with simulated or standardized patients, in-home medication reviews, and joint Objective Structured Clinical Examinations. The Integrated Patient Management skill aims to develop interprofessional competencies in communication, collaboration, and role sharing among medical, pharmacy, and nursing students. Knowledge, skills, and abilities are the three key elements that healthcare professionals possess as part of an interprofessional team [15,18]. IPE education is one approach to reducing barriers between professions. In IPE, students are taught to understand other professions, thereby enhancing their ability to collaborate. Implementing IPE from the undergraduate level aims to introduce the characteristics of interprofessional teamwork early on. This IPE practice plays a crucial role, even becoming a flagship curriculum at the ASEAN level, with some programs making it a core course. For institutions just beginning to implement IPE, there are several aspects that can support its success, based on evaluation results [26,27].

Medical errors leading to death rank fifth in the United States, with 120,000 people dying in hospitals due to medical errors [16,19]. One of the key issues contributing to medical errors is poor communication among healthcare professionals, lack of teamwork and collaboration, and the provision of non-integrated healthcare services. IPE is one approach offering solutions for the future in addressing these issues.

5. 1-10-100: Uniting goals to mobilize global action against antimicrobial resistance

World leaders gathered in New York to chart a path forward on AMR at the United Nations General Assembly High-Level Meeting in September 2024. This involves developing the 1–10-100 goals to drive global policy change and investment for antimicrobial resistance mitigation: 1 Health; 10 million lives saved; and 100% sustainable access to effective antimicrobials [18]. Sustainable development goals regarding global norms direct attention to relevant activities and serve as a motivating force for long-term action. The 1–10–100 goal proposes to unite the world through a One Health approach to protect human health, animal welfare, agrifood systems, and the environment from the emergence and spread of drug-resistant microbes and infections; saving more than 10 million lives by 2040 through collective efforts to prevent and treat infections appropriately while maintaining vital systems and services dependent on the sustained effectiveness of antimicrobials; and committing to ensuring that antimicrobials are available and affordable for all, used wisely, and secured for the future through innovation [19]. Compared to existing technical targets, these goals offer the advantages of focusing on prevention, promoting multisectoral action and collaboration, promoting health equity, recognizing the need for innovation, and integrating with the Sustainable Development Goals [28]. By committing to One Health, 10 million lives saved, and 100% sustainable access to effective antimicrobials, we can protect lives and livelihoods today and safeguard options for the future.

IV. CONCLUSION

Antimicrobial resistance (AMR) has become one of the most significant global health challenges of the 21st century, with serious implications for public health, patient safety, and the stability of healthcare systems worldwide. This study confirms that the primary cause of the rise in AMR is the irrational use of antibiotics, both in the human and animal health sectors, as well as weak regulation and oversight in many countries, including Indonesia. Globalization, population mobility, international trade, and climate change are accelerating the spread of resistant microorganisms across national borders, making AMR a transnational issue requiring a coordinated global response.The One Health approach, which integrates human health, animal health, and the environment, has proven to be the most comprehensive strategy for addressing AMR. The WHO, FAO, and WOAH have initiated various global policies and action plans, but implementation at the national level still faces obstacles, especially in low- and middle-income countries. These obstacles include limited resources, lack of technical capacity, weak surveillance systems, and low political awareness of the urgency of AMR.

Analysis shows that the temporary decline in antibiotic consumption during the COVID-19 pandemic in developed countries has not been accompanied by long-term improvements in antibiotic use practices. In Indonesia, antibiotic consumption has actually increased again after the pandemic, indicating the need for more effective control strategies. The use of antibiotics in the agricultural and livestock sectors is also an important factor that must be strictly regulated to prevent the spread of resistant bacteria through the food chain.Efforts to combat AMR require interprofessional collaboration (Interprofessional Education/IPE) to strengthen coordination, communication, and role sharing, thereby minimizing medical errors and enhancing the effectiveness of infection management. The global targets of 1–10–100—One Health, saving 10 million lives, and 100% access to effective antimicrobials are key milestones in mobilizing international action.Therefore, addressing AMR must be a global priority through evidence-based policies, strengthening antibiotic use regulations, developing affordable new antibiotics, and increasing public awareness. Without integrated and sustained interventions, AMR has the potential to cause a health crisis greater than the current pandemic, with a significant burden of deaths and economic losses in the coming decades.

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