

The implementation of antimicrobial stewardship in Indonesia: a regional survey in hospitals

Heni Lutfiyati^{1,2}, Nanang Munif Yasin³, Jarir At Thobari^{4,5}, Zullies Ikawati^{1,3*}

¹Doctoral Program in Pharmaceutical Sciences, Faculty of Pharmacy, Universitas Gadjah Mada, Yogyakarta, Indonesia. ²Department of Pharmacy, Faculty of Health Science, Universitas Muhammadiyah Magelang, Magelang, Indonesia. ³Department of Pharmacology and Clinical Pharmacy, Faculty of Pharmacy, Universitas Gadjah Mada, Yogyakarta, Indonesia. ⁴Department of Pharmacology and Therapy, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia. ⁵Clinical Epidemiology and Biostatistics Unit, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia.

Correspondence: Zullies Ikawati, Doctoral Program in Pharmaceutical Sciences, Faculty of Pharmacy, Universitas Gadjah Mada, Yogyakarta, Indonesia. zullies_ikawati@ugm.ac.id

ABSTRACT

Antibiotic resistance is becoming more common worldwide because of irrational antimicrobial use. Antimicrobial resistance occurs practically all over the world, leading the World Health Organization (WHO) to create a “Global Action Plan on Antimicrobial Resistance” in 2015. This study investigates the implementation of the antimicrobial stewardship program’s actions in Indonesia’s hospitals from the perspective of health professionals. This survey describes activities, the role of pharmacists, the impacts and barriers to the antimicrobial stewardship program. Purposive sampling was used to recruit respondents, including doctors, pharmacists, nurses, pharmaceutical technical employees, and laboratory analysts from two referral hospitals in Central Java Province, Indonesia. Activities of the antimicrobial stewardship program in hospitals are to develop policies and guidelines for using hospital antibiotics 81.48%, develop policies on antimicrobial stewardship 74.07%, and disseminate and increase understanding and awareness of antimicrobial stewardship principles 55.56%. The role of the pharmacist in the antimicrobial stewardship program was to make policies and guidelines for using antibiotics and work programs to control resistance 81.50%, information services for patients and their families and other health workers 74.10%, with the therapy committee team to select and procure antibiotics 55.70% and provide patient counseling 51.90%. The effect of the antimicrobial stewardship program improved the quality of handling infectious cases, antibiotic use 55.56%, and germ patterns 40.74%. The obstacles to implementing the antimicrobial management plan are infrastructure 40.74% and finance 37.04%. Antimicrobial stewardship programs have been implemented in Indonesian hospitals, but some obstacles remain.

Keywords: Antimicrobial stewardship, Antibiotic, Resistance, Healthcare professional

Introduction

Antimicrobial resistance has become a global concern in health care and other areas, such as livestock, agriculture, and society [1]. Antimicrobial resistance could be caused by the inappropriate use of antibiotics, including their use outside the healthcare system [2]. Thus, combating antimicrobial resistance

is a major public health concern requiring a multidisciplinary collaborative approach [3]. Antibiotic resistance is becoming more common in developing nations, resulting from irrational antimicrobial use [4]. Poor hospital regulations are one of the reasons contributing to antibiotic resistance in underdeveloped nations [5]. Antimicrobial resistance occurs practically worldwide, leading the World Health Organization (WHO) to create a “Global Action Plan on Antimicrobial Resistance” in 2015 [6]. With the “Antimicrobial Stewardship Program,” most countries attempt to combat the increase in antimicrobial resistance. Some research has been conducted to evaluate the influence of antimicrobial control strategies on antibiotic resistance.

Several studies have been performed to evaluate the effect of antimicrobial control strategies on antibiotic resistance. Implementing the antimicrobial stewardship program has

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increased antibiotic rationalization and patient safety, decreased antimicrobial use and rates of nosocomial infections caused by resistant pathogens, decreased length of stay (LOS), increased prescription compliance, and reduced their use [7-10]. Implementing antimicrobial stewardship programs and optimizing clinical informatics systems reduces vancomycin use and vancomycin prescribing errors, improves the quality of care, and promotes the safety of hospitalized children [11]. A prospective audit with feedback affects reducing antibiotic use in children's hospitals [12].

In Indonesia, the antimicrobial stewardship program is executed through a nationwide movement program managed by the Ministry of Health and conducted nationally. Antimicrobial resistance control programs are implemented by establishing teams, forming rules and guidelines for antibiotic use, prudent antibiotic use, and infection control preventive concept use. Through planning, organizing, executing, monitoring, and evaluating, the teams created an attempt to implement antibiotic resistance management strategies in hospitals [13].

The success of an antimicrobial stewardship program in hospitals can be measured by several performance indicators, including decreased types of antimicrobials used, reduced defined daily doses, decreased use of antibiotics without indications, improved sensitivity patterns, and decreased hospital infection rates caused by multi-drug-resistant organisms. The quality of interdisciplinary infectious case management can be increased by establishing a forum to evaluate infection cases and an "Infectious Disease Service Integrated Team" [13]. This study investigates the implementation of an antimicrobial stewardship program in Indonesia's hospitals as represented by healthcare professionals.

Materials and Methods

This study is an analytical descriptive study consisting of a series of actions to collect evidence relating to implementing the antimicrobial stewardship program in hospitals via a survey in July 2021. Purposive sampling recruited respondents, including doctors, pharmacists, pharmaceutical technical employees, and laboratory analysts from two referral hospitals in Central Java Province, Indonesia. The questionnaire was developed from the Minister of Health Regulation No. 8 of 2015 and input by healthcare professionals in Indonesia. The data entry and collection are both anonymous and de-identified. Data collection activities began after the research protocol obtained ethical clearance from the Research Ethics Commission of the Faculty of Medicine, Gadjah Mada University, Yogyakarta (KE/FK/0960/EC/2020).

Results and Discussion

This study had several responses (27/40) (67.5%). Most survey respondents were pharmacists. Apart from pharmacists, the participation of doctors, nurses, pharmaceutical technical employees, and analysts in this study was extremely promising. **Table 1** shows the characteristics of respondents.

Table 1. Characteristics of healthcare professionals

Gender	
Male	4 (14.80%)
Female	23 (85.20%)
Age	
25–30 years	8 (29.63%)
31–35 years	7 (23.63%)
36–40 years	6 (22.22%)
>40 years	6 (22.22%)
Profession	
Medical doctor	6 (22.2%)
Pharmacist	14 (51.85%)
Pharmacy technician	3 (11.11%)
Analyst laboratory	2 (7.41%)
Nurse	2 (7.41%)
Experience	
<5 years	12 (44.44%)
6–10 years	8 (29.63%)
11–15 years	3 (11.11%)
16–20 years	3 (11.11%)
>20 years	1 (3.70%)

The majority of respondents were females between the ages of 25 and 30 years old. Most respondents were pharmacists, and many had five years of professional experience. Activities of the antimicrobial stewardship program in hospitals are more than 50% when implementing developed policies and guidelines for using hospital antibiotics, developing policies on antimicrobial stewardship, disseminating and increasing understanding and awareness of the antimicrobial stewardship principles, promoting wise antibiotic use, and advocating adherence to infection control prevention through education, training, and surveying antibiotic use patterns.

Activities of the antimicrobial stewardship program

The activities carried out by the antimicrobial stewardship program can be seen in **Table 2**. The most common activity is the development of antibiotic policies and guidelines in hospitals because implementing these standards reduces prescribing antibiotics [14]. The increased adherence to these guidelines decreases antibiotic prescription and incorrect drug selection, resulting in lower antimicrobial resistance [15]. The Ministry of Health has been running an annual antibiotic awareness campaign since 1999 aimed to educate health professionals and reduce public expectations of antibiotic prescriptions for coughs and colds. Thus, it also supports general practitioners in their efforts to reduce antimicrobial resistance. Since 2008, the campaign has been run annually to coincide with the European Antibiotic Awareness Day on November 18 [16]. The most common activities in hospitals worldwide are developing specific guidelines on infection treatment and prophylaxis of surgical site infections, limited antibiotic authorization, telephone advice, routine follow-up of patients with bacteremia, guidance on intravenous-to-oral switching, automated discontinuation, and permitting pharmacists to optimize dosing. Less often utilized

activities include the prescription of distinct antimicrobials, measurement of inflammatory indicators such as procalcitonin to avoid beginning antibiotics or aiding early cessation of antibiotics,

restricting access to pharmacy representatives, and antibiotic cycles [17].

Table 2. Activities of the antimicrobial stewardship program

Activity	n
Develop policies and guidelines for hospital antibiotics	22 (81.48%)
Develop policies on antimicrobial resistance control	20 (74.07%)
Disseminate and increase understanding and awareness of the principles of antimicrobial resistance control, the wise use of antibiotics, and adherence to infection control prevention through education and training	15 (55.56%)
Surveillance of patterns of antibiotic use	14 (51.85%)
Forum for study/discussion of infectious disease (ID) management cases	10 (37.04%)
Evaluating and supervising the implementation of antimicrobial resistance control in hospitals	10 (37.04%)
Surveillance of infection-causing microbial patterns and their susceptibility to antibiotics	9 (33.33%)
Clinical supervision of antibiotics	4 (14.81%)

Table 3. The role of pharmacists in the antimicrobial stewardship program

The role of pharmacists	n
Together with the antimicrobial stewardship program team, make policies and guidelines for antibiotics and work programs to control resistance	22 (81.50%)
Provide drug information services to patients and/or their families and other health workers	20 (74.10%)
Together with the pharmacy and therapy committee team, select and procure antibiotics	18 (66.7%)
Provide patient counseling	14 (51.90%)
Monitor side effects of antibiotics	13 (48.10%)
Together with the ID control team, develop guidelines for using antiseptics, determine policies for using single-dose package antibiotics and multiple lecturer containers	11 (40.70%)
Assess the suitability of indications, patients, types, and doses of antibiotic regimens against established guidelines/policies	11 (40.70%)
Assess potential adverse drug reactions, drug interactions with drugs or food	10 (37.00%)
Assess laboratory suitability with antibiotic administration	2 (7.40%)
Assess stability, incompatibility, and antibiotic administration schedule	1 (3.70%)

According to the healthcare analysis and information group assessment on the implementation of the antimicrobial stewardship program, actions such as formulary restrictions on antimicrobial use and the annual dissemination of antibiograms, are almost universal in some countries. Other activities that are only partly implemented include inpatient infectious disease (ID) consultations, written clinical lines/guidelines for specific conditions, pharmacy residency programs, automatic stop orders, clinical pharmacists overseeing day-to-day administration operations, use of electronic medical records to facilitate antimicrobial stewardship program activities, and education for prudent antibiotic use [18]. The general components of the hospital's antimicrobial activities include the commitment of the hospital's leadership to human resources, finances, and information technology, accountability with one responsible leader, pharmacy leadership, tracking antibiotic use, regular antibiotic use and resistance reporting, and specific remedial interventions such as education [19]. According to a global study of healthcare professionals, the most commonly reported components of stewardship were the implementation of policies and guidelines, the review of antibiotic prescriptions, the presence of a special stewardship committee, antibiotic availability and reporting, and minimal surveillance reports. This education and training in infection control and antibiotic

stewardship are not widespread. It requires greater resources, particularly in healthcare settings where physicians are still viewed as key decision-makers and leaders in infection management and antibiotic stewardship [20].

The role of pharmacists in antimicrobial stewardship programs

The role of pharmacists in antimicrobial stewardship programs was more than 50%, together with the pharmacy and therapy committee team to select and procure antibiotics, provide drug information services to patients and/or their families, and other health workers and patient counseling. Only a few respondents reported the role of pharmacists on antimicrobial stewardship program activity, such as monitoring antibiotic side effects, together with the ID control team, developing guidelines for antiseptic use, determining policies for the use of single-dose package antibiotics and multiple lecturer containers, assessing the suitability of indications, patients, types, and doses of antibiotic regimens against established guidelines/policies, assessing potential adverse drug reactions and drug interactions with drugs or food. The role of pharmacists in the antimicrobial stewardship program can be seen in **Table 3**.

The antimicrobial stewardship team should include various healthcare professionals with relevant competencies and contributions to the team and overall goals. It is recommended that the antimicrobial stewardship hospital core team includes an ID doctor or microbiologist, if available, and a pharmacist. Other professionals, such as prescribers, administrators, infection control experts, and other information technology workers, may also be included on the larger antimicrobial stewardship committee. Involving a variety of professionals may help teams obtain new insights and adopt methods and processes that require a wide range of abilities [20]. The most often reported pharmacist participation pharmacists are reported most often to participate in antimicrobial stewardship programs with the pharmacy and therapy committee team, select and procure antibiotics together with the ID control team, develop guidelines for antiseptic use, determine policies for the use of single-dose package antibiotics and multiple lecturer containers, assess the suitability of indications, patients, types, and doses of antibiotic regimens against established guidelines/policies, assess potential adverse drug reactions, drug interactions with drugs or food, drug information services to patients and/or their families and other health workers, provide patient counseling, and monitor antibiotic side effects. The increasing importance of specialist and general pharmacists in antibiotic stewardship in acute care in the UK can help hospitals fulfill the antibiotic stewardship agenda. However, this role must be expanded to include more interdisciplinary participation [21]. Antimicrobial stewardship programs combining doctors and pharmacists can help rationalize expenses while also changing the pattern of bacterial resistance [22]. Antibiotic stewardship pharmacist-led emergency care programs significantly increased antimicrobial prescriptions in concordance with guidelines [23]. Antibiotic consumption decreased when the antibiotic advisor was a pharmacist, and all prescriptions were evaluated by the pharmacy team.

The antimicrobial stewardship program implemented in hospitals, involving a team of pharmacists, resulted in decreased antimicrobial consumption and increased antibiotic route switches from IV to oral for pharmacist intervention during the first year [24]. These findings show that pharmacist-initiated interventions have a beneficial effect and should be supported [25]. A multidisciplinary antimicrobial stewardship approach, active involvement of a drug and therapy committee or equivalent, formulary limitations, and the availability of antimicrobial stewardship education and training for pharmacists and physicians are essential components for an antimicrobial stewardship program to be considered successful in Makkah region hospitals [26].

The potential for pharmacist involvement in Antimicrobial stewardship program in the incidence of Adverse drug events shows a much lower proportion of Adverse events than in other hospitals that do not involve a pharmacist. These results suggest that the active involvement of pharmacists in multidisciplinary Antimicrobial stewardship program contributes to reducing the incidence of antimicrobial adverse drug events in hospitalized patients [27]. Pharmacist-led ASP was associated with a reduction in the number of days of antimicrobial therapy for

uncomplicated gram-negative bacteremia among patients admitted to a community hospital without an infectious disease specialist. Therefore, pharmacists should discuss not only the type of antimicrobial agent but also the duration of treatment with the treating physician [28].

The effect of the antimicrobial stewardship program

More than half of respondents said that the antimicrobial stewardship program positively affected the quality of antibiotic use and managed contagious infections using a multidisciplinary approach. Economic gains resulted from adopting an antimicrobial stewardship program in a big hospital in South India via various stewardship interventions, such as audits and feedback. The earliest outcomes of India's antimicrobial stewardship program are encouraging, but national efforts to establish, implement, and continue ASP in acute care hospitals must be extended. Clinical pharmacists' collaboration is vital to the antimicrobial stewardship program's success. A follow-up study was performed to enable academic pharmacists to collaborate in antimicrobial management in acute care inpatient hospitals [29]. The benefits of implementing an antimicrobial stewardship program at health institutions in Saudi Arabia have been reduced use and cost of antimicrobials and the decreased incidence of healthcare-related illnesses [30].

The successful implementation of a multidisciplinary antimicrobial stewardship team in a hospital provides economic benefits. An antimicrobial stewardship program effectively implements several stewardship interventions, such as audit and feedback [29]. An antimicrobial stewardship program has a significant effect on decreasing antibiotic use and surgical antibiotic prophylaxis. To some extent, an antimicrobial stewardship program is significantly associated with antibiotic use [31]. Its implementation is sometimes attributed to a lack of personnel, finance, and medical staff support and being low on the priority list [32]. Several other studies comparing antimicrobial utilization before and after implementing the antimicrobial stewardship program reported decreased antimicrobial use, costs, irrational antibiotic use, and hospital LOS [33]. Pre- and post-implementation of the antimicrobial stewardship program at the Veterans Affairs Health Care reported a decrease in the percentage of patients treated with antimicrobial therapy, a decrease in antimicrobial therapy duration, a decrease in the defined daily dose per 1000 patient bad days for piperacillin/tazobactam, vancomycin, and ciprofloxacin, and a decrease in the total cost. The Antimicrobial Resistance Control Program has been broadly accepted by providers [34].

During the first year of implementing the antimicrobial stewardship program in Malaysia, the research found that the guidelines were well accepted. Most recommendations were to cease antimicrobial therapy, with piperacillin/tazobactam, meropenem, amoxicillin/clavulanate, and vancomycin being the most commonly auto-discontinued antimicrobials [35]. The antimicrobial stewardship program affected antibiotic suitability

and prescribing behavior in Middle Eastern countries, with antibiotic suitability increasing from 30% to 100%, adherence to guidelines increasing from 21% to 85%, and the incidence of *C. difficile* infections decreasing from 0.11 to 0.07 per 1000 patient days [36]. The multidisciplinary antimicrobial stewardship program is useful for decreasing antibiotic costs and use. The method is feasible and realistic to suggest to public health care [37]. Implementation of the Antimicrobial Stewardship program in four private tertiary hospitals in two cities in Saudi Arabia reduced the use and cost of antimicrobials and decreased the incidence of healthcare-associated infections [38].

Barriers to the antimicrobial stewardship program

Infrastructure (40.74%) and finance (37.04%) provide the biggest barriers to implementing antimicrobial resistance management initiatives. Barriers to the implementation of antimicrobial stewardship can be seen in **Figure 1** [39]. Several factors related to the successful implementation of an antimicrobial stewardship program strategy implementation have been reported, including the way of communication and relationships between members of the antimicrobial stewardship program and non-antimicrobial stewardship program, and factors related to conflict management in an organization [36]. Adequate program resources, such as IT staff and competencies, can also help to optimize the plan implementation process. Qualitative research among primary care physicians supports some of the findings, such as the time restrictions experienced by busy clinical professionals. Furthermore, the local person or team in leadership of programming the antimicrobial stewardship program and conducting audits and feedback is essential for the antimicrobial stewardship program's effectiveness [40].

The limitations of human health resources and information technology to support antimicrobial management must be resolved before implementing the antimicrobial stewardship program [41].

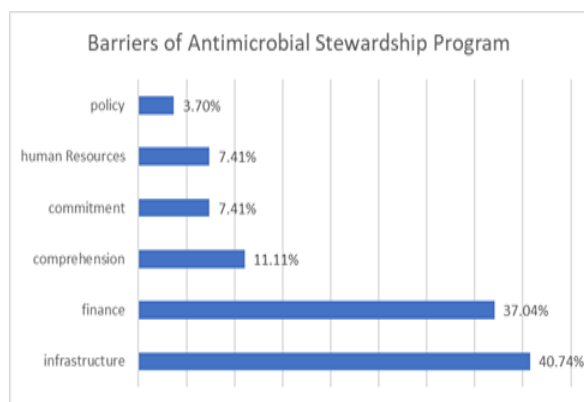


Figure 1. Barriers to the antimicrobial stewardship program

Access to infectious diseases or clinical microbiology support is the most significant barrier to implementing antimicrobial stewardship programs in regional and rural hospitals. Healthcare institutions lack internal expertise with limited exposure to

education and training [42]. According to a study conducted in Saudi Arabia's Eastern Province, the main barriers to implementing antimicrobial stewardship were a lack of internal policies/guidelines, specific antimicrobial stewardship information sources, and administrative awareness about the antimicrobial stewardship program. personnel, time constraints, limited training opportunities, confidence, financial or funding problems, and information. The barriers to supporting antimicrobial stewardship can be seen in the first two factors, a lack of internal policies/guidelines and, second, a lack of specialized antimicrobial stewardship information sources [43]. A survey of 248 hospitals from 74 countries reported that the main barriers to implementing an AMS program were lack of time, lack of knowledge about good prescribing practices and funding. Hospitals in low- and middle-income countries more often report unavailability of prescribing guidelines, insufficient laboratory capacity and maximum use of available laboratory services [44].

The implementation and impact of the antimicrobial stewardship program in Indonesian hospitals had received limited attention. According to the results of a study by Rukmini *et al.* (2019) on the implementation of policy at RSUP DR. Wahidin Sudiro Husodo Makasar, Indonesia, antimicrobial stewardship policies and activities have been implemented, although not completely. The antimicrobial stewardship program policy has not been fully implemented due to a variety of challenges, such as finance, a lack of commitment, and internal hospital coordination between the antimicrobial stewardship program team, management implementers, clinicians/departments/functional medical staff/clinical pharmacy/clinical microbiology that is not yet optimal, socialization of work programs, and activities are still limited, due to the personnel work overload, inadequate infrastructure, and the problem of antibiotic resistance in referral patients. According to a study of antimicrobial stewardship program members who attended the antimicrobial stewardship workshop, most respondents believed that just a few doctors were capable of carrying out their responsibilities as antimicrobial stewardship members in hospitals [45].

Antimicrobial stewardship program plays an important role to reduce bacterial resistance and increasing the use of antibiotics, there are many obstacles that affect the implementation of the program. According to research, there are barriers to antimicrobial stewardship program including erratic clinical workflow in certain settings such as workload, time constraints, and decision fatigue, Patient pressure and satisfaction, Diagnostic barriers, Social, logistical, and ethical barriers, Hospital hierarchy, Lack of training and knowledge, Communication between microbiology laboratories and clinical units. Lack of training and knowledge, interprofessional and inter speciality conflicts, and lack of resources are the most common barriers [46].

Several limitations should be highlighted in our study. First, our study center used only two hospitals, but our interpretation of the data is likely relevant to other centers. The method used was a survey, not an in-depth interview, so it could not retrieve complete information. The results described illustrating the

implementation of ASP in hospitals based on the judgment of health professionals.

Conclusion

The antimicrobial resistance control program is being implemented successfully in Indonesian hospitals. Almost all antimicrobial stewardship components have been implemented in hospitals. However, some obstacles remain, such as infrastructure and finance. So, a strategy to overcome these obstacles is required. Pharmacists play an active role in supporting the program's implementation, and hospitals feel the impact. Other health professionals' contributions are also necessary for the program's success.

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