Abstract
The incidence of antimicrobial resistance (AMR) worldwide is getting worse. The issue of antimicrobial resistance, or AMR, is a new health threat and constitutes 1 in 10 world health threats. AMR is a serious problem in the world of health that must be addressed. Therefore, further studies will be carried out on AMR control by the government according to Health Law Number 36 of 2009 and examine the role of the POM in controlling AMR. This paper uses a normative research method, namely finding material from the literature or applicable regulations and conducting a qualitative analysis. The results of this study, the government has tried to fulfill the mandate of the Health Law by creating integrated AMR control across sectors through Permenko No 7/2021 concerning the National Action Plan for Antimicrobial Control. In addition, the Food and Drug Supervisory Agency laid out the AMR control policy through the Decree of the Head of BPOM No. HK.02.02.1.2.03.20.98 of 2020

Keywords: Antimicrobial Resistance, Cross Sector, National Action Plan

A. Introduction
The main health problem in several countries is infectious disease, especially in developing countries. Several microorganisms, including bacteria with pathogenic properties or disease germs, are the main cause of inspection. To inhibit the cause of infection used, several antimicroorganisms were used. These materials have long been developed, both cellular and molecular. These anti-microorganisms include anti-fungal, antimicrobial, and antibiotics.¹

The incidence of antimicrobial resistance (AMR) worldwide is getting worse. The issue of antimicrobial resistance, or AMR, is a new health threat and constitutes 1 in 10 world health threats. Global Burden Disease (GBD) data shows that in 2019, the number of deaths due to AMR worldwide reached 4.95 million, while 1.27 million were caused directly by AMR. Deaths from AMR are higher than deaths caused by HIV/AIDS and malaria.²

AMR does not only have an impact on health but also affects the economy. AMR will increase health costs caused by a much longer healing and treatment time, more antimicrobial doses used for therapy, the need for new antimicrobial alternatives with higher costs, the complexity of disease diagnosis, and increased costs of services to patients.³

The definition of AMR is a condition in which microorganisms can survive therapeutic doses of antimicrobial compounds in medicinal actions in humans, animals, fish, and plants.\(^4\) Therefore, AMR control must be carried out across global, regional, and national sectors as mandated by Law Number 36 of 2009 concerning health. As an implementation of the law’s mandate, priority action is taken, namely increasing the implementation of the Indonesian National Action Plan (RAN) for AMR.

AMR is a serious problem in the world of health that must be addressed. Therefore further studies will be carried out on AMR control carried out by the government according to Health Law Number 36 of 2009 and examine the role of the POM in controlling AMR. This paper uses a normative research method, namely finding material from the literature or applicable regulations and conducting a qualitative analysis.

The incidence of antimicrobial resistance (AMR) worldwide is getting worse. The issue of antimicrobial resistance, or AMR, is becoming a new health threat and is 1 of the ten world health threats. The definition of AMR is a condition in which microorganisms can survive with certain therapeutic doses of antimicrobial drugs. Based on Law 36 of 2009, the government is responsible for public health conditions, including AMR. One of the government agencies appointed to control AMR is the Food and Drug Administration. The POM Agency carries out AMR control by drafting policies related to antimicrobials, supervising the circulation of pre-market and post-market antimicrobials from upstream to downstream, supervising relevant stakeholders, and conducting technical guidance and counseling related to antimicrobials.

AMR is caused by irrational or inappropriate use of antibiotics because they are given without a doctor's prescription. The activities carried out include supervision of pharmaceutical service facilities using a special form of AMR supervision in the downstream post market sector carried out by UPT Badan POM, UPT Balai Besar POM in Bandar Lampung surveillance data showed that 89% of pharmacies dispensed antibiotics without a doctor's prescription in 2022. The surveillance data has a close relationship with AMR. The higher use of antibiotics without a doctor's prescription will increase AMR cases. The role of the POM Agency is very strategic in controlling AMR in Indonesia.

B. Discussion

1. Control of Antimicrobial Resistance in Indonesia

One of the pillars of a nation's development is public health, a basic human need. In this case, the principles of participatory, non-discriminatory, protective, and sustainable are used in every effort to increase public health. This is in the context of increasing the nation's competitiveness because if the health quality of human resources in Indonesia increases, the national development will be directed, and the defense system will improve.\(^5\)

Law 36 of 2009 article 14, paragraph (1) states, "The government is responsible for planning, organizing, implementing, fostering and overseeing the implementation of health efforts that are equitable and affordable to the community." These health efforts can be preventive, curative, promotive, and rehabilitative. One of the efforts made by the government is to deal with the AMR problem, which is currently a serious health problem.\(^6\)

The definition of AMR is when microorganisms can survive with certain therapeutic doses of antimicrobial drugs; this causes microorganisms to develop, reduces antimicrobial potency.


increases the likelihood of disease spread, worsens conditions, and can cause death. AMR control must be carried out across sectors at the global, regional, and national levels.

The following are some conditions that describe AMR events that occurred in Indonesia, including:

a. *Extended-spectrum beta-lactamase*, or what is often known as *ESBL*, is an enzyme produced by certain bacteria, which causes bacteria to resist commonly used antibiotics. Twelve countries in the Asia Pacific in 2011, including Taiwan and India, conducted surveillance on resistance to ESBL or *Extended-Spectrum-11-Beta-Lactamase* and CARB-R or *Carbapenem resistance*. These activities show that Indonesia has the highest AMR compared to other countries in Asia Pacific. The AMR value for *Escherichia coli* bacteria is the highest, namely 71%, while other countries are 47%.

b. AMR also occurs in animals. Incorrect use of antibiotics in animals, namely to maintain a healthy condition or stimulate growth regularly, causes animals to experience AMR. The Ministry of Agriculture conducted AMR research on animals and their products using AST (*Antimicrobial Susceptibility Testing*). Testing of *Escherichia Coli* bacteria isolates from caecum samples of boiler chickens in Greater Jakarta and Depok in 2019 showed 79%, 84%, and 92% respectively, resistance to Trimethoprim, Ciprofloxacin, and Ampicillin.

c. In the period from 2016 to 2019, KKP (Ministry of Marine Affairs and Fisheries) conducted research using the AST (*Antimicrobial Susceptibility Testing*) and MIC (*Minimum Inhibitory Concentration*) methods on freshwater fish. Tests were carried out on isolates of *Aeromonashydrophila* bacteria from freshwater fish such as catfish, carp and tilapia using tetracycline, enrofloxacin, and oxytetracycline antibiotics. The AMR test using tetracycline antibiotics increased by 45% to 50% in 2019 from 5% in 2016. Meanwhile, enrofloxacin antibiotics using *Aeromonas hydrophila* AMR isolate increased to 92.4% 2019.

d. In addition to the direct causal factors, indirect causal factors cause AMR, namely the polluted environment. Consumption of freshwater contaminated with antimicrobials is one of the causes of AMR. Improper industrial waste disposal processes, improper disposal of leftover antimicrobials due to damage or expiration, and human and animal excretion can trigger the environment to become polluted. AMR originates from the extensive use of antibiotics, which does not remain the cause of AMR, not only in humans but also in animals such as livestock, fisheries, and plant. Animals also consume most of the antibiotics consumed by humans. Based on these conditions, *one health policy was created, which required* a comprehensive, integrated, and coherent approach from various related sectors so that the health problems caused by AMR could be overcome.

AMR events in animals, plants, and the environment will affect public health because humans will consume the products produced. So to overcome this, integrated efforts across sectors must be carried out. The government issued PMK Number 7 of 2021, "National Action Plan for Antibiotic Resistance Control for 2022-2024," to realize the goals stated in the Health Law above. This regulation mentions several ministries involved in carrying out AMR prevention, response, and control, including the Ministry of Health, Food and Drug Administration, Ministry of Defense, Ministry of Maritime Affairs and Fisheries, and Ministry of Agriculture. In addition, the government can involve:

a. Professional organizations
b. International organizations

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c. community organization
d. business actor association
e. educational institutions and industry

Each party collaborates in making policies according to their duties and functions. This policy facilitates cooperation and coordination across sectors at the central and regional levels, providing a clear picture of planning, implementing, and communicating policies on resistance control policies. As an example of the program carried out in 2017, the Center for Veterinary Research researched veterinary policy analysis related to AMR. The research is developing a model for handling AMR in livestock in Indonesia by focusing on broiler livestock. Two (two) types of antibiotics are used: Enrofloxacin and Oxytetracycline. The results of this study are used to obtain initial recommendations for handling AMR through the development of this structure because the complexity of the problem can be identified.

Management of AMR in humans at the national level is contained in Permenkes Number 8 of 2015, making policies regarding AMR prevention. The strategy for the Antimicrobial Resistance Control Program is stated in Article 3 of the Minister of Health, namely: "controlling the development of resistant microbes due to selection pressure by antibiotics, through the wise use of antibiotics; and preventing the spread of resistant microbes through increased adherence to the principles of infection prevention and control."10

The World Health Organization (WHO) plays an active role in controlling AMR at the international level. One concrete step is to develop a world resistance management strategy. Items made include:11

a. Optimizing the Antimicrobial Stewardship Program
b. Improving the system of prescribing antibiotics
c. Preventing bacterial infections by increasing the body’s resistance
d. Increasing public awareness to use antibiotics wisely by providing counseling

In addition to implementing an integrated program, targeted financing is also needed. Most of the funding from the APBN and APBD is used to improve public health, as outlined in the form of BOK (special operational costs). Funding from the APBN and APBD is maximized for preventive and promotive services as much as two-thirds of its share to fulfill the Health Law 36/2009 mandate.12

2. The Role of BPOM in Controlling Antimicrobial Resistance

Presidential Regulation of the Republic of Indonesia 80/2017 states, "The Food and Drug Supervisory Agency (Badan POM) is a non-ministerial government agency that continues to be strengthened to be able to carry out government affairs in the field of drug and food control more effectively." Regarding managing AMR, the POM Agency has issued a Decree of the Head of BPOM No. HK.02.02.1.2.03.20.98 of 2020. The regulation states the strategic objectives of the action plan for AMR control within the Food and Drug Supervisory Agency for 2020 to 2024. Plans AMR control actions carried out by the BPOM, namely:13

a. Compilation of policies related to antimicrobials

The preparation of drug and food control policies is the main task and function of the POM Agency. Regarding AMR, the policies are from the upstream sector (production) and distribution (pharmaceutical wholesalers/PBF and pharmaceutical service facilities/saryanfar).

9 Noor M, dkk; Antimicrobial Resistance In Indonesia: http://repository.pertanian.go.id/handle/123456789/8912, 2017
11 Asharina I, Resistensi Antibiotik di Indonesia Tak Usah Dulu Bermain Dengan Undang-Undang, DOI:10.13140/RG.2.2.21560.65281
13 Kepala badan POM, Keputusan Kepala BPOM Nomor HK.02.02.1.2.03.20.98 Tahun 2020, Jakarta, 2020.
AMR supervision is carried out as a special AMR or in conjunction with routine supervision. Apart from that, together with cross-sectors, the POM has developed other policies for controlling AMR, such as joint inspection policies.

b. Supervision of antimicrobial production, distribution, and sampling

Supervision is carried out comprehensively from upstream to downstream of:

1. Pharmaceutical industry

Various conditions that become challenges for BPOM include the industrial sector. These challenges can be internal or external, one of which is AMR. The POM Agency must encourage the competitiveness of the industrial sector. However, on the other hand, the POM Agency must still pay attention to aspects of the safety, quality, and efficacy of the drugs it produces.14

In carrying out its duties, the POM Agency also pays attention to public health and drug abuse’s impact. For example, the economic burden is in the form of a decrease in GDP (Gross Domestic Income) due to failure to handle AMR. Apart from that, other impacts are caused, namely increasing costs for treatment, and there is a potential decrease in income or even death.15

AMR control starts from the upstream sector, namely the pharmaceutical industry. The pharmaceutical industry must apply good drug production methods (GMP) per applicable regulations. Specifically for antimicrobial production, AMR data is used as input in registration and production, namely analyzing disease patterns and drug requirements. In addition, the pharmaceutical industry must ensure the quality of antimicrobials circulating online. In addition, checking the procurement of raw materials used is related to procurement sources and certificates of analysis to ensure that the raw materials to be used in the production process are medicinal raw materials specifically used for humans.

2. Pharmaceutical Wholesalers (PBF) and Government Pharmaceutical Installations (IFK)

PBF and IFK are the first distribution chain in the distribution of antimicrobials. PBF and IFK must comply with the provisions on good drug distribution practices (CDOB) throughout the distribution chain, namely in terms of procurement, storage and distribution of drugs. AMR control in PBF or IFK is carried out by:16

a. Procurement must be sourced from suppliers who have appropriate qualifications by making supplier qualifications.

b. Storage of antimicrobials must meet the requirements so that the quality is maintained, so that when consumed it still gives the expected effect.

c. Distribution of antimicrobials in reasonable quantities to pharmaceutical service facilities. The reasonableness of the amount of antimicrobial distribution can be anticipated by PBF by making customer qualifications regarding the need for antimicrobials in a certain period of time.

From monitoring data for the PBF facility which is the cathment area of the Balai Besar POM in Bandar Lampung, the procurement and storage of antimicrobials still meet the requirements. discrepancies occur in terms of distribution, namely that customer qualification has not been carried out regarding the reasonableness of the amount of antimicrobial distribution.

3. Pharmacy Service Facility

AMR can cause many other problems besides health problems. AMR can be caused by taking antibiotics without a doctor's prescription. This condition raises a problem, namely the

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14 Barlow, P., dkk; Trade challenges at the World Trade Organization to national noncommunicable disease prevention policies: a thematic document analysis of trade and health policy space. PLoS Medicine, 15(6), e1002590. https://doi.org/10.1371/journal.pmed.1002590
uncontrolled use of antibiotics which causes AMR if the condition persists. Antimicrobials are a class of hard drugs which based on the provisions must be based on a doctor's prescription. In addition, rational prescribing and not providing services that are not in accordance with authority can be a factor causing AMR.

Health workers also contribute to the problem of using antibiotics. The results of research in the Province of the Special Region of Yogyakarta show that data on consumption of antibiotics is not based on a doctor's prescription. These drugs are obtained from health workers in the appropriate field.17

By referring to PerBPOM No. 24 of 2021 concerning "Supervision of the Management of Drugs, Medicinal Materials, Narcotics, Psychotropics and Pharmacy Precursors", the POM routinely carries out supervision at pharmaceutical service facilities. This routine oversight function is carried out by the technical implementation unit. Monitoring data from the POM Center in Bandar Lampung for 2022, sales of antimicrobials, especially antibiotics without a doctor's prescription, are still widely found in pharmacy service facilities. The percentage of sales of antibiotics without a prescription is very high, namely 89%, as shown in the following figure:

![Figure 1. Percentage of sales of antibiotics without a doctor's prescription](image)

Blue circles indicate non-prescription antibiotics and red circles indicate prescription antibiotics.

**Figure 1. Percentage of sales of antibiotics without a doctor's prescription**

The POM Agency has issued an AMR monitoring policy by creating a special format that is used together when routine supervision is carried out. This is done to facilitate the collection of data on the use of antimicrobials, especially antibiotics for further mapping and evaluation. Results of monitoring the distribution of antibiotics in facilities that do not comply with the provisions, are followed up by imposing administrative sanctions. The facility is obliged to provide antimicrobials based on a doctor's prescription.18

4. **Join inspection with related stake holders**

The POM Agency together with the Ministry of Agriculture, the Ministry of Health and the Ministry of Fisheries and Maritime Affairs conducted a joint inspection of the facilities. This activity aims to ensure that the distribution chain is in accordance with their respective routes. in the material presented by sources from the ministry of agriculture at a cross-sectoral meeting related to AMR in December 2022, cases of the sale of antimicrobials were not in accordance with the provisions, for example there were pharmacies selling antimicrobials but by buyers whose intended use was for animals or plants, and vice versa.

It has been regulated in Law 18 of 2009 concerning Animal Husbandry and Animal Health article 5 paragraph (31) "Everyone is prohibited from using certain animal drugs in livestock

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17 Pambudi RS, dkk; Tingkat Pengetahuan Penggunaan Antibiotik Pada Mahasiswa Kesehatan Universitas Sahid Surakarta; Jurnal Dunia Farmasi; Volume 4 No.3 (2020), DOI: https://doi.org/10.33085/jdf.v4i3.4708
whose products are for human consumption”. The government has provided individual products and distribution channels for antimicrobials used in humans and animals. Use that is not in accordance with the provisions will result in adverse health effects.

5. Technical guidance, cross-sector advocacy and counseling

To carry out these strategic goals, the POM, according to its main duties and functions, continues to collaborate with other relevant ministries/institutions to support the implementation of antimicrobial resistance control. This is done by providing technical guidance, advocacy across sectors and outreach to the wider community about antimicrobials and the dangers of AMR.19

Besides that, education is also carried out in the destruction of drugs, namely the destruction of drugs is carried out properly in service facilities. Inappropriate drug disposal methods can cause environmental damage. In addition, it can cause clinical problems that are detrimental to society. The pharmacist in charge at pharmaceutical service facilities is expected to have knowledge in carrying out drug destruction and provide education to the public about proper drug disposal including antimicrobials.20

The right of the public to obtain clear information about the drugs they are taking. And it is the government's obligation to provide knowledge about rational drug use. So that in addition to health service facilities such as Puskesmas, the government is also trying to provide guidance on rational drug use to the community. Since 2008, the Ministry of Health has stated that the CBIA method or Active Individual Learning Method has been developed. This is an effort to empower the community in the rational use of drugs.21

The POM Agency must prepare itself to become an adaptive organization in formulating various policies including in terms of AMR control. In order to produce policies that can support business development and at various levels of society, adequate resources are needed.22

Many efforts have been made to control AMR, but more effort and consistency is needed in overseeing all policies implemented. Routine monitoring is needed to evaluate and see the effectiveness of the efforts that have been made. Tackling antimicrobial resistance will be resolved quickly if the RAN (National Action Plan) for Antimicrobial Resistance can run in an integrated and comprehensive manner.

C. Conclusion

The conclusions that can be drawn from the above description are:

Health Law No 36/2009 which was passed down through Permenko No 7/2021 concerning the NAP for Antimicrobial control. The AMR control program is carried out across sectors. AMR is a global problem and needs to be controlled across sectors because AMR does not only occur in humans, but also in animals and plants. AMR does not only have an impact on health, but also affects the economy.

The POM Agency has formulated an Action Plan for AMR Control in the Decree of the Head of BPOM No. HK.02.02.1.2.03.20.98 of 2020 which is set forth with 4 strategic objectives, namely Formulation of policies related to antimicrobials; Supervision of antimicrobial production, distribution and sampling; Join inspection with related stake holders; Technical guidance, cross-sector advocacy and counseling.

19 R Rahman, dkk; Peningkatan Pengetahuan Masyarakat tentang Bahaya Resistensi Antimikroba Terhadap Penyakit Infeksi di Puskesmas Kalimuta kabupaten Ternate; Vol 1 No 2, 2022; http://ejournal.unkhair.ac.id/

20 Pamestutie HR., dkk; Pengetahuan dan Ketepatan Apoteker dalam Pemusnahan Obat Sisa, Obat Rusak dan Obat Kedaluarsa; Jurnal Farmasi Indonesia, Vol 8 No 3 (2021) ; https://e-journal.unair.ac.id/JFFIKI/article/view/24638

21 Morika HD, dkk; Gerakan Cermat Menggunakan Obat; Jurnal Abdimas Saintika Volume 1 Nomor 1 (2019); DOI: http://dx.doi.org/10.30633/jas.v1i1.461

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