



Thailand's Second National Action Plan on Antimicrobial Resistance

2023-2027

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Executive **Summary**



Antimicrobial Resistance (AMR) is increasingly recognized as a significant global health threat. The prevalence of AMR continues to rise, while the development of new antimicrobial medicines to combat resistant pathogens has significantly declined. No new class of antimicrobial medicines has been introduced worldwide in over 30 years. This situation poses a serious risk of death from antimicrobial-resistant infections due to the lack of effective treatments. As a result, AMR represents a global crisis affecting countries worldwide.

AMR is a widespread concern because resistant pathogens can spread among humans, animals, food, and the environment, crossing international borders. Globally, antimicrobial-resistant infections are responsible for an estimated 1.27 million deaths each year, with approximately 38,000 fatalities in Thailand. According to the World Bank, AMR will have a profound impact on the global economy, increasing healthcare costs, reducing market competitiveness in industries and agriculture, and negatively affecting workforce productivity. Low- and middle-income countries will be especially vulnerable. Furthermore, by 2050, it is projected that AMR could push 28.3 million people into extreme poverty.

Efforts to address AMR have been initiated at global, regional, and national levels. In 2015, the World Health Assembly endorsed the Global Action Plan on AMR (GAP-AMR) and urged Member States to develop their own national action plans. In 2016, the United Nations General Assembly adopted the Political Declaration on the High-Level Meeting on Antimicrobial Resistance, elevating AMR to the political agenda on a global scale. Most recently, in 2020, the United Nations incorporated AMR as an indicator under the Sustainable Development Goals (SDGs), requiring every nation to report on it.

In Thailand, comprehensive efforts to tackle AMR have been implemented across various sectors. In 2016, the cabinet approved Thailand's National Strategic Plan on Antimicrobial Resistance 2017-2021 (NSP-AMR), marking the country's first national strategy to address AMR in an integrated manner using the One Health

approach. The implementation period was later extended to 2022 to align with the country's 20-year national strategy.

The NSP-AMR has yielded successes in several areas and achieved three out of its five goals. These accomplishments include reducing antimicrobial consumption in both humans and animals as planned and enhancing Thailand's AMR management capacity to meet international standards. Despite these advances, significant challenges remain, such as rising infection rates from antimicrobial-resistant pathogens and limited public awareness of AMR. Recognizing the need for ongoing efforts, the National Policy Committee on Antimicrobial Resistance has approved the creation of the 2nd National Action Plan on Antimicrobial Resistance 2023-2027 (NAP-AMR).

The 2nd NAP-AMR is built on four core principles: (1) continuity from the NSP-AMR 2017-2022, (2) an action-oriented strategy, (3) a coordinated approach for synergy across efforts, and (4) political commitment to ensure multi-sectoral collaboration under the One Health approach.

The vision of the 2nd NAP-AMR is: "Thais have a low risk of threats from AMR in humans, animals, food, and the environment." The plan is guided by two missions: (1) reducing the risk and impact of AMR through collaboration across all sectors, and (2) addressing AMR issues sustainably under the One Health approach.

The 2nd NAP-AMR outlines six main goals and six corresponding strategies as follows:

Goals

Goals

1. Reduce AMR morbidity in humans.
2. Reduce the risk of AMR in food and the environment.
3. Reduce antimicrobial consumption in humans.
4. Reduce antimicrobial consumption in animals.
5. Increase AMR literacy among the general public.
6. Increase the capacity of Thailand's AMR management system to meet international standards.

Indicators and target values

1. 10% reduction in AMR morbidity in humans.
2. There is a system for detecting contamination of antimicrobial-resistant pathogens and antimicrobial residues in food and the environment according to international standards.
3. 30% reduction in antimicrobial consumption in humans (compared to 2017).
4. 50% reduction in antimicrobial use in animals (compared to 2017).
5. 30% of people have literacy about AMR.
6. The capacity of Thailand's AMR management system meets Level 4 or above in line with international standards.

Strategy

- | | |
|-------------------|---|
| Strategy 1 | Antimicrobial resistance surveillance under the One Health approach |
| Strategy 2 | Regulation of antimicrobial distribution |
| Strategy 3 | Infection prevention and control in healthcare facilities and antimicrobial stewardship in humans |
| Strategy 4 | AMR prevention and control and antimicrobial stewardship in agriculture and animals |
| Strategy 5 | Improvement in AMR literacy for the public |
| Strategy 6 | Governance mechanisms to move AMR policy and actions forward in a sustainable manner |

The 2nd NAP-AMR is a strategic plan that emphasizes continuity with the previous plan. It aligns with the overarching National Strategy, as well as other second-level plans, including the master plans under the National Strategy, national reform initiatives, national economic and social development plans, and national security policies and plans. The plan is designed to be implemented in harmony with both domestic and international policies. It also has a strategic focus aimed at driving meaningful change and ensuring a positive impact on implementation. Notably, the plan places significant emphasis on expanding collaborations with civil society and various sectors, going beyond the scope of previous years.

The 2nd NAP-AMR includes a robust framework for monitoring progress and evaluating outcomes. Specific, measurable goals have been established for each strategy, and an overview of the action plan is clearly defined. To address challenges and barriers that may arise during implementation, the design includes provisions for regular monitoring and adjustments based on evolving circumstances. Furthermore, plans are in place to continuously track progress and key factors influencing operations, as well as to assess the status of antimicrobial resistance using the One Health approach.

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Operational **Definition**



Antimicrobial Resistance (AMR)

AMR refers to the ability of microbes (e.g. bacteria, viruses and fungi) to grow or survive even after exposure to antimicrobial agents at concentrations that are normally sufficient to inhibit or kill that particular strain of the organisms. In this plan, AMR predominantly means AMR in bacteria.

Antimicrobial agent

Antimicrobial agents are those that have antimicrobial properties or the ability to inhibit growth or metabolic processes in microbes (e.g. bacteria, viruses and fungi). They are obtained from living organisms or through synthesis. In this plan, antimicrobial medicines are used interchangeably with antibiotics and predominantly mean antibiotics or antimicrobial medicines with bactericidal properties, including those with the ability to stop bacterial growth.

Antimicrobial stewardship

Prudent and responsible management of antimicrobial medicine use that focuses on systematic coordination of inter-professional efforts in the provision of patient care, thereby enabling appropriate selection of antimicrobial medicines for treatment (type, dosage, commencement, direction and treatment duration). This ensures that antimicrobial medicines are most appropriately administered for prevention and treatment of infection, leading to minimal undesirable side effects, minimal impact on AMR and potential subsequent AMR spread, and reduction in unnecessary economic loss.

Antimicrobial Resistance literacy (AMR literacy)

Antimicrobial resistance (AMR) literacy refers to the ability to access, understand, and apply information about both antimicrobial resistance and the proper use of antimicrobials. This includes the skills needed to analyze, interpret, and assess health-related data from various sources, including health services and external information. With this knowledge, individuals are better equipped to make informed decisions regarding self-care and personal health management, ultimately supporting the maintenance of good health. Additionally, they can offer advice to others—such as family members and communities—on how to prevent AMR and use antimicrobials responsibly, promoting collective health and well-being. Therefore, AMR literacy encompasses not only knowledge of antimicrobial resistance but also the principles of using antimicrobial agents appropriately.

The Outbreaks of Critically Important Multidrug-Resistant Organisms or Emerging Multidrug-Resistant Organisms

The finding of one or more patients who have been detected with a newly emerging drug-resistant organism or an organism never before found in Thailand, or the finding of two or more patients with infections caused by critically-important antimicrobial-resistant organisms or newly emerging antimicrobial-resistant organisms that have epidemiological connections.

Abbreviation



ALISS	AMR Laboratory Information Sharing System
AMR	Antimicrobial Resistance
ARC	Antibiotic Resistance Coalition
ASEAN	Association of Southeast Asia Nations
CAC	Codex Alimentarius Commission
CCS-AMR	WHO Country Cooperation Strategy Program on AMR
CIA	Critically Important Antimicrobial
CRAB	Carbapenem-resistant <i>Acinetobacter baumannii</i>
CRE	Carbapenem-resistant <i>Enterobacteriaceae</i>
DeNARs	Development of National AMR surveillance and response system
DID	Defined daily dose per 1000 inhabitants per day
ESBL	Extended-spectrum beta-lactamase
FAO	Food and Agriculture Organization of the United Nations
GAP	Good Agriculture Practice
GAP-AMR	Global Action Plan on AMR
GDP	Gross Domestic Product
GHSA	Global Health Security Agenda
GLASS	Global Antimicrobial Resistance and Use Surveillance System
GMP	Good Manufacturing Practice
GRAM	Global Research on AMR
HAI	Hospital-acquired Infection
IAM	Integrated AMR Management in hospital
JEE for IHR	Joint External Evaluation Tool: International Health Regulations
MDRO	Multidrug-Resistant Organism
MRSA	Methicillin-Resistant <i>Staphylococcus aureus</i>
NARST	National Antimicrobial Resistance Surveillance Center, Thailand
NDM	New Delhi metallo- β lactamase
PCU_{Thailand}	Population Correction Unit, modified by Thailand
PIC/S	Pharmaceutical Inspection Co-operation Scheme
SAARC	South Asia Association for Regional Cooperation

SDG	Sustainable Development Goal
SEARO	WHO South-East Asia Region Office
Thailand SAC	Thailand Surveillance of Antimicrobial Consumption
UNEA	United Nations Environment Assembly
UNEP	United Nations Environment Program
VRE	Vancomycin-resistant <i>Enterococcus</i>
WHO	World Health Organization
WOAH	World Organization for Animal Health
WTO	World Trade Organization

Scope of **the Plan**



Since antimicrobial resistance is an urgent and important problem with widespread impacts, and requires an integrated national strategic plan to address the issue, the 2nd NAP-AMR (2023-2027) has been developed as a strategic action plan that aligns with and continues the work of the Thailand's NSP-AMR (2017-2022), focusing primarily on managing bacterial resistance. Therefore, in this plan, the term "antimicrobial-resistant organisms" refers to "drug-resistant bacteria," and the term "antimicrobials" refers to "antibacterials" or "antibiotics."

The 2nd NAP-AMR does not include management of AMR issues in specific diseases, i.e., tuberculosis, malaria, and AIDS, since these diseases already have specific policies and national plans in place. However, in cases where there is overlap in the situation and approaches to managing drug resistance problems, coordination and collaboration will occur to ensure effective problem-solving.

Furthermore, the 2nd NAP-AMR aligns with the GAP-AMR that was endorsed at the 68th World Health Assembly.

Section 1 | Rationale



Antimicrobial resistance (AMR) affects humans, animals, food, and the environment, posing a global crisis that transcends national borders. AMR can spread not only within species but also across different species, making it a challenge for all countries worldwide.

Recent research shows that, in 2019, antimicrobial-resistant infections were responsible for 4.95 million deaths globally. Of these, approximately 1.27 million deaths were directly caused by AMR infections¹ —an increase from an estimated 700,000 deaths per year in 2016.² According to the World Bank, the global gross domestic product (GDP) is projected to decline by 1.1% to 3.8% by 2050 due to the impacts of AMR. In low- and middle-income countries, the decrease could exceed 5%, potentially pushing 28.3 million people into extreme poverty.³

In Thailand, it was estimated that in 2010, there were approximately 88,000 cases of antimicrobial-resistant infections annually, with about 38,000 of these cases resulting in death. The economic impact of AMR in Thailand was estimated at over THB 40 billion. Patients with resistant infections had extended hospital stays, accounting for a total of approximately 3.24 million days in hospital.⁴

Given the global nature of the AMR crisis, no single country can solve this issue alone. Therefore, in 2015, the 68th World Health Assembly formally endorsed the Global Action Plan on AMR and urged all Member States to develop their own National Action Plans to address AMR within two years.⁵

In response, and to align with the global effort, the Thai government approved the National Strategic Plan on Antimicrobial Resistance 2017-2021 (NSP-AMR) on August 17, 2016. This plan, designed under the One Health approach, aims to address AMR in Thailand in an integrated manner. The plan's implementation was later extended until 2022 to align with Thailand's 20-year National Strategy (2017-2036).⁶

The implementation of Thailand's NSP-AMR 2017-2022 is overseen by the National Policy Committee on Antimicrobial Resistance. The Prime Minister designates the Deputy Prime Minister to serve as the Chair of the Committee, while the Ministry of Public Health, the Ministry of Agriculture and Cooperatives, and the Ministry of Natural Resources and Environment act as joint secretariats, coordinating efforts with various agencies. In addition, there are five subcommittees under the National Policy Committee, each responsible for driving different aspects of the strategy. Simultaneously, the antimicrobial resistance program under the WHO-Royal Thai Government Country Cooperation Strategy 2017-2021 (CCS-AMR program) is being implemented. This program focuses on developing a monitoring and evaluation system, generating research and academic evidence, and facilitating the ongoing implementation of NSP-AMR.⁷⁻⁸

The results of the NSP-AMR implementation show significant progress, with three out of five national goals having been achieved. The reduction in antimicrobial consumption in both humans and animals has been successfully met. From 2017 to 2020, antimicrobial consumption decreased by 15.2% in humans and 36.0% in animals. Notably, the reduction in human antimicrobial consumption was driven by a 24.8% decline in the use of antibiotics (antibacterial drugs), which was a primary focus of the NSP-AMR. Thailand's capacity for managing AMR has also improved. In 2022, the country's score on the Joint External Evaluation Tool for the International Health Regulations (2005) (JEE for IHR) increased to 4.2 points, up from 3.0 points in 2017 (a full score of 5), indicating significant progress in AMR management.⁹

However, two national goals have not yet been fully achieved. AMR-related morbidity continues to rise, indicating that the burden of AMR remains a pressing issue. Additionally, public awareness on AMR and antimicrobial use has increased by 1.3% from 2017 to 2021 according to a survey by the National Statistical Office. It also reflects that only one in four Thai people currently have a good understanding of AMR and its implications.¹⁰

The implementation of the NSP-AMR has achieved significant progress. However, several challenges remain. To address these, the National Policy Committee on AMR has approved the development of the 2nd NAP-AMR (2023-2027). This plan aims to ensure continuity, effectiveness, and intersectoral coordination in tackling AMR, leading to sustainable solutions.

Rationale

1. To address the country's AMR problem and reduce its impact on public health and people's lives. This NAP-AMR will serve as the country's main policy for managing antibiotic-resistant bacteria. Previously, AMR has only been addressed as a sub-issue within various policies, resulting in a lack of clear national direction for solving the problem. Additionally, having the 2nd NAP-AMR will enable the development of effective, unified, and sustainable national mechanisms for managing AMR.

2. To prevent negative impacts from the spread of AMR on the economic system, trade, and tourism. Cross-border transportation, international trade, and Thailand's status as a hub for medical care—particularly through the promotion of medical tourism—amplify the risks of AMR transmission across borders.

3. To align with global efforts in addressing AMR, which is categorized as a significant global health security threat, and to prepare for public health emergency responses that may arise from AMR issues.¹¹ Thus, Thailand aligns its efforts with global initiatives, such as the GAP-AMR and the Political Declaration of the High-Level Meeting on AMR¹² adopted by the United Nations General Assembly during its 71st session that calls on Member States to develop and implement NAP-AMR.

Therefore, having the 2nd NAP-AMR is essential for addressing the country's AMR problems and safeguarding public health. It also demonstrates Thailand's commitment and responsibility in working together with the global community to solve the problem of AMR.

Section 2 | Policy Coherence



The 2nd NAP-AMR is connected to national plans at different levels within the country, as well as other international policies, which can be summarized as follows:

Coherence with Country's Plans at different levels

In line with Cabinet resolutions dated December 4, 2017 and December 3, 2019, the 2nd NAP-AMR functions as a third-level plan. It acts as a key mechanism to translate the National Strategy (first-level plan) and the second-level plans (i.e., the Master Plans under the National Strategy, National Reform Plans, and National Economic and Social Development Plans) into implementation. These efforts collectively contribute to Thailand's goal of becoming "a developed country with security, prosperity, and sustainability in accordance with the Sufficiency Economy Philosophy" by 2037.

The 2nd NAP-AMR is aligned with the first-and second-level plans as follows:

1. The National Strategy (first-level plan):

The 2nd NAP-AMR is aligned with the National Strategy 2018-2037 in three key areas.

► Strategy 2. National Strategy on National Competitiveness

Enhancement: This strategy aims to enhance Thailand's competitiveness. Therefore, the 2nd NAP-AMR contributes to this strategy in the following ways: *Strategic Guideline 1:* Supporting value-added agriculture by ensuring animal husbandry, livestock production, and agricultural practices meet national and international AMR standards. This enhances food safety and productivity for domestic consumption and export. *Strategic Guidelines 2 and 3:* Facilitating the development of future industries and services, including medical tourism, by implementing effective AMR management systems in hospitals and communities. This bolsters Thailand's reputation as an international medical hub offering comprehensive healthcare services.

► **Strategy 3. National Strategy on Developing and Strengthening Human Capital:** This strategy focuses on multidimensional human development. The 2nd NAP-AMR is aligned with: *Strategic Guideline 5:* Enhancing the physical, mental, and social well-being of all Thais by preventing, controlling, and managing AMR risks to human and animal health, food, and the environment, establishing AMR standards in healthcare systems and might contribute to emergence or spread of AMR, and enhancing people knowledge through community-based approaches; and *Strategic Guidelines 2 and 3:* Promoting lifelong learning and reforming educational processes. The plan incorporates digital platforms and academic innovations to improve public knowledge and professional skills for addressing AMR challenges effectively.

► **Strategy 5. National Strategy on Eco-Friendly Development and Growth:** The 2nd NAP-AMR supports Thailand's commitment to the Sustainable Development Goals (SDGs) including societal, economic, environmental, governance and collaborative national and international partnerships through: *Strategic Guideline 1:* Promoting sustainable consumption and production by monitoring antimicrobial usage, AMR trends, and antimicrobial residues in food and the environment. This will support efforts to avoid the emergence of resistant organisms and inform the regulation of antimicrobials from production to disposal. *Strategic Guideline 4:* Managing pollution and agricultural chemicals in urban, rural and industrial settings and strengthening public health systems, this ensuring compliance with international standards that will help to address AMR-related challenges. *Strategic Guideline 5:* Safeguarding national environmental resources and water security by monitoring and managing antimicrobial residues and AMR pathogens in water bodies and ecosystems.

2. Second-Level Plans

The 2nd NAP-AMR is also aligned with Second-Level Plans.

2.1 Master Plans under the National Strategy¹³

The 2nd NAP-AMR supports the Master Plans under the National Strategy in the following three areas:

1) National Competitiveness Enhancement: There are two related master plans

- Master Plan 3: Value-Added Agriculture: focuses on sustainable agriculture through the development of quality standards, safety certification systems, and traceability mechanisms recognized by both domestic and international markets.
- Master Plan 5: Promoting Tourism Diversity: includes the health tourism sub-plan, which supports Thailand's development as a health and wellness destination.

2) Social Cohesion and Equity

- Master Plan 13: Enhancing Well-Being Among Thais includes four sub-plans:
 1. Building public knowledge about well-being and addressing risk factors that threaten to undermine it.
 2. Ensuring equitable and high-quality access to public health services.
 3. Distributing quality public health services universally and efficiently.
 4. Developing adaptive systems to address emerging and reemerging diseases influenced by climate change.

3) Eco-Friendly Development and Growth

- Master Plan 18: Pollution and Chemical Management emphasizes compliance with international standards across the agricultural sector to reduce environmental impacts.
- Master Plan 23: Research and Innovation Development supports innovation across all strategies to enhance competitiveness, reduce social inequalities, and promote sustainable growth.

2.2 National Reform Plans

The 2nd NAP-AMR aligns with three National Reform Plans as follows:

1. National Reform in Public Health (Plan 7): Promoting public health service systems and information technology infrastructure to effectively address AMR challenges. Key initiatives include public awareness, risk reduction, and integration of modern innovations with traditional Thai medicine and herbal treatments.

2. National Economic Reform (Plan 5): Promoting high-value agriculture by raising the standards of animal husbandry and agricultural practices to meet international standards on AMR, ensuring local and global recognition.

3. National Reform on Natural Resources and Environment (Plan 6): Focusing on environmental stewardship, including managing antimicrobial residues and AMR pathogen contamination in water bodies and the broader environment to ensure ecosystem conservation and public health protection.

2.3 The 13th National Economic and Social Development Plan (2023-2027)¹⁴

The 2nd NAP-AMR aligns with the following two dimensions:

1. Targeted Manufacturing and Service Sector Dimension
 - Milestone 1: Establishing Thailand as a leading country in high-value agricultural produce and processed agricultural products.
 - Milestone 4: Positioning Thailand as a high-value medical and wellness hub.
2. Natural resources and environmental sustainability Dimension
 - Milestone 10: Transitioning Thailand into a circular economy with low-carbon emissions.

2.4 The National Security Policy and Plan (2023-2027)

The 2nd NAP-AMR supports two key goals of the National Security Policy and Plan:

- Goal 1: Addressing communicable and infectious diseases.
- Goal 2: Strengthening the public health system to respond effectively to emergencies and deliver quality emergency medical services.

Coherence with Third-Level Plans and Policies

The 2nd NAP-AMR is interconnected with third-level national plans and policies, as outlined below:

1. The National Drug Policy and Drug System Development Strategy (2020-2022). A new draft of the National Action Plan on Drug System Development for 2023-2027, is currently under preparation. This plan addresses critical AMR-related issues, such as ensuring access to essential medicines and maintaining national drug security for uninterrupted availability in both normal and emergency situations. It also focuses on strengthening the national drug regulatory system, enhancing the global competitiveness of the Thai pharmaceutical industry, and developing systems and mechanisms for rational drug use to ensure public safety and positive health outcomes.

2. The National Strategic Action Plan for Hospital-Associated Infection Prevention and Control (2023-2027), governed by the Communicable Diseases Act 2015, emphasizes the control and prevention of healthcare-associated infections (HAIs). This includes addressing antimicrobial-resistant infections, emerging and reemerging infectious diseases, and implementing surveillance and management systems for those HAIs which are classified as communicable diseases requiring monitoring under the Act.

3. Resolutions from the National Health Assembly (NHA). The 6th NHA passed a resolution on multidisciplinary collaboration on health care for humans, animals and environment towards sustainable well-being (One Health)¹⁵ to emphasize the importance of using the One Health approach to address complex issues affecting human health, animal health and the environment. The 8th NHA passed a resolution on AMR,¹⁶ highlight the need for collaboration among multiple sectors to address AMR sustainably, engaging stakeholders to manage antibiotic-resistant bacteria and elevate AMR as a national priority.

4. The First National Action Plan for Food Management (2023-2027) is primarily aimed at establishing sustainable national food security by ensuring access to high-quality, nutritious food. It recognizes AMR as a critical issue within the dimensions of food security and safety, addressing its impact on public health and the food supply chain.

5. The Action Plan to Drive Thailand's Development with the BCG Economic Model (2023-2027) integrates AMR considerations into strategies such as training skilled healthcare professionals, investing in infrastructure for agricultural residue testing, foodborne pathogen analysis, and medical equipment testing, as well as promoting environmentally friendly, high-quality growth aligned with the principles of the Bio-Circular-Green (BCG) Economy.

6. The Five-Year Official Action Plans (2023-2027) developed by relevant ministries align with the objectives of the NAP-AMR. These include, for example, the Ministry of Public Health, focusing on AMR management in healthcare; the Ministry of Agriculture and Cooperatives, addressing AMR in animal husbandry and agriculture; and the Ministry of Natural Resources and Environment, managing environmental AMR risks. The Ministry of Education and the Ministry of Higher Education, Science, Research, and Innovation enhance public and professional awareness through education and research, while the Ministry of Defence and the Ministry of Digital Economy and Society support AMR efforts through infrastructure and digital innovation.

Coherence with International and Global Policies

The 2nd NAP-AMR aligns closely with several global and regional policies, as outlined below:

1. Sustainable Development Goals (SDGs).¹⁷ In 2020, the SDGs incorporated AMR into SDG indicator 3.d.2, which measures the percentage of bloodstream infections caused by selected AMR organisms. Specifically, countries are required to report data on two key antimicrobial-resistant bacteria: 3rd generation cephalosporin-resistant *Escherichia coli* and methicillin-resistant *Staphylococcus aureus* (MRSA).

2. Global Action Plan on Antimicrobial Resistance (GAP-AMR).⁵ Adopted during the 68th World Health Assembly in 2015, GAP-AMR encourages member states to develop national action plans aligned with its five strategic objectives:

1. Improve awareness and understanding of AMR.
2. Strengthen knowledge through surveillance and research.
3. Reduce the incidence of infection.

4. Optimize the use of antimicrobial agents.
5. Develop sustainable investment systems to meet global needs, including research and development of new drugs, diagnostic tools, and vaccines.

3. Political Declaration of the High-Level Meeting of the General Assembly on AMR.¹² Endorsed during the 71st regular session of the United Nations General Assembly in 2016, this declaration emphasized the global commitment to combat AMR. Thailand, through its Prime Minister as chair of the G-77, endorsed the declaration.

4. Global Health Security Agenda (GHSA).¹⁸ GHSA focuses on preventing, detecting, and responding to global health emergencies, including AMR, as part of its 11 action packages. Thailand plays a key role as a contributing country to the AMR action package.

5. Joint External Evaluation Tool for International Health Regulations (JEE for IHR).¹⁹ The JEE for IHR assesses countries' capacities to manage health emergencies, including AMR, as one of its 19 priority areas. Thailand's first JEE assessment occurred in 2017, with subsequent evaluations planned every five years.

6. Quadripartite Collaboration: Strategic Framework for Collaboration on AMR.²⁰ This framework involves the World Health Organization (WHO), Food and Agriculture Organization (FAO), World Organization for Animal Health (WOAH), and United Nations Environment Program (UNEP). It aims to strengthen global mechanisms to tackle AMR and supports national and regional action aligned with the GAP-AMR.

7. World Organization for Animal Health (WOAH). WOAH, formerly the OIE, provides guidelines for drug use and AMR control in its Terrestrial Animal Health Code,²¹ Aquatic Animal Health Code,²² and Manual of Diagnostic Tests and Vaccines for Terrestrial Animals.²³ It also formulated the WOAH Global Strategy on AMR and the WOAH List of Antimicrobial Agents of Veterinary Importance. Additionally, WOAH provides training for national coordinators on AMR management in animal products.

8. Food and Agriculture Organization (FAO). The 39th FAO Assembly in June 2015 adopted a resolution emphasizing the prudent use of antibiotics in agriculture.²⁵ FAO supports setting food standards, conducting studies on antimicrobial use along the food production chain, building laboratory capacity, and enhancing AMR

surveillance. It also facilitates collaboration among countries in ASEAN and South Asia Association for Regional Cooperation (SAARC)²⁶ for data exchange, capacity building, surveillance, and AMR risk management.

9. United Nations Environment Program (UNEP). At the 5th session of the United Nations Environment Assembly (UNEA 5.2) in February 2022, UNEP presented the report "The Summary for Policymakers - Environmental Dimensions of Antimicrobial Resistance."²⁷ The report called for environmental action using a One Health approach, highlighting how environmental conditions and pollutants intensify AMR issues and offering recommendations for environmental interventions.

10. Codex Alimentarius Commission (CAC). The CAC developed the Code of Practice to Minimize and Contain Foodborne Antimicrobial Resistance (CXC 61-2005, amended in 2021)²⁸ and the Guidelines on Integrated Monitoring and Surveillance of Foodborne Antimicrobial Resistance (CXG 94-2021).²⁹ These documents address AMR challenges within the food chain.

11. The ASEAN Community comprises three main pillars: the ASEAN Socio-Cultural Community, the ASEAN Economic Community, and the ASEAN Political-Security Community. Under the Socio-Cultural pillar, in the health domain, the post-2015 ASEAN Health Development Goals³⁰ are divided into four clusters, with AMR falling under Cluster 2: Responding to All Hazards and Emerging Threats. In 2017 and 2018, ASEAN endorsed two significant political declarations: the ASEAN Leaders' Declaration on AMR: Combating AMR through the One Health Approach³¹ and the ASEAN Plus Three Leaders' Statement on Cooperation Against AMR,³² respectively. These declarations aim to strengthen regional efforts to combat AMR within the ASEAN community.

12. South-East Asia Collaboration. The WHO's South-East Asia Regional Office (SEARO) serves as a secretariat facilitating collaboration among 11 member states. Regional commitments to addressing AMR were first formalized in the Ministerial Jaipur Declaration on AMR in 2011.³³ Subsequently, in 2014, AMR was identified as one of the SEARO flagships by the Regional Director of SEARO.³⁴

Furthermore, Thailand has joined in declaring its intent through the political declarations on AMR, demonstrating political commitment to support operations

addressing AMR issues in Thailand, as well as commitment to cooperate with the global community in addressing such problems, as summarized in Table 2-1.

Beyond governmental frameworks, collaborative efforts from civil society and the private sector have also contributed significantly to addressing AMR. For instance, the Declaration on Antibiotic Resistance was issued by the Antibiotic Resistance Coalition (ARC),³⁵ a group of over 30 international civil society organizations, during the 2014 World Health Assembly. Similarly, the Declaration on Combating Antimicrobial Resistance was presented by the AMR Industry Alliance,³⁶ a consortium of more than 80 private sector companies spanning medical supplies, diagnostics, biotechnology, and other industries, during the 2016 World Economic Forum.

In summary, AMR is a cross-cutting issue that transcends national, international, and global policies. It affects multiple sectors, including human health, animal health, food systems, and the environment, necessitating coordinated and multisectoral responses.

Table 2-1 The political declarations on AMR that are affiliated with Thailand

Political Declarations on AMR		Year
Prime Minister level		
1.	Political Declaration of the High-Level Meeting of the General Assembly on Antimicrobial Resistance	2016
2.	ASEAN Leaders' Declaration on AMR: Combating AMR through One Health Approach	2017
3.	ASEAN Plus Three Leaders' Statement on Cooperation against Antimicrobial Resistance	2018
Ministerial level		
4.	Jaipur Declaration on Antimicrobial Resistance	2011
5.	Call to Action Declaration on AMR by Alliance of Champions against Antimicrobial Resistance	2015
6.	Communiqué of Tokyo Meeting of Health Ministers on Antimicrobial Resistance	2016
7.	Ghana Declaration on Call to Action on Antimicrobial Resistance	2018
8.	Muscat Ministerial Manifesto on Antimicrobial Resistance	2022

Section 3

Impact and Situation of AMR and AMU



Antimicrobial resistance (AMR) has been identified as one of the top 10 global health threats³⁷ due to its severe and far-reaching impacts. Resistant pathogens and antimicrobial genes can spread across borders through humans, animals, food, and the environment, posing a significant threat to all nations.

Impact of Antimicrobial Resistance

AMR has profound implications across various sectors, which can be categorized into 3 major areas:

1. Increased Morbidity and Mortality

Research under the Global Research on AMR (GRAM) project estimated that in 2019, approximately 4.95 million deaths worldwide were associated with AMR. Of these, about 1.27 million deaths were directly attributable to antimicrobial-resistant infections.¹ This marks a significant increase from 2016, when predictive data suggested approximately 700,000 annual deaths due to resistant infections.² In Thailand, estimates from 2010 indicated around 88,000 cases of resistant infections per year, resulting in approximately 38,000 deaths annually.⁴ A prospective study in a major hospital in a rural province reported 106 deaths among 1,385 AMR cases (7.7%).³⁸ These figures highlight the escalating seriousness of AMR. If effective measures were in place to prevent and manage AMR, countless lives could have been saved, allowing patients to recover from their illnesses.

2. Rising Medical Costs and Economic Loss

AMR significantly increases healthcare costs. In Thailand, it has been found that AMR extends hospital stays by 3.24 million days annually, resulting in an economic loss of 40 billion baht/year.⁴ If the AMR crisis remains unresolved, projections indicate that by 2050, AMR could lead to 10 million deaths annually worldwide and cause a cumulative economic loss of 100 trillion USD.³

3. Higher Business Risks

The agricultural export sector is particularly vulnerable to AMR. Trading partners may impose stringent regulations or reject exports containing residual antimicrobials or resistant bacteria above acceptable limits. Such restrictions pose significant challenges to agricultural exports. The medical hub and tourism industries are also affected by AMR. For instance, cases have been reported where individuals affected with NDM-1 producing *Enterobacteriaceae* while seeking medical care in South Asia. These resistant pathogens were later transmitted to other individuals upon their return.³⁹⁻⁴⁰ Similarly, European tourists who visited Asia and contracted antibiotic-resistant bacteria inadvertently brought these pathogens back to their home countries.⁴¹⁻⁴³ Most commonly, these infections involved extended-spectrum beta-lactamase-producing *Escherichia coli* (ESBL-producing *E. coli*), which are more prevalent in South and South-East Asia than in Africa or Central America.⁴² Such cases have prompted calls for stricter screening and preventive measures to curb the spread of resistant bacteria.⁴³

The World Bank underscores the severe economic consequences of AMR. By 2050, AMR is expected to reduce the GDP by 3.8%, potentially driving an estimated 28.3 million people into extreme poverty, with low-income countries bearing the brunt of the impact.³

Additionally, the growing prevalence of AMR is anticipated to hinder critical medical procedures, such as surgeries, transplants, and chemotherapy, which rely heavily on effective antibiotics to prevent and treat infections. The lack of new antimicrobial medicines exacerbates the problem, threatening the foundations of modern medicine and endangering countless lives.²

The impacts of AMR extend beyond health, affecting the quality of life and sustainable development in social, economic, and environmental dimensions. This directly impedes the achievement of several SDGs, as illustrated in Table 3-1.

Table 3-1: The impacts of AMR on achieving the Sustainable Development Goals (SDGs)



SDG 1: The escalating AMR crisis has the potential to drive millions into extreme poverty. According to a World Bank forecast, by 2050, the economic repercussions of AMR could reduce the annual global GDP by 1.1% to 3.8%. This impact would be especially severe in lower-middle-income countries, where the annual GDP decline could surpass 5%, pushing an estimated 28.3 million people into extreme poverty.



SDG 3: The loss of antimicrobial efficacy will significantly impact several SDGs by exacerbating the burden of communicable diseases such as pneumonia and septicemia, as well as complications arising from non-communicable diseases like diabetes. It will also jeopardize life-saving medical procedures, including surgeries, cancer treatments, and organ transplants, along with increasing risks associated with childbirth complications and preterm births.

SDG 2: The inappropriate use of antimicrobials in the agricultural sector, particularly in food-producing animals, poses a serious threat to food security and the health and livelihoods of farmers.



SDG 8: Economic growth is closely tied to the achievement of SDGs. However, it can be hindered by AMR through escalating medical costs, strained resources, and reduced economic productivity resulting from increased morbidity and mortality.



SDG 5 & SDG 10: Like many infectious diseases, AMR disproportionately affects certain populations, including women, children, migrants, and refugees. This uneven impact exacerbates social inequalities and deepens existing socioeconomic disparities.



SDG 6, SDG 14, SDG 15: AMR can contaminate soil and water sources used by both humans and animals. They spread through the environment via untreated waste or from waste treatment plants that fail to effectively eliminate them.



SDG 12: The use of antimicrobials in food-producing animals can contribute to the development of AMR and leave antimicrobial residues in food products.



SDG17: AMR is a global challenge that requires collective action. Collaborative efforts at international, regional, and national levels are crucial to effectively address this issue.

The AMR situation encompasses multiple interconnected sectors, including human health, animal health, food production, and the environment, as illustrated in Figure 3-1. The details are summarized as follows:

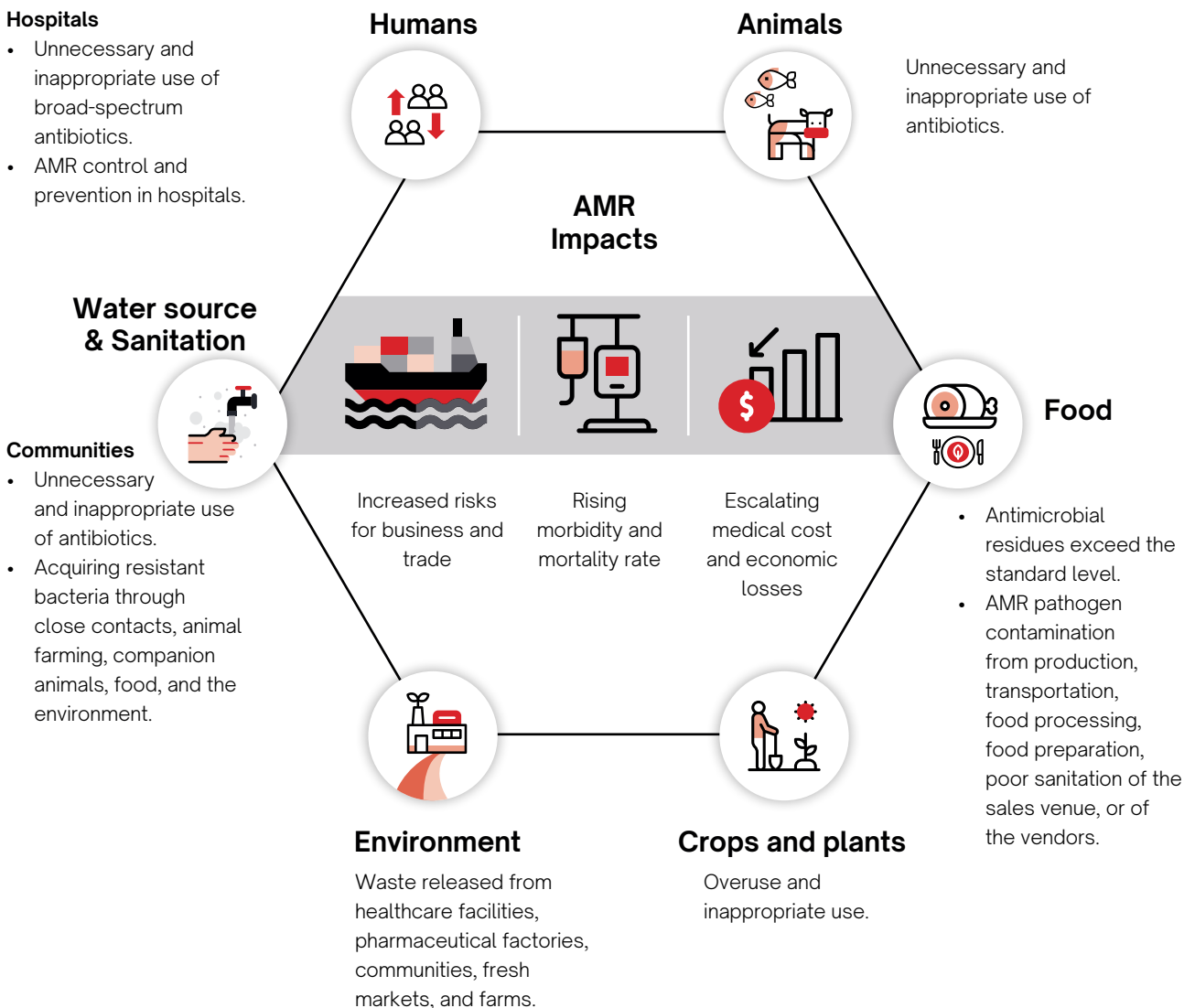


Figure 3-1

The impact and situation of AMR and antimicrobial use in humans, animals, food and the environment

(Modified from Interagency Coordination Group on AMR, 2019)

AMR Situation in Thailand

1. AMR in Humans: The AMR situation in humans can be categorized into two main components: within hospital settings and in communities. While these components differ, they are closely interconnected. AMR in hospitals is typically more severe and virulent compared to community settings due to two primary factors. First, hospitals frequently rely on broad-spectrum antibiotics—drugs capable of targeting multiple types of bacteria—to save patients' lives during critical treatments. However, this practice often results in unintended consequences, particularly the development of selective pressure on resistant bacteria through natural selection. This means that non-resistant bacteria are eradicated, while resistant strains survive and adapt, becoming prevalent in the hospital environment. Second, effective AMR control and prevention in hospitals depends on comprehensive monitoring and surveillance systems to provide timely epidemiological data. These systems enable prompt responses to emerging resistance trends. According to the National Antimicrobial Resistance Surveillance Center, Thailand (NARST); antimicrobial resistance rates for critically important bacteria have risen significantly over the past decade (2010-2020). For instance, the prevalence of carbapenem-resistant *Enterobacteriaceae* (CRE) increased from 0.6% to 11.6%, while carbapenem-resistant *Acinetobacter baumannii* (CRAB) rose from 58% to 70.1%.

In contrast, the AMR situation in communities is influenced by a broader range of factors that act as key drivers, including inappropriate or unnecessary antibiotic use, as well as the transmission of resistant bacteria through close human contact, animal farming, companion animals, contaminated food, and environmental exposure. The predominant antibiotic-resistant bacteria in communities include ESBL-producing *E. coli* (found in humans, animals, food, and the environment) and *Salmonella* spp. resistant to fluoroquinolones and 3rd generation cephalosporins (commonly found in food). Notably, a 2010 study conducted in Thailand revealed that 65% of fecal samples from healthy individuals in a community contained ESBL-producing *E. coli*.⁴³⁻⁴⁴ The growing AMR situation in communities can increase selective pressure,

further exacerbating the AMR problem in hospitals through the heightened use of broad-spectrum antibiotics.

2. AMR in livestock farming and food chains: Based on AMR monitoring data from the Department of Livestock Development for chicken and pork food chains collected between 2017-2020, the antimicrobial resistance rate of *E. coli* to 3rd generation cephalosporins (such as cefotaxime, ceftazidime) was likely decreasing and remained under 20%. The resistance rate to colistin was below 5% with no observed resistance to meropenem. Additionally, the antimicrobial resistance rate of *Enterococcus* spp. to vancomycin was less than 2%.

Regarding the AMR situation in aquaculture, the Department of Fisheries initiated surveillance of antibiotic resistance in aquaculture in 2017 by collecting water samples from tilapia, asian seabass, and pacific white shrimp farm for analysis (not collected directly from aquatic animals). The surveillance results from 2017 to 2019 indicated that water from aquaculture sources had a rising trend in the resistance rate of *E. coli* to the fluoroquinolone group, such as enrofloxacin and ciprofloxacin (from 16.5% to 31.6% and from 12.8% to 20.3%, respectively). On the other hand, resistance to the cephalosporin group, such as ceftazidime and cefotaxime, tended to decrease (from 13.9% to 6.5% and from 10.1% to 8.9%, respectively). The resistance to amoxicillin remained relatively stable.

3. AMR in companion animals: Research has identified antimicrobial-resistant bacteria in companion animals, such as dogs and cats, even when they are asymptomatic.⁴⁴⁻⁴⁵ In particular, stray dogs were found to have a higher incidence of such bacteria (e.g., ESBL-producing *Enterobacteriaceae*) compared to pet dogs (62% vs. 8%). Furthermore, MRSA was also detected in pet dogs. Therefore, companion animals can serve as reservoirs for these resistant bacteria, potentially facilitating their spread from animals to humans or vice versa.⁴⁵⁻⁴⁶

4. AMR and Antimicrobial Residues in Food: Under the food safety policy, the Department of Medical Sciences conducts annual random inspections of various food types on a rotational basis. For example, in 2016, the focus was on antimicrobial-resistant bacteria and antimicrobial residues in chicken, pork, and beef. In 2017, chicken and duck eggs were analyzed, while fish and shrimp were inspected in 2018. Oranges were also tested in 2017. These surveys aimed to ensure compliance with food safety laws and regulations, which differ from surveillance programs monitoring specifically for AMR in food.

From 2016 to 2021, the inspection results revealed no antimicrobial residues in chicken or beef samples. However, out of 105 pork samples, one sample of unknown origin collected from a market was found to contain sulfadimidine residues exceeding the limit set by the Ministry of Public Health. Similarly, no antimicrobial residues were detected in duck eggs, but 3 out of 107 chicken egg samples contained residues of doxycycline, enrofloxacin, and ciprofloxacin. Ampicillin residues were also found in 6% of the 111 orange samples tested. Among aquatic animal samples, 4.6% (7 out of 150) contained antimicrobial residues.

The contamination of resistant bacteria was also detected in raw meat samples, including chicken, pork, and beef. In 2016, *S. aureus* and *Enterococcus* spp. resistant to tetracycline were identified in 75% and 65% of the samples, respectively. While no resistance to the carbapenem group was detected, the *mcr-1* resistance gene was found in certain meat samples. However, it remains unclear whether the antimicrobial-resistant bacteria originated from the production process, transportation, food processing, preparation, the sanitation of sales venues, or from the vendors themselves.

5. AMR in the Environment: Monitoring AMR in the environment typically focuses on surface water, wastewater, and sludge. Research on AMR pathogens in the Chao Phraya River and its tributaries has shown that the resistance rates of bacteria are not necessarily dependent on whether the water is upstream or

downstream but are instead linked to urbanization. Water sources near densely populated urban areas exhibit significantly higher levels of resistant bacteria.⁴⁶

In community settings, research on AMR in market environments revealed alarming findings. AMR pathogens were detected in 80% of washed market fluid samples, 60% of market leachate samples, 80% of cockroach samples, and 100% of rat and fly samples. Apart from ESBL-producing *Enterobacteriaceae*, other significant resistant bacteria commonly found in hospitals, such as CRE, CRAB, VRE, carbapenem-resistant *Pseudomonas aeruginosa*, colistin-resistant *Enterobacteriaceae*, and MRSA were also identified.⁴⁷

Research on antibiotic residues has found that community wastewater treatment plants have antibiotic residue concentrations up to 60 times higher than those in hospital wastewater treatment plants before treatment and 10 times higher after treatment. Additionally, the quantity of specific antibiotics entering community wastewater treatment plants exceeds that of hospital treatment plants by 30 to 3,530 times. Ciprofloxacin was identified in significant amounts in sludge, while sulfamethoxazole was found in the highest concentrations in both community and hospital wastewater treatment plants. This antibiotic is particularly difficult to eliminate during treatment processes.⁴⁸

The Ministry of Natural Resources and Environment, through the Pollution Control Department, has been monitoring AMR in the environment since 2020. Initial efforts focused on two major river basins, the Chao Phraya River and the Tha Chin River, where surface water samples were collected. In 2021, monitoring expanded to include the Mae Klong River basin, with continued surveillance in the Chao Phraya and Tha Chin Rivers in 2022. Samples collected from community surface water and wastewater treatment plants were analyzed for water quality and the presence of three resistant bacteria: ESBL-producing *E. coli*, fluoroquinolone-resistant *Salmonella* spp., and vancomycin-resistant *Enterococcus* spp. (VRE). The analysis was conducted by the Department of Medical Sciences, Ministry of Public Health.

From 2020 to 2022, surveillance data revealed no traces of fluoroquinolone-resistant *Salmonella* spp. or VRE bacteria in any of the surveyed rivers. However, ESBL-producing *E. coli* was detected in all examined rivers and community wastewater treatment facilities across every surveyed site. VRE bacteria were also found in community wastewater treatment plants in the Chao Phraya River basin (specifically in the wastewater treatment system of Nakhon Sawan Municipality) and the Tha Chin River basin (in the wastewater treatment system of Suphan Buri). Notably, the prevalence of AMR pathogens was higher in river sections passing through densely populated urban areas and agricultural regions.

Given the findings, it is crucial to continuously monitor AMR in the environment and identify specific sources of AMR pathogens. This will allow the implementation of effective control measures to mitigate the spread of AMR.

6. Connection Between AMR in Humans, Animals, Food, and the Environment: Two significant initiatives have been implemented to address the interconnectedness of AMR across humans, animals, food, and the environment. The first initiative, the Tricycle Project, focuses on the surveillance of ESBL-producing *E. coli* following guidelines established by the WHO. This project is a collaborative effort led by the Department of Medical Sciences, the Department of Livestock Development, and the Pollution Control Department. Monitoring results have revealed the widespread presence of ESBL-producing *E. coli* across sectors: 80% in the excrement of butchers, 70% in farm workers, 47% in chicken intestines, 1.7% in chicken meat, 91% in municipal wastewater, and 50% in rivers. These findings highlight the pervasive nature of antimicrobial-resistant bacteria in humans, animals, food, and the environment. However, establishing direct connections between these sectors remains challenging due to differing sampling periods. Despite this limitation, the Tricycle Project serves as a vital starting point for collaborative AMR surveillance under the One Health approach.

The second initiative is the development of Thailand's Integrated Antimicrobial Resistance Surveillance with One Health Approach Guideline, jointly undertaken by the Ministry of Public Health, the Ministry of Agriculture and Cooperatives, and the Ministry of Natural Resources and Environment. This guideline emphasizes surveillance of four key types of resistant bacteria across humans, animals, food, and the environment: *E. coli* resistant to 3rd generation cephalosporins, *Salmonella* spp. resistant to fluoroquinolones, *Enterococcus faecalis* resistant to vancomycin, and *Enterococcus faecium* resistant to vancomycin.

Antimicrobial Consumption and Usage in Thailand

1. Antimicrobial Consumption and Use in Humans: Between 2017 and 2020, Thailand achieved a 15.2% reduction in antimicrobial consumption among humans. Notably, the use of antibiotics, particularly antibacterial agents (the main focus of this national plan), declined by 24.8%,⁸ surpassing the set target of a 20% reduction. Narrow-spectrum antibiotics, which are preferred for the empiric treatment of common infections due to their lower side effects and reduced potential for fostering antimicrobial resistance, saw a 36% decline in consumption. Meanwhile, the use of antimicrobials in the Watch group (antibiotics with a higher potential for resistance development and primarily used for severe infections) remained unchanged, as did consumption within the Reserve group (last-resort antibiotics reserved for treating multidrug-resistant infections).

A point prevalence survey conducted in inpatient departments (IPD) in 2021 revealed that the prevalence of antibiotic use was 53%. Among the patients surveyed, 68.6% were prescribed antibiotics to treat infections, 26.7% received antibiotics as a preventive measure, and 4.7% were administered antibiotics for other reasons or with unclear indications.⁵⁰ These findings align with the results of the integrated one-day surveillance conducted in 2019, which reported an antibiotic consumption prevalence of 51.5%. In that survey, 80% of patients were prescribed

antibiotics for infection treatment, while carbapenems, ideally reserved for severe or drug-resistant infections, were used in 10% of cases. Additionally, 21% of patients received antibiotics for infection prevention, with 94% of those cases involving surgical prophylaxis. Cefazolin was the primary antibiotic used for this purpose.⁵¹

Since 2009, outpatient departments (OPD) have been monitored to track antibiotic usage for three common conditions: upper respiratory tract infections, acute diarrhea, and fresh traumatic wounds.⁵² In 2012, specific targets were established to limit antibiotic use for these conditions to 20%, 20%, and 40%, respectively.⁷ Monitoring data from 2016 to 2022 indicate a continued decline in antibiotic use for these target diseases across hospitals and primary care units, as shown in Figure 3-2.

Rate of antibiotic use (%)

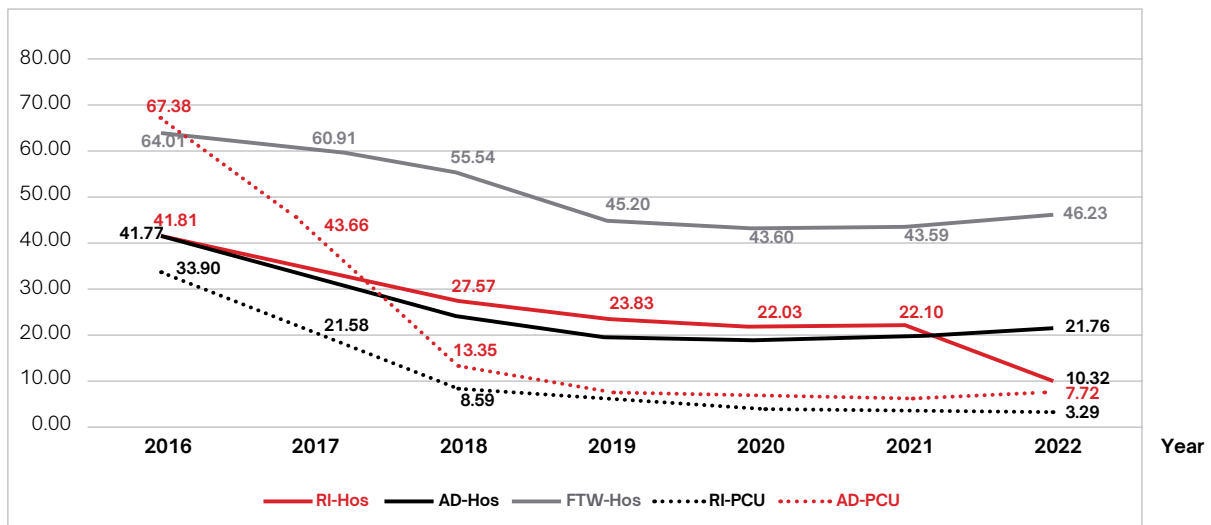


Figure 3-2: Percentage of antibiotic use in outpatient departments for upper respiratory tract infections, acute diarrhea, and fresh traumatic wounds, 2016-2022

Note: RI = Upper Respiratory Infection, AD = Acute Diarrhea, FTW = Fresh Traumatic Wound, Hos = Hospital, PCU = Primary Care Unit

Source: Health Administration Division, Ministry of Public Health

2. Antimicrobial Use in Food Animals: From 2017 to 2020, antimicrobial use in food animals in Thailand decreased by 36%, surpassing the target reduction of 30%. The consumption dropped from 658.7 mg/PCU_{Thailand} (Population Correction Unit) in 2017 to 421.5 mg/PCU_{Thailand} in 2020. Examples of antibiotics with declining usage trends include amoxicillin, halquinol, tylosin, and sulfadimidin. The use of Critically Important Antimicrobials (CIAs) for food animals also showed a declining trend. Specifically, the consumption of the highest priority CIAs decreased significantly, from 237.4 mg/PCU_{Thailand} in 2017 to 70.2 mg/PCU_{Thailand} in 2020, primarily driven by reductions in macrolides and ketolides. However, the use of high-priority CIAs increased during the same period, rising from 21.6 mg/PCU_{Thailand} to 151.9 mg/PCU_{Thailand}, with a notable increase in the consumption of aminopenicillins within the penicillin group.⁹

3. Antimicrobial Use in Agriculture: There are no antimicrobials officially registered with the Department of Agriculture for the treatment of plant diseases. However, some citrus growers have been using antimicrobials such as tetracycline, ampicillin, streptomycin, and penicillin to prevent and treat greening disease, a practice not endorsed by the Department. A national survey conducted by the Department of Agricultural Extension in 2020 revealed that antimicrobials were used in 18 provinces, representing 20% of the total citrus cultivation area (approximately 60,000 acres). Among citrus crops, sweet orange orchards had the highest proportion of antimicrobial use, followed by lime, tangerine, and pomelo orchards.

4. Antimicrobial Use in Companion Animals: Antimicrobials used in companion animals, such as dogs and cats, include both human and veterinary medicines. Research conducted in 2021, based on antimicrobial dispensations from a database of 71 animal hospitals and clinics (out of approximately 3,200 nationwide), revealed that the most used antimicrobials in companion animals were cephalexin, amoxicillin-clavulanic acid, and doxycycline. Human antimicrobials were used in animals 2.5 times more frequently than veterinary-specific antimicrobials between 2018 and

2020. The highest usage recorded in animal hospitals and clinics occurred in 2020, with 159.4 kg of human antimicrobials and 64.4 kg of veterinary antimicrobials dispensed for 203,578 dogs and 105,137 cats.⁵³

Antimicrobial Access and Distribution

Under the Drug Act 1967, most antimicrobials in Thailand are classified as "dangerous drugs." This classification permits both physicians and pharmacists to dispense these medications. Consequently, antimicrobials are widely available at healthcare facilities and pharmacies, allowing the public to access and purchase them without a prescription from a doctor but still under pharmacists' supervision.

The National Statistical Office's Health Welfare Survey conducted in 2017, 2019, and 2021, which sampled approximately 27,960 households, revealed that the percentage of individuals who consumed antibiotics in the past month was 7.9%, 6.3%, and 7.0%, respectively. The primary sources of antibiotics were healthcare facilities, followed by pharmacies and grocery stores.

A notable trend was observed in the increasing reliance on pharmacies for antibiotics, with usage rising from 26.7% to 39.8%. Conversely, the proportion of antibiotics obtained from healthcare facilities declined from 70.3% to 56.9%, as shown in Table 3-2. One potential reason for this shift was the COVID-19 pandemic, which began in late 2019. During the pandemic, there was a significant decline in the number of people seeking treatment at healthcare facilities, particularly for respiratory-related illnesses. Lockdown measures further limited patients' ability to travel.⁵⁴ At the same time, government policies promoted an expanded role for pharmacies in patient care, facilitating easier access to antibiotics during the pandemic.⁵⁵

Table 3-2: Survey results on public antibiotic access, 2017-2021

Public antibiotic access	Health and Welfare Survey		
	2017	2019	2021
1. Number of people who received antibiotics in the past month	2,167,293 (7.9% of 27,300,649)	2,167,293 (7.9% of 27,300,649)	1,901,589 (6.9% of 27,700,174)
2. Number of people who received antibiotics in the following sources			
2.1 Healthcare facilities	1,523,899 (70.3%)	1,137,709 (64.7%)	1,081,788 (56.9%)
2.2 Pharmacies	578,793 (26.7%)	587,779 (33.4%)	757,124 (39.8%)
2.3 Grocery Stores	51,668 (2.4%)	21,426 (1.2%)	56,088 (2.9%)

Source: National Statistical Office

In the context of antimicrobial distribution in the agriculture sector, a survey of 32 livestock farmers in a district of Roi Et province revealed that farmers access antimicrobials through various channels.⁵⁶ This highlights the high demand for animal health support and presents an opportunity to strengthen distribution systems and promote responsible antimicrobial use within the farming community.

To control the distribution of antimicrobials for both human and animal use, two primary mechanisms have been established and need to be strengthened. The first is a regulatory mechanism, which includes legal measures such as reclassifying antimicrobials as prescription-only drugs, requiring prescriptions

from physicians or veterinarians. The second is a professional mechanism, where medical professionals—including doctors, veterinarians, and pharmacists—serve as gatekeepers to ensure that farmers and the general public access antimicrobials in the correct type and dosage.

Disposal of Unused Antimicrobial Agents

Unused antimicrobials refer to those that are expired, unused, or contaminated and that are released into the environment. Improper disposal of these substances can have widespread adverse effects on the environment and ecosystems. In 2016, the Food and Drug Administration (through the Chemical Safety Group), the Department of Health (via the Bureau of Environmental Health), and the Faculty of Pharmacy at Mahidol University introduced the Chemical-Based Medical Waste Management Guideline. This guideline specifies that hazardous drugs, including antibiotics, should be incinerated at temperatures exceeding 1,200 degrees Celsius. However, no national assessment has been conducted on the management of unused antimicrobials in either the public health or agricultural sectors.

The methods for managing unused or expired antimicrobials vary by setting. A nationwide hospital survey (N = 1,355; response rate: 12.4%) revealed that 73% of hospitals outsourced the disposal of their unused or expired antimicrobials to external agencies, including municipalities (26%) and private companies (74%). The survey also found that hospitals of different sizes used different disposal methods.⁵⁷

Most pharmacies use stock management systems to minimize expired medications. They typically return drugs nearing expiration to manufacturers in exchange for new stock. Additionally, the Community Pharmacy Practice Unit at the Faculty of Pharmacy, Mahidol University, has implemented a pioneering program for managing chemical-based medical waste. The program accepts expired medications—such as antibiotics, hormone treatments, contraceptives, and chronic disease medications—from individuals for proper disposal, following guidelines established by the Chemical Safety Group.⁵⁸

In livestock farming, specific guidelines are in place for farms certified under Good Agricultural Practice (GAP) standards. These guidelines address the proper disposal of unwanted veterinary drugs and align with the Thai Agricultural Standards: Code of Practice for Control of the Use of Veterinary Drugs (TAS 9032-2009). The primary objective of these guidelines is to minimize environmental contamination resulting from the disposal of veterinary drugs.

For pharmaceutical manufacturing plants, under the Drug Act 1967, all pharmaceutical manufacturing plants—both for human and veterinary medications—are required to be inspected and certified under Good Manufacturing Practice (GMP) standards before beginning production. In 2016, Thailand strengthened its GMP standards by joining the Pharmaceutical Inspection Co-operation Scheme (PIC/S). This international scheme includes stringent measures to prevent cross-contamination among drug groups, particularly antibiotics such as penicillin and cephalosporin, due to their high risk of causing allergic reactions.⁵⁹

In 2022, during the most recent PIC/S committee meeting, a resolution was adopted to enhance environmental measures at pharmaceutical manufacturing plants producing antimicrobials. These measures focus on the treatment of waste and wastewater generated during the drug production process before it is discharged into the environment. The aim is to reduce the environmental and community impacts of pharmaceutical manufacturing, particularly regarding antimicrobial residues.

Public Knowledge and Awareness of AMR and Antimicrobial Use in Thailand

Since 2017, Thailand has systematically monitored public knowledge and awareness regarding AMR. This effort has been facilitated through the inclusion of AMR-related questions in the Health and Welfare Surveys, conducted biennially by the National Statistical Office in collaboration with the International Health Policy Program. These surveys involve interviews with approximately 27,000 individuals aged 15 and older from sampled households.

The results from 2017 to 2021 showed a slight improvement in public knowledge. The percentage of respondents correctly answering 4–6 AMR-related questions increased by 1.3%, from 23.7% in 2017 to 25.0% in 2021. Despite this progress, the surveys revealed persistent misconceptions about antimicrobials and antibiotics. For example, a common misunderstanding was the belief that "antimicrobials/antibiotics and anti-inflammatory drugs are the same." The proportion of incorrect responses to this question rose significantly, by 17.3%, from 22.8% in 2017 to 40.1% in 2021.

Another prevalent misconception was that "antimicrobials/antibiotics can kill viruses." The proportion of incorrect answers to this question increased by 2.3%, from 49.8% in 2017 to 52.1% in 2021. Despite these misconceptions, the proportion of the population receiving knowledge about the appropriate use of antibiotics rose by 4.8%, from 17.8% in 2017 to 22.6% in 2021. Most of this information was obtained through interactions with medical professionals.

The survey results highlighted that public interest and awareness of AMR were at a moderate level. However, a significant proportion of the population continued to misuse antimicrobials, largely due to misconceptions about their purpose and a lack of access to reliable sources of information. This issue may be attributed to the limited dissemination of information on resistant pathogens and antimicrobials. Additionally, public outreach regarding resistant bacteria remained insufficient, with only a small segment of the population actively seeking information on AMR.

Section 4

Achievement and Gap Analysis



The Achievement

1. Outcomes of NSP-AMR

Thailand's National Strategic Plan on Antimicrobial Resistance (NSP-AMR) for 2017-2022 successfully achieved its goals of reducing antimicrobial consumption in humans and animals, as well as increasing the national capacity of the AMR management system (Goal 2, Goal 3, and Goal 5). However, the goals to decrease morbidity from resistant pathogens (Goal 1) and to increase public knowledge of AMR and awareness of appropriate uses of antimicrobials (Goal 4) have not yet been fully realized. The details are as follows:

Goal 1: Reduction in AMR morbidity by 50%

Between 2017 and 2021, data from the NARST, under the Department of Medical Sciences, monitored antibiotic-resistant pathogens, including eight critically important antimicrobial-resistant pathogens. The findings can be summarized as follows:

- The resistance rates of two bacterial species showed a decline. For MRSA, resistance dropped from 9.6% to 8.3%. For penicillin-resistant *Streptococcus pneumoniae*, resistance decreased significantly from 8.2% to 2.1%.
- Resistance rates in six bacterial species demonstrated a rising trend, particularly in the carbapenem, fluoroquinolone, and 3rd generation cephalosporin groups. Notable examples include *A. baumannii*, with carbapenem resistance increasing from 67.4% to 75.8%, and *Klebsiella pneumoniae*, with carbapenem resistance rising from 9.2% to 15.2%, reflecting significant growth over the past five years.

Data from the Bangrak Clinic-Sexually Transmitted Diseases Cluster under the Department of Disease Control showed no detected antimicrobial resistance

in *Neisseria gonorrhoeae* to cefixime, the oral drug of last resort for treating this infection.

The antimicrobial resistance trends for the nine critically important bacteria are illustrated in Figure 4-1.

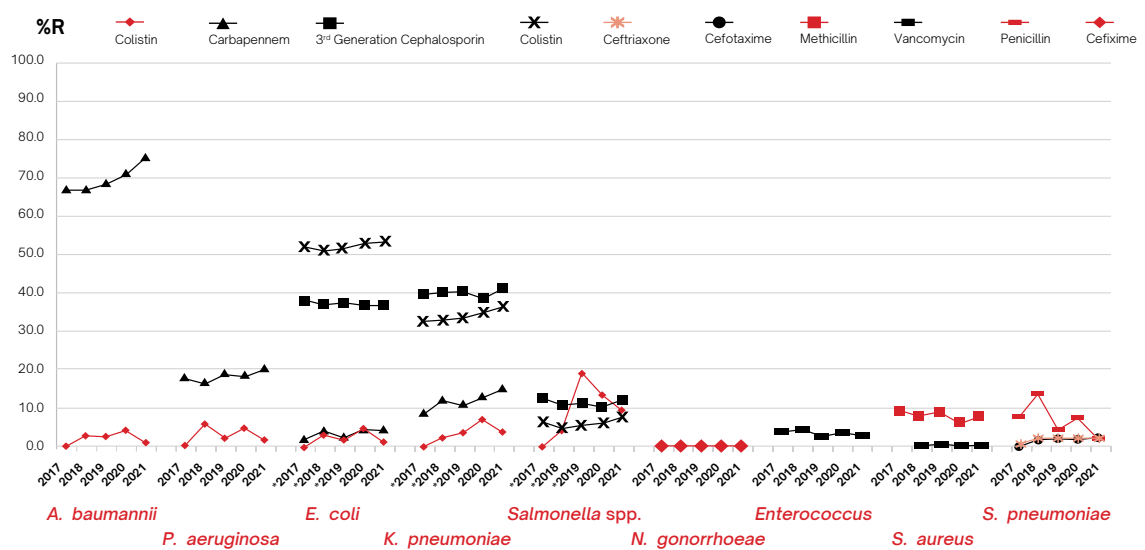


Figure 4-1: Trend of antimicrobial resistance in nine critically important bacteria, 2017-2021

Source: National Antimicrobial Resistance Surveillance Center, Thailand (NARST), Department of Medical Sciences

Goal 2: Reduction in antimicrobial consumption in humans by 20%

According to data from Thailand's Surveillance of Antimicrobial Consumption (Thailand SAC), human antimicrobial consumption was reduced by 15.2%, decreasing from 54.62 Defined Daily Doses per 1,000 inhabitants per day (DID) in 2017 to 46.32 DID in 2020. Antibiotic consumption showed an even more significant decline, dropping by 24.8%, from 36.1 DID in 2017 to 27.2 DID in 2020.⁸ The trend of antimicrobial consumption in humans is illustrated in Figure 4-2.

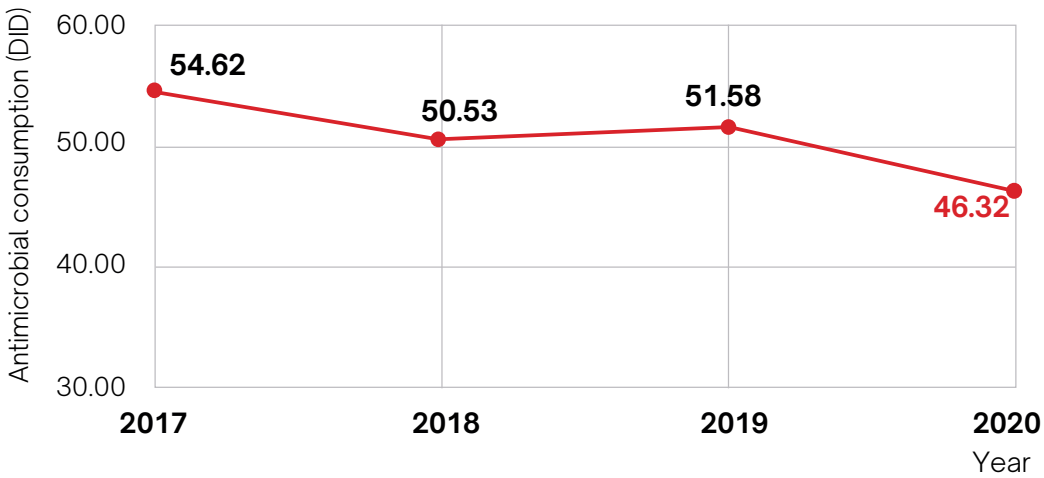


Figure 4-2: Antimicrobial consumption in humans, 2017-2020

Source: Food and Drug Administration. Thailand’s Surveillance of Antimicrobial Consumption 2020 report in human and food-producing animal use and 2017-2020 trends

Goal 3: Reduction in antimicrobial consumption in animals by 30%

Years 2017-2020: Based on the data of Thailand SAC, it was found that antimicrobial consumption in animals declined by 36.0% (from 658.73 to 421.53 mg/PCU_{Thailand})⁸ as illustrated in Figure 4.3.

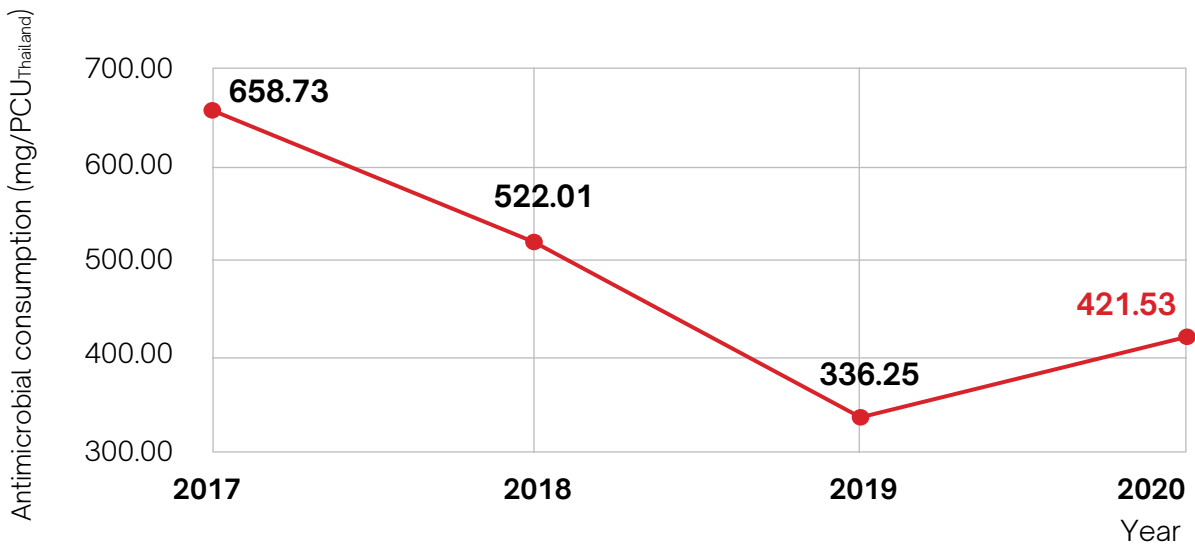


Figure 4-3: Antimicrobial consumption in animals, 2017-2020

Source: Food and Drug Administration. Thailand’s Surveillance of Antimicrobial Consumption 2020 report in human and food-producing animal use and 2017-2020 trends

Goal 4: Increase public knowledge of AMR and awareness of the appropriate use of antimicrobials by 20%

Years 2017-2021: The results of the Health and Welfare Survey¹¹ indicated that the proportion of the population with AMR knowledge and an awareness of the appropriate use of antimicrobials is at a moderate to good level (correctly answering at least 4 out of 6 questions). This proportion has increased by 1.3% (from 23.7% to 25.0% among approximately 27,000 people aged 15 and older), as shown in Figure 4-4.

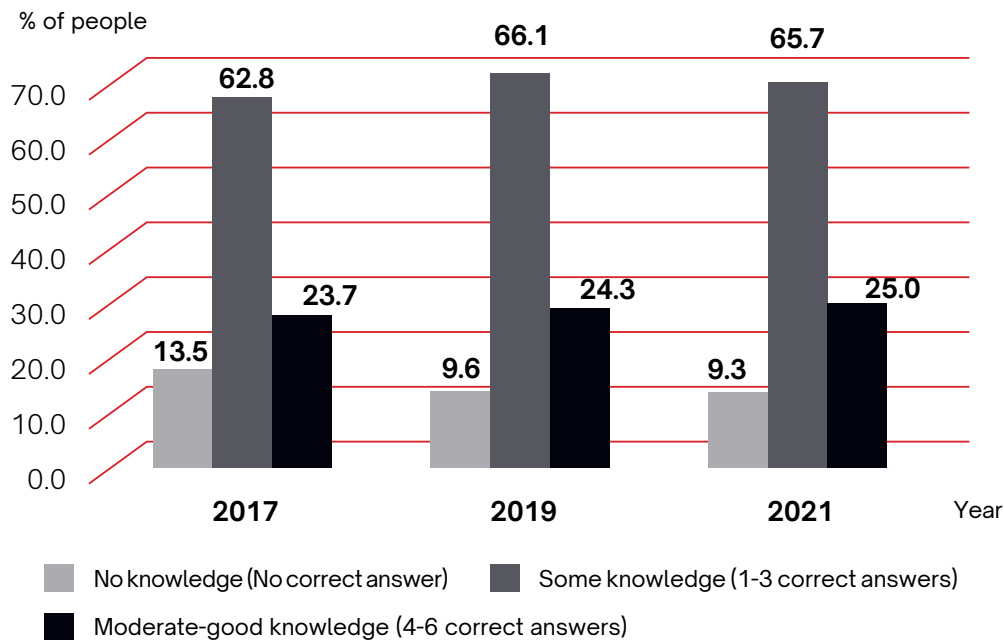


Figure 4-4: Public AMR knowledge and awareness of appropriate use of antimicrobials, 2017-2021

Source: National Statistical Office and International Health Policy Program

Goal 5: The country's capacity of the AMR management system is improved to at least level 4

Years 2017-2022: Thailand's antimicrobial resistance management capability increased from 3.0 to 4.2 points (out of a total of 5 points) according to the Joint External Evaluation criteria for International Health Regulations (JEE for IHR), details as shown in Table 4-1

Table 4-1: The assessment results of Thailand's AMR capacity management according to the WHO JEE for IHR for 2017 and 2022

2017 Result	Score	2022 Result	Score
1. Antimicrobial resistance detection	4	1. Effective multisectoral coordination on AMR and the national action plan	5
2. Surveillance of infections caused by antimicrobial resistant pathogens	3	2. AMR Surveillance	4
3. Health care-associated infection (HCAI) prevention and control programmes	3	3. Prevention of MDRO transmission in health-care facilities	4
4. Antimicrobial stewardship activities	2	4. Optimal use of antimicrobials in humans	4
		5. Optimal use of antimicrobials in animals and agriculture	4
Average Score	3.0	Average Score	4.2

2. Progress, Challenges, and Key Pending Tasks

The implementation of the NSP-AMR has led to tangible improvements in addressing AMR in Thailand. These are, for example, the elevation of AMR to a national policy level, which has guided the operations of relevant agencies. National structures and mechanisms have been established to systematically drive efforts to combat AMR. Additionally, a comprehensive monitoring and evaluation system has been developed to align with the plan's goals. The significant accomplishments, challenges, and key tasks still pending under Strategies 1–6 of NSP-AMR are detailed in Table 4-2.

Table 4-2: Progress, challenges, and key pending tasks of the NSP-AMR

Strategy	Before NSP-AMR	After NSP-AMR	
		Important Achievement/ Progress	Key Pending Tasks
1. AMR surveillance under the One Health approach	AMR surveillance was primarily conducted in the human health sector.	<ul style="list-style-type: none"> • Develop Thailand's guideline on integrated Surveillance on AMR under the One Health Approach. • Establish and implement epidemiological surveillance systems for resistant bacteria patients such as GLASS, HAI-AMR surveillance, and DeNARs (Development of National AMR Surveillance and Response System). 	<ul style="list-style-type: none"> • Sustainable implementation of Thailand's guideline on integrated Surveillance on AMR under the One Health Approach. • Develop an information system to link data at the hospital level to monitor the mobility rate caused by AMR.
2. Regulation of antimicrobial distribution	Nearly all antimicrobial drugs were dispensed without a prescription.	<ul style="list-style-type: none"> • Reclassification of critically important antimicrobials for animals to be prescription-only by veterinarians. • Reclassification of anti-tuberculosis drugs and injectable antimicrobials for humans to be prescription-only. • Thailand SAC System. 	<ul style="list-style-type: none"> • Reclassification of human oral antimicrobials. • Antimicrobial distribution monitoring. • Develop Thailand SAC to link data on antimicrobial use at the hospital, clinic, pharmacy, and farm levels.

Strategy	Before NSP-AMR	After NSP-AMR	
		Important Achievement/ Progress	Key Pending Tasks
3. Infection prevention and control and antimicrobial stewardship in humans	Technical and clinical approaches were primarily employed to address the issues, with actions being implemented separately.	<ul style="list-style-type: none"> • A systems-based approach, within the framework of Integrated AMR Management in hospitals (IAM) has been used for addressing the AMR issues. • Inclusion of IAM in the Ministry of Public Health policy regarding the service plan and IAM implemented in 127 hospitals under the Office of the Permanent Secretary, the Ministry of Public Health. • Pilot the use of IAM in 10 hospitals, both under and outside the authority of the Ministry of Public Health. 	<ul style="list-style-type: none"> • Expand the implementation of IAM in hospitals outside the purview of the Office of the Permanent Secretary, the Ministry of Public Health. • Establish a human resource plan for infectious diseases personnel. • Enhance the long-term sustainable operation of IAM. • Strengthen antimicrobial stewardship.
4. AMR prevention and control and antimicrobial stewardship in agriculture and animals	<ul style="list-style-type: none"> • Enacted legislation prohibiting the use of antimicrobials for growth promotion. • Implemented Good Agricultural Practice standards (GAP) as a guideline. 	<ul style="list-style-type: none"> • Enact legislation on medicated feed that requires a veterinarian's prescription. • Program for raising animals with reduced/no use of antibiotics. • Guidelines/practices for the responsible and prudent use of antimicrobials in terrestrial animals, aquatic animals, and companion animals. • Analyze the situation of antibiotic use in companion animals and plants. • Thai Agricultural Standards: Code of Practice for Antimicrobial Resistance Surveillance and Monitoring in Livestock. 	<ul style="list-style-type: none"> • Develop an information system with data linkage for systematic monitoring of antimicrobial use in animals. • Establish practices/standards for the responsible and prudent use of antimicrobials in animals, aligned with international standards (Codex and WTO). • Promote cultivation and technological application in producing oranges free from greening disease. • Strengthen biosecurity and animal health and welfare in livestock farms.

Strategy	Before NSP-AMR	After NSP-AMR	
		Important Achievement/ Progress	Key Pending Tasks
5. Public knowledge of AMR and awareness of appropriate use of antimicrobials	Only few of the agencies worked on raising public awareness.	<ul style="list-style-type: none"> An increasing number of agencies are involved in disseminating knowledge. Joint agencies have been established to coordinate efforts. Health and Welfare Survey. 	<ul style="list-style-type: none"> Create mechanisms for efficient coordination and collaboration. Build networks dedicated to educating the youth and the general public. Develop a system for monitoring and evaluating the level of knowledge regarding appropriate antimicrobial use, and AMR awareness in targeted groups. Address the concern of insufficient public knowledge and awareness that can lead to inappropriate antimicrobial use.
6. Governance mechanism to execute and sustain AMR-related actions	No central mechanism at the country level.	<ul style="list-style-type: none"> Elevating AMR efforts to a political policy level. National mechanism for managing plans, as well as monitoring and evaluation. Multisectoral collaboration under the One Health approach. The Royal Thai government-WHO country cooperation strategy program on AMR, 2017-2021 (CCS-AMR program) as an academic mechanism to support the NSP-AMR. Developing the monitoring and evaluation system for the NSP-AMR. 	<ul style="list-style-type: none"> Maintain commitment and support from the political sectors. Ensure the sustainability of national mechanisms to drive the plan, inclusive of a framework for budgetary provisions for the plan implementation and in addressing AMR and support of research and development. Promote a greater role for non-governmental organizations e.g., civil society organizations and the private sector.

SWOT Analysis of AMR Management in Thailand

The Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis of Thailand's AMR management highlights the following key points:

Strengths

S1: The endorsement of the National Strategic Plan on Antimicrobial Resistance 2017-2022 by the cabinet elevates it to an official government directive, ensuring recognition across agencies and facilitating effective implementation.

S2: Policy-driven mechanisms and dedicated agencies are in place to drive AMR-related efforts, supported by initiatives to promote academic research in this area.

S3: The action plan features clear and measurable goals, coupled with a robust monitoring and evaluation system to ensure progress.

S4: The implementation of the plan follows a multi-sectoral and transdisciplinary approach under the One Health framework, fostering collaboration across sectors.

S5: The National Antimicrobial Resistance Surveillance Center, Thailand (NARST), acts as a central hub for collecting AMR data, providing a strong foundation for further development of AMR surveillance across various sectors.

S6: Legal measures have been enacted and enforced to support agencies in addressing AMR issues effectively.

S7: Thailand actively collaborates with regional and global agencies to address AMR challenges. Notably, NARST, under the Department of Medical Sciences,

is a WHO Collaborating Center for Antimicrobial Resistance Surveillance and Training. Similarly, the Faculty of Veterinary Science at Chulalongkorn University serves as the FAO Reference Center for Antimicrobial Resistance, playing a vital role in monitoring drug-resistant foodborne pathogens in partnership with WHO.

S8: Thailand has gained international recognition for its efforts to combat AMR through both regional and global collaborations.

Weaknesses

W1: The current management mechanisms for the plan lack stability, and the central agency responsible for coordinating and overseeing its implementation has an unclear status. This undermines the continuity and long-term sustainability of the plan in subsequent stages.

W2: Databases for antimicrobial-resistant pathogens and antimicrobial use are fragmented, creating challenges in forming a comprehensive understanding of the country's AMR situation.

W3: Many public hospitals face space constraints relative to the number of patients they serve, leading to overcrowding. This congestion complicates efforts to prevent the transmission of drug-resistant pathogens.

W4: There is a shortage of specialized personnel in infectious diseases. Additionally, some existing personnel lack the specific skills or motivation needed to excel in this field and maintain professional expertise in infectious disease practice.

W5: Diagnostic capacities for pathogens are limited and not universally available. Challenges include adherence to pathogen culturing guidelines, insufficient knowledge and technology regarding advanced resistant pathogens,

and a lack of specialized diagnostic tools, such as rapid tests with high sensitivity and specificity for bacterial genome analysis.

W6: Effective methods and alternatives for reducing or replacing antimicrobials in livestock farming and crop cultivation are not being adequately implemented in practice.

W7: Existing legal measures for antimicrobial distribution are insufficiently stringent, allowing easy access for both the general public and farmers. Additionally, there is insufficiency of comprehensive antimicrobial stewardship across all healthcare facilities, particularly in private healthcare settings. Furthermore, protocols for the disposal of expired or unused antimicrobials remain inadequate.

W8: Communication and dissemination of the plan at the local level are insufficient, resulting in incomplete implementation in local areas.

W9: The CCS-AMR program, a key mechanism providing academic and financial support for the effective implementation of the NSP-AMR, ended in 2021, leaving a gap in resources for ongoing efforts.

Opportunities

O1: Thailand has a framework of national laws and policies that support and promote efforts to address AMR, including the Drug Act 1967 and its amendments, the Communicable Diseases Act 2015, and the Animal Feed Quality Control Act 2015, among others.

O2: Thailand's robust healthcare system and its goal of becoming a regional medical hub necessitate the development of medical service capacities, including AMR management in healthcare facilities, aligned with international standards.

O3: The COVID-19 pandemic heightened public awareness of hygiene and disease prevention, fostering widespread adoption of practices such as regular handwashing and the use of face masks, which contribute indirectly to combating AMR.

O4: Thailand's transition toward becoming a digital government facilitates the integration of medical information and the continuous development of health and medical database systems, which can strengthen AMR monitoring and response.

O5: The clarity of global policies on AMR, along with the global mechanisms and cooperation of the Quadripartite alliance (WHO, FAO, WOA, and UNEP), significantly contributes to tackling AMR challenges in Thailand.

O6: Thailand's designation as a collaboration center for emerging infectious diseases in South-East Asia presents an opportunity to develop human resources in infectious disease management and advance technologies for addressing drug-resistant pathogens.

Threats

T1: AMR is a highly complex issue, making it difficult to effectively communicate and raise awareness among key stakeholders, including politicians, administrators, and the general public.

T2: As Thailand transitions into an aging society, the number of patients seeking medical care at hospitals is expected to increase, potentially leading to greater long-term use of antibiotics.

T3: Societal attitudes in Thailand, such as familiarity with self-prescribed medications, easy access to antimicrobials, and their integration into business

models, contribute to resistance against changes and law enforcement efforts aimed at controlling antimicrobial distribution and usage.

T4: Living in a consumer-driven society encourages excessive consumption of goods and services, including the unnecessary or inappropriate use of drugs and food. This includes antimicrobials, which are widely used in human and animal healthcare as well as in the food production chain.

T5: The overwhelming abundance of information, both online and offline, including rumors, misinformation, and disinformation, promotes inappropriate antibiotic use in humans and animals.

Determination of Strategic Focuses

A gap analysis of the NSP-AMR 2017-2022 was conducted by evaluating existing capacities and limitations alongside an assessment of contextual factors. This analysis identified key gaps that informed the determination of strategic focuses for future efforts. These gaps and their corresponding strategic focuses are detailed in Table 4-3.

Table 4-3: Strategic focus

Strategic focus	Strategy	Analysis Result
1. Establishing the interconnectivity of database systems at the hospital level and central agency to gain clear insight into the AMR situation and the use of antimicrobials in hospitals.	1 and 3	S 1-5, 7 W 1-2, 8 O 1-2, 5, 6
2. Reclassification of human antimicrobials.	2	S 1-6 W 1-2, 7 O 1-2, 4-5 T 3-4
3. Developing a tracking and tracing system for antimicrobial distribution.	2	S 1-6 W 1-2, 7 O 1-2, 4-5 T 3-4
4. Developing a monitoring system for AMR in food and the environment.	1	S 4-5, 7 W 2-3, 5 O 1-2, 4-5
5. Addressing the problem of AMR in hospitals through hospital leadership within the framework of Integrated AMR Management (IAM).	3	S 1-4 W 1-5, 7-9 O 1-5 T 1-4
6. Implementing standards and regulations in the livestock farming sector effectively.	4	S 1-6 W 1-2, 7-8 O 1-2, 4-5 T 1-4
7. Monitoring the use of human critically important antibiotics in animal health and agriculture sectors.	2 and 4	S 1-6 W 1-2, 7 O 1-2, 4-5 T 3-4

Strategic focus	Strategy	Analysis Result
8. Modifying the approaches and mechanisms to raise knowledge and awareness about antimicrobial resistance among the public.	5	S 1-4 W 1-2, 8-9 O 4-5 T 1-5
9. Expanding collaboration with civil society and various other sectors.	5	S 1-4 W 1-2, 8-9 O 4-5 T 1-4
10. Adjusting the governance mechanisms in driving the plan to ensure accountability in its implementation.	6	S 1-4, 7 W 1, 8-9 O 1, 4-5 T 1-4
11. Improving the monitoring and evaluation system of the NAP-AMR.	6	S 1-4 W 2, 8-9 O 4, 5 T 1-4

Section 5

**Concept,
Guiding Principle, and
Objective of the Plan**



The development of Thailand's 2nd National Action Plan on Antimicrobial Resistance 2023-2027 is founded on two underlying concepts and guided by four key principles, as outlined below:

Underlying Concepts

1. The One Health Approach: This approach emphasizes collaboration across the human, animal, and environmental sectors to synergize efforts and actions, ultimately enhancing the health of all living beings.

2. The "Mountain-Moving Triangle" Concept: This concept suggests that addressing difficult and complex issues requires coordinated efforts across three dimensions: knowledge generation, social movement, and political/policy commitment. Knowledge generation serves as the foundation for social movement and informed policy decisions. The integration of these three elements drives systemic change, reforming social rules, laws, and structures through the combined influence of intellectual, societal, and governmental power.

Guiding Principles

1. Continuity from the NSP-AMR 2017-2022: To address unresolved challenges and gaps from the initial plan, continuous progress in implementation, monitoring, and evaluation is essential. Development of relevant agencies must also continue to achieve the intended goals.

2. Action-Oriented Strategy: The plan sets clear, practical objectives to guide implementation by relevant agencies and sectors. It ensures coordinated and systematic operations with measurable outcomes, allowing for continuous adjustments and operational enhancements.

3. Synergized and Orchestrated Strategy: The plan emphasizes collaboration across sectors with integrated coordination. It does not aim to override or replace existing policies, strategies, or operations. Instead, it streamlines processes to enhance the capabilities of various agencies and sectors, ensuring unified and consistent actions to combat AMR in Thailand.

4. Emphasis on Political Commitment: Political commitment is essential for prioritizing issues, designing policies and measures, overseeing implementation, and ensuring appropriate resource allocation. This commitment is vital for the effective and sustainable management of AMR in Thailand.

Objectives of the Plan

1. Strategic Framework for AMR Management: Provide a comprehensive framework to address AMR under the One Health approach, ensuring substantial and sustainable progress.

2. Integration Across Sectors: Align policies and operational plans from all relevant sectors to effectively tackle AMR under the One Health framework.

3. Good Governance-Based Management: Establish a framework for management, coordination, implementation, resource allocation, and budgeting across public and private sectors and civil society. The plan emphasizes consistent monitoring and evaluation of all relevant agencies to ensure effective implementation, achieve measurable results, and deliver tangible outcomes in addressing AMR.

Section 6

Vision, Mission, and Goal



Vision

Thais have a low risk of threats from antimicrobial resistance in humans, animals, food, and the environment.

Missions

1. Reduce the risk and impact of AMR through collaboration across all sectors.
2. Address AMR issues sustainably under the One Health approach.

Goals

1. Reduce morbidity caused by AMR in humans.
2. Reduce the risk of AMR in food and the environment.
3. Reduce antimicrobial consumption in humans.
4. Reduce antimicrobial consumption in animals.
5. Increase AMR literacy among the general public.
6. Increase the capacity of Thailand's AMR management system to meet international standards.

Table 6-1: Indicators and target values of the 2nd NAP-AMR

Goals*	Indicators and target values*
1. Reduce morbidity caused by AMR in humans.	10% reduction in AMR morbidity in humans.
2. Reduce the risk of AMR in food and the environment.	There is a system for detecting contamination of antimicrobial-resistant pathogens and antimicrobial residues in food and the environment according to international standards.

Goals*	Indicators and target values*
3. Reduce antimicrobial consumption in humans.	30% reduction in antimicrobial use in humans (compared to 2017).
4. Reduce antimicrobial consumption in animals.	50% reduction in antimicrobial use in animals (compared to 2017).
5. Increase AMR literacy among the general public.	At least 30 % of people have literacy about AMR.
6. Increase the capacity of Thailand's AMR management system to meet international standards.	The capacity of Thailand's AMR management system meets Level 4 or above in line with international standards.

Note: * Antimicrobial resistant pathogens refers to 'drug-resistant bacteria,' and antimicrobial drugs refers to 'antibacterial drugs' or 'antibiotics.'

Section 7

Strategy to Tackle AMR



The 2nd National Action Plan on Antimicrobial Resistance 2023-2027 includes six strategies and 25 strategic actions:

Strategy 1: Antimicrobial Resistance Surveillance under the One Health Approach

1. Strategic Goal

Thailand has a national integrated AMR surveillance system under the One Health approach, complemented by a national early warning system on AMR.

2. Strategy Targets

- 2.1 A system developed to detect antimicrobial-resistant pathogens and antimicrobial residues in food and the environment, adhering to international standards.
- 2.2 A monitoring system implemented for AMR morbidity in humans that provides representative national-level data.
- 2.3 A warning system established for outbreaks of critically important antimicrobial-resistant pathogens and newly emerging resistant pathogens.

3. Outcome Indicators

- 3.1 An integrated AMR surveillance system across human, animal, food, and environmental sectors under the One Health approach. The system should, at minimum, provide surveillance data on two types of antimicrobial-resistant bacteria: third-generation cephalosporin-resistant *E. coli* and fluoroquinolone-resistant *Salmonella* spp. This data must be accessible for utilization by all sectors.
- 3.2 An information system to link and process epidemiological surveillance data on antimicrobial-resistant pathogens in humans.
- 3.3 An integrated report on Thailand's AMR situation, adhering to the One Health approach.

4. Strategic Actions

Strategic Action 1: Develop an Integrated AMR Surveillance System Based on the One Health Approach

This initiative aims to establish a comprehensive AMR surveillance system encompassing humans, animals, food, and the environment. It employs the One Health approach, risk assessments for antimicrobial-resistant bacteria, and progress monitoring.

Operational Guidelines:

1. Develop an AMR surveillance system for tracking prevalence and morbidity in humans.
2. Establish monitoring systems for AMR in food chains and the environment.
3. Coordinate a unified AMR surveillance framework with the Department of Medical Sciences, Department of Disease Control, Department of Health, Food and Drug Administration, Department of Livestock Development, Department of Fisheries, Pollution Control Department, and other relevant agencies, including the identification of focal persons and arrangements to share information.

Strategic Action 2: Strengthen Laboratory Capacity and Networks

Enhancing laboratory capacity across all sectors is essential for reliable analysis of AMR.

Operational Guidelines:

1. Increase the number of sentinel laboratories and evaluating their capacity according to the One Health approach.
2. Establish standardized protocols for analysing antimicrobial-resistant bacteria.
3. Enhance laboratory capacity through inter-laboratory comparisons and international certification.

4. Improve laboratories' ability to detect antimicrobial residues in food and the environment within the integrated surveillance framework.

Strategic Action 3: Develop Information Technology Systems to Improve Data Standards

This action focuses on developing robust IT systems for data standardization and sharing among agencies.

Operational Guidelines:

1. Establish a central data standard aligned with global benchmarks.
2. Create a hospital-level data linkage system to monitor AMR infections and morbidity, incorporating the AMR Laboratory Information Sharing System (ALISS) that includes key activities as follows.
 - Analyzing problems and obstacles in the hospital-level data connection system.
 - Developing surveillance and monitoring systems for infections caused by AMR pathogens in humans.
 - Developing systems for collecting and analyzing data in AMR surveillance for continuous prediction or forecasting of prevalence or outbreaks.
 - Developing information systems for data collection, data backup, and data dashboard at hospital, regional health, and national levels.

Strategic Action 4: Build Capacity for Data Analysis and Surveillance Management

Strengthening the skills of personnel responsible for AMR surveillance data management as well as ensuring the sufficient number of the personnel are critical.

Operational Guidelines:

1. Provide foundational training on and prepare readiness for strengthening AMR pathogen surveillance.
2. Enhance expertise in antimicrobial-resistant pathogen analysis.
3. Build capacity in data development, maintenance, and analysis.
4. Create AMR-specific course curricula for professionals and relevant sectors such as curricula for AMR testing and analysis, for systematic management of AMR data and for integrated AMR management in conjunction with related policies.
5. Support the development of a national human resource development plan for AMR data system management.

Strategic Action 5: Strengthen AMR Surveillance and Develop an Alert System for Outbreaks of Critical Resistant Pathogens

A robust surveillance and alert system are essential for preventing, detecting and managing outbreaks of critically important or emerging resistant pathogens.

Operational guidelines:

1. Enhance personnel capacity and communication networks for AMR surveillance at local, national, and international levels.
2. Establish networks for detecting and reporting critically important antimicrobial-resistant pathogens.
3. Develop an alert system to signal outbreaks of high-priority resistant pathogens.
4. Include critically important AMR pathogens in the infectious disease watchlist under the Communicable Disease Act 2015.
5. Create protocols for outbreak investigation, reporting, and community-level surveillance system implementation.

Strategy 2: Regulation of antimicrobial distribution

1. Strategic goal

Thailand has a comprehensive system for regulating and tracking the distribution of antimicrobials for human and animal use that covers all levels to provide critical information on the country's situation.

2. Strategy Targets

- 2.1 30% reduction in antimicrobial consumption in humans (compared to 2017).
- 2.2 50% reduction in antimicrobial consumption in animals (compared to 2017).
- 2.3 Enhance Thailand's capacity to manage and regulate antimicrobial distribution to meet international standards.

3. Outcome Indicators

- 3.1 At least 60% of total antimicrobial consumption consists of antibiotics from the Access group, as defined in the WHO AWaRe classification, (compared to 2017).
- 3.2 A 20% reduction in the consumption of colistin in animals (compared to 2023, monitoring by the Department of Livestock Development and aligning with Strategy 4).
- 3.3 A regulatory system established to oversee antimicrobial distribution in pharmacies and clinics, with a particular focus on high-resistance antibiotics such as fluoroquinolones, cephalosporins, and beta-lactam/beta-lactamase inhibitors.
- 3.4 A guideline for the appropriate disposal of antimicrobials to minimize environmental contamination.

4. Strategic Actions

Strategic Action 1: Reclassify Oral Antimicrobials for Humans

A program to expedite the reclassification of oral antimicrobials, especially critically important antibiotics (CIAs), is essential to ensure their effectiveness and proper usage.

Operational guidelines:

1. Explore current policies, laws, and regulations related to antibiotic reclassification, and analyze past obstacles and challenges.
2. Review and revise the classification of prioritized oral antibiotics for human use to align with current policies and regulations and develop guidelines for monitoring antimicrobial distribution across all channels to ensure compliance with legal designations.
3. Establish a support system to monitor and mitigate impacts resulting from reclassification through a participatory process involving all stakeholders.

Strategic Action 2: Develop an Antimicrobial Tracking and Tracing System

A project to study the feasibility of a tracking and tracing system aims to assess the possibility of tracing antimicrobials from raw materials to manufacturing and distribution and ultimately to end users, including when antimicrobials for human use are used in animals. This system will enhance oversight and enable the recall of antimicrobials if issues arise.

Operational Guidelines:

1. Analyze the supply chain of antimicrobials for human use, from raw material producers to end users (patients and farmers), while engaging all relevant stakeholders.
2. Assess the basic capacities needed for developing a robust antimicrobial tracking and tracing system.

3. Prepare policy recommendations for developing the tracking and tracing system, including an analysis of advantages, disadvantages, and requirements.
4. Translate policy recommendations into actionable plans with clear operational processes.

Strategic Action 3: Prepare a Situational Report on Antimicrobial Use

The Thailand Surveillance of Antimicrobial Consumption (Thailand SAC) system has been established to monitor and report antimicrobial use.

Operational Guidelines:

1. Study the current situation regarding the mechanisms of dispersion, distribution and reporting of antimicrobials in Thailand, including the proportion used for human and animal purposes.
2. Formulate policy recommendations to improve the Thailand SAC system.
3. Improve the Thailand SAC system to enable comprehensive and accurate tracking of antimicrobial distribution.

Strategic Action 4: Develop Guidelines for Managing Unused or Expired Antimicrobials

A project to develop appropriate antimicrobial management guidelines aims to prevent improper disposal, which can lead to environmental contamination and contribute to antimicrobial resistance.

Operational Guidelines:

1. Explore legal frameworks and existing guidelines on antimicrobial disposal practices across various sectors, including pharmaceutical manufacturers, hospitals, clinics, pharmacies, farms, and households.
2. Assess the current practices for antimicrobial disposal in these sectors.
3. Develop comprehensive guidelines for appropriate antimicrobial disposal through a participatory process involving relevant stakeholders.

Strategy 3: Infection prevention and control in healthcare facilities and antimicrobial stewardship in humans

1. Strategic Goal

Healthcare facilities are equipped with efficient systems on infection prevent and control and antimicrobial stewardship to reduce infections and lower costs caused by AMR pathogens.

2. Targets of the Strategy

- 2.1 10% reduction in AMR morbidity in humans.
- 2.2 Joint target: 30% reduction in antimicrobial consumption in humans (compared to 2017).

3. Outcome Indicators

- 3.1 10% reduction in bloodstream infections caused by carbapenem-resistant *Enterobacteriaceae* (CRE).
- 3.2 10% reduction in bloodstream infections caused by carbapenem-resistant *Acinetobacter baumannii*.
- 3.3 10% reduction in bloodstream infections caused by 3rd generation cephalosporin-resistant *E. coli*.
- 3.4 10% reduction in blood stream infections caused by methicillin-resistant *Staphylococcus aureus* (MRSA).
- 3.5 Antimicrobial consumption from the Access group constitutes at least 60% of total antimicrobial consumption (compared to 2023).
- 3.6 50% of hospitals address AMR issues following specified standards.

4. Strategic actions

Strategic Action 1: Address AMR Issues in Public and Private Healthcare Facilities in a Systematic and Integrated Manner

The Integrated AMR Management (IAM) in Hospitals program was established to address AMR in public and private hospitals systematically and efficiently.

Operational Guidelines:

1. Support public and private hospitals in conducting gap analyses to assess their capacity for integrated AMR management using the IAM Thailand Index. This index, developed by the working group on hospital AMR management, was adapted from the IAM External Evaluation Tool for greater practicality, specifically to address limitations, including the time and resource constraints of hospital internal and external inspection teams.

2. Establish policies to support the implementation of IAM within hospitals, focusing on:

- Promoting awareness of antimicrobial-resistant infections among hospital executives and public health system leaders.
- Building hospital capacities to implement antimicrobial stewardship at all levels.
- Strengthening infection prevention and control systems through coordination with infection control units in hospitals.

Strategic Action 2: Strengthen the Competency of Infectious Disease Personnel

This program aims to develop the skills and capacity of infectious disease personnel and assess the resources required for managing infectious disease services.

Operational Guidelines:

1. Establish central mechanisms to develop policies and plans for infectious disease resource development and service system management.

2. Conduct surveys and analyze infectious disease resource needs to systematically formulate national resource development plans.

3. Implement concurrent measures to address resource challenges, including:

- Increasing personnel in shortage areas, such as training infectious disease

physicians, deploying epidemiologists to hospitals, and organizing training for general practitioners in diagnosing and treating common infectious diseases and implementing antimicrobial stewardship.

- Developing standardized clinical microbiology laboratories, ensuring continuous training and regular performance evaluations.
- Promoting career advancement for infection control nurses, including increasing their numbers to meet specified hospital criteria.
- Training pharmacists specializing in infectious diseases and educating general pharmacists to support antimicrobial stewardship implementation.

Strategic Action 3: Monitor and Evaluate AMR Management in Healthcare Facilities

Projects for monitoring and evaluating AMR management in healthcare facilities will provide essential data for policy formulation and improving Integrated AMR Management in hospitals.

Operational Guidelines:

1. Develop monitoring and evaluation tools and indicators, including key statistics such as morbidity rates from AMR pathogens, antimicrobial use, and the burden of AMR infectious diseases.
2. Support the integration of data systems (including information, infection prevention, and laboratory-based AMR surveillance) in hospitals to monitor AMR situations and evaluate outcomes.
3. Align with Strategy 1 to enhance information systems, improve data standards, and strengthen national AMR outbreak surveillance systems.

Strategic Action 4: Implement Antimicrobial Stewardship in Private Clinics and Primary Care Units

The project to report antimicrobial use in clinics and primary care units aims to gather necessary data for policy development and improving antimicrobial stewardship programs.

Operational Guidelines:

1. Develop monitoring and evaluation tools for antimicrobial use following the World Health Organization's AWaRe guidance.
2. Conduct surveys on antimicrobial use in clinics and primary care units at least twice.
3. Establish guidelines for implementing antimicrobial stewardship.

Strategy 4: AMR prevention and control and antimicrobial stewardship in agriculture and animals

1. Strategic Goal

Integrated management systems for containing AMR and reducing antimicrobial use in the agricultural and animal sectors are well-established and in alignment with both public and private stakeholders.

2. Targets of the Strategy

- 2.1 50% reduction in antimicrobial use for animals (compared to 2017).
- 2.2 There is a system for detecting contamination of AMR pathogens and antimicrobial residues in animals, food, and the environment.

3. Outcome Indicators

- 3.1 10% reduction in total antimicrobial consumption in terrestrial and aquatic animals (compared to 2023).
- 3.2 20% reduction in the consumption of antimicrobials in the CIAs (Colistin) group (compared to 2023).
- 3.3 Establish an AMR surveillance and monitoring system in aquatic animals.
- 3.4 Increase the adoption of alternative methods or innovations, which replace antimicrobial use, by orange farmers to combat greening disease by 20%.
- 3.5 Implement a reporting system for antimicrobial use in companion animals.
- 3.6 Establish an AMR surveillance and monitoring system for companion animals.
- 3.7 Reduce or prevent significant increases in the rate of AMR in food animals.

4. Strategic Actions

Strategic Action 1: Develop Database and Monitoring Systems for Antimicrobial Use in Agriculture and Animal Sectors

Streamline the database and monitoring systems for antimicrobial use in food animals (livestock and aquatic), companion animals, and plant cultivation to operate more systematically and efficiently.

Operational Guidelines:

1. Conduct research projects to quantify and monitor antimicrobial use in livestock farms and feed mills.
2. Conduct research projects to quantify and monitor antimicrobial use in aquaculture and cultivation (orange).
3. Survey antimicrobial use practices in orange orchards and companion animals.
4. Develop a reporting system for antimicrobial use in veterinary services for companion animals.

Strategic Action 2: Define Standards and Implement Practice Guidelines for Addressing AMR and Antimicrobial Use in Food Animals and Crops

Establish standards and implement practice guidelines for addressing AMR pathogens and responsible antimicrobial use in animals and plants, supported by legislative measures.

Operational guidelines:

1. Establish Agricultural Standards for:
 - Responsible and prudent use of antimicrobials in livestock.
 - Bacterial antimicrobial susceptibility testing.
 - Risk analysis of food-borne antimicrobial resistance.
2. Create science-based guidelines for the responsible and prudent use of antimicrobials in orange cultivation.

Strategic Action 3: Promote Alternatives to Antimicrobial Use in Animals and Agriculture

Encourage the adoption of alternative methods and agents to reduce reliance on antimicrobials while maintaining productivity in livestock farming and crop cultivation.

Operational Guidelines for Livestock Farming:

1. Scale up the implementation of no antibiotic use in livestock farming.
2. Promote the research and use of antimicrobial alternatives, such as herbs, vaccines, and other innovative solutions.

Operational Guidelines for Aquaculture:

1. Promote the use of antimicrobial alternatives in aquaculture.
2. Encourage no antibiotic use in aquaculture practices.

Operational Guidelines for Orange Cultivation:

1. Test and implement technologies to prevent and control greening disease, including promoting the production and use of disease-free citrus species.
2. Promote the adoption of technologies to prevent and control insect vectors of greening disease.

Strategic Action 4: Develop Knowledge and Capacity for Responsible Antimicrobial Use in Animals and Agriculture

Develop guidelines, curricula, and training programs to educate professionals and personnel about the responsible and prudent use of antimicrobials. Target groups include undergraduate students, veterinarians, livestock volunteers, and farmers involved in livestock and plant cultivation.

Operational Guidelines:

1. Develop guidelines for the responsible and prudent use of antimicrobials in agriculture and livestock sectors.
2. Enhance teaching and training capacities for all related professionals, including undergraduate students, veterinarians, livestock volunteers and farmers engaged in livestock and plant cultivation.

Strategy 5: Improvement in AMR literacy for the public

1. Strategic Goal

People are literate about AMR and the appropriate use of antimicrobials to enhance self-reliance in health management and reduce unnecessary antimicrobial use.

2. Target of the Strategy

At least 30% of the population achieves AMR literacy.

3. Outcome Indicators

3.1 At least 50% of the target population demonstrates knowledge and awareness of AMR, based on defined criteria.

3.2 At least 30% of the target population exhibits correct behaviour in antimicrobial use.

4. Strategic Actions

Strategic Action 1: Create a System to Strengthen AMR Literacy for the Public

Develop and implement plans and methods to disseminate knowledge, enabling the public to access, understand, and act upon information related to AMR and proper antimicrobial practices.

Operational Guidelines:

1. Establish a centre for AMR information management and knowledge dissemination.
2. Create a system to provide consultation and enhance public understanding of AMR.
3. Design effective assessment tools for AMR literacy and conduct regular assessments.

Strategic Action 2: Expand Collaboration with and Empower Network Partners

Foster collaboration among public, private, and civil society sectors to disseminate AMR knowledge and promote appropriate antimicrobial use.

Operational Guidelines:

1. Expand operational networks to include public, private, educational, and civil society organizations, including the Thailand Consumer Council.
2. Develop educational modules and build the capacity of network partners and community leaders.
3. Establish coordination mechanisms to empower and monitor network activities for efficiency.

Strategic Action 3: Create Synergy to Enhance AMR Literacy for the Public

Promote AMR literacy across society by aligning communication efforts of various agencies to target specific audiences.

Operational Guidelines:

1. Integrate communication plans, projects, and activities from different agencies.
2. Develop key messages, communication materials and channels to improve public AMR literacy.
3. Implement the communication plans in a synergistic and unified approach.
4. Disseminate AMR knowledge to all target groups and promote learning among children and youth.

Strategic Action 4: Develop Policy Initiatives to Improve Public AMR Literacy

Engage organizations and agencies in recognizing the importance of AMR and antimicrobials, ensuring public dissemination of relevant knowledge.

Operational Guidelines:

1. Review research gaps and initiate projects that support public AMR knowledge enhancement.
2. Propose policy recommendations to relevant organizations to increase awareness and promote safety against AMR.

Strategy 6: Governance mechanism to move AMR policy and actions forward in a sustainable manner

1. Strategic Goal

Thailand has sustainable governance mechanisms in addressing AMR at the national level that align with high-level plans.

2. Target of the Strategy

Thailand's AMR management system achieves Level 4 capacity or higher, based on international standards.

3. Outcome Indicators

- 3.1 Enhanced multi-sectoral collaboration.
- 3.2 Strengthened international and academic cooperation to support the implementation of the 2nd NAP-AMR.
- 3.3 Established mechanisms for overseeing, monitoring, and evaluating the 2nd NAP-AMR implementation.
- 3.4 National forums for sharing scientific and academic information related to AMR.

4. Strategic Actions

Strategic Action 1: Develop Governance and Policy Communication Mechanism according to Good Governance Principles to Promote Sustainable Collaboration among Government Agencies, Private Sectors, Civil Society Organizations, and Others in Implementing the Plan Sustainably.

Program 1: Strategic Review of Plan Governance Mechanisms

Review the legal status, structures, and mechanisms driving the 2nd NAP-AMR implementation to ensure sustainability.

Operational guidelines:

1. Assess the current legal status, structures, and governance mechanisms of the 2nd NAP-AMR implementation, comparing them with other national policies and international plans addressing AMR.
2. Develop policy options for the legal status, structures, and governance mechanisms of the plan, including advantages and disadvantages of the options, by analyzing effectiveness, constraints, and feasibility.
3. Expand collaboration with other sectors such as civil society, private, and academic sectors.

Program 2: Enhancing Policy Communication Mechanisms and Driving the Plan into Actions

Strengthen policy communication to ensure implementing agencies understand their collaborative roles.

Operational guidelines:

1. Identify key policy messages and prepare appropriate communication media for central and local levels.
2. Convene multi-level meetings to enhance understanding of the 2nd NAP-AMR.
3. Clearly outline roles and responsibilities for each department and define collaborative mechanisms.

4. Facilitate collaboration across sectors, including public, private, civil society, and academia.
5. Harmonize efforts with third-level policies to improve capacity and reduce redundancy.

Strategic Action 2: Develop Monitoring and Evaluation System

Establish monitoring and evaluation systems and mechanisms to assess the progress, outcomes, and challenges of the 2nd NAP-AMR.

Operational Guidelines:

1. Develop a framework for monitoring and evaluating the implementation of the 2nd NAP-AMR.
2. Conduct evaluations focused on progress, desired outcomes, and challenges, providing actionable recommendations.
3. Prepare and disseminate periodic monitoring and evaluation reports.

Strategic Action 3: Create Academic Collaboration Across Sectors

Program: Strengthening research and academic cooperation to resolve AMR

Leverage cooperation with academic sectors and research institutes to enhance research and evidence-based solutions for AMR.

Operational Guidelines:

1. Promote collaborative research and development (R&D) involving public institutions, academia, and private research organizations, while coordinating with funding agencies.
2. Organize national forums on AMR to facilitate policy and academic exchange among stakeholders and inform policymakers.
3. Foster collaboration between plan-implementing agencies and academic networks.
4. Establish collaborative mechanisms and strengthen partnerships between government agencies and the education sector.

Strategic Action 4: Sustain Thailand's Proactive Role in Tackling AMR at Global and Regional Levels






Strengthen Thailand's international engagement to address AMR issues effectively at the national level and contribute to global efforts.

Operational Guidelines:

1. Integrate collaboration with foreign agencies, including participation in joint R&D initiatives to address AMR.
2. Represent Thailand in international forums, such as the United Nations General Assembly, World Health Assembly, and CODEX meetings, to influence AMR policies and discussions.
3. Disseminate Thailand's AMR research findings in international journals to advance knowledge and foster broader academic collaboration.

Figure 7-1: A summary of the 2nd National Action Plan on Antimicrobial Resistance 2023-2027

Vision	Thais have a low risk of threats from AMR in humans, animals, food, and the environment.
Missions	<ol style="list-style-type: none"> 1. Reduce the risk and impact of AMR through collaboration across all sectors. 2. Address AMR issues sustainably under the One Health approach.
Goals	<ol style="list-style-type: none"> 1. 10% reduction in AMR morbidity in humans. 2. There is a system for detecting contamination of antimicrobial-resistant pathogens and antimicrobial residues in food and the environment according to international standards. 3. 30% reduction in antimicrobial consumption in humans (compared to 2017). 4. 50% reduction in antimicrobial consumption in animals (compared to 2017). 5. At least 30 % of people have literacy about AMR. 6. The capacity of Thailand's AMR management system meets Level 4 or above line with international standards.

					
	Strategy 1: Antimicrobial resistance surveillance under the One Health approach	Strategy 2: Regulation of antimicrobial distribution	Strategy 3: Infection prevention and control in healthcare facilities and antimicrobial stewardship in humans	Strategy 4: AMR prevention and control and antimicrobial stewardship in agriculture and animals	Strategy 5: Improvement in AMR literacy for the public
Strategic goals	Thailand has a national integrated AMR surveillance system under the One Health approach, complemented by a national early warning system on AMR.	Thailand has a comprehensive system for regulating and tracking the distribution of antimicrobials for human and animal use that covers all levels to provide critical information on country's situation.	Healthcare facilities are equipped with efficient systems on infection prevention and control and antimicrobial stewardship to reduce infections and lower costs caused by AMR pathogens.	Integrated management systems for containing AMR and reducing antimicrobial use in agricultural and animal sectors are well-established and in alignment with both public and private stakeholders.	People are literate about AMR and the appropriate use of antimicrobials to enhance self-reliance in health management and reduce unnecessary antimicrobial use.
Strategic actions	<ol style="list-style-type: none"> 1. Develop an integrated AMR surveillance system based on the One Health approach. 2. Strengthen laboratory capacity and networks. 3. Develop information technology systems to improve data standard. 4. Build capacity for data analysis and surveillance management. 5. Strengthen AMR surveillance and develop an alert system for outbreaks of critical resistant pathogens. 	<ol style="list-style-type: none"> 1. Reclassify of oral antimicrobials for humans. 2. Develop an antimicrobial tracking and tracing system. 3. Prepare a situational report on antimicrobial use. 4. Develop guidelines for managing unused or expired antimicrobials. 	<ol style="list-style-type: none"> 1. Address AMR issues in public and private healthcare facilities in a systematic and integrated manner. 2. Strengthen the competency of infection disease personnel. 3. Monitor and evaluate AMR management in healthcare facilities. 4. Implement antimicrobial stewardship in private clinics and primary care units. 	<ol style="list-style-type: none"> 1. Develop database and monitoring systems for antimicrobial use in agriculture and animal sectors. 2. Define standards and implement practice guidelines for addressing AMR and AMU in food animals and crops. 3. Promote alternatives to antimicrobial use in animals and agriculture. 4. Develop knowledge and capacity for responsible antimicrobial use in animals and agriculture. 	<ol style="list-style-type: none"> 1. Create a system to strengthen AMR literacy for the public. 2. Expand collaboration with and empower network partners. 3. Create synergy to enhance AMR literacy for the public. 4. Develop policy initiatives to improve public AMR literacy.



Strategy 6: Governance mechanisms to move AMR policy and actions forward in a sustainable manner

Strategic goal: Thailand has sustainable governance mechanisms in addressing AMR at national level that align with high-level plans.

- Strategic actions**
1. Develop governance and policy communication mechanism based on good governance principles to promote sustainable collaboration among government agencies, private sectors, civil society organizations, and others for implementing the Plan sustainably.
 2. Develop monitoring and evaluation system.
 3. Create academic collaboration across sectors.
 4. Sustain Thailand's proactive roles in tackling AMR at global and regional levels.

Section 8

Implementation of the Plan



The 2nd NAP-AMR outlines an implementation framework as follows.

1. Governance Structure and Mechanism

1.1 The National Governance structure is led by the National Policy Committee on Antimicrobial Resistance, chaired by the Prime Minister or a Deputy Prime Minister designated by the Prime Minister. The committee is supported by a joint secretariat comprising high-level executives from the Ministry of Public Health, the Ministry of Agriculture and Cooperatives, and the Ministry of Natural Resources and Environment. These ministries collaborate with various agencies to develop policies, provide strategic direction, and monitor operations in line with the 2nd NAP-AMR. Subcommittees and working groups under the National Policy Committee are responsible for driving specific strategic elements, including monitoring, accelerating, and supporting the implementation of the plan.

1.2 At the mission (function/mandate) and area levels, governance involves central and regional agencies under or overseen by relevant ministries or authorities responsible for addressing AMR.

1.3 At the network level, there are networks of organizations and mechanisms from the public and private sectors, professional associations and organizations, civil society, academia, and other stakeholders addressing AMR. These collaborative networks consist of agencies, groups, or individuals working collectively to tackle AMR issues.

2. Process of Translating Policy into Practice

2.1 Participatory workshops were conducted to develop the 2nd NAP-AMR. These workshops engaged stakeholders from various sectors, including the public sector, private sector, community organizations, local administration, civil society networks, media, and the general public. The objective was to foster collaborative efforts and ensure a systematic, unified approach to addressing AMR.

2.2 The 2nd NAP-AMR has been linked to related policies to ensure alignment and consistency across all strategic frameworks.

2.3 At the ministry or central agency level, adherence to a participatory approach is emphasized. The 2nd NAP-AMR serves as the guiding framework, with data used to formulate guidelines, measures, and operations for addressing AMR in a structured manner. At the local level, participatory processes involving relevant stakeholders help tailor goals, objectives, guidelines, programs, and projects to local problem situations and contexts and align with the 2nd NAP-AMR and broader government policies.

Section 9

Monitoring and Evaluation



M

onitoring and Evaluation Framework for the 2nd National Action Plan on Antimicrobial Resistance (2023-2027).

1. Performance Report

All agencies involved in the implementation of the 2nd NAP-AMR need to submit performance reports to the Secretariat of the National Policy Committee on Antimicrobial Resistance. The Secretariat will compile, process, analyze and present the results to the National Policy Committee on AMR for an annual review.

2. Strategic Review

The strategic review process involves:

1. Evaluation based on the goals and indicators of the 2nd NAP-AMR to monitor operational outcomes. Detailed evaluation criteria and results are outlined in Table 9-1 below.

Table 9-1: Evaluation based on goals and indicators of the 2nd NAP-AMR

Goals	Indicators and target value	Measurement methods
1. Reduce AMR morbidity in humans	<ol style="list-style-type: none"> 1) A 10% reduction in cases of carbapenem-resistant <i>Enterobacteriaceae</i> (CRE) bloodstream infections. 2) A 10% reduction in cases of carbapenem-resistant <i>A. baumannii</i> bloodstream infections. 3) A 10% reduction in cases of 3rd generation cephalosporin-resistant <i>E. coli</i> bloodstream infections. 4) A 10% reduction in cases of methicillin-resistant <i>S. aureus</i> (MRSA) bloodstream infections. 	<ol style="list-style-type: none"> 1. Incidence of AMR infections per 100,000 population (reflecting the national overall AMR morbidity rate). 2. Incidence of AMR infections in patients per 100,000 patients with blood culture (hemoculture) (reflecting AMR morbidity rate in hospitals). The results will then be compared with 2023 baseline data, using tools such as the Global AMR Surveillance System (GLASS), AMR surveillance and monitoring MOPH dashboard*, and hospital-acquired infection rates and AMR surveillance, among other methods.

Goals	Indicators and target value	Measurement methods
2. Reduce the risk of AMR in food and the environment	Thailand has an AMR monitoring system under the One Health approach that covers the following two types of bacteria. - 3 rd generation cephalosporins resistant <i>E. coli</i> - fluoroquinolone-resistant <i>Salmonella</i> spp.	Integrated Antimicrobial Resistance Surveillance System with One Health approach.
3. Reduce antimicrobial consumption in humans.	1) A 30% reduction in antimicrobial consumption in humans (compared to 2017). 2) Antimicrobial consumption in the Access group is not less than 60% of the total antimicrobial consumption (compared to 2023).	Thailand surveillance of antimicrobial consumption (Thailand SAC) and WHO AwaRe antibiotic classification.
4. Reduce antimicrobial consumption in animals.	1) Antimicrobial consumption in animals reduced by 50% (compared to 2017). 2) Antimicrobial consumption in the CIAs group (Colistin) decreased by 20% (compared to 2023).	Thailand surveillance of antimicrobial consumption (Thailand SAC) and Medicated feed database.
5. Increase AMR literacy in the general public.	At least 30% of the public has AMR literacy.	Comparison assessment with baseline data in 2021 using the National Health and Welfare Survey and the Literacy Assessment Tool.
6. Enhance the capacity of the national AMR management system to meet international standards.	The capability of Thailand's AMR management system meets international standards at no less than level 4.	Joint External Evaluation Tool for International Health Regulations (JEE for IHR).

Note: * The dashboard is based on the AutoMated tool for Antimicrobial resistance Surveillance System (AMASS).

2. Monitoring progress and key factors that impact the implementation and evaluation of the plan, including challenges and obstacles. This process informs necessary adjustments to the action plan, including monitoring progress and challenges to modify work plans, conducting mid-term evaluations and performing end-of-plan assessments.

3. Monitoring and assessment the AMR situations under the One Health Approach.

Appendix



Appendix A

Examples of major resistant bacteria and antimicrobials

Examples of critically important antibiotic-resistant bacteria		Significant impact on			
		Humans	Animals	Food	Environment
1.	<i>Acinetobacter baumannii</i> - carbapenem - colistin	✓ ✓			
2.	<i>Pseudomonas aeruginosa</i> - carbapenem - colistin	✓ ✓			
3.	<i>Neisseria gonorrhoeae</i> - cefixime	✓			
4.	<i>Klebsiella pneumoniae</i> - carbapenem - colistin - 3 rd generation cephalosporin (ESBL)	✓ ✓ ✓			
5.	<i>Staphylococcus aureus</i> - methicillin (MRSA) - vancomycin	✓ ✓			
6.	<i>S. pneumoniae</i> - penicillin - ceftriaxone or cefotaxime	✓ ✓			
7.	<i>Enterococcus faecalis</i> and <i>Enterococcus faecium</i> - vancomycin (VRE)	✓	✓	✓	✓
8.	<i>Escherichia coli</i> - colistin - carbapenem - fluoroquinolone - 3 rd generation cephalosporin (ESBL)	✓ ✓ ✓ ✓	✓ ✓ ✓ ✓	✓ ✓ ✓ ✓	✓
9.	<i>Salmonella</i> spp. - colistin - fluoroquinolone - 3 rd generation cephalosporin (ESBL)	✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓

Note: WHO highlights seven antimicrobial resistant bacteria are *E. coli*, *K. pneumoniae*, *S. aureus*, *S. pneumoniae*, *Salmonella* spp., *Shigella* spp. and *N. gonorrhoeae*

Examples of major antimicrobials

	Antibiotic class	List of antibiotics
1.	Polymyxins	colistin
2.	Carbapenems	doripenem ertapenem imipenem meropenem
3.	3 rd generation cephalosporins	ceftriaxone cefixime ceftazidime cefotaxime
4.	Fluoroquinolones	ciprofloxacin norfloxacin ofloxacin levofloxacin
5.	Beta-lactamase inhibitor combination	amoxicillin-clavulanic acid piperacillin-tazobactam

Appendix B

Examples of Critically Important Multidrug-Resistant Organisms (MDROs) or Emerging MDROs

Critically Important MDROs or Emerging MDROs	
1.	vancomycin-resistant <i>Staphylococcus aureus</i>
2.	vancomycin-resistant <i>Enterococcus</i> spp.
3.	colistin-resistant <i>Pseudomonas aeruginosa</i>
4.	colistin-resistant <i>Acinetobacter baumannii</i>
5.	3 rd generation cephalosporin-resistant <i>Neisseria gonorrhoeae</i>
6.	other emerging MDRO

Appendix C

Working Group for the Development of Thailand's 2nd National Action Plan on Antimicrobial Resistance (2023-2027)

The Subcommittee on Antimicrobial Resistance Strategy issued Subcommittee Order No. 1/2564 dated August 13, 2021, regarding the appointment of the Working Group for the Development of Thailand's Action Plan on Antimicrobial Resistance Phase 2 (2023–2027). Subsequently, during its first meeting of 2022 (Meeting No. 1/2565) held on August 31, 2022; the Subcommittee approved the revision of the plan's name from “Thailand's Action Plan on Antimicrobial Resistance Phase 2 (2023–2027)” to “The 2nd National Action Plan on Antimicrobial Resistance (2023–2027),” and also approved the change in the name of the working group to “Working Group for the Development of the 2nd National Action Plan on Antimicrobial Resistance 2023–2027” while remaining the same composition, duties and authorities as before (stipulated in Subcommittee Order No. 1/2564 dated August 13, 2021).

(Official Emblem)**Subcommittee on AMR Strategy****Order No. 1/2564**

Re: Appointment of the Working Group on the Development of the 2nd National Action Plan on Antimicrobial Resistance (2023-2027)

Pursuant to the National Policy Committee on Antimicrobial Resistance Order No. 1/2563 issued on September 29, 2020, the Committee appointed the Subcommittee on AMR Strategy as the first of its kind. During its Meeting No. 1/2021 held on March 24, 2021, the Subcommittee appointed the Working Group on the Development of the 2nd National Action Plan on Antimicrobial Resistance (2023-2027).

To ensure the effective development of the 2nd National Action Plan on Antimicrobial Resistance (2023-2027) and to meet its goals, the Working Group on the Development of the 2nd National Action Plan on Antimicrobial Resistance (2023-2027) was formed. This establishment was in accordance with clause 1.2(5) of the National Policy Committee on Antimicrobial Resistance's Order No. 1/2564, dated September 29, 2020, and the resolutions from the Subcommittee on Antimicrobial Resistance Strategy's Meeting No. 1/2564 on March 24, 2021. The Working Group has been assigned the following components, authority, and responsibilities.

1. Components

- | | | |
|-----|--|-----------------|
| 1.1 | Secretary General of the Food and Drug Administration | Advisor |
| 1.2 | Deputy Secretary General of the Food and Drug Administration (or designated alternate) | Chairman |
| 1.3 | Mr. Suriya Wongkongkathep | Deputy chairman |
| 1.4 | Mr. Kumthorn Malathum
Faculty of Medicine Ramathibodi Hospital, Mahidol University | Deputy chairman |

- | | | |
|------|---|---------------|
| 1.5 | Designated alternate, Thai Health Promotion Foundation | Working group |
| 1.6 | Director, National Drug Policy Division, Food and Drug Administration | Working group |
| 1.7 | Director, Health Education Division, Department of Health Service Support | Working group |
| 1.8 | Director, Primary Health Care Division, Department of Health Service Support | Working group |
| 1.9 | Director, Aquatic Animal Health Research and Development Division, Department of Fisheries | Working group |
| 1.10 | Director, Hazardous Waste and Substance Management Division, Pollution Control Department | Working group |
| 1.11 | Director, Fresh Water Source Subdivision, Water Quality Management Division | Working group |
| 1.12 | Designated alternate, Bureau of Environment Health, Department of Health | Working group |
| 1.13 | Ms. Noppavan Janejai, National Institute of Health of Thailand, Department of Medical Sciences | Working group |
| 1.14 | Ms. Wantana Paveenkittiporn, National Institute of Health of Thailand, Department of Medical Sciences | Working group |
| 1.15 | Mr. Thitipong Yingyong, Epidemiology Division, Department of Disease Control | Working group |
| 1.16 | Ms. Varaporn Thienthong, International Disease Control Ports and Quarantine Division, Department of Disease Control | Working group |
| 1.17 | Ms. Lantharita Charoenpong, Bamrasnaradura Infectious Disease Institute, Department of Disease Control | Working group |
| 1.18 | Ms. Amornrat Vijitleela, Division of Medical Technical and Academic Affairs, Department of Medical Services | Working group |
| 1.19 | Ms. Nattawan Palavuthitotai, Lerdsin Hospital, Department of Medical Services | Working group |

- | | | |
|------|---|---------------|
| 1.20 | Ms. Phairam Boonyarit, Health Administration Division, Office of the Permanent Secretary, Ministry of Public Health | Working group |
| 1.21 | Ms. Sripen Tantivess, Health Intervention and Technology Assessment Program, Office of the Permanent Secretary, Ministry of Public Health | Working group |
| 1.22 | Mr. Anond Kulthanmanusorn, International Health Policy Program, Office of the Permanent Secretary, Ministry of Public Health | Working group |
| 1.23 | Ms. Julaporn Srinah, Animal Feed and Veterinary Products Control, Department of Livestock Development | Working group |
| 1.24 | Ms. Thammarath Sujit, National Institute of Animal Health, Department of Livestock Development | Working group |
| 1.25 | Ms. Supaporn Wongsrichai, Bureau of Quality Control of Livestock Products, Department of Livestock Development | Working group |
| 1.26 | Ms. Mintra Lukkana, Bureau of Standards, National Bureau of Agricultural Commodity and Food Standards | Working group |
| 1.27 | Ms. Nuttima Kositcharoenkul, Plant Protection Research and Development Office, Department of Agriculture | Working group |
| 1.28 | Ms. Kingdao Intarukdach, Water Quality Management Division, Pollution Control Department | Working group |
| 1.29 | Ms. Niyada Kiatying-Angsulee, Drug System Monitoring and Development Center, Faculty of Pharmaceutical Sciences, Chulalongkorn University | Working group |
| 1.30 | Ms. Walasinee Sakcamduang, Faculty of Veterinary Science, Mahidol University | Working group |
| 1.31 | Mr. Direk Limmathurotsakul, Faculty of Tropical Medicine, Mahidol University | Working group |

- | | | |
|------|---|-----------------------------|
| 1.32 | Ms. Nithima Sumpradit, Medicines Regulation Division, Food and Drug Administration | Working group |
| 1.33 | Ms. Sukanya Namsawad, Medicines Regulation Division, Food and Drug Administration | Working group and Secretary |
| 1.34 | Ms. Sirima Punnin, Medicines Regulation Division, Food and Drug Administration | Working group and Secretary |
| 1.35 | Ms. Nuntiya Somjetanakul, Medicines Regulation Division, Food and Drug Administration | Working group and Secretary |

2. Duties and authority

2.1 Review the situation and issues of AMR in Thailand, consolidate existing knowledge, highlight pathways for international collaboration, and evaluate the results of the previous National Strategic Plan on AMR implementation. Additionally, identify gaps in implementation, obstacles, opportunities, and challenges in addressing antimicrobial resistance over 5-year- period.

2.2 Gather diverse perspectives on the policies, structures, goals, and strategies in addressing AMR from all sectors and partners, including government agencies, civil society, academia, the private sector, and stakeholders. Compile these insights to strategically shape the Second National Action Plan on Antimicrobial Resistance 2023-2027.

2.3 Draft the Second National Action Plan on Antimicrobial Resistance 2023-2027 to present to the Subcommittee on Antimicrobial Resistance Strategy and National Policy Committee on Antimicrobial Resistance for consideration.

2.4 Provide other recommendations related to policies and strategies in addressing AMR.

2.5 Perform duties or other tasks as assigned.

This Order shall come into force from this day onwards.

Ordered on 13 August 2021

(Mr. Anutin Charnvirakul)

*Minister of Public Health Chairman of
Subcommittee on Antimicrobial Resistance Strategy*

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