제4차 식품유래 항생제 내성 국제콘퍼런스에 대한 미팅 리포트

Meeting Report of the 4th Global Conference on Foodborne Antimicrobial Resistance

김성일, 정지연, 이소운

Sung Il Kim, Chi Yeun Cheung, Sowoon Lee

식품의약품안전처 식품소비안전국 축산물안전정책과

Livestock Products Safety Policy Division, Ministry of Food and Drug Safety, Republic of Korea

Meeting Report of the 4th Global Conference on Foodborne Antimicrobial Resistance

The Ministry of Food and Drug Safety (MFDS), led by Minister Oh Yu-Kyoung, hosted the 4th MFDS Global Conference on Foodborne Antimicrobial Resistance (GCFA) in Seoul on September 24-25. With the theme "Global Cooperation and Solidarity to Combat Foodborne AMR," the two-day conference featured four sessions and 14 presentations. Fourteen Korean and international experts, including representatives from the U.S. Food and Drug Administration (FDA) and the World Trade Organization (WTO), shared insights and policies to address the challenges of foodborne AMR.

Now in its fourth year since its launch in 2021, this conference emphasizes the importance of managing foodborne antimicrobial resistance. It has become a key event for sharing strategies and policies driven by the efforts of various countries and international organizations. The Ministry of Food and Drug Safety leads global efforts to raise awareness about reducing foodborne antimicrobial resistance and continues to collaborate internationally to minimize resistance and prevent its spread.

The conference opened with a welcoming address by Minister Oh Yu-Kyoung of the MFDS, followed by a congratulatory speech from Tanawat Tiensin, Assistant Director-General of the FAO. Day one focused on strategies to combat antimicrobial resistance in the Asia-Pacific region, highlighting cases from Australia and Thailand, as well as AMR management approaches in food production, including livestock and agriculture. Day two shifted focus to the latest technologies in AMR management, such as AI-driven antibiotic selection and surveillance techniques. It also covered the efforts of international organizations like the WTO and FAO to reduce foodborne antimicrobial resistance.

Session 1. Sharing of Strategies to Tackle AMR in Asian and Pacific Countries (Chair: Woohyun Kim, Professor, Gyeongsang National Univ.)

1-1. AMR Containment Strategies in Thailand

Julaporn Srinha, Department of Livestock Development, Ministry of Agriculture and Cooperatives, Head of veterinary product and AMR containment Section

Since 2017, Thailand has implemented a national action plan to reduce antimicrobial resistance, aiming to decrease antimicrobial use in animals by 30%. Recognizing antimicrobial resistance (AMR) as a cross-cutting issue linking humans, animals, and the environment, Thailand has adopted a One Health approach, emphasizing the need for cooperation across sectors and nations. Thailand monitors AMR through an integrated surveillance system that enforces stricter antibiotic regulations and strengthens collaboration with the private sector and farmers.

To further control antibiotic use, veterinary drugs in animals require a veterinarian's prescription, and antibiotics are strictly regulated to prevent their use for prophylactic purposes. Additionally, educational initiatives targeting veterinarians and farmers are continuously conducted to raise awareness about the severity of AMR. Veterinarians strictly monitor the use of antibiotic-containing feed, and medicated feed with antibiotics, such as prescription premixes, is regulated by law. As an alternative approach to reducing AMR, the Thai government is promoting antibiotic-free farming through natural substitutes, such as herbs, with initial results showing promise.

Thailand monitors antibiotic use through an ICT system and raises public awareness by collaborating with the private sector during AMR Awareness Week initiatives. On the international stage, Thailand actively engages in global cooperation by discussing AMR issues at high-level UN meetings. The country also plans to conduct a GAP analysis to identify weaknesses in its current systems, aiming to tackle AMR challenges through enhanced training and education for experts.

Thailand is now implementing its second National Action Plan (2023 - 2027), building on the efforts of the first plan, with a goal of reducing antibiotic use in animals by 50%. Through improved management of pharmaceutical imports and exports and strengthened policies in collaboration with international organizations, Thailand is working to position itself as a global leader in combating AMR in the livestock sector.

1-2 Food Standards Australia New Zealand Implementation of a National Food Surveillance Plan for AMR

Zoe Bartlett, Food Standards Australia New Zealand, Senior microbiologist

Food Standards Australia New Zealand (FSANZ) is the regulatory authority responsible for food safety in both Australia and New Zealand. To ensure national food safety, FSANZ operates an antimicrobial resistance (AMR) surveillance program based on the Australia and New Zealand Food Standards Code, with guidance from WHO and Codex guidelines.

With AMR potentially causing 10 million deaths by 2050, preventing its spread through food is critical, which led to the establishment of this national program. The program aims to prevent the

transmission of antimicrobial-resistant bacteria through food and to ensure food safety. Since food lies at the intersection of humans, animals, and the environment, an integrated AMR monitoring system is essential. Under the "2020 Strategy," the program focuses on monitoring and analyzing AMR across humans, animals, and the environment.

FSANZ, in collaboration with state and territory governments, has established a comprehensive surveillance system, incorporating expert consultation for sampling and laboratory analysis through coordinated partnerships. Based on Codex guidelines, the program targets poultry, cattle, pigs, eggs, and fish as key surveillance categories. With *Salmonella*, *Campylobacter*, *E. coli*, and *Enterococcus* designated as the primary microorganisms for testing. Specifically, chicken is monitored for *Salmonella* and *Campylobacter*, while pork and beef are tested for *Salmonella*, *E. coli*, and *Enterococcus*. Sampling is conducted randomly across Australia in major supermarkets, small retailers, and butcher shops, covering both major cities and regional areas. A total of 2,000 samples was collected from poultry and pork each, and 1,000 from cattle. These samples are analyzed using whole-genome sequencing (WGS) and antibiotic susceptibility testing (AST).

The data gathered through this program have enhanced the understanding of global AMR trends by enabling comparisons with international datasets. The implementation of a robotic-based analysis system has improved the efficiency and reliability of testing. The data not only support microbial risk analysis but also serve as critical resources for building a comprehensive national AMR monitoring system, improving food safety, and addressing AMR issues in the future.

1-3 Malaysia's Experience in Developing and Implementing National Action Plans on AMR

Nor Farah Bakhtiar, Ministry of Health, Senior Principal Assistant Director, Head of Infection Control Unit

Malaysia's efforts to reduce antimicrobial resistance (AMR) began in 1998 with the establishment of the National Surveillance of Antibiotic Resistance (NSAR) led by the Institute for Medical Research (IMR). Over the years, Malaysia strengthened its policies, including the launch of the Policies and Procedures on Infection Control in 1998 and establishment of the Healthcare Associated Multidrug Resistant Organism (HA-MDRO) surveillance program in 2003. In 2008, the first version of the National Antibiotic Guideline was introduced. In 2014 - 2015, the World Health Assembly (WHA) approved the Global Action Plan on AMR. Malaysia aligned with this initiative by incorporating it into its national strategy, leading to the establishment of the National Antimicrobial Resistance Committee (NARC) with four technical working groups (TWGs). Subsequently, NARC launched Malaysia's first Action Plan on AMR (MyAP-AMR) for the period 2017 - 2021.

Malaysia's National Antibiotic Resistance Committee (NARC) comprises experts from diverse fields, including medicine, pharmacy, veterinary medicine, non-profits organizations, academia and NGO to develop strategies for reducing AMR. Currently, the second action plan (2022 - 2026) is underway, focusing on four priority areas: increasing AMR awareness, strengthening

surveillance and research, enhancing infection prevention and control, and reducing antimicrobial use. The outcome indicators of action plan are to increase level of awareness, knowledge and understanding of AMR, to reduce antimicrobial use in animals' sector by 5% by 2026 compared to 2022, to prohibit the use of critical antimicrobials in both human and veterinary medicine as growth promoter by 30% by 2026, 60% of overall antibiotic consumption in humans comprised from ACESS group of antibiotics by 2026 and 30% reduction of healthcare associated blood stream infection due to selected MDRO by 2026 compared to 2021.

Malaysia has achieved significant successes in its AMR response, including expanded awareness campaigns, strengthened AMR surveillance and laboratory capacity, increased infection prevention and control (IPC) and antimicrobial stewardship (AMS) programs, advancements in veterinary and agricultural practices, and the phasing out of critical antibiotics to combat AMR risks. Raising awareness of AMR has been a key strategy, with various events and programs involving the public, private sector, experts, and policymakers to support this goal. A campaign for the proper disposal of unused, expired, or damaged medicines is also underway, and Malaysia collaborates with strategic partners to ensure environmental sustainability, reducing health risks, and preventing AMR. In partnership with the WHO, Malaysia has developed a self-paced online IPC module, covering essential IPC topics to enhance healthcare workers' knowledge and implementation of IPC measures. Malaysia's research and collaboration efforts have advanced AMR studies, highlighted by participation in the WHO One Health @Tricycle Project and the TRIuMPH project under the JPI AMR initiative, both focusing on monitoring ESBL-producing E. coli and CPE across human, animal, and environmental sectors. Malaysia has bolstered its IPC and AMS initiatives by providing regular training, updating guidelines, enhancing hospital accreditation criteria, and strengthening immunization programs in both the human and animal sectors.

However, challenges remain, such as delays in implementation due to limited authority in some departments, insufficient financial support for surveillance and training programs, low levels of public awareness, and the need to improve technology and logistics management. Additionally, data integration and the reduction of antibiotic use in agriculture while maintaining animal health are critical issues. While Malaysia has made notable progress in reducing AMR, challenges related to intersectoral coordination, budget constraints, and workforce shortages persist. Despite these challenges, efforts to combat AMR continue.

Session 2. Sharing of global strategies to contain in animal and agricultural sector (Chair: Jangwon Yoon, Professor, Kangwon National Univ.)

2-1 Animal Feed Practices to Reduce the Use of Antimicrobials in Animal Production

Daniela Battaglia, FAO, Animal Production Officer

The FAO focuses on reducing antimicrobial resistance (AMR) through international collaborations and the development of sustainable agri-food systems, expressing gratitude for the contributions of the South Korea government. AMR

is a global threat, particularly in low- and middle-income countries, where the use of antibiotics has surged alongside increased livestock production. According to FAO statistics, global livestock production is projected to

increase by 25% by 2040, which will likely drive a corresponding rise in antibiotic use.

As of 2021, approximately 88,927 tons of antibiotics were used in the livestock sector. Between 2016 and 2018, antibiotic use decreased by 27% in the Americas and Europe; however, it increased by 179% in Africa. Despite positive efforts to reduce antibiotic use, many countries still use antibiotics as growth promoters, with 36 countries lacking legal restrictions on such practices. Another significant concern is environmental pollution from antibiotics. Approximately 80% of antibiotics administered to animals remain unmetabolized and are excreted into the environment. This can contaminate agricultural products and the food chain, posing risks to human health. Therefore, effective disposal and management of antibiotics are crucial.

To combat AMR, the FAO highlights the importance of improved husbandry practices, enhanced hygiene, and increased animal welfare as key solutions for reducing antibiotic resistance. It emphasizes the use of high-quality feed, vaccines, and functional additives. Among these, phytogenic additives-plant derived compounds-have gained attention as a cost-effective alternative, particularly in low-income countries. Furthermore, the FAO provides scientific data and technical support to assist countries in reducing antibiotic use and implement sustainable livestock farming practices.

2-2 Investigation on Antibiotic Resistance in Enterobacteriaceae from Fresh Produce and Agriculture Environments

Gyu-Sung Cho, Max Rubner-Institut, Federal Research Institute of Nutrition and Food, Principal Investigator

Antibiotic resistance is recognized as a major global threat, requiring awareness and proactive actions from both policymakers and the general public. The "One Health" concept, introduced in 2008, highlights the close interconnection of humans, animals, and the environment. Since 2017, the WHO has been actively promoting this approach. In many countries, including South Korea, research focused on reducing AMR is being conducted across various sectors, including human health, animal health, the environment, and food. Notably, the COVID-19 pandemic has led to an increase in unnecessary antibiotic use, further exacerbating the resistance problem.

The World Bank projects that AMR could result in a 3.8% loss in global GDP by 2050, with the issue often described as a “silent pandemic” due to its critical impact. Asia and Africa are expected to be especially affected, highlighting the need for international cooperation and action. Strategies to tackle AMR have been discussed at the G7 summit and UN high-level meetings, where funding and research efforts are being mobilized to support global action against AMR.

In South Korea, extensive research is underway to prevent the spread of AMR bacteria in agricultural environments. Studies are analyzing antibiotic-resistant microorganisms in home-grown vegetables, as well as in water and soil collected from agricultural settings. One study on lettuce

identified very few strains resistant to meropenem. Among these isolates, a novel *Scandinavium* sp. isolate exhibited approximately 96% genetic similarity in quinolone resistance to the *qnr*B96 gene previously identified in Sweden.

Interestingly, isolates from agricultural environments showed much lower antibiotic resistance rates compared to hospital-derived strains, although the two were genetically very similar.

Research in Germany has also demonstrated that antibiotic resistance genes in bacteria like *Klebsiella pneumoniae* and *E. coli* can be transferred to other strains through plasmids under certain laboratory conditions. These findings suggest that reducing antibiotic use in agriculture, as well as managing fertilizer and pesticide applications, are crucial for effectively addressing AMR.

2-3 [KOREA] AMR Situation and Containment Strategies in Animal Sector

Sukgyung Lim, Animal and Plant Quarantine Agency, Senior Researcher

In alignment with the WHO's Global Action Plan, South Korea implemented its first National Action Plan on antimicrobial resistance (AMR) from 2016 to 2020 and is now executing the second phase, spanning from 2021 to 2025. AMR management in both human and non-human sources in Korea is overseen by the Korea Disease Control and Prevention Agency, the Ministry of Agriculture, Food, and Rural Affairs, and the Ministry of Food and Drug Safety, respectively. Information from both sectors is integrated and shared through the One Health portal system. Furthermore, since 2008, the Korean Veterinary Antimicrobial Resistance Monitoring System (KVARMS) has been tracking antibiotic usage and resistance data in the livestock sector.

South Korea's antibiotic management strategy consists of two key policies. First, the addition of antibiotics to all feed has been prohibited since 2011. Second, a veterinarian prescription system was introduced in 2013, and as of 2022, all antibiotics can only be administered with a veterinarian's prescription. These policies have significantly reduced antibiotic usage, which has been maintained at an annual level of 700 to 730 tons. However, antibiotic use remains high in pigs and poultry, where multidrug-resistant bacteria are notably prevalent. In particular, fluoroquinolone resistance in poultry remains high, ranging from 60 ~70%.

Salmonella poses a significant risk of transmission from livestock to humans, and in South Korea, there is a high prevalence of resistance to third-generation cephalosporins. Notably, the *S. Enteritidis* and *S. Virchow* strains are particularly problematic in poultry. Additionally, multidrug-resistant *Salmonella* Infantis, which exhibits resistance to various antibiotics due to the presence of megaplasmids, is predominantly found in chickens in South Korea.

Colistin resistance due to the *mcr* gene is also a growing concern. Since the gene was first reported in China in 2015, the *mcr*-1 gene has been frequently detected in pigs and chickens in South Korea, with a resistance rate of approximately 15%. Whole genome sequencing (WGS) analysis has confirmed the potential for transmission of resistant

bacteria from livestock to human.

In response, the South Korean government is restricting the use of fluoroquinolones and third-generation cephalosporins and has established antibiotic prescription guidelines for major diseases to ensure that critical antibiotics are used only as a last resort. To address AMR, awareness-raising activities are conducted both online and offline. Following the One Health concept, the integration of human and non-human data is being managed. Since 2019, R&D projects have been initiated to promote research on AMR.

Session 3. The latest technologies to contain AMR (Chair: Insun Joo, Director, MFDS)

3-1 Application of WGS for AMR Surveillance along the Food chain: a perspective from France

Sophie A. Granier, French Agency for Food, Environmental and Occupational Health & Safety (ANSES), Scientific Expertise Coordinator

The French Agency for Food, Environmental and Occupational Health & Safety (ANSES) operates France's antibiotic resistance surveillance system under the slogan "Investigate, Assess, Protect." The agency works to safeguard human, animal, and plant health while supporting policy decisions through scientific evaluation. ANSES manages a comprehensive global surveillance program for public health, which includes five vigilance schemes: toxicovigilance, nutrivigilance, phytopharmaco-vigilance, veterinary pharmacovigilance, and a national network for monitoring and preventing occupational diseases. In particular, ANSES is coordinating two laboratory surveillance networks dealing with antibiotic resistance on diseased animals or along the food chain.

Inside or outside ANSES, France was operating in 2021, 48 surveillance programs to monitor Antimicrobial Resistance (AMR), Antimicrobial Use (AMU) and antibiotic residues in either human, animals or the Environment (Collineau et al., Eurosurveillance 2023).

Among these, 35 programs collect antibiotic resistance data. Specifically, 31 programs gather data from human clinical samples. Only seven surveillance programs are collecting Whole Genome Sequencing (WGS) data.

In France, WGS-based AMR surveillance is limited, primarily managed by national reference centers for human and *Salmonella* data. Although the European center for disease control (ECDC) and European Food safety Authority (EFSA) publishes an annual report on AMR in food-producing animals and humans. Nevertheless, WGS data remains limited and often supplementary to the predominantly phenotypic data. WGS is well-suited to identifying specific genotypic resistance, such as ESBL, yet remains limited in predicting antibiotic susceptibility.

The take home message is that WGS is a good tool for surveillance of emerging resistance mechanisms but is not suitable for susceptibility tests as the clinicians need. There are still limitations in implementing first line WGS surveillance programs due to the high costs and processing speed challenges of WGS.

Recent studies highlight the challenges of establishing a WGS-based AMR surveillance system and suggest that standardization, such as ISO-

certified genomic workflows, can help facilitate its implementation. There are reasons to be optimistic: researchers are focusing on multinational collaboration to develop standardized procedures for WGS-based AMR surveillance, which is expected to enhance both the quality and cost-efficiency of surveillance efforts in the long term.

※ The views developed in this article by Sophie A. Granier are personal and do not reflect the one from her institute (ANSES)

3-2 An AI algorithm to predict personalized empirical antibiotic selection

Raewoong Park, Ajou Univ., Professor

An AI-based algorithm has been developed to select the optimal antibiotic while considering the risks of antibiotic resistance. Antibiotic resistance is a significant public health threat, and improper prescriptions can worsen the problem. For patients with severe infections, empirical prescriptions are often necessary since waiting for test results is not always feasible. However, inaccuracies in this process can lead to increased resistance and treatment failures.

Hospitals typically rely on antimicrobial susceptibility test results to select antibiotics, but these data are often not updated frequently enough to fully reflect the current status. To address this limitation, we developed an AI-based resistance prediction model that integrates a patient's medical history, current condition, and the latest antimicrobial susceptibility (AST) data in real-time. This model was built by converting the hospital's electronic health records (EHR) into the OMOP-CDM format, enabling tailored prescriptions, especially for patients with urinary tract infections.

The AI model's performance was evaluated using various metrics, including Brier Score, AUROC, and AUPRC. Optimization was achieved through models such as Lasso logistic regression, XGBoost, and Random Forest. Analysis using SHAP values revealed that for antibiotics like piperacillin-tazobactam, antimicrobial test results were critical, while for ESRD infections, the patient's current condition played a more influential role. This enables physicians to quickly select the appropriate antibiotic without the need to analyze every variable manually.

To further enhance usability, a web application was developed to allow physicians to check patient conditions and antibiotic susceptibilities in real-time. Through this application, physicians can select antibiotics tailored to the patient's condition and easily monitor susceptibility rates and resistance trends over time and across seasons.

Integrating this system with the OMOP-CDM network across major hospitals in Korea could enable real-time national AMR monitoring, facilitating consistent data sharing and strengthening infection response capabilities. This research opens up possibilities for improving traditional empirical prescriptions, effectively reducing antibiotic resistance, and contributing to the establishment of a national AMR monitoring system.

3-3 NARMS Use of Technologies for AMR Surveillance and Monitoring in Food

Heather Tate, USFDA CVM, Science Lead

The National Antimicrobial Resistance Monitoring System (NARMS) is a program jointly managed by the CDC, FDA, and USDA to monitor antibiotic resistance across the United States. Adopting a One Health approach, NARMS integrates resistance data from humans, animals, and the environment. The CDC collects data on human infections, the FDA monitors resistant bacteria in retail foods, and the USDA gathers resistance data from livestock and plants. These results are consolidated into comprehensive reports. NARMS also collaborates with Canada and the EPA to monitor antibiotic-resistant bacteria in companion animals, livestock, and waterways.

NARMS has been studying the correlation between the genotypes and phenotypes of key pathogenic bacteria. Since 2015, it has introduced whole genome sequencing (WGS), initially for monitoring resistance in *Salmonella* and *Campylobacter*, expanding in 2019 to include *E. coli*, multidrug-resistant organisms, and *Enterococcus*. This approach has enhanced surveillance sensitivity and outbreak detection speed, with all genomic data shared in real-time through NCBI. From 2023, phenotypic susceptibility testing (AST) has been conducted on selected isolates, and analysis has been strengthened using tools such as SE Zero, AMRinder Plus, and Tableau.

Additionally, NARMS now compares WGS-based predictive phenotypes with actual phenotypes from AST, while the Resistome Tracker visually tracks the origins and spread of resistance genes across countries. In 2014, a case of multidrug-resistant *Salmonella* Infantis was identified as having entered the United States, highlighting regional variations in resistance trends.

Long-read sequencing enables precise analysis of plasmid structures and variations, helping to track the transmission routes of AMR genes. FDA researcher Dr. Lucas uses the Lociq tool to analyze plasmid locations and subtypes. Metagenomic analysis helps monitor shifts in resistance genes by assessing the entire microbial community composition. However, it faces limitations in data coverage and regulation, leading to plans to incorporate cross-linking and long-read sequencing technologies.

Dr. Daniel Tadesse's team has used Hi-C crosslinking to link resistance genes with plasmids, addressing regulatory issues. Dr. Andrea Ottesen's team is identifying representative strains through a quasi-metagenomic approach and exploring optimal methods for proliferating AMR genes. Dr. Chih-Hao Hsu's team has developed an AI model that predicts susceptibility and resistance for MIC for 25 antibiotics, evaluating the potential for AST replacement. While the model has shown high accuracy, challenges remain due to the lack of resistant isolates and susceptibility errors for some antibiotics. It is expected that the model's accuracy will improve as more isolates and global data are incorporated.

3-4 AMR surveillance and monitoring new technology and changing landscapes

Kaitlin Tagg, CDC, Data Scientist

The CDC's National Center for Emerging and

Zoonotic Infectious Diseases is responsible for monitoring foodborne antibiotic resistance, and the National Antimicrobial Resistance Monitoring System (NARMS) has been jointly operated by the FDA, CDC, and USDA since 1996. Initially, PulseNet and NARMS operated separately, with PulseNet utilizing PFGE (Pulsed-Field Gel Electrophoresis) technology and NARMS conducting antibiotic susceptibility testing (AST). However, both have now transitioned to whole genome sequencing (WGS), enabling closer collaboration. PulseNet conducts genetic sequencing, while NARMS analyzes phenotypic data, allowing for comprehensive AMR surveillance. Starting in 2019, WGS has been used to track the genomes and resistance data of foodborne pathogens like Shiga Toxin-producing *Escherichia coli* and *Salmonella* in real time, integrating this information into a central database for management.

PulseNet performs 100% genomic analysis on data reported by each state, while NARMS conducts phenotyping tests on approximately 5% of the 80,000 isolates, creating a dataset that includes both genotype and phenotype information. Additionally, the BEAM dashboard provides resistance data by pathogen and year, enhancing clinical understanding. Through predictive resistance, NARMS and PulseNet offer public health alerts to both the public and experts, delivering real-time information during outbreaks.

Current AMR research requires long-read sequencing, yet most studies still rely on short-read sequencing. PulseNet International is collaborating with 80 countries to establish WGS-based foodborne AMR research and standardized protocols. Training for technology transfer is ongoing in Africa and the Asia-Pacific region. While AMR surveillance systems have high initial costs, they offer significant long-term savings. A 2016 study indicated that for every dollar spent on PulseNet, a savings of $70 in healthcare costs and productivity losses could be expected. PulseNet 2.0 and metagenomic approaches will play a crucial role in future disease prevention.

Session 4. Sharing of global efforts in various ways to reduce AMR (Chair: Jongchan Chae, Professor, Jeonbuk National Univ.)

4-1 AMR - What role for the WTO?

Camille Fléchet, World Trade Organization, Dispute Settlement Lawyer

The WTO, responsible for 98% of global trade, is a key international organization working with its members to address trade-related aspects of antimicrobial resistance (AMR). The WTO promotes access to medicines by reducing tariffs on antibiotics and allowing compulsory licensing in certain countries to support domestic production and export of pharmaceuticals. Additionally, through the SPS Agreement, the WTO oversees trade measures that relate to food safety and the life and health of animals and plants, such as those implementing restrictions on antibiotic use and setting residue limits related to AMR, thereby promoting smooth trade while protecting public health.

The SPS Agreement strongly encourages WTO Members to prevent unnecessary trade barriers by referencing standards from key international organizations: World Organization for Animal

Health (WOAH), the International Plant Protection Convention (IPPC), and Codex. Under WTO rules, countries should align their SPS measures with international standards; if not, they must conduct their own risk assessment considering Codex risk assessment methods. Given the complexity of risk assessments, following international standards is often more efficient. Although international standards like Codex are voluntary, their adherence is reinforced within WTO agreements, promoting global action against AMR.

Member states are required to notify the WTO of new draft SPS regulations affecting international trade and take trading partners' comments into account in regulatory efforts, promoting regulatory co-operation. Of approximately 2,000 SPS notifications each year, only 37 are expressly identified by WTO Members as relating to AMR (with the actual number of AMR related notifications likely to be higher). For example, Morocco has notified restrictions on substances for livestock, while Malaysia and North Macedonia have reported on their AMR programs. Through these notifications, countries share their regulations, and information is accessible on the ePing SPS & TBT platform.

The WTO's SPS Committee provides a forum where members discuss food safety measures and the WTO offers technical assistance to developing countries. This support helps these countries strengthen their regulatory capabilities by referencing established approaches, and Korea actively shares AMR-related information and participates through this platform.

In addition, the WTO monitors international standards, such as those from Codex and WOAH, to support global AMR responses, helping to mitigate trade tensions and resolve disputes. Through multilateral cooperation, the WTO plays an active role in addressing AMR, engaging in the UN coordination group and discussions on the WHO's pandemic treaty.

4-2 FAO work on AMR in the agri-food system

Jorge Pinto Ferreria, FAO, Food Safety Officer

The FAO, a UN specialized agency, works to eliminate hunger and ensure food safety. Guided by the principle, "If it's not safe, it's not food," the FAO has an action plan to address AMR issues, supporting countries through nine AMR reference centers. Working with Codex Alimentarius, the FAO also sets international food standards, collects antibiotic use data in plants/crops, and builds a repository of AMR management information.

Additionally, FAO collaborates with the Fleming Fund to boost AMR response capabilities, with a partnership meeting planned in Cambodia.

The FAO is advancing two major initiatives for AMR response: "RENOFARM (Reduce the Need for Antimicrobials on Farms for Sustainable agri-food System transformation)" and "MSPP (Multi-Stakeholder Partnership Platform)." RENOFARM, aimed at transitioning to sustainable agri-food systems, is a ten-year initiative launched in 2023. It operates on the 5G principles (Good Production practice, Good Alternatives, Good Health Service, Good Connection, and Good Incentives) with the goal of training globally 50% of animal and plant health workers. RENOFARM uses behavioral promoters to raise awareness about AMR, encourage behavior change, and drive research and innovation.

The project also strengthens collaboration with the private sector and engages youth to support a global response to AMR. Through this multifaceted approach, the FAO plans to continue making significant contributions to AMR mitigation efforts.

FAO's RENOFARM project emphasizes youth participation and sustainable agriculture in its AMR response efforts. Aiming to provide action-oriented support for livestock and plant sectors, it promotes collaboration across various industries. In Indonesia, a Farmer Field School is underway with 190 members actively participating, receiving practical cooperation and support.

4-3 The International FAO Antimicrobial Resistance Monitoring System (InFARM), a Practical Approach for the Implementation of the Codex Guidelines on Integrated Monitoring and Surveillance of Foodborne AMR

Alejandro Dorado Garcia, FAO, Animal Health Officer

FAO's InFARM is a global information system consisting of an IT platform and related activities strengthening surveillance of antimicrobial resistance (AMR) in agri-food sectors and use of antimicrobial pesticides in plant health. In its early implementation, the IT platform supports countries in collating, collecting, analyzing and utilizing their AMR data primarily in livestock, aquaculture, and food commodities. Currently the platform is being expanded to also accommodate data on the use of antimicrobial pesticides in plant production. The system supports the monitoring of AMR in microorganisms such as *Salmonella*, *Campylobacter*, and *E. coli*. InFARM supports and complements the global integrated surveillance of AMR and AMU in collaboration with the Quadripartite. Currently, GLASS collects AMR and AMU data in humans, ANIMUSE handles AMU data in animals, and the FAO manages AMR data from animals and food.

The goal of InFARM is to produce high-quality AMR data at national, regional, and global levels for evidence-based decision making. It also aims to provide timely evidence to strengthen surveillance systems and to share information regularly with diverse stakeholders. The FAO requests countries to designate focal points, identify AMR surveillance components (i.e. peripheral and reference laboratories, and national coordinating centers), report agri-food data and establish AMR surveillance systems through these InFARM focal points. Starting in 2024, member countries have started to submit AMR data through the first annual call for submissions. In July 2024, as part of the open call for data a regional InFARM training, participants were educated on how to participate and use their data for dissemination across stakeholders. In 2025, after closing the call for data the FAO will assess the feasibility of integrating all data into a global report. Starting in 2026, it plans to expand surveillance to include NGS and WGS data, covering plants and crops as well. The FAO expresses its gratitude to the Ministry of Food and Drug Safety of the Republic of Korea and the United Kingdom's Fleming Fund for their support in these efforts.

4-4 FAO work on AMR in agri-food system and Implementation of Codex standards on AMR (ACT project)

Myoengsin Choi, FAO, Food Standard Officer

AMR has already deeply infiltrated our daily lives, and urgent action is needed to address it. Every

year, approximately 5 million people die from AMR-related infections, highlighting its severity as a "silent pandemic." To combat this issue, the FAO launched the ACT project in 2021 to support the implementation of Codex AMR texts. With a $10 million contribution from the Korea's Ministry of Food and Drug Safety, this project provides five years of support to six countries: Bolivia, Cambodia, Colombia, Mongolia, Nepal and Pakistan.

The ACT project aims to implement the three main/most recent Codex AMR texts, supporting countries AMR responses in three key areas: awareness-raising, surveillance, and best practices application. To achieve this, the project promotes laboratory capacity building, training for food chain stakeholders, and improvements of legal frameworks. Additionally, the project developed the ACT tool to help review each country's legal framework, ensuring alignment with international standards.

In Bolivia, AMR testing was initially unfeasible, and awareness of AMR issues was low. However, through the new national coordinating body, CC-RAM, AMR issues are now actively discussed, and a surveillance system is gradually being established. Additionally, there is growing recognition across various sectors, including the beef industry, of the importance of complying with Codex standards.

Building on these positive changes and achievements, continued support for other countries is essential to address AMR. Since AMR is a global issue that transcends borders, a collaborative response is necessary.

The 4th MFDS Global Conference on Foodborne Antimicrobial Resistance

Global Cooperation and Solidarity to Combat Foodborne AMR

September 24 (Tue.) – 25 (Wed.), 2024 Naru Ballroom 2F, HOTEL NARU SEOUL MGALLERY

Tue, 24 Sep, 2024 (Day 1)			
Time	**Min.**	**Title and Speaker**	
Opening Ceremony			MFDS
13:00~13:03	3′	Opening	**Director General**
13:03~13:08	5′	Welcoming Address	**Minister of MFDS**
13:08~13:20	12′	Congratulatory Speech	**Thanawat Tiensin** (Assistant Director General, FAO / Video)
Session 1. Sharing of Strategies to Tackle AMR in Asian and Pacific Countries (Chair: Woohyun Kim, Associate Professor)			
13:20~13:45	25′	Thailand AMR Containment Strategy	**Julaporn Srinha** (Senior Professional Veterinary Officer, DLD)
13:45~14:10	25′	Food Standards Australia New Zealand Implementation of A National Food Surveillance Plan for AMR	**Zoe Bartlett** (Senior Microbiologist, FSANZ)
14:10~14:35	25′	Malaysia's Experience in Developing and Implementing National Action Plans on AMR	**Nor Farah Bakhtiar** (Senior Principal Assistant Director, Ministry of Health)
14:35~14:55	20′	Summary and Discussion (Q&A)	Chair and Speakers
14:55~15:15	20′	Break Time	
Session 2. Sharing of Global Strategies to Contain in Animal and Agricultural Sector (Chair: Jangwon YOON, Professor)			
15:15~15:40	25′	Animal Feed Practices to Reduce the Use of Antimicrobials in Animal Production	**Daniela BATTAGLIA** (Animal Production Officer, FAO)
15:40~16:05	25′	Investigation Antibiotic Resistance in Enterobacteriaceae from Fresh Produce and Agriculture Environments	**Gyu-Sung Cho** (Principal Investigator, Max Rubner-Institut)
16:05~16:30	25′	AMR Situation and Containment in Food Animals	**Suk-Kyung Lim** (Senior Researcher, APQA)
16:30~16:50	20′	Summary and Discussion (Q&A)	Chair and Speakers
16:50~16:55	5′	Closing of Day 1	MFDS

Wed, 25 Sep, 2024 (Day 2)			
Time	**Min.**	**Title and Speaker**	
Session 3. The Latest Technologies to Contain AMR (Chair: Insun JOO, Director)			
10:00~10:05	5′	Intro of Day 2	MFDS
10:05~10:30	25′	Application of Whole Genome Sequencing for AMR Surveillance	**Sophie GRANIER** (ANSES)
10:30~10:55	25′	An AI Algorithm to Predict Personalized Empirical Antibiotic Selection	**Rae Woong Park** (Professor, Ajou University)
10:55~11:20	25′	The National Antimicrobial Resistance Monitoring System (NARMS): Food Section	**Heather Tate** (NARMS Science Lead, FDA)
11:20~11:45	25′	AMR Surveillance and Monitoring: New Technology and Changing Landscapes	**Kaitlin Tagg** (Data Scientist, CDC)
11:45~12:05	20′	Summary and Discussion (Q&A)	Chair and Speakers
12:05~12:25	20′	Break Time	
Session 4. Sharing of Global Efforts in Various Ways to Reduce AMR (Chair: Jong-Chan Chae, Professor)			
12:25~12:50	25′	WTO Efforts to Contain AMR	**Camille Flechét** (Dispute Settlement Lawyer, WTO)
12:50~13:15	25′	FAO Work on AMR in the Agrifood System	**Jorge Pinto Ferreira** (Food Safety Officer, FAO)
13:15~13:30	15′	The International FAO Antimicrobial Resistance Monitoring System (InFARM), a Practical Approach for the Implementation of the Codex Guidelines on Integrated Monitoring and Surveillance of Foodborne AMR	**Alejandro Dorado Garcia** (Animal Health Officer, FAO)
13:30~13:45	15′	FAO Work on AMR in the Agrifood System and Implementation of Codex Standard on AMR (ACT project)	**Myoengsin Choi** (Food Standard Officer, FAO)
13:45~14:05	20′	Summary, Discussion and the Way Forward (Q&A)	Chair and Speakers
14:05~14:10	5′	Closing Remarks	MFDS

https://mfdsgcfa.kr

Ministry of Food and Drug Safety