

The current state of AMR research activities including Alternative to antimicrobials (ATA) and collaboration opportunities in Republic of Korea

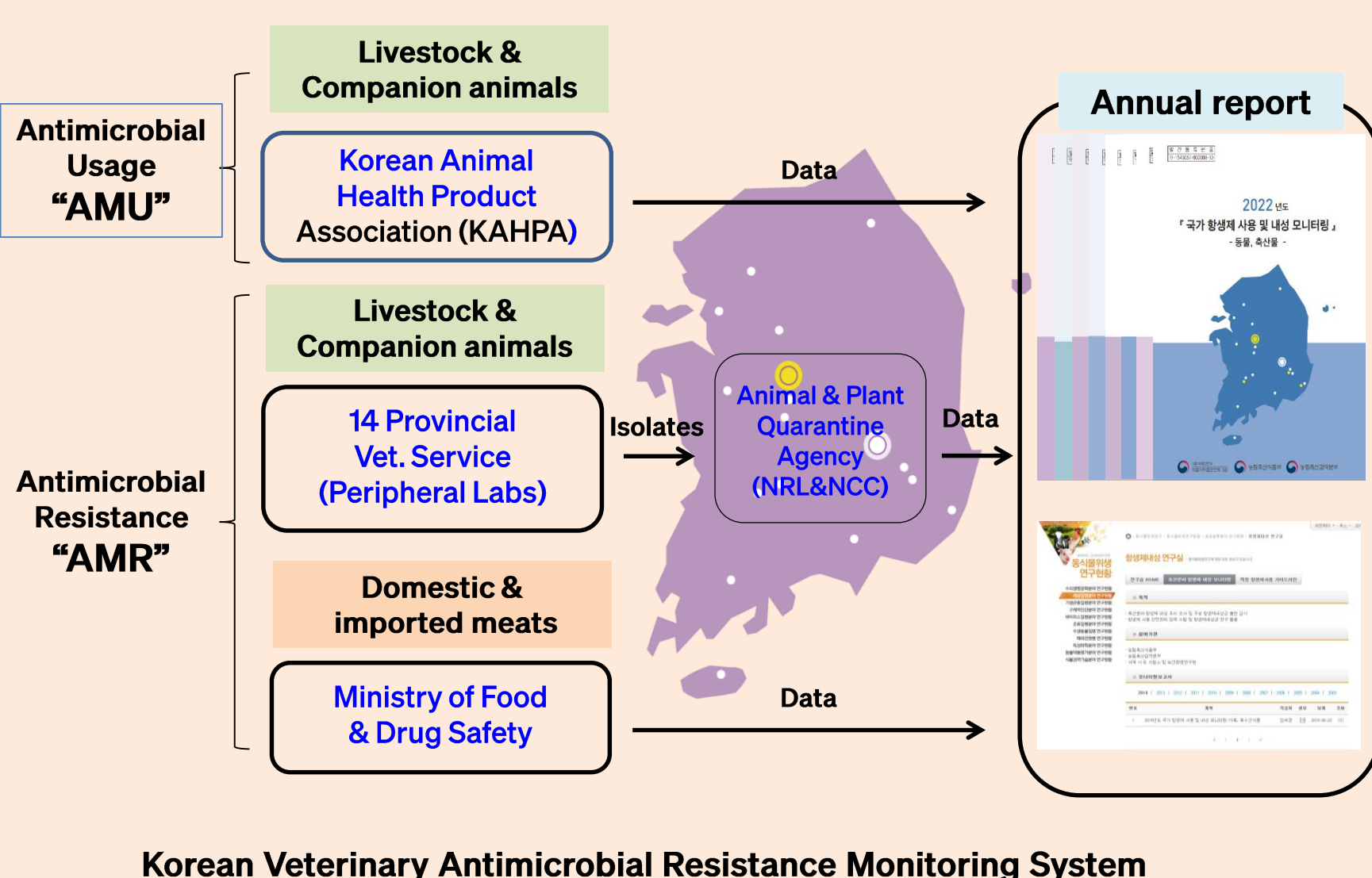
YOU Juyeon/Veterinary researcher

The Government of
the Republic of Korea

Background on AMR research in ROK

◆ AMU/AMR Monitoring (2008 -)

● Organization

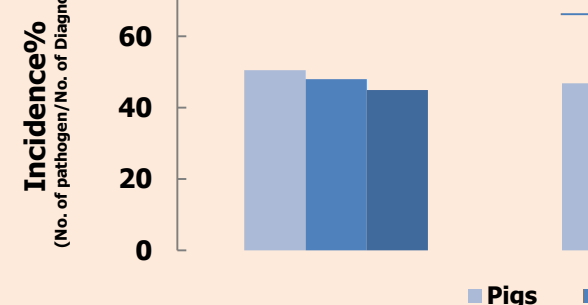


● Current status of AMU/AMR

■ Livestock

• Infectious disease

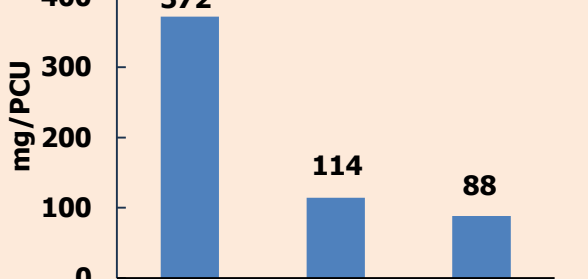
Bacterial > Viral > parasite



• AMU (mg/PCU)

Pigs > Chicken > cattle

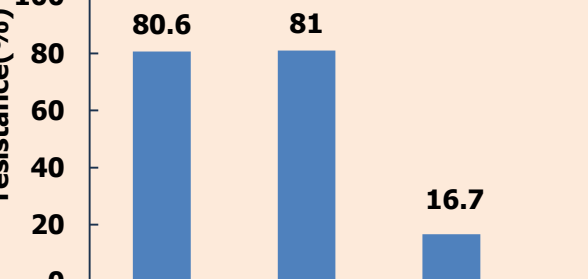
Antimicrobial consumption (2022)



• AMR (MDR, E. coli)

Pigs, Chicken > cattle

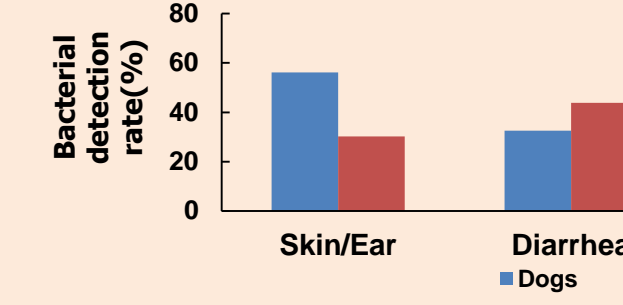
Multidrug resistance (2022)



■ Companion animal

• Bacterial disease

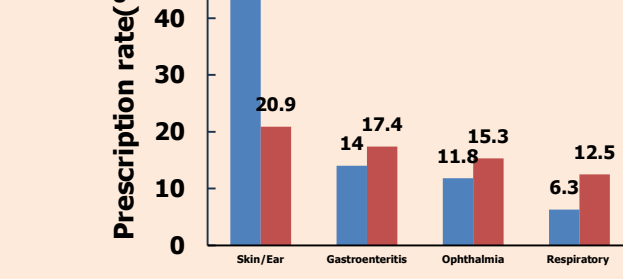
Skin/Ear > Diarrhea > Urine > Respiratory



• AMU (Prescription)

Skin/Ear > Diarrhea > Urine > Respiratory

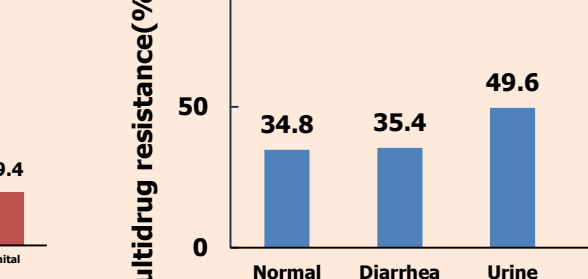
Prescription rate (%)



• AMR (MDR, E. coli)

Skin > Urine > Diarrhea > Normal

Multidrug resistance (%)

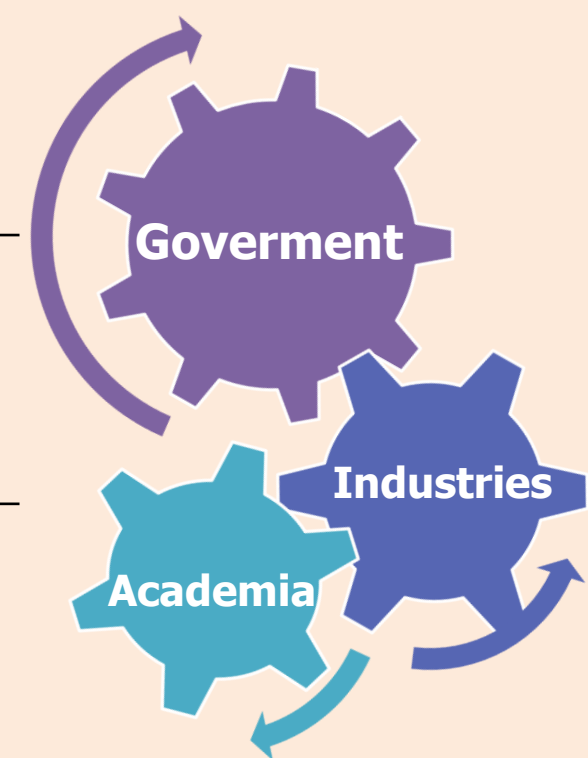


◆ Regulation

- Ban on antibiotics for feed additives (middle of 1990 – 2011)
- Prescription requirement to use antibiotics in animals (2013 – present)
- Restriction use of HP CIAs (fluoroquinolones & 3rd G. cephalosporins) in chicken (2021-present)

◆ Key stakeholder

	Role
Government	<ul style="list-style-type: none"> Establish and enforce regulations Invest in surveillance programs Support research and development
Academia	<ul style="list-style-type: none"> Conduct research Educate future professionals Provide expert advice
Industry	<ul style="list-style-type: none"> Responsible antibiotic use Develop alternatives Transparency and data sharing

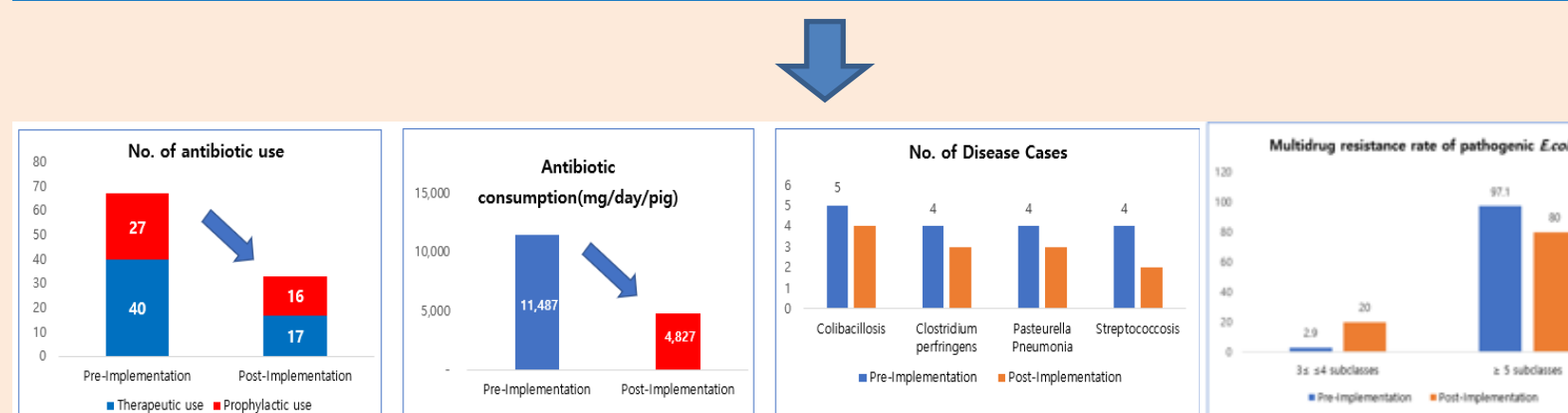


AMR/ATA Research Focus

◆ Prudential use

■ Development of prudential use model in pigs

- Antibiotic reduction Model**
 - Implementation of the veterinary advisory service contracts
 - Conduct antibiotic susceptibility testing before antibiotic administration
 - Reduction of prophylactic antibiotic use
 - Application of medicated water system for precise antibiotic administration
- Environmental Residual Resistant Bacteria Prevention Model**
 - Applying All-in/All-out system
- Disease Reduction Model**
 - Strengthening biosecurity measures and upgrading farm facilities



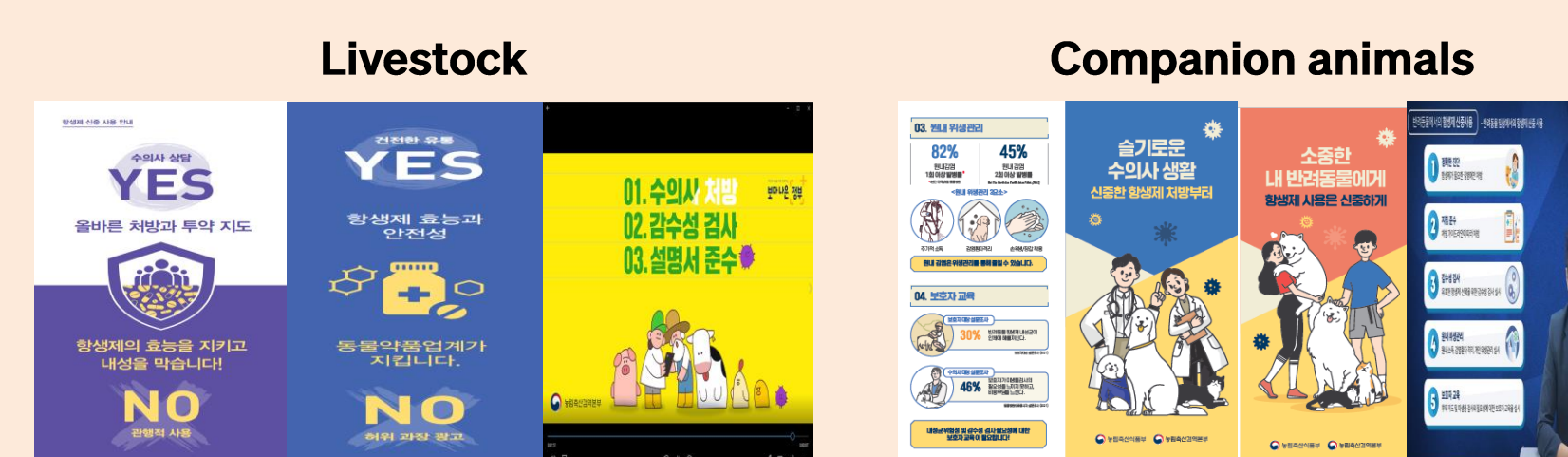
- 50.7% reduction in the frequency of antibiotic use (67 to 33 times)
- 62.7% reduction in the amount of antibiotic use (11,488 to 4,827mg/day/pig)
- Decrease in disease
- Decrease in Multidrug Resistance Rate in Pathogenic *E. coli*

■ Development Prescription guidelines

- Development of prescription guidelines for each animal pathogen
- Recommend the last choice of HP CIAs



■ Raising awareness

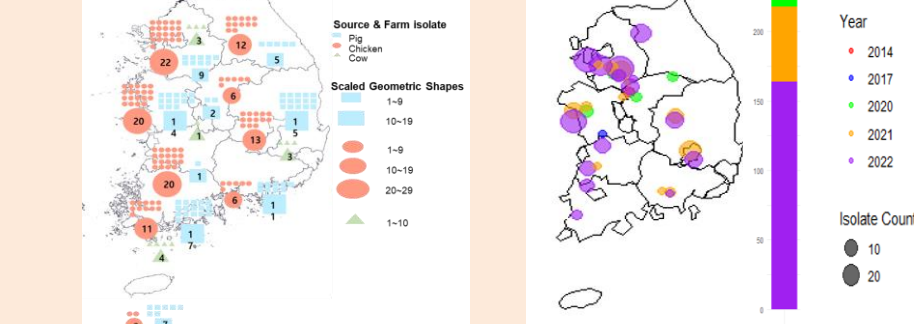


◆ One health approach research

■ ESBL-producing *Enterobacteriaceae*

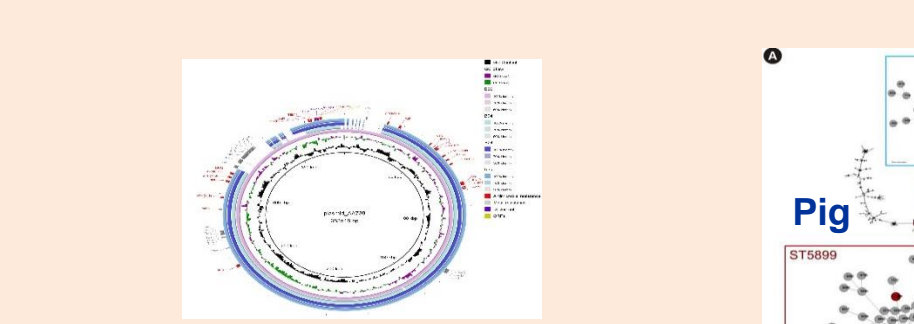
• Prevalence

ESBL-producing *Enterobacteriaceae* are highly isolated from chickens than pigs and cattle < *E. coli* >



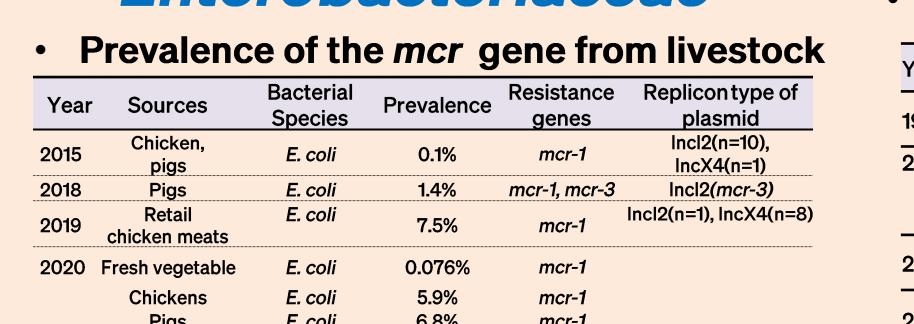
• Plasmid type

Nationwide spread of *E. coli* carrying a 380Kb mega plasmid with *bla*_{CTX-M-55}



• Transmission

Pig & farm environment : ST457, IncFIC-InfIB
Farm worker : ST69, InfIB

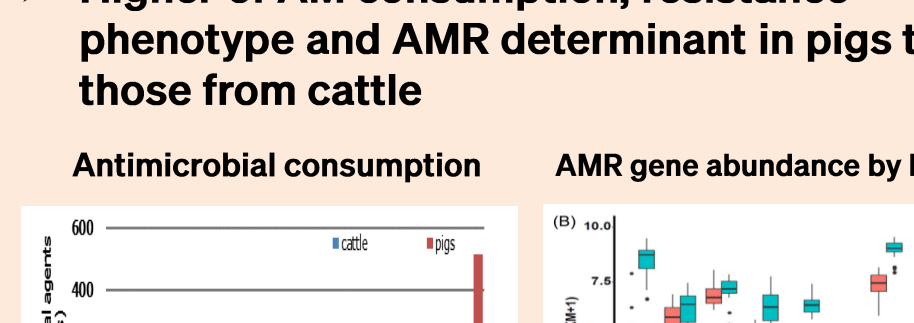


• Colistin resistant *Enterobacteriaceae*

Prevalence of the *mcr* gene from livestock



• Comparisons of CRE isolates from humans and pigs



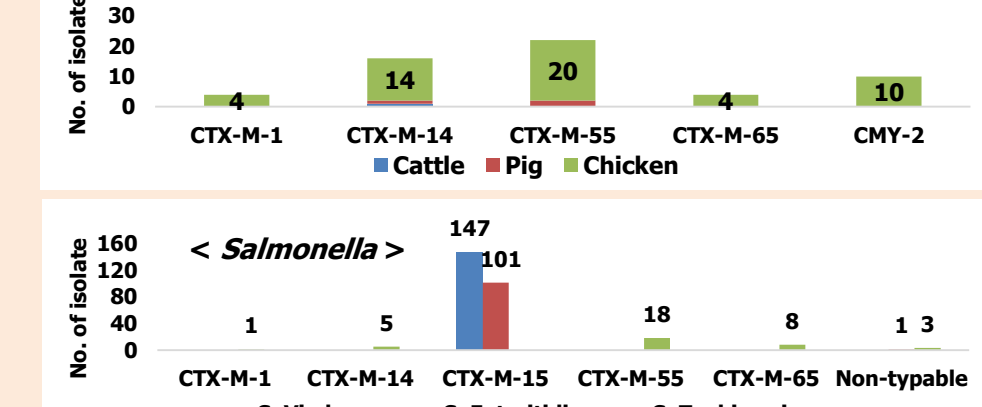
• Resistome of healthy animals

Higher of AM consumption, resistance phenotype and AMR determinant in pigs that those from cattle

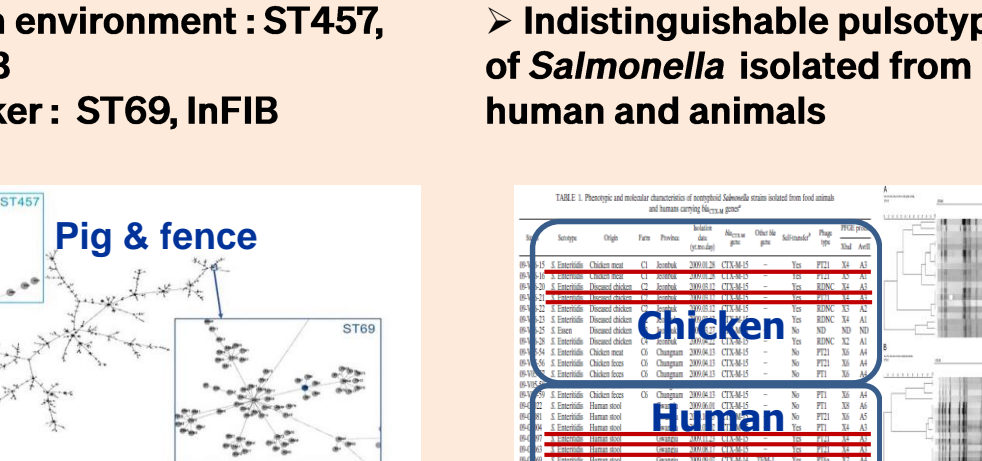


• Genotype

E. coli: CTX-M-55, *Salmonella*: CTX-M15 in chicken

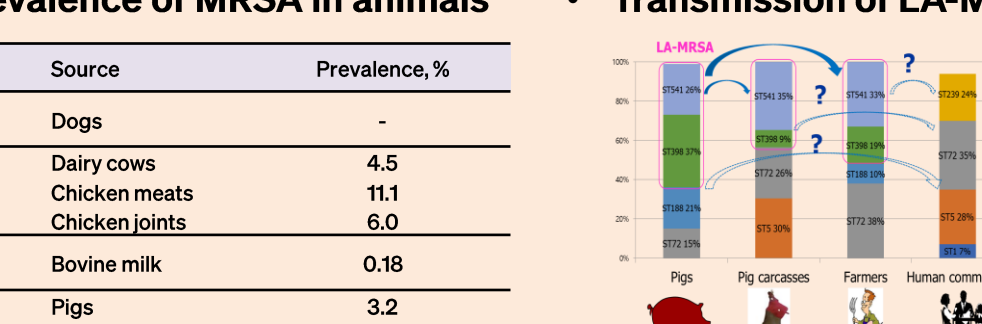


• Indistinguishable pulsotypes of *Salmonella* isolated from human and animals

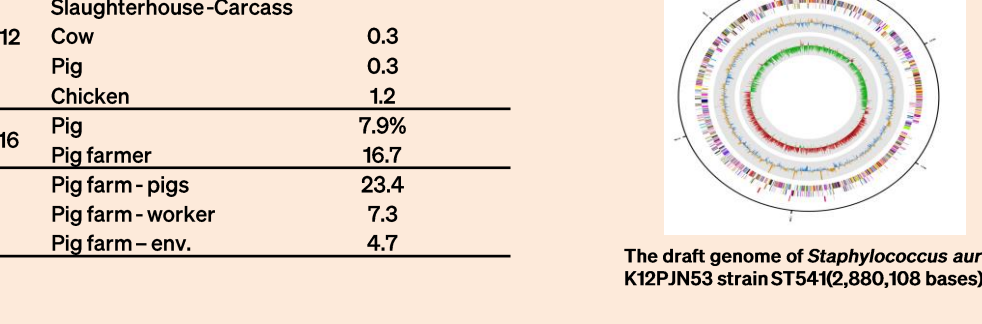


• Methicillin-resistant *S. aureus*

Prevalence of MRSA in animals

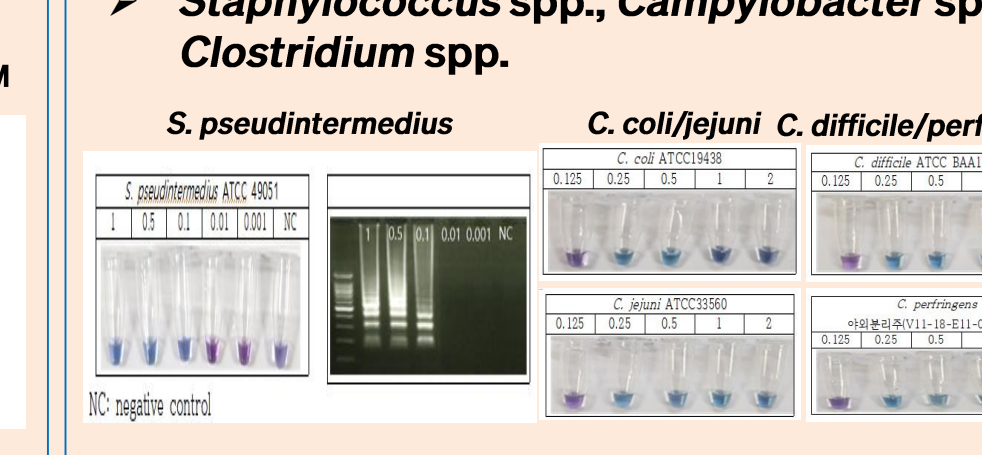


• Transmission of LA-MRSA



• Rapid detection of pathogen

Rapid detection for bacterial pathogen
Qualitative and Quantitative Analysis
Staphylococcus spp., *Campylobacter* spp., *Clostridium* spp.



◆ Development ATA

■ Probiotic/Prebiotic

- Improve gut health, enhance immunity, resistance to disease
- Feed additive as growth promoter
- Method for preparing a probiotic composition for feed to improve body weight gain or immunity
- Complex feed supplement and method for making fermented green tea probiotics
- Manufacturing method of probiotics for feed additives and probiotics manufactured by the method
- New *Bifidobacterium* strain and nutraceutical composition for improving growth comprising the same
- Composition for treating irritable bowel syndrome of companion animals comprising novel *Lactobacillus ruteri* lbr_c1 strain and novel *Lactobacillus acidophilus* lba_c5 strain
- Novel *Pediococcus pentosaceus* SMFM2016-GK1 strain and method for producing fermented meat using the same

■ Phytochemical

- Targets bacteria
- Growth promoter and disease prevention
- Animal feed composition comprising an extract of *Diospyros kaki*
- Antimicrobial composition containing the essential oil of *Rosmarinus officinalis* L. and the conventional antibiotics
- Chicken feed composition and preparing method thereof
- Method for manufacturing subsidiary feeder for livestock containing coffee
- α -Mangostin: A potential antimicrobial agent against *Staphylococcus* spp. in dogs and cats

■ Organic acid

- Targets bacteria
- Growth promoter and disease prevention
- Coated organic acid for feed additive composition, coating method of the organic acid and feed containing thereof
- Poultry fermented additive feed composition containing the novel lactic acid bacteria having anti-pathogenic microorganism and organic matter decomposition activity microorganism
- Eco-friendly feed additive for producing meat with low fat content in livestock meat and rich in essential fatty acids and omega-3 fatty acid among unsaturated fatty acids and manufacturing method thereof

* List of patents for livestock and companion animals in Korea

■ Immune modulator

- Stimulates and enhance host immune response
- Disease prevention
- A composition for modulating the innate immune response of chickens comprising gga-mir-200a-3p, mimics thereof or inhibitors of gga-mir-200a-3p
- Composition for immune enhancement comprising chicken interleukin-26
- Novel *Lactobacillus reuteri* PSC102 strain and use thereof

■ Bacteriophage

- Targets bacteria
- Disease prevention and treatment
- Novel Bacteriophage Having Killing Activity Specific to *Salmonella* selected from Infectious Bacteriophages of *Salmonella Gallinarum*
- Novel Bacteriophage Having Killing Activity Specific to *Salmonella* selected from Infectious Bacteriophages of *Salmonella Enteritidis*
- Method for prevention and treatment of infection of *Salmonella choleraesuis* or *Salmonella Dublin*
- Novel *Clostridium perfringens* specific bacteriophage CP5 and antibacterial composition comprising the same
- Novel *Campylobacter* specific bacteriophage OPT-CJ1 and antibacterial composition comprising the same
- Novel *Vibrio* specific bacteriophage VP4 and antibacterial composition comprising the same
- Novel *Proteus mirabilis* specific bacteriophage PM2 and antibacterial composition comprising the same
- Avirulent modified *Salmonella Gallinarum* strains and pharmaceutical composition using the same

Challenges & Solutions of AMR/ATA research

• Challenge : AMR research

Ensuring Sustainable AMR Research & Financial Issues

- To maintain research continuity, securing continuous funding is essential.

Systematic Data Collection

- AMR data must be collected across humans, animals, and the environment, but current systems are insufficient to provide the AMR information for research.

Lack of multi-sectoral & International Cooperation

- AMR is a cross-border issue, yet collaboration remains limited.

• Challenge : ATA research

Safety & Efficacy Issue

- Alternatives must demonstrate efficacy and safety comparable to existing antibiotics.

Innovative techniques

- A variety of ATAs are currently used in veterinary medicine, but the development of new ATAs requires innovative technologies.

Cost Issues

- The price of ATAs is typically higher than existing antibiotics due to development costs, making farmers reluctant to choose them.

Regulatory challenges

- The lack of regulation and lengthy approval process for new alternatives increase time and costs.

• Solution : AMR research

Securing Sustainable Research Funding

- Develop policies to ensure continuous financial support for AMR research.
- * Multi-sectoral one health research project (2019- 2023, \$ 50 million)

Establishing a Systematic Data Collection

- Develop an integrated, standardized AMR data system.
- * One Health Portal: AMU/AMR data sharing & research exchange

Enhancing Multi-Sectoral & International Cooperation

- Build an multi-sectoral and international network to encourage collaboration.
- * Facilitate personnel exchange between different sectors.

• Solution : ATA research

Collaborative Research

- Validate safety and efficacy through partnerships with universities, institutions, and industry.

Technological Solutions

- Invest budgets and personnel to develop new targets.

Cost Issues

- Develop scalable production technologies to reduce ATA costs.
- Governments can offer financial incentives, subsidies, or grants to farmers.

Regulatory Issues

- Governments should create approval documents for ATAs.
- Develop standardized protocols to test ATA efficacy and safety.

Collaboration opportunities

• Establish regular international ATA conference

Global information exchange

- Sharing research and technological advancements in ATA
- Regulatory Harmonization & Policy Alignment**
- Standardizing ATA approval processes across countries can facilitate smoother market entry

• Asia-Pacific ATA Development project

Research & Innovation Collaboration

- Strengthening global R&D efforts on ATA
- Shared expertise and resources can speed up R&D on ATA
- Cross-border research enhances scientific validation and applicability

