Addressing Antimicrobial Usage in Asia's Livestock, Aquaculture and Crop Production Systems

OSRO/RAS/502/USA

Proceedings of the Consultation Workshop on AMR Surveillance

24 – 25 November 2016

Bangkok, Thailand.

Contents

List of Abbreviations

AMU	Antimicrobial Use
AMR	Animal Health
ATLASS	Assessment Tool for Laboratory and AMR Surveillance System
CU	Chulalongkorn University
ECTAD	Emergency Centre for Transboundary Animal Diseases
FAO	Food and Agriculture Organization of the United Nations
FAORAP	FAO Regional Office for Asia and the Pacific
GLASS	Global AMR Surveillance Systems
OIE	World Organization for Animal Health
USAID	United States Agency for International Development
US CDC	United States Centers for Disease Control and Prevention
WHO	World Health Organization

Background:

Use of antimicrobials in the livestock production industry for therapeutic, preventative, and growth promotion purposes across Asia is widespread. Weak or non-existent regulatory frameworks governing antimicrobial use, sub-optimal enforcement and compliance with existing guidelines, low levels of AMR awareness, and inadequate commitment to responsible antimicrobial stewardship are driving development of AMR. Regionally, AMR mitigation measures in the livestock production industry—from guidelines for prudent use of antimicrobials to monitoring antimicrobial usage (AMU) and enhancing AMR surveillance—lag the human health sector.

Key challenges in addressing AMU and AMR in the livestock production industry of relevance in Asia include following aspects: 1) Sector-specific considerations; 2) Policy, regulatory environment, and harmonization of standards; and 3) Advocacy, awareness raising and compliance.

In consideration of the complex and nuanced operating environment driving AMU and AMR in the livestock production industry in Asia, a multi-track approach is essential to promoting responsible AMU stewardship. One of the outputs expected under the project OSRO/RAS/502/USA Addressing the usage of antimicrobials in Asia' s livestock sector is strengthening technical capacities on surveillance and laboratory diagnosis to detect antimicrobial resistance. Surveillance is a major tool to assist in efforts to address the AMR problem but challenges are ever present in conducting AMR surveillance. Countries are overwhelmed on how to start AMR surveillance as they are already struggling with TADs surveillance. Surveillance capacity must be complemented with laboratory capacity but most several countries in the region do not have this in place.

With these issues in mind, a discussion document on AMR surveillance was developed focusing on need and importance of surveillance, context and basis for designing surveillance, classification and options and recommendations to implement AMR surveillance.

The design of an effective surveillance system depends on the nature of the decisions and actions that will be taken based on the information collected. In the case of AMR, the range of possible

actions is somewhat limited, so it is worth considering them carefully hence a workshop to discuss and agree on the design, approaches and protocols is warranted.

Summary

The consultation workshop on AMR Surveillance was held from 24 -25 November 2016 in Bangkok, Thailand. A total of 36 participants attended the workshop. The 36 comprised of representatives from 10 countries, 16 FAO staff from HQ, RAP and country offices staff, 10 representatives from partners such as the academia, private sector and OIE.

The broad workshop objective was to review the AMR surveillance discussion document and come up with a surveillance plan. Specific outcomes as defined at the commencement of the workshop were:

- To brief the Meeting on the surveillance guidance document on AMR and obtain their views for appropriate adjustment.
- To discuss the practical applications of the surveillance guidance document on AMR
- To agree on the options and protocols to conduct surveillance and diagnosis.
- To plan the implementation of said options and protocolsthis plan with country public health and wildlife authorities

The workshop was structured around presentations of existing activities and developments on AMR surveillance by partners, a survey poster walk on participants' understanding of AMR surveillance as well as resources needed to do surveillance, discussion of the surveillance document developed by Angus Cameron, presentation of surveillance and laboratory protocols and development of plans for AMR surveillance.

A summary of the workshop presented in a diagram was presented in the last session showing the flow from sampling to laboratory testing to database and deciding on the use the data. The data analysis factors into the treatment guidance, promotion of good production practices, policy development and doing a joint risk assessment and how it impacts human health.

1. Introduction

The workshop commenced with a general welcome from Wantanee Kalpravidh, ECTAD Regional Manager. This was followed by an introduction of workshop objectives by C. Benigno, Regional Project Coordinator and expected deliverables by the end of the workshop. She walked through the agenda explaining each agenda item and how each would contribute to coming up with the expected deliverables, namely: an agreement on surveillance protocols and a surveillance plan of action.

The agenda topics are as follows:

- Interactive poster walk
- Report on the tripartite meeting on AMR surveillance
- Presentation of the draft guidance document
- Discussion:
  –Perspectives from the field and the laboratory
  –Options
- Surveillance protocols
- Addressing Challenges
- Way forward: Implementation plan

1.1 Workshop programme

24 November 2016 DAY 1	
0830 - 0900	Registration (30')
0900 - 0915	Opening Ceremony
0915 - 0930	Agenda 1: Workshop introduction and participants' introduction
0930 - 1000	Agenda 2: AMR surveillance activities: partners, countries (poster walk)
1000 - 1030	Group Photo and Coffee Break
1030 - 1100	Summary of the poster walk
1100 - 1130	Update on the Tripartite Meeting on Surveillance
1130 - 1230	Presentation and discussion of the surveillance guidance document
1230 - 1330	Lunch Break
1330 - 1430	Facilitated Discussion including perspectives from the field and the laboratory
1430 - 1530	Options, approaches on AMR surveillance: What is feasible?
1530 - 1600	Coffee break
1600 - 1700	Putting together Day 1 discussion
End of Day 1	

Friday, 25 November 2016 DAY 2

09.00-09.15	Update and progress of day 1
09.15 – 10.30	Surveillance protocols (to include laboratory arrangements)
1030 - 11000	Coffee break
1100 - 1200	Practical challenges and how to address them
1230 - 1300	Lunch
1300 - 1500	Implementation plan discussion
1500 - 1530	Coffee break
1530 - 1630	Way forward Closing

1.2 Workshop Participants

A total of 36 participants attended the workshop. The 36 comprised of representatives from 10 countries, 16 FAO staff from HQ, RAP and country offices staff, 10 representatives from partners such as the academia, private sector and OIE. List of participants appears as **Annex 1.**

2. Worksop sessions

2.1 Session 1 – Interactive Poster Walk

This session was designed to get an idea on the participants' (both countries and partners) understanding of AMR surveillance and the requirements of how it is implemented.

The participants were requested to gauge their understanding of AMR surveillance, to assess how often is AMR/AMU Surveillance is done and list the issues/challenges in doing AMR surveillance. Participants were requested to put their answers on a prepared poster sheet.

The summary findings are as follows:

a. Although most of the participants indicated they are aware of technical aspects of AMR surveillance, very few understood its importance or the necessary operations.

b. How often is AMR/AMU Surveillance done?

   Very few participants indicated they regularly do AMR surveillance in livestock in the region. Several other confirmed that AMR studies in livestock and aquaculture are being undertaken, but with limited geographic coverage (pilot sites only). Further, very few conduct one-time study on AMR in the livestock sector, environment and is also limited to select sites only.

c. Issues/Challenges in doing AMR/AMU Surveillance

   Identified issues that can be addressed nationally:

- Human resource requirements
- Laboratory capacity
- Sharing data across sectors
- Policies/Legislation on AMU and AMR
- Promoting AMU stewardship amongst farmers/producers

Identified issues that can be addressed with external support:

- Protocol development
- Monitoring and Evaluation
- Capacity building
- Laboratory networking
- Regional reference laboratory
- Harmonized laboratory testing for AMR surveillance
- Awareness campaign
- Partnerships
- Policy review framework

The posters appear as **Annex 2**.

2.2 Report on the tripartite meeting on AMR surveillance

A.Patriarchi gave an update on the tripartite collaboration on AMR Surveillance, the highlights of which are the following:

- UN General Assembly called upon the Tripartite to support the development and implementation of national action plans and antimicrobial resistance activities at the national, regional and global levels.
- FAO and its tripartite partners can support national level progress through fostering multisectoral collaboration, develop tools on NAP self-assessment, surveillance; supporting capacity development and developing standards and guidance on best available evidence.
- A meeting on surveillance was organized among FAO, OIE and WHO at the FAO Headquarters during the period 14 – 15 September 2016. The meeting discussed how the data gathering will contribute to a better understanding of how resistance develops and spreads including how resistance circulates within and between humans and animals and through food, water and the environment.
    - A Tripartite Global Platform on AMR/AMU is envisioned but the construction of an integrated surveillance system needs a proper set of data. The complexities of data gathering in the food and agriculture sector were acknowledged.

- The objectives of the tripartite global platform are to gain an overview of national AMU in humans, animals and crops and overview of national AMR patters on the same.
- Currently each organization has its own platforms on AMR/AMU, namely: the Global AMR Surveillance Systems (GLASS) for the public health sector, OIE Database on AMU and the Assessment Tool for Laboratory and AMR Surveillance System (ATLASS). With these tools, the meeting agreed that each organization will compile data relevant to its mandate avoiding overlaps amongst the three organizations. This process is a modest start to having an integrated surveillance on AMU/AMR.

2.3 Presentation and discussion of the surveillance guidance document

A. Cameron, consultant contracted to develop a discussion document on AMR surveillance presented the said document for discussion. The executive summary appears below. Access to the full discussion document can be obtained through this QR code.

Need for antimicrobial surveillance

- There is clear evidence that higher levels of use of antimicrobials leads to increased levels of antimicrobial resistance.
- Some studies have shown that up to three times as much antimicrobials are used for animal production as for humans, (although these levels have been questioned and are inflated using products such as ionophores), representing a major potential driver for the development of resistance.
- The cost of AMR today is huge. For example, in the US it results in over 23,000 deaths per year, and direct costs of up to $20 billion.
- One report has estimated that by 2050, AMR and the resultant inability to treat infections will be a leading global cause of death (10 million per year) and result in a reduction of global GDP of 100 trillion US dollars. Again, this finding is subject to debate, as is the relative contribution of antimicrobial usage in animal.
- Coordinated global action is required to address this problem, which demands an integrated One Health approach.
- Understanding the extent of the problem, and the drivers for development of resistance is essential to taking effective action.
- AMR and AMU surveillance is required for risk assessment and risk management which can inform policy development and decision-making including priority setting.

Context and basis for designing surveillance

- Surveillance systems must be developed to provide the information needed to take action to combat increasing AMR and implement appropriate risk management.

- The surveillance information needs are driven by the control tools available
    - For AMR as a result of clinical usage in humans and animals, the main tool is *antimicrobial stewardship*
    - For non-therapeutic usage, the main tool is *regulation* (either government regulation or industry self-regulation) which includes control at the point of access (such as hospitals, pharmacies, veterinary suppliers and feed mills).
    - Controlling the movement of people, animals or animal products (and other products) carrying organisms with resistant genes may also play a role in preventing spread of AMR
- Stewardship and regulation both require extensive accurate information on the level and distribution of AMR, antimicrobial usage (AMU), but more importantly, the context around AMU including who, when, where, why and to what effect. Enough disaggregated detail is required in order to be able to assess whether use is inappropriate, to be able to develop strategies to combat this and to assess whether the strategies are succeeding.
- For non-therapeutic usage, extensive data is needed to better assess the current levels of usage, the risk it poses for the development of AMR in human pathogens, the potential impact of restricting particular antimicrobials and alternatives available.

Classification of surveillance targets

- Surveillance can be separated into:
    - AMR – in the clinical context (animal and human) through analysis of case-related pathogens
    - AMR – related to non-therapeutic usage (growth promotants, prophylactic and metaphylactic use) based on sampling healthy animals or animal products[1]
        - Sampling can be done at multiple stages including animal feeds, animals on-farm, animals at slaughter, product at abattoirs or processing plants, products at retail
        - Other targets for sampling may include wildlife, crops, and the environment
    - Antimicrobial residues – primarily in animal products but also contamination in other foods and the environment
    - AMU for clinical cases in humans and animals (including companion animals)
    - Non-therapeutic AMU in livestock and agriculture, as well as humans

Weaknesses in current surveillance

- Validity of prevalence estimates in surveillance for AMR in clinical pathogens
    - Human pathogens in particular (but veterinary as well) represent the most direct measure of the threat of AMR, so testing of human pathogens provides the key data source.
    - Almost universally, surveillance for AMR from clinical cases is based on passive reporting
        - Use of laboratory samples
        - Use of sentinel sites (hospitals, clinics, veterinary practices etc.).

    - The main outcome measure of this surveillance is the prevalence of AMR by organism and antimicrobial. Other outcomes include detecting emergence or demonstrating absence
    - Unbiased, suitably precise prevalence estimates are essential to assess the scale of the problem, prioritise actions, and measure the impact of interventions.
    - Current prevalence estimates based on *clinical cases* are almost always statistically completely invalid, based on a sampling approach that is known to be highly biased, using grossly inadequate sample sizes, and with unmeasurable precision. However, collecting samples from clinical cases to detect AMR emergence or absence constitutes passive surveillance and considered still important especially in determining the type of treatment to be given to animals and humans. Active surveillance for food-borne and commensal bacteria are often better designed and are able to provide reliable estimates. Active surveillance also addresses and demonstrates issues at the animal health – human health interface.
    - As a result, in some important areas related to specific pathogens, policy makers are basing decisions and developing programs on unreliable data
    - The reason for this is that there have been no practical ways to apply representative sampling to *clinical cases* of relevant diseases.
    - This issue should be addressed as the highest priority.
    - New developments in surveillance theory and information and communication technology offer effective solutions to this problem and should be assessed immediately.
- Molecular studies
    - Molecular epidemiological techniques can be used to provide valuable data to understand AMR, in particular in relation to the transfer of resistance genes from one population to another.
    - To be valid, these studies should be based on an awareness of the genetic variability of the target populations and should use traditional epidemiological sampling approaches to ensure representativeness and precision.
    - When applied to population-based surveillance, current molecular studies usually lack the sample size or sample selection methodology required to draw conclusions with confidence.
    - Assessment of causation also requires a range of further evidence that is rarely included in such studies.
- Antimicrobial usage surveillance
    - Antimicrobial usage is recognised as a part of an overall surveillance program[2] but is generally neglected and few countries are able to generate anything more than aggregated statistics on average volume used per person or livestock unit.
    - Development of an effective antimicrobial stewardship program will depend on detailed information on why different health providers (physicians, veterinarians, community nurses, para-veterinarians etc.) prescribe antimicrobials, and whether it is appropriate or if there are alternatives.
    - A very small number of countries have centralised prescription databases, but almost none are able to capture the information required at fine enough

resolution to support the evidence-based development of an efficient and highly targeted antimicrobial stewardship program.
    - Again, new surveillance approaches and technology have made this level of AMU data collection possible, as has been demonstrated in Indonesia's iSIKHNAS system.
- Integration
    - The concept of integration is widely used in the AMR world, but with a range of different meanings
    - AMU in both human medicine and agriculture are both driving the development of AMR. It is essential that a One Health approach be taken to surveillance and other activities to address AMR.
    - There is also a need to closely integrate surveillance with response. In almost all current programs, the collection of surveillance data, and the implementation of actions to address AMR (such as training to support stewardship, enforcement of regulation or movement control) are implemented as independent activities. In order for both to be effective, they must be integrated within a holistic approach. The report provides examples of how this could operate in practice.
    - Data integration is required so that the development of resistance can be understood in the context of usage, and that usage can be understood in the context of the suspected diagnosis, as well as the skills and level of training of the prescriber. This includes integration ARM data generated to inform individual case treatment, as well as surveillance for food safety purposes.
    - International integration is also important. AMR should be considered in a similar way to an analogous global threat – global warming and climate change. The actions of one group in one country can threaten the future availability of antimicrobial resources for all on the planet. International data sharing, support, harmonisation of programs and technical collaboration are all important to successfully address the problem.

Current strengths and opportunities

- AMR surveillance for non-therapeutic usage
    - Active surveillance for AMR has built on many years of experience in on-farm, abattoir or product sampling methodologies used by veterinary services for management of disease, food safety and other reasons. As a result, these programs often have the capacity to use epidemiologically sound sampling strategies and generate unbiased estimates of known precision.
- AMU
    - Some systems exist (such as in Denmark) for complete disaggregated capture of prescribing data in livestock and humans. This offers a model for other countries. Global and regional systems for human and animal health exist (WHO, OIE, EU) but generally capture aggregated data.
- Integrated systems
    - Some models exist for fully integrated systems, including iSIKHNAS in Indonesia, which demonstrates how many of the current problems with AMU and AMR surveillance globally may be addressed.

Surveillance options and recommendations

- A range of different options are available to implement the different types of surveillance required for an integrated One Health AMR/AMU surveillance program
- The main differences between the options presented are
    - Validity and usefulness of the data collected
    - Cost
    - Practicality of implementation in the target regions of South and Southeast Asia
- Current low-cost approaches are often not able to support the needs of effective control, and high-cost systems implemented in developing countries are unlikely to be feasible in the target regions.
- New approaches are required to achieve the volume and quality of data required at appropriate costs.

Target pathogens and antimicrobials

- Each country should develop its own lists of combinations of target indicator organism or pathogen and antimicrobial combinations for surveillance
- For global and reginal harmonisation, this list should be based on the recommendations of WHO and OIE
- Common organisms for inclusion in such a program are *Campylobacter*, *Salmonella*, *E. coli* and *Enterococcus*
- Further combinations may be added depending on local need and capacity
- There is also an important requirement for early detection of emerging problems. To achieve this, the program must make allowance for testing of combinations not on the list, where there is a suspicion of clinically significant AMR

Organisation and coordination

- Nationally coordinated multi-stakeholder programs are required
- While different organisation models may be appropriate in different countries, any approach must ensure that both private and public stakeholders (across human, animal and environmental health) contribute financially to the program, and have shared decision-making power.
    - One approach that has been shown to be effective for this type of organisation is a company structure in which all private and public stakeholders are shareholders (e.g. Animal Health Australia, which has responsible for coordination of national surveillance and disease control programs).
    - Structures are required to ensure that the involvement of the private sector does not bring with it limitations of access to data or the perceptions of conflict of interest.

Laboratories

- To meet the epidemiological requirements to provide data to support reliable evidence-based decision making, there is a need to move the emphasis from using very detailed expensive tests (e.g. genomic approaches) to focusing on processing much higher volumes of meaningful samples from the right sources.

- While the latest tests and automated systems may be appropriate for developed countries, they are difficult to implement and hard to sustain in developing country laboratories and the high set-up and training costs are at the expense of sample volume
- In the target region, there is a need to strengthen basic capacity for isolation and identification of organisms.
- Hierarchical networks should therefore be established or strengthened consisting of
    - A regional reference laboratory, capable of the most sophisticated tests and responsible for regional quality control
    - A national reference laboratory in each country, with a similar role but more limited tests
    - Local laboratories that do the vast bulk of the routine testing, using existing equipment, staff and procedures at high volume.
- An alternative model would be to centralise AMR testing in one or a small number of reference laboratories within the region. National and local laboratories would be responsible for primary isolation before passing on samples to the reference laboratories for AMR testing.
- The most robust, least expensive, high volume test currently available for use in local laboratories in the target is the disk diffusion test, and it is recommended that this be used as the foundation for assessing AMR in clinical cases. For active surveillance, it is necessary to estimate trends in the minimum inhibitory concentration (MIC), and this is best done using the agar or both dilution tests. These tests are feasible but currently much less widely used in the target regions. In general, only new or unusual specimens being referred to reference laboratories for further investigation.
- There is a strong need to ensure that procedures, measurements and interpretations adhere to national, regional and global standards. It is recommended that a single leading global standard be nominated as the regional standard for South and Southeast Asia (e.g. CLSI), and that all new training be based around this standard, while labs using existing standards progressively shift to the single regional standard.

Program Evaluation and Monitoring

- The use of standardised tools for transparent evaluation of laboratories and surveillance activities are useful, both to compare between laboratories and countries, and to assess progress.
- Summarising many complex factors into a simple series of figures and graphics is appealing but risks missing some of the subtle details.

2.4 Exercise on Objectives, Prioritization and Approaches

2.4.1. Participants were divided into country groups to discuss the objectives of AMR surveillance. Five groups were formed, namely: Indonesia, Vietnam, Cambodia/Lao PDR, Bhutan/SAARC and Singapore/Philippines/Thailand/ASEC.

The objectives varied as follows:

- To obtain information on prevalence and patterns of AMR
- To identify risk of AMR for humans and animals

- To obtain information on AM usage and purpose of usage in farms
- To determine which antibiotics are resistant

2.4.2. Prioritization

A.Cameron presented the various factors in considering how to prioritize areas AMR or AMU surveillance

2.4.2.a. Where to start?

- AMR – clinical cases
- AMR - general population
- Residues
- AMU – therapeutic
- AMU – non-therapeutic

2.4.2.b. Balance

- Importance: Does it help solve the problem?
- Practicability: Are the skills, time and human resources available?
- Cost: Can we afford it:
- Integration: Do similar programs already exist:
-

2.4.2.c. The participants then were asked to prioritize the surveillance based from the above and the approaches they would need to take to implement the surveillance. From the group discussions of the proposed basic program would involve a) AMR surveillance of the general population involving active surveillance and mostly samples collected at abattoirs, markets and farms, b) AMR surveillance in clinical cases which is passive surveillance dependent on laboratory submissions c) AMU surveillance which involves high level, aggregated data from importer, distributors, feed companies and d) residues which involves integrated active surveillance.

An advanced program was also proposed which involves the same types as above except that under the AMR surveillance in clinical cases, there is a real-time case selection and under AMU surveillance, disaggregated usage data from farmer, veterinarian level will be generated.

2.4.2.d. Country/regional groupings identified their specific approaches, as follows:

- Indonesia will conduct passive surveillance from clinical cases and active surveillance riding on their food safety programme. Coordination with the Ministry of Marine and Fisheries will be done. Usage data will be captured by ISIKHNAS.
- Vietnam will finalize its National Action Plan and seek approval from MARD. Once approved, this will be the jump off point of activities that includes surveillance, capacity building, etc.
- ASEAN and SAARC will implement the basic programme through a regional approach.

2.5 Surveillance protocols

S. Simjee gave a summary of the minimum requirements for a laboratory to fully function and support surveillance. The following areas must be considered by countries in setting up a fully functional laboratory:

- Staff training
- Sample storage
- Transport of samples
- Traceability: animal data
- Laboratory equipment and supplies to be used and maintained: water bath, autoclave, pipettes, media
- Tests to be conducted
- CLSI
- IT support
- Database

He also shared some sample protocols. The meeting agreed that Chulalongkorn University (which has an LOA with FAO on laboratory assessments and training) would assess and adjust these according to the regional situation.

2.6 Addressing Challenges

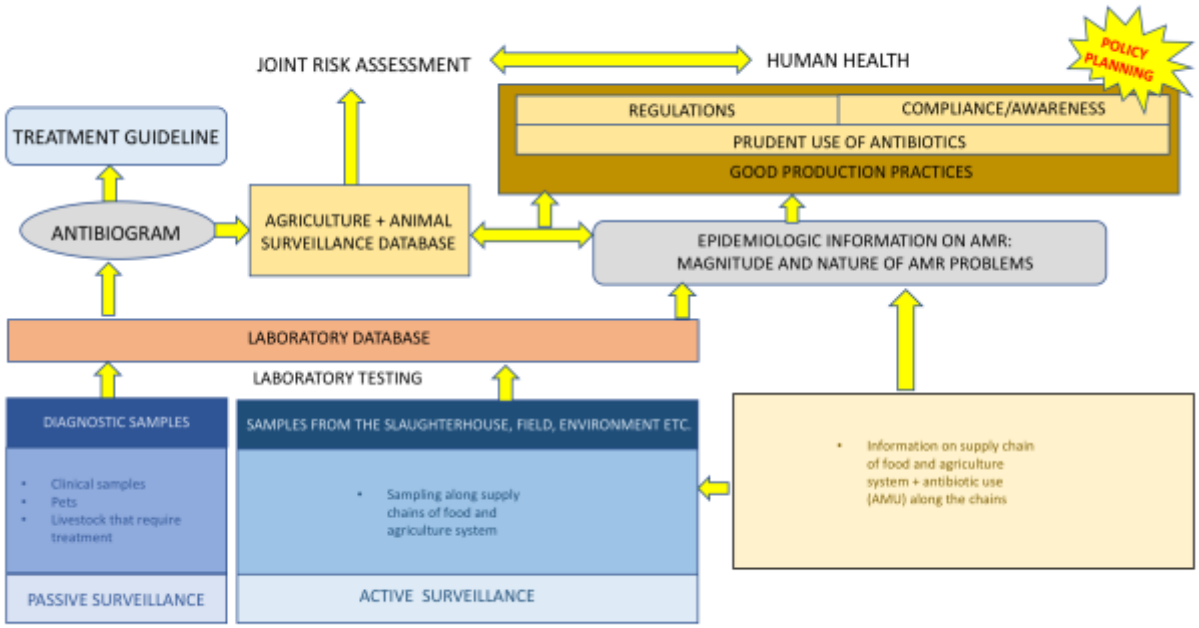
There are varying laboratory capacities in the countries of the region hence putting those with limited capacities at par with the rest would need to be addressed. Laboratory assessments through the ATLASS will be conducted by CU initially in selected countries and then rolled out to other countries. The results could indicate how the countries should maintain or level up in terms of AMR surveillance and laboratory capacities. CU would then conduct a regional training and in-country trainings, as needed.

Since surveillance will push through already, various modalities on testing samples were discussed. For instance, in countries with limited capacities, laboratory work could start from collection, detection and isolation and characterization can be done through the assistance of CU. For countries with regional laboratories and one or two national laboratories, sample collection, detection and isolation can be done at the regional laboratories while characterization can be done at their national laboratories. These modalities will make for efficient use of resources.

Indicator organisms were also discussed and the meeting agreed to focus on four indicator organisms that have an impact on human health, namely: Salmonella, E. coli, Campylobacter and Enterococcus. Other organisms could be tested when doing passive surveillance for treatment guidelines and animal welfare considerations.

3. Way Forward

The participants agreed on the surveillance framework below where objectives of surveillance must be laid out and that decisions and actions on what to do from the surveillance results should be of primary concern. The countries will do active surveillance mainly but will be mindful of passive surveillance in clinical cases. All samples to be tested and result generated thereafter will go through the laboratory database. The data will be used to develop an antibiogram and to be used for epidemiologic information on AMR. All the analysis then would trigger some forms of action, namely: assessing treatment guidelines, promotion of good production practices, policy planning, development and implementation, or joint risk assessment.



4. Conclusions

The following points were agreed upon by the Meeting:

a. Pilot surveillance will commence in 2017. FAO will support countries willing to undertake AMR surveillance if countries agree that data from this activity will be shared and presented during the PMAC 2018.

b. Surveillance and laboratory assessments will commence in the first and second quarter of 2017 in selected countries. This will then be rolled out to other countries where they can do self-assessments and monitor their progress.

c. Regional training will be held on the third and fourth quarter of 2017 and in-country trainings can be conducted in countries needing closer support.

d. Protocols and other guidelines will be reviewed and revised by FAO RAP and Chulalongkorn University as surveillance activities are underway since lessons and experiences will be documented and would be valuable inputs in revising the guidelines.

e. Establishment of a coordination meeting on AMR or an AMR Technical Advisory Group will be explored.

Annex 1: List of participants

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Annex 2: Posters on Understanding AMR Surveillance, AMR Surveillance activities, Issue and Challenges