Food and Agriculture Organization of the United Nations

INTEGRATED REGIONAL PROJECT IN ANTIMICROBIAL RESISTANCE

Assessment of antimicrobial resistance risks in six Latin American countries

2019–2021

Summary report

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1 Introduction

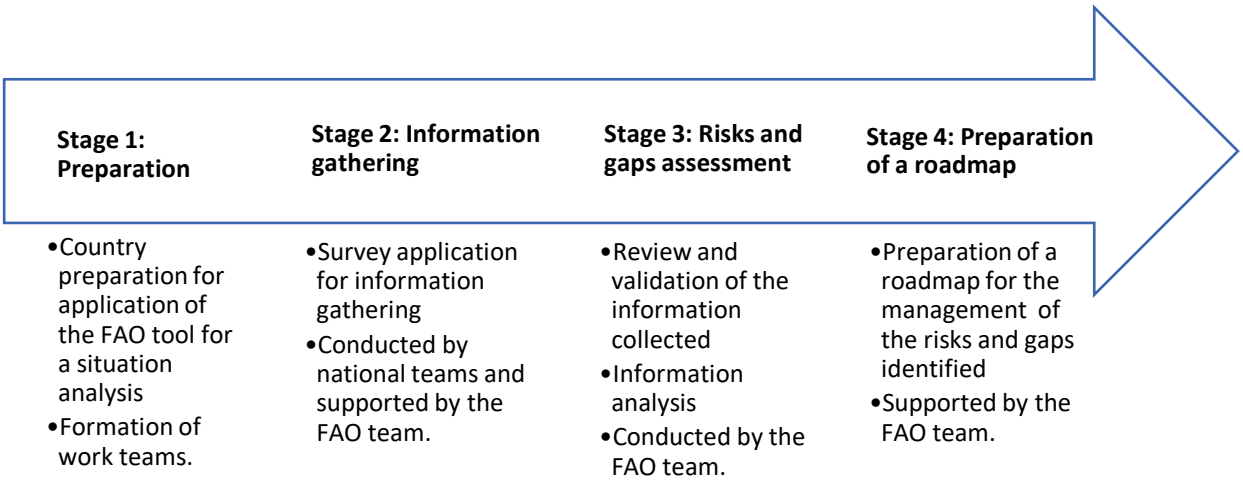
In 2019, FAO launched the Integrated Regional Project (TCP/RLA/3708 and OSRO/GLO/812/NOR) in four countries of Latin America. The objective of the project was to design and adopt antimicrobial resistance (AMR) containment strategies based on the existing risks in terrestrial and aquatic animal production. The strategies were to be accompanied by technical and regulatory support, as well as the expansion of risk communication capacities.

One of the project outcomes is a qualitative assessment of the risks of AMR in terrestrial and aquatic animal production systems, using the *FAO tool for a situation analysis of AMR risks in the food and agriculture sectors*, developed by the FAO Regional Office for Latin America and the Caribbean (RLC). The aim of this tool is to provide a qualitative and systematic assessment of the risks and gaps related to AMR at the national level.[1] Such risks and gaps concern animal production systems (terrestrial and aquatic species), that can affect both animal and human health. The assessment, as well as the results the tool provides, are based on factors and subfactors that contribute to the generation and spread of AMR.

The tool consists of three main instruments, which were applied in four stages with the support of the FAO team (Figure 1):

i. survey: data collection for a situation analysis of AMR risks;
ii. methodological procedure for the analysis of information obtained through the survey; and
iii. instructions for the preparation of a national roadmap for the containment of AMR. The roadmap includes guidance for the prioritization of needs and sectoral actions consistent with the characteristics of the productive, health and institutional systems in the countries. The roadmap also aligns with the national action plan on AMR.

Figure 1. Stages for the application of the FAO situation analysis tool



Source: Elaborated by the authors.

[1] From the use of antibiotics in animals.

The survey and the risks and gaps assessment consider the following risk factors (Table 1):

Table 1. Risk and sustainability factors for AMR from animal production

Risk factor ([1])	Sustainability factors ([1])
▪ Characterization of animal production system (1)[2] ▪ Sanitary conditions in animal production (3)[2] ▪ Farming practices in animal production (12)[2] ▪ Practices of antibiotics use in food producing animals (14)[2] ▪ Feed practices (20)[2] ▪ Environmental management practices (11)[2] ▪ Consumption of food of animal origin (2)[3] ▪ Consumption of food of animal origin contaminated with bacteria (1)[3] ▪ Consumption of food of animal origin contaminated with antibiotic residues (1)[3] ▪ Direct contact with food-producing animals and animal products (1)[3]	▪ Antibiotic use surveillance (7) ▪ AMR surveillance (18) ▪ Institutional governance of One Health and the agrifood sector (36) ▪ Communication, awareness and training (23) ▪ Research and innovation (2)

Source: Elaborated by the authors.

Notes: [1] Number of risk subfactors.

[2]Evaluated in animal health and human health.

[3]Evaluated only in human health.

Through the Integrated Regional Project, the tool was initially deployed in four beneficiary countries from Latin America. However, thanks to a no-cost extension provided by the Norwegian Agency for Development Cooperation (NORAD) until May 2021, two more countries from the region were included. All countries applied the four stages of the tool (Figure 1). Two countries in Africa also piloted the tool.

2 Results

A summary of the results following the application of the tool in the six Latin American countries is outlined below. To respect the privacy of country information, the results are presented as aggregated data.

The contents are organized in four sections: 1) the information gathering process; 2) the characterization of the animal production system; 3) the assessment of AMR risks for intensive production and family farming; and 4) the identification of gaps in the sustainability of the system.

2.1 Information gathering process

Information gathering was conducted over a period of two to three months. Each National Focal Point was responsible for the coordination and consolidation of the information requested. More than 130 professionals from the public and private sectors and academia participated in this stage.

Five countries applied the tool to the seven selected species (broiler chickens, laying hens, pigs, beef cattle, dairy cattle, fish, and crustaceans). For internal reasons, one country preferred to apply the tool to only three out of seven species. Four out of six countries gathered information from family farming.

2.2 Characterization of the animal production system

The information about the number of animals, animal production establishments and slaughterhouses within a country is vital to identifying available information and the population at risk of AMR.

The most significant species for all countries – in relation to the animal population, number of animal production establishments and number of slaughterhouses – were broilers, laying hens and cattle (beef).

Country livestock production is destined for domestic consumption and export. Family farming was considered an important sector in most of the countries surveyed.

2.3 Risk assessment and gap identification

2.3.1 Risk assessment

The following sections present results for each of the assessed risk factors. Risk factors (Table 1) are composed of risk subfactors. The probability of risk and the effectiveness of the associated mitigation measures are evaluated for each risk subfactor.

For the purposes of this report only those risk subfactors with significant gaps are mentioned. A gap is identified when the assessment of the risk subfactors results in high or moderate final risks. The

lack of information or no answer are considered as having a high probability of occurrence or a low effectiveness, depending on whether it is a risk subfactor or a mitigation measure, respectively. Results are provided independently for intensive animal production and family farming. Table 2 shows a summary of the main subfactors with risks and gaps in the countries assessed.

Table 2. Main subfactors with risks and gaps in six Latin American countries assessed

Risk factor	Risk subfactor	
	Intensive animal production	**Family farming**
Sanitary conditions	· Presence of infectious agents	· Presence of infectious agents
Farming practices in animal production	· Registration of animal population · Diagnoses carried out by an authorized health professional or technician · Application of internal and external biosecurity measures · Application of animal welfare measures	· Registration of animal population · Access to veterinarian assistance or other authorized health professional · Diagnoses carried out by an authorized health professional or technician · Application of biosecurity measures
Practices of antibiotics use in food producing animals	· Antibiotics used (list of) · Level of dependence of the animal production system on the use of antibiotics · Administration of antibiotics supported by a prescription from a legally qualified person or veterinarian · Prescription of antibiotics accompanied by instructions · Purpose of the use of antibiotics (therapeutic, preventive, growth promoter) · Observance of withdrawal periods	· Use of authorized antibiotics points of sale · Decisions on the use of antibiotics made by a legally qualified person or veterinarian · Administration of antibiotics supported by a prescription from a legally qualified person or veterinarian · Prescription of antibiotics accompanied by instructions · Use of antibiotics following recommendations made in the prescription · Use of damaged, expired or contaminated antibiotics · Use of antibiotics following the recommendations made by the manufacturer · Purpose of the use of antibiotics (therapeutic, preventive, growth promotion) · Observance of withdrawal periods
Feed practices	· Production of medicated and non-medicated feed on separate processing lines · Decision to use antibiotics made by a legally qualified person or a veterinarian · Manufacture of medicated feed with antibiotics supported by a legally qualified person or a veterinarian	· Use of medicated and non-medicated feed (single subfactors assessed)

Risk factor	Risk subfactor	
	Intensive animal production	**Family farming**
	· Prescription of medicated feed with antibiotics accompanied by instructions and following manufacturer recommendations · Purpose of medicated feed · Use of antibiotics authorized and registered by the national competent authority · Registration of the application of medicated feed	
Environmental management practices	· Disposal of guano/manure and slurry (in the farm) · Disposal of dead animals (in the farm) · Disposal of antibiotics and antibiotic containers (in the farm) · Disposal of dead animals in slaughterhouses	· Disposal of guano/slurry · Disposal of dead animals · Disposal of antibiotics and their containers
Consumption of food of animal origin	· Amount of food consumed	· Amount of food consumed
Consumption of food of animal origin contaminated with bacteria	· Consumption of food potentially contaminated with bacterial agents	· (Not assessed)
Consumption of food of animal origin contaminated with antibiotic residues	· Consumption of food of animal origin potentially contaminated with antibiotic residues	· (Not assessed)
Direct contact with food-producing animals and animal products	· Number of people who work in direct contact with animals or their products	· Number of people who work in direct contact with animals or their products
Sustainability of the system	· Antibiotic use surveillance · AMR surveillance · Institutional governance of One Health and the agrifood sector · Communication, awareness and training.	

Source: Elaborated by the authors.

2.3.1.1 Intensive animal production

Sanitary conditions (animal health)

In this assessment, the main diseases driving the use of antibiotics are listed according to their frequency, resulting in relevant information for AMR management. It also revealed the existence of infectious agents, with risks for both animal health and human health.

There are similarities between the most prevalent agents identified for each species in each country. Most of the agents reported do not belong to the diseases that require mandatory notification in the country. This lack of notification can hinder estimates of their frequency and distribution by official veterinary services. The public sector customarily focuses on exotic, transboundary or emerging infectious agents, while endemic diseases are managed only by the private sector. Some of the declared agents controlled with antibiotics are viral or parasitic. This practice denotes a misuse of antibiotics.

The results present the assessment of the risks of AMR from animal production systems (terrestrial and aquatic species) to animal and human health, respectively. They show that the species with the highest levels of risk for animal health are broiler chickens, laying hens, pigs, and crustaceans. For human health, broiler chickens, which is one of the most important foodstuffs of animal origin in the human diet, show the highest levels of risk.

Farming practices in animal production

Twelve risk subfactors were evaluated. The subfactors with the largest gaps were: the registry of animal population; the lack of diagnoses carried out by an authorized health professional or technician; the application of internal and external biosecurity measures; and the application of animal welfare measures.

The use of records constitutes the starting point for good sanitary management and influences practices around the use of antibiotics. The diagnostic decision is a specialized and complex activity that must consider several technical aspects (clinical, epidemiological and pharmacological, as well as diagnostic) that are exclusive to a veterinarian. Overlooking these elements can cause inefficient treatment affecting animal health, and consequently AMR generation and spread. Biosecurity measures are of significant importance in this regard, preventing the entry and dissemination of diseases. Animal welfare is also considered an important element for animal health, as its adequate application contributes to reducing the risk of AMR.

Although all productive species revealed gaps related to the farming practices factor, pigs, crustaceans, poultry and cattle particularly stand out.

Practices of antibiotics use in food producing animals

Fourteen subfactors were assessed. Most of these have important gaps in at least one of the seven species evaluated.

Antibiotics used (list of) is one of the risk subfactors with the largest gaps.[2] Most antibiotics identified in this survey are classified as "critically important" by the World Organization for Animal Health (WOAH) List of Antimicrobial Agents of Veterinary Importance; and as "very important" or "critically important" based on the WHO List of Critically Important Antimicrobials for Human Medicine.

Another subfactor with major gaps is the level of dependence of the animal production system on the use of antibiotics. High levels of dependence indicate the importance of antibiotics for terrestrial and aquatic animal production systems, highlighting a potential risk of AMR and the need for a rational and prudent use of antimicrobials.

The administration of antibiotics supported by a prescription from a legally qualified person or veterinarian, as well as the prescription of antibiotics accompanied by instructions, are two more relevant risk subfactors that the countries identified. The first justifies and supports the use of antibiotics; the second contributes to the use of these drugs in proper treatment.

The purpose of the use of antibiotics, whether therapeutic, preventive – for prophylaxis or metaphylaxis – or as a growth promoter, stands out as a risk subfactor of concern. In some species,

[2] This subfactor relates to type of antibiotics used in the production system.

the countries identified the use of antibiotics for growth promotion. The application of antibiotics in sub-therapeutic doses increases the risk of generating and disseminating AMR.

Another significant risk subfactor is the observance of withdrawal periods. A lack of compliance with the withdrawal period could lead to the commercialization of products containing antibiotic residues, with ensuing consequences for human health.

The risk subfactors detected for the use of antibiotics are notable in all productive species evaluated, but particularly relevant in crustaceans, pigs, broiler chickens and laying hens.

Feed practices

Feed is one of the main ways of administering antibiotics in birds, pigs and aquatic species. Medicated feed is the most significant problem observed in the feed practices risk factor. Many of the risk subfactors outlined are similar to those identified in the use of antibiotics.

One gap lies in the failure to produce medicated and non-medicated feed on separate processing lines, which increases the probability of marketing non-medicated feed contaminated with antibiotics.

Other risk subfactors with relevant gaps include: the decision to use antibiotics made by a legally qualified person or a veterinarian; the manufacture of medicated feed with antibiotics supported by a legally qualified person or a veterinarian; and the prescription of medicated feed with antibiotics accompanied by instructions and following manufacturer recommendations. The lack of these practices compromises proper application of treatment and its efficacy.

The purpose of medicated feed, whether therapeutic, preventive (for prophylaxis or metaphylaxis) or as a growth promoter, as well as the observance of withdrawal periods in terrestrial species, all emerge as risk subfactors, as seen in the use of antibiotics.

Another risk subfactor with gaps is the use of antibiotics authorized and registered by the national competent authority. This represents a significant risk, not only because it calls into question the efficacy of the products, but also distorts and hinders any estimation of the amount of antibiotics used in animal production.

Further gaps are evident in the maintenance of a registry that records the application of medicated feed in animal production systems. The maintenance of records is important for an adequate application of all antibiotic treatments and should be accompanied by self-declaration or audits by the relevant authority.

The species with the highest level of gaps are broiler chickens, laying hens and pigs. These species are significant consumers of both medicated and non-medicated feed.

Environmental management practices

Environmental management practices include the disposal of organic, chemical and physical residues from animal production establishments, feed production establishments, and slaughterhouses and food processing plants of animal origin.

The main risks identified are associated with the primary production (at the farm level) and secondary production (processing) of foods of animal origin.

At the farm level, the assessment highlights a lack of methods for the elimination of guano/manure and slurry. These products are often used as fertilizer in pastures and agricultural production, or in many cases discarded in the environment without previous neutralizing treatment. Another important risk subfactor in animal production establishments is the disposal of dead animals, which represents a risk for environmental contamination, as well as an exposure risk for animals and humans. Similar shortcomings in the disposal of antibiotics and antibiotic containers could be related to the complexity and cost associated with proper farm management – for example its removal by a specialized company.

In secondary production, one important risk is the elimination of dead animals in slaughterhouses. These animals could contain significant bacterial loads, and thus act as sources of contamination and exposure for the environment and for people who come into direct or indirect contact with them.

Risk subfactors associated with environmental management practices are evident mainly in crustaceans, pigs, broiler chickens and laying hens. Cattle and fish production also present significant gaps for this risk factor, albeit to a lesser extent.

Consumption of food of animal origin

The consumption of food of animal origin represents an exposure risk for human health, in which the level and practice of consuming these foods are important risk subfactors.

The significant consumption of poultry products (poultry meat and eggs) and dairy cattle reflects the importance of the exposure risks for human health.

Trends in consumption may guide the design and implementation of measures for AMR management.

Consumption of food of animal origin contaminated with bacteria

Due to the detection of contaminated food, and/or the lack of surveillance programmes for foodborne diseases that would enable its evaluation, gaps associated with the consumption of food potentially contaminated with bacterial agents stand out in broiler chickens, pigs, beef cattle, dairy cattle, and fish. This situation is often worsened by a lack of adequate mitigation measures, in cases where official slaughter control and processing systems for foods of animal origin may have limited coverage.

It is important to note that a proportion of the food of animal origin that is consumed comes from imports. This type of food must therefore be subject to adequate controls to ensure its safety.

Consumption of food of animal origin contaminated with antibiotic residues

The consumption of food of animal origin potentially contaminated with antibiotic residues was detected in broilers and fish. As in the previous case, this situation may be caused by the missed detection of contaminated food, or the shortage of programmes for the surveillance of antibiotics in food.[3]

[3] The lack of surveillance programmes is considered a gap by the tool's methodological procedure.

Direct contact with food-producing animals and animal products

The number of people who work in direct contact with animals or their products is complex information to obtain, as this information was not submitted by most countries. This is the main reason for the gaps detected, especially in broiler chicken, pigs and cattle. Deficiencies in the application of good practices in animal production establishments, slaughterhouses and processing plants could effectively constitute a risk for the people who work in such environments.

2.3.1.2 Family farming

Family farming requires policies and programmes that are differentiated, as well as elaborated and implemented in an effective manner, and that respond to the sector's specific characteristics/needs.

Sanitary conditions

There are similarities between the most prevalent agents identified for each species in each country. In some cases, the declared diseases are viral or fungal, and these should not be treated with antibiotics.

Difficulties in obtaining this information were particularly apparent in the aquatic sector.

Farming practices in animal production

Six of eight subfactors presented important gaps in terrestrial animals. Subfactors with important gaps in terrestrial and aquatic species were: registering the animal population; accessing the assistance of a veterinarian or other authorized health professional; ensuring a diagnosis was made by an authorized health professional; and the application of biosecurity measures.

The importance of benefiting from the assistance of a veterinarian or technical specialist in family farming should be noted. Such assistance will guide producers in the application of measures that can help prevent sanitary situations with minimum economic expense.

Practices of antibiotics use in food producing animals

Most of the risk subfactors assessed presented gaps, both in terrestrial and aquatic species.

Risks related to the use of antibiotics are associated with the following subfactors:

- use of authorized selling points for antibiotics (only terrestrial species);
- decisions on the use of antibiotics made by a legally qualified person or veterinarian;
- administration of antibiotics supported by a prescription from a legally qualified person or veterinarian;
- prescription of antibiotics accompanied by instructions for their use (only terrestrial species);
- the use follows recommendations made in the prescription;
- using damaged, expired or contaminated antibiotics;
- the use follows the recommendations made by the manufacturer;

- the purpose of using antibiotics, whether therapeutic, preventive (for prophylaxis or metaphylaxis) or as a growth promoter; and
- the observance of withdrawal periods (only terrestrial species).

Many of these risk subfactors are the same as those identified for intensive animal production.

Feed practices

Both terrestrial and aquatic species in family farming use concentrated feed and, when necessary, concentrated medicated feed. Without the proper management and mitigation measures, these practices can pose a risk to animal and human health.

Environmental management practices

All of the subfactors evaluated in family farming presented gaps. It is important to address both organic residues (guano/slurry, dead animals) and chemical residues (antibiotics and their containers). The former may contain high concentrations of microbiological agents; the latter are a direct risk for the environment and convey secondary implications for animal and human health.

The disposal of chemicals (antibiotics and their containers) is not a common practice for family farming. In some cases, the remoteness and isolation of family farming systems can hinder the establishment of proper removal practices.

Consumption of food of animal origin

Although the countries mentioned that food from animal origin is consumed cooked (thereby reducing the risk of consuming food contaminated with resistant agents), the preceding analysis shows that there are relevant risks in the production chain of those foods. This implies a need to implement and reinforce relevant programmes throughout the production system (e.g., good productive practices, biosecurity, environmental practices, etc.).

Direct contact with food-producing animals and animal products

While not all countries were able to obtain information regarding the number of people working in family farming, it is an important number in some countries. Direct contact could represent a significant risk for those people and their families, considering the gaps detected in both terrestrial and aquatic species. This is even more probable bearing in mind the deficiencies in the application of good practices and the permanent contact with animals.

2.4 Identification of gaps in the sustainability factors of the system

Sustainability constitutes the common foundation on which terrestrial and aquatic animal production systems rest (Table 1). It is founded on those crosscutting measures necessary for the containment of AMR. The general characteristics of the sustainability component apply to the entire production system, regardless of its size and species.

Important gaps were observed in these cross-cutting factors related to the generation and dissemination of AMR: surveillance of antibiotic use, AMR surveillance, governance and the

communication of risks, as well as the awareness and training associated with the system's sustainability factors.

3 General recommendations

Addressing AMR involves significant and complex actions (policies, regulations, evidence and capacity building, among others). Private-sector collaboration in activities carried out by the public sector to reduce risks is essential for the purposes of compliance. Indeed, the public sector has a large number of technical and budgetary challenges that make it difficult to prioritize AMR, particularly in the agricultural sector.

With this scenario and the results obtained from the application of the tool, the following general recommendations are provided to guide country work in management of AMR:

- Public policies should be developed in coordination with the public and private sectors. The effectiveness of any public policy requires a high level of consensus with the private sector in terms of its design, regulation and implementation. The independent evaluation of family farming highlights the need for differentiated, tailored policies and programmes.
- The ability to generate and implement appropriate regulation is very important for the application of satisfactory public policy. Its success depends not only on its preparation, but on the technical and economic evaluation of the policy, as well as on the capacity for implementation. Measures should be monitored and fine-tuned to ensure their effectiveness.
- The measures implemented should be based on the best evidence available.
- Mitigation measures should be prioritized and developed in a progressive manner, based on risk, available resources, and in collaboration with the private sector and with the involvement of other stakeholders.
- The management of AMR should be multidisciplinary and multi-institutional, to involve the highest level of commitment from the relevant national services, since it requires not only resources but important medium- and long-term decisions.

4 Conclusions

The countries involved in the assessment took an active part in every stage set out by the tool methodology. The information gathering process collected data that was either disaggregated or difficult to access. The tool therefore revealed apparently non-existent information through the estimation of data, obtaining a baseline of the AMR situation in animal production.

The tool provides an evaluation of the factors involved in the epidemiological pathways of AMR, the mitigation measures associated with these pathways, and the sustainability aspects of the system that are connected to the generation and dissemination of AMR from the animal production chain. It considers all the actors involved in this process.

The use of the tool contributes to enhanced participation between the different stakeholders involved in the animal production chain by: understanding and raising awareness of the risks derived from AMR, increasing the participatory and collaborative intersectoral work in the public and private sectors, and emphasizing the shared responsibility in AMR.

The results of the AMR risk assessment (embodied in the national reports) experienced a positive reception from the countries involved. Some of the national reports have been used to:

- improve livestock development plans in AMR;
- incorporate AMR into the incoming Ministry of Agriculture's political agenda and strengthen political buy-in for AMR in the country;
- support the intersectoral and inter-institutional work between public–public and public–private stakeholders;
- strengthen the National Action Plan for AMR as it relates to the agrifood sector; and
- reinforce interest to obtain increasingly accurate information. This is the case of one country that requested a second implementation of the tool.

The results provide a picture of the current situation and guide decision-making for the containment of AMR under the One Health approach, considering country needs and resources. As mentioned in Figure 1, the risks and gaps identified are addressed in the development of a first country roadmap to guide AMR work.

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