Food and Agriculture Organization of the United Nations

# ANTIMICROBIAL USE PRACTICES IN THE LIVESTOCK SECTOR IN UKRAINE

## SURVEY REPORT

UNDERSTANDING ANTIMICROBIAL USE IN FOOD AND AGRICULTURE

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## Survey report

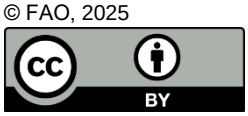
Food and Agriculture Organization of the United Nations

Budapest, 2025

Required citation:
FAO. 2025. *Antimicrobial use practices in the livestock sector in Ukraine – Survey report*. Understanding Antimicrobial Use in Food and Agriculture. Budapest. https://doi.org/10.4060/cd7638en



ISBN 978-92-5-140308-2

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# ACKNOWLEDGEMENTS

Anne Deckert, Daniel Beltran-Alcrudo, and Eran Raizman developed the surveys and associated materials (e.g. field instructions, consent forms, etc.) to assess the use of antimicrobials in the livestock sector. Dora Kovacs and Daniel Beltran-Alcrudo created the templates and guide for survey analysis and reporting, with technical input from Anne Deckert and Eran Raizman.

The Association of Ukrainian Pig Breeders lead the field implementation, which included translating the surveys, compiling information on antimicrobial products, and conducting pilot surveys, with the overall coordination of Oksana Yurchenko and technical support from Vitalii Bashynskyi and Oleksandr Ryevnivtsev. Eran Raizman and Daniel Beltran-Alcrudo oversaw this work. The "Strategic Development Agency" (SDA) managed the online implementation of the surveys through the KoboCollect platform.

Tamas Nagy conducted the survey analysis and report writing, with technical input from Dora Kovacs.

# ABSTRACT

To support countries in tackling antimicrobial resistance (AMR) and promote the prudent use of antimicrobials in the livestock sector, the Food and Agriculture Organization of the United Nations (FAO) developed and carried out surveys in a series of countries on antimicrobial use (AMU) in the livestock sector by priority livestock production systems, field veterinarians, veterinary pharmacies and feed mills. The surveys in Ukraine were conducted under the national project "Strengthening National Capacities for Antimicrobial Resistance (AMR) in the Livestock Sector" (TCP/UKR/3702).

In Ukraine, surveys targeted 335 farms of priority livestock production systems (chickens, pigs, beef cattle, dairy cattle, small ruminants, bees, and backyard), 74 veterinarians, 67 veterinary pharmacy personnel, and 28 feed mill personnel. Participants were interviewed face-to-face between 11 December 2020 and 25 April 2021, and their responses were collected on electronic devices (tablets) through the KoboCollect platform. After completion of the survey, participants were provided with an information leaflet on the use of antibiotics in livestock, and misconceptions were explained to them.

This report is the first of its kind to provide a comprehensive overview of AMU in the livestock sector in Ukraine, including the sources of antibiotics, the main use patterns and indications for treatment, and AMR awareness. The analysis found some gaps in the knowledge and practices of participants related to AMR and AMU, which could be targeted in the future to reduce the need for antimicrobials and would support the prudent use of them, thus reducing the risk of AMR development.

It is important to note that the surveys were conducted in 2020 and2021, before the start of the war between Ukraine and the Russian Federation, and the findings presented in this report reflect the situation at that time. Since then, there has been gradual improvement in farmers' knowledge and understanding of AMR. The development and adoption of industry standards for the careful use of antimicrobials in the poultry and pig sectors have greatly contributed to increased awareness, particularly among large, vertically integrated companies, leading to an improvement in the AMR situation. However, the ongoing war in Ukraine has significantly affected information sharing and slowed down the implementation of pre-war legislative initiatives. Despite these major challenges, efforts towards prudent AMU and a reduction of AMR continue and shows signs of gaining speed, mainly driven by European integration goals and clear deadlines for alignment with European Union regulations.

# INTRODUCTION

Antimicrobial resistance (AMR) is a major threat to human, animal, and plant health. A main driver of AMR development is the overuse and misuse of antimicrobials; therefore, it is crucial to gain knowledge on antimicrobial use (AMU) practices and support the prudent application of these drugs in all fields. The livestock sector has a special role in this process, since AMR developed in food-producing animals can enter the food chain and the environment.

The aim of this survey was to collect information on AMU in the livestock sector in Ukraine, from farmers of priority livestock production systems, veterinarians, veterinary pharmacy personnel, and feed mill personnel. Analysing the collected data allowed for the identification of knowledge gaps and inappropriate practices. Based on these, intervention measures can be implemented to promote the prudent use of antimicrobials, thus reducing the development of AMR, while improving animal health and productivity.

A description of the materials and methods, together with the key findings and recommendations are provided in the following pages. A detailed and systematic description of all the survey questions and answers can be found in the following chapters and annexes.

# MATERIALS AND METHODS

The surveys in Ukraine were conducted under the national project "Strengthening National Capacities for Antimicrobial Resistance (AMR) in the Livestock Sector" (TCP/UKR/3702). The survey and survey instructions were developed by the Food and Agriculture Organization of the United Nations (FAO) (Annex 1). The survey implementation was conducted by the Association of Ukrainian Pig Breeders through a letter of agreement signed with FAO.

Farmers (of priority livestock species), veterinarians, veterinary pharmacy personnel, and feed mill personnel were interviewed (face-to-face) between 11 December 2020 and 25 April 2021. Respondents were selected by the State Service of Ukraine on Food Safety and Consumer Protection. The total number of surveys performed can be seen in Table 1.

Survey data collection was carried out through electronic devices (tablets) and responses were recorded in the KoboCollect platform. The questionnaires were provided by FAO and were translated into Ukrainian for implementation. Before the surveys, pre-testing of the questionnaires was carried out and enumerators were trained on survey implementation. All participants had to sign an informed consent before the administration of the survey, and their personal information was treated confidentially. Details on the survey process are available in Annex 1 (Survey instructions). Where the most commonly used antimicrobials had to be reported, a coded list of antimicrobials was provided to participants, and they responded with the numbers corresponding to the veterinary medicinal product used. The list of antimicrobials can be found in Annex 2.

For farmers, the survey was divided into a first, general part (Farmer section) that had to be completed by all participants, followed by species-specific parts that were chosen and completed based on the animal species housed on the farms.

Upon completion of the survey, participants were provided with an information leaflet on the use of antibiotics in livestock and the issue of AMR and misconceptions on AMR were also explained to them. Completed surveys were checked by the interview supervisor to ensure they were complete and correct. The responses were analysed with Microsoft® Excel.

Table 1. Total number of surveys performed in Ukraine by stakeholder

| Participants | | Total number of surveys |
|---|---|---|
| Farmer section – general | | 335 |
| Species-specific sections | Chicken farmers | 82 |
| | Pig farmers | 51 |
| | Beef cattle farmers | 18 |
| | Dairy cattle farmers | 46 |
| | Small ruminant farmers | 30 |
| | Beekeepers | 64 |
| | Backyard farmers | 44 |
| Veterinarians | | 74 |
| Veterinary pharmacy personnel | | 67 |
| Feed mill personnel | | 28 |

Source: Author's own elaboration.

# KEY FINDINGS AND RECOMMENDATIONS

Farmers involved in the survey were predominantly male, and over 40 years of age. Most veterinarians were also male, but they were generally younger, with around half of them being between 25 and 40 years old. On the other hand, almost half of the surveyed veterinary pharmacy personnel were female, and the majority were over 40 years old. Most farmers of priority livestock species had some formal education or training on animal health, animal husbandry, or pharmacology, which is partly explained by the fact that many of them (around 60 percent) were veterinarians. It is noteworthy that not all of veterinarians and veterinary pharmacy personnel reported having information on AMR included in their education (64 percent of veterinarians and 80 percent of pharmacy personnel reported learning about AMR).

Record keeping was more commonly practiced by farmers than veterinarians and veterinary pharmacy personnel. Most farmers had records about animal health-related data, such as treatments, vaccinations, and veterinary visits, while most veterinarians and veterinary pharmacy personnel did not record much information about the antimicrobials they sold or prescribed

In general, chicken and pig farmers performed well in terms of hygiene and biosecurity measures; almost all of them reported always following the good practices included in the questionnaire. Most dairy farmers also followed good hygiene and biosecurity practices, with the only exception being the separation of new animals on the farm, which was only reported by around half of the farmers surveyed. An important finding among beekeepers was that many farmers did not separate the hives affected with diseases from other hives. On backyard farms, having wheel dipping or vehicle disinfection at the entrance was very rare, and giving protective clothing to visitors was not practiced by any of the surveyed farmers.

In terms of AMU, more than half of the surveyed farmers (64 percent) reported using antimicrobials in their animals. When comparing the different groups, AMU was more common among farmers with livestock-related education or training than among those without. In addition, antimicrobials were more commonly used on semi- and large commercial farms than on backyard farms. There was a difference between AMU of farmers housing different animal species: 96 percent of dairy farmers, 92 percent of pig farmers, 74 percent of chicken farmers, 60 percent of small ruminant farmers, 50 percent of beef farmers, and 8 percent of beekeepers used antibiotics in their animals. Using antibiotics was generally not a first-choice measure in case of disease on the surveyed farms.

The main source of antibiotics for farmers were wholesalers, and to a lesser extent, veterinary pharmacies. The decision to use antimicrobials and advice on the dose and duration of treatment mainly originated from company veterinarians. Farmers also often checked the product label of the drugs and relied on veterinary laboratory results and their previous experience for this purpose.

When veterinary pharmacies sold antibiotics to farmers, 90 percent rarely or never required a prescription. This was in accordance with veterinarians' responses: most (77 percent) reported never or rarely writing prescriptions for antibiotics. However, the responses of farmers were different: 96 percent stated that they always bought antibiotics with a prescription. When selling antibiotics to farmers, all veterinarians and almost all veterinary pharmacy personnel (95 percent) reported informing them about the withdrawal period.

Using antimicrobials for growth promotion was reported by only one chicken farmer (0.3 percent of farmers). This was remarkably lower than the ratio of veterinarians who reported the

administration of antibiotics for promoting growth in healthy animals (10 percent). Some veterinary pharmacy personnel (7 percent) also thought that antimicrobials are commonly used for this purpose.

Sending samples from sick animals to diagnostic laboratories was most common among chicken farmers and beekeepers, and least common among backyard farmers. Most veterinarians (84 percent) reported having good access to veterinary diagnostic laboratories and having antimicrobial susceptibility testing available (81 percent) in the laboratories that they worked with. Nonetheless, only 44 percent of veterinarians reported that they would send samples to the laboratory in case of a single infection in a regular client's herd, while 89 percent would do so if an infectious disease outbreak occurred.

When farmers had to choose the definition of antibiotics, 95 percent chose the right definition ("*medicine that kills bacteria*") from the list provided, however none of them chose only the correct answer. They believed that other definitions were also correct, such as "*medicine that kills or prevents diseases*", "*medicine that kills germs*", and "*medicine that makes animals grow faster or bigger*". Surprisingly, farmers with veterinary education made the same mistakes in this question. Other than misconceptions about the definition of antibiotics, all farmers had good knowledge about the general aspects of AMU, with the exception of confusing the definition of antimicrobial residues with that of AMR. In addition, almost all farmers (98 percent) using antibiotics reported having heard about AMR. On the other hand, even though almost all farmers were aware that antibiotics cannot be freely discarded without having an effect on the environment, many of them reported throwing expired antibiotics in the garbage.

Antibiotics that were commonly used, advised, or sold in Ukraine by the different stakeholders are listed below, including their ranking according to the World Health Organization (WHO).[1]

- Highest priority critically important antimicrobials: ceftiofur, enrofloxacin, colistin
- Critically important antimicrobials: streptomycin, tilmicosin, tylosin
- Highly important antimicrobials: amoxicillin, benzylpenicillin, doxycycline, oxytetracycline

In most cases, the listed substances were used for the treatment of diseases, and only rarely for prevention, except on commercial chicken farms, where preventive use was more common than therapeutic use. Among the indications, intestinal diseases, breathing problems, reproductive diseases and mastitis were most commonly treated with antimicrobials. Veterinarians preferred to use these drugs for individual treatment instead of mass medication. If treatment with the chosen drug did not yield the expected results, actions farmers took included using a different antibiotic, doing nothing, or consulting with a veterinarian. The likelihood of taking each of these actions depended on the species housed on the farm, with pig and dairy farmers typically being more independent in choosing a different drug for the treatment. However, only a small number of the farmers that would use a different antibiotic reported that they would send samples to a diagnostic laboratory for identification of the pathogen and antimicrobial susceptibility testing before choosing another drug.

When participants were asked about their experience about the efficacy of antimicrobials, 25 percent of farmers, 49 percent of veterinarians, and 45 percent of veterinary pharmacy personnel

[1] World Health Organization. 2024. Medically Important Antimicrobial List: a risk management tool for mitigating antimicrobial resistance due to non-human use. Geneva. [Cited 04 November 2025]. https://www.who.int/news/item/08-02-2024-who-medically-important-antimicrobial-list-2024

reported observing decreased efficacy of these substances, suggesting that resistance is present in the livestock sector.

According to the surveyed farmers, veterinarians, and veterinary pharmacy and feed mill personnel, the lockdown due to the COVID-19 pandemic had some impact on animal health and the accessibility of veterinary drugs and services in the country.

Based on the main findings summarized above, the following recommendations can be given to Ukraine to support the prudent use of antimicrobials and decrease the need for the use of these drugs:

- train farmers on issues related to prudent AMU and the development of AMR, such as the right disposal of antibiotics and the difference between antimicrobial residues and resistance;
- train veterinarians on issues related to AMR, such as the factors that may increase the risk of resistance development (e.g. antimicrobial use for growth promotion);
- encourage farmers to consult with veterinarians when treating their animals;
- promote record keeping of animal health and drug use data among field veterinarians and veterinary pharmacy personnel;
- reinforce regulations on obtaining antimicrobials for animal use with prescription only;
- eliminate the use of antimicrobials as growth promoters;
- reduce the use of highest priority critically important antimicrobials as first-choice drugs in livestock, if less valuable substances are also available and can be effective; and
- promote the importance of laboratory testing among farmers and veterinarians.

It should be noted that the surveys were conducted in 2020 and 2021, before the start of the war between Ukraine and the Russian Federation, and the findings presented in this report reflect the situation at that time. Since then, there has been gradual improvement in farmers' knowledge and understanding of AMR, even though the war has slowed down the process. Nevertheless, the efforts towards prudent AMU and a reduction of AMR continue despite the challenges, mainly driven by European integration goals.

# FARMER SURVEYS

## FARMER SECTION

**General data of surveys**

*Total number of surveys:* 335

*Date of surveys*

- First survey: 17 December 2020
- Last survey: 23 April 2021

*Distribution of surveys*

The highest number of farmer surveys were conducted in Kyiv (13 percent), Dnipropetrovsk (8 percent), Vinnytsia (8 percent), and Cherkasy (7 percent). Surveys were also conducted in the following oblasts: Chernihiv, Chernivtsi, Donetsk, Ivano-Frankivsk, Kharkiv, Kherson, Khmelnytskyi, Kirovohrad, Luhansk, Lviv, Mykolaiv, Odesa, Poltava, Rivne, Sumy, Ternopil, Volyn, Zakarpattia, Zaporizhzhia, and Zhytomyr.

Figure 1. Map of Ukraine


Note: Refer to the disclaimer on page ii for the names and boundaries used in this map.
Source: United Nations Geospatial. 2023. Map of Ukraine. New York, United States of America, United Nations. https://www.un.org/geospatial/content/ukraine-0

**Information on farms and farmers involved in the survey**

*Type of farms included*

- Backyard: 107 (32 percent)
- Semi-commercial: 35 (10 percent)
- Large commercial: 179 (53 percent)

*Note: Six farmers did not reply to this question, and eight farmers replied by choosing "Other".*

*Role and education of farmers*

Among the surveyed farmers:

- 35 percent were the owner of the farm;
- 27 percent were the manager of the farm;
- 56 percent were employees; and
- 63 percent were veterinarians.

*Note: More than one answer could be provided.*

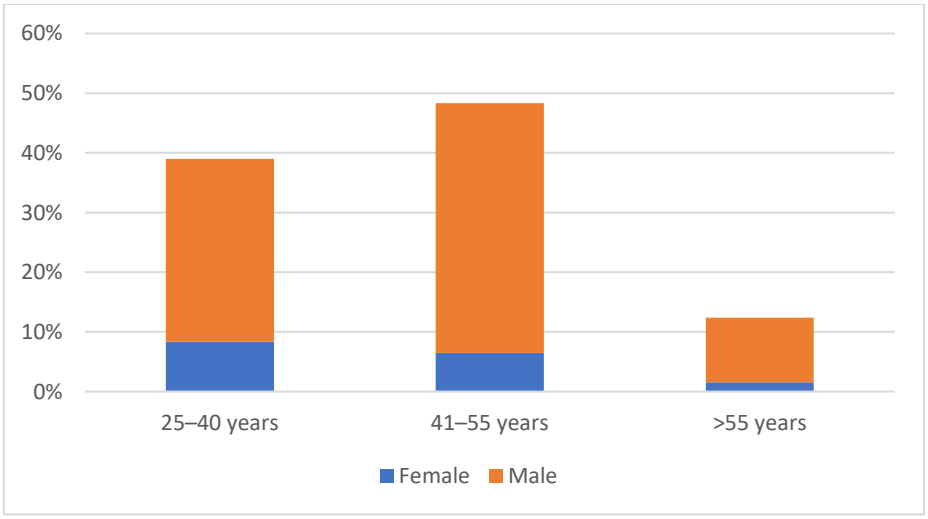
A high number of the surveyed farmers had previous education or training in animal health (73 percent education and 3 percent training), but less had education or training in animal husbandry (15 percent and 5 percent, respectively), and in pharmacology (0 percent and 4 percent, respectively). Interestingly, only 5 percent of veterinarian farmers reported having had education or training in pharmacology.

*Number of years farmers spent working with livestock*

- Median: 17 years
- Range: 2–48 years

*Age and gender of farmers*

Figure 2. Age and gender distribution of farmers participating in the survey (Total: 323 farmers replied)




Source: Author's own elaboration.

More than half of the farmers surveyed (59 percent) were over the age of 40. Male farmers represented the majority (80 percent) of farmers in Ukraine. *Note: Not all farmers indicated their age or gender.*

*Farm record availability*

In general, record keeping was commonly practiced by the surveyed farmers. Among the various data included in the questionnaire, treatment records were most frequently kept on the surveyed farms (90 percent). In addition, over 85 percent of farmers kept records about vaccinations, births, animal medicines purchased, treatment protocols, veterinary visits, prescriptions and mortality. Around two-thirds of farmers (65 percent) had records of all animal health-related data (medicines purchased, treatments, vaccinations, treatment protocols, veterinary visits, prescriptions, and mortality). Detailed responses to this part of the survey can be found in Annex 3.

**Animals on the surveyed farms**

*Distribution and number of animal species on the surveyed farms*

Only 49 farms (15 percent) housed multiple species, regardless of the farming type (backyard, semi-commercial, or large commercial). Among these, 76 percent were backyard farms, 18 percent were semi-commercial farms and 2 percent were large commercial farms.

*Note: In this context, dairy and beef cattle, as well as broiler and layer chickens were counted separately.*

*Average number of animals on farms at the time of the survey*

*Backyard farms*

Among the surveyed backyard farms, 65 percent housed one animal species only, while keeping two, three, or four or more different species were practiced by 8 percent, 6 percent, and 22 percent of farms, respectively. The highest number of different animal species per farm was nine.

*Note: In this context, dairy and beef cattle, as well as broiler and layer chickens were counted separately.*

The ratio of backyard farms housing different animal species, and the average number of animals on these farms can be seen in Table 2.

Table 2. Species distribution of the surveyed backyard farms (Total: 107 farms)

| Species | Ratio of farms housing this species (%) | Average no. of young animals (incl. ranges) | Average no. of adult animals (incl. ranges) |
|---|---|---|---|
| Bees (beehives) | 65 | 112 (3–1 000) | 139 (4–2 600) |
| Layer chickens | 33 | 23 (7–70) | 24 (7–70) |
| Pigs | 29 | 17 (1–120) | 5 (1–29) |
| Dairy cattle | 22 | 9 (1–50) | 4 (1–33) |
| Rabbits | 15 | 37 (7-100) | 14 (3–50) |
| Ducks | 10 | - | 15 (2–50) |
| Beef cattle | 10 | 2 (1–5) | 9 (2–18) |
| Broiler chickens | 8 | 50 (40–60) | 26 (8–50) |

| Species | Ratio of farms housing this species (%) | Average no. of young animals (incl. ranges) | Average no. of adult animals (incl. ranges) |
|---|---|---|---|
| Sheep | 6 | 7 (2–20) | 20 (1–60) |
| Geese | 5 | - | 13 (2–40) |
| Goats | 5 | 4 (2–6) | 3 (2–5) |
| Horses for milk | 4 | - | 2 (1–2) |
| Turkeys | 3 | - | 8 (5–14) |
| Horses for meat | 1 | - | 1 (1–1) |

Source: Author's own elaboration.

Bees were the most commonly housed species on backyard farms, followed by layer chickens, pigs, and dairy cattle.

*Semi-commercial farms*

Among the surveyed semi-commercial farms, 77 percent housed only one animal species. Keeping two species was rare (24 percent), and none of the surveyed farms kept three of four species. The highest number of different animal species per farm was seven, which occurred on only one farm.

*Note: In this context, dairy and beef cattle, as well as broiler and layer chickens were counted separately.*

The ratio of semi-commercial farms housing different animal species, and the average number of animals on these farms can be seen in Table 3. Sheep were kept on the highest number of semi-commercial farms, followed by goats and dairy cattle. Broiler chickens were kept in the largest groups, but there was a high variation in the number of animals.

Table 3. Species distribution of the surveyed semi-commercial farms (Total: 35 farms)

| Species | Ratio of farms housing this species (%) | Average no. of young animals (incl. ranges) | Average no. of adult animals (incl. ranges) |
|---|---|---|---|
| Sheep | 83 | 399 (10–3 750) | 955 (20–10 500) |
| Goats | 26 | 115 (6–300) | 327 (6–2 000) |
| Dairy cattle | 11 | 50 (6–160) | 42 (17–80) |
| Broiler chickens | 6 | 2 065 (30–4 100) | 1 973 (45–3 900) |
| Layer chickens | 3 | 30 (*1 farm*) | 45 (*1 farm*) |
| Ducks | 3 | – | 12 (*1 farm*) |
| Beef cattle | 3 | 1 (*1 farm*) | – |
| Pigs | 3 | – | 2 (*1 farm*) |
| Bees (beehives) | 3 | – | 2 (*1 farm*) |

Source: Author's own elaboration.

*Large commercial farms*

Table 4. Species distribution of the surveyed large commercial farms (Total: 179 farms)

| Species | Ratio of farms housing this species (%) | Average no. of young animals (incl. ranges) | Average no. of adult animals (incl. ranges) |
|---|---|---|---|
| Dairy cattle | 25 | 939 (12–5 800) | 1 113 (24–5 682) |
| Pigs | 22 | 15 497 (380–82 000) | 2 087 (40–9 000) |
| Broiler chickens | 20 | 1 685 583 (25 000–15 000 000) | 2 129 686 (50 000–19 000 000) |
| Layer chickens | 18 | 511 539 (5 000–4 200 000) | 801 406 (20 000–6 700 000) |
| Beef cattle | 10 | 432 (80–1630) | 702 (50–2 257) |
| Turkeys | 1 | 140 000 (140 000–140 000) | 75 000 (10 000–140 000) |
| Ducks | 0.6 | 80 000 (*1 farm*) | 80 000 (*1 farm*) |

Source: Author's own elaboration.

All but one of the surveyed large commercial farms (99 percent) housed only one species, and the remaining farm housed two species. *Note: In this context, dairy and beef cattle, as well as broiler and layer chickens were counted separately.* Only dairy cattle, pigs, broiler chickens, layer chickens, beef cattle, turkeys and ducks were kept on large commercial farms. Dairy cattle were kept on the highest number of large commercial farms, and chickens were kept in the largest groups. There was a very high variation in the number of animals on the surveyed farms and the average number of animals on these farms were usually much higher than those on other farm types.

**General information on antimicrobial use**

*Knowledge about antibiotics: self-evaluation*

The majority of farmers knew what antibiotics are:

- Yes: 294 (88 percent)
- No: 30 (9 percent)
- Did not reply: 11 (3 percent)

Male farmers and those with less experience showed slightly limited knowledge compared to female and more experienced farmers (see details in Tables 5–7).

Table 5. Farmers' knowledge of antibiotics by gender

| Gender | Ratio of farmers knowing antibiotics (%) |
|---|---|
| Female (n=54) | 96 |
| Male (n=271) | 88 |

Source: Author's own elaboration.

Table 6. Farmers' knowledge of antibiotics by age group

| Age group | Ratio of farmers knowing antibiotics (%) |
|---|---|
| Under 25 years (n=1) | 100 |
| 25–40 years (n=129) | 93 |
| 41–55 years (n=156) | 89 |
| Over 55 years (n=40) | 88 |

Source: Author's own elaboration.

Table 7. Farmers' knowledge of antibiotics by experience in livestock farming

| Experience in livestock farming | Ratio of farmers knowing antibiotics (%) |
|---|---|
| ≤ 10 years of experience (n=58) | 76 |
| 11-20 years of experience (n=146) | 88 |
| 21-30 years of experience (n=102) | 100 |
| > 30 years of experience (n=17) | 100 |

Source: Author's own elaboration.

Among farmers with veterinary training (211 participants, 63 percent) only one (1 percent) reported having no knowledge about antibiotics.

*Knowledge about antibiotics: by definition*

Among those who claimed to know what an antibiotic is, 95 percent chose the right definition ("*medicine that kills bacteria*") from the list provided, but none of them chose only the correct answer but chose other incorrect definitions as well. Surprisingly, none of the farmers with veterinary training answered the question correctly (i.e. choosing only the right answer).

Most common incorrect answers:

- "medicine that prevents diseases" – 276 (94 percent)
  (incl. 200 veterinarian)
- "medicine that kills germs" – 287 (98 percent)
  (incl. 206 veterinarians)
- "medicine that kills diseases" – 293 (100 percent)
  (incl. 207 veterinarians)
- "medicine that makes animals grow faster/bigger" – 262 (89 percent)
  (incl. 190 veterinarians)

*Note: Only farmers saying "Yes" to the previous question were included in this part.*

*Use of antibiotics*

When farmers were asked "Do you use antibiotics?", the following answers were collected:

- Yes: 215 (64 percent)
- No: 109 (33 percent)
- Did not reply: 11 (3 percent)

All farmers who reported using antibiotics (215 participants) reported that they knew what antibiotics are. However, none of these individuals chose only the correct definition of antibiotics ("*medicine that kills bacteria*"). They all believed that some other definitions were also correct (see those previously listed). The relationship between antibiotic use and different demographic data is summarized in Tables 8–11.

*Relationship with education data and farming type*

The overall ratio of farmers having education or training related to livestock farming was relatively high, which is partly explained by the fact that many of them were veterinarians. Antibiotic use was more common among farmers with livestock-related education or training than among those without (Table 8).

*Note: Some farmers had more than one type of education or training.*

Farmers on larger farms tended to use antibiotics more commonly: the proportion of antibiotic users was highest on large commercial farms, and lowest on backyard farms (Table 9).

Table 8. Distribution of antibiotic users among farmers with different education levels

| Education/training type | Total (%) | Antibiotic users (%) | Non-antibiotic users (%) |
|---|---|---|---|
| Veterinary (n=211) | 63 | 87 | 13 |
| Animal health (n=253) | 76 | 76 | 24 |
| Animal husbandry (n=67) | 20 | 45 | 55 |
| Pharmacology (n=12) | 4 | 83 | 17 |
| Without education or training (n=62) | 19 | 16 | 84 |

Source: Author's own elaboration.

Table 9. Distribution of antibiotic users among farmers of different farming types

| Farm type | Ratio of farmers using antibiotics (%) |
|---|---|
| Backyard (n=107) | 26 |
| Semi-commercial (n=35) | 66 |
| Large commercial (n=179) | 80 |

Source: Author's own elaboration.

*Relationship with age and experience in livestock*

Table 10. Distribution of antibiotic users among farmers of different age groups

| Age group | Ratio of farmers using antibiotics (%) |
|---|---|
| Under 25 years (n=1) | 100 |
| 25–40 years (n=129) | 74 |
| 41–55 years (n=156) | 62 |
| Over 55 years (n=40) | 58 |

Source: Author's own elaboration.

Table 11. Distribution of antibiotic users among farmers with different experience in farming

| Experience in livestock farming | Ratio of farmers using antibiotics (%) |
|---|---|
| ≤ 10 years of experience (n=58) | 69 |
| 11–20 years of experience (n=146) | 59 |
| 21–30 years of experience (n=102) | 75 |
| > 30 years of experience (n=17) | 65 |

Source: Author's own elaboration.

There was no remarkable difference in terms of the frequency of antibiotic use among farmers of different ages or with different years of experience in livestock farming.

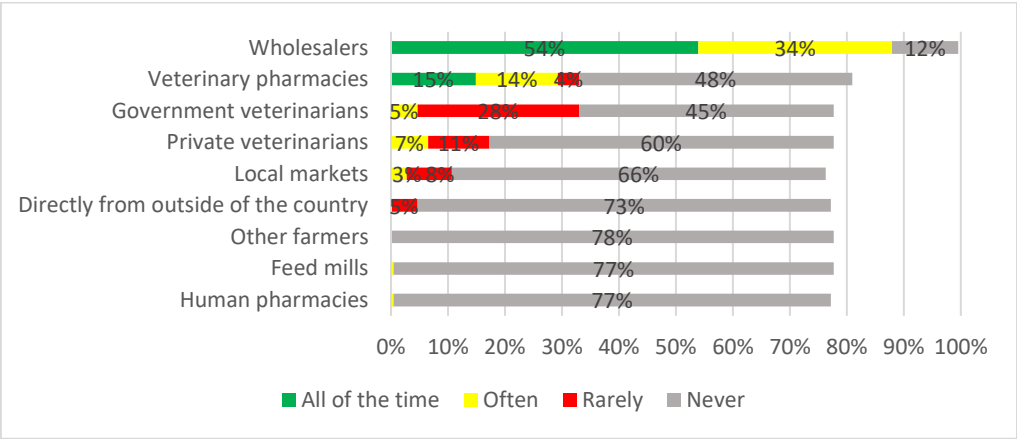
*Notes: None of the 30 farmers who reported not knowing what antibiotics are used them.*

The following AMU related questions only include answers from farmers using antibiotics (215 surveys).

*Common sources of antibiotics*

Farmers most frequently purchased antibiotics from wholesalers (88 percent) or from veterinary pharmacies (29 percent).

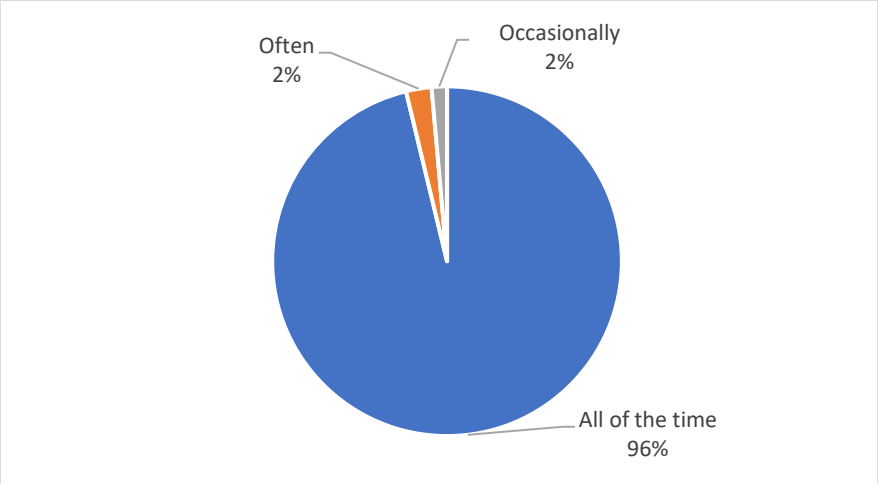
Figure 3. Antibiotic sources of farmers (Total: 214 farmers replied)




Source: Author's own elaboration.

*Obtaining antibiotics with prescription*

Figure 4. Frequency of prescription use for obtaining antibiotics among farmers (Total: 212 farmers replied)



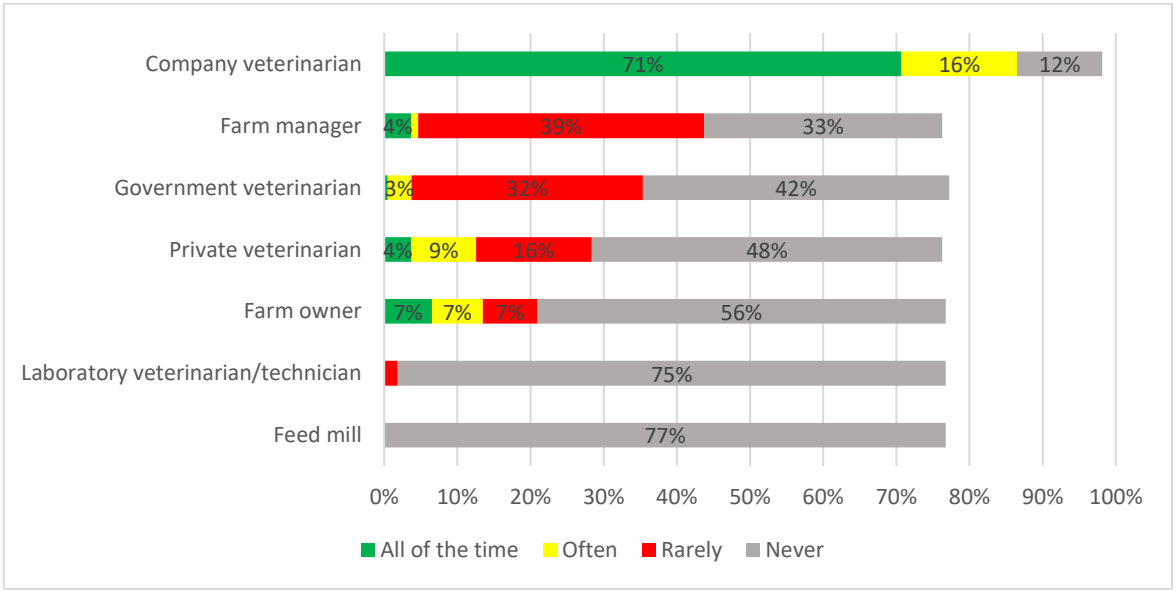

Source: Author's own elaboration.

In almost all cases, farmers obtained antibiotics with a prescription. The majority of the surveyed farmers (96 percent) always bought antibiotics with a prescription, while a small minority (2 percent often and 2 percent occasionally) had a prescription for purchase.

*Antibiotic use decision making*

On the surveyed farms, company veterinarians were most likely to decide on when to use antibiotics (Figure 5).

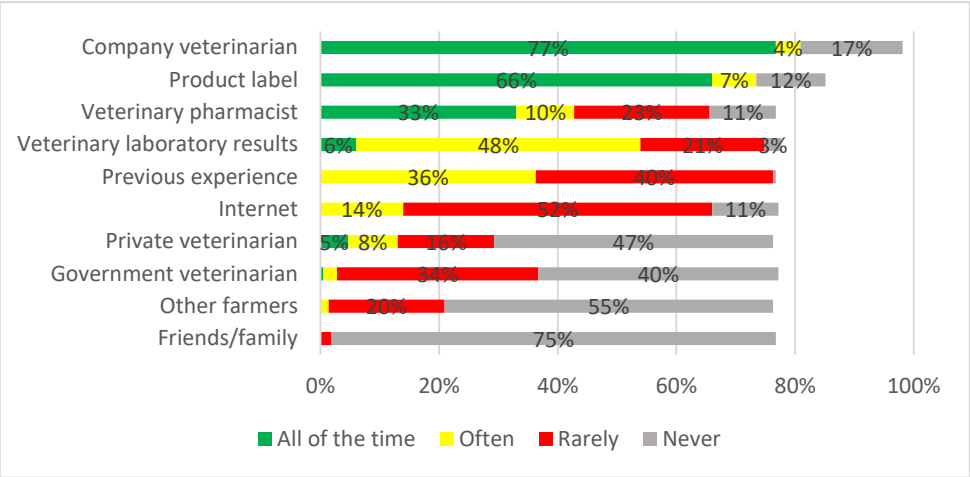
Figure 5. Decision making on antibiotic use on the surveyed farms (Total: 211 farmers replied)




Source: Author's own elaboration.

*Antibiotic use advice*

Figure 6. Sources of advice on antibiotic use on the surveyed farms (Total: 211 farmers replied)




Source: Author's own elaboration.

Farmers usually got advice on what antibiotic to use from company veterinarians (81 percent), but they also frequently reviewed the product label (74 percent), and consulted with veterinary pharmacists (43 percent). Veterinary laboratory results (54 percent) and previous experience (36 percent) also guided antibiotic use. Advice from the internet, private veterinarians, government veterinarians, other farmers, and from friends and family were not common sources of advice.

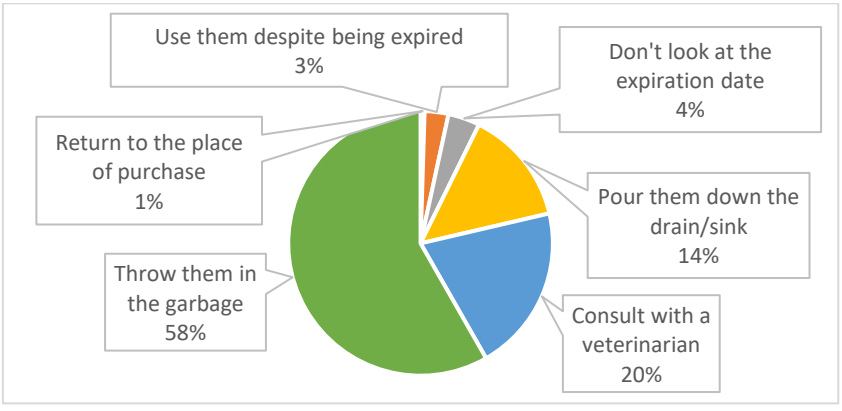
*Use of antibiotics as advised*

Almost all farmers (99 percent) reported using antibiotics as advised in terms of dose and duration of treatment. The remaining 1 percent of farmers did not respond to this part of the survey.

*Handling after expiration*

After expiration, more than half of the surveyed farmers reported throwing antibiotics in the garbage (56 percent), and around one-fifth consulted with a veterinarian (20 percent).

Figure 7. Handling of expired antibiotics on the surveyed farms (Total: 211 farmers replied)




Source: Author's own elaboration.

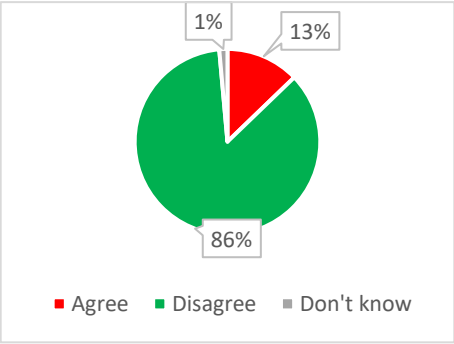
*Note: Consultation with a veterinarian refers to government, private and company veterinarians.*

*Knowledge on antimicrobial use and resistance*

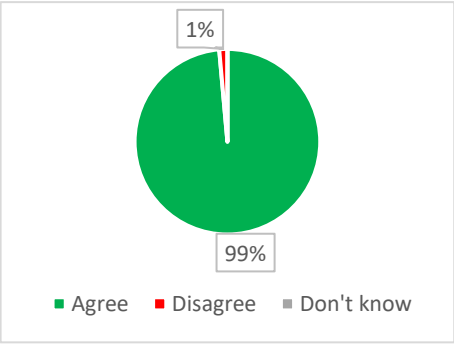
Several questions were asked in the survey to assess the knowledge of farmers on AMU and AMR. Almost all farmers (98 percent) using antibiotics reported having heard about AMR. Further responses are summarized in Figure 8. On all charts, correct answers are marked with green, incorrect answers with red, and “Don’t know” with grey.

Figure 8. Farmers' knowledge on antimicrobial use and resistance (Total: 212 farmers replied)

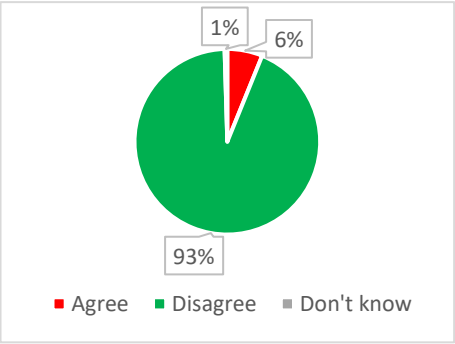
Q1. You can stop giving antibiotics to an animal if their symptoms are improving.
*Correct answer: Disagree*



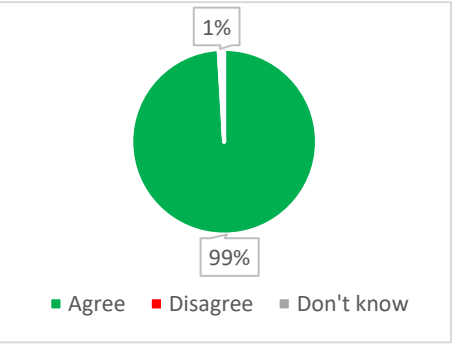

Q2. If antibiotics are given too often, they might stop working.
*Correct answer: Agree*



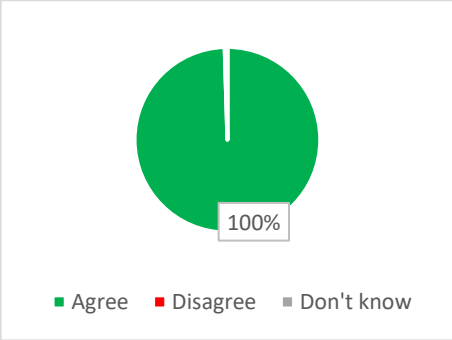

Q3. Giving antibiotics to healthy animals will prevent them from getting sick in the future.
*Correct answer: Disagree*



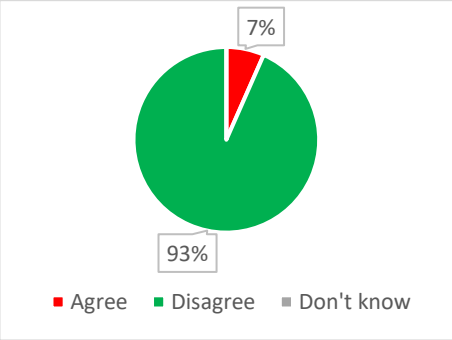

Q4. Using vaccines can prevent the use of antibiotics.
*Correct answer: Agree*



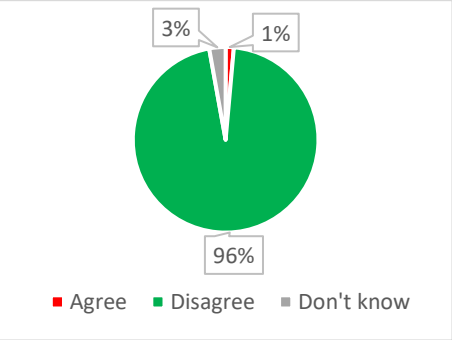

Q5. Animals can transmit disease to humans.
*Correct answer: Agree*



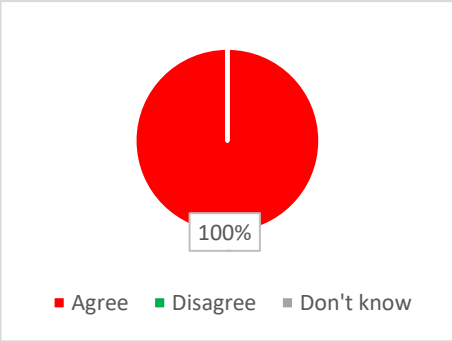

Q6. Antibiotic use in animals does not affect human health.
*Correct answer: Disagree*



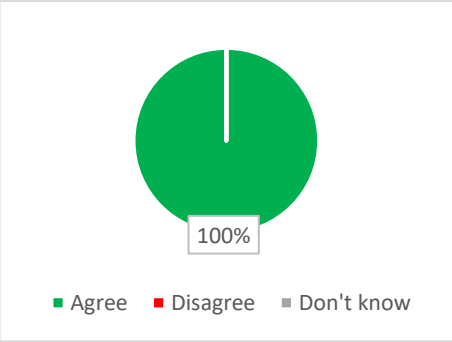

Q7. Antibiotics may be freely discarded without having an action/effect on the environment.
*Correct answer: Disagree*



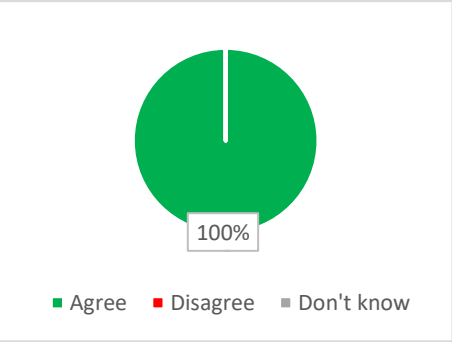
Q8. Antibiotic resistance occurs when antibiotics are found in the meat or milk of an animal.
*Correct answer: Disagree*




Q9. When you use antibiotics there is a certain number of days you should wait before selling the animals for slaughter, selling eggs, milk or honey.
*Correct answer: Agree*




Q10. With prevention and early detection, you can reduce the use of antibiotics.
*Correct answer: Agree*




Source: Author's own elaboration.

Except for Q8, the majority of farmers answered the questions correctly. Responses to Q8 suggest confusion between AMR and antibiotic residues, thus, understanding the difference between these concepts could be an important objective in future educational initiatives. It is interesting to note that even though most farmers knew that antibiotics cannot be freely discarded without having an effect on the environment (Q7), many of them reported throwing expired antibiotics into the garbage.

In total, ten questions were asked about AMU and AMR in the above section (Figure 8). The average number of correct answers given was 8.6 among all the surveyed farmers, indicating that farmers generally had good knowledge about the topic. The average values in the different groups are presented in Tables 12–16. There was no remarkable difference found in the knowledge of different groups.

Table 12. Farmers' knowledge on antimicrobial use and resistance by gender

| Gender | Average number of correct answers |
|---|---|
| Female (n=37) | 8.5 |
| Male (n=176) | 8.7 |

Source: Author's own elaboration.

Table 13. Farmers' knowledge on antimicrobial use and resistance by age

| Age | Average number of correct answers |
|---|---|
| Under 25 years (n=1) | 8.0 |
| 25–40 years (n=95) | 8.8 |
| 41–55 years (n=96) | 8.6 |
| Over 55 years (n=23) | 8.5 |

Source: Author's own elaboration.

Table 14. Farmers' knowledge on antimicrobial use and resistance by experience in farming

| Experience in livestock farming | Average number of correct answers |
|---|---|
| ≤ 10 years (n=40) | 8.5 |
| 11–20 years (n=86) | 8.7 |
| 21–30 years (n=76) | 8.8 |
| > 30 years (n=11) | 8.0 |

Source: Author's own elaboration.

Table 15. Farmers' knowledge on antimicrobial use and resistance by education

| Previous education/training related to livestock farming | Average number of correct answers |
|---|---|
| Yes (n=208) | 8.6 |
| No (n=7) | 8.3 |

Source: Author's own elaboration.

Table 16. Farmers' knowledge on antimicrobial use and resistance by farming type

| Farm type | Average number of correct answers |
|---|---|
| Backyard (n=28) | 8.2 |
| Semi-commercial (n=22) | 8.9 |
| Large commercial (n=156) | 8.7 |

Source: Author's own elaboration.

*Change in the efficacy of antibiotics – farmers' experience*

Most farmers (75 percent) thought that antibiotics are as effective as they were in the past. Only 19.8 percent and 5 percent believed that antibiotics are slightly or much less effective than they used to be, respectively.

*Interest in learning more about antibiotics*

Most farmers (75 percent) were interested in learning more about antibiotics.

*Impact of the COVID-19 pandemic*

During or after the COVID-19 pandemic lockdown, only a few farmers experienced animal health-related problems. Four farmers had problems accessing disinfectants, and the same number had issues with obtaining vaccines. Three farmers had to use antibiotics more frequently than usual, and one of those also had to increase the dose of the drugs used. One farmer had problems accessing antibiotics.

## CHICKEN FARMS

*Number of surveys:* 82

*Note: No farmers refused to answer any of the questions.*

**Information on farms and farmers involved in the survey**

*Number of animals on the surveyed farms (last 12 months)*

Table 17. Number of animals on the surveyed chicken farms (Total: 82 farms)

| | Average | Minimum | Maximum |
|---|---|---|---|
| Chicks <1 week old | 1 887 258 | 25 | 30 000 000 |
| Broiler chickens | 2 733 051 | 20 | 30 000 000 |
| Layers | 666 797 | 19 | 7 000 000 |

Source: Author's own elaboration.

There was a high variation in the minimum and maximum number of chickens housed on the surveyed farms in the last 12 months.

*Types of chicken farms*

On the surveyed farms chickens were usually kept either for meat (51 percent) or for eggs (45 percent). Keeping chickens for both meat and eggs was much less frequent (4 percent).

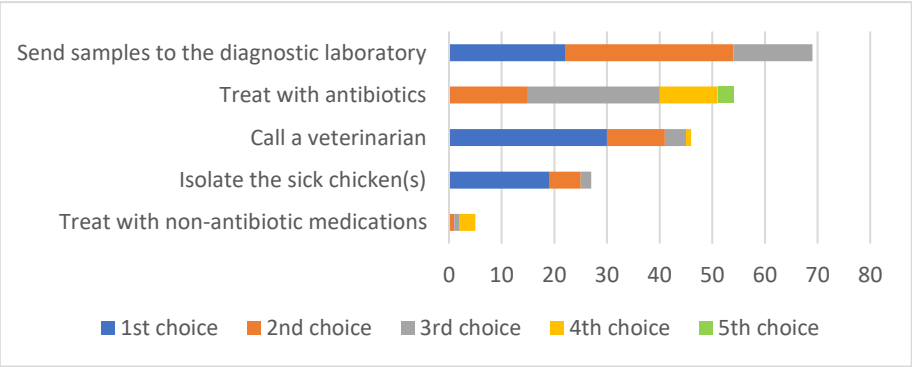
*Source of eggs and chickens*

More than half (54 percent) of the surveyed chicken farmers in Ukraine purchased eggs or chicks, 38 percent reported raising their own animals, and only 2 percent doing both. The rest of the farmers did not reply to this question.

*Measures in case of disease*

In case of disease, 84 percent of surveyed farmers reported sending samples to diagnostic laboratory mostly as their first or second choice. Treatment with antibiotics was also reported by many farmers (66 percent), usually picked as a second or third choice. Calling a veterinarian was considered by slightly less farmers (56 percent), however, it was typically a first-choice measure. Isolating the sick animals was also a typical first-choice measure, however, only around one-third of farmers reported doing so. Treatment with non-antibiotic medication was uncommon.

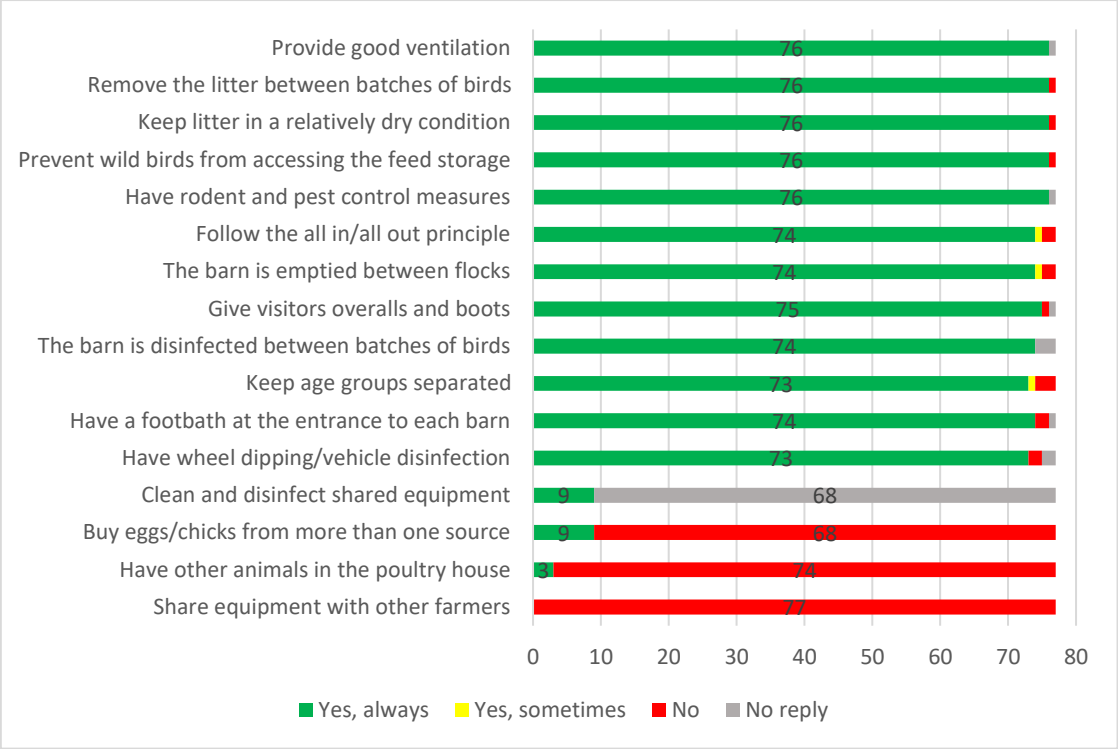
Figure 9. Measures in case of disease on the surveyed chicken farms (Total: 69 farmers replied)




Source: Author's own elaboration.

*Hygiene and biosecurity*

Figure 10. Hygiene and biosecurity measures on the surveyed chicken farms (Total: 77 farmers replied)




Source: Author's own elaboration.

In general, chicken farmers performed well in terms of hygiene and biosecurity measures: almost all of them reported always following the good practices included in the questionnaire. Five farmers did not reply to this part of the survey.

*Occurrence and severity of health issues or syndromes (last 12 months)*

Table 18. Health issues and vaccination on the surveyed chicken farms (Total: 82 farms)

| | Health issue | Ratio of farms affected (%) | Average ratio of animals affected (%) | Average mortality ratio (%) | Average ratio of vaccinated animals (%) |
|---|---|---|---|---|---|
| Chicks | Injuries | 15 | 1 | 1 | - |
| | Intestinal problems | 10 | 2 | 2 | 100 |
| | Breathing problems | 6 | 1 | 1 | 100 |
| | Lameness | 6 | 1 | 1 | 100 |
| | Skin or feather problems | 0 | - | - | 100 |
| | Blindness | 0 | - | - | 100 |
| | Nervous system problems | 0 | - | - | 100 |

| | Health issue | Ratio of farms affected (%) | Average ratio of animals affected (%) | Average mortality ratio (%) | Average ratio of vaccinated animals (%) |
|---|---|---|---|---|---|
| Broiler chickens | Injuries | 20 | 2 | 2 | - |
| | Intestinal problems | 16 | 2 | 1 | 100 |
| | Lameness | 15 | 1 | 1 | - |
| | Breathing problems | 10 | 2 | 1 | 100 |
| | Nervous system problems | 1 | 2 | 1 | 100 |
| | Skin or feather problems | 0 | - | - | 100 |
| Layer chickens | Injuries | 26 | 3 | 3 | - |
| | Intestinal problems | 12 | 3 | 3 | 100 |
| | Breathing problems | 5 | 2 | 2 | 100 |
| | Not laying | 5 | 3 | 3 | 100 |
| | Lameness | 5 | 2 | 1 | 100 |
| | Blindness | 0 | - | - | 100 |
| | Nervous system problems | 0 | - | - | 100 |
| | Skin or feather problems | 0 | - | - | 100 |

Source: Author's own elaboration.

In the case of chicks, injuries (15 percent), and intestinal problems (10 percent) affected the highest number of surveyed farms, followed by lameness (6 percent) and breathing problems (6 percent). Similarly, broiler chickens were affected mostly by injuries (20 percent) and intestinal problems (16 percent). In the case of layer chickens, the most frequent health issues on the surveyed farms were also injuries (26 percent) and intestinal problems (12 percent) These were followed breathing problems (5 percent) and not laying (5 percent). The ratio of animals affected by the different diseases, and the mortality ratios were low in all groups (1–3 percent). Vaccination was very common in all age groups against numerous diseases. None of the farmers experienced an increase in the occurrence of any health issues due to problems related to the COVID-19 pandemic.

**Information on antimicrobial use**

On the surveyed chicken farms, 26 percent of farmers did not use any antibiotics at all. Of the 74 percent of participants who used antibiotics, the majority (59 percent) used only one drug, eleven (18 percent) used two substances, and eleven (18 percent) reported using three different substances. Only three farmers (5 percent) reported using four or more antibiotics. On average, 59 percent of chickens on the surveyed farms received antibiotics at least once between birth and market (including medicated feed), and 39 farmers (48 percent) reported treating 100 percent of their chickens. One farmer (1 percent) reported using an antibiotic (bacitracin) for growth promotion, which was administered to all chicks for 30 days.

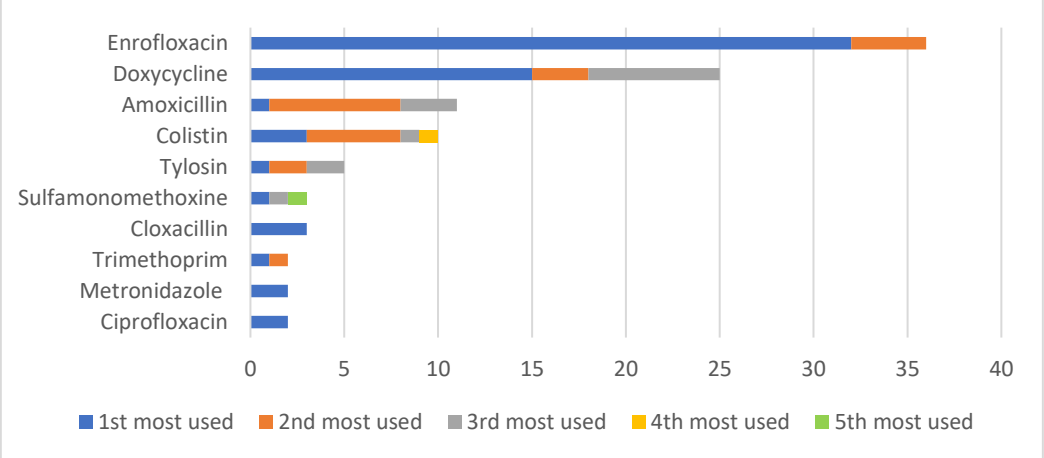
The most used antimicrobials are summarized in Figure 11.

On chicken farms, enrofloxacin was the most commonly used antibiotic, followed by doxycycline, amoxicillin and colistin. The other substances were reported by a small number of farmers.

The main indications for antimicrobial use were intestinal problems (67 percent) and breathing problems (21 percent), accounting together for 89 percent of cases. Lameness was also treated with antimicrobials, although less frequently.

The most common indication for antibiotic therapy was intestinal problems. Antibiotics were most commonly used in chicks (73 percent of cases), and in fewer cases in broilers (16 percent) and layers (9 percent). Antibiotics were more commonly applied for prevention (61 percent of cases) than for treatment. The substances were given via water in 99 percent of cases. The average duration of treatment was 4 days, in a range of 3 to 7 days. If the treatment with the chosen drug did not yield the expected results, 23 percent of farmers would consult with a veterinarian and 17 percent would do nothing. Most farmers replied “Other” to this question, without further clarifying what actions they would take.

Figure 11. Most used antimicrobials on the surveyed chicken farms (Total: 61 farms)




Source: Author’s own elaboration.

## PIG FARMS

*Number of surveys:* 51

*Note: Four pig farmers refused to answer all species-specific questions in the survey.*

### Information on farms involved in the survey

*Number of animals on the surveyed farms (last 12 months)*

Table 19. Number of animals on the surveyed pig farms (Total: 47 farmers replied)

| | Average | Minimum | Maximum |
|---|---|---|---|
| Sows | 1 746 | 273 | 7 000 |
| Boars | 16 | 26 | 62 |
| Piglets (suckling the sow) | 4 228 | 100 | 15 000 |
| Fattening pigs | 8 134 | 3 574 | 67 500 |

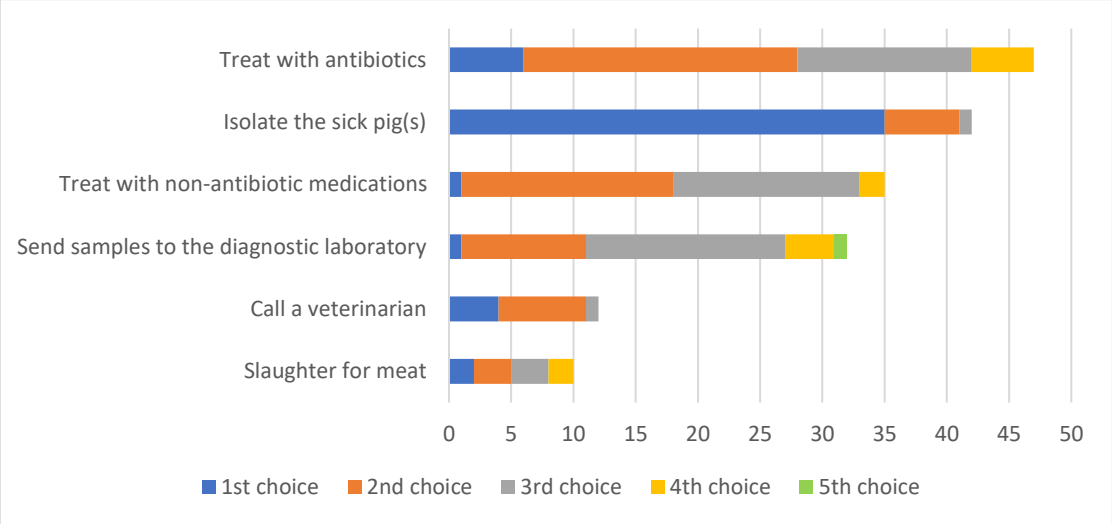
Source: Author's own elaboration.

There was a high variation in the minimum and maximum number of pigs housed on the surveyed farms in the last 12 months.

*Measures in case of disease*

In case of disease, the highest number of farmers reported treating animals with antibiotics, but only as a second or third choice. The most typical first-choice measure was the isolation of sick animals. Treatment with non-antibiotic drugs and sending samples to a diagnostic laboratory were second or third choices for many farmers. Interestingly, calling a veterinarian was only reported by around one-quarter of farmers, although it was usually a first- or second-choice measure. Slaughtering for meat was not common either.

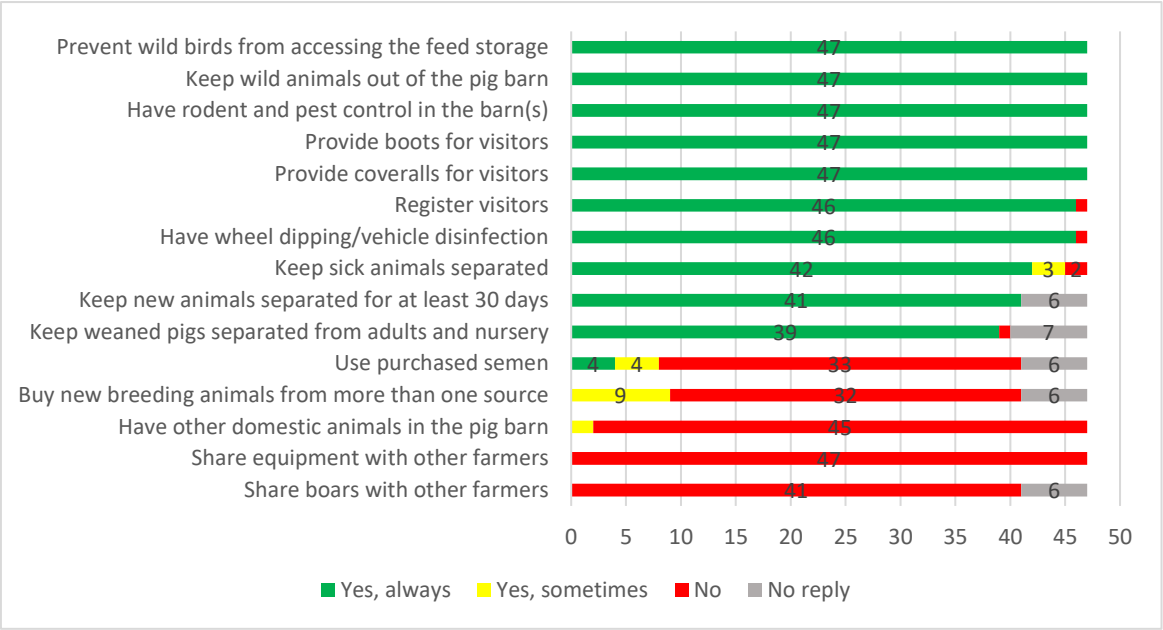
Figure 12. Measures in case of disease on the surveyed pig farms (Total: 47 farmers replied)




Source: Author's own elaboration.

*Hygiene and biosecurity*

Figure 13. Hygiene and biosecurity measures on the surveyed pig farms (Total: 47 farmers replied)




Source: Author's own elaboration.

Similar to chicken farmers, pig farmers followed good hygiene and biosecurity practices on the surveyed farms, with the majority complying with all measures included in the questionnaire. A few exceptions included farmers that did not keep new animals and age groups separated, and those that kept other domestic animals in the pig barn. Using purchased semen for breeding was rarely practiced.

*Mortality due to disease (last 12 months)*

The average mortalities recorded on the surveyed farms are summarized in Table 20. In the 12 months prior to the survey, average mortality due to disease was highest among piglets and lowest among sows.

Table 20. Mortality on the surveyed pig farms (Total: 45 farmers replied)

| | Average (%) | Range (%) |
|---|---|---|
| Piglets | 8 | 1–14 |
| Sows | 2 | 0–13 |
| Fattening pigs | 3 | 0–13 |

Source: Author's own elaboration.

*Occurrence and severity of health issues or syndromes (last 12 months)*

Table 21. Health issues on the surveyed pig farms (Total: 47 farmers replied)

| | Health issue | Ratio of farms affected (%) | Average ratio of animals affected (incl. ranges) (%) | Average mortality ratio (incl. ranges) (%) |
|---|---|---|---|---|
| Piglets (suckling the sow) | Diarrhoea | 20 | 30 (8–100) | 3 (1–10) |
| | Breathing problems | 10 | 3 (1–6) | 1 (0.5–3) |
| | Lameness | 6 | 8 (5–10) | 1 (0–2) |
| | Other intestinal problems | 4 | 20 (20–20) | 2 (2–3) |
| | Porcine reproductive and respiratory syndrome (PRRS) | 2 | 1 (*1 farm*) | 5 (*1 farm*) |
| Fattening pigs | Diarrhoea | 18 | 18 (0–100) | 1 (0–3) |
| | Breathing problems | 16 | 15 (1–70) | 2 (1–3) |
| | Other intestinal problems | 8 | 7 (0–20) | 2 (0–10) |
| | Lameness | 4 | 4 (2–5) | 1 (0–3) |
| | Porcine reproductive and respiratory syndrome (PRRS) | 2 | 30 (*1 farm*) | 3 (*1 farm*) |
| Sows/boars | Lameness | 14 | 10 (0–30) | 2 (0–7) |
| | Reproductive problems | 8 | 5 (0–10) | 3 (0–6) |
| | Not milking | 6 | 13 (0–20) | 1 (0–3) |
| | Diarrhoea | 4 | 1 (1–1) | 1 (0.5–1) |
| | Skin disease | 2 | 0.1 (*1 farm*) | 0 (*1 farm*) |
| | Porcine reproductive and respiratory syndrome (PRRS) | 2 | 0.1 (*1 farm*) | 0 (*1 farm*) |
| | Breathing problems | 2 | 12 (*1 farm*) | 4 (*1 farm*) |
| | Other intestinal problems | 2 | 5 (*1 farm*) | 2 (*1 farm*) |

Source: Author's own elaboration.

On the surveyed farms, piglets and fattening pigs were most frequently affected with diarrhoea and breathing problems, while sows and boars were most commonly affected with lameness and reproductive problems. Nervous system problems, swine dysentery, and sudden death were not reported by the surveyed farmers.

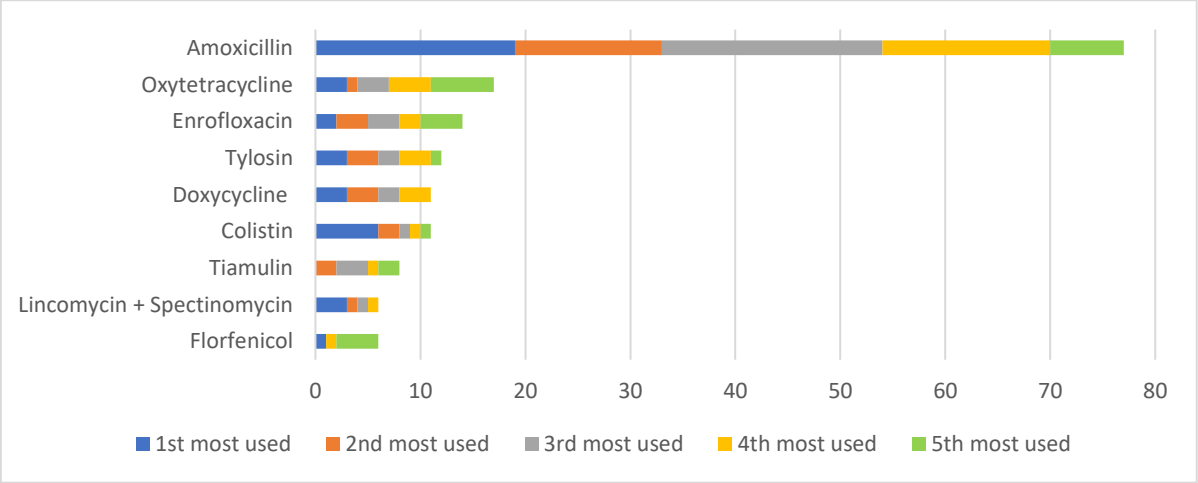
None of the farmers experienced increase in the occurrence of any health issues due to problems related to the COVID-19 pandemic.

Vaccination was performed against breathing problems, porcine reproductive and respiratory syndrome (PRRS), skin diseases, diarrhoea, reproductive problems, porcine circovirus 2, (PCV-2) and mycoplasmas.

**Information on antimicrobial use**

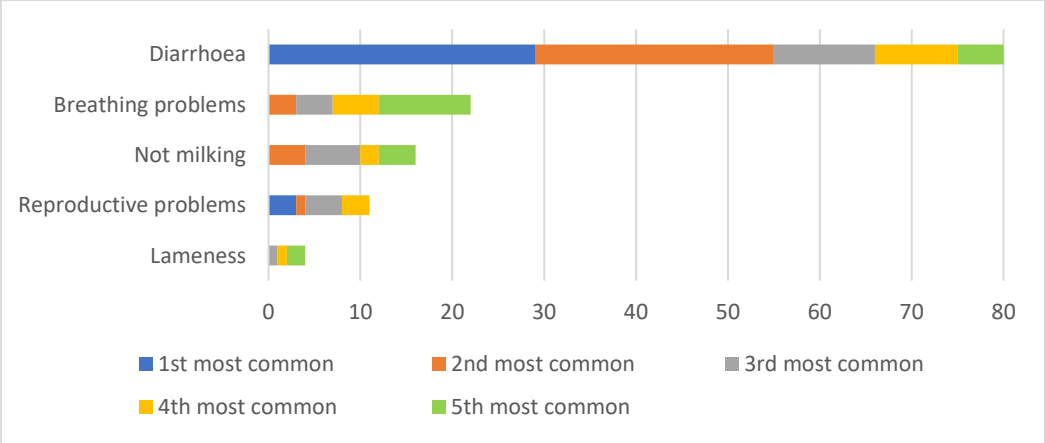
All but four pig farmers responded to the species-specific survey questions and of those that did, 100% reported using antibiotics. Most farmers (68 percent) frequently used five different substances, 13 percent used four different drugs, 13 percent used three antibiotics, 4 percent used two substances and only one farmer (2 percent) reported using only one substance. None of the farmers reported using antimicrobials for growth promotion. The most frequently used antimicrobials (reported by the highest number of farmers) are shown in Figure 14, and the most common indications for AMU are shown in Figure 15. Amoxicillin was by far the most used antibiotic by pig farmers, followed by oxytetracycline, enrofloxacin, tylosin, doxycycline and colistin.

Figure 14. Most used antimicrobials on the surveyed pig farms (Total: 47 farmers replied)




Source: Author's own elaboration.

Figure 15. Most common indications for antibiotics on the surveyed pig farms (Total: 47 farmers replied)




Source: Author's own elaboration.

Diarrhoea was the most common indication for antibiotic use on the surveyed farms. Antibiotics were most often used in fattening pigs (53 percent), and less commonly in sows, boars, and piglets. Treatment of diseases (63 percent) was the main goal of using antibiotics, but preventive usage also occurred (37 percent). The route of administration was usually via injection (68 percent), and less commonly via water (26 percent). The average duration of administration was 5 days (in a range of 1 to 15 days) and on average 45 percent of animals were treated with antibiotics on the surveyed farms (in a range of 1 percent to 100 percent).

If treatment with the chosen antimicrobials did not yield the expected results, in most cases (87 percent) farmers would use a different antibiotic. Less frequently, farmers would use the same drug in a higher dose, or simply repeat the treatment with the same antibiotics. When choosing another drug for treatment, some farmers reported sending samples to the diagnostic laboratory for identification of the pathogen and for antimicrobial susceptibility testing. None of the farmers reported consulting a veterinarian in such cases.

## BEEF FARMS

*Number of surveys:* 18

*Note: Two beef farmers refused to answer all species-specific questions in the survey.*

**Information on farms and farmers involved in the survey**

*Number of animals on the surveyed farms (last 12 months)*

Table 22. Number of animals on the surveyed beef farms (Total: 16 farmers replied)

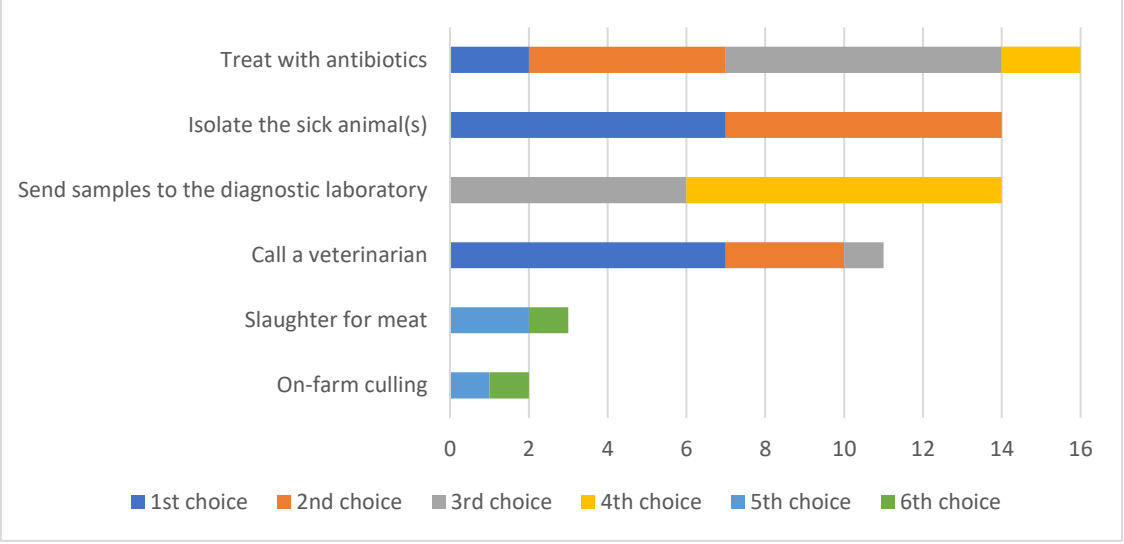
| | Average | Minimum | Maximum |
|---|---|---|---|
| Cows | 463 | 50 | 1 886 |
| Bulls | 268 | 0 | 1 350 |
| Calves under 6 months | 254 | 5 | 1 104 |
| Young cattle (heifers/steers) over 6 months | 250 | 0 | 895 |

Source: Author's own elaboration.

*Measures in case of disease*

In case of disease, calling a veterinarian and isolating sick animals were the most common first- and second-choice practices on the surveyed beef farms. Treatment with antibiotics was usually a second- or third-choice measure, followed by sending samples to diagnostic laboratory (third or fourth choice). On-farm culling and slaughtering for meat were rare. No farmers reported treating animals with non-antibiotic drugs.

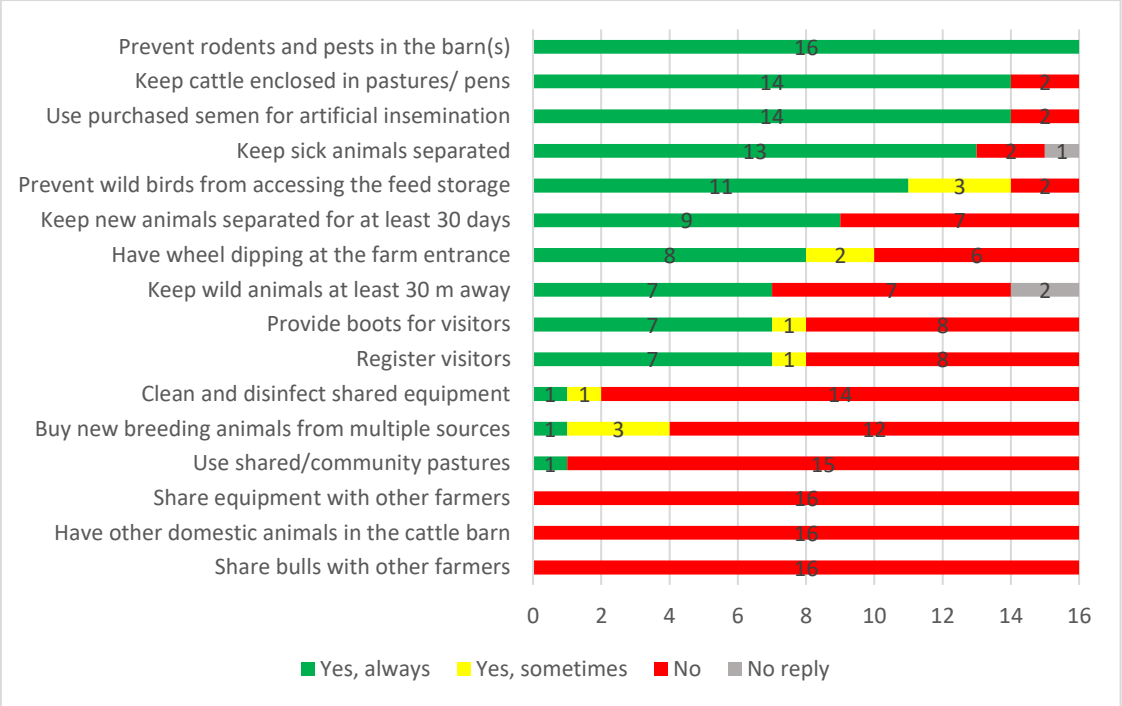
Figure 16. 17Measures in case of disease on the surveyed beef farms (Total: 16 farmers replied)




Source: Author's own elaboration.

*Hygiene and biosecurity*

Figure 18. Hygiene and biosecurity measures on the surveyed beef farms (Total: 16 farmers replied)




Source: Author's own elaboration.

On the surveyed farms, preventing rodents and pests from entering the barns, keeping cattle enclosed in pastures or pens, using purchased semen for artificial insemination, and keeping sick animals separated were the most commonly practiced measures. In addition, no farmers reported sharing equipment or bulls with other farmers, and no farmers had other domestic animals in the cattle barns. On the other hand, registering visitors and providing boots for them were only practiced by around half of the surveyed farmers.

*Occurrence and severity of health issues or syndromes (last 12 months)*

Table 23. Health issues on the surveyed beef farms (Total: 16 farmers replied)

| | Health issue | Ratio of farms affected (%) | Average ratio of animals affected (incl. ranges) (%) | Average mortality ratio (incl. ranges) (%) |
|---|---|---|---|---|
| Calves under 6 months | Diarrhoea | 67 | 11 (1–30) | 1 (1–4) |
| | Other lameness | 39 | 4 (1–10) | 3 (1–13) |
| | Breathing problems | 33 | 7 (1–20) | 1 (0–2) |
| | Other intestinal problems | 28 | 2 (1–5) | 1 (0–2) |
| | Hardware disease | 22 | 1 (0–1) | 0.3 (0–1) |
| | Nervous system problems | 6 | 1 (*1 farm*) | 1 (*1 farm*) |
| | Foot rot | 6 | 1 (*1 farm*) | - |
| | Anaplasmosis | 6 | 1 (*1 farm*) | - |

| | Health issue | Ratio of farms affected (%) | Average ratio of animals affected (incl. ranges) (%) | Average mortality ratio (incl. ranges) (%) |
|---|---|---|---|---|
| Heifers | Other lameness | 22 | 3 (2–5) | 0 |
| | Breathing problems | 17 | 2 (0–3) | 0 |
| | Foot rot | 11 | 1 (1–1) | 0 |
| | Anaplasmosis | 6 | 1 (*1 farm*) | - |
| | Diarrhoea | 6 | 1 (*1 farm*) | 0 (*1 farm*) |
| | Hardware disease | 6 | 1 (*1 farm*) | - |
| | Nervous system problems | 6 | 1 (*1 farm*) | 1 (*1 farm*) |
| Cows | Other lameness | 50 | 9 (1–30) | 0 |
| | Mastitis | 39 | 7 (1–30) | 0 |
| | Metritis | 28 | 8 (1–20) | 0 |
| | Diarrhoea | 28 | 3 (1–10) | 0 |
| | Hardware disease | 28 | 3 (1–5) | 0 |
| | Other intestinal problems | 17 | 1 (0–2) | 0 |
| | Breathing problems | 17 | 1 (0–3) | 0 |
| | Nervous system problems | 11 | 1 (1–1) | - |
| | Foot rot | 11 | 9 (2–15) | 0 |
| | Anaplasmosis | 6 | 1 (*1 farm*) | - |

Source: Author's own elaboration.

In the case of calves under 6 months of age, diarrhoea affected the highest number of surveyed farms (67 percent), but only an average of 11 percent of animals were affected by the disease, with a low average mortality ratio (1 percent). Other diseases commonly occurring on the farms were lameness (39 percent), breathing problems (33 percent), intestinal problems (28 percent), and hardware disease (22 percent). All these diseases affected only a small number of animals per farm, and resulted in low mortality.

Heifers were less commonly affected with diseases than calves. Lameness (22 percent) and foot rot (11 percent) affected the highest number of surveyed farms in the last 12 months. The ratio of animals affected, and mortality caused by these diseases were low.

In the case of cows, the most common health issue on the surveyed farms was lameness, occurring on 50 percent of farms, followed by mastitis (39 percent), diarrhoea (28 percent), metritis (28 percent) and hardware disease (28 percent), but with no reported mortality. Respiratory problems were also encountered on some farms (17 percent).

Only a few farmers reported data about vaccination. Based on their responses, vaccines were mainly administered to calves against breathing problems, intestinal problems, and diarrhoea.

One farmer (6 percent) reported experiencing an increase in the occurrence of health issues due to problems related to the COVID-19 pandemic.

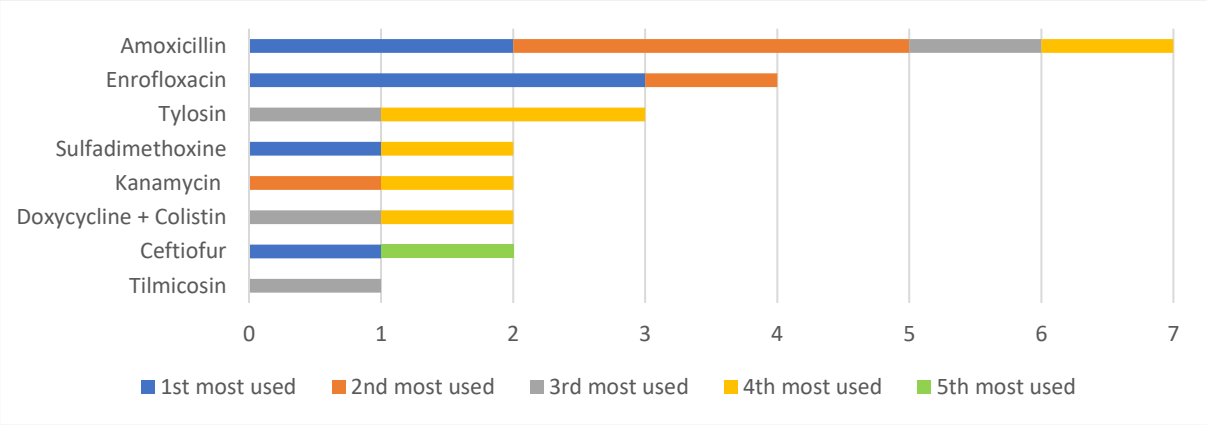
**Information on antimicrobial use**

On the surveyed beef farms, half of the farmers did not use antimicrobials at all. Among those who used antimicrobials in their animals, one farmer (11 percent) reported using two, two farmers (22 percent) used three, five farmers (56 percent) reported using four, and only one farmer (11 percent) reported using five different drugs. None of the surveyed farmers reported using only one antimicrobial. None of the farmers reported antibiotic use for growth promotion.

The most used antimicrobials (reported by the highest number of farmers) are summarized in Figure 18.

On beef farms, amoxicillin (21 percent) was the most used antimicrobial, followed by enrofloxacin (12 percent). The main indication for antimicrobial use was diarrhoea and, less commonly, mastitis in cows. Antibiotics were applied as treatment in most cases (94 percent), and more commonly in cows (66 percent) than in calves. The substances were mainly as administered via injection (86 percent) and to a lesser extent, mixed in feed (6 percent). The average duration of treatment was 3 days, in a range of 1 to 5 days. If treatment with the chosen drug did not yield the expected results, farmers usually repeated the treatment with the same or a different antibiotic. None of the farmers reported testing samples to identify the pathogen and its antimicrobial susceptibility before choosing another antibiotic for treatment.

Figure 19. Most used antimicrobials on the surveyed beef farms (Total: 9 farmers)




Source: Author's own elaboration.

## DAIRY FARMS

*Number of surveys:* 46

*Note: No dairy farmers refused to reply to the species-specific part of the survey.*

**Information on farms involved in the survey**

*Number of animals on the surveyed farms (last 12 months)*

Table 24. Number of animals on the surveyed dairy cattle farms (Total: 46 farms)

| | Average | Minimum | Maximum |
|---|---|---|---|
| Cows (milking and dry) | 1 197 | 24 | 5 682 |
| Bulls | 124 | 1 | 600 |
| Calves under 6 months | 490 | 8 | 2 900 |
| Heifers/Steers (young cattle over 6 months old) | 493 | 4 | 2 900 |

Source: Author's own elaboration.

There was a high variation in the minimum and maximum number of cattle housed on the surveyed farms in the last 12 months.

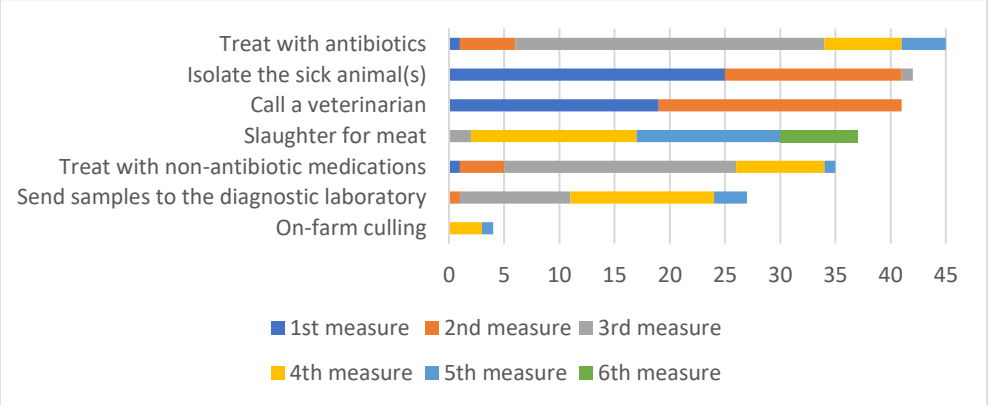
*Housing*

On the surveyed farms, most farmers kept their animals in the stables all day (78 percent). Grazing on the same property as the barn (13 percent) or on a different property (7 percent) was rare.

*Measures in case of disease*

In case of disease, isolating the sick animals (91 percent) and calling a veterinarian (89 percent) were the most common first- and second-choice practices on the surveyed dairy farms. Treatment with antibiotics was reported by the highest number of farmers (98 percent), but it was typically a third-choice measure. Treatment with non-antibiotic drugs was less common, but was also mainly a third-choice practice. These options were followed by slaughter for meat (80 percent) and treatment with non-antibiotics (76 percent), usually as a third or later choice. Slaughtering for meat and sending samples to diagnostic laboratory were mainly fourth or later choices. Culling was rare.

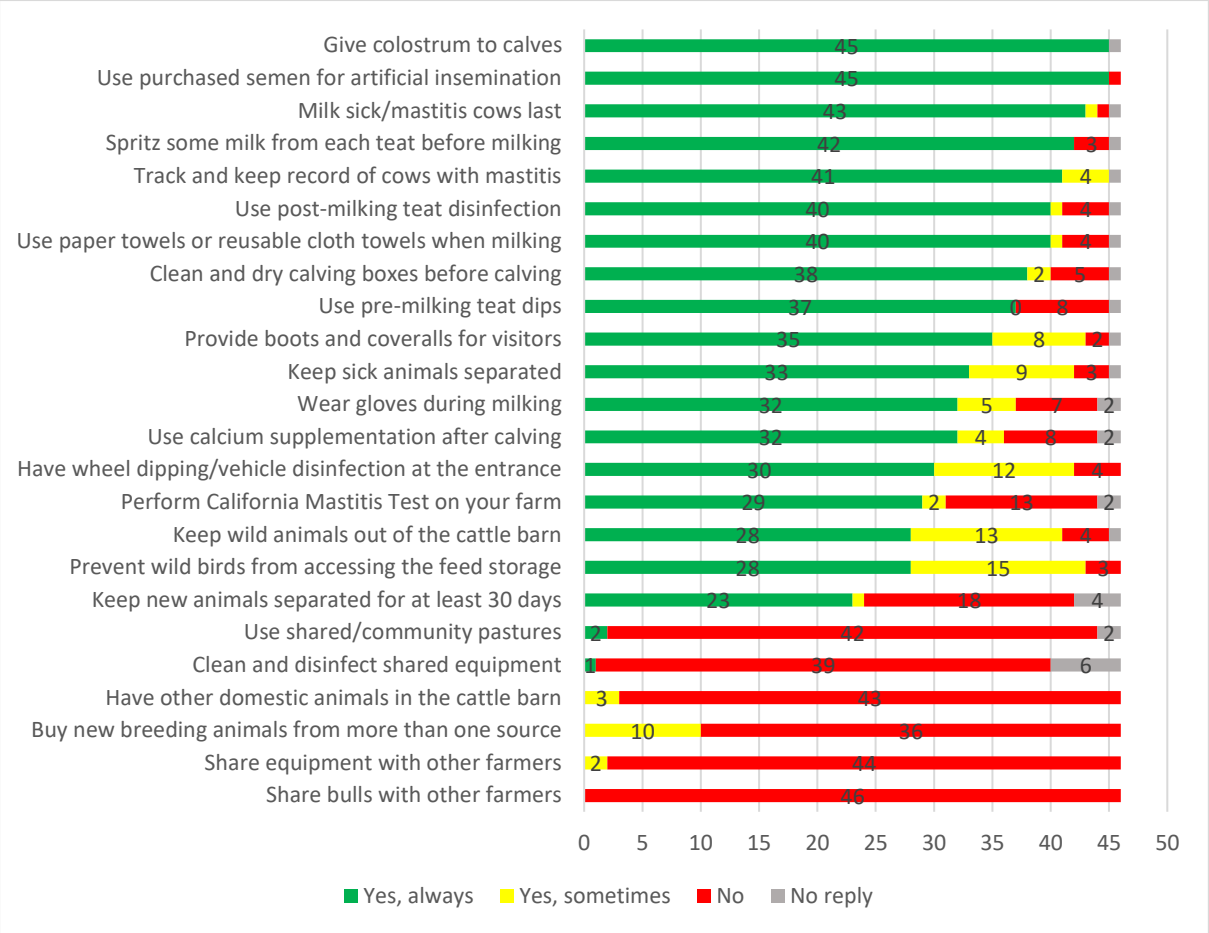
Figure 20. 21Measures in case of disease on the surveyed dairy farms (Total: 46 farms)




Source: Author's own elaboration.

*Hygiene and biosecurity*

Figure 22. Hygiene and biosecurity measures on the surveyed dairy farms (Total: 46 farms)




Source: Author's own elaboration.

In general, dairy farmers followed good hygiene and biosecurity practices, with the majority complying with all measures included in the questionnaire. The only exception was the separation of new animals on the farm, which was only reported by around half of the farmers surveyed.

*Occurrence and severity of health issues or syndromes (last 12 months)*

Table 25. Health issues and vaccination on the surveyed dairy farms (Total: 46 farms)

| | Health issue | Ratio of farms affected (%) | Average ratio of animals affected (incl. ranges) (%) | Average mortality ratio (incl. ranges) (%) | Average ratio of vaccinated animals (incl. ranges) (%) |
|---|---|---|---|---|---|
| Calves under 6 months | Diarrhoea | 83 | 14 (1–100) | 2 (0–5) | 94 (5–100) |
| | Breathing problems | 70 | 6 (1–35) | 1 (1–3) | 95 (20–100) |
| | Other intestinal problems | 20 | 4 (1–11) | - | 91 (10–100) |
| | Other lameness | 17 | 4 (1–10) | - | - |

| | Health issue | Ratio of farms affected (%) | Average ratio of animals affected (incl. ranges) (%) | Average mortality ratio (incl. ranges) (%) | Average ratio of vaccinated animals (incl. ranges) (%) |
|---|---|---|---|---|---|
| | Nervous system problems | 4 | 1 (1–1) | - | - |
| | Foot rot | - | - | - | 100 (*1 farm*) |
| | Anaplasmosis | - | - | - | 100 (*1 farm*) |
| Heifers | Other lameness | 20 | 4 (1–10) | - | - |
| | Breathing problems | 17 | 10 (1–30) | 1 (1–1) | 94 (25–100) |
| | Diarrhoea | 13 | 11 (1–30) | 1 (1–1) | 93 (2–100) |
| | Other intestinal problems | 11 | 2 (1–5) | - | 86 (1–100) |
| | Foot rot | 4 | 2 (2–2) | - | - |
| | Hardware disease | 4 | 1 (1–1) | - | - |
| Cows | Other lameness | 76 | 6 (1–22) | 1 (0–1) | 84 (2–100) |
| | Hardware disease | 46 | 2 (1–15) | 1 (1–2) | - |
| | Other intestinal problems | 37 | 3 (1–10) | - | 93 (20–100) |
| | Breathing problems | 28 | 5 (1–50) | - | 97 (50–100) |
| | Foot rot | 26 | 8 (1–30) | - | 100 |
| | Diarrhoea | 24 | 3 (1–10) | 1 (1–1) | 100 |
| | Mastitis | 4 | 7 (3–10) | - | - |
| | Other reproductive problems | 2 | 40 (*1 farm*) | - | - |

Source: Author's own elaboration.

In the case of calves, diarrhoea affected the highest number of surveyed farms (83 percent), followed by breathing problems (70 percent). Vaccines were also commonly administered, mainly as a preventative measure against these diseases. In the case of heifers and cows, lameness was the most frequently encountered health issue, being more common in cows (76 percent of farms) than in heifers (20 percent). Breathing and intestinal problems also affected these groups, but vaccination against them was common. Two farmers (4 percent) experienced an increase in the occurrence of health issues due to problems related to the COVID-19 pandemic.

**Information on antimicrobial use**

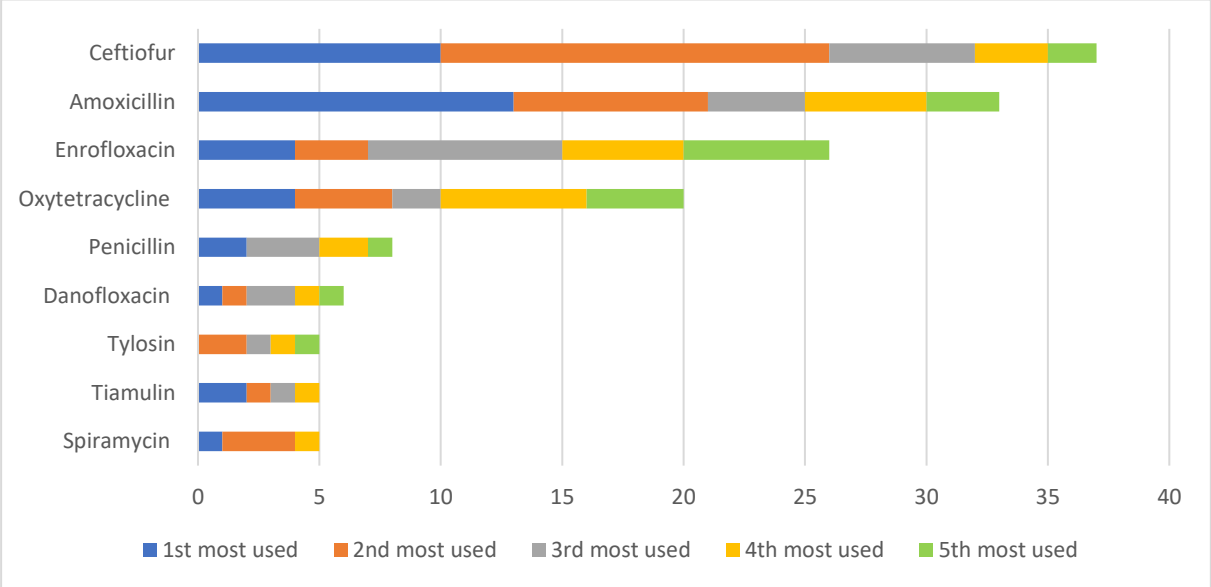
On the surveyed dairy farms, almost all farmers (96 percent) reported using antibiotics, but none of the respondents reported using these drugs for growth promotion or production enhancement. The majority of these farmers (61 percent) reported using five substances and the remaining 38 percent used between two and four different antimicrobials.

Half of the surveyed farmers reported using dry cow treatment in their animals. Among them, 53 percent applied dry cow treatment in 100 percent of cows, 44 percent in less than 5 percent, and the rest (one farmer) in 6–25 percent of their cows. The surveyed farmers used enrofloxacin, marbofloxacin, amoxicillin, ceftiofur, tiamulin and cloxacillin for this purpose.

On the surveyed farms, the average proportion of animals that received antibiotics during their lifetime was 21 percent in cows, 11 percent in heifers, and 31 percent in calves.

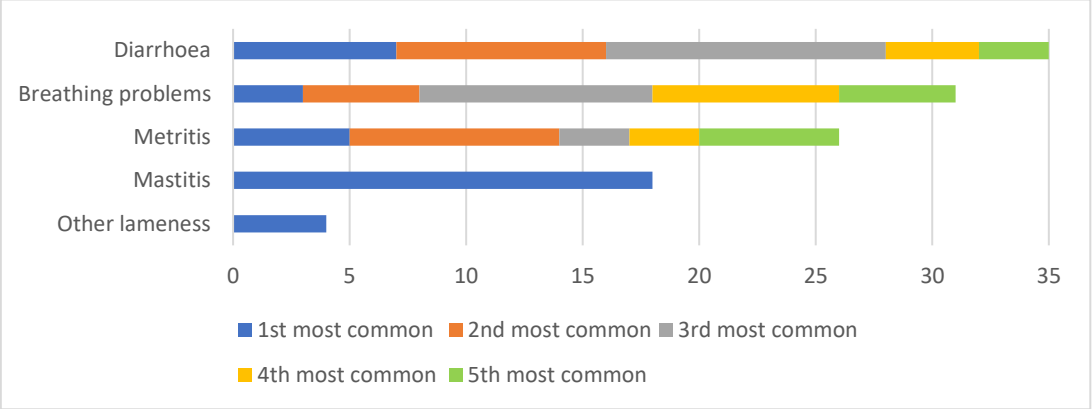
The most used antimicrobials (reported by the highest number of farmers) are summarized in Figure 21. On dairy farms, ceftiofur and amoxicillin were the most used antibiotics, followed by oxytetracycline and enrofloxacin. The main indication for antimicrobial use was diarrhoea, followed by breathing problems, metritis and mastitis. A summary of diseases against which the most used antimicrobials were applied can be seen in Figure 22.

Figure 23. Most used antimicrobials on the surveyed dairy farms (Total: 44 farmers replied)




Source: Author's own elaboration.

Figure 24. Most common indications for antimicrobial use on the surveyed dairy farms (Total: 44 farmers)




Source: Author's own elaboration.

Antibiotics were most commonly used in cows (68 percent) and less often in calves, and were applied as treatment in 86 percent of cases. The substances were most commonly applied as injections (88 percent), and sometimes as intramammary infusions (6 percent). Other application methods such as topical, in feed, in water, or as drench were less common. The average duration of treatment was 3 days (in a range of 1 to 6 days). If treatment with the chosen drug did not yield the expected result, farmers usually used a different antibiotic (57 percent) or consulted with a veterinarian (18 percent). Only one farmer reported testing samples to identify the pathogen and its antimicrobial susceptibility before choosing another antibiotic for treatment.

## SMALL RUMINANT FARMS

*Number of surveys:* 30

*Note: No small ruminant farmers refused to reply to the species-specific part of the survey.*

### Information on farms and farmers involved in the survey

*Number of animals on the surveyed farms (last 12 months)*

Table 26. Number of animals on the surveyed small ruminant farms (Total: 30 farms)

| | Average | Minimum | Maximum |
|---|---|---|---|
| Ewes | 937 | 20 | 16 000 |
| Rams | 120 | 1 | 2 000 |
| Lambs | 401 | 10 | 5 000 |
| Adult goats | 271 | 5 | 1 800 |
| Bucks | 32 | 1 | 200 |
| Kids | 90 | 6 | 300 |

Source: Author's own elaboration.

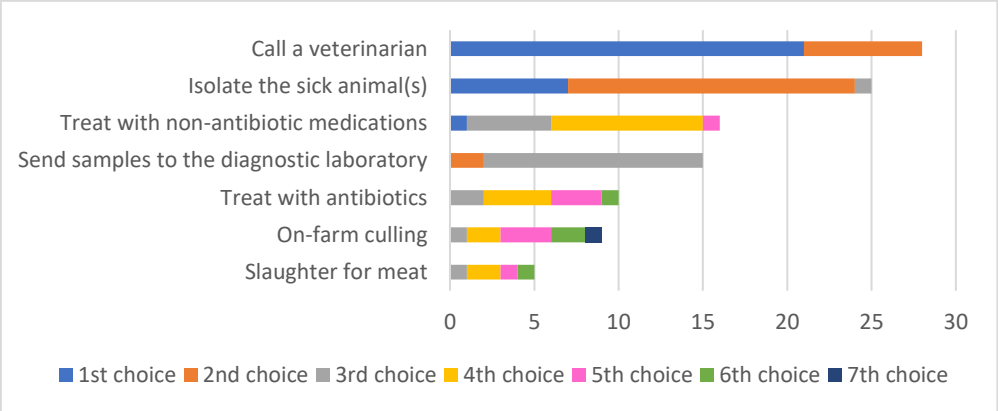
There was a high variation in the minimum and maximum number of small ruminants housed on the surveyed farms in the last 12 months.

*Type of animals on the surveyed farms*

Most farmers housed only sheep (63 percent), while keeping both sheep and goats (27 percent) or only goats (3 percent) were less common. Sheep were mostly kept for meat (70 percent) and less often for both meat and wool (30 percent). In the case of goat farms, the main utilization of animals was for milk (78 percent), while keeping them for meat (11 percent) and for both meat and milk (11 percent) were rare.

*Measures in case of disease*

Figure 25. Measures in case of disease on the surveyed small ruminant farms (Total: 30 farms)



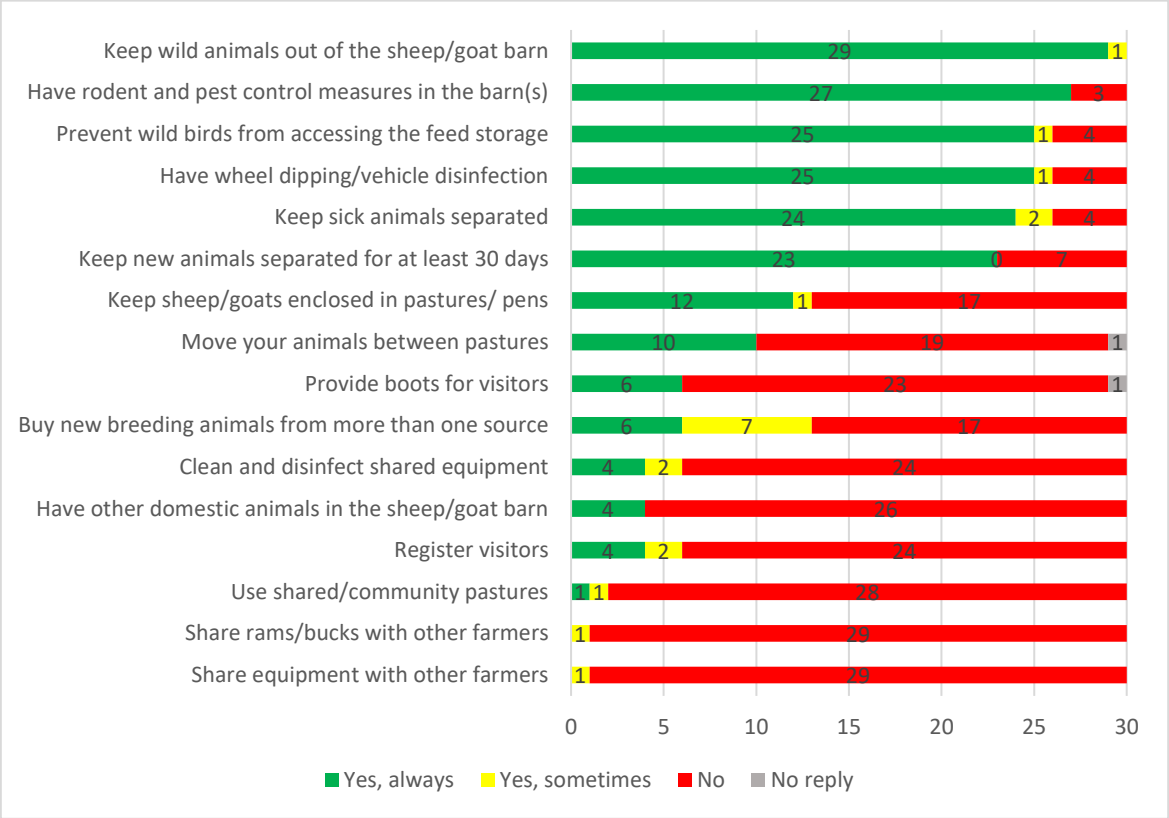

Source: Author's own elaboration.

In case of disease, 93 percent of the surveyed farmers reported calling a veterinarian, mostly as a first (70 percent) or second (23 percent) choice. Isolation of sick animals was the second most preferred answer (83 percent) and it was also usually practiced as a first or second choice. Sending samples to laboratory was practiced by half of the farmers, and usually as a third-choice measure. Treatment with non-antibiotic medications and with antibiotic drugs were third- and fourth-choice measures, with the former being reported by more farmers. On-farm culling and slaughter were not common.

*Hygiene and biosecurity*

On the surveyed farms, keeping all wild animals out of the sheep or goat barn (100 percent), and having rodent and pest control measures in the barn (90 percent), were practiced by most farmers. Preventing wild birds from accessing the feed storage (87 percent), having wheel dipping or vehicle disinfection at the entrance to the farm (87 percent), keeping sick animals separated (87 percent), and keeping new animals separated (77 percent) were also commonly followed good practices. Only one farmer shared equipment and rams or bucks with other farmers. On the other hand, 80 percent of farmers never registered visitors and 80 percent never provided boots for them either.

Figure 26. Hygiene and biosecurity measures on the surveyed small ruminant farms (Total: 30 farms)




Source: Author's own elaboration.

*Occurrence and severity of health issues or syndromes (last 12 months)*

Table 27. Health issues on the surveyed small ruminant farms (Total: 30 farms)

| | Health issue | Ratio of farms affected (%) | Average ratio of animals affected (incl. ranges) (%) | Average mortality ratio (incl. ranges) (%) |
|---|---|---|---|---|
| Lambs | Diarrhoea | 23 | 4 (1–10) | 2 (1–2) |
| | Other intestinal problems | 20 | 4 (1–10) | 1 (1–1) |
| | Breathing problems | 7 | 1 (1–1) | 1 (1–1) |
| | Lameness | 7 | 1 (1–1) | - |
| | Skin disease | 3 | 2 (*1 farm*) | - |
| | Sudden death | 3 | 3 (*1 farm*) | 2 (*1 farm*) |
| Kids | Diarrhoea | 3 | 20 (*1 farm*) | 1 (*1 farm*) |
| | Other intestinal problems | 3 | 1 (*1 farm*) | - |
| Ewes/Adult goats | Breathing problems | 20 | 3 (1–15) | 1 (1–1) |
| | Other intestinal problems | 7 | 1 (1–1) | 1 (1–1) |
| | Diarrhoea | 10 | 1 (1–2) | 2 (2–2) |
| | Mastitis | 7 | 10 (10–10) | - |
| | Lameness | 3 | 2 (*1 farm*) | - |
| | Sudden death | 3 | 1 (*1 farm*) | 1 (*1 farm*) |

Source: Author's own elaboration.

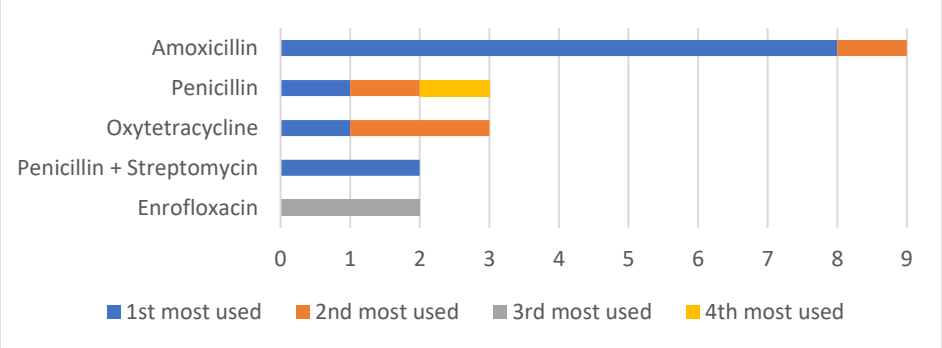
In the case of lambs, diarrhoea (23 percent) and other intestinal problems (20 percent) affected the highest number of the surveyed farms. For kids, only two farmers reported health issues: one reported diarrhoea and one reported other intestinal problems. In ewes and adult goats, the most frequent health issues on the surveyed farms were breathing problems, affecting 20 percent of farms, followed by diarrhoea (10 percent) and other intestinal problems (17 percent). Farmers did not commonly report vaccination against any of the previously mentioned diseases . Only one farmer (1 percent) experienced an increase in the occurrence of health issues due to problems related to the COVID-19 pandemic.

**Information on antimicrobial use**

On the surveyed small ruminant farms, 40 percent of farmers did not use any antibiotics at all. Of the 60 percent of participants who used antimicrobials, most (61 percent) used only one substance, two (11 percent) reported using two drugs, four reported using three substances (22 percent), and one farmer (6 percent) reported using four different antibiotics. No farmers reported administering antibiotics for growth promotion. The most used antimicrobials are summarized in Figure 25. On small ruminant farms, amoxicillin was by far the most used antibiotic. The main indications for antimicrobial use were breathing problems, diarrhoea, other intestinal problems, and mastitis. A summary of diseases against which the most used antimicrobials were applied can be seen in Figure 26.

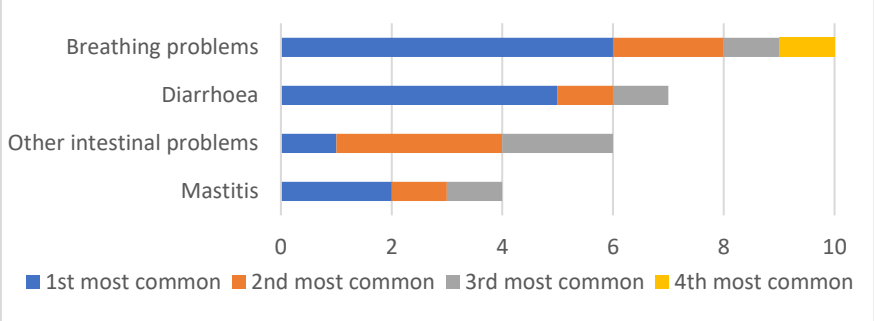
Antibiotics were most commonly used in ewes (61 percent), in fewer cases in lambs (29 percent) and rarely in kids (7 percent). On average, only 3 percent of animals were treated with antibiotics per year, ranging from 0 percent to 15 percent. Antibiotics were applied as treatment in 100 percent of cases, and never as prevention. The substances were given only as injections (100 percent), and the average duration of treatment was 2 days (in a range of 1 to 5 days). If treatment with the chosen drug did not yield the expected results, farmers usually (26 percent) used a different antibiotic, but none of the farmers reported testing samples to identify the pathogen and its antimicrobial susceptibility before choosing another antibiotic for treatment. Consulting with a veterinarian (9.7 percent) or repeating the treatment with the same drug (3 percent) were rare. Many farmers reported "Other" measures, without further specifying what they did.

Figure 27. Most used antimicrobials on the surveyed small ruminant farms (Total: 18 farmers)




Source: Author's own elaboration.

Figure 28. Most common indications for antimicrobial use on the surveyed small ruminant farms (Total: 18 farmers)




Source: Author's own elaboration.

## BEE FARMS

*Number of surveys:* 64

### Information on farms and farmers involved in the survey

*Purpose of beekeeping*

On the surveyed bee farms, keeping bees for multiple purposes was very common. Bees were kept most commonly for honey (97 percent of farmers), swarms (66 percent), propolis (64 percent), wax (55 percent), pollen (48 percent), queen bees (42 percent), and pollination (41 percent).

*Origin of bees*

Most of the surveyed farmers (84 percent) raised their own bees without purchasing others, while 16 percent reported both raising their own bees and purchasing them.

*Moving bees to different locations*

On the surveyed farms, moving of bees occurred at the following frequency:

- 61 percent did not move bees;
- 14 percent moved bees once a year;
- 8 percent moved bees twice a year; and
- 16 percent moved bees more than twice a year.

*Number of hives on the surveyed farms (last 12 months)*

There was a high variation in the minimum and maximum number of beehives housed on the surveyed farms in the last 12 months.

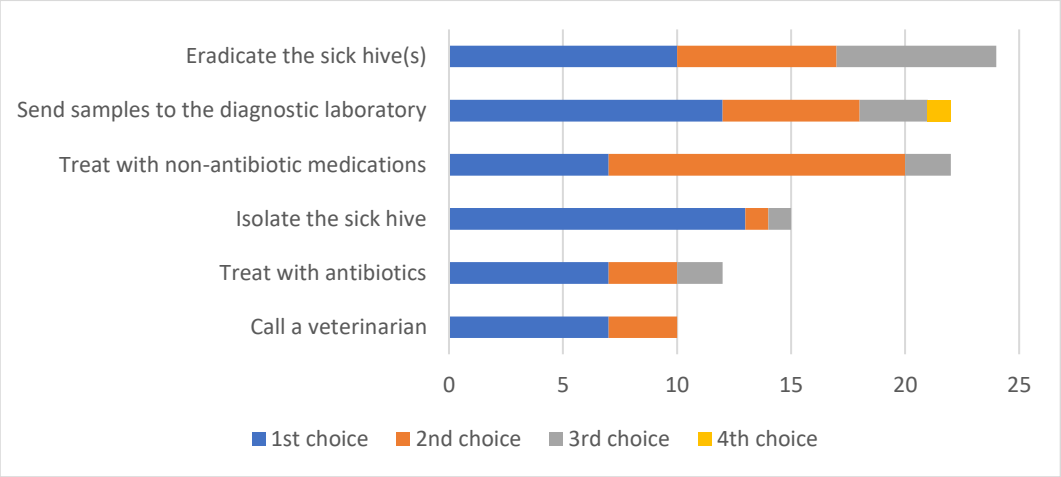
Table 28: Number of hives on the surveyed bee farms (Total: 60 farmers replied)

| | Average | Minimum | Maximum |
|---|---|---|---|
| Nucleus hives (beginner hives or swarms) | 95 | 0 | 1 000 |
| Production hives (colonies) | 142 | 4 | 2 700 |

Source: Author's own elaboration.

*Measures in case of disease*

Figure 29. Measures in case of disease on the surveyed bee farms (Total: 24 farmers replied)



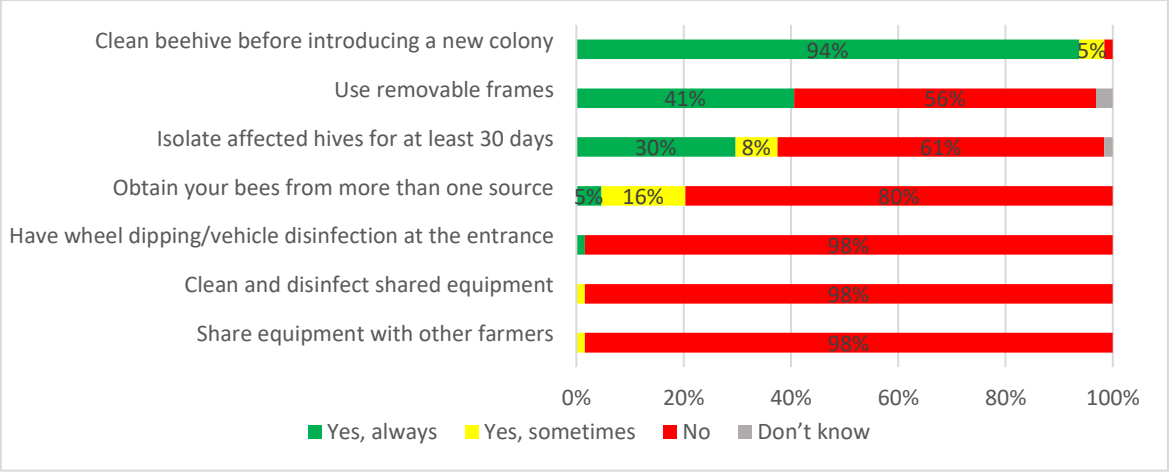

Source: Author's own elaboration.

In case of disease, eradication of hives, sending samples to diagnostic laboratories and treating bees with non-antibiotic medications were practiced by most farmers, usually as first- or second-choice measures. These were followed by the isolation of sick hives and treatment with antibiotic drugs, also mainly practiced as first- or second-choice measures. Surprisingly, calling a veterinarian was reported by the lowest number of farmers, although when it was, it was also chosen as a first- or second-choice measure.

*Hygiene and biosecurity*

On the surveyed bee farms, complete cleaning of hives before introducing a new colony was always done by most farmers (94 percent), and most farmers did not share equipment with other farmers (98 percent). On the other hand, the rest of the hygiene and biosecurity measures included in the questionnaire were not commonly practiced by the surveyed farmers. Keeping affected hives in separate locations (quarantine apiary) for at least 30 days was practiced by only 38 percent of farmers. Most farms (98 percent) did not have vehicle disinfection at the entrance of the farm.

Figure 30. Hygiene and biosecurity measures on the surveyed bee farms (Total: 64 farms)




Source: Author's own elaboration.

*Occurrence and severity of health issues or syndromes (last 12 months)*

Table 29. Health issues on the surveyed bee farms (Total: 37 farmers replied)

| | Health issue | Ratio of farms affected (%) | Average ratio of animals affected (incl. ranges) (%) | Average mortality ratio (incl. ranges) (%) |
|---|---|---|---|---|
| Nucleus hives | Varroa infection | 58 | 53 (2–100) | 9 (1–50) |
| | Pesticide toxicity | 9 | 40 (2–100) | 4 (0–6) |
| | Nosema infection | 5 | 12 (1–20) | 10 (*1 farm*) |
| | Diarrhoea | 3 | 13 (*2 farms*) | - |
| | European foulbrood | 3 | 2 (*2 farms*) | - |
| | Deformed wings | 2 | 25 (*1 farm*) | - |
| Production hives | Varroa infection | 70 | 55 (1–100) | 9 (1–50) |
| | Pesticide toxicity | 14 | 64 (2–100) | 14 (2–25) |
| | Nosema infection | 9 | 29 (1–100) | 5 (1–10) |
| | American foulbrood | 2 | 2 (*1 farm*) | - |
| | Deformed wings | 2 | 25 (*1 farm*) | - |
| | Diarrhoea | 2 | 1 (*1 farm*) | - |
| | European foulbrood | 2 | 1 (*1 farm*) | - |

Source: Author's own elaboration.

On the surveyed farms, production hives were more frequently affected with health issues than nucleus hives. The most common problems included Varroa and Nosema infections and pesticide toxicity. Due to the COVID-19 pandemic, two beekeepers (3 percent) experienced an increase in the occurrence of health issues.

**Information on antimicrobial use**

Among the respondents, only five beekeepers (8 percent) reported using antimicrobials. Two of these farmers reported using antimicrobials in 100 percent of their bees. Four farmers used registered products only, and one farmer reported that their choice of products depended on unspecified factors. The details of antimicrobial use were only reported by two farmers. One farmer used amoxicillin in production hives as prevention against Nosema disease, applied in sugar water for 1 day, in 15 percent of hives. The other farmer used metronidazole in nucleus hives as treatment against Nosema disease, applied in sugar water for 28 days, in 10 percent of hives.

## BACKYARD FARMS

*Number of surveys:* 44

*Note: No farmers refused to answer any of the questions.*

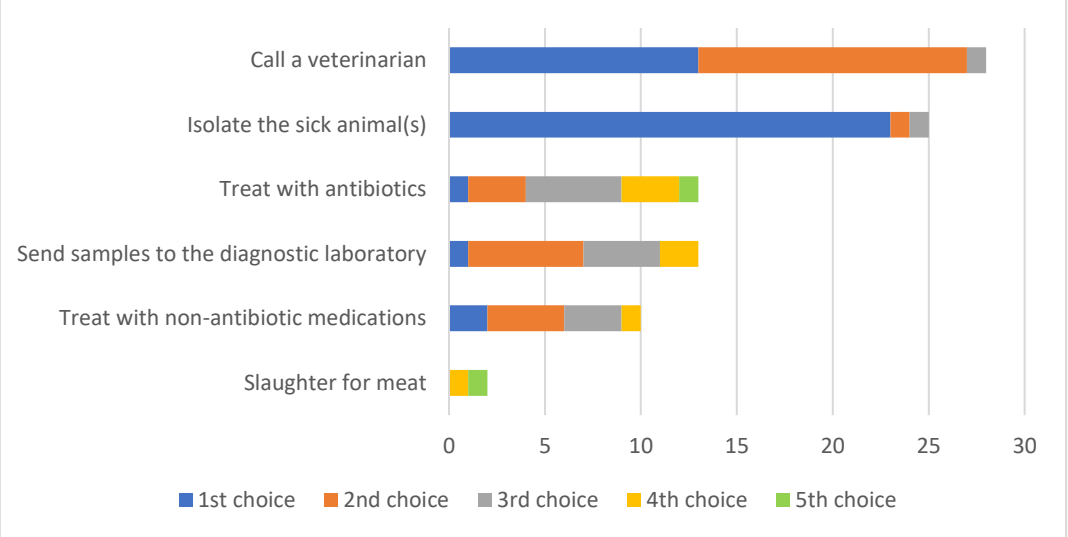
### Information on farms and farmers involved in the survey

The surveyed backyard farms mainly housed layer chickens, broiler chickens, dairy cattle, sheep, pigs and rabbits.

*Measures in case of disease*

In case of disease, calling a veterinarian and isolation of sick animals were most frequently done by the surveyed farmers, and these were usually practiced as first- or second-choice measures. Treatment with antibiotics was slightly more common than the use of non-antibiotic drugs. Sending samples to diagnostic laboratory was usually a second- or third choice measure, practiced by around one-third of farmers. Sending the animals for slaughter was rarely practiced.

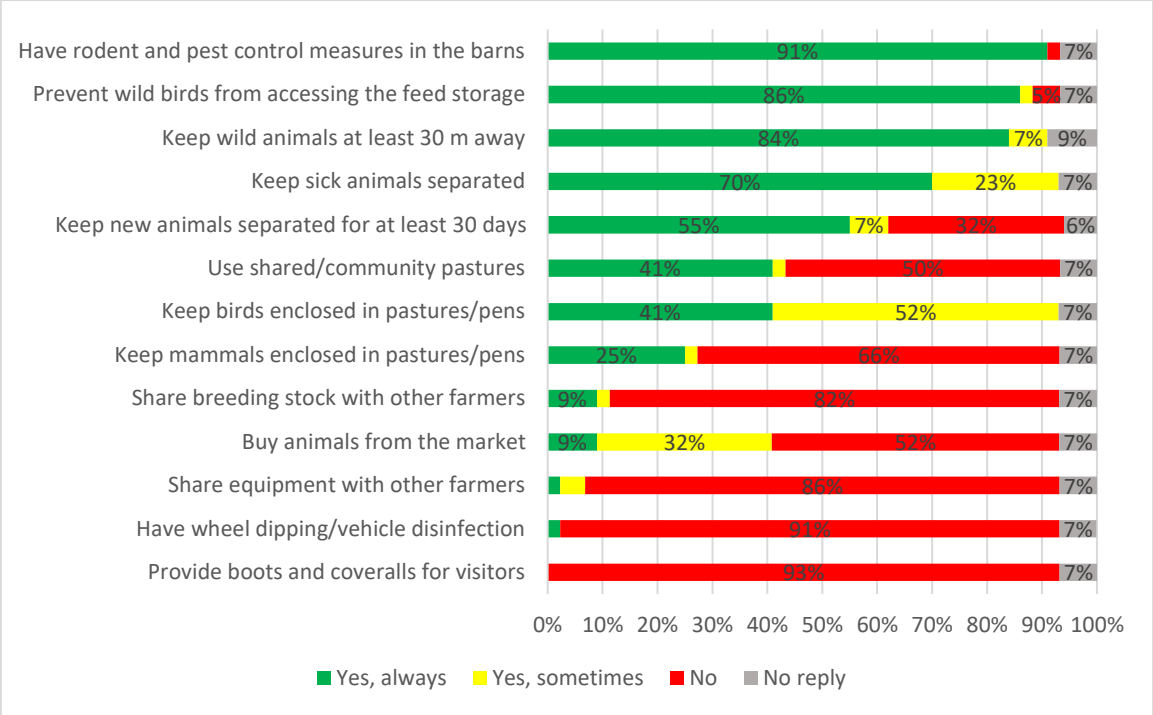
Figure 31. Measures in case of disease on the surveyed backyard farms (Total: 41 farmers replied)




Source: Author's own elaboration.

*Hygiene and biosecurity*

Figure 32. Hygiene and biosecurity measures on the surveyed backyard farms (Total: 41 farmers replied)




Source: Author's own elaboration.

Having rodent and pest control measures in the barns (91 percent), preventing wild birds from accessing the feed storage (86 percent) and keeping wild animals away from farm animals (84 percent) were regularly practiced by the highest number of backyard farmers. Keeping sick animals separated was also relatively common (71 percent), and most farmers never shared equipment (86 percent) or breeding stock (82 percent) with other farmers. On the other hand, having wheel dipping or vehicle disinfection at the farms' entrances was very rare, and giving protective clothes to visitors was not practiced by any of the surveyed farmers.

*Mortality due to disease (last 12 months)*

Only 12 farmers reported mortality data about their animals. On these farms, the average mortality was lowest in broiler chickens (2 percent in chicks and 1 percent in adults), and highest in pigs (13 percent in piglets and 43 percent in adults).

*Occurrence and severity of health issues or syndromes (last 12 months)*

Table 30. Health issues on the surveyed backyard farms (Total: 44 farms)

| Species | Health issue | Age | Number of farms affected | Average ratio of animals affected (incl. ranges) (%) | Average mortality ratio (incl. ranges) (%) |
|---|---|---|---|---|---|
| Broiler chickens | Intestinal problems | Young | 1 | 5 | 1 |
| | Lameness | Young | 2 | 10 (5–15) | 2 |
| | | Adult | 2 | 6 (1–10) | 1 |
| | Injuries | Adult | 2 | 6 (2–10) | - |
| | Skin or feather problems | Adult | 1 | 20 | - |
| | Nervous system problems | Adult | 1 | 15 | - |
| Layer chickens | Breathing problems | Young | 1 | 5 | 1 |
| | | Adult | 1 | 5 | 5 |
| | Intestinal problems | Young | 2 | 8 (5–10) | 4 |
| | | Adult | 1 | 20 | 10 |
| | Lameness | Young | 3 | 10 | - |
| | | Adult | 1 | 35 | 20 |
| | Injuries | Young | 2 | 10 | - |
| | | Adult | 1 | 5 | - |
| | Not laying | Adult | 1 | 10 | - |
| | Skin or feather problems | Young | 1 | 40 | 5 |
| | | Adult | 2 | 56 (12–100) | - |
| | Nervous system problems | Young | 2 | 10 | 1 |
| Beef cattle | Intestinal problems | Young | 2 | 15 (10–20) | - |
| Dairy cattle | Breathing problems | Young | 1 | 50 | - |
| | | Adult | 2 | 26 (2–50) | - |
| | Intestinal problems | Young | 2 | 15 (10–20) | - |
| | | Adult | 4 | 41 (5–100) | - |
| | Ear or eye problems | Adult | 1 | 5 | - |
| | Mastitis | Adult | 14 | 61 (3–100) | - |
| | Lameness | Adult | 5 | 15 (4–50) | - |
| | Injuries | Adult | 4 | 41 (3–100) | - |
| | Reproductive problems | Adult | 7 | 36 (6–50) | - |
| | Skin or feather problems | Young | 1 | 2 | - |
| | | Adult | 2 | 29 (7–50) | - |
| Sheep | Intestinal problems | Young | 2 | 2 (1–2) | 1 |
| | Injuries | Young | 1 | 3 | - |
| | Reproductive problems | Adult | 1 | 10 | - |
| | Skin or feather problems | Adult | 1 | 20 | 1 |

| Species | Health issue | Age | Number of farms affected | Average ratio of animals affected (incl. ranges) (%) | Average mortality ratio (incl. ranges) (%) |
|---|---|---|---|---|---|
| Rabbits | Breathing problems | Young | 1 | 30 | 3 |
| | Intestinal problems | Young | 4 | 43 (5–100) | 21 (3–50) |
| | | Adult | 2 | 30 (10–50) | 18 (5–30) |
| | Ear or eye problems | Young | 5 | 18 (1–60) | 6 (1–10) |
| | | Adult | 3 | 12 (10–15) | 15 |
| | Injuries | Young | 1 | 10 | - |
| | Reproductive problems | Adult | 1 | 2 | - |
| | Nervous system problems | Young | 1 | 1 | - |
| Pigs | Breathing problems | Young | 3 | 60 (3–100) | 14 (2–25) |
| | | Adult | 3 | 28 (9–50) | 14 (2–25) |
| | Intestinal problems | Young | 8 | 40 (10–100) | 5 |
| | | Adult | 7 | 35 (13–100) | 51 (2–100) |
| | Mastitis | Young | 2 | 39 (27–50) | - |
| | Lameness | Young | 2 | 9 (5–13) | - |
| | Injuries | Young | 1 | 6 | - |
| | Reproductive problems | Adult | 1 | 33 | - |
| | Skin or feather problems | Young | 3 | 67 (50–100) | - |
| | | Adult | 1 | 100 | - |
| Horses for milk | Breathing problems | Young | 1 | 100 | - |
| | | Adult | 1 | 100 | - |
| | Lameness | Adult | 1 | 50 | - |
| | Injuries | Adult | 1 | 50 | - |
| Ducks | Lameness | Young | 1 | 10 | - |

Source: Author's own elaboration.

The occurrence and severity of diseases varied among different animal species and age groups. No farmers experienced an increase in the occurrence of health issues due to the COVID-19 pandemic. *Note: In cases when only one farmer reported data, no ranges are shown in the table.*

*Vaccination*

Vaccination was common on the surveyed backyard farms: an average of 74 percent of young animals and 62 percent of adult animals were vaccinated against diseases that frequently occurred on the farms. Vaccination was most commonly used to prevent intestinal and breathing diseases in young animals, and mastitis, intestinal, breathing, and reproductive diseases in adults.

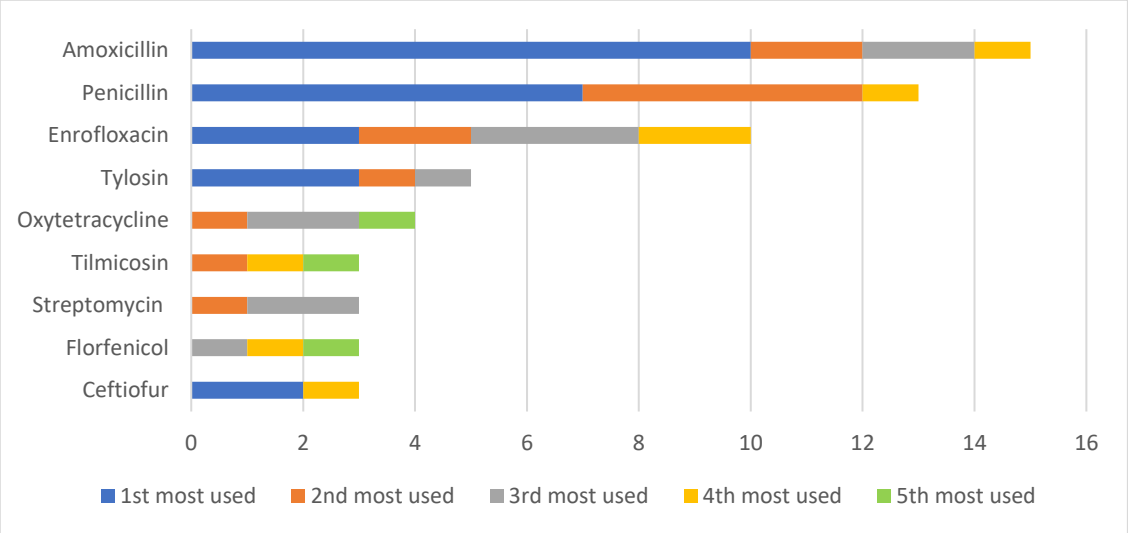
**Information on antimicrobial use**

On the surveyed backyard farms, 43 percent of farmers did not use antimicrobials at all. The rest of the farmers (57 percent) reported different proportions of their animals being treated with antimicrobials.

Of the 57 percent of participants who used antimicrobials, most used one (28 percent) or two (24 percent) different substances. Using three, four or five different antimicrobials was less common (12 percent, 20 percent, and 16 percent, respectively). None of the farmers reported using antibiotics for enhancing growth or production of animals.

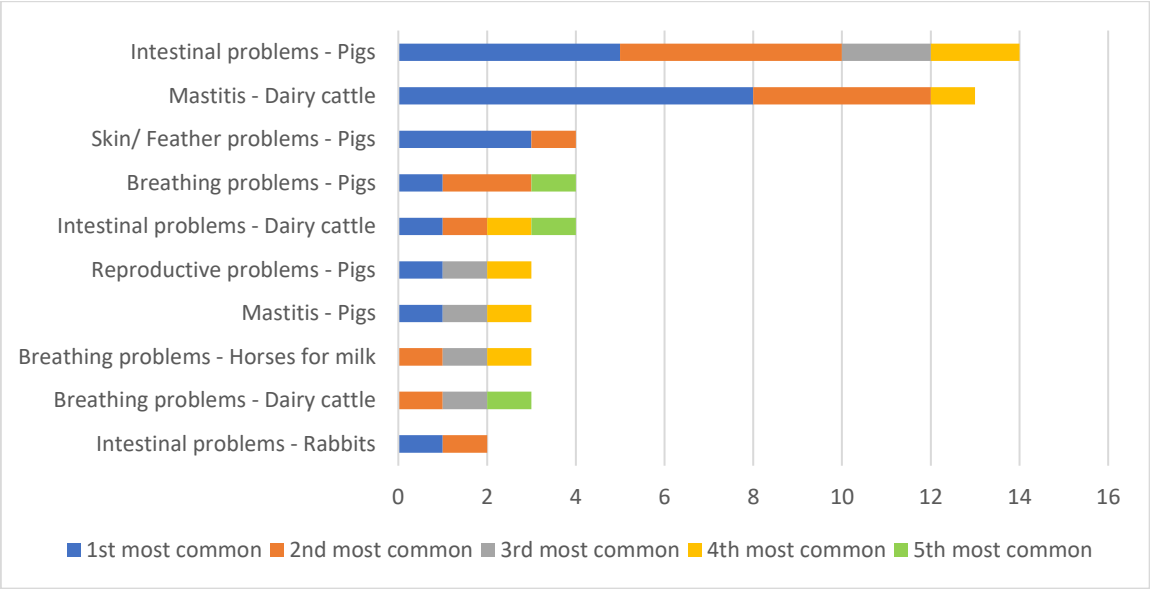
The most used antimicrobials are summarized in Figure 31. On the surveyed backyard farms, amoxicillin and penicillin were the most used antimicrobials, followed by enrofloxacin. The main indications for antimicrobial use were intestinal problems in pigs and mastitis in dairy cattle. A summary of diseases against which the most used antimicrobials were applied can be seen in Figure 32.

Figure 33. Most used antimicrobials on the surveyed backyard farms (Total: 25 farmers)




Source: Author's own elaboration.

Figure 34. Most common indications for antimicrobial use on the surveyed backyard farms (Total: 25 farmers)




Source: Author's own elaboration.

Administering antimicrobials to adults was more common (61 percent of cases) than to young animals. Antimicrobials were mainly given as treatment (90 percent) and preventive use was less frequently reported. These medications were most commonly administered via injection (94 percent) and sometimes via water (5 percent) or as drench (2 percent). In most cases, antimicrobials were administered for 3 days (in a range of 1 to 8 days), and an average of 53 percent of animals (in a range of 3 percent to 100 percent) were treated with them per year. If treatment with the chosen drug did not yield the expected result, farmers reported doing nothing (50 percent), consulting with a veterinarian (29 percent) or repeating the treatment (21 percent).

# VETERINARIAN SURVEYS

## GENERAL DATA OF SURVEYS

*Total number of surveys:* 74

*Note: No veterinarians refused to answer any of the questions.*

*Date of surveys*

- First survey: 23 March 2021
- Last survey: 25 April 2021

*Distribution of surveys*

The surveyed veterinarians practiced in the following oblasts: Chernihiv, Chernivtsi, Donetsk, Ivano-Frankivsk, Kharkiv, Kherson, Khmelnytskyi, Kirovohrad, Kyiv, Luhansk, Lviv, Mykolaiv, Poltava, Rivne, Sumy, Vinnytsia, Volyn, Zakarpattia, and Zhytomyr.

## INFORMATION ON VETERINARIANS INVOLVED IN THE SURVEY

*Role and education of veterinarians*

Among the surveyed professionals:

- 12 percent were the owner or co-owner of the veterinary practice;
- 43 percent were the manager of the veterinary practice; and
- 45 percent were employees.

*Note: More than one answer could be provided.*

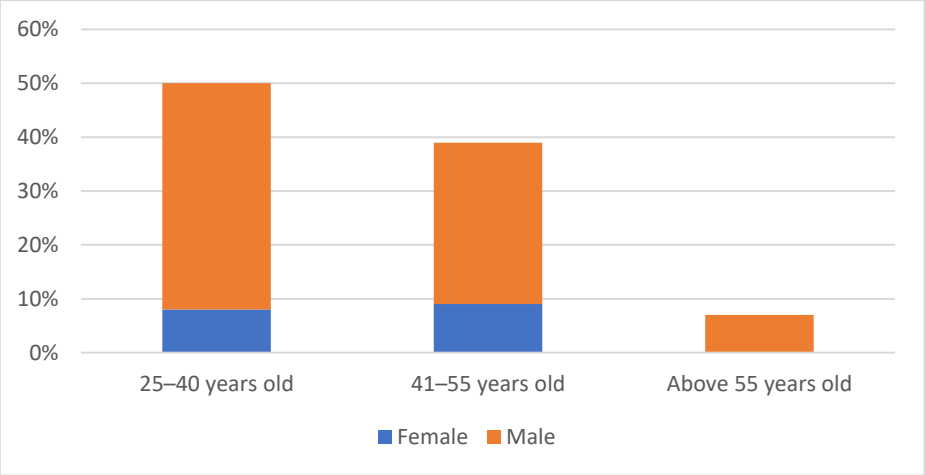
To become veterinarians, participants reported obtaining higher education or a master's degree (84 percent), or a college education (16 percent). Many, but not all (64 percent), reported having information on AMR included in their education.

*Number of years veterinarians practised veterinary medicine*

- Mean: 18 years
- Range: 2–48 years

*Age and gender of veterinarians*

Figure 35. Age and gender distribution of veterinarians participating in the survey (Total: 74 veterinarians)




Source: Author's own elaboration.

The veterinarians surveyed were mostly between 25 and 55 years of age (89 percent), and predominantly male (78 percent). All surveyed female veterinarians (13) were between 25 and 55 years of age. All of the surveyed veterinarians had pigs in their practice and most of them also treated beef cattle, dairy cattle, layer chickens and goats.

*Income of veterinarians*

Approximately one-quarter (26 percent) of the surveyed veterinarians had income from sources other than their veterinary practice, but the origin of the income was not specified.

*Practice record availability*

The most commonly recorded data among the veterinarians was the type of livestock species (82 percent), followed by the number (77 percent) and size (73 percent) of farms in their practice. On the other hand, only a few veterinarians kept records about the antibiotics they sold or prescribed. Keeping records of the names of antibiotics sold or prescribed per year was the most common practice among respondents, but was only done by 28 percent of respondents (see more details in Annex 4).

*Number and type of farms in veterinary practices*

Table 31. Number and type of farms visited by the surveyed veterinarians (Total: 74 veterinarians)

| Species | Ratio of veterinarians working with this species (%) | Type of farms in practice |
|---|---|---|
| Dairy cattle | 93 | Approximately half of veterinarians only visited backyard dairy cattle farms, but visiting large commercial farms was common as well. |
| Pigs | 91 | Approximately half of the surveyed veterinarians only visited backyard pig farms, two farmers visited backyard and semi-commercial farms, and the rest worked on backyard and large commercial farms. |

| Species | Ratio of veterinarians working with this species (%) | Type of farms in practice |
|---|---|---|
| Beef cattle | 64 | Approximately half of veterinarians only visited backyard beef cattle farms, but visiting large commercial farms was common as well. Visiting all three farm types was not reported. |
| Goats | 62 | Most veterinarians only visited backyard goat farms, while some reported visiting both backyard and large commercial farms. |
| Sheep | 54 | Most veterinarians visited backyard sheep farms, some visited large commercial farms, and only one participant reported visiting semi-commercial farms. |
| Bees | 53 | Most veterinarians only visited backyard bee farms, one visited backyard and semi-commercial farms, and two veterinarians reported visiting backyard and large commercial bee farms as well. |
| Layer chickens | 51 | Most veterinarians only worked with backyard layer chicken farms. Some visited large commercial farms as well. |
| Rabbits | 50 | Most veterinarians only visited backyard rabbit farms, and one farmer reported visiting only large commercial farms. |
| Turkeys | 42 | Most veterinarians only visited backyard turkey farms. |
| Ducks | 42 | Most veterinarians only visited backyard duck farms. |
| Geese | 34 | Most veterinarians only visited backyard geese farms. |
| Horses for meat | 16 | Veterinarians only visited backyard meat horse farms. |
| Broiler chickens | 12 | Most veterinarians only worked with backyard broiler chicken farms. Some visited large commercial farms as well. |
| Horses for milk | 8 | Veterinarians in the country only visited backyard milk horse farms. |

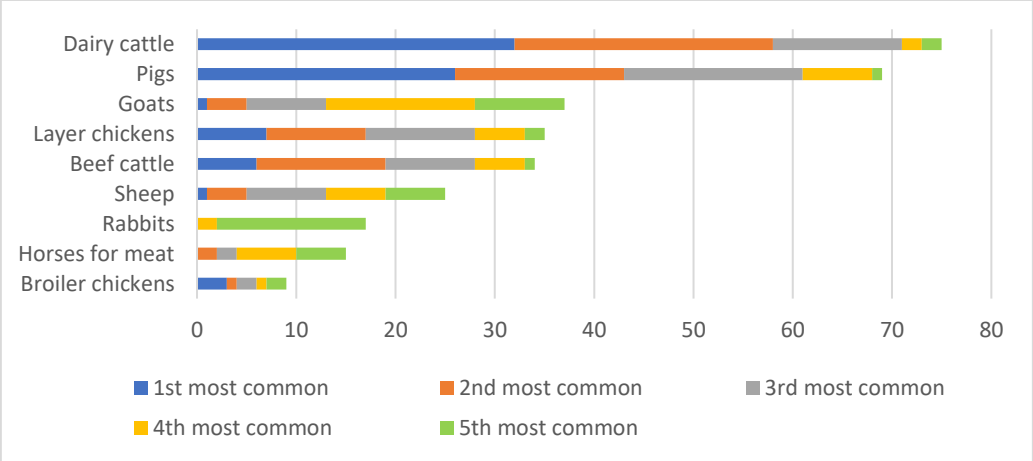
Source: Author's own elaboration.

Veterinarians commonly treated several different species in Ukraine: the average number of different species was 7, with 12 being the maximum. Only four veterinarians reported working with only one species. (*Note: In this context, dairy and beef cattle were counted separately*). Nearly all surveyed veterinarians had dairy cattle and pig farms in their practice, and around half worked with beef cattle, goats, sheep, bees, layer chickens and rabbits. Visiting backyard farms was most common, followed by large commercial farms, while semi-commercial farms were least frequently involved in veterinarians' practices.

## INFORMATION ON ANTIMICROBIAL USE

*Antibiotic prescription per animal species*

Figure 36. Rank of species by the volume of antibiotics prescribed by the surveyed veterinarians (Total: 74 veterinarians)




Source: Author's own elaboration.

Dairy cattle and pigs were listed by the highest number of veterinarians as the animal for which they prescribed the most antibiotics. Antibiotics were also often prescribed for goats, layer chickens and beef cattle. Most antibiotics were prescribed for animals kept on backyard farms (79 percent), followed by large commercial farms (21 percent). No veterinarians reported using these substances in semi-commercial farms.

*Antimicrobial use practices*

The majority the surveyed veterinarians reported never writing prescriptions for antibiotics (57 percent), while 9.5 percent always and 20 percent rarely did so. This was in contrast with farmers' responses, where almost all participants reported having a prescription when obtaining antibiotics (Figure 4). Selling antibiotics to farmers (12 percent) and sending prescriptions to feed mills for antibiotics given in feed (7 percent) were also rare.

In terms of the purpose of antibiotic use, all veterinarians reported using antibiotics for treating sick animals, and 32 percent and 10 percent also reported administering these substances for prevention of diseases and for growth promotion, respectively. (*Note: More than one answer could be provided.*)

When comparing the frequency of group and individual treatments, 76 percent of veterinarians reported that in all cases they gave antibiotics to the sick animals only, while treating all animals in the pen, and not just the ill ones, was a less common practice. Giving antibiotics to all animals on the farm was least frequently reported (76 percent of farmers never did so, and 18 percent did so only rarely). The choice between individual and group treatment was usually influenced by the species being treated (64 percent of veterinarians) and the age group of animals (58 percent).

The majority, but not all veterinarians (87 percent), reported always examining animals before advising antibiotic use, with an additional 12 percent doing so usually. Almost all veterinarians (97 percent) always informed the farmer about the withdrawal period when advising antibiotic use, and another 1 percent also usually did so (one veterinarian did not answer this question).

Only 42 percent of veterinarians reported that they found antibiotics as effective as they used to be, while 35 percent found them a little less effective, and 14 percent thought that they were much less effective than they had been in the past.

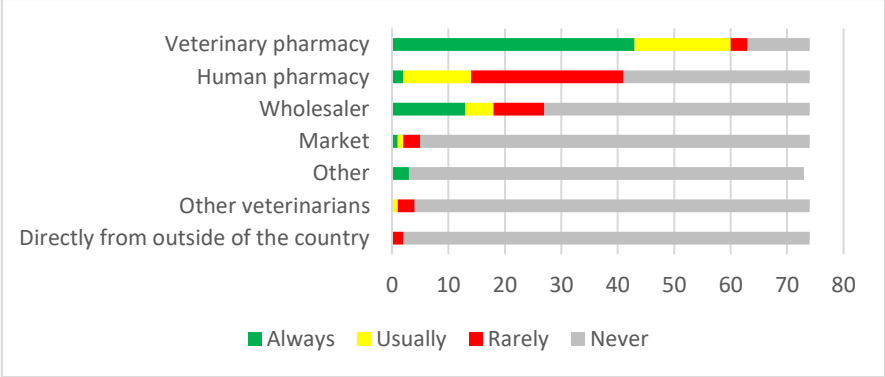
*Common sources of antibiotics*

Veterinary pharmacies were the most common sources of antibiotics for the surveyed veterinarians (Figure 35). Some of them also bought antibiotics from human pharmacies and wholesalers. Other responses included buying from the internet, from the manufacturer, or not buying at all.

*Most common health issues or syndromes*

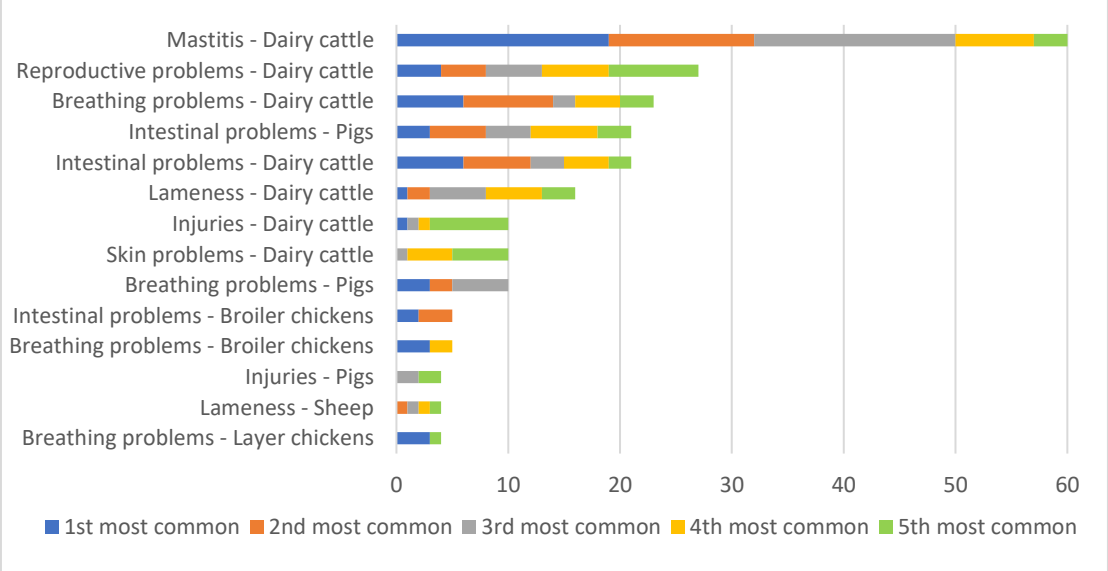
The surveyed veterinarians listed the diseases seen in Figure 36 as the most commonly diagnosed problems in their practice (combining the top five answers of each veterinarian). Mastitis and reproductive, respiratory and intestinal problems were most frequently diagnosed by the veterinarians. These problems were reported mostly in dairy cattle, which may be explained by the fact that this species was treated by the highest number of veterinarians (see Table 31).

Figure 37. Antibiotic sources of veterinarians (Total: 74 veterinarians)




Source: Author's own elaboration.

Figure 38. Most common health issues diagnosed by the surveyed veterinarians (Total: 73 veterinarians replied)



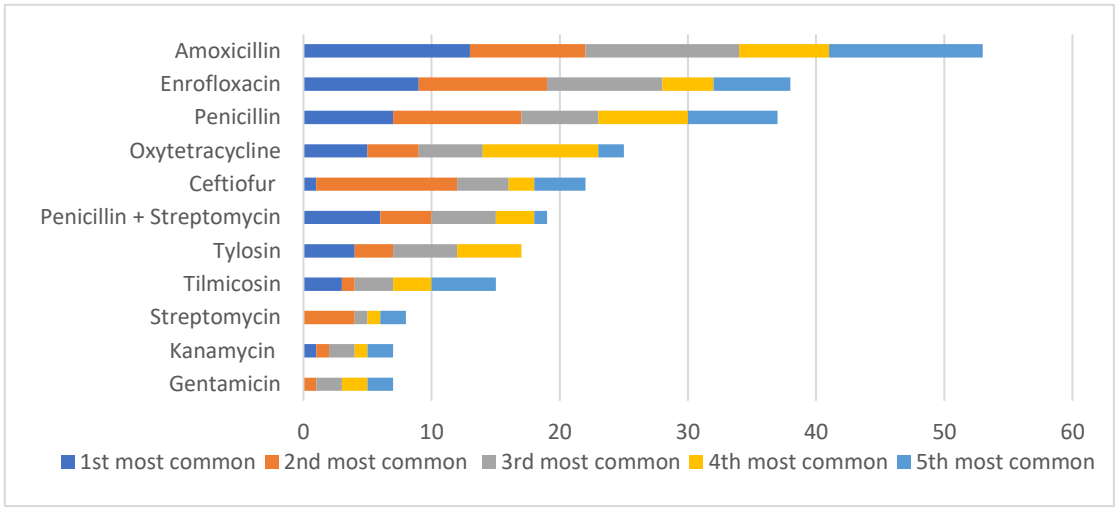

Source: Author's own elaboration.

*Antimicrobial use*

Amoxicillin, enrofloxacin, penicillin, oxytetracycline, and ceftiofur were most frequently recommended by the surveyed veterinarians (Figure 37). In 96 percent of cases, veterinarians advised the use of these drugs for the treatment of diseases instead of preventive usage. The drugs were prescribed for adult animals in 63 percent of cases and to young animals in 37 percent of cases.

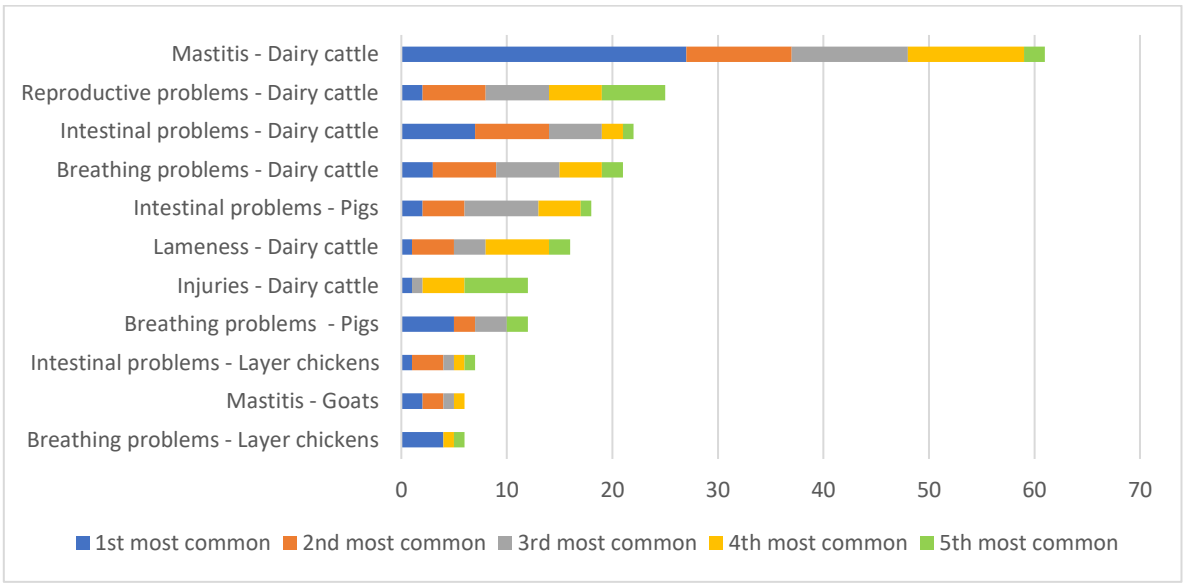
Mastitis in dairy cattle was found to be by far the main indication for the administration of antibiotics by veterinarians in Ukraine, followed by reproductive, intestinal and respiratory diseases in dairy cattle and intestinal problems in pigs (Figure 38). This was in accordance with the most commonly diagnosed health issues (Figure 36), and the rank of animal species by the volume of antibiotics prescribed for them (Figure 34).

Figure 39. Antibiotics most commonly advised by the surveyed veterinarians (Total: 74 veterinarians)




Source: Author's own elaboration.

Figure 40. Most common indications for antimicrobial use listed by the surveyed veterinarians (Total: 74 veterinarians)




Source: Author's own elaboration.

*Importance of antibiotics for different health issues or syndromes (according to veterinarians)*

Table 32. Importance and common use of antibiotics according to veterinarians (Total: 73 veterinarians replied)

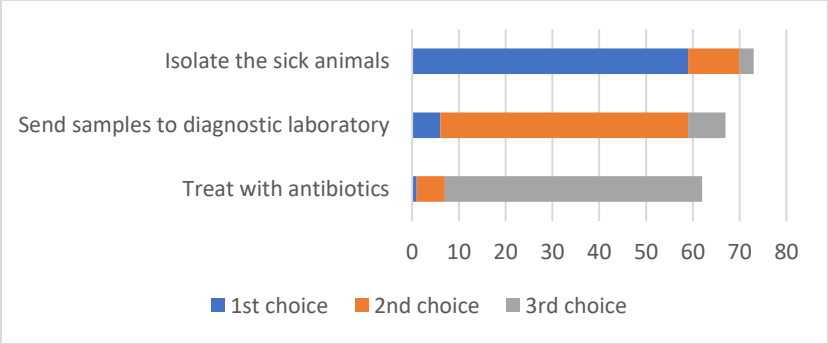
| Health issues/syndromes | Ratio of veterinarians reporting importance of antibiotics for this issue (%) | Ratio of veterinarians reporting common use of antibiotics for this issue (%) |
|---|---|---|
| Breathing problems or pneumonia | 93 | 93 |
| Mastitis | 89 | 87 |
| Reproductive problems | 55 | 64 |
| Other animals are dying | 41 | 38 |
| Lameness | 38 | 53 |
| Animals are to be stressed (weaned, surgery, grouped, transferred) | 34 | 41 |
| Not eating, abnormal stool or gastrointestinal infections | 32 | 45 |
| Feather or skin problems | 15 | 23 |
| Nervous system diseases | 14 | 20 |
| Improved growth or production of milk or eggs | 10 | 10 |

Source: Author's own elaboration.

The surveyed veterinarians believed that antibiotics were most important and commonly used for treating breathing problems and mastitis, followed by the management of reproductive problems. Some veterinarians (10 percent) also thought that antibiotics were important and commonly used for improved production, which correlates with their responses covered under the *Antimicrobial use practices* section.

*Measures in case of disease*

Figure 41. Measures taken in case of disease by the surveyed veterinarians (Total: 73 veterinarians replied)




Source: Author's own elaboration.

For most veterinarians, isolation of the sick animals was the first measure taken when diseases occurred. Sending samples to diagnostic laboratory was the most common second choice, and for most respondents the third step was treatment with antibiotics. In terms of laboratory diagnostics in regular clients' herds, only 44 percent of veterinarians would send samples to the laboratory in case of a single infection, while 89 percent would do so if an infectious disease outbreak occurred.

For newly visited herds, the proportion of veterinarians who would send samples for laboratory diagnostics was 65 percent and 85 percent for single cases or outbreaks, respectively. In the comparison of different animal species, sampling would most likely happen in dairy cattle, pigs and beef cattle – followed by broiler and layer chickens.

*Laboratory diagnostics*

Most veterinarians (84 percent) reported having good access to a veterinary diagnostic laboratory. However, it should be noted that a few professionals (7 percent) thought that laboratory testing was not necessary, while others had the following problems that interfered with laboratory diagnostics:

- for 39 percent, the client(s) did not want to pay for testing;
- for 12 percent, the laboratory was too far; and
- for 7 percent, the testing took too long.

Antimicrobial susceptibility testing was known to be available at 81 percent of the laboratories where the veterinarians were sending samples. A few veterinarians (5 percent) reported that it was not available, while 12 percent had no information on its availability. Nevertheless, almost all of the surveyed professionals (95 percent) stated that they would change antibiotic therapy based on susceptibility testing results and 88 percent would also use the obtained information for future treatment decisions.

*Impact of the COVID-19 pandemic*

During or after the lockdown due to the COVID-19 pandemic, only one of the veterinarians experienced problems accessing antibiotics. More commonly, veterinarians had problems accessing disinfectants (16 percent), vaccines (15 percent) and farms (12 percent). Despite these problems, only 7 percent of the surveyed veterinarians observed increased mortality in their practice, but 11 percent had to use antibiotics more often and 6 percent had to increase the dose used.

# VETERINARY PHARMACY SURVEYS

## GENERAL DATA OF SURVEYS

*Total number of surveys:* 67

*Note: Several participants (11) refused to answer the questions in the survey.*

*Date of surveys*

- First survey: 11 December 2020
- Last survey: 23 April 2021

*Distribution of surveys*

The surveyed pharmacies had clients from the following oblasts: Cherkasy, Chernihiv, Chernivtsi, Dnipropetrovsk, Ivano-Frankivsk, Kharkiv, Kherson, Khmelnytskyi, Kirovohrad, Kyiv, Luhansk, Lviv, Mykolaiv, Odesa, Poltava, Rivne, Sumy, Ternopil, Vinnytsia, Volyn, Zakarpattia, and Zhytomyr.

## INFORMATION ON PARTICIPANTS INVOLVED IN THE SURVEY

*Role and education of participants*

Among the surveyed veterinary pharmacy personnel:

- 93 percent were veterinary pharmacists;
- 82 percent were the owner or co-owner of the veterinary pharmacy;
- 16 percent were the manager of the veterinary pharmacy; and
- 7 percent were employees.

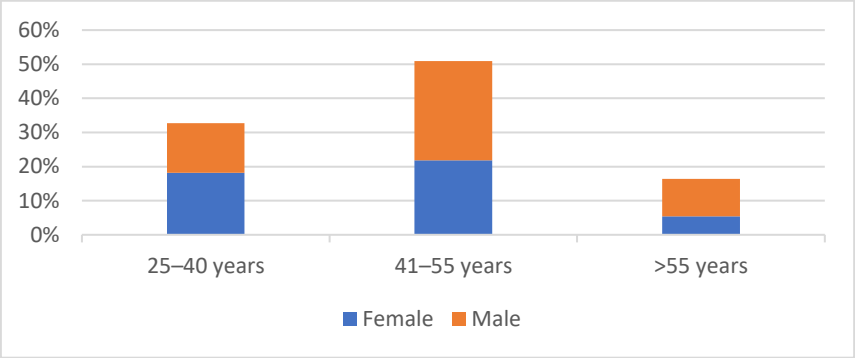
Among the surveyed professionals, all but one (98 percent) reported completing some sort of veterinary pharmacist education. In total, 80 percent had information on AMR included in their education.

*Number of years veterinary pharmacy personnel practiced the profession*

- Median: 19 years
- Range: 4–40 years

*Age and gender of participants*

Figure 42. Age and gender distribution of veterinary pharmacy personnel participating in the survey (Total: 55 participants replied)




Source: Author's own elaboration.

The highest number of surveyed veterinary pharmacy personnel were between the ages of 41 and 55 (52 percent). There were slightly more males than females surveyed; however, the ratio of women in this group was higher (46 percent) than that of the farming and veterinary groups.

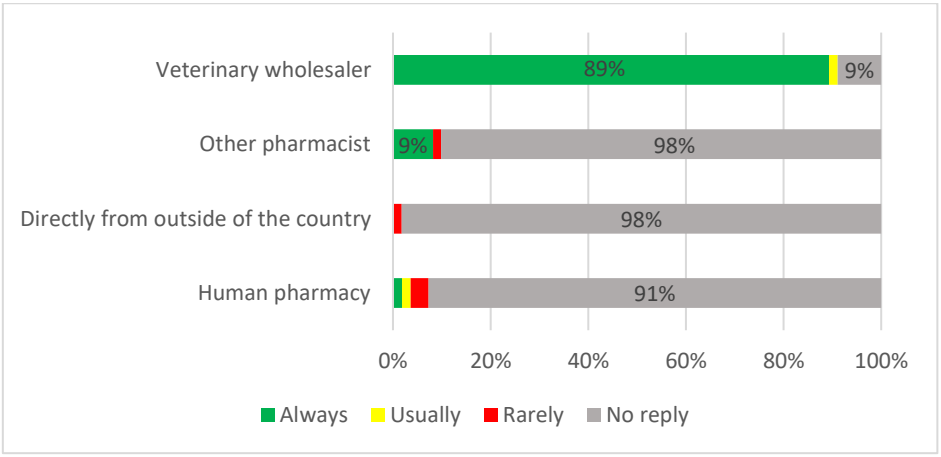
*Pharmacy record availability*

Overall, almost half of the surveyed veterinary pharmacy personnel (45 percent) did not have any records about the antibiotics they sold. The most commonly recorded data included the names (29 percent) and volume (25 percent) of antibiotics sold per year, and the species and production stage of animals for which antibiotics were sold (25 percent). Less participants recorded other information on the names, value or volume of antibiotics sold (per year, per client, per purchase, or per animal species) (see details in Annex 5). Many, but not all participants (70 percent), reported knowing what the most frequently sold antibiotic-containing products at their pharmacy were.

## INFORMATION ON ANTIMICROBIAL USE

*Obtaining and selling medication*

Figure 43. Antibiotic sources of veterinary pharmacies (Total: 56 participants replied)




Source: Author's own elaboration.

Veterinary pharmacy personnel almost exclusively purchased antibiotics from veterinary wholesalers. The pharmacies' main customers were the public (including farmers), accounting for an average ratio of 74 percent of all sales. Less commonly, pharmacies supplied medications to private and official veterinarians, at average sale ratios of 25 percent and 23 percent, respectively. Two pharmacies reported selling products to distributors and one of them also sold to feed mills.

When selling antibiotics directly to farmers, only 10 percent of veterinary pharmacy personnel reported always or usually asking for a prescription, with the remaining 90 percent rarely or never doing so. This was in accordance with the responses of veterinarians, who reported rarely writing prescriptions, but was in contrast to farmer responses that reported frequent use of a prescription when obtaining antibiotics. Providing information on the withdrawal period to farmers was more common, being practiced by 95 percent of participants. They usually obtained this information from the manufacturer's instructions of the products.

Regarding the efficacy of antibiotics, 50 percent of participants thought that they were as effective as they had always been, 36 percent found them a little less effective, and 8.9 percent found them to be much less effective than they were in the past, or only effective if used at a higher dosage.

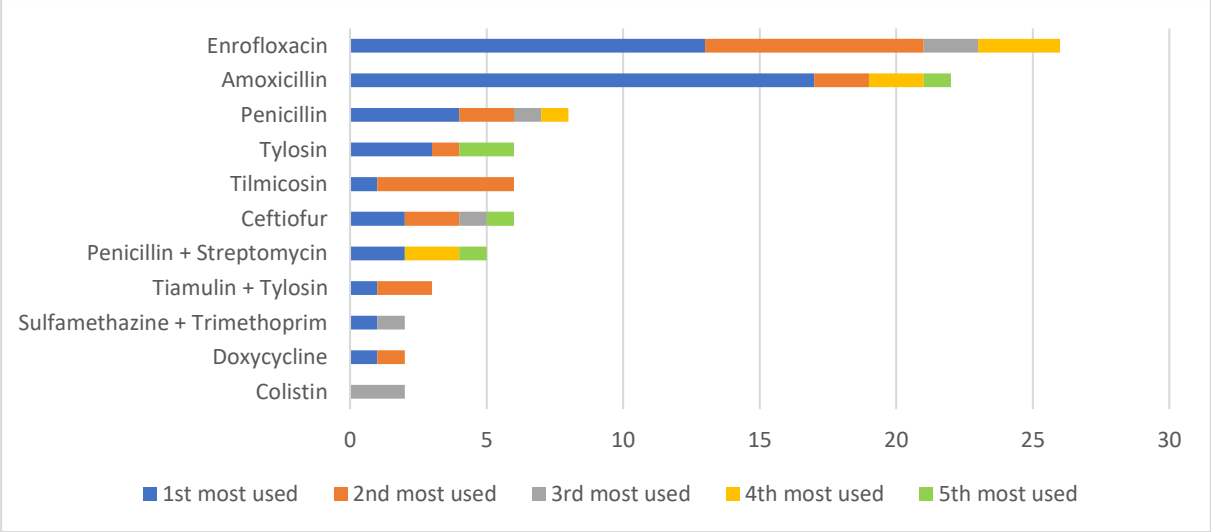
*Most frequently sold antimicrobials*

Enrofloxacin and amoxicillin were by far the most commonly sold antimicrobials in the surveyed veterinary pharmacies. The most common reasons for obtaining antimicrobial drugs from the surveyed veterinary pharmacies were breathing problems, intestinal problems and mastitis in cattle. Antimicrobials were almost exclusively sold for the treatment of disease (99 percent), and very rarely for prevention or growth promotion. The drugs were used in adults more frequently (94 percent of cases) than in young animals.

*Note: Not all participants knew the purpose of use and the age group for which the drugs were sold.*

The surveyed veterinary pharmacy personnel listed the following antimicrobials as the most commonly sold substances (combining the top ten answers of each participant):

Figure 44. Antibiotics most commonly sold by the veterinary pharmacies (Total: 46 participants replied)




Source: Author's own elaboration.

*Impact of the COVID-19 pandemic*

During or after the lockdown due to the COVID-19 pandemic, no pharmacies had to sell expired antibiotics, but 12 pharmacies (18 percent) had problems accessing vaccines, 10 pharmacies (15 percent) had problems accessing disinfectants and 6 pharmacies (9 percent) had problems accessing antibiotics.

*Importance of antibiotics for different health issues or syndromes (according to veterinary pharmacy personnel)*

According to the surveyed veterinary pharmacy personnel, antibiotics were most important and commonly used for treating breathing problems and mastitis. A few participants thought that they were important (7 percent) and commonly used (7 percent) for enhancing animal growth or production. These responses were in accordance with the responses collected from veterinarians in the country (Table 32).

Table 33. Importance and common use of antibiotics according to veterinary pharmacy personnel (Total: 56 participants replied)

| Health issue/syndrome | Ratio of participants reporting importance of antibiotics for this issue (%) | Ratio of participants reporting common use of antibiotics for this issue (%) |
|---|---|---|
| Breathing problems or pneumonia | 95 | 95 |
| Mastitis | 95 | 95 |
| Reproductive problems | 52 | 52 |
| Not eating or abnormal stool | 45 | 45 |
| Lameness | 24 | 24 |
| Animals are to be stressed (weaned, surgery, grouped, transferred) | 21 | 20 |
| Other animals are dying | 20 | 20 |
| Feather or skin problems | 14 | 16 |
| Improved growth or production of milk or eggs | 7 | 7 |
| Nervous system diseases | 6 | 4 |

Source: Author's own elaboration.

# FEED MILL SURVEYS

*Total number of surveys:* 28

*Note: No participants refused to answer any of the questions.*

*Date of surveys*

- First survey: 27 January 2021
- Last survey: 26 March 2021

None of the surveyed feed mills were preparing medicated feed.

# ANNEXES

## ANNEX 1. SURVEY INSTRUCTIONS

**Instructions for the implementation of the antimicrobial use (AMU) survey**

**Sections:**

A. KoboCollect administration
B. Participant selection
C. Survey administration
D. Definitions for the antimicrobial use survey
E. Information to provide to participants on antimicrobial resistance

Appendix 1: Instructions for downloading forms and uploading surveys

**A. KoboCollect Administration**

1. In order to facilitate survey administration, the FAO will create accounts for a. the FAO national consultant in each country, b. a supervisor in each country and c. for each interviewer.
    a. The designated supervisor of interviewers will be responsible for data validation, and data quality. The account for this person will permit them to:
        i. View all surveys from interviewers in their country in order to ensure that the surveys are complete and correct.
        ii. Once the surveys have been reviewed by the supervisor, the "Submit" button should be clicked to initiate upload.
        iii. Once surveys have been submitted, they cannot be edited.
    b. The interviewer accounts will permit each interviewer to:
        i. enter data;
        ii. view and edit surveys that they have entered; and
        iii. save the surveys as “draft” in order to facilitate review by the supervisor.

    Interviewers will not be able to view other interviewers’ surveys.
2. Please see detailed instructions on downloading the survey forms and uploading the results in Appendix 1.
3. Surveys may be completed offline in areas where online completion is not possible. Surveys should be uploaded to the server as soon as reliable connectivity is available, preferably by the end of the day that the survey was completed.
4. All survey interviews will include the GPS coordinates of the premises. The GPS coordinate data will be destroyed at the conclusion of the project.
5. In order to facilitate quality assurance protocols, contact phone numbers will be collected for all survey interviews. This information will be destroyed at the conclusion of the project.
6. When all surveys have been completed, the dataset needs to be cleared at the country level.
7. Along with the dataset, the service provider must also submit:
    a. an Excel file with free text answers (related to answering “Other” options) with the question number, the answer in the original language, and the corresponding English translation, and
    b. pictures taken at the farms (see description in Section C).

**B. Participant Selection**

1. Regional Representation:
   Survey participants in each category should be enrolled from each of the selected regions as specified in the letter of agreement (LoA).

   If there are insufficient participants in a particular region, additional participants should be enrolled in other regions in order to achieve the desired national total.

2. Participant Selection:
   Survey participants should be identified and recruited as described in the LoA. If there are less than the required potential participants in any category, (for example feed mills) then efforts should be made to enrol all potential participants.

   If identified potential participants decline to participate in the survey, reasons for refusal should be recorded.

3. Participant Identification:
   i. All individual or personal information of participants will remain confidential.
   ii. Participants will be identified using Codes according to the following system.
   **Country–Interviewer number–Survey type–Participant number**
      a. Three letter country identifier
         i. Montenegro -MNE
      b. Interviewer identification
         i. Sequential numbers should be assigned to identify each interviewer, e.g. 01, 02, etc.
      c. Survey type identifier
         i. Farm – F
         ii. Veterinarian – V
         iii. Veterinary Pharmacy – P
      d. Participant identification
         i. Sequential numbers should be assigned to each participant interviewed by an interviewer, e.g. 001, 002, 003

   For example: the code for the first farm surveyed by interviewer #2 in Kyrgyzstan would be: Kyr-02-F-001

**C. Survey Administration**

It is essential that the **Informed Consent document** is explained, read and signed by each participant prior to beginning the survey. A signed copy of the Informed Consent must be provided to the participant and a copy must be retained by the service provider (SP) until the completion of the project. This document must NOT be provided to FAO. To facilitate quality assurance protocols, a contact phone number must be collected from all survey participants and retained until the completion of the project. This contact information will only be used to clarify survey responses and ensure data quality and will be destroyed upon completion of the project. The contact phone number must be linked with the Participant Code.

**Feed Mills:** Administer the survey to an owner or manager that has knowledge of the antimicrobial use policies and practices of the feed mill.

**Veterinary Pharmacies:** Administer the survey to an owner or manager that has knowledge of the policies and practices of the veterinary pharmacy.

**Veterinarians:** Administer the survey to a veterinarian or para-veterinarian who provides direct services to farmers (of the selected priority livestock species within the country).

**Farmers:** Administer the survey to an owner or manager that has knowledge of the antimicrobial use practices of the farm. The survey for farmers consists of several different sections. The sections completed on each farm will depend on the type of animals found on that farm. **All farmers complete Section 1**. **All applicable species-specific sections should also be completed (see diagram below).** The same Participant identification code should be used for all the sections that are completed for one farm.

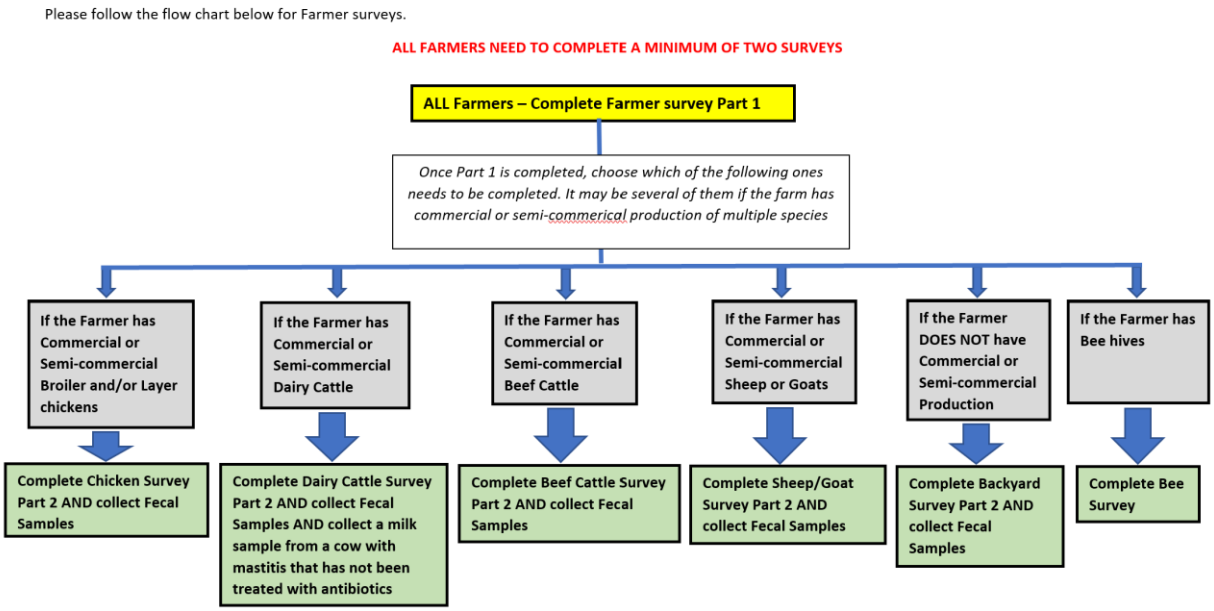
**For example:**

If a farmer has commercial or semi-commercial broiler chickens, then the *Farmer Section* and the *Chickens Section* should be completed.
If a farmer has commercial or semi-commercial broiler chickens and commercial or semi-commercial bee production, then the *Farmer Section*, the *Chicken Section*, and the *Bee Section* should be completed.
If a farmer does not have any commercial or semi-commercial production, then the *Farmer Section* and the *Backyard Section* should be completed.

While administering the KoboCollect survey to all farmers, the surveyor should take one picture of the veterinary medicines (where they are stored), and at least one other picture of the place where animals are kept. Pictures should be labelled with the Participant Code followed by "Medicines" or "Farm" (for the first and second type of pictures, respectively).

**Chicken survey:** When completing the *Chicken Section*, questions referring to birds should only be answered with regards to chickens. Other types of poultry are not included in this section of the questionnaire

**Cattle surveys:** If cattle are kept for dual purpose (both for meat and milk), then the Dairy Cattle survey should be completed




In the survey, there are directions to collect available **records** from participants for the previous 12 months if they are available. It is important to note that these records should be collected only IF the participant is willing to share these. Provision of these records is NOT a requirement of participation. However, if requested records are available and the participant is not willing to provide these, this should be recorded in the comments section at the end of the survey, as well as any reasons given for this decision.

In the survey, if there are questions that participants are **not willing to answer**, record this where indicated in the survey and provide the reasons given for not answering. Participants should not be pressured to provide answers; however, the interviewer should also avoid suggesting that not all questions need to be answered.

When misconceptions are identified, provide explanations and clarifications as described in Section E.

When the survey has been completed, provide the participant with the Antimicrobial Resistance information leaflet.

### D. Definitions for the Antimicrobial Use Survey

*Note: When translating these definitions, the terms used should be the same as the terms used in the KoboCollect survey.*

**Antimicrobial**: antimicrobials are substances that kill or stop micro-organisms from growing and that help us treat diseases caused by microbes in humans, livestock, fish, plants and pets. For this survey, we are asking about antimicrobials that kill or stop bacteria from growing. These are often referred to as antibiotics.

**Young animals**: animals that have not reached breeding age.

**Adult animals**: animals that have reached breeding age.

**Heifers:** > 6 months old but have not given birth.

**Piglets**: pigs that are suckling the sow

**Fattening pigs**: pigs between the time of weaning and slaughter

**Feed antimicrobials:** antimicrobials that are mixed into or spread on top of the animal feed.

**Water antimicrobials**: antimicrobials that are mixed into the water that the animals drink.

**Drench:** an antimicrobial liquid that is given directly into the mouth.

**Bolus:** an antimicrobial tablet that is given directly into the mouth.

**Topical:** an antimicrobial that is applied to the skin or hooves/feet.

**Backyard farm:** an enterprise where the animals/birds raised are primarily for the consumption of the household.

**Semi-commercial**: an enterprise where the animals/birds are raised for the consumption of the household, as well as for sale, however this is not a primary source of income for the farmer.

**Commercial:** an enterprise where animals/birds are raised primarily for sale and this is a primary source of income for the farmer.

**Treatment:** antimicrobials given when a disease is present on the farm in at least one animal/bird.

**Prevention:** antimicrobials given to control disease when animals/birds when it is likely that they will become sick.

**Growth promotion:** antimicrobials given to make animals/birds grow bigger and/or faster, not to treat or control disease.

**Withdrawal times** (for vet survey)**:** the time required after giving an antimicrobial to an animal/bird before the animal/bird can be slaughtered for food or the milk or eggs from the animal can be consumed. This is to prevent antimicrobial residues in the meat or the milk, which can cause people to become sick.

**On-farm culling**: The animal/bird is euthanized and not used for meat.

**Education:** As part of the curriculum towards a degree or certificate.

**Training:** Short-term learning opportunity.

**E. Information to provide to participants on antimicrobial resistance**

The information provided in this section is intended to increase the participants' awareness and understanding of antimicrobial resistance. Other than the question on what antibiotics are, this information should not be provided to the participant until AFTER they have finished the survey.

1. **This information should be provided to the participant <u>immediately after they have answered the question</u>.**

***Question:***

**Do you know what antimicrobials are?** Yes No

If yes, please circle all that apply:

medicine that prevents disease
medicine that kills disease
medicine that kills germs
medicine that kills bacteria
medicine that makes animals grow faster/bigger
medicine that kills viruses
medicine that kills parasites
Other: _____

*Answers:*

- If participant answers **No**
  - Microorganisms are everywhere and include bacteria, viruses, parasites and fungi. They include bacteria that can sometimes cause disease and infection in humans, animals and plants.
  - Antimicrobials are substances that kill or stop microorganisms from growing and that help us treat diseases caused by microbes in humans, livestock, fish, plants and pets. For this survey, we are asking about antimicrobials that kill or stop bacteria from growing. These are often referred to as antibiotics.

- If participant answers **Yes** to the first part AND answers **Yes to either "medicine that kills viruses"** or **"medicine that kills parasites"**:
  - Antimicrobials are substances that kill or stop microorganisms from growing and that help us treat diseases caused by microbes in humans, livestock, fish, plants and pets. For this survey, we are only asking about antimicrobials that kill or stop <u>bacteria</u> from growing. These are often referred to as antibiotics.

2. **The information for the questions below should be provided to the participant <u>at the conclusion of the survey</u>**

***Question:***

**If the antimicrobials that you have become expired, what do you do?**

Use them
Throw them in the garbage
Consult with a veterinarian (if yes pharmacy, private, government)
Pour them down the drain/sink
Return them to where you purchased them
I don't look at the expiration date
Expiration date is not on the medications I use

*Answers:*

- If answer **"Use them"** or **"I don't look at the expiration date"**:
    - Expired medicines may have lost much of their potency or might even be harmful to the diseased animal.
    - They may also contribute to the development of resistant bacteria in the animal, herd or flock, which may make it more difficult to treat infections in these animals in the future.
- If answer **"Throw them in the garbage"** or **"Pour them down the drain/sink"**
    - Expired medicines may be harmful to the environment. They may contribute to the development of resistant bacteria in the environment, which may make it more difficult to treat infections in animals and people in the future. They should be returned to the retailer, e.g. pharmacy, if possible.
- If answer **"Expiration date is not on the medications I use"**:
    - This may be an indication that the medication you are using is not made by a reputable company. Medications are effective only for a specific time period.
    - Expired medicines may have lost much of their potency or might even be harmful to the diseased animal.
    - They may also contribute to the development of resistant bacteria in the animal, herd or flock, which may make it more difficult to treat infections in these animals in the future.

***Question:*** How much do you agree with the following statements:

**You can stop giving antimicrobials to an animal if their symptoms are improving**

If **agree**: Antimicrobials should be given until the end of the period that is on the label or was recommended by your veterinarian. Even when an animal's symptoms are improving, the bacteria that caused the symptoms may still be present and if you stop giving the antimicrobials, the bacteria will cause disease again and the antimicrobials may not work at all because bacteria have become resistant.

**If antibiotics are given too often they might stop working**

If **disagree**:

Bacteria can become resistant to antibiotics when repeatedly exposed to them and then the antibiotic will not work the way it used to. Using antibiotics only when necessary will help to avoid this.

**Giving antimicrobials to healthy animals will prevent them from getting sick in the future**

If **agree**:

Antimicrobials can treat diseases caused by bacteria, sometimes just before symptoms appear. However, antimicrobials cannot prevent animals from getting diseases in the future.

**Using vaccines can prevent the use of antibiotics**

If **disagree**:

Vaccines for specific diseases can protect animals from becoming sick with those diseases. When the animals stay healthy, the antimicrobials are not needed.

**Animals can transmit disease to humans**

If **disagree**:

Some microorganisms can be present in more than one host or species, including both animals and people. These microorganisms can spread from animals to

humans, through food, direct contact or the environment. Sometimes these microorganisms do not make animals sick but can make people ill.

**Antimicrobial use in animals does not affect human health**

If **agree**:

Antimicrobial use in animals can affect human health in several different ways. When microorganisms become resistant to a particular antimicrobial, they can then infect different hosts, including humans, through the food chain or the environment. The antimicrobial will then no longer work to treat the infection or disease in humans.

Antimicrobial use in animals can also affect human health when antimicrobials are still present in meat, milk, or honey when consumed by people. This is called antimicrobial residue and can cause problems in people who are allergic or have a negative physical reaction when exposed to these antimicrobials.

**Antimicrobials may be freely discarded without having an action/effect on the environment**

If **agree**:

When antimicrobials are discarded improperly, they can persist in the environment. This can lead to antimicrobial resistance.

**Antimicrobial resistance occurs when antibiotics are found in the meat or milk of an animal**.

If **agree**:

When antimicrobials are found in the meat or milk of an animal or in honey, this is an antimicrobial residue. Antimicrobial residues can cause problems in people who are allergic or have a negative physical reaction when exposed to these antimicrobials. However, antimicrobial resistance is when microorganisms become resistant to a particular antimicrobial. The antimicrobial will then no longer work to treat the infection or disease in animals or humans.

**When you use antimicrobials, there is a certain number of days you should wait before selling the animals for slaughter, selling eggs, milk or honey.**

If **disagree**:

When animals or birds or bees are given antimicrobials, the antimicrobials can be present in the meat, milk, eggs or honey for a certain number of days after the last time they were given. When antimicrobials are still present in meat, milk, eggs or honey when it is consumed by people, this is called antimicrobial residue and can cause problems in people who are allergic or have a negative physical reaction when exposed to these antimicrobials.

**With prevention and early detection, you can reduce the use of antimicrobials**

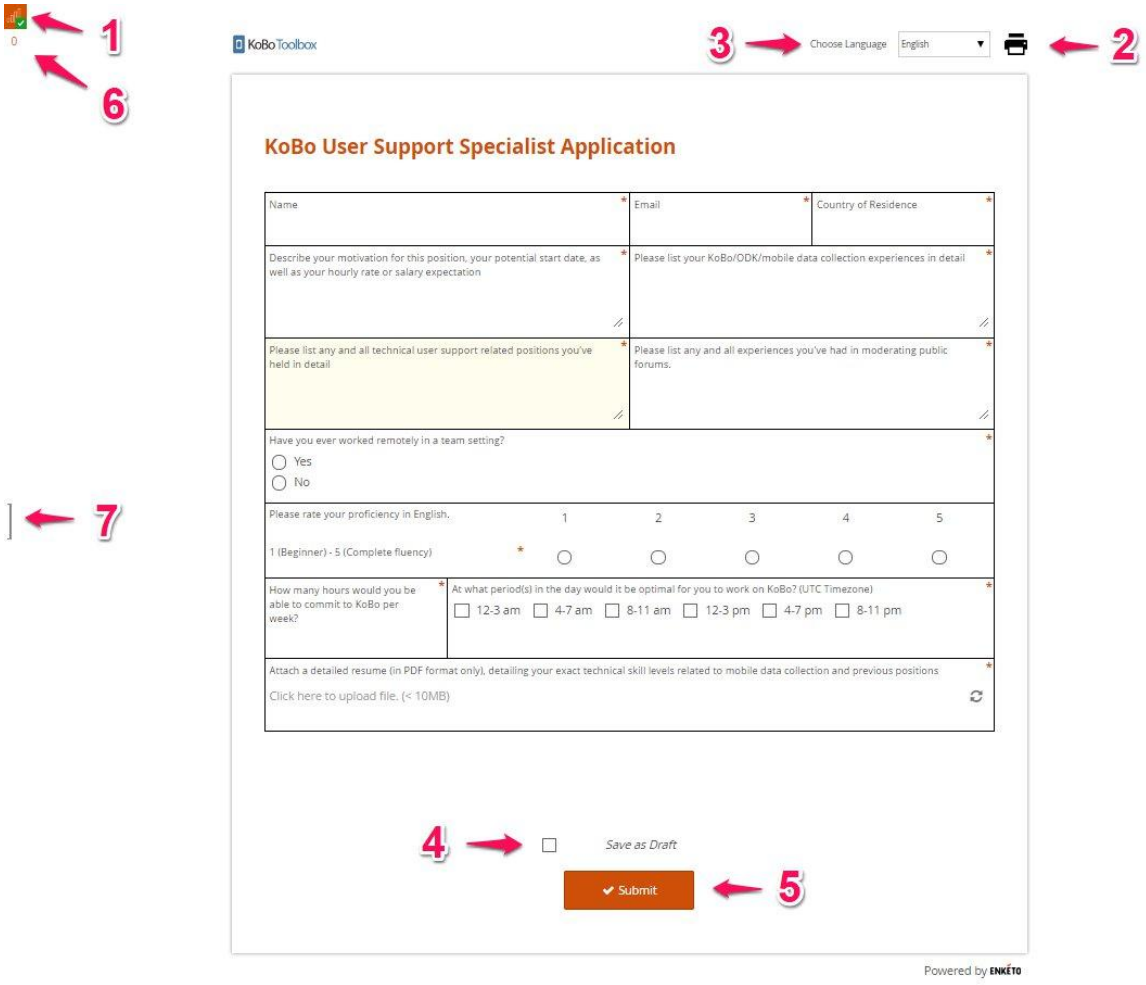
If **disagree**:

When animals/birds/bees are fed a good diet, are in a good environment, and are not exposed to other animals/birds/bees that are carrying disease, they are less likely to get sick and require antimicrobial treatment. Therefore, disease is prevented and antimicrobial use is reduced. If disease in animals/birds/bees is detected when they first become sick or when it is present in only a few animals/birds/bees, then less antimicrobials are often required to make the animals/birds/bees healthy again. It is also possible that less animals/birds/bees will die.

**Appendix 1: Instructions for downloading forms and uploading surveys**

In the drop-down menu under "Collect data," you have several options available:

Choose “Online-Offline (multiple submission)”: This allows online and offline submissions and is the best option for collecting data in the field. Then press “OPEN” to open the survey form to a new tab in your browser. Once the form is opened, you should see a screen like the one shown in the image below:




1. To enable offline data entry:

    a) Open the survey link provided (as was done during the pre-testing).

    b) Select “Add to Home screen” from the settings.

    c) Touch and hold the “Add” tab to add it to the home screen.

    d) The KoboCollect icon will appear on the screen of the tablet and the Interviewer will easily open the file from the screen during the surveys.

2. Printer icon: The printer icon provides you access to save it as a PDF version. For this, press the printer icon and then select Destination (“Save as PDF” to save your survey form as a PDF).

3. Choose language: The survey is available in various languages used in the Europe and Central Asia region. You're able to toggle between the default language (English) and other languages present in the survey form.

4. Save as draft: Use this feature to edit or update the record before submitting it to the KoboToolbox server. Once you have checked "Save as Draft" you will have an option to "Save Draft." The draft record gets queued but does not sync with KoboToolbox server. To sync it with the server the Supervisor will open the record from the queued list and uncheck "Save as Draft" and press "Submit."

5. Submit: The Supervisor will press the "Submit" button once the information in a survey is verified as final and complete and ready to be uploaded to the KoboToolbox server. After pressing the "Submit" button, you will not have an option to edit the records on your device.

6. Queued records counter: The queued records counter shows you the total number of records submitted and waiting to be uploaded to a server. The queued records are uploaded automatically in the background every 5 minutes when the web page is open and an internet connection is available. The application will always attempt to upload data immediately and will retry until a connection has been established again.

All synchronization is proofed even against poor Internet connection quality. Should a connection time out or be interrupted while a specific form is being transferred, it will be resent with the next upload attempt. The server will not integrate half received data in this case. Only when a record has been uploaded successfully and the server confirms receipt will the survey data be removed from the upload queue.

7. Queue records pane: Clicking the side button shows you the records that are available as drafts (which can still be edited) and finalized submitted records queued to be uploaded to the server with an internet connection.

8. Open-ended Questions:

> Questions that are answered using text in the language of the country, for example "If other, please specify," will be recorded in the database in the original language. In addition, an Excel file should be created with the following columns:

Participant code  Question number  Original version  Translated English

## ANNEX 2. LIST OF ANTIMICROBIALS

| Name of medicine | Latin name of medicine | Active substance of medicine |
|---|---|---|
| Аколан | Acolan wsp | Colistin |
| Амікс Вет А | AMIXT vet A wsp | Amoxicillin |
| Амікс Вет Д | AMIXT vet D wsp | Doxycycline |
| Амікс Вет Т | AMIXT vet T wsp | Tiamulin |
| Амікс вет ХТЦ | AMIX vet CTC wsp | Chlortetracycline |
| Амокланід | Amoclanid wsp (Amoxacillini Kalii Clavulonat) | Amoxicillin |
| Амоксан-150 | Amoxan (Amoxacillini trygidrat) Inj | Amoxicillin |
| Амоксан-500 | Amoxan (Amoxacillini trygidrat) wsp | Amoxicillin |
| Амоксидев 60 | Amoxidev (Amoxicillin) wsp | Amoxicillin |
| Амоксикрід ретард 15% | Amoxicrid retard 15% inj | Amoxicillin |
| Амоксицилін 10% | Amoxicillin 10% wsp | Amoxicillin |
| Амоксицилін 15% (ін'єкції) | Amoxicillin 15% inj | Amoxicillin |
| Амоксід-80 | Amoxid-80 wsp | Amoxicillin |
| Амоксінсол 50 | Amoxinsol 50 inj | Amoxicilin |
| Амоксоіл ретард | Amoxoil retard inj | Amoxicillin |
| Ампідексалон | Ampidexalone inj | Ampicillin + Colistin + Dexamethasone |
| Байтрил 10% | Baytril 10% wsp | Enrofloxacin |
| Бензилпеніцилін | Benzylpenicillin Inj | Benzylpenicillin |
| Бернофлок 500 | Bernoflok 500 pills | Ciprofloxacin |
| Бовікен | Boviken (Marbofloxacin and Ketoprofen) Inj | Marbofloxacin |
| Біовіт-80, 10% | Biovit (Chlortetraciclinum)p | Chlortetracycline |
| Біомутін 20% | Biomutin 20% inj | Tiamulin |
| Біомутін 45% | Biomutin 45% wsp | Tiamulin |
| Біцилін-3,-5 | Bicillin-3, -5 inj | Benzylpenicillin |
| Бофлокс | Bofloks inj | Marbofloxacin |
| *Біфлоксил* | Bifloxyl Inj | Enrofloxacin + Ciprofloxacin |
| Бровасептол | Brovaseptol Inj | Sulfadimethoxine Sulfadiazine Trimethoprim |
| Бровасептол порошок для перорального застосування | Brovaseptol wsp | Sulfathiazole Sulphaguanidine Trimethoprim Oxytetracycline Tylosin |
| Бровафом новий | Brovafom (Colistin Oxitetraciclinum Trymetoprim) wsp | Colistin Oxytetracycline |
| Бромодокс | Bromodox (Doxiciclinum and Bromgexinum) Inj | Doxycycline + Bromhexine |

| Name of medicine | Latin name of medicine | Active substance of medicine |
|---|---|---|
| Ветбіцилін-3 | Vetbicilini (Bensilpenicilini benzatinum) Inj | Benzylpenicillin benzathine |
| Ветримоксин 15% | Vetrimoxin 15% inj | Amoxicillin |
| Ветримоксин 50% | Vetrimoxin 50% wsp | Amoxicillin |
| Гамарет | Gamaret T | Novobiocin<br>Neomycin<br>Penicillin<br>Dihydrostreptomycin |
| Гента 100 | Genta-100 Inj | Gentamicin |
| Гентадев | Gentadev (Gentamicini sulfatis) Inj | Gentamicin |
| Гентазимвет | Gentazimvet wsp | Gentamicin + Sulfadimezin + Trimethoprim |
| Гентаміцин 4% | Gentamycine 4 % inj | Gentamicin |
| Гентаміцин-П | Gentamycin-P wsp | Gentamicin |
| Гентамокс | Gentamox inj | Amoxicillin + Gentamicin |
| Геоміцин Ф | Geomycin F TIU | Oxytetracycline |
| Гістеродев | Gisterodev (Oxitetraciclini hydrochloridum and Dimetilsulfoxid ) SII | Oxytetracycline |
| Данофлокс 18% | Danoflox (Danofloxacini mezilatum) Inj | Danofloxacin |
| Доксидев 80 | Doxidev (Doxiciclini giclatum) wsp | Doxycycline |
| Доксициклін 50% | Doxycycline 50% wsp | Doxycycline |
| Доксициклін 20% | Doxycycline 20% p | Doxycycline |
| Доксикол | Doxycol wsp | Doxycycline |
| Драксин | Draxxin inj | Doxycycline<br>Colistin |
| Енрамоксин | Enramoxin (Amoxacilinum and Enrofloxacinum) Inj | Tulathromycin |
| Енроксил 5%/10% | Enroxil 5% or 10% inj | Enrofloxacin |
| Енроксил 10% оральний | Enroxil 10% l | Enrofloxacin |
| Енроксил Макс | Enroxil Max inj | Enrofloxacin |
| Енроксан-50, -100 | Enroxan (Enrofloxacinum) inj | Enrofloxacin |
| Енродокс | Enrodox (Enrofloxacinum and Doxiciclinum) inj | Enrofloxacin + Doxycycline |
| Енрофлоксацин 10 оральний | Enrofloxacin 10 L | Enrofloxacin |
| Енрофлоксацин 100 | Enrofloxacin 100 Inj | Enrofloxacin |
| Енрофлоксацин 5%, 10%, 50% ін'єкції | Enrofloxacin 5% or 10% or 50% inj | Enrofloxacin |
| Енрофлокс 5% | Enroflox 5%  Inj | Enrofloxacin |
| Ефікур | Eficur Inj | Ceftiofur |
| Зактран | Zactran inj | Gamithromycin |
| Зелеріс | Zeleris (Florfenicolum) inj | Florfenicol |
| Зинаприм | Zinaprim inj | Sulfamethazine + Trimethoprim |

| Name of medicine | Latin name of medicine | Active substance of medicine |
|---|---|---|
| Зупрево18% | Zuprevo 18% inj | Tildipirosin |
| Зурітол 5% | Zuritol 5% o | Toltrazuril |
| Канаміцин 10%, 25%, Канаміцину сульфат | Kanamycin 10%, 25% inj, Kanamycin inj | Kanamycin |
| Кетофур 200 | Ketofur (Ceftiofur hydrochloridum) inj | Ceftiofur |
| Кламоксил ЛА | Clamoxyl LA inj | Amoxicillin |
| Кламоксан | Klamoxan (Amoxicilini tryhydratum) inj | Amoxicillin |
| Клоксацилін | Cloxacillin inj | Amoxicillin |
| Кінокол | Kinokol L | Cloxacillin |
| Кобактан 2,5% | Cobactan inj | Enrofloxacin + Colistin |
| Колістин 4800 | Colistine 4800 wsp | Colistin |
| Колістин 6М | Colistin (Colistinum) swp | Colistin |
| Комбікел 40 | Combikel 40 inj | Benzylpenicillin + Dihydrostreptomycin |
| Коцефен 200 | Cocefen (Ceftiofurum) inj | Ceftiofur |
| Лінкол ВП | Lincol (Lincomicinum and Colistinum) wsp | Lincomycin + Colistin |
| Лінкол ПД | Lincol (Lincomicinum Colistinum) inj | Lincomycin + Colistin |
| Лінкоміцин 10% | Lincomycin 10 inj | Lincomycin Colistin |
| Марбоцил 10% | Marbocyl 10% Inj | Lincomicinum |
| Марфлоксін 10% | Marbofloxin Inj | Marbofloxacin |
| МАСТ НКС | Mast ncs (Cloxacilinum and Neomicini sulfatum and Sulfatiasoli natrium) t | Marbofloxacin |
| Макролан 200 | Macrolan 200 inj | Cloxacillin + Neomycin and Sulfathiazole |
| Макролан ВП | Macrolan wsp | Tylosin |
| Мастопред | Mastopred t | Tylosin |
| Мастієт форте | Mastijet Forte t | Cloxacillin + Neomycin |
| Метацин Форте | Metacin (Doxiciclinum and Colistinum) wsp | Oxytetracycline Bacitracin Neomycin |
| Метронідазол 5% | Metronidasol (Metronidasolum) inj | Doxycycline + Colistin |
| Мукортіл | Mukortil l | Metronidazole |
| Мультімаст | Multimast t | Enrofloxacin |
| Міліколі | Milicoli (Colistini sulfatis) l | Benzylpenicillin procaine + Penethamate + Neomycin |
| Наксель | Naxcel inj | Ceftiofur |
| Нафцилін | Nafcilin (Nafcilinum) inj | Nafcillin |
| Ніфулін | Nifulin p | Metronidazole + Furazolidone + Oxytetracycline |

| Name of medicine | Latin name of medicine | Active substance of medicine |
|---|---|---|
| Норофлокс 10% | Noroflox Inj | Norfloxacin |
| *Окси-100* | Oxi-*100* Inj | Oxytetracycline |
| Окситетрациклін (20%) | Oxytetracycline 20% LA inj | Oxytetracycline |
| Окситетра 20% | Oxytetra 20% inj | Oxytetracycline |
| Окситетравет 20% | Oxitetravetum 20% inj | Oxytetracycline |
| Окситол | Oxitol (Oxitetraciclini hydrochloridum) inj | Oxytetracycline |
| Оксі ЛА 20% | Oxi LA (Oxitetraciclini hydrochioridum) inj | Oxytetracycline |
| Оксіпрол | Oxiprol (Oxitetraciclini trigidratum) inj | Oxytetracycline |
| Орбенін EDC | Orbenin EDC t | Cloxacillin benzathine |
| Пенбекс | Penbeks inj | Penicillin procaine + Dihydrostreptomycin |
| Пені ДНС | Peni DHS coophavet inj | Benzylpenicillin procaine + Dihydrostreptomycin |
| Пеніпрок | Peniprok inj | Penicillin procaine + Dihydrostreptomycin |
| Пеніцилін | Penicillin Inj | Benzylpenicillin |
| ПенСтреп 400 | Penstrep 400 inj | Penicillin + Spectinomycin |
| Процифен 100 | Procifen (Ceftiofurum) inj | Ceftiofur |
| Ремокс 500 | Rhemoks 500 wsp | Amoxicillin |
| Ресфлор | Resflor Inj | Florfenicol |
| Ріфмокс 50% | Reefmox wsp | Amoxicillin |
| Родотіум 10% | Rodotium 10% inj | Amoxicillin |
| Севаксель RTU | Cevaxel RTU inj | Tiamulin |
| Синулокс | Synulox inj | Ceftiofur |
| Спелімікс | Spelimix inj | Amoxicillin clavulanic acid |
| Спелімікс 100 | Spelimix 100 wsp | Lincomycin + Spectinomycin |
| Спелімікс 44 | Spelimix 44 p | Lincomycin + Spectinomycin |
| Спіровет | Spirovet Inj | Spiramycin |
| Стрептоветин | Streptovetinum inj | Streptomycin |
| Стрептоміцин | Streptomycin Inj | Streptomycin |
| Супрім 240 | Supreme 240 inj | Sulfamethoxazole + Trimethoprim |
| Тетравет ЛА | Tetravet LA inj | Oxytetracycline |
| Тіавалт 45% | Tiavalt 45% wsp | Tiamulin |
| Тіамвет 45% | Tiamvet 45 wsp | Tiamulin |
| Тілмікодев | Tilmicodev (Tilmicosini fosfatum) wsp | Tilmicosin |
| Тилмікон-250 | Tilmicon (Tilmicosinum) l | Tilmicosin |
| Тилмікон 300 | Tilmicon (Tilmicosinum) inj | Tilmicosin |
| Тилозин-200, 5% | Tilozin 200, 5% inj | Tilmicosin |
| Тилозин субстанція | Tilozinum s | Tylosin |
| Тило-кел 20 | Tylo-kel 20 Inj | Tylosin |
| Тіакур | Tiakur wsp | Doxycycline + Tiamulin |
| Тіамодев 80 | Tiamodev (Tiamulinum) wsp | Tiamulin |

| Name of medicine | Latin name of medicine | Active substance of medicine |
|---|---|---|
| Тіамулін 45% | Tiamulinum 45% BT wsp | Tiamulin |
| ТієлВел 20% | TielVel 20% inj | Imipenem + Cilastatin |
| Тілозомікол 5 % | Tilosimicol (Tilosina tartratum) inj | Tylosin |
| Тілоксон | Tiloxon (Doxiciclin and Tilisini tartratum) wsp | Doxycycline + Tylosin |
| ТімТіл | Timtil (Tiamulinum and Tilosinum) inj | Tiamulin + Tylosin |
| Тромексин | Tromexin wsp | Sulfamethoxypyridazine + Trimethoprim + Tetracycline |
| Тримазин 90 | Trimazin 90 wsp | Trimethoprim |
| Тримератинвет | Trimeratinvet (Sulfadimidin and Trimetoprim) wsp | Sulfadimidine + Trimethoprim |
| Триметоприм | Trimethoprimum s | Trimethoprim |
| Трисульфон | Trisulfon wsp | Sulfamonomethoxine + Trimethoprim |
| ТТ Гард | TT Guard inj | Tiamulin + Tylosin |
| Фармазин 50, 200 | Pharmasin 50, 200 inj | Tylosin |
| Фармазин 500 | Pharmasin 500 wsp | Tylosin |
| Фармастар 200 | Pharmastar 200 inj | Tylosin |
| Фарматіл-50 | Formatil Inj | Tylosin |
| Фатроксимін | Fatroximin (Rifaximinum) IF | Rifaximin |
| *Фловет* 30% | Flovet Inj | Florfenicol |
| Фловет 200 | Flovet 200 wsp | Florfenicol |
| Флоркем | Florkem inj | Florfenicol |
| Флорон 10% | Floron 10% l | Florfenicol |
| Флорон 30% | Floron 30% inj | Florfenicol |
| Флорфенікол 30% | Florfenikol 30% inj | Florfenicol |
| Флорфенікол пероральний порошок 10% | Florfenicol Oral Powder 10% wsp | Florfenicol |
| Флоцин-300 | Flocin (Fluorfenicolum) inj | Florfenicol |
| Хлортетрациклін субстанція | Chlortetracycline Hydrochloride s | Chlortetracycline |
| Цебактал | Cebactal inj | Cefquinome |
| Цефінель | Cefinel Inj | Ceftiofur |
| Цефокел | Cefokel inj | Ceftiofur |
| Цефтіодев 5% | Ceftiodev (Ceftiofurum) inj | Ceftiofur |
| Цефтіонель-50 | Ceftionel 50 Inj | Ceftiofur |
| Цефтіофур-50 | Ceftiofur (Ceftiofurum) inj | Ceftiofur |
| Цефтіфорт 5% | Ceftifort 5% Inj | Ceftiofur |
| Цефтіфур-50 | Ceftifur inj | Ceftiofur |
| Цефур | Cefur Inj | Ceftiofur |
| Цефтіоклін | Ceftiocline Inj | Ceftiofur |
| Цефтріаксон | Ceftriaxon inj | Ceftriaxon |
| Ципрокол | Ciprocol L | Ciprofloxacin + Colistin |

| Name of medicine | Latin name of medicine | Active substance of medicine |
|---|---|---|
| Шотадін-ВС | Shotadin VC (Digidrostreptomicinum and bensilpenicilinum and bensatinum) Inj | Dihydrostreptomycin + Benzylpenicillin benzathine |
| SL 44 | SL 44 wsp | Lincomycin + Spectinomycin |
| Біоміцин М | Biomicini M t | Amoxicillin + Neomycin |
| Байоклокс | Byokloks t | Cloxacillin |
| Доксициклін 200 | Doxycycline 200 inj | Doxycycline |
| Ноземат | Nozemat wsp | Metronidazole + Oxytetracycline |
| Цефазолін | Cefazolin inj | Cefazolin |
| Лінкоспектин | LincoSpectin inj | Lincomycin + Spectinomycin |
| Мультибіо | Multibio inj | Ampicillin + Colistin |
| Метрикур | Metricure | Cephapirin |
| Івермектин | Ivermectin 1 % inj | Ivermectin |
| Біофлок 10% | Bioflock 10% inj | Enrofloxacin |
| Сульфацеф | Sulfacef t | Cefquinome |
| Бетамокс | Betamoks | Amoxicillin |
| Мастисан | Mastisan | Sulfadimidine + Benzylpenicillin + Streptomycin |
| Мастідев Лінко | Mastidev linko t | Lincomycin + Sulfathiazole + Trimethoprim |
| Мастилекс | Mastileks | Cefalexin Gentamicin |
| Ветасептол | Vetaseptol wsp | Erythromycin + Oxytetracycline |
| Мастилонг | Mastilong t | Tetracycline + Bacitracin + Neomycin |
| Медецилат | Medicelat wsp | Bacitracin |
| Параміцин | Paramicin wsp | Enrofloxacin + Colistin |
| Тріколін | Trikolin wsp | Enrofloxacin + Colistin + Trimethoprim |

Source: Author's own elaboration.

## ANNEX 3. FARM RECORD AVAILABILITY

The table below presents (in decreasing order) the ratio of farmers keeping record of certain data related to animal health and animal husbandry.

| Type of data | Ratio of farmers keeping record of the data (%) |
|---|---|
| Treatment records | 90 |
| Vaccination records | 90 |
| Births | 90 |
| Animal medicines purchased | 89 |
| Treatment protocols | 88 |
| Veterinarian visits | 88 |
| Prescription records | 87 |
| Mortality | 86 |
| Amount of animals, eggs or milk sold | 48 |
| Amount of feed purchased | 34 |
| Net income | 34 |
| Amount of feed manufactured on the farm | 28 |

Total: 335 farmers

Source: Author's own elaboration.

## ANNEX 4. PRACTICE RECORD AVAILABILITY (VETERINARIANS)

The table below presents (in decreasing order) the ratio of veterinarians keeping records of certain data related to their practice and antimicrobial use.

| Type of data | Ratio of veterinarians keeping record of the data (%) |
|---|---|
| Type of livestock species in practice | 82 |
| Number of farms in practice | 77 |
| Size of farms in practice | 73 |
| Names of antibiotics sold or prescribed per year | 28 |
| Names of antibiotics sold or prescribed per farm | 26 |
| Volume of each antibiotic sold or prescribed per year | 21 |
| Names of antibiotics sold or prescribed per farm visit | 18 |
| Volume of each antibiotic sold or prescribed per farm visit | 18 |
| Volume of each antibiotic sold or prescribed per farm | 15 |

Total: 74 veterinarians

Source: Author's own elaboration.

## ANNEX 5: PHARMACY RECORD AVAILABILITY

The table below presents (in decreasing order) the ratio of veterinary pharmacy personnel keeping records of certain data related to the distribution of antibiotics.

| Type of data | Ratio of pharmacies keeping record of the data (%) |
|---|---|
| Number of clients | 30 |
| Names of antibiotics sold per year | 29 |
| Species and production stage of animals that antibiotics are sold for | 25 |
| Volume of each antibiotic sold per year | 25 |
| Value of each antibiotic sold per year | 23 |
| Names and addresses of clients | 23 |
| Names of antibiotics sold per purchase | 21 |
| Number of animals that antibiotics are to be used in | 21 |
| Names of antibiotics sold per client | 18 |
| Volume of each antibiotic sold per purchase | 13 |
| Volume of each antibiotic sold per client | 9 |
| Value of each antibiotic sold per client | 5 |
| Volume of each antibiotic sold per animal species | 4 |

Total: 56 participants replied

Source: Author's own elaboration.

The *Understanding Antimicrobial Use in Food and Agriculture* series is a compilation of country reports, each describing antimicrobial use (AMU) practices and awareness of antimicrobial resistance (AMR) in the livestock sector. The data presented in these reports was obtained through knowledge-attitudes-practices (KAP) field surveys conducted with farmers of priority livestock production systems, field veterinarians, veterinary pharmacies, and feed mills. This issue of the series summarizes the results of interviews performed in Ukraine between December 2020 and April 2021, involving a total of 335 farmers (from chicken, pig, beef cattle, dairy cattle, small ruminant, bee and backyard farms), 74 veterinarians, 67 veterinary pharmacy personnel and 28 feed mill personnel.

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**FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS**
Budapest, Hungary

ISBN 978-92-5-140308-2
9 789251 403082
CD7638EN/1/11.25