Strategy on Antibiotic Resistance StAR

Fact sheet
Swiss Antibiotic Resistance Report 2024

When bacteria become immune or less responsive to antibiotics, this is referred to as antibiotic resistance. Such resistant bacteria can make it more difficult or even impossible to treat infections. To promote the responsible use of antibiotics and to curb the spread of resistant organisms, the Swiss Antibiotic Resistance Strategy (StAR) was launched in 2015. These efforts have been further bolstered through the new One Health Action Plan 2024-27 StAR. The surveillance of antibiotic use and resistance in humans, livestock, and domestic animals and in the environment is a key part of the strategy and action plan. The results of this monitoring and surveillance have been summarised every two years since 2016 in the Swiss Antibiotic Resistance Report.

Development of antibiotic consumption

Every time antibiotics are used, resistant bacteria can develop. It is therefore crucial that these medicines are used as appropriately as possible in humans and animals. It is important that antibiotics are used as much as necessary but as little as possible. It is also key that the right antibiotic is used, in the right dosage and for the right duration. This is why the sale and use of antibiotics is monitored and analysed.

In human medicine, antibiotic use has increased again following the COVID-19 pandemic

In human medicine, total antibiotic consumption (in both medical practices and hospitals) amounted to 10.8 defined daily doses (DDD) per 1,000 inhabitants per day in 2023. Following a significant decline during the COVID-19 pandemic (2021: 8.6 DDD), consumption has therefore returned to a similar level to 2019 (10.6 DDD, +3%). The significant wave of respiratory diseases in the winter/spring of 2023 is likely to have played a part in this. Compared to the rest of Europe, however, Switzerland remains one of the countries with the lowest consumption (consumption in EU countries in 2022: min. 9.1 DDD, max. 33.5 DDD, Ø 19.4 DDD[i]). The goal of Switzerland's StAR One Health Action Plan is to reduce consumption to 10.2 DDD by 2027.

In terms of critical antibiotics from the Watch group, there has been a 26% decline since 2014 (2014: 4.9 DDD; 2022: 3.4 DDD; 2023: 3.6 DDD). The proportion of the less critical Access antibiotics, which should be prescribed as the first choice, as a share of total consumption therefore increased to 66%. Since 2019 Switzerland has exceeded the World Health Organization's target for Access antibiotics of 60%. The Action Plan aims to further improve the proportion to 69%.

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Bundesamt für Gesundheit BAG

Bundesamt für Lebensmittelsicherheit und Veterinärwesen BLV

Bundesamt für Landwirtschaft BLW

Bundesamt für Umwelt BAFU

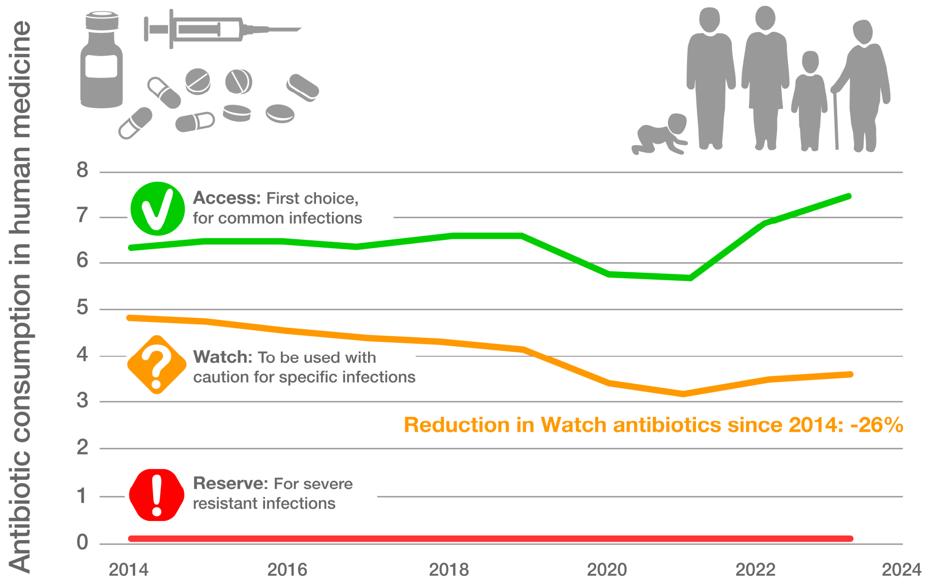

Figure 1. Per-capita consumption of antibiotics in human medicine (in defined daily doses per 1000 inhabitants per day) by AWaRe (Access, Watch and Reserve antibiotics) category.

In Switzerland 87% of antibiotics are used in medical practices and 13% in hospitals

The majority of antibiotics are used in outpatient settings (particularly in medical practices). Consumption per capita (9.4 DDD) has significantly increased following the COVID pandemic (2021: 7.3 DDD; 2022: 8.7 DDD), but is still relatively low by international comparison: in the EU, only the Netherlands recorded lower consumption in outpatient settings in 2022 (8.3 DDD). The EU average was 17.0 DDD.

There are marked regional differences in consumption across Switzerland: in German-speaking parts of the country, consumption per inhabitant (at 7.8 DDD) is lower than in the French-speaking and Italian-speaking parts (at 13.1 DDD and 12.4 DDD, respectively). The Action Plan seeks to reduce these regional differences. In 2023, general practitioners prescribed most antibiotics to treat diseases of the upper respiratory tract (30%) and urinary tract infections (28%). Around 20% of prescriptions involved classes of antibiotics that are not recommended in the national guidance.

Meanwhile, in Swiss hospitals, per-capita consumption at 1.4 DDD in 2023 (2022: also 1.4 DDD) is roughly in line with the EU average (2022: 1.6 DDD). Consumption is therefore slightly lower than before the COVID-19 pandemic (2019: 1.5 DDD). Around a third of hospitalised patients received an antibiotic in 2023.

Antibiotic use continues to decline in veterinary medicine

Antibiotics are used to treat bacterial infections. In 2023, a total of 24 tonnes were used in veterinary medicine in Switzerland, the majority of which were administered to livestock and only around 3% to domestic animals. The total volume of antibiotics sold to veterinarians in 2023 decreased by 14% compared with 2021 and by 48% compared with 2014. In particular, the downward trend continued in so-called critical antibiotics where potential resistance is especially problematic and which should only be used to treat certain infections. Since 2014, the volume of critical antibiotics sold to veterinarians for livestock has declined by 76%, and a significant decrease has also been recorded for domestic animals. By European comparison, Switzerland is already among the countries with relatively low antibiotic use. The goal is to be one of the five best-performing countries in Europe in terms of the sale of critical antibiotics by 2027.

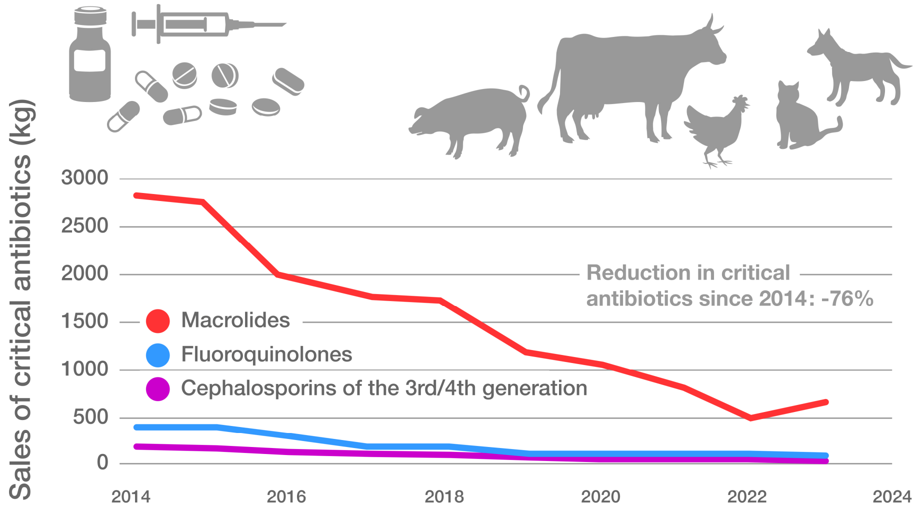

Figure 2. Sales of critically important antibiotics for veterinary medicine (livestock and domestic animals) in kilograms.

Since 2019, veterinarians have also recorded every single antibiotic prescription in the dedicated information system (IS ABV). Analysis of this data shows that primarily first-line antibiotics are used for all species and that veterinarians in Switzerland are therefore following the treatment guidelines effectively. In livestock, cattle are the most likely to be treated with antibiotics (564 treatments per 1,000 animals), followed by poultry, small ruminants (sheep and goats) and pigs (fewer than 80 treatments per 1,000 animals).

Cattle were given antimicrobials primarily for udder infections (30.3%), pigs for infections of the gastrointestinal tract (53.6%), poultry for young bird disease (85%), goats/sheep for respiratory diseases (32%), horses/donkeys for musculoskeletal diseases (34%), and dogs and cats for skin conditions (24.5% and 28.5% respectively). The distribution of antibiotic use across the various diseases for each species has remained relatively stable over time.

Antibiotics in the environment

Antibiotic pollution in rivers, lakes and groundwater can be reduced by retrofitting sewage treatment plants

After antibiotics have been ingested by humans and animals, they are partially excreted and can thus end up in wastewater, waterbodies and soil. Antibiotic concentrations decrease from wastewater to river water due to dilution effects. From river water to ground water, the concentrations decrease further as antibiotics are partly degraded or retained during bank filtration or when they pass through the soil.

Conventional sewage treatment plants can only partially remove antibiotics. However, additional treatment steps to eliminate micropollutants can reduce the measured concentrations of antibiotics by a factor of ten. In 2024, around 15% of Swiss wastewater was purified in such treatment steps, and by 2040 that figure is set to be 70%. Measurements conducted in Furtbach (AG/ZH) show that by retrofitting a sewage plant, the concentration of antibiotics is reduced so much that the Environmental Quality Standards are no longer exceeded. Based on current evidence, it is unlikely that the antibiotic concentrations measured in Swiss waterbodies are directly promoting the development of resistance.

Resistance situation

Many microorganisms are naturally present in the environment and on the skin, in the mucosa or in the intestine of humans and animals (e.g for digestion). However, if these bacteria enter the body and multiply excessively, this is referred to as an infection. This happens, for example, if the skin or mucosa are damaged, or in people with immunodeficiency. If the bacteria that cause the infection are resistant to certain antibiotics, it becomes difficult, or even impossible, to treat the infection.

Data on resistance rates in humans and animals has been collected in Switzerland for around 20 years. It is always done for a specific bacterium and class of antibiotic. The most important pathogens and antibiotics show a mixed picture: while antibiotic resistance has significantly increased in some bacteria, it has remained stable or decreased in others. Overall, resistance rates have stabilised in recent years.

Resistance rates have stabilised in human medicine

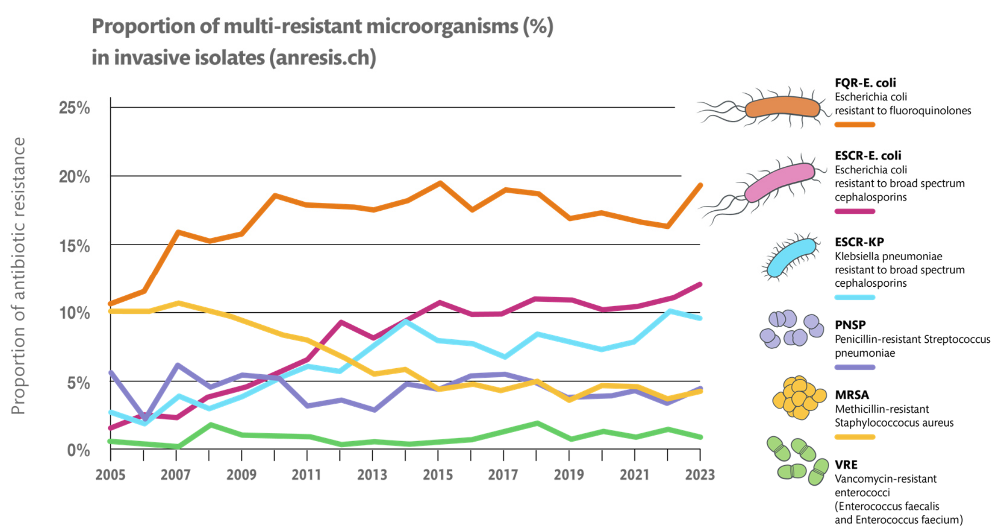

Figure 3. Resistance among major pathogens in human medicine: percentages of bacteria resistant to specific antibiotics in invasive infections.

One of the most important resistant pathogens is *S. aureus*, which is resistant to methicillin (MRSA). Rates of MRSA have fallen from 10% to 4% since 2005, and have continued to decline slightly in the last few years. The rate of penicillin-resistant *S. pneumoniae* remains constant at a low level (4%).

Resistance rates to the antibiotic classes fluoroquinolones and cephalosporins in the bacteria *E.coli* and *K. pneumonia* have remained relatively stable since 2015, but increased slightly in 2022 and 2023. If resistance to cephalosporins increases, the antibiotic class of carbapenems will have to be used more frequently (see separate section on carbapenem resistance).

Infections caused by the bacterium *C. difficile* pose a risk in hospital settings. The use of antibiotics can facilitate such infections, as antibiotics damage the gut flora, which allows *C. difficile* to multiply. A study conducted at the Inselspital in Bern shows that a decline in antibiotic use has also led to a reduction in *C. difficile* infections.

Based on resistance data, modelling can be used to estimate the disease burden and number of deaths caused by antibiotic resistance. For Switzerland it is estimated that the disease burden is around 85 infections per 100,000 inhabitants and that around 300 people a year die from infections caused by resistant pathogens. [ii] Relative to the size of its population, Switzerland is less affected by infections caused by resistant bacteria than France or Italy, but more so than the Netherlands or Scandinavian countries.

Monitoring resistance in animals

The monitoring of resistance rates in animals is carried out via two different surveillance systems. To assess the potential risk to humans, commensal indicator bacteria and zoonotic bacteria are monitored from healthy slaughter animals and meat. Commensal indicator bacteria do not normally cause diseases themselves, but can pass on resistance to other bacteria, including to those that can cause diseases in humans. The monitoring of indicator bacteria, in particular *E. coli* in slaughter animals and meat, therefore gives a good overview of the development of resistance. Zoonotic bacteria can be transmitted from animals or food to humans. The diseases they cause are called zoonotic diseases or zoonoses.

Resistance has also been monitored since 2019 in pathogenic bacteria for livestock and domestic animals. This data can help guide the choice of antibiotics used to treat infections.

Antibiotic resistance has evolved differently in slaughter animals, meat, livestock and domestic animals

Resistance rates in *E. coli* bacteria from the intestines of broiler chickens, fattening pigs and slaughter calves evolved differently between 2021 and 2023. Rates of fluoroquinolone-resistant *E. coli* from broiler chickens decreased to 34%. These resistance rates in fattening pigs and slaughter calves are unchanged at under 10%. Rates of resistance to tetracyclines and sulfonamides are declining in all livestock species. For cephalosporin-resistant *E. coli*, which is important in human medicine (so-called ESBL/AmpC-producing *E. coli*), and which is often also resistant to other antibiotics (multi drug resistance), resistance rates decreased significantly in broiler chickens (to 4.3% in 2022), stagnated in pigs (at 6.2% in 2023), but increased in slaughter calves (32.7% in 2023).

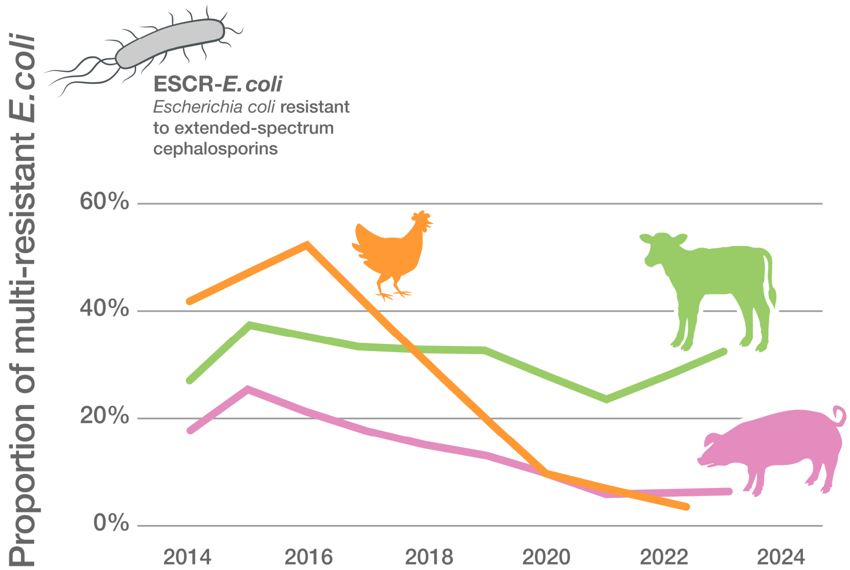

Figure 4. Resistance rates in the veterinary field: proportions of extended-spectrum cephalosporin-resistant E. coli (resistant to third- and fourth-generation cephalosporins) found in the appendixes of slaughtered animals (broiler chickens, veal calves and fattening pigs).

Since 2020 there has been a further decline in ESBL/AmpC-producing *E. coli* in retail chicken samples: in chicken of Swiss origin it was present in 4.2% of samples, and in chicken of foreign origin 47.4% in 2022. Detection rates have therefore declined sharply since 2014, both in chicken of Swiss origin (2014: 65.5%) and in chicken of foreign origin (2014: 85.6%).

Retail turkey meat was tested for the first time in 2022. ESBL/AmpC-producing *E. coli* was detected in 25.7% of the turkey samples of foreign origin, and in none of the turkey samples from Switzerland. In retail pork and beef samples, these values have been very low for years (around 1%). No ESBL/AmpC-producing *E. coli* was detected in imported beef.

Samples are also tested for methicillin-resistant *S. aureus* (MRSA). While in 2009 MRSA was detected in only 2% of samples from fattening pigs, the detection rate rose to around 53.6% by 2019 and has since stagnated (2023: 53.5%). This MRSA is known as ‘animal-associated’ MRSA, which means there is only a transmission risk for people who have regular close contact with pigs. MRSA prevalence in slaughter calves has stabilised at a low level (under 10%).

Rates of resistance in campylobacter from chicken are stable

Infection caused by Campylobacter bacteria (campylobacteriosis) is the most common zoonosis in Switzerland and in other European countries. Campylobacter are frequently transmitted through food, in particular raw chicken, and cause gastroenteritis. A bacterial foodborne infection can be prevented by meticulously following some simple hygiene rules in the kitchen.

Fluoroquinolone-resistant *Campylobacter (C. jejuni)* was detected in 45.7% of Swiss broiler chickens in 2022, and the rate has therefore stabilised at a high level since 2018. Rates of resistance to macrolides – a class of antibiotic that can be used to treat severe infections caused by *Campylobacter* – remained at a low level (under 5%).

Antibiotic resistance has developed differently in diseased livestock and domestic animals

The spectrum of potentially pathogenic bacteria in livestock and domestic animals is very broad. The resistance situation therefore also varies widely depending on the type of bacteria and species concerned. The rate of resistance to fluoroquinolones in pathogenic *E.coli* from broiler chickens has decreased to 20%. In general, the tested bacteria from dogs and cats showed a high level of resistance to aminopenicillins. Rates of resistance to other classes of antibiotic are below 20%. Pathogenic bacteria causing udder infections in cows are usually responsive to penicillin (with the exception of *S. aureus*).

New methods allow a better understanding of the spread of carbapenem resistance

Carbapenems are important reserve antibiotics for treating severe infections and should therefore be used as sparingly as possible. Carbapenemase-producing Enterobacterales (CPE) are resistant to carbapenems. These multi-resistant bacteria pose a particular threat to public health, which is why they are subject to a reporting obligation in human medicine. Compared with the countries in the EU, carbapenem resistance in Switzerland is at a low level, but is on the rise. For example, rates of resistance in the enterobacterium *K. pneumoniae*, which is particularly transmitted in hospital settings, exceeded 1% for the first time in 2023. In addition, more carbapenem-resistant *K. pneumoniae* that are particularly virulent (pathogenic) have been detected in recent years.

Because of the importance of CPE in human medicine, these are also monitored in animals. As before, no cases of CPE have been detected in healthy livestock in Switzerland. However, CPE are increasingly detected in samples from domestic animals. Using whole genome sequencing (WGS), researchers have studied the spread of CPE in veterinary clinics. This showed that an easily transmissible DNA molecule called a plasmid is responsible for the spread of carbapenem resistance between enterobacteria in domestic animals, and that this can also be transmitted to staff at veterinary clinics. The fear is therefore that these CPEs are also transmitted to livestock and could enter the food chain. To prevent this happening, surveillance and hygiene measures are also needed in veterinary clinics.

---

[i] European Centre for Disease Prevention and Control. Antimicrobial consumption in the EU/EEA (ESAC-Net) - Annual Epidemiological Report 2022. Stockholm: ECDC; 2023. https://www.ecdc.europa.eu/sites/default/files/documents/AER-antimicrobial-consumption.pdf

[ii] Gasser et al: Associated deaths and disability-adjusted life-years caused by infections with antibiotic-resistant bacteria in Switzerland, 2010 to 2019, Euro Surveill. 2023;28(20). https://doi.org/10.2807/1560-7917.ES.2023.28.20.2200532