Designing AMR Governance

Netherlands

DESIGNING AMR SOLUTIONS

NIVEL Research for better care

YORK UNIVERSITÉ UNIVERSITY

Systems workshop summary report, August 2024

Executive summary

What was the purpose of the systems workshop?

In June 2024, Dutch stakeholders participated in a systems analysis workshop focused on the role of the Dutch system in the emergence and spread of antimicrobial resistance (AMR). This workshop was undertaken as part of DESIGN, a six-country project funded by the Joint Programming Initiative on AMR, focused on improving policy and governance for antimicrobial stewardship at national and global levels. The workshop objectives were to:

- Understand the factors influencing the emergence and spread of AMR in the Netherlands;
- Share perspectives across sectors; and
- Identify priority actions to combat antimicrobial resistance in the Netherlands.

Who contributed?

Seven contributors working in different sectors and disciplines attended an online workshop to participate in structured discussions and exercises to articulate the problem; map the system of relevant factors and relationships; and identify priority actions over different time scales. The workshop took a One Health approach, bringing together actors with expertise in human, animal and environmental health and reflecting on interconnections between sectors. The group included researchers working in animal health, food safety and agricultural economics, and national policymakers working in public health and at the human-animal interface.

What were the key systems insights and priority actions?

Contributors could not agree on a prediction for how the problem of AMR was likely to evolve in the Dutch context, though the substantial progress made in the Netherlands in reducing antimicrobial use was discussed. They noted that trends would look different in different sectors (human vs. veterinary vs. environment), for different micro-organisms, and even, in some cases, within the same type of micro-organisms.

Contributors identified numerous factors and relationships across the human, animal and environmental sectors that contributed to this problem, ranging from antimicrobial use in different sectors and animal production systems, to national and regional policy and the global context. The discussion of ongoing spread of resistant pathogens within and between different environments and populations, as well as similar issues in policy and practice across sectors, highlighted the importance of cross-sectoral collaboration. The importance of cost considerations, particularly in guiding decision-making in food production, was also highlighted. Finally, contributors highlighted policy and broader contextual drivers including the importance of sustained efforts around stewardship, surveillance and prevention; potential regional and global influences on AMR, through the arrival of AMR strains with people and goods travelling from other jurisdictions; and the potential of regional bodies to make policy progress and build capacity in other nations. To conclude the workshop, contributors identified a number of priority actions for the Netherlands over the short-, medium- and long-term.

What are the next steps?

This workshop is one of five happening globally in different countries: the Netherlands, Canada, Hungary, Senegal and the Philippines. Once we have completed these workshops and received feedback from contributors, we will bring together insights from the workshop to support our project goals of strengthening context-appropriate policy and governance for antimicrobial stewardship. We will share cross-country insights with all contributors once the workshops are complete.

Acknowledgements

We would like to take this opportunity to thank our workshop contributors for generously giving their time to this project and sharing their essential expertise and insights. We would like to thank the Dutch DESIGN team, Lotte van Heuvel, Caroline Schneeberger, Foekje Stelma and Michel Dückers of Nivel, for their support in organising the workshop and input on this report.

We also thank Valentina De Leon for her support in facilitating the workshop and our colleagues in the Global Food System & Policy research group for their input in piloting workshop materials and activities.

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If you have any responses, thoughts or additional insights, please get in touch.

Goals, format and contributors

This report summarises the systems workshop undertaken in the Netherlands as part of the Designing AMR Solutions project. This is a six-country project aiming to strengthen national and global governance for improved antimicrobial (AM) stewardship.

The workshop was focused on the role of the Dutch system in driving the emergence and spread of antimicrobial resistance (AMR). The workshop objectives were:

- Understand the factors influencing the emergence and spread of AMR in the Netherlands;
- Share perspectives across sectors; and
- Identify priority actions to combat AMR in the Netherlands.

The workshop was informed by a One Health perspective, which "recognises the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) as closely linked and interdependent".

The workshop took place virtually in June 2024 over two two-hour sessions. Attendees participated in structured discussions and exercises to develop a systems map of the problem and identify and discuss priority actions.

Seven stakeholders[1] participated in the workshop, including representatives from research and government institutions. Contributors were recruited based on their professional roles and expertise and work on topics related to AMR and its drivers in the human health, animal health, environment, and food and agriculture sectors. The group included researchers working in animal health, food safety and agricultural economics, and national policymakers working in public health and surveillance at the human-animal interface. No contributors had specific expertise in the environment sector, though contributors with this background were invited.

[1] Five stakeholders attended on both days. Two stakeholders attended one of the workshop days only.

Workshop discussion and outputs

Articulating the problem

The beginning of the workshop focused on exploring and describing the emergence of AMR in the Dutch system. The exercise entailed asking the contributors to think about how they perceived the trends in AMR from past to present. Contributors also subsequently provided insight into how they believed the trends in AMR would change in the future if no change was imposed (status quo), the best-case scenario with substantial positive change, for example in policy and practice, and then worst-case scenario with negative change, based on their expertise and knowledge. Each contributor was then invited to share their perspectives with the group. During this discussion, the value of developing scenarios of how AMR is likely to involve in the Netherlands was raised, particularly for policy decision-making. These scenarios can help inform decision-making, as well as raise awareness and mobilise action on this important issue.

All contributors were hesitant to graph the progression of AMR throughout time. Some contributors provided a broad overview of AMR, suggesting that it had increased over time but then began to decrease when more stringent policies related to antimicrobial use (AMU) in food-producing animals were established. It was noted that substantial progress had been made around reducing AMU in food-producing animals in the Netherlands, with robust surveillance systems in animals supporting efforts to monitor progress. This had resulted in a decline in AMR in some production systems and species, though not to a level comparable with the reduction in AMU. It was hypothesised that multi-resistance contributed to this more limited progress. Reductions in AMR were also not seen in all production systems and species. For example, in production animals, extended spectrum beta-lactamase (ESBL) infections had declined, but Methicillin-resistant Staphylococcus Aureus (MRSA) infections had seen minimal impacts.

Some contributors anticipated that the actions in the Dutch AMR national action plan, including continuing to reduce AMU, public awareness campaigns, increased surveillance, and AM stewardship programs, will help minimise the increase in AMR in the country. Changes in animal husbandry systems, for example to less dense production approaches or slower growing species, were seen as a potential lever for impact. However, the economic importance of this sector and food exports in the Netherlands were discussed as potential barriers to change.

The participants found it difficult to predict future trends in AMR because of the many different drivers in play. These included factors that may be difficult to predict, such as the development of new AM and other technological innovation that might help to combat AMR. Knowledge gaps also contributed to this uncertainty, with a lack of evidence around some barriers and facilitators to the emergence and spread of AMR, such as the role of insecticides used in crop production.

The group also discussed how to frame AMR in a productive way, debating whether taking a broader view of the issue was of value rather than focusing on drivers that were well-evidenced to be of greater importance. While some contributors argued that this broad perspective made the issue needlessly complex, others thought that it could highlight novel ways to intervene in the problem of AMR.

Contributors were engaged with the process and took time to consider both their expertise as well as various contextual factors when voicing their perspective. There was no collective agreement on the overall progression of AMR emergence. Potential differences in trends were identified across different resistance strains and pathogens and between different types of companion and livestock animals, as well as variation due to different transmission pathways within and between humans, animals and the environment.

In articulating the problem, contributors began to discuss the numerous factors that contribute to the issue of AMR in the Netherlands. These factors included AMU in human and animal health (with some use of anti-fungals in crop production); the health and welfare of production animals; on-farm biosecurity measures; different types of animal production system; and patterns of migration and travel. This exercise initiated the next phase of the workshop, where these factors were expanded on and their interconnections were identified.

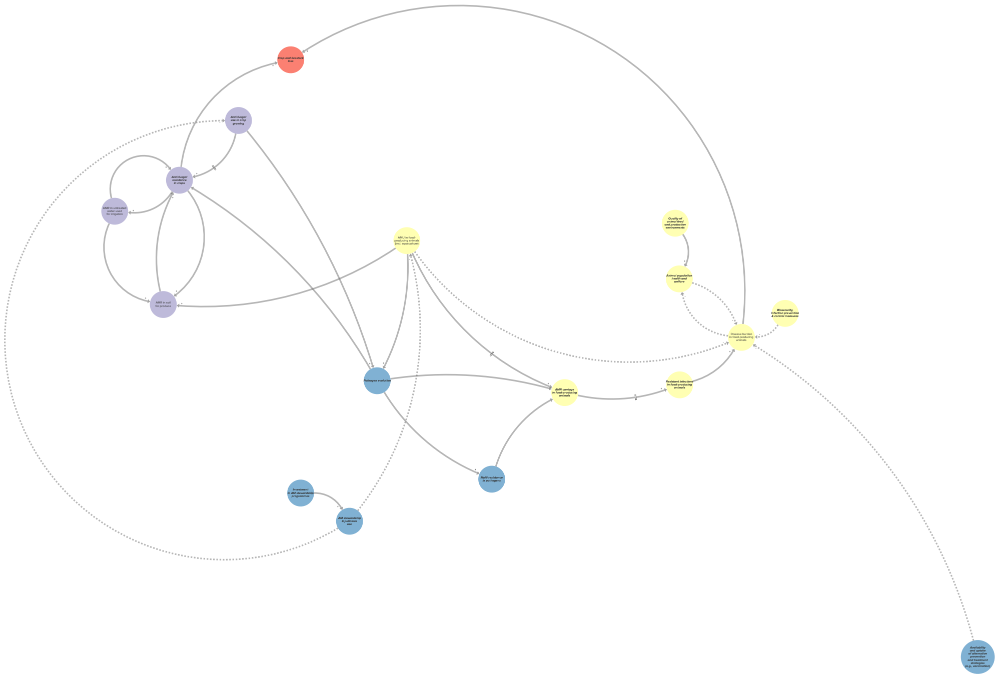
Mapping the system

Workshop contributors developed a systems map to illustrate the role of the Dutch system in the emergence of AMR. At the start of this exercise, the facilitation team introduced a 'seed structure': a simple model to be used as a starting point for the mapping exercise, which contributors were invited to change and expand. This seed structure was developed based on an ongoing systematic literature review focused on understanding the structural determinants of AMR from a One Health perspective.

After contributor input and alterations to the seed structure, the finalised systems map was developed. This map contained several key sections, which are summarised below. Relative to the seed structure, the map was much more expansive, and contained distal and upstream drivers including national and regional policy and governance and the global context. In addition, some drivers initially included in the seed structure were removed as they did not apply to the Dutch context. For example, the use of antimicrobials for growth promotion, which was discussed in the literature, is illegal in the European Union, including the Netherlands, and therefore not an important driver.

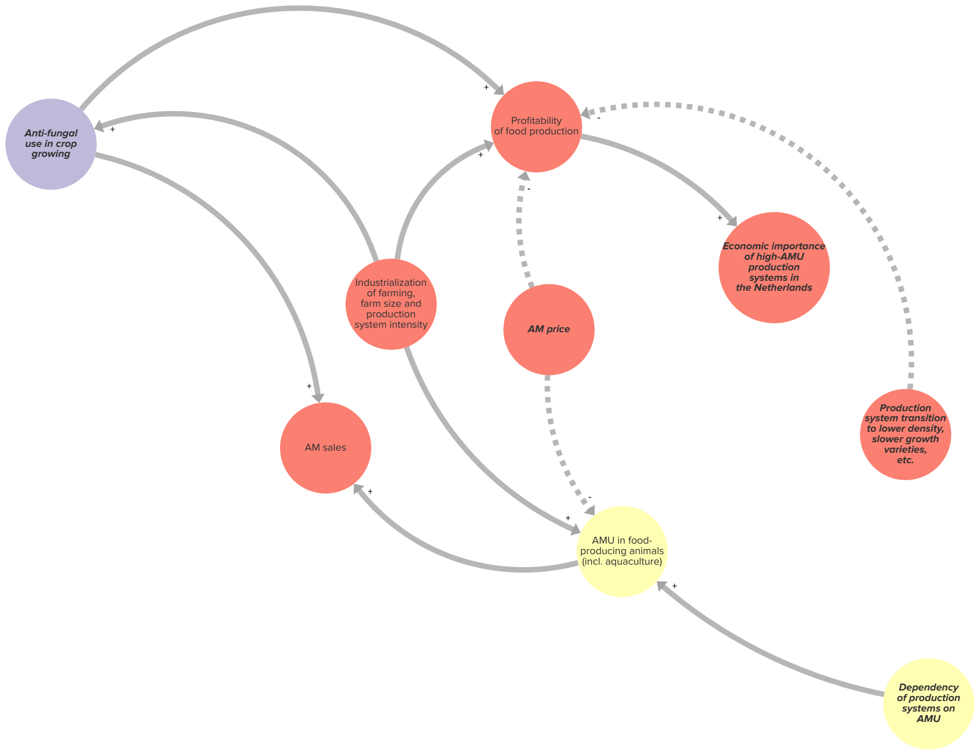
In all figures, new or altered factors proposed by workshop contributors are indicated with a bold font. Larger versions of all included figures can be found at the end of this report. For more in-depth exploration of the systems map developed during the workshop, please visit the online version of the map at: https://kumu.io/GFSPR/design-amr-the-netherlands.

ANTIMICROBIAL USE IN CROPS AND FOOD-PRODUCING ANIMALS



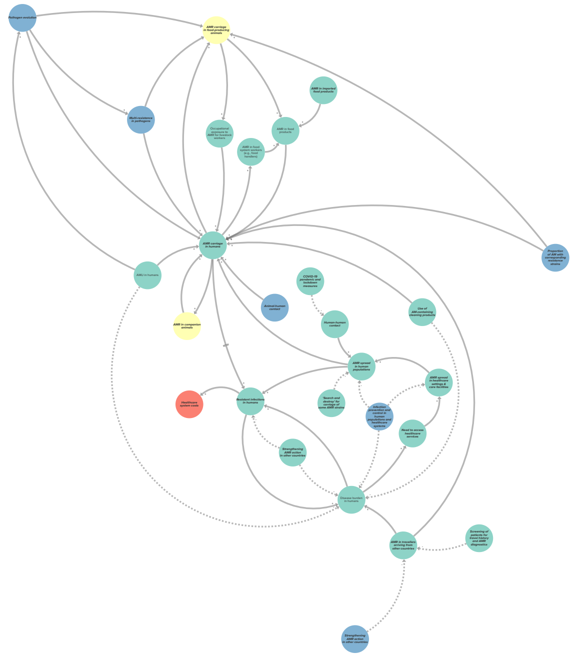
- When rearing livestock (including in aquaculture contexts), antimicrobials are frequently used to reduce the burden of disease. Anti-fungals are also used to prevent disease in crop production.
- More use can contribute to accelerated pathogen evolution, contributing to pathogen resistance.
- Resistant pathogens can spread to the environment and other populations, and multi-resistant strains can also emerge.
- Biosecurity and infection prevention & control measures reduce the burden of disease and the need for AMU. Animal population health and welfare, which can be impacted by factors like the quality of feed and production environments, can also reduce the burden of disease and the need for AMU.
- High burden of disease in food-producing animals and crops can lead to crop and livestock loss.
- Investment in AM stewardship programmes can improve judicious use, while the use of alternative disease prevention measures, such as vaccination, can reduce the need for AMU.
- Where AM are used in veterinary medicine, regulation in the Netherlands restricts the use of AM that are critically important for human medicine, reducing the risk of AMR emergence and transmission.

ECONOMIC FACTORS IN FARMING AND PRODUCTION INTENSIFICATION



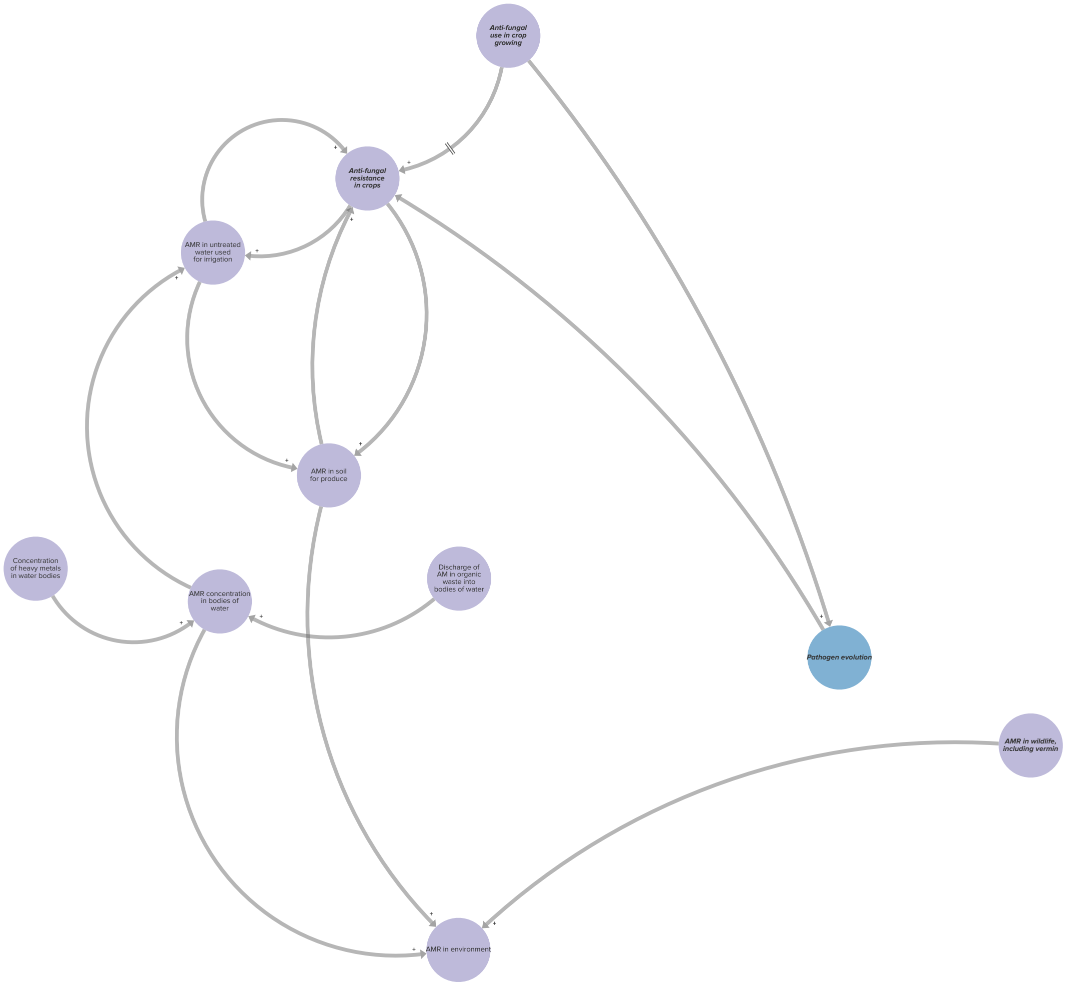
- Economic factors in farming and production intensification drive antimicrobial use in livestock and crop production.
- AMU can prevent disease and improve the health of crops and livestock, thereby increasing profitability.
- Increased use also drives the sale of antimicrobials.
- Profitability of food animal production supports the economic importance of the sector, with food exports being an important contributor to the Dutch national economy.
- A transition to production systems with lower density and slower growth varieties may reduce profitability, but also reduce reliance on AMU.

TRANSMISSION TO HUMANS AND INCREASED DISEASE BURDEN



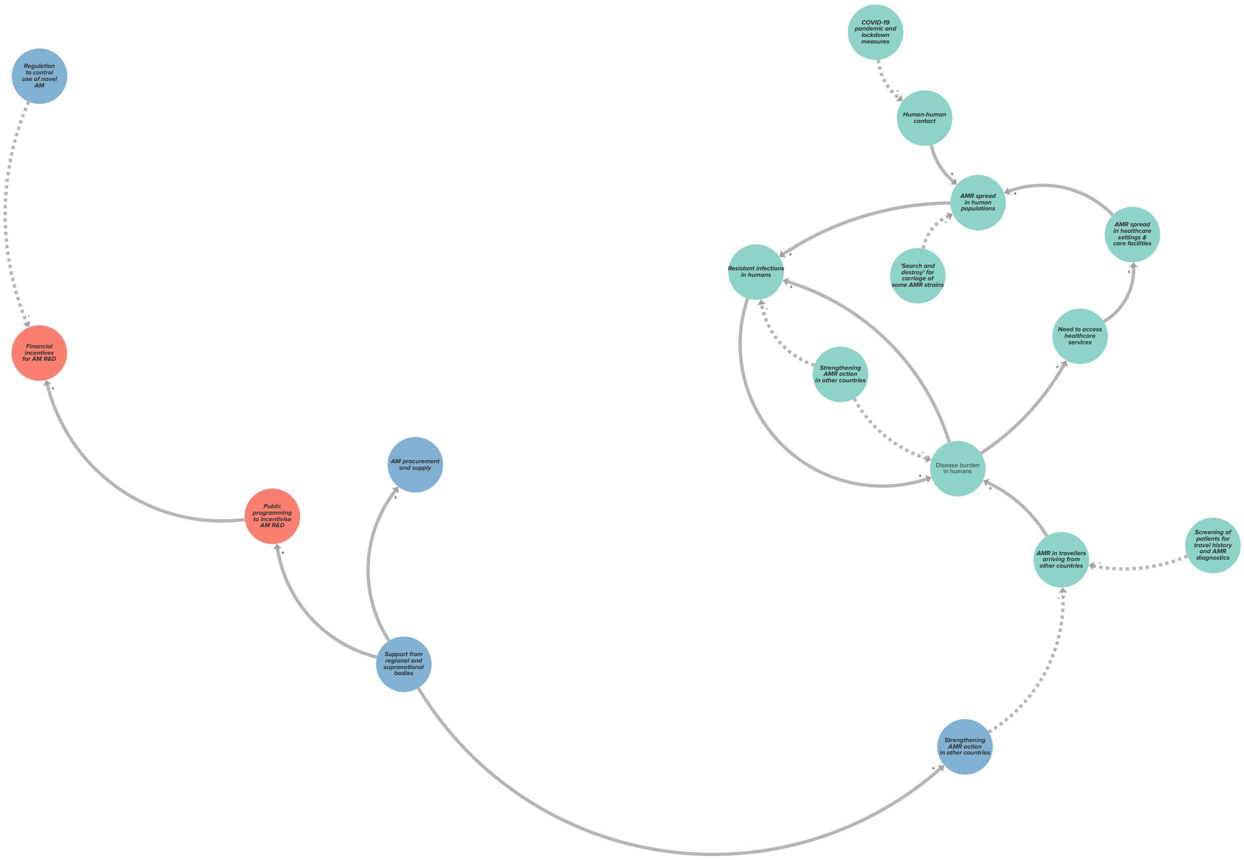
- Antimicrobials reduce the disease burden in humans by reducing illness due to microbes.
- However, antimicrobial use also contributes to pathogen evolution and the emergence and spread of resistant infections, including multi-resistant strains, which can in turn contribute to the burden of disease and healthcare system costs.
- AMR in food-producing animals can also impact humans when they handle or consume livestock and related products, including AMR found in imported food products which may include strains that are rare or non-existent in the Dutch or EU context. However, the risk of spread from animals to humans is lower than human to human transmission, and the risk of transmission from food is as yet unknown.
- Conversely, AMR in human healthcare settings and human populations can spread from humans to humans, animals and the environment, feeding back into the larger system.
- AMR in companion animals can also be transmitted to humans, and vice versa, given their close interactions
- Programmes to support infection prevention and control in the human population and healthcare systems; a 'search and destroy' policy for the carriage of some AMR strains; screening of patients to understand their travel history prior to entering a healthcare setting; and strengthening AMR action in other countries may all contribute to reducing emergence and spread of AMR in human populations, and also in the system as a whole.

ACCELERATED EMERGENCE AND SPREAD IN THE ENVIRONMENT



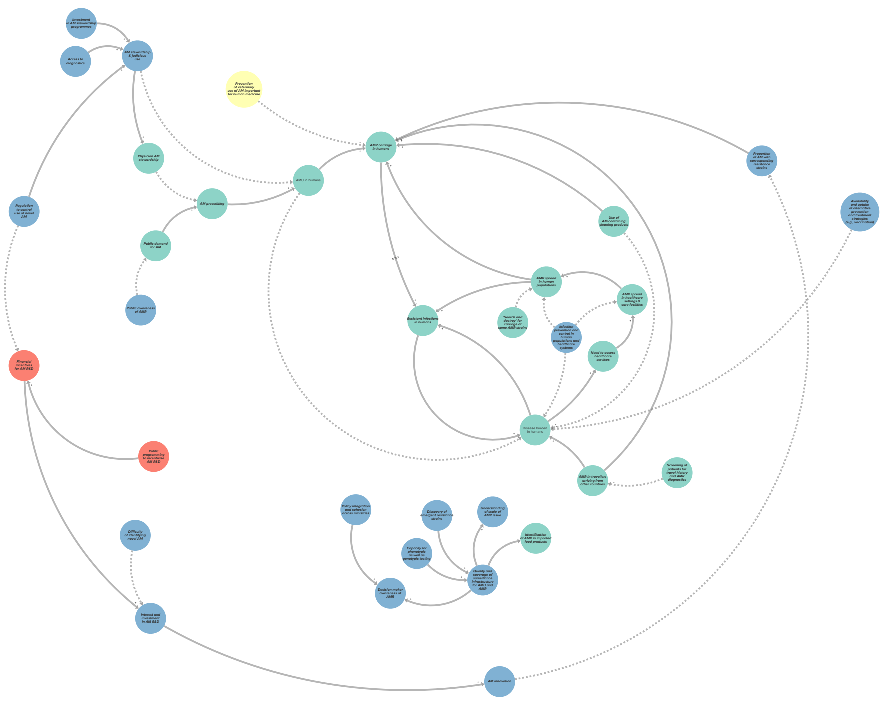
- Anti-fungal use in crop production can drive pathogen evolution, contributing to anti-fungal resistance in crops.
- AMR from human and animal populations can spread to the environment through contact with wildlife, including vermin, or dispersal through water (e.g., waste-water from healthcare settings and farms) and soil.
- AMR in the environment can return to the broader system, for example spreading through water used for irrigation.
- Meanwhile, environmental drivers such as concentrations of heavy metals in bodies of water, can drive AMR in environmental reservoirs.
- The knowledge gaps around AMR in the environment are numerous, with the role of various products (e.g., pesticides) in the emergence and spread of AMR remaining unclear. However, regulations in the Netherlands limiting the use of AM in crop production may go some way to mitigating potential harms.

REGIONAL AND GLOBAL INFLUENCES



- While regulation to control the use of novel AM protects their efficacy, it also reduces financial incentives to invest in AM research and development.
- Public programming to incentivise AM research and development can increase these financial incentives. This programming can be supported through regional and supranational bodies
- Regional EU bodies can also support AM procurement and supply, as well as help to strengthen AMR action in other countries, which protects the global community.
- For example, stronger action on AMR in other jurisdictions reduces risks linked to AMR in travelers arriving from other countries, which may then transmit to Dutch populations and healthcare settings. Dutch authorities can contribute to strengthening AMR action outside their borders, for example by providing technical support and guidance to other nations through their roles in EU and global bodies.
- Global events, such as the COVID-19 pandemic, may also have national impacts, for example by reducing human-to-human contact and the spread of pathogens, including resistant strains.

STEWARDSHIP, SURVEILLANCE, PREVENTION AND PUBLIC AWARENESS



- Controlling the increase in AMU depends on AM stewardship and judicious use, including from medical practitioners.

- This can include adequate regulation to control use, investment in AM stewardship programmes and increasing access to diagnostics for both humans and animals by lowering costs and improving offer at point of care.

- Infection prevention and control in both human and animal populations is also an important part of reducing AM reliance, as are the availability and uptake of alternative prevention and treatment strategies (e.g., vaccination).

- Surveillance can also contribute to decision-maker awareness of AMR and understanding of the scale of the problem, with the Netherlands having a robust surveillance system for AMU and AMR in human and animal populations.[2] However, a need for further strengthening was discussed, as were the challenges of developing surveillance mechanisms for emergent resistance strains.

- Finally, while there are financial and technical barriers to developing new AM, public programming can incentivise AM innovation. In the context of the Netherlands, pooling resources with other EU nations was discussed as a mechanism to advance this agenda.

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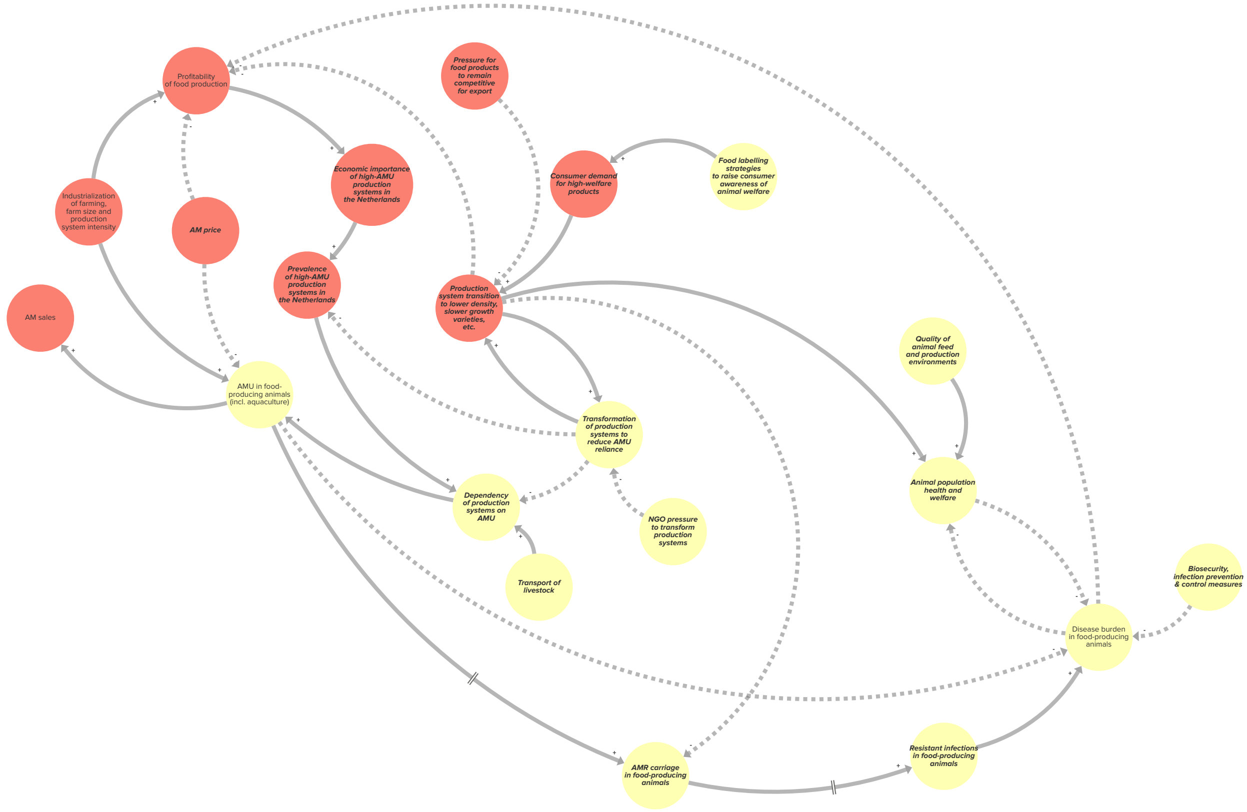
[2] https://www.rivm.nl/publicaties/nethmap-2023-consumption-of-antimicrobial-agents-and-antimicrobial-resistance

PRODUCTION SYSTEM TRANSITION



- Production system transitions for food-producing animals can reduce the reliance on AMU in the livestock sector. For example, transitioning to lower density and slower growth varieties can reduce the need for AMU in livestock production.
- Measures to improve animal population health and welfare, including biosecurity measures such as improving the quality of feed and production environments, , infection prevention and control measures, including vaccination, can also reduce the burden of disease in animal populations, meaning that less AMU is required. This can reduce resistance rates and maintain the efficacy of existing AM for cases where they are needed.
- However, this transition in production systems can entail economic costs, possibly leading to reduced profitability for the sector and potentially impacting competitiveness in the international market.
- The economic importance of the sector can also support a lobby against sectoral change.
- Pressure from actors such as non-governmental organisations can drive sectoral change. Consumer pressure may also be levied through labelling strategies to raise consumer awareness of animal welfare.

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Priority actions to control the emergence and spread of AMR

Contributors identified priority actions to control the emergence and spread of AMR in the Netherlands context (Table 1). Contributors individually reflected to identify priority actions over the short- (2 years), medium- (2-5 years) and long-term (5+ years).

Contributors then shared a few of their priority actions with the group, discussing the ways in which the actions had the potential to transform the system.

Contributors noted that many of the proposed actions are included in the recently published AMR National Action Plan (NAP) for the Netherlands [2024 – 2030]. Some contributors raised the potential utility of this action prioritisation exercise for reviewing the recent AMR NAP to gather insight around which actions should be prioritised in the short and long term.

Table 1 Priority actions to control the emergence and spread of AMR in the Netherlands

Short Term (2 years)	Medium Term (2-5 years)	Long Term (5+ years)
• Informed regulatory and policy development • Strengthen monitoring and surveillance systems for AMU and AMR including for Gram-positive bacteria • Facilitate the sharing of microbial sequence data at national and international levels • Implement and strengthen infection prevention and control measures* • Ensure the rational use of antibiotics in the human healthcare sector	• Develop and advance point-of-care diagnostics • Increase awareness and understanding of AMR • Enhance the speed of detecting potential clusters through WGS • Address the impact of stigma related to being a carrier of multi-resistant strains, and consider related laws and privacy issues	• Foster the development of new antibiotics • Enhance AMU practices in LMICs • Transform the food system towards regenerative agriculture • Increase the availability of over-the-counter diagnostics for infections • Establish a comprehensive animal public health system • Improve animal production systems to reduce alliance on AMU • Promote vaccination to prevent various infections • Investing and expanding research programs

AMU=antimicrobial use, AMR=antimicrobial resistance, WGS=whole genome sequencing, LMICs=low- and middle-income countries

*Action was proposed as both short- and medium-term solution

Reflections on the mapping process

During the workshop, contributors reflected on the mapping process and highlighted some challenges and limitations of the approach:

- Talking about AMR as an overarching category is challenging: how this is evolving over time is different for different resistance strains and different sectors.
- Contributors reflected that the rate of emergence and spread of AMR is uncertain and variable across contexts, and that representing these trends in a deterministic way may not be appropriate given the level of uncertainty around how the problem is likely to evolve.

Contributors also reflected on how the systems map developed in the workshop could be built on and improved. Some contributors highlighted considering these factors in a binary way (i.e., whether or not they mattered) conceals the fact that some factors are more important than others. It would therefore be helpful to build on this work by quantifying or ranking these relationships. This could be done through synthesis of existing data or additional data collection and would help to identify which areas are most important to act on.

Conclusions and next steps

Contributors identified a range of factors and relationships across the human, animal and environmental sectors that impacted the emergence and spread of AMR in the Netherlands, though it was noted that a substantial amount of progress had been made in the Netherlands, particularly with regard to reducing AMU in animal production. Nevertheless, AMR remained a public health threat. The discussion of ongoing spread of resistant pathogens within and between different environments and populations highlighted the importance of cross-sectoral collaboration.

The importance of economic considerations was also highlighted, with the need for value-for-money being a key driver in food production. While a transformation in production systems, for example to transition to lower density systems or slower growing varieties, was raised as a way to make progress on AMR and reduce AM reliance, this may impact food system profitability. Sustained efforts around surveillance, stewardship and prevention were also discussed as an important part of the solution.

Contributors identified a number of priority actions to control AMR in the Dutch context over the short-, medium- and long-term, and discussed ways forward, including collaborating with regional partners to invest in AM innovation and build capacity in other jurisdictions.

Designing AMR Solutions features five case study countries, including the Netherlands. Parallel systems workshops are ongoing across the other country contexts in order to understand context-specific drivers and dynamics. Project outputs and activities will continue to be shared on our website:

https://design.dighr.org/

Whole-system map