SPECIAL SOC AMR Curriculum

Training social scientists on social dimensions of AMR

Sonar-Global WP5

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SPECIAL SOC AMR Curriculum: Training social scientists on the social dimensions of AMR

CURRICULUM HANDBOOK

This curriculum is developed as part of the European Committee funded Sonar-Global project and produced by the Amsterdam Institute for Global Health and Development (AIGHD).

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OVERVIEW

Introduction: The social sciences remain highly underrepresented in scholarship on antimicrobial resistance (AMR). Even though AMR is on the rise, many social scientists are unaware about the scope of the problem. There is a relatively high need for training programs to educate social scientists on this issue, so that they can contribute to a more effective response to the AMR challenge.

The Sonar-Global SPECIAL SOC AMR training curriculum is an intended ***resource for trainers*** who aim to provide a high-level training on the relevance of social sciences in AMR to scholars or professionals with a university level social science background. It is presumed that participants of the training are interested in integrating knowledge on AMR in their professional or academic practice. With the curriculum documents, an experienced trainer (preferably with some knowledge in the field of health) or team of interdisciplinary teachers, will be able to organize a training.

Training aims:

- Training of social scientists in basic biomedical and public health aspects of AMR
- Introducing the social, economic, and political dimensions of AMR
- Understanding the different contributions various social science disciplines make to AMR (e.g. sociology, anthropology, history, political science, economics, and geography)
- Discuss the integration and application of different social science contributions to the design, implementation, and/or evaluation of interventions in an interdisciplinary manner
- Developing ideas and plans for future social science work in AMR

Organization: The training consists out of a set of training modules that total five days of training. The training modules are organized based on the idea that interdisciplinarity is a key skill needed to work in AMR. For this reason, One Health is used as an integrative analytical framework, allowing for an introduction to the basics of AMR. We are working under the presumptions that social scientists have not previously been introduced to this topic from a public health perspective.

Curriculum development process: The development of the training modules has been a collaborative project, supported by a Sonar-Global appointed Academic Advisory Committee. This outline has evolved through two separate consultations (individually) with most members of the Scientific Advisory committee in August and September 2019. An invited expert consultation was held in Amsterdam on October 14th and 15th 2019 to finalize the structure of the curriculum and brainstorm ideas for each independent module. After the expert consultation, finalization of each module occurred remotely in collaboration based on specific expertise of members of the Scientific Advisory committee.

Dissemination: The training curriculum will be open access and shared on the Sonar-Global website. A roster of potential trainers will be included as part of the Sonar-Global network database.

Modules: Below is a list of modules. After a general introduction module (blue), the modules are arranged from a micro to a macro level (modules 2-5, green). The final modules (6+7, orange) increasingly focus on participatory development of own projects or future collaboration for and among the students.

Module contents:

Legend:

= video
= internet source
= literature
= model/framework
= project
= case study
= pedagogical consideration
= Sonar-global project outcomes

1. INTRODUCTION

AMR as wicked problem/complexity, definition of "social sciences", Science and Technology Studies orientation into perspectives, One Health & interdisciplinarity, course introduction

Summary: This module provides an introduction to AMR, presents a brief historical account of how AMR gradually gained global attention, highlights the relation of AMR to epidemics and introduces the role social science plays in this field. Also, a course overview will be provided.

Length: 1 day

Aims/objectives:

- Understand the complexity of AMR
- Demonstrate the potential of social scientists to make important contributions to research/action on AMR
- Engage students to get involved – develop a research question/draft protocol

Content:

1.1 Setting the problem of AMR

Introducing the issue in a participatory and historical manner.

- **Participatory:** What is AMR? Ask participants about:
  - Personal experiences with AMR & questions they bring with them
  - How do they think about the relevance of "the problem" of AMR: how do they frame antibiotics – as valuable agents (or not) across human and veterinary medicine?
  - Expectations about the training
- Introduce the theme by usage of visual materials to visualize personal stories. Possible topics/videos:
  - Antibiotic Resistance: Are we creating super viruses? Link: https://www.youtube.com/watch?v=zENv5EDElgA
  - Al Jazeera English (2016). The Rise of the Superbug. Link: https://www.youtube.com/watch?v=_LGA2tcS-Fs
  - Davies, Sally (2013) The drugs don't work. TED xAlbertopolis: https://www.youtube.com/watch?v=7evvWt8XN7o.
- Beyond Resistance **[case study 1.1]** - AMR offers the unique opportunity to interrogate human-microbe relationships at a critical juncture, asking: what is the impact of the military metaphor on human/microbe relationships and how might these be imagined differently? Beyond Resistance is an interdisciplinary network that embraces a multispecies ethnography to investigate understandings of our bodies as republics of viruses, bacteria, and fungi.

- Nerlich, B., and James, R. (2009). "The post-antibiotic apocalypse" and the "war on superbugs": catastrophe discourse in microbiology, its rhetorical form and political function. *Public Underst Sci* 18(5): 574–590.

1.2 Historical milestones in the development of attention to the issue

From Fleming discovering penicillin in 1928, to the "wonder drug" revolution post World War II, critics have raised concerns from the beginning about the use and prescription of antibiotics in animals and humans due to fears of antimicrobial resistance. Initial measures mostly steered towards regulating the drug industry, but today the focus is increasingly on the prescription and development of drugs to face the challenge (Podolsky, 2015). This is reflected in both the Global Action Plan of the WHO (2015) and the O'Neill review (2016).

The O'Neill report was commissioned in 2014 by UK Prime Minister David Cameron and the Wellcome Trust and was published on May 19th 2016. Led by economist Jim O'Neill, the report includes 10 headline recommendations, including raising awareness, increasing global surveillance, infection prevention, optimal use, and investments for the development of new medicines, more diagnostic tools, vaccines, and other interventions. The report emphasized the magnitude of the problem: "we estimate that by 2050, 10 million lives a year and a cumulative 100 trillion USD of economic output are at risk due to the rise of drug resistant infections if we do not find proactive solutions now to slow down the rise of drug resistance."

- O'Neill J. (2016). Review on Antimicrobial Resistance. Tackling drug resistant infections globally: final report and recommendations.
- Barber, S., and Sutherland, N. (2017). DEBATE PACK: O'Neil Review into Antibiotic Resistance. London: House of Commons Library.
- Aminov, R.I. (2010). A brief history of the antibiotic era: lessons learned and challenges for the future. *Frontiers in Microbiology* 1: 134.
- Kirchelle, C. (2020). *Pyrrhic Progress. The History of Antibiotics in Anglo-American Food Production.* New Brunswick, NJ: Rutgers University Press. A short summary per chapter can be found here: https://www.jstor.org/stable/j.ctvscxrvf
- Podolsky S.H. (2015). *The antibiotic era: reform, resistance, and the pursuit of a rational therapeutics.* Baltimore, MD: Johns Hopkins University Press. An overview of this book's content can be found in this review by Gabriel, J.M. (2015) in the *Journal of the History of Medicine and Allied Sciences* 70(3), pp.487-89.
- Bud, R. (2007). *Penicillin: Triumph and tragedy*. Oxford: Oxford University Press. Insight into the content of this book can be found in the following review by Quirke, V. (2008) in *Technology and Culture* 49(3).

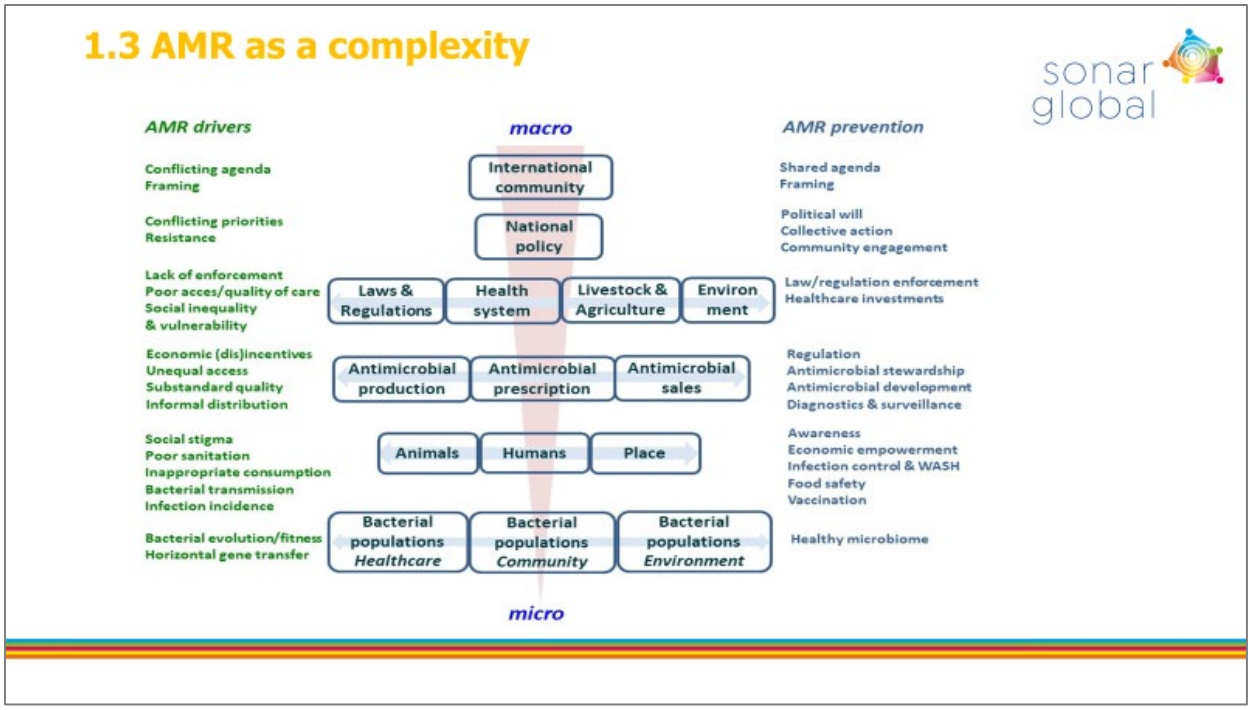
1.3 The complexity of AMR

AMR is a "complex" problem. Comparisons have been made to the issue of climate change because the need to intervene occurs at all levels of society. But what is meant by this? Complexity science suggests that the "natural" state of things is not a state of equilibrium, but of dynamic uncertainty. If we take this seriously, there is an inevitability of unpredictability and of unintended consequences. For social sciences, this is recognized in the open dynamic character of all social systems which can be seen as a network of relationships that interact at multiple levels in a variety of interdependent, contextualized communities changing across time, space, and place. Because of this complexity, as social scientists we need to be critical of conceptual boundaries regarding any topic, including AMR, because such boundaries are set by the human lens (e.g. dualist "natural" vs. "social" or "macro-structure" vs. "micro-agency"). This is because:

- People can perceive the same phenomenon differently; one could even argue that multiple realities co-exist at the same time if one assumes that what exists in the world is only there because it is done in *practices* (ontological multiplicity)
- Context is needed to fully understand an issue/situation, or taking it a step further, context in facts may create *different* objects
- Note that the presentation of "evidence" on AMR related issues can be partial or incomplete – what counts as evidence?

Hence, it also depends on where you are as an actor or social scientist—your positionality—how you perceive and engage with your study object. Complex problems are typically defined as those that include the ability to approach them from multiple, sometimes competing, perspectives and which may have multiple possible solutions. For this reason, interventions in complex issues require broad stakeholder involvement including researchers from different epistemic and disciplinary cultures as well as citizens.

- Micro to macro model to define and describe the complexity of AMR **[slide 1]** and **[case study 1.2]**
- Model from WUR: AMR can also be seen as a "wicked problem" (Cabral & Lambert, 2016). According to Conklin and colleagues, "Problem wickedness is not about a higher degree of complexity, it is about a fundamentally different kind of challenge to the design process, one that makes solution secondary and problem understanding central." (Conklin *et al.*, 2006). This means **[slide 2]**:
    - Complexity/complex interdependences (Complex Systems)
    - High levels of uncertainty and high decision stakes
    - Potentially severe risks for humanity, animals, and ecosystems
    - Multiple stakeholders with diverse values and interests
    - Multidimensional drivers, costs, and (unforeseen) consequences/impacts
    - Difficult to define (a good problem for claim-making activities)



Slide 1 micro-macro model

Slide 2 WUR model

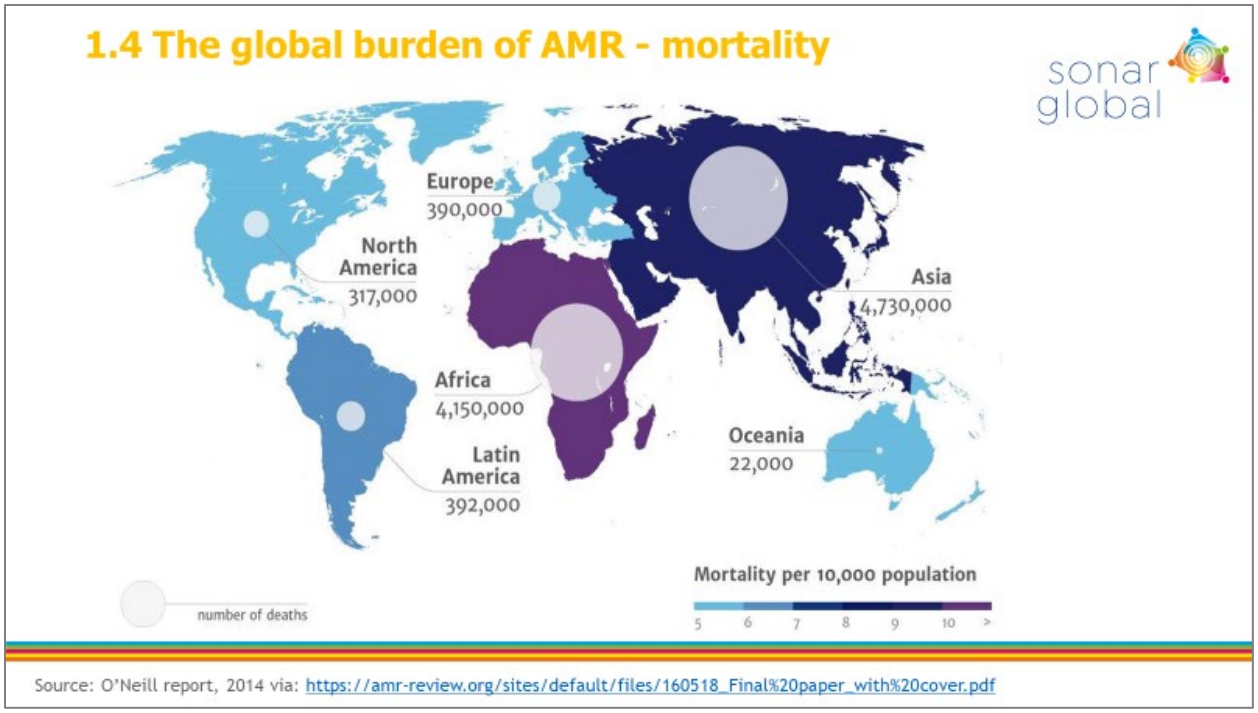
1.4 The global burden of AMR

Typically, the burden of disease is measured in number of cases, attributable deaths, and disability-adjusted life years (DALYs). However, for AMR, there are many challenges to estimating the burden. There is limited current and historical information on the geographical distribution, prevalence, and incidence of AMR and its health burden, which makes the burden of AMR difficult to measure and limits our ability to devise geographically explicit strategies for its control. A study guided by the European Centre for Disease Prevention and Control (Cassini *et al.,* 2019) estimates that in the EU/EAA, the overall DALY rate is 170 per 100 000 population, which is a burden comparable to that of influenza, tuberculosis, and HIV/AIDS *combined*. It also explains that 75% of the burden of disease is due to healthcare-associated infections (HAIs), and that 39% of the burden is caused by infections with bacteria resistant to last-line antibiotics such as carbapenems and colistin.

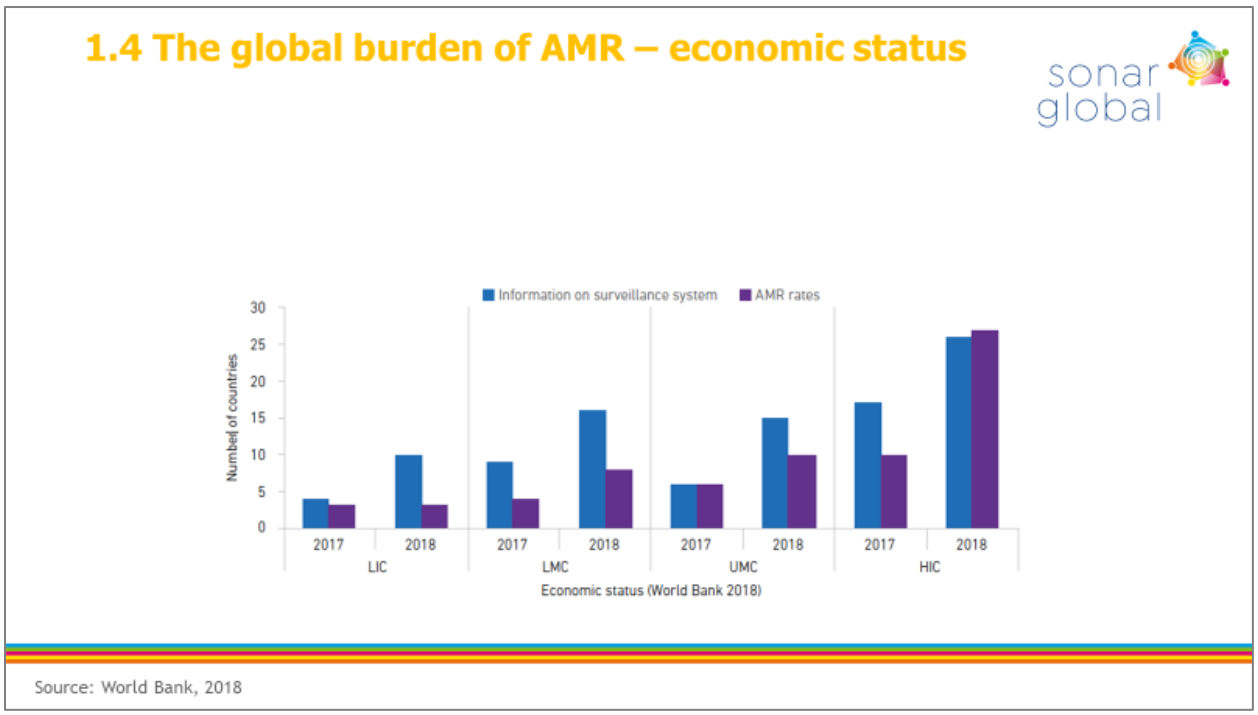
- The ReAct Toolbox is a web-based and open access resource for taking action on antibiotic resistance, including the burden of antibiotic resistance and the long term consequences. The useful flowchart "cost of inaction" can be found on the bottom of this page.
- Number of global deaths due to AMR **[slide 3]**
- Economics status and AMR **[slide 4]**

The WHO Global Antimicrobial Resistance Surveillance System – GLASS – aims to support global surveillance and research in order to strengthen the evidence base on antimicrobial resistance (AMR) and help inform decision-making and drive national, regional, and global actions. GLASS initially focused on surveillance data on human priority bacterial pathogens considered the greatest threat globally and is progressively incorporating information from other surveillance systems related to AMR in humans, such as monitoring of the use of antimicrobials, foodborne AMR and surveillance of infections associated with healthcare. **[slide 5]**

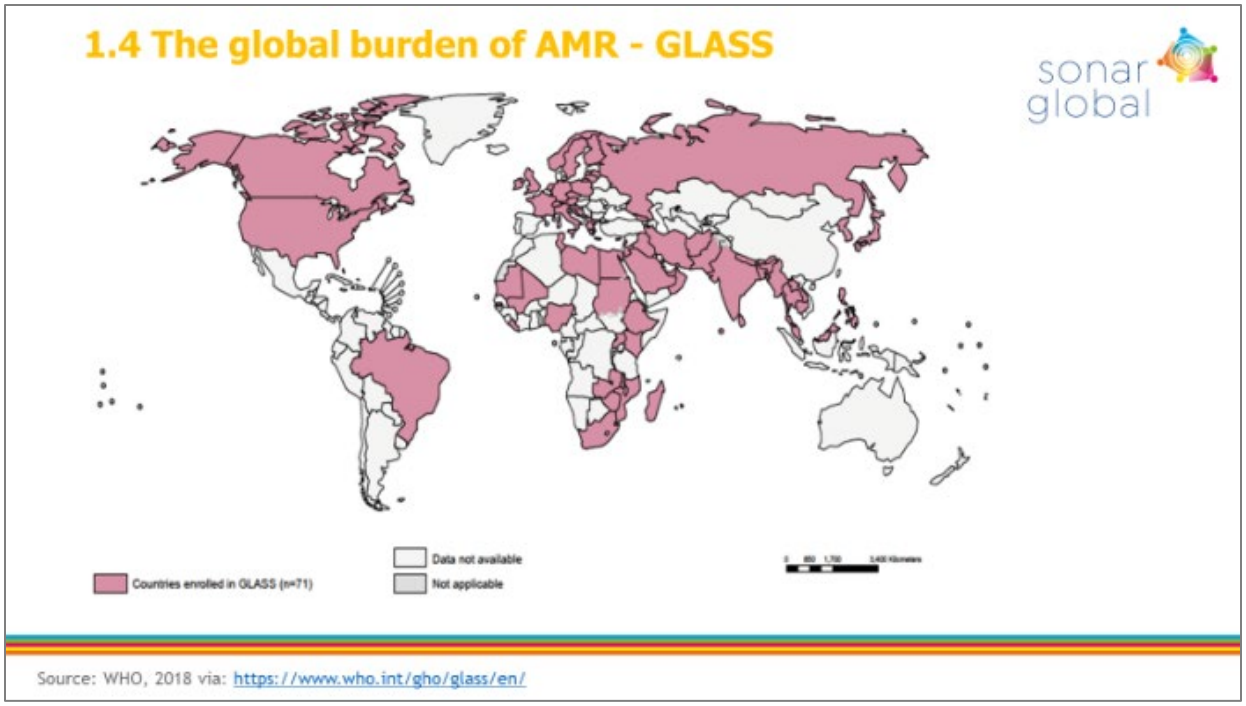
- **Discussion point:** What are some limitations of the numbers reported through the surveillance systems?
- The World health Organization (2014). ANTIMICROBIAL RESISTANCE: Global Report on Surveillance.



Slide 3 AMR mortality (global differences)



Slide 4 AMR related to economic status



Slide 5 AMR surveillance GLASS

1.5 Definition of the social sciences

The training is about the role of the social sciences in AMR. But what do we mean by "social sciences"? What are differences and similarities? Are there major points of contention between the disciplines? How do social sciences relate to what is called "behavioural change"? Broadly, social sciences embrace all those subjects which deal with human affairs. The social sciences overlap each other. Many scholars in public health actually are social scientists. In some domains, such as WASH (Water, Sanitation and Hygiene), the social sciences have a more comfortable working contribution compared to the problem of antibiotic usage in clinics. In addition, there are regional differences in what is considered a social science; it is not consistent.

- A helpful definition from the ESRC: https://esrc.ukri.org/about-us/what-is-social-science/.
- Historical Background of Social Sciences review by the Indian Council of Social Science research: https://shodhganga.inflibnet.ac.in/bitstream/10603/40587/8/10_chapter1.pdf
- Daniel Little: The social science disciplines. Blog: https://undsoc.org/2007/11/25/the-social-science-disciplines/
- For much more in depth analysis, see H. Scott Gordon (2002). The History and Philosophy of Social Science. New York: Routledge.
- **Debate:** Is there a right way to examine AMR using the social sciences? Are some social science disciplines more relevant than others?

1.6 Social science as a gap in the field of AMR

Review what we already know about the role of the social sciences.

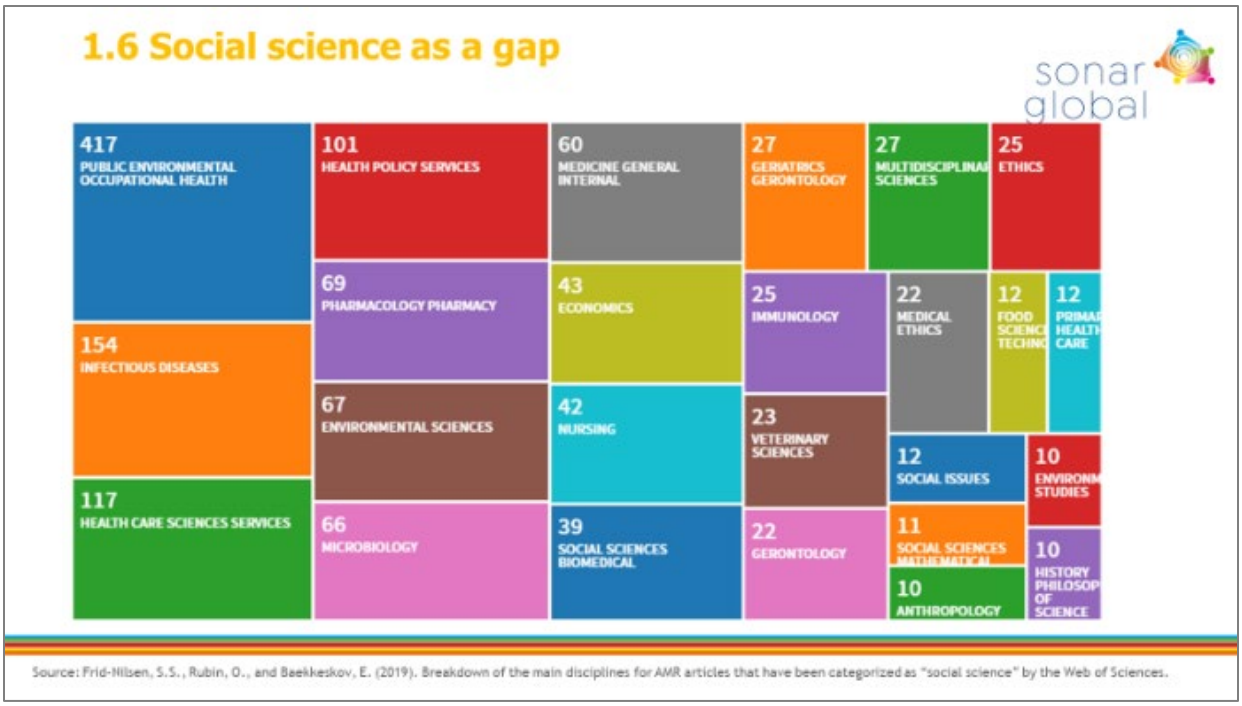
- Overview of social sciences publishing in AMR **[slide 6]**.
  Until recently, very few "traditional" social science disciplines have been active in the study of AMR. The slide shows a breakdown of the main disciplines for AMR articles that have been categorized as "social science" by the Web of Sciences using bibliometric data from 1956–2018 (Frid-Nielsen, Rubin, and Baekkeskov, 2019). Most of them would not be considered traditional social science. Economics and ethics are there. Anthropology just makes it on the list. Political Science, sociology, international relations, security studies are not listed. The main reason is that many of the articles included in the other academic categories (e.g. the largest: "public environmental occupational health") are interdisciplinary, which in many respects is a good thing. However, it may also mean that most articles do not engage in-depth with theories, methods, and debate that belong to particular social science disciplines.
  - Frid-Nielsen, S.S., Rubin, O., and Baekkeskov, E. (2019). The state of social science research on antimicrobial resistance. *Social Sciences and Medicine, 242,* doi: 112596
- The following articles can be used as further basis for **discussion**:
  - Vedadhir, A.A., Rodrigues, C., and Lambert, H.S. (2019). Social science research contributions to antimicrobial resistance: protocol for a scoping review. *Systematic Reviews* 9, 24.
  - Orzech, K.M., and Nichter, M. (2008). From Resilience to Resistance: Political Ecological Lessons from Antibiotic and Pesticide Resistance. *Annual Review of Anthropology, 37(1)*, 267-282.
  - McIntyre, S. (2014) Anti-Microbial Resistance: Setting the Social Science Agenda. Report of an ESRC Working Group: July 2014.

1.7 AMR and epidemics

AMR has been a slowly increasing public health threat causing long term impact on the health system and severe immediate impacts on affected individuals. AMR, as such, is not an epidemic condition, however, it may complicate epidemics. For example, influenza, causes direct viral effects but can also lead to secondary bacterial complications. AMR can impact an influenza pandemic through both antiviral and antibiotic resistance. Because bacterial infections can contribute to up to 50% of total influenza deaths, when bacterial AMR is a factor, then in the worst-case scenario up to 50% of deaths could not have been prevented.

- MacIntyre, C. R., & Bui, C. M. (2017). Pandemics, public health emergencies and antimicrobial resistance - putting the threat in an epidemiologic and risk analysis context. Archives of public health = Archives belges de sante publique, 75, 54.

🕮 De Vries, D., Hofstraat, K., and Spaan, V. (2020, July 10). *COVID-19 as analogy for antimicrobial resistance.* Retrieved from: http://somatosphere.net/2020/covid-19-analogy-amr.html/



Slide 6 social science as a gap

1.8 Overview of the course

- A brief biomedical and public health background will be supplemented by the contributions of a variety of social science disciplines to display the social, economic, and political dimensions of AMR. After the introduction (M1) the modules will follow a "micro" to "macro" perspective: from Microbes and Resistance (M2), to People and Publics (M3), Systems and Environments (M4) and Institutions and Policies (M5). The last two modules are more transformative in nature – highlighting the contribution of the social sciences to AMR interventions (M6) and the possibilities for participatory development and involvement in the AMR issue (M7).

🗔 Introduction of own project: In small groups students will develop a project proposal. Projects could be individually or in pairs, but will be discussed in small groups. Students should be asked what they may want to do, and brainstorm ideas at the end of the session. What methods will they use?

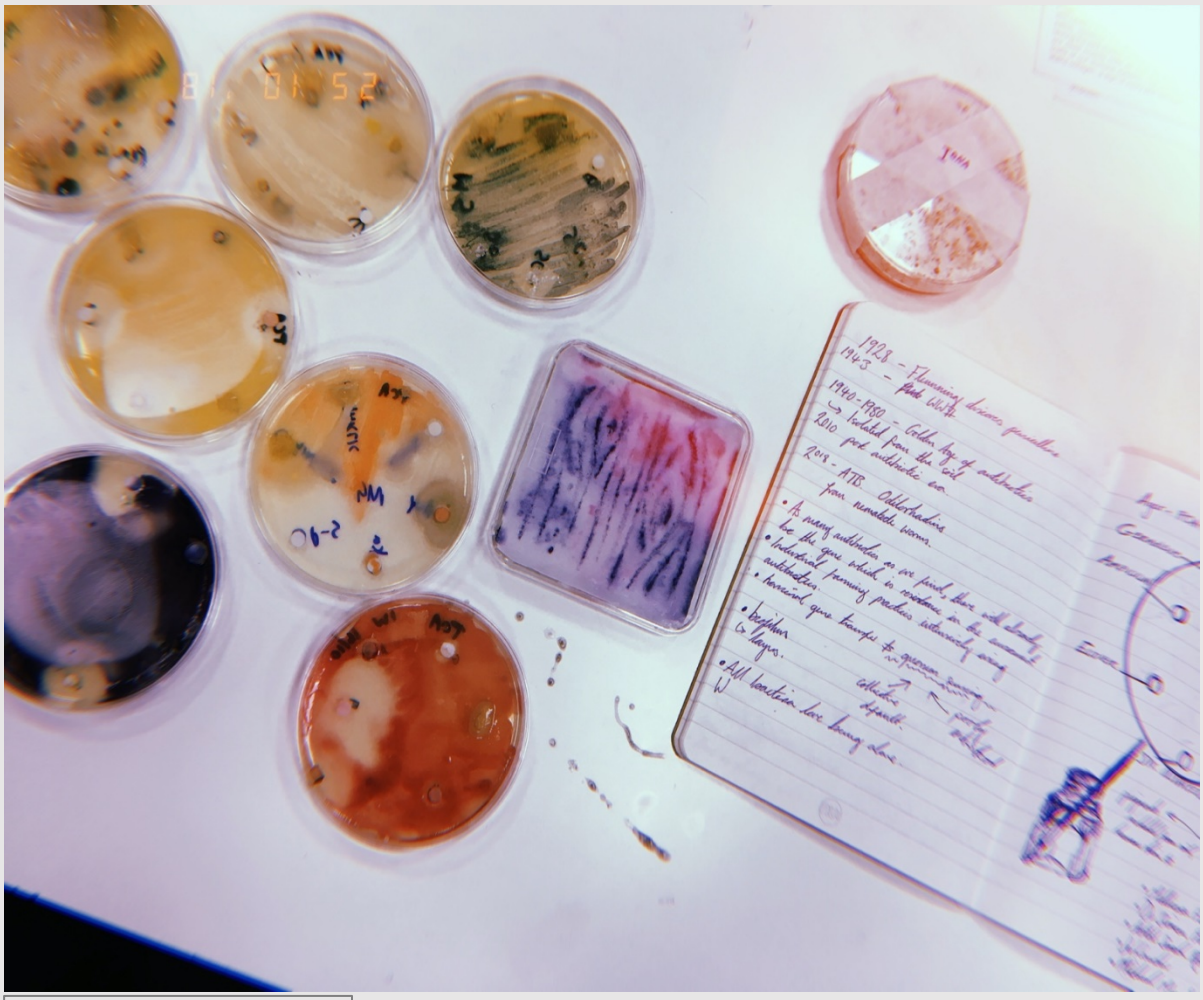
Pedagogical considerations:

- Provide room to listen to **participant stories** and make notes in order to reference these experiences later on in the training if needed.
- Include a moment for **student discussion**: Many of the materials and stories around AMR focus on the medical aspects. For example, the book "Superbugs" starts with the experience of a medical doctor with a patient where there is no solution. But AMR is broader; it is not just about the medical issue, but also includes agricultural and ecological systems, plus inequalities and social structures, which is why we emphasize a One Health approach in the training. Where do the students see themselves in this? Are they more aware of the medical perspective, or the veterinary/agricultural? How come there is this dominance of the medical discourse?
- Student are expected to develop a project throughout this course either alone or with one other student. In order to group students together, a "speed dating" exercise can be arranged. Each student spends 2 minutes explaining their topic of interest. After this, the students can organize themselves in small groups.
- Introduction video – patients and/or farms.

References:

- Cabral, C., and Lambert, H. (2016, May 19). *What can Leonardo Da Vinci teach us about tackling drug resistant infections?* Retrieved from: https://amrchamp.blogs.bristol.ac.uk/2016/05/19/what-can-leonardo-da-vinci-teach-us-about-tackling-drug-resistant-infections/
- Cassini, A., Diaz Högberg, L., Plachouras, D., Quattrocchi, A., Hoxha, A., and Simonsen, G.S. (2019). Attributable deaths and disability-adjusted life-years caused by infections with antibiotic-resistant bacteria in the EU and the European Economic Area in 2015: a population-level modelling analysis. *The Lancet Infectious Diseases* 19(1), pp. 56-66.
- Conklin, J. (2006). *Wicked problems & social complexity*. San Francisco, CA: CogNexus Institute.

Case study 1.1: (Re)imaging AMR: military metaphors and artistic attention



In the Lab by Iona Walker (2019)

Author

- Iona Walker, PhD Student in Social Anthropology at the University of Edinburgh

Military metaphors

Antimicrobial resistance (AMR) is an urgent global challenge as the antibiotics which once protected us so diligently from infection and illness become increasingly ineffective. Responses to AMR are often centred in, and characterised by, militaristic metaphors and approaches. We talk of "fighting" the "invading" "superbugs" with "magic bullets" as we engage in an "arms race against bacteria" to find the next effective antibiotic (Hall, MacDonell, and O'Neil, 2018, p.43). Headlines proclaiming the antibiotic apocalypse speak to the threat of immanent crisis as public health campaigns are structured around military style framings. Yet as conventional therapies to "kill bugs" decline in effectiveness, research increasingly asserts the integral role of microbiome in human health (Pflughoeft and Versalovic, 2012; Man, De Steenhuijsen Piters, and Bogaert, 2017; Gilbert *et al.*, 2018). Where did this military language come from and how can we imagine the future of human/microbe relationships?

The language we use to articulate our relationship with the world informs, reflects, and reinforces how we understand and construct our realities (Haraway, 2000; Sontag, 2007; Semino, 2008). However, relatively little attention is paid to the consequences of a military framing for our understanding of bodies, knowledge making practices and wider environment. This is significant as the human body is comprised to a large extent of bacteria and fungi such that our bodies are composed not of mass which is genetically "us" but instead constitute an ecosystem of microbial life. Therefore, there is a tension between the war metaphors used for "germs" and the symbiotic relationships with microbes necessary for human wellbeing.

Magic bullets

Tracing the historical roots of this language can help unravel the assumptions, agendas, and underpinnings behind it. The history of microbiology offers insights into how biological discourse has subsequently influenced knowledge production inside laboratory spaces, public opinion, and representations of AMR. From the nineteenth century, humans have understood microbes primarily as pathogens. After Louis Pasteur revolutionised modern medicine by creating the means to identify microbes as agents of disease, Robert Koch produced "magic bullets" (antibiotics) to quell infectious threats. By giving the age-old scourge of disease a recognisable, definitive form, Pasture and Koch provided the means to transform previously unknowable entities into a "common enemy" to be defeated in the name of the common good. The subsequent mass production of antibiotics meant that for the first time in history, physicians and surgeons could identity the cause of infection and control it.

Although Pasteur himself was driven by curiosity rather than warfare in his study of microbes, his discovery did more than alter scientific theorising. Public health, infectious disease medicine, hygienists and others invested in eliminating microbial threats begun to initiate a change in the way the world had to be constructed in order to assert human control over life itself (Paxson, 2008). Pasture's microbes were discovered and controlled within the confines of the laboratory; therefore, the outside of the world began to be provisioned with lab-like surveillance and infrastructure. Today we recognise terms like "biosecurity" from government discourse, with institutions such as the Centre for Disease Control endowed with military-like powers to enforce lockdowns, secure zones, and set up outposts on foreign soil.

The tension created by the need to treat infectious diseases while acknowledging the life sustaining role played by microbes is an important one. While disease causes suffering, overuse of antibiotics or cleaning products can cause chronic health conditions through disrupting the balance of the microbiome (Bloomfield *et al.*, 2016; Wolf-Meyer, 2017; Greenhough *et al.*, 2018). The microbiome influences immunity, digestion and even our brain chemistry. Life without it would not be possible. As further research emerges regarding the importance of the microbiome for human health, the notion that humans are individual fortresses against the "microbial onslaught" (Tsing *et al.*, 2017) is not only too simplistic, but is limiting our ability to reimagine new possibilities. Art is one way to transcend language and expand the possibilities for understanding the microbial world we live with.

Art and the "disrupted body"

Reimagining the human relationship to the microbial beyond the military metaphor requires confronting what it means to live in fundamental interdependence with these non-human others (the majority of microbes are either directly beneficial or neutral towards humans). Often this requires re-thinking categorisations of between the self and other, purity and danger (Douglas,

2002). However, disrupting the sanctity of previous stable bodily boundaries can be an uncomfortable project. Mark Fisher states that "Freud's unheimlich" -- translated to mean "uncanny" or "unhomely" - "is about the strange within familiar" (Fisher, 2016). In this case, confronting the uncanny microbes living inside the familiar body without means to control them evokes emotion, creates tension, and demands response.

Art and contagion have a long history. Depictions of plagues, treatments, and bodies affected by microbial encounters provide insight into attitudes, beliefs, and understandings of health in the past. In the present artistic engagement can transcend language, create opportunities for curiosity about new ways of perceiving the body. Art has dealt with questions of the disrupted body through the evoking the abject, which reveals tangibly the "uncanny" truths about the ecological nature of the "human" body. An example might be the revulsion we may feel seeing cultures of bacteria sampled from human bodies. Artists working with the microbial world can use the power of the abject to challenge understandings of the more-than-human body. Bioartist Sonja Baumel's works *Expanded Self (2012)* and *Oversized Petri dish (2009)* make visible the microbes that live in tandem with her resulting in an uncanny self-portrait. Baumel's work illustrates her healthy body as an entity inseparable from its non-human kin. Her work transforms the familiar medium of the self-portrait into something unexpected and unsettling – troubling the viewers understanding of "self" (Figure 1).

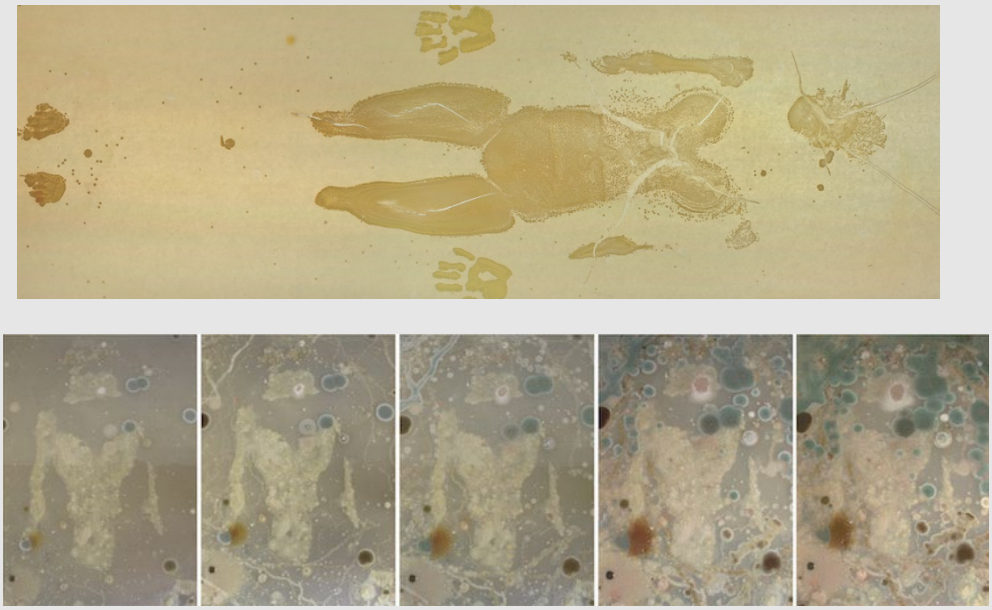


Figure 1: Sonia Baumel. Expanded Self (2012) and below: Oversized Petri-dish (2009)

Rebecca Harris' textile work *Symbiosis (2015)* uses the microbiome to embellish rather than blemish the body. Her use of colour and everyday material (cloth and thread) invite tactile engagement, wonder and curiosity as well as evoking the existence of "everyday microbes" outside of the lab. The "corporeal, embodied nature" (Greenhough, 2012: 291) of human-pathogen encounters - illness - often leaves traces, marks, and scars which can invoke stigma, fear, and victimisation (examples include leprosy, smallpox). Harris transforms the uncanny microbe into something new, demonstrating the nested ecosystems of living human, microbe, and foetus. The pregnancy highlights the ways in which infants acquire their microbiome after birth and raises questions around the safety of rising Caesarean-section rates in the age of AMR (Figure 2).

Figure 2: Rebecca D. Harris. Symbiosis, embroidery on fabric (2015)

Sarah Craske's work The Disease Map (2018) is a time-lapse film of Vibrio Cholerae interacting with synthetic peptides across a map of Basel by Matthäus Merian. Craske's work invites use to consider the disease map as both an epidemiological tool throughout history and also the ebb and flow of human pathogen interactions over time. Craske addresses antibiotic resistance directly, using an antibiotic substance to suggest the limits of human disease control and highlight the ways humans create conditions for disease to flourish (Figure 3).

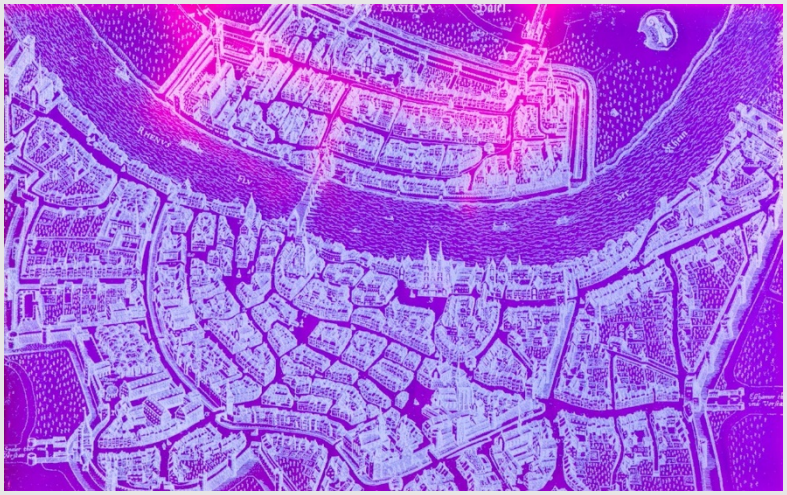


Figure 3: Sarah Craske. The disease map (2018)

Figure 4: American Society for Microbiology Agar Art Contest 2017. ''Germs Gone Global,'' Elizabeth Tremblay, MPH, CPH, CIC. Copyright © 2017 American Society for Microbiology. All rights reserved.

Finally, "Germs Gone Global" is a submission to the American Society for Microbiology Agar Art Competition. The artist has cultured common drug resistant "superbug" methicillin-resistant Staphylococcus aureus (MRSA) to illustrate a world map. The artist urges us to consider the impact of a globally connected world on the spread of potentially deadly microbes (Figure 4).

Conclusion

Microbes are here to stay. Bacteria, fungi, and viruses are the oldest organisms on the planet, they are integral to life on Earth. The human body itself is comprised to a large extent of microbes such that our bodies are composed not of mass which is genetically "us" but instead an ecosystem of microbial life. The advent of antibiotics enabled modern biomedicine to treat infectious diseases and control the human relationship to the microbial. Subsequently, antimicrobial resistance has become an urgent global challenge; antibiotics which once protected us so diligently become increasingly ineffective against infection. Thus, humans are approaching a critical juncture: in the era of AMR can we look beyond the military metaphor? What does it mean to live with microbial life that at once sustains and threatens human wellbeing? What tools, questions and expertise are required?

That is why in my PhD Project I am trying to understand how the limits, possibilities and consequences imposed and created by the military metaphor shape scientific research pertaining to AMR. Using ethnographic methods informed by feminist multispecies scholars such as Anna Tsing I pay attention to more-than-human science making practices. In addition, I use speculative fiction, poetry, and other imaginative literary works to reflect on the possibilities for new languages and conceptions of human-microbe relationships. These questions contribute to conversations in medical anthropology, science, and technology studies about living in the Anthropocene. However, many disciplines are concerned with AMR. In order to transcend silo thinking and combine our expertise I established the BEYOND RESISTANCE Network. The network exists to facilitate conversations and catalysing collaborations between the medical sciences, humanities, arts, and social sciences. In doing so, we might be better placed to invent new ways of investigating and imagining AMR.

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Case study 1.2: The complexity of antimicrobial resistance

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AMR as complexity

Antimicrobial resistance is a health threat of high complexity with impact at global scale. Comparisons have been made with climate change because AMR requires interventions at all levels of society. The dynamics of AMR deal with issues that include the interplay between bacterial evolution, access to healthcare and social behavior, policies and strategies in different countries. And while current systems of classification and categorization have proven to be useful, also in the sciences, they are also limited because they compartmentalize knowledge. The term "One Health" has been used to break through such disciplinary silos and connect human, veterinary, and environmental health. One Health recognizes that interdisciplinary collaborations and shared communications are needed to understand the web of connections that make up AMR.

We have learned from complexity theory that complex systems organize through highly unstable and deeply interconnected processes. Complex systems show interactions across multiple organizational scales, from the microbial to the global, which tend to self-organize. However, the equilibria that emerge are temporary, and normal behavior is more typically described as adaptation to disturbances. Social scientists also have introduced the notion of the "assemblage" to describe complexity (Nail 2017). Assemblages are not unities, or organic wholes. Instead the elements of an assemblage are defined only by their external relations. Assemblages also are not essences—unchanging eternal features—but instead events; it is not about *what* something is, but how it comes to be, when and where, and from what point of view. In other words, assemblages are social and historical processes (Nail, 2017, p. 24).

So, when we approach AMR as complex, we can use ideas coming from complexity sciences or assemblage theories to provide a framework of analysis. This may mean that we need to look at how what we see is ordered and re-ordered. That we look not at institutions, but at exchanges between elements, and how these elements combine to form unified wholes (Deuchars, 2010). And that we measure changes and think of interventions across multiple dimensions, while at the same time making the interconnectedness more visible to policy makers and the public (Wernli *et al.*, 2017).

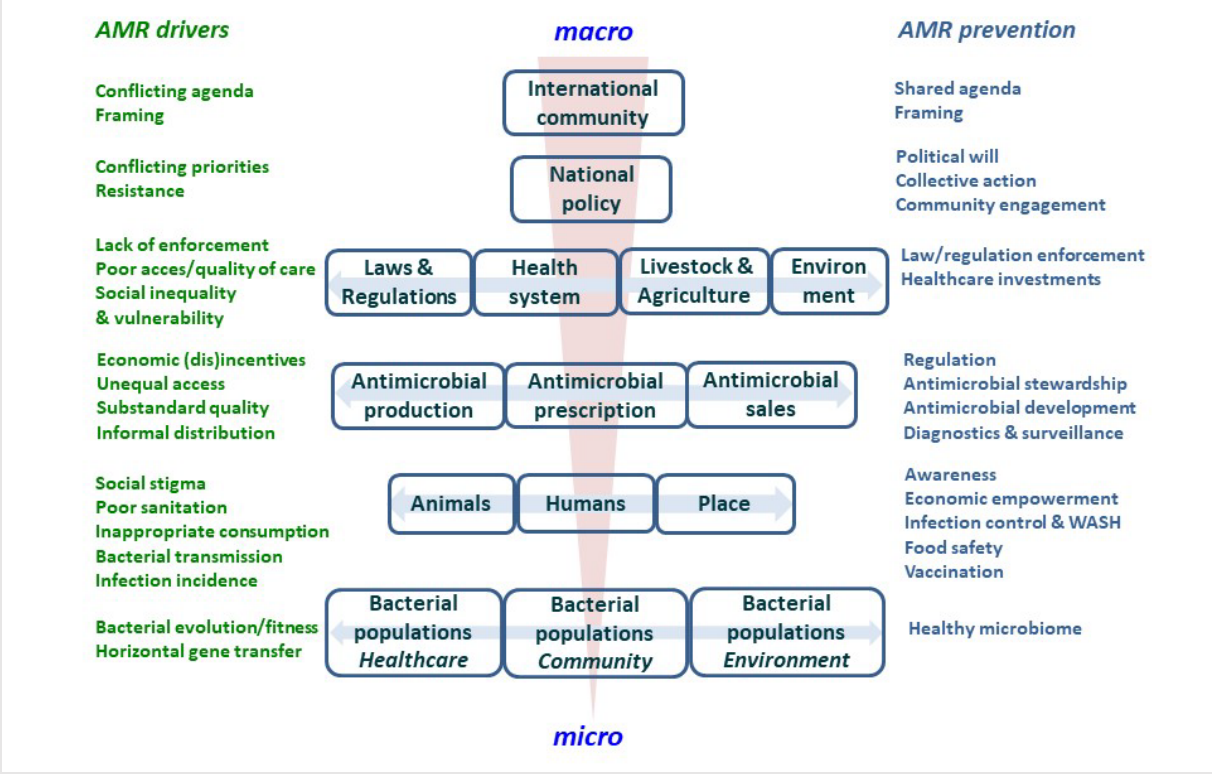
A working model

If we agree on the premise that complex systems are dynamic and historical, it is clear we will never agree on a definite model of what "the complexity of AMR" looks like. Any model will be a static approximation, simplification. Yet, as we discovered, there is a strong need to have some sort of working model of how complex AMR really is.

We learned this, for example, when we tried to discuss the strategy of AMR Global, which is a collaboration aimed at building a partnership to collaborate on applied research on antimicrobial

resistance. The collaboration includes very different partners, namely academic researchers, representatives from public institutions such as the ministry of health, small start-ups, medium enterprises, and representatives from larger pharmaceuticals. While we were fully aware of the potential differences among all of these partners in their primary objectives, we still wanted to define a shared vision of the partnership and set long- and short-term goals. During our meetings our discussions covered multiple domains, disciplines, and levels and it became clear that boundaries needed to be defined. One of us (Schultsz) had developed a model to summarize the complexity of AMR, and this model became something the group turned back to repeatedly, to take a step back and reflect on what we were doing and discussing at that moment. *Where* in the model are we discussing this issue? Did we get stuck again forgetting the interaction this location had with other elements in the complexity of AMR? What we saw is that we needed this abstract model to communicate and reflect on the complexity of AMR. The framework, even if limited, proofed valuable in defining the scope and setting boundaries.

Based on the initial model, we have further refined it to include more social factors, as shown below. We see this model as a heuristic that helps to visualize how "big" we need to think to make a dent in the problem. It also humbles us, as we realize that individually we can only affect a small portion of the problem. However, it encourages us to seek out broader interdisciplinary collaborations.



It is important to have insight in the complexity of AMR when embarking on research to better understand drivers of and to design and test possible interventions to prevent further emergence. It is crucial to understand and acknowledge that none of these phenomena and events are independent of each other, and that the drivers of AMR are interlinked, in order to be successful, or avoid unintended consequences elsewhere.

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2. MICROBES AND RESISTANCE

Microbiological, alternative options, animals, ecology - One Health

Summary: This module introduces AMR from a biomedical perspective, including microbes and their history, different understandings of AMR, modes of transmission, notions of misuse, and animal antimicrobial uses. On top of that the conditional nature of scientific knowledge/practice will be discussed and illustrated by several scientific controversies related to AMR.

Length: 1 day

Aims/objectives:

- Define what AMR is from a biomedical perspective
- Introduce multiple pathways to AMR: acquiring resistance through trends in population-level antimicrobial use and through environmental transfer (horizontal gene transfer)
- Understand that resistance is an inevitable natural and social phenomenon
- Critically discuss scientific knowledge and practice as a social/cultural construction

Content:

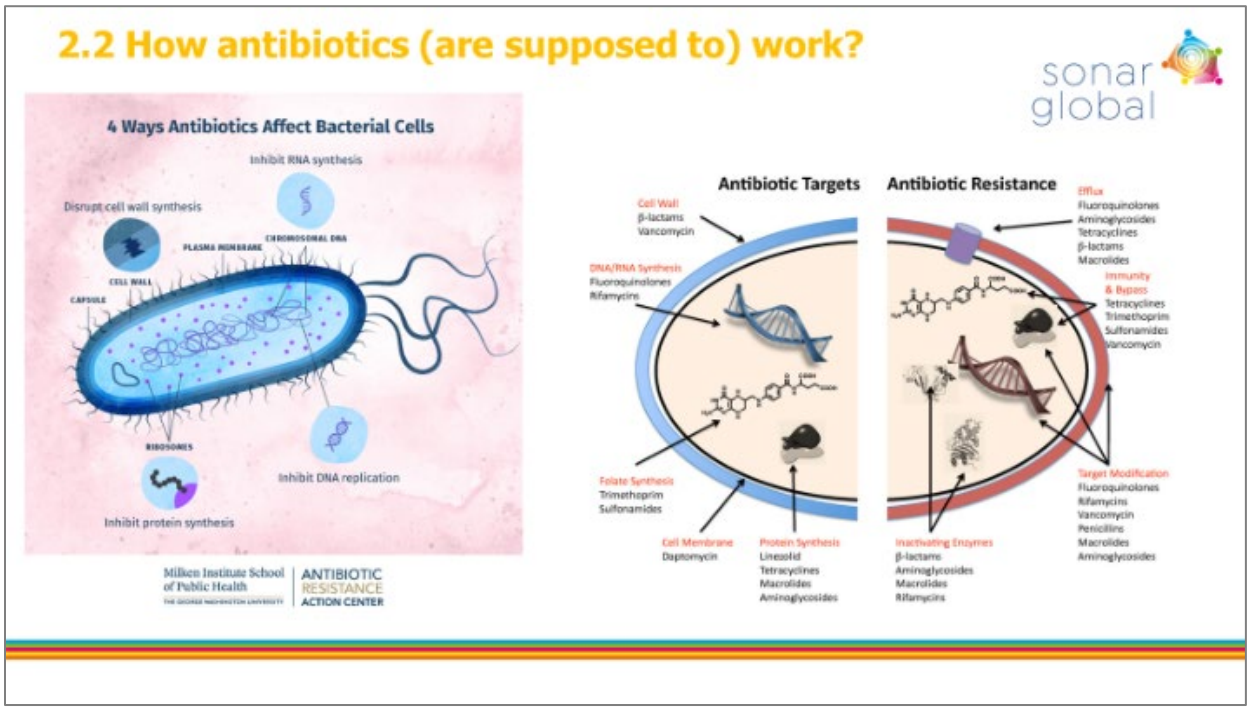
2.1 Microbial and human ecology

- The **microbiome** is the genetic material of all of the microbes - bacteria, fungi, protozoa, and viruses - that live on and inside the human body. The number of genes in all the microbes in one person's microbiome is 200 times the number of genes in the human genome. The microbiome may weigh as much as five pounds.
    - For more background information: https://youtu.be/VzPD009qTN4

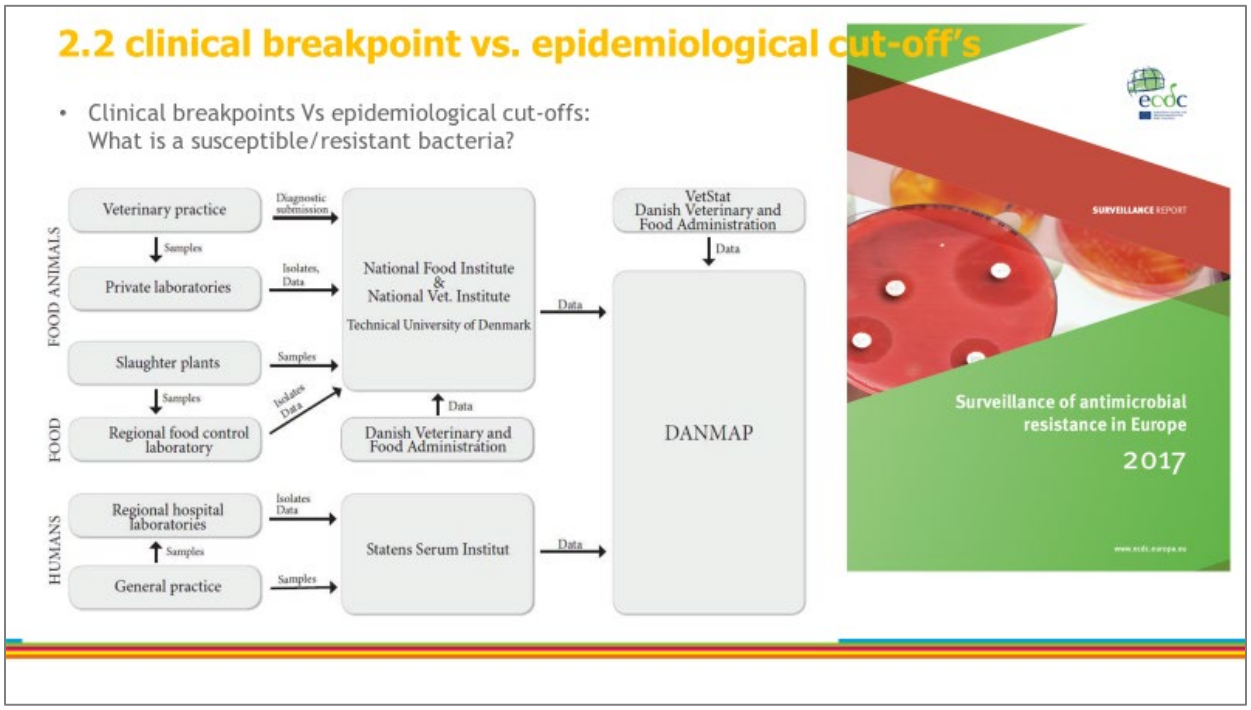
- **Antibiotic resistance and persistence:**
    - Resistance: Mutations can result in antibiotic resistance in bacteria. Resistant bacteria survive antibiotic treatment and can increase in numbers by natural selection. The ReAct Toolbox is a web-based and open access resource for taking action on antibiotic resistance, including the mutations and selection.
    - Persistence: Next to resistance, another survival strategy by bacteria to avoid extinction by antibiotic treatments is persistence. These are called "persister cells". They can sustain high doses of antibiotics because they go dormant until favourable conditions reoccur.

2.2 What is AMR?

- What are antimicrobials and how are they supposed to work? **[slide 7]**
- Microbiological and clinical perspectives: clinical breakpoint, therapeutic failure (dominant definition) **[slide 8, 9 & 10]**
- Epidemiological perspectives: cut-off's (alternative definition) **[slide 8, 9 & 10]**



Slide 7 how antibiotics work



Slide 8 clinical breakpoints vs. epidemiological cut-off's 1

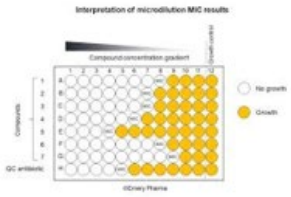
2.2 clinical breakpoint vs. epidemiological cut-off's

- Clinical breakpoints Vs epidemiological cut-offs: What is a susceptible/resistant bacteria?

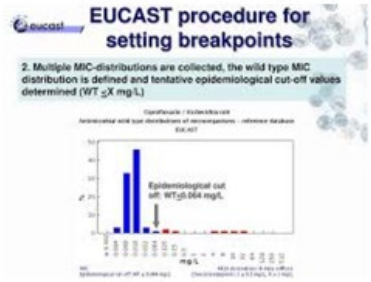
- Clinical breakpoints determine the therapeutical failure/success of an antibiotic : Antibiograms or minimal inhibitory concentration (MIC)

- Epidemiological cut-offs separate wild type and non-wild type bacteria at a populational level

Antibiogram



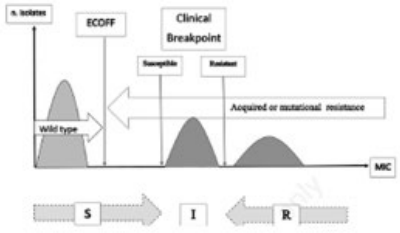
MICs



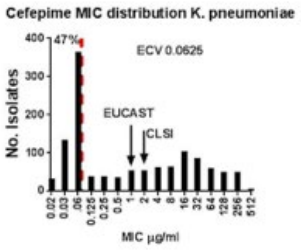
Slide 9 clinical breakpoints vs. epidemiological cut-off's 2

2.2 clinical breakpoint vs. epidemiological cut-off's

- But breakpoints and cut-offs very rarely match!
  - Two different logics in the conception of AMR : individual VS populational
  - Two different purposes : healing patients Vs guiding policy
  - Tension in antibiotic development : which purpose should determine



Ecoffs and breakpoints are not in the same place (in terms of MICs)



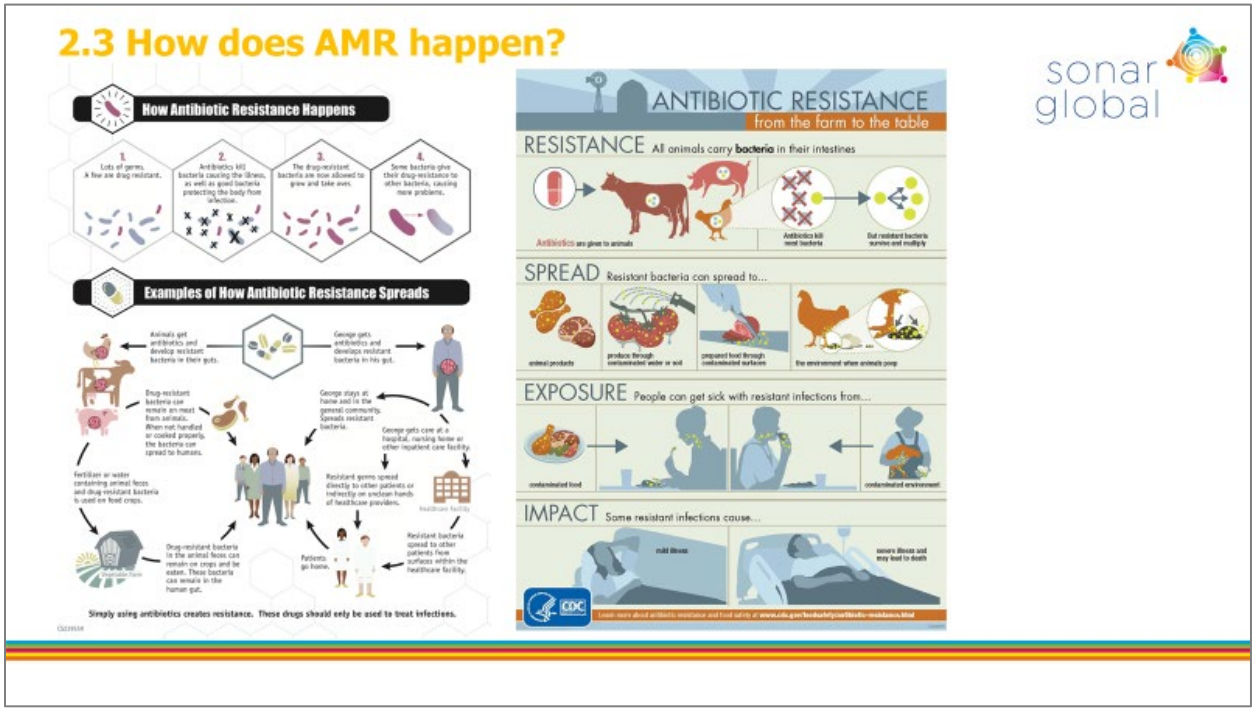
Different breakpoints between European (EUCAST) and American (CLSI) referents

Slide 10 clinical breakpoints vs. epidemiological cut-off's 3

2.3 How AMR develops – microbial and ecological aspects

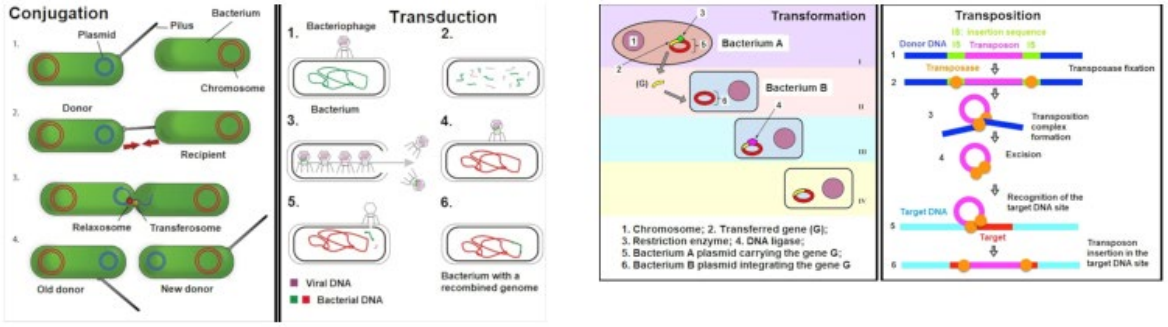
A handy overview of what causes AMR.

- Usage of antimicrobials in animals and humans: e.g. prophylaxia, metaphylaxis, therapeutic use leads to selective pressure where resistance naturally develops. **[slide 11]**
- Resistance mechanisms **[slide 12]**:
  - Intrinsic: the organism naturally lacks the specific pathway targeted by the drug
  - Mutation associated: induced changes are passed vertically to descendants
  - Acquired via horizontal gene transfer (HGT) between organisms: acquired genes being passed vertically to progeny
  - Transmission routes and sources of human exposure to AMR determinants, through the One Health nexus of animal, human, and environment interactions **[slide 13]**:
    - Transmission of AMR elements across microbes within individual patients
    - Transmission of antibiotic resistant bacteria, or their resistance genes, from animals to humans
    - Transmission of resistant bacteria to humans through exposure in local environments



Slide 11 how AMR happens

2.3 Resistance mechanisms



Slide 12 resistance mechanisms

2.3 Transmission routes

Source: Hernando-Amado, S., Coque, T.M., Baquero, F. et al. Defining and combating antibiotic resistance from One Health and Global Health perspectives. Nat Microbiol 4, 1432-1442 (2019) doi:10.1038/s41564-019-0503-9

Slide 13 transmission routes

2.4 Conditional nature of science

Science and Technology Studies (STS) is a relatively new academic field. Driven by historians and sociologists of science, and scientists themselves, the object of study is the relationship between scientific knowledge, technological systems, and society. Thomas Kuhn's classic 1962 study, "The Structure of Scientific Revolutions", is a key example of the new approach to historical and social studies of science in which scientific facts were seen as products of scientists' socially conditioned investigations rather than as objective representations of nature. How do society, politics, and culture affect scientific research and technological innovation, and how do these, in turn, affect society, politics, and culture? How do they "co-produce" each other? (Jasanoff, 2004).

Use an STS approach to think about concepts as cultural constructions, and work to deconstruct their meaning. A key concept here is framing, seen as a schema of interpretation, a collection of anecdotes and stereotypes, that individuals rely on to understand and respond to events. In other words, people build a series of mental "filters" through biological and cultural influences.

- **Antibiotics as objects:** Instead of accepting established risk frames, regulatory responsibilities, and granting "scientific" methods analytical privilege, examine how the risks of antibiotics are framed at a number of locations (e.g. parliamentary politics, science, stakeholder sectors, food supply chains, clinicians, vets etc.). Explore how these sites interfere and co-exist with each other, and how this shapes antibiotic governance and its practices (rather than the instruments of sciences). Turn your gaze away from wanting to capture human behaviour and turn it towards the action of the object itself: antibiotics.

- **Resistance** – e.g. metaphors of resistance. Resistance is the dominant metaphor. But what is this?
    - The global health case of malaria eradication in the 1950's and the resistance that the parasite developed to DDT and chloroquine may be an example of how the concept gained attention in global health and tropical medicine.
        - 🕮 D'Alessandro, U., and Buttiëns, H. (2001). History and importance of antimalarial drug resistance. *Tropical Medicine and International Health* 6(11), pp. 845-848.
    - Humans make antibiotics by farming microbes, chemically tinkering with microbial metabolites, and mimicking them with synthetic antibiotics. Antibiotic resistance arises when microbes gain the capacity to evade these drugs. Conceptually, this resistance connects individual therapies targeted at single pathogens in individual bodies with environmental events affecting bacterial evolution far beyond single bodies through horizontal gene transfer (a process in which an organism transfers genetic material to another organism that is not its offspring). This trans-individual effect is the result of an environment that is structured by industrial scale antibiotic manufacturing.

- 🕮 Landecker, H. (2016). Antibiotic Resistance and the Biology of History. *Body & Society, 22(4),* 19–52.

- **One Health** can be defined as "...the collaborative effort of multiple disciplines – working locally, nationally, and globally – to attain optimal health for people, animals and our environment…" (AVMA, 2008). The three domains that are targeted by the One Health approach – people, animals, and the environment – also converge in the issue of antimicrobial resistance. Therefore, to reach a solution for this complex problem a holistic, collaborative approach, such as the One Health approach, is needed.
  - 🕮 Robinson, T. P., Bu, D. P., Carrique-Mas, J., Fèvre, E. M., Gilbert, M., Grace, D., Hay, S. I., Jiwakanon, J., Kakkar, M., Kariuki, S., Laxminarayan, R., Lubroth, J., Magnusson, U., Thi Ngoc, P., Van Boeckel, T. P., Woolhouse, M. E. J. (2016). Antibiotic resistance is the quintessential One Health issue, *Transactions of The Royal Society of Tropical Medicine and Hygiene, 110(7)*, 377–380.
  - 🕮 Kahn, L.H. (2017). Antimicrobial resistance: a One Health perspective. *Transactions of The Royal Society of Tropical Medicine and Hygiene, 111(6),* 255–260.
  - 🕮 Kamenshchikova, A., Wolffs, P.F.G., Hoebe, C.J.P.A., and Horstman, K. (2018). Anthropocentric framings of One Health: an analysis of international antimicrobial resistance policy documents. *Critical Public Health.* DOI: 10.1080/09581596.2019.1684442.

2.5 Examples of scientific controversies

- **AMR food transmission:** Can you get resistance from eating meat? Introduce how social scientists can "trace" the construction of truth claims (a proposition or statement that a particular person or belief system holds to be true) as a methodology to interrogate AMR framing. The AMR food transmission debate originated from the antibiotic growth promotor (AGP) debate in the 1960's. In the late 1940s, American researchers at Cyanamid's Lederle Laboratories found that unextracted antibiotic residues were capable of increasing animals' weight gains, and low-dosed antibiotic growth promoters were also believed to preventively protect against bacterial disease. Lederle sales boomed. In 1969, the Swann committee concluded that antibiotic growth promotor use could pose a risk to AMR food transmission and AGP use became restricted (eventually banned in some continents). However, scientific uncertainties circulated on how other types of veterinary usages (such as metaphylactic, prophylactic, therapeutic) contributed to transmission in meat, which resulted in a *continuation* of their use. Up to date, global efforts aim to restrict veterinary use to therapeutic use only, unless evidence suggests differently.
  - 🕮 Kirchelle, C. (2016). Toxic confusion: the dilemma of antibiotic regulation in West German food production (1951-1990). *Endeavour* 40(2): 114-127.

- 🕮 Thoms, U. (2012). Between Promise and Threat. Antibiotics in Foods in West Germany 1950–1980. *N.T.M.* 20: 181-214.

- **Human vs. animal (blaming) [slide 14, 15, 16 & 17]:** Problematically, resistant bacteria such as MRSA and ESBL-E continue to develop and spread between animals, humans, and the environment. The ongoing uncertainty about the potential sources, transmission routes, and risk factors of these resistant bacteria translates in competing truth claims upon the food chain contribution to AMR and how to regulate:
  - Causation (risk/driver): Is there a human or animal causation? veterinarians blame medical doctors and vice versa. A study by Golding et al. (2019) found that vets and farmers are sceptical about the threat posed by agricultural antimicrobial use, especially in relation to human health, arguing that the vast majority of antimicrobial resistance is actually created within the human population, and the animal contribution is actually relatively small. This scepticism means that, alongside a sense of ownership for the problem, vets and farmers engage in other-blaming for rising rates of AMR. Going beyond this, one could argue that there is a myth of separation of these two worlds, which links back to the One Health concept. In order to move forward and really reduce the AMR problem, we will have to move beyond the disciplinary silo's and look at shared monitoring, causation, and regulation. So, to see the interrelationships becomes a crucial exercise.
    - 🕮 Jerolmack, C. (2012). Who's worried about turkey's? How 'organisational silos' impede zoonotic disease surveillance. *Sociology of Health & Illness* 35(2): 200-212. doi: 10.1111/j.1467-9566.2012.01501.x
    - 🕮 Rousham E.K., Unicomb L., and Islam M.A. (2018). Human, animal and environmental contributors to antibiotic resistance in low-resource settings: integrating behavioural, epidemiological and One Health approaches. *Proc. R. Soc. B* 285: 20180332.
    - 🕮 Woolhouse, M., Ward, M., van Bunnik, B., & Farrar, J. (2015). Antimicrobial resistance in humans, livestock and the wider environment. *Philosophical transactions of the Royal Society of London. Series B, Biological sciences*, *370*(1670), 20140083.
  - 🔍 Decoupling **[Case study 2]:** Should vets be allowed to sell antibiotics? Human health stakeholders proposed to decouple the prescription and delivery of veterinary drugs by transferring the right to sell antibiotics from veterinarians to pharmacists, just as in the human medicine model. Northern European countries continuously lobby to take up decoupling in

the EU law, this is however opposed by Southern and Western European countries who argue that decoupling does not lead to a reduction in antimicrobial use.

- Critical important vs. non-critical important antibiotics: according to WHO watch list we should preserve antibiotics for human use. This public health claim by the WHO contradicts the market claim from pharmaceutical compagnies. Restriction of veterinary antibiotic purposes leads to a loss in economic value of these veterinary antibiotics for pharmaceutical compagnies, which in turn leads to a shift in R&D investments in other products.

- **Behavioural:** Is the concept of an antibiotic course still valid? Guidelines on the duration of antibiotic course have historically argued against stopping partway through a prescribed regimen, to avoid resistance developing. However, some researchers have argued that the message to "complete the course" is not always valid. These authors point out that: a) the length of courses (5,7,10 days) is mostly not determined by any scientific evidence but rather by convention; b) taking longer courses of antibiotics more likely increase the development of resistance than to decrease it; and c) AMR is likely to be acquired mostly through being colonized by resistant genes from other bacteria, not from new development within each individual. Finding an alternative message, however, is difficult since the real question - how long should the course actually be in order for patients to safely stop taking them without excessive usage? – is still unanswered due to a lack of scientific evidence and political hesitancy to admit this. (Lambert, 1999; Llewelyn et al. 2017)
    - 🕮 Llewelyn, M.J., Fitzpatrick, J.M., Darwin, E., Tonkin-Crine, S., Gorton, C., John, P. et al. (2017). The antibiotic course has had its day. *BMJ* 358: j3418.
    - 🕮 Lambert, H.P. (1999). Don't keep taking the tablets? *The Lancet* 354(9182).

2.5 Controversies – who takes the blame?

- CIAs, HIAs, IAs: the great divide, again?
- Antibiotic stewardship: experts' compromise and bargaining
  - Prudent/rationale/reduced/judicious use…
  - Good/best practices…

Évaluation des risques d'émergence d'antibiorésistances liées aux modes d'utilisation des antibiotiques dans le domaine de la santé animale

- Calling a practice "good" or "bad": what do the colours mean?
- From risks to risky practices and risky contexts: how to integrate socio-economic factors in risk analysis?

Source: Fortané N., Defining standards through their scope. Veterinary expertise and the definition of legitimate use of antibiotics", forthcoming.

Slide 14 controversy blaming 1

2.5 Controversies – who takes the blame?

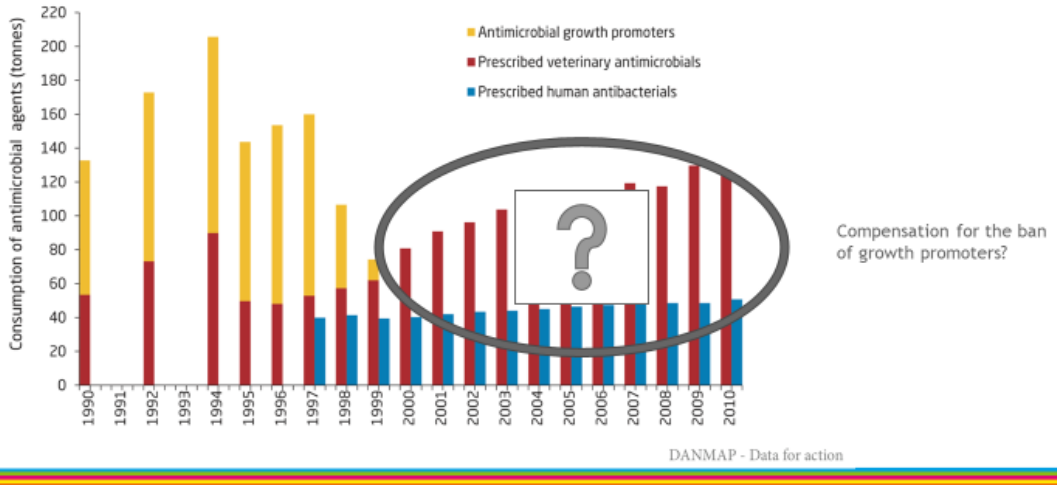
- The competing definitions of the legitimate use of antimicrobials: Growth promotion, prophylaxis, metaphylaxis, therapeutic, antibiotic-free…

Growth promotion	Prophylaxis/ prevention	Metaphylaxis	Therapeutic	Antibiotic-free
Sub-therpaeutic dose of antibiotics usually integrated in animal feed, in order to increase productivity. Ban in Europe since 2006.	Systematic group treatment at some critical moments of the production cycle (birth, weaning…). Ban in Europe from 2022 in vet medicine. Individual preventive treatment possible in human medicine	Group treatment (of a herd or a flock) when a small amount of animals is clinically sick : 2% to 10% of sick animals are usually acceptable to launch metaphylactic treatment	Individual or collective treatment when hulmans or animals are clinicaly sick	Meat, milk or eggs that are supposed to have been produced without any use of antibiotics. Nevertheless the standards sometimes have restrictions (e.g. no antibiotics after weaning, or after a few weeks…)

Slide 15 controversy blaming 2

2.5 Controversies – who takes the blame?

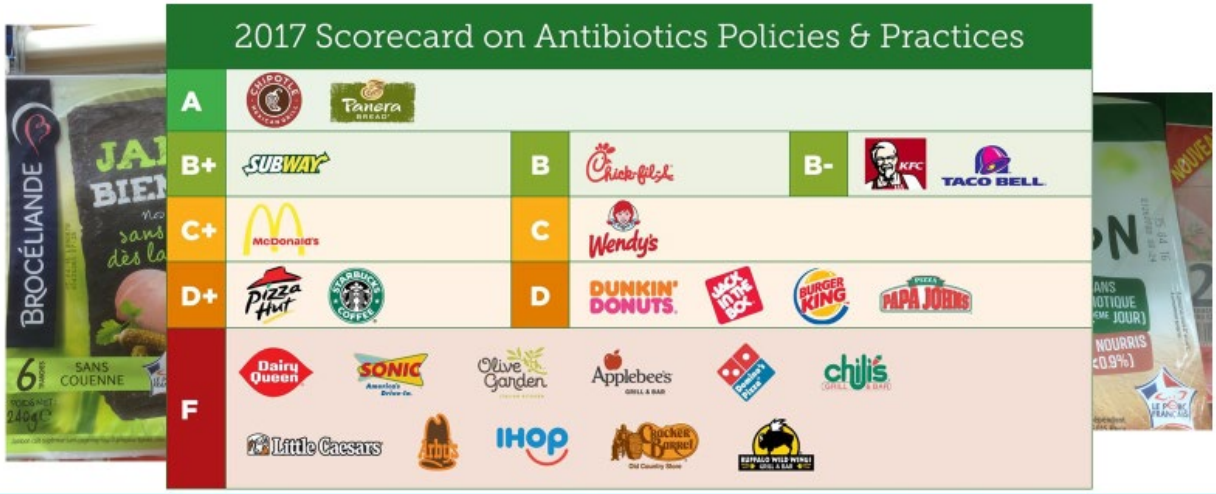
- Shifting categories, renaming practices: “everything must change so that everything can stay the same”?



Slide 16 controversy blaming 3

2.5 Controversies – who takes the blame?

- The multiple meanings of « antibiotic-free » products



Slide 17 controversy blaming 4

Pedagogical considerations:

- **Explore** preconceived ideas: start with the dominance of partially correct information on AMR, such as where AMR comes from, the notion that it is mainly about indiscriminate prescribing and "overuse" of antibiotics, ignoring environments and ecology (development of resistant bacteria because you live close to farming company). In fact, what constitutes resistance is not in agreement, there are many conceptions.
- Throughout this module, there is an opportunity to **illustrate** the construction of science facts—integrating a Science and Technology Studies emphasis—such as in the diagnosis of AMR. Also consider that at the same time there is a need to deal with public and social science scepticism surrounding science "facts" as well which could negatively affect AMR advocacy. E.g. many social scientists already deconstruct and are very sceptical; do we need more or less of this? This could be an issue of discussion in the groups. There are different ways of seeing according to different aims.
- The examples of scientific controversies described in submodule 2.5 can be covered in this module, but they can also be discussed and used selectively as examples related to topics covered in other (sub)modules.
- It is advisable to invite a biomedical scientist at the end of this session for students to have **panel discussion/interaction** for clarification. What is the role of social sciences according to the biomedical scientists? The focus should be on understanding how biomedical sciences frame the issue and compare this framing with other frames (e.g. cultural constructivist, or public populist denial of science facts).

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Case study 2: Decoupling: should vets be allowed to sell antibiotics?

Author

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Introduction

The problem of antimicrobial resistance (AMR) presents a specific challenge because of the peculiarity of the veterinary medicines market, which is regulated in many countries in a different way from human medicines. Unlike doctors, the veterinary profession often has a double monopoly on the prescription and dispensing of medicines. This means that veterinarians sell the medicines they prescribe.

With respect to AMR, this situation has been criticized as it has often been considered to lead to over-prescription of antibiotics since veterinarians have an economic interest in the abundant use of these medicines. “Decoupling" thus refers to the idea of separating the prescribing and dispensing of antibiotics in veterinary medicine, prohibiting veterinarians from selling medicines and reserving this activity for pharmacists, as is the case for human drugs.

In France, this controversy has structured the way the debates on AMR took place in the early 2010's during the first stages of the preparation of the government’s action plan (called “Plan EcoAntibio”), and on the measures that were subsequently adopted to foster the reduction of antibiotic use in livestock farming. This example is a particularly interesting case study to understand how social sciences can contribute to the analysis of the AMR problem and to identify actions that can be taken to reduce antibiotic use in livestock farming.

From guilt to responsibility: the evolving positioning of the veterinary profession

In France, when due to the above described dual monopoly veterinarians were accused of being primarily responsible for the AMR problem, the profession came to be perceived very negatively in the public debate (mostly in the specialized media but also to some extent in the general press): it was "guilty". Yet, this political framing of the AMR problem was carried out by *human* health actors who appeared to have a vested interest in putting the blame for the problem on the agricultural sector (in particular pharmacists who were expecting to gain new shares on the veterinary drug market). They encouraged the construction of strong political and technical solutions aimed at in-depth reform of the veterinary drug market and the profession's economic model. However, the bill on "decoupling" was opposed by stakeholders from the livestock farming sector, in particular veterinarians, who mobilised on the basis that there was a risk for the profession to disappear, which would necessarily be counterproductive

Figure 1: ‘Do you really want a world without veterinarians?’

regarding animal health and welfare (see for instance the brochure in Figure 1 above, which was a communication material issued by the veterinary unions in 2013 (Fortane, 2019)). Veterinarians won their case thanks to an important compromise: although they retained the right to deliver antibiotics, the veterinary drug market has become much more regulated than in the past (see paragraph on regulating the antibiotics market below).

This sequence is particularly interesting because it shows how a professional group deeply involved in the AMR problem has succeeded in a few years to radically change its image and establish itself as a key player in the solution to a problem, rather than as the cause of the problem. Indeed, veterinarians have successfully imposed an alternative narrative to the dominant discourse in which they define themselves as the guardians of responsible use of antibiotics: thanks to their professional expertise (and their monopoly) on animal health, they would be the only ones in a position to encourage a reduction of antibiotic use by promoting preventive (rather than curative) approaches to animal diseases that consume far less antibiotics (see for instance the poster in Figure 2, issued by the government in 2016, that shows how the image of veterinarians has shifted in just a couple of years (Fortane, 2019; Fortane, 2020)). This change in image has empowered those veterinarians who have taken responsibility to give themselves the means to change their prescribing practices.

Figure 2: "My vet is far more than a mere hands-on man, he is an advisor always there to prevent and vaccinate".

Regulating the antibiotics market: which impact on prescribing practices?

This trend towards reduced antibiotic use seems to be sustainable so far (nearly 40% reduction of antibiotic use in the livestock sector between 2012 and 2017: see the charts in Figure 3, a leaflet issued by the government in 2018 (French General Directorate for Food, 2018)). One of the reasons is probably that not only individual prescribing behaviour has changed, but that in parallel structural changes in the functioning of the antibiotic market have been implemented. Since 2014, veterinarians have to charge the same price to all their customers and, above all, they can no longer benefit from "back margins" on the sale of antibiotics, i.e. commercial discounts granted by the pharmaceutical industry if a certain annual sales volume is reached (Law for food, agriculture, and forestry, 2014). Also, since 2016, veterinarians have been required to perform sensitivity tests before prescribing critically important antibiotics, which has considerably reduced the use of this class of antibiotics (Law for food, agriculture, and forestry, 2016).

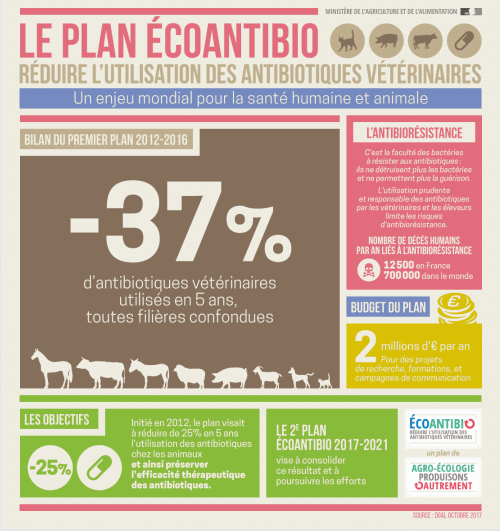

Figure 3: "-37% of veterinary antibiotics used in 5 years, all sectors included".

One can thus see that regulating the veterinary drug market, in particular controlling the conditions of sale and prescription (and providing the means to enforce these measures, and to sanction non-compliance), is an essential lever for changing practices in the use of antibiotics. Nevertheless, there are still unknowns, both for the social sciences and for AMR policies. On the one hand, these measures focus mainly on veterinarians and take very little account of the other stakeholders in the drug chain (pharmaceutical industries, wholesalers, distributors) who are known to have a major influence on the way antibiotics are used. On the other hand, these measures leave in the shadows the transition in terms of professional and economic models that veterinary businesses have to make in order to promote preventive approaches and be less dependent on the sale of medicines. These are probably the challenges that future AMR European policies will have to take into account, at least with regard to the prescription and sale of veterinary medicines, to ensure a sustainable decrease of antibiotic use.

Conclusion

All in all, this case-study shows how social sciences make it possible to understand the mechanisms influencing antibiotic use, pointing in particular to the fact that changing prescribing practices is far from being just a matter of individual behaviour and representations. It actually must be based on major structural transformations, as it is these that ultimately set the economic and institutional frameworks in which the actors' practices and knowledge are embedded.

References

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- Fortané, N. (2020). "Antimicrobial resistance: Preventive approaches to the rescue? Professional expertise and business model of French 'industrial' veterinarians", *Review of Agricultural, Food and Environmental Studies*, Online first.
- French General Directorate for Food (DGAL). (2018). Activity Report – Key Facts 2017. Ministry of Agriculture and Food: Paris.
- Law for food, agriculture, and forestry. Decree n° 2014–1170 of October 13th, 2014.
- Law for food, agriculture, and forestry. Decree n° 2016–317 of March 16th, 2016.

3 PEOPLE AND PUBLICS

Populations, experience, illness, relationships, food, pharmaceuticals, professionals, stigma, consumption & use, media

Summary: This module aims to portray the exposed/involved actors – including those most vulnerable -, their roles, and their relation to each other and to the wider infrastructures. It also highlights people's experiences with and its effect upon provision and consumption of antimicrobials. Moreover, the relationship between AMR and the media will be illustrated.

Length: 1 day

Aims/objectives:

- Discuss the experience of different groups engaged in the use and (direct) provisioning of antimicrobials
- Discuss the different groups exposed to resistant bacteria
- Understand how these different people and groups interact amongst each other and with(in) the systems that surround them, including the media
- Reflect upon the structural and relational aspects of access and use of antimicrobials and vulnerability to antimicrobial resistance

Content:

3.1 Experiences

- Highlight the role of illness experience on consumption and the experiences of those with resistance strains: e.g. isolation, stigma.
    - Processes of stigmatization related to AMR felt by pig farmers:
        - 🕮 Fynbo, L., and Jensen, C.S. (2018). Antimicrobial stigmatization: Public health concerns about conventional pig farming and pig farmers' experiences with stigmatization. *Social Science & Medicine* 201, 1-8.
    - 🔍 Should resistance related to tuberculosis drugs be seen as a special case of AMR? **[Case study 3.1]**
        - 🕮 Seeberg, J. (2019). Fear of Drug-resistant Tuberculosis as Social Contagion. *Ethnos 0(0)*, 1–14.
- 🔍 The Antimicrobials in Society (AMIS) Uganda Project: The AMIS Project Uganda is an anthropological research project aimed at better understanding the use of antimicrobials in Ugandan society. The study aims to understand the roles and context of antimicrobials in daily life in Tororo, Wakiso and Kampala districts from the perspective of healthcare providers, farmers, and day wage urban workers. The research focuses on the ways in which antimicrobials enable particular ways of life and livelihoods and explores the context and the wider reasons for antimicrobial use in Uganda. **[Case study 3.2]**

3.2 Vulnerability

Children are more susceptible to resistant bacteria because their immune systems are not fully developed. Women with lower levels of education or resources living in rural or remote areas may be less likely to receive or less able to afford the needed first and second-line treatments if they contract an antibiotic resistant infection. In hospitals, elderly, infants, or patients with impaired immune systems are more vulnerable to the impact of multidrug-resistant forms of *K. pneumoniae*. These are vulnerable population groups. Vulnerabilities refer to the inability of people, organizations, and societies or even systems to withstand adverse impacts from stressors to which they are exposed. From a system's perspective, Birkmann and colleagues synthesise that "factors of vulnerability from disaster-risk reduction and climate change adaptation include system exposure to a hazard or stressor, the susceptibility of a system, and its resilience or adaptive capacity" (Birkmann *et al.*, 2013, p. 207). Factors that contribute to vulnerability change over time and are place specific.

- In the Sonar-global project, vulnerability assessment related to AMR will take place in Bangladesh. This vulnerability assessment will help identify groups most likely to be affected by AMR, as well as characterize vulnerability in the specific context in which the pilot will take place. The assessment focuses on understanding the meaning(s) of antimicrobials at a community level and the relational processes that contribute to the construction of rationalities at all levels and sectors of antimicrobial circulation.
  - Jeleff, M., Lehner, L., Giles-Vernick, T., Dückers, M.L.A., Napier, D., Jirovsky, E., and Kutalek, R. (2019). Vulnerability assessment tools for infectious threats and antimicrobial resistance: a scoping review protocol. *BMJ Open* 9, e031944.
- Environmental Justice: Opposing Industrial Hog Farming: https://www.pbslearningmedia.org/resource/envh10.sci.life.eco.hogfarming/environmental-justice-opposing-industrial-hog-farming/#.XfObOEFCdPY
- Doron, A., and Broom, A. (2019). The Spectre of Superbugs: Waste, Structural Violence and Antimicrobial Resistance in India. *Worldwide Waste: Journal of Interdisciplinary Studies* 2(1): p.7.

3.3 Knowledge, access, and usage

What is the influence of people's experiences of and symbolic relationships with antimicrobials and other technologies in access to and consumption of antimicrobials? Explore how local conditions influence access to and use of antimicrobials and the development and transfer of resistance: e.g. counterfeit drugs, patients demand, defecation practices, hospital hygiene, farming practices. Also reflect on the important, mediating role of professional and lay experts with knowledge about antimicrobials.

- The Antibiotic footprint is a tool to measure and understand the total magnitude of antibiotic use. Using a holistic approach, the Antibiotic Footprint seeks to measure the total amount of antibiotics used in all human activities, including direct antibiotics consumption at the community and hospital levels, and indirect

consumption in agricultural production. A country's Antibiotic Footprint is the total amount of antibiotics consumed in that country. We estimate this by combining the total amount of antibiotics consumed by humans and by animal agriculture: www.antibioticfootprint.net

- Illustration of the social lives of antibiotics in the informal sector in Bangladesh. **[Case study 3.3]**
- Lambert, H., Chen, M., and Cabral, C. (2019). Antimicrobial resistance, inflammatory responses: A comparative analysis of pathogenicities, knowledge hybrids and the semantics of antibiotic use. *Palgrave Communications* 5, 85.
- Kliemann, B.S., Levin, A.S., Moura, M.L., Boszczowski, I., and Lewis, J.J. (2016). Socioeconomic Determinants of Antibiotic Consumption in the State of São Paulo, Brazil: The Effect of Restricting Over-The-Counter Sales. *PLoSONE* 11(12), e0167885.
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- Rodrigues, C.F. (2020). Self-medication with antibiotics in Maputo, Mozambique: practices, rationales and relationships. *Palgrave communications* 6(6).

3.4 Networks and relationships

Antimicrobials move within complex local and global networks of relations that include humans, animals, and objects that bring us into contact with microbial worlds embedded in particular histories, legacies, and political economies. In sociology, the relationships are often seen in the form of social structures or social organisations, while in anthropology the idea of "socialities" can be seen as a dynamic matrix of relations through which persons come into being, and which is navigated by an ethically imaginative and affectively receptive human subject. Regardless, the networks and relationship described are key to dealing with AMR where actors come from sectors ranging from health, food safety, and agriculture to environment and trade. AMR is a complex public health threat with a complex set of actors.

- ReAct Europe has conducted a global mapping of stakeholders working with antimicrobial resistance in 2016. The mapping provides an overview of then key actors in the field of antimicrobial resistance (AMR). Because AMR is a complex problem, stakeholder mapping can be enormous. ReAct has aimed to capture relevant actors in key areas, including policy, advocacy, innovation & research, surveillance, and funding.
- Relationships that co-produce the environment also include non-human actors in these networks. E.g. Alhaji, N.B., and Tajudeen, O.I. (2018). Antimicrobial Usage by Pastoralists in Food Animals in North-Central Nigeria: The Associated Socio-Cultural Drivers for Antimicrobials Misuse and Public Health Implications. *One Health 6,* 41–47.

- Application of Latour's network theory on AMR can be found in Chandler, C.I.R., Hutchinson, E., and Hutchison, C. (2016). Addressing Antimicrobial Resistance Through Social Theory: An Anthropologically Oriented Report. London School of Hygiene & Tropical Medicine.

3.5 Infrastructures

- Looking at AMR from the point of view of the infrastructures that maintain it is interesting for at least two reasons. First of all, infrastructure hints at the connections between different sites. A multi-sited approach goes beyond reductionist studies of antimicrobial use and offers a means to explore AMR as a problem of connections that takes issues like inequalities and inequities as seriously as resistance itself. A piece written by Hutchison (2019) clarifies this approach. He states "For example, a researcher might follow antibiotics through supply chains from manufacturing to sale point, consumption, and even expulsion in the form of residues. Or they might attempt to trace the origins of mass bacterial resistance to specific antibiotics, institutional forms, social practices, ways of living and working."

  Another way of looking at infrastructure is introduced by Clare Chandler. Following Bowker and Star (2000) she notes that webs of sociotechnical networks (infrastructures) enable the world to work in the way that it does. The way these are assembled also means that some things become inevitable while others become impossible to even imagine. To understand how the world is working and being shaped, we need to render this infrastructure visible. This is a hard task, but one that social scientists are often attempting in order to ask how we are living in the world. Bowker and Star argue that it can be achieved through "inversions" of infrastructure – where you up-end what is currently "normal" and see what comes with it. In the case of AMR, Chandler argues that the concern around AMR is itself a moment of inversion – suddenly rendering visible how many places antibiotics are present and at work – that therefore antibiotics are infrastructural. They enable trade, political values, etc. to continue. They are entangled in and enable these ways of thinking and living. Therefore, the quest to reduce our reliance on them will bring with it an assortment of other things that we may not have expected. For example, if they enable standardisation (of meat, fruit, clothes) then what happens when they are removed from those supply chains?
  - Chandler, C.I.R. (2019). Current accounts of antimicrobial resistance: stabilisation, individualisation and antibiotics as infrastructure. *Palgrave Communications 5(53)*, doi:10.1057/s41599-019-0263-4.
  - Denyer Willis, L., and Chandler C.I.R. (2019). Quick fix for care, productivity, hygiene and inequality: reframing the entrenched problem of antibiotic overuse. *BMJ Global Health* 4:e001590. doi:10.1136/bmjgh-2019-001590.
  - Brives, C. and Pourraz, J. (2020). Phage therapy as a potential solution in the fight against AMR: obstacle and possible futures. *Palgrave Communications* 6, 100.

3.6 Media

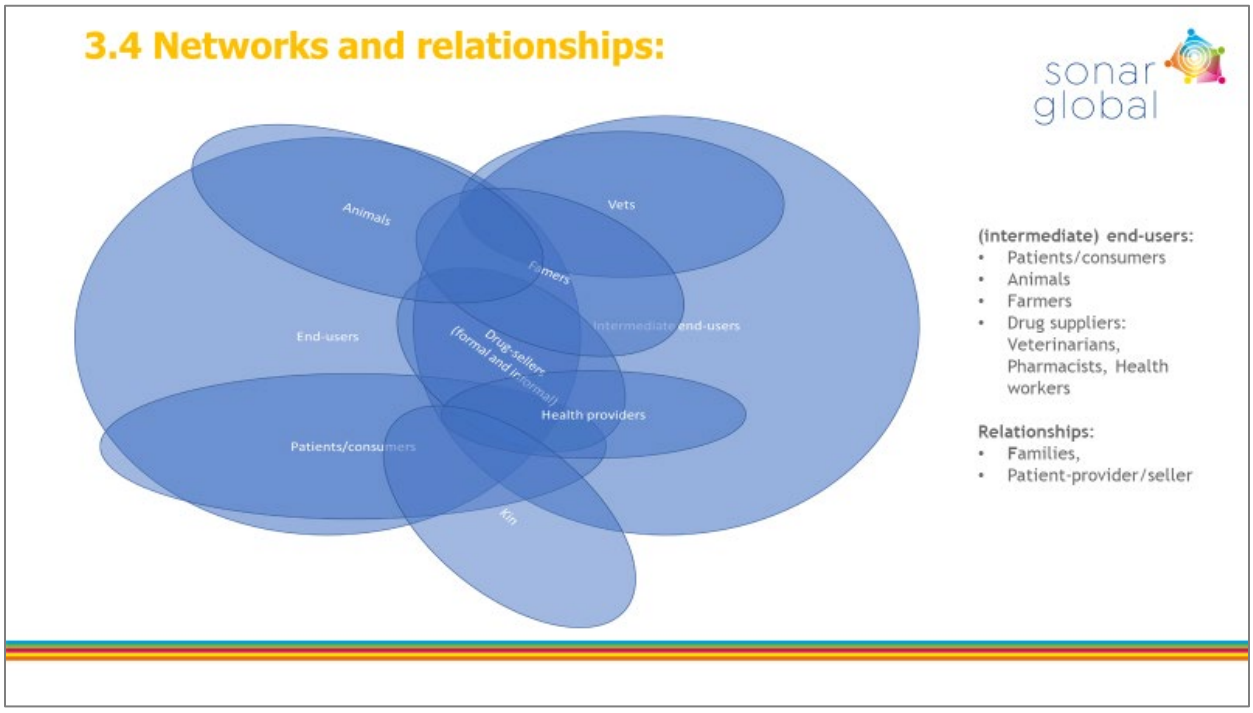
The relationship between AMR and the media is diverse in terms of possibilities to frame the issue of AMR and ways to mediate, receive, and apply the AMR message. Media can play a significant role in promoting public awareness via adhering to health/science communication methods but also in leading to misinformation and stimulate misuse (Davis *et al.* 2019; Groshek *et al.* 2018). Moreover, the framing of AMR in the media can enhance (scientific) controversies and further divide the human, animal, and agricultural sectors (see Module 2.5). Finally, framing can substantially influence discourse in the public policy domain. For this reason, this section also strongly links to the issues of institutions and policies discussed in Module 5.

- 🕮 Morris, C., Helliwell, R., and Raman, S. (2016). Framing the agricultural use of antibiotics and antimicrobial resistance in UK national newspapers and the farming press. *Journal of Rural Studies* 45: 43-53.
- 🕮 Collins, L.C., Jaspal, R. and Nerlich, B. (2018). Who or what has agency in the discussion of antimicrobial resistance in UK news media (2010-2015)? A transitivity analysis. *Health (London)* 22(6): 521-540. doi: 10.1177/1363459317715777.
- 🕮 Davis, M., Whittaker, A., Lindgren, M., Djerf-Pierre, M., Manderson, L., and Flowers, P. (2018). Understanding media publics and the antimicrobial resistance crisis. *Global Public Health* 13(9): 1158-1168. doi: 10.1080/17441692.2017.1336248.
- 🕮 Groshek, J., Katz, J.E., Andersen, B., Cutino, C., and Zhong, Q. (2018). Media use and antimicrobial resistance misinformation and misuse: Survey evidence of information channels and fatalism in augmenting a global health threat. *Cogent Medicine* 5(1), 1460898
- 🎓 **Student search:** Student search for news item on AMR on their chosen case study topic and discuss aspects that are striking. Consider issues discussed so far (experience, access, vulnerability, infrastructure, etc.).

Pedagogical considerations:

- 🎓 **Group work / role play:** Illustrate key concepts and methodology via case studies (going the other way around from “macro” to “micro” starting with Infrastructure):
  - 🎓 **Infrastructure**: Infrastructure mapping of a chosen AMR topic in smaller groups following the first method of connections between different sites. What do we see along this infrastructure? Trace where the object (the microbe) is moving, not focusing on the farmer or doctor, but trace how the AMR object is shaping the field (infrastructure) of the network, including the other objects. This illustrates how AMR is embedded in life, without reflecting on what it means, physically but also mentally; in habits, practices, politically and economically. In addition, the question can be asked, following the second way of looking at infrastructure as enabling what just “works”, we can ask what happens to the infrastructure if antimicrobials are taken out of the system.

- **Networks and relationships**: Conduct a stakeholder mapping and have people take on roles of those actors involved. Examine how (social) relationships and interactions among these groups can contribute to the use and the development/transfer of resistance **[slide 18]**. For example:
    - People who are (overly) exposed to resistant bacteria
    - The resistant infections – malaria, TB, HIV
    - Users of antibiotics
    - Producers of antibiotics
- **Vulnerability:** In the identified infrastructures, can students localize and discuss systemic vulnerabilities where resistance may develop, and also identify which actors may be more vulnerable than others (vulnerable populations)?



Slide 18 example network and relationships AMR

Additional readings:

- David, P. (2019). «Ce sont maintenant les résistances qui vont nous tuer». Insécurités pharmaceutiques, ruptures de stock et résistances aux traitements contre le VIH en Afrique centrale. *Anthropologie & Santé 19.*
- Gryseels, C., et al. (2013). Injections, Cocktails and Diviners: Therapeutic Flexibility in the Context of Malaria Elimination and Drug Resistance in Northeast Cambodia. PLoS One 8(11), e80343.
- Hancart-Petitet, P., Dumas, C., Faurand-Tournaire, A., Desclaux, A., and Vong, S. (2011). Social and cultural dimensions of hygiene in Cambodian health care facilities. *BMC Public Health 11*, 83.

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- Birkmann, J., Cardona, O.D., Carreño, M.L., *et al.* (2013). Framing vulnerability, risk and societal responses: the move framework. *Natural Hazards* 67*:*193–211*.*
- Bowker, G.C., and Star, S.L. (2000). Sorting Things Out: Classification and Its Consequences. Cambridge, MA: MIT Press.
- Hutchison, C. (2019, December 5). A multi-sited, flowing approach: A means to study antimicrobial use and resistance as problems of connection. Retrieved from: https://www.antimicrobialsinsociety.org/commentary/a-multi-sited-following-approach-a-means-to-study-antimicrobial-use-and-resistance-as-problems-of-connection/

Case study 3.1: Is drug-resistant tuberculosis a special case of AMR?

Poor urban neighborhood in a large city in India. DRTB patient (squatting) in front of his house while coughing up bloody sputum. His relative (middle) holds his small daughter. The woman to the right is a research assistant. (photo by Jens Seeberg © 2016)

Author

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Introduction

Is drug-resistant tuberculosis (DRTB) a special case of antimicrobial resistance (AMR)? The question has two parts. The first part would be, "is DRTB a case of AMR?" This may seem to be asking for the obvious, since the relation of DRTB to AMR is that of a part to the whole. AMR includes all forms of antimicrobial resistance, therefore also DRTB. Moving to the second part, then, why should it be a *special* case of AMR? This question is less trivial than it

may seem at first. If one looks at the global health efforts involved in reduction of AMR compared to those involved in control of tuberculosis (TB) and its drug-resistant strains, collectively known as DRTB, the answer seems to be "yes" – so special that it is hardly considered as part of the general AMR problem. This special status may act for TB control as a barrier to addressing some of the structural dynamics that lead to AMR in society in general.

Why is drug-resistant tuberculosis a special case of TB?

DRTB is caused by strains of *Mycobaterium tubercolusis* resistant to Isoniazid and Rifampicin, two of the four first-line anti-tuberculosis drugs, but may also involve resistance to one or several second-line drugs. Although tuberculosis was nearly eliminated in western countries after World War II, only around 25% of the estimated number of DTRB patients around the world receive treatment (WHO, 2020). In 2014, the World Health Organization (WHO) launched the "End TB Strategy" (WHO, 2014) in response to not only the Sustainable Development Goals, but also because of the failure to halt the increase of DRTB worldwide. These efforts have been the topic of considerable political attention, resulting in the first ever UN high-level meeting on TB in 2018 (Herbert, 2018). On a parallel track, a UN high-level meeting held in 2016 adopted a political declaration on AMR (UN General Assembly, 2016). However, the logics of these two tracks are quite different.

TB control has a long public health history of being a "vertical", or disease focussed programme, with its own ideology of paternalistic public health ethics, perhaps most clearly expressed in the DOTS strategy (Directly Observed Treatment – Short course), where patients were to be observed taking their medications to increase adherence. The vertical approach is reflected in the ambitious goal of 'ending TB', e.g. to achieve that TB is no longer a major public health concern through a 90% reduction of TB incidence and 95% reduction of TB deaths in 2035 compared to 2015 (WHO, 2014). In contrast to this disease focus, the recent global efforts of AMR control take a much more "horizontal" One Health approach, seeing AMR as a complex problem evolving in the complex dynamics of human, animal and environmental health and requiring interdisciplinary research and a wide range of interventions to limit excessive use of antibiotics, control environmental pollution with antibiotics, etc. An admittedly oversimplified yet telling articulation of the difference between DRTB and AMR policies could be that AMR policies seek to better control treatment based on the *problem of resistance* as the point of departure, whereas DRTB policies seek to better control disease based on a *disease-specific* point of departure.

Should drug-resistant TB be considered a special case of AMR?

On this background, it does indeed seem to that DRTB control is a special case. We may rephrase the question and ask, whether it *ought* to be considered as a special case. Here, the answer is much less obvious. Let us start with the observation that given a disease-specific point of departure, most if not all infections involving AMR are likely to present particular problems. The increase in infection with Methicillin-resistant Staphylococcus aureus (MRSA) linked to overuse of antibiotics in industrial pig production (Khanna *et al.*, 2008; Voss *et al.*, 2005) is different from, say, an epidemic of fluoroquinolone-resistant gonorrhoea linked to overuse of Ciprofloxacin in human healthcare (Harrell, 2014). Biosocial dynamics involved in the development of AMR – e.g. disease characteristics such as latency period and mode of infection; virulence; transmission, including possible zoonotic properties; access to effective

treatment; duration of treatment; and severity of side effects – are just some of the factors that need to be taken into account when addressing any type of AMR. From this perspective, there is nothing special about TB. However, TB control policies have focused primarily on the public healthcare sector, which is the sector that directly responds to WHO policies. Strategies such as DOTS were developed in this political context and thus worked through public health systems. Realizing the de facto involvement of the private healthcare sector in TB control, WHO began, during the early 2000s, to establish policies to engage private practice in the DOTS programme while disregarding the fact that many private practitioners worked actively against the DOTS strategy (Ecks and Harper, 2013). In India, which holds approximately one quarter of the world's TB cases, and where DRTB incidence is fast rising, attempts to include commercial healthcare in the national TB control strategy have failed (Seeberg, 2014; Udwadia, Pinto and Uplekar, 2010). It can be argued that this is so, in part *because* TB and DRTB are given "special case" status. After all, TB control and the development of drug resistance that it gives rise to are addressed as isolated problems without due consideration of the larger problem of AMR in society. Staying with the example of India (but noting, at the same time, that this problem is in no way limited to India), approximately 70% of TB treatment is provided outside the government TB control programme, i.e. in the commercial sector. Big variations in treatment regimens occur and incorrect and interrupted treatment are common (Udwadia, Pinto and Uplekar, 2010). Yet, within the TB control programme, these are seen as problems that are specific to TB treatment, with solutions that can be specific to TB (such as new DRTB drugs and better DRTB diagnostics) rather than as general AMR problems that undermine treatment of many infectious diseases, including TB.

Conclusion

It seems justified to argue that one of the greatest barriers to more effective DRTB prevention is linked to the understanding within global health policy, financing and infrastructure that DRTB, along with TB, *is* a special case, considered to be completely unlike other forms of AMR. This understanding is a reflection of the verticality of TB control. However, TB – and with it DRTB – is a profoundly biosocial disease (Seeberg, in press). It seems highly unlikely that it will ever be controlled based on medical technologies without seriously taking into consideration the need for improvement of the living conditions of poor populations at highest risk of TB infection and disease (Seeberg, in press). To the extent that a One Health approach to AMR control can be pushed in this direction by taking the biosocial dynamics of AMR fully into account, it may be time to remove the "special" status of DRTB and begin to see it as this: a kind of AMR.

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Case study 3.2: Understanding the role of antimicrobials in daily life in Tororo, Wakiso and Kampala districts of Uganda: Vignettes from Healthcare, Farming and Urban work.

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- Miriam Kayendeke - The Antimicrobials in Society (AMIS) Uganda Project and Infectious Diseases Research Collaboration (IDRC), Kampala, Uganda.

Introduction

The AMIS Uganda Project is part of the AMIS Hub, which is a collaborative research program led by the London School of Hygiene and Tropical Medicine (LSHTM), with IDRC (Uganda) and Mahidol University and Ministry of Public Health (Thailand) as partners. The AMIS Uganda project is a four-year social science study aimed at better understanding the roles of antimicrobials in society and everyday life. We set out to identify how antimicrobials shape and enable ways of life within households, healthcare facilities, among urban workers, and in animal farming. By addressing how people actually use antimicrobials, and the wide-reaching reasons for reliance on these drugs, we will provide a detailed account that can be used by policy makers working on antimicrobial resistance in Uganda. Using established social science methods, we provide fresh approaches to the study of antimicrobials in Ugandan society, to demonstrate how antibiotics are linked to social, economic, and political systems. Our research focuses on antibiotics, but also includes antimalarials, antiretrovirals and antifungals.

Project sites in Uganda currently include Nagongera (Tororo), Namuwongo (Kampala) and Wakiso (see Figure 1 below). Tororo district in Eastern Uganda is a rural area where most residents engage in agriculture as their main economic activity. Nagongera Sub County in Tororo, just like most areas in eastern Uganda, is a place long neglected by governmental programs and existing within and between piecemeal well-meaning NGO efforts. Namuwongo in Kampala capital city is a large informal settlement where many people who work in the city centre and the surrounding affluent neighbourhoods reside. Wakiso district is a peri-urban area approximately 20 kilometres northwest of Kampala. It is an agricultural district which has been ranked as a top producer of poultry and piggery in Uganda.

Key definitions

Through our research we have developed the following working definition of quick farming: it can be understood as a phenomenon that combines rapid production of meat (through exotic breeds, commercial feeds); smaller space of production (confinement housing); increased financial investments (biological inputs, utilities, and infrastructure) and forms of caring through medicines (antibiotics, antimicrobials, and nutritional supplements).

Precarity has been defined by Judith Butler 2009 as a politically induced condition in which certain populations suffer from failing social and economic networks becoming differentially exposed to injury, violence, and death. Precarity also entails lack of stable work, steady incomes, unpredictable cultural and economic terrain, and conditions. Precarity is experienced by marginalized, poor, and

disenfranchised people who are exposed to economic insecurity, injury, violence, and forced migration.

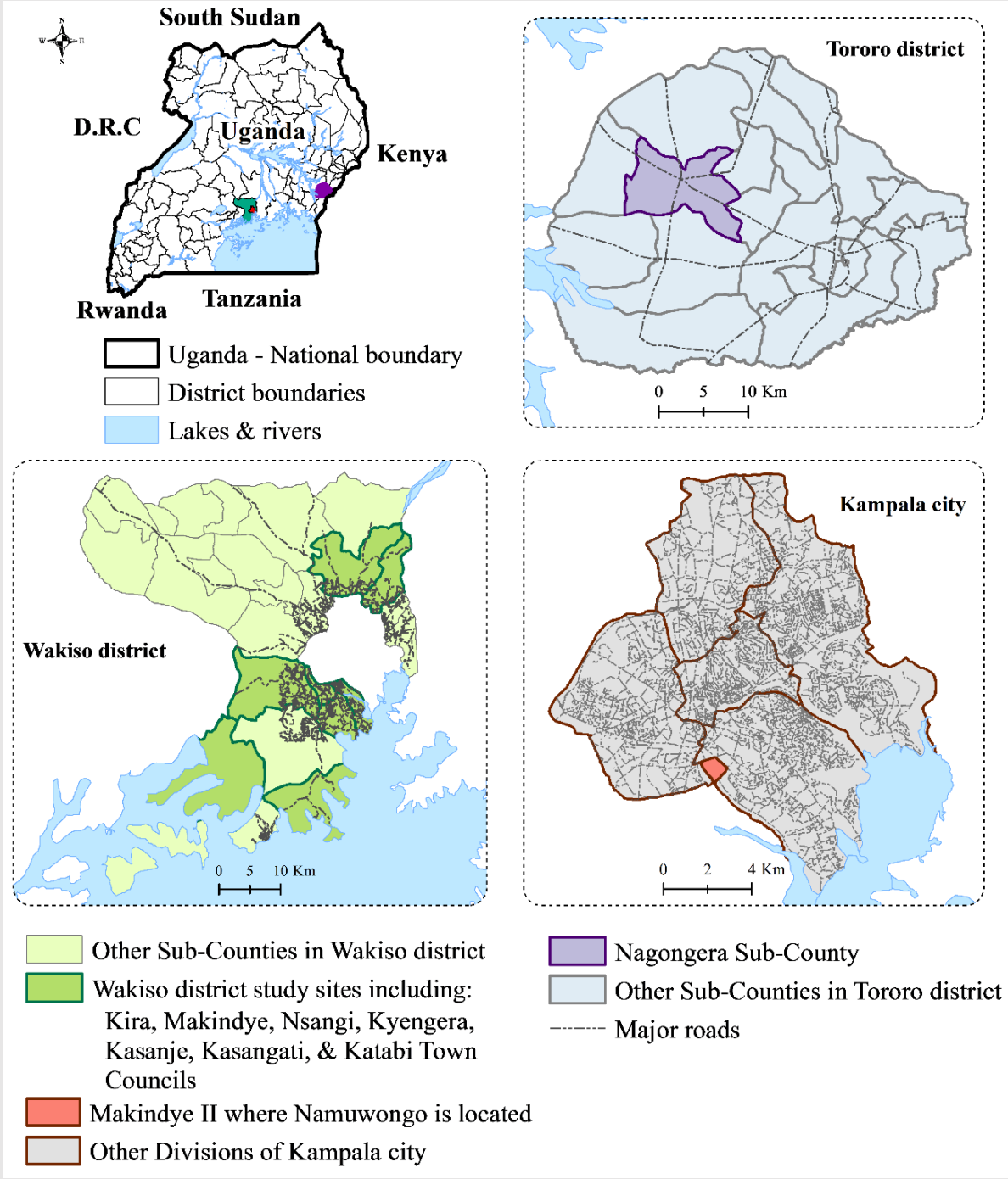

Figure 1: Map of study sites - Nagongera (Tororo), Namuwongo (Kampala) and Wakiso.

Healthcare: Experiences with antibiotics from the rural Tororo district

As I walk up the dusty main road leading up to Harriet's home in Nagongera Sub County, Uganda, I notice that the gardens in almost every homestead are filled with people uprooting groundnuts from the dry and sandy land. Using the foot path beside the huge rock in front of Harriet's house, I make my way past the cows grazing on one side of her compound. I sit on a stool in the kitchen to chat with Harriet. As she prepares the one meal of the day that she can manage to provide for her five children, she tells me about the medications she and her husband were prescribed this morning and asks me whether the purple and black capsules (referring to Ampiclox) treat everything. She explains to me that they have been receiving Ampiclox a lot at the research clinic where her whole family is enrolled as study participants. She expresses to also be concerned about the possible effect of taking Ampiclox alongside the Doxycline that she only managed to obtain today, even though she was told to buy it a few days back as part of her treatment for pelvic inflammatory disease. A month ago, Harriet was told by the clinician at the nearby health facility to get a scan done in a private health facility, but she was then unable to raise the money to cover this cost. When the scan was finally done one month later and confirmed pelvic inflammatory disease, she was prescribed ciprofloxacin, metronidazole and paracetamol and asked to buy Doxycline which was out of stock at the time.

A rural household in Nagongera,Tororo district where ethnography is being conducted

Harriet strikes me as a very organized woman: she has seven children including two who are away from home and over whom she continues to worry. She manages to get food on the table, enrol in the various schemes on offer for planting groundnuts, and make herself available to relations in the city to care for their animals. However, in the context where she lives, Harriet is very much alone in shouldering responsibility. When the groundnuts do not grow because of climate instability, she has to repay the loan. When the animals are stolen, she has to find the funds to replace them and begins to sleep with them inside the house to avoid similar losses. When her persistent pelvic inflammation requires treatment, she is the one who must find money to pay.

Farming: Experiences with antibiotics from the peri-urban Wakiso district

"Quick farming: is it a recipe for antibiotic use?"

A morning drive through the heavy city traffic to the eastern side of Wakiso district, leads us to Kira town council. Mzee Byenkya's poultry farm has been our ethnography study site this season. He is a soft spoken, eloquent man, in his late 50s. Born and raised in the city, poultry farming has led him to live in the fringes. Without any experience in exotic poultry farming, establishing this farm was a key retirement goal. The farm sits on 2 acres of land stretching from a busy dusty road inland. Two-thousand brown laying chickens are raised here, in double story – corrugated iron sheet structures. 'It is three years now', he says. Inspired by the hearsay lucrativeness of this venture, raising these two batches of chicken has been a learning curve. Prestige, new friends and having folks interested to learn from this farm are aspects of his new enterprise that he is keen to tell me about.

However, poultry farming has not been straightforward. Mzee Byenkya is always preoccupied with the status of his chickens. With these "exotic" breeds, he knows they are vulnerable to infection as well as to theft. He pays close attention to their behaviour - listening to their chuckling, observing their agility, monitoring their droppings, feeding and egg laying pattern. Changes in any of these signs could mean infection. A man on a mission, he is! On a regular morning, Mzee Byenkya will conduct a thorough inspection of the entire exterior of the farm. With long confident strides, he walks through the many chickens, picking up some to take a closer look at their eyes, feet, and bottom. He is keen to recognize the weak and dozing; isolate the underweight; and check for eggs in the laying boxes plus popular laying corners. Today, five sick chicken are singled out because of illness. Just as we try to figure out what disease it may be, the expected number of egg trays is not attained too! Lost in a deep gaze, thoughts race and linger on in the man's mind. Only for him to dash into his room and come out holding a spoon and Tylosin powder - an antibiotic and a feed additive. Drinking water is the medium. And later with a huge smile on his face, he concludes 'More eggs tomorrow'.

A poultry farm in Wakiso district where ethnography is being conducted. (photo by Magdalena Bondos, LSHTM ©)

Urban work: Experiences with antibiotics from the urban Kampala district

"Four red and black capsules"

Mary was recently involved in a motorcycle accident and sustained several wounds on her legs and shoulder—or at least those are the ones I can see. The wounds were going septic and they gave her a fever the night before I spoke to her. She had no money for a full dose of the antibiotics recommended by a friend but was able to buy just four pills from a local drug shop, which she described as red and black capsules. As we talk, I am distracted by the houseflies buzzing around the wounds on her legs. She occasionally fans off the flies with a piece of cloth that she is using to cover the biggest wound. She recognizes that she will need more medicine to feel better but just does not have the money to afford a full course of antibiotics. She says a friend had earlier recommended Ampiclox when the accident happened, but she did not have money to buy the medicines at that time either.

A major drainage channel in Namuwongo after heavy rain. (photo by Magdalena Bondos, LSHTM ©)

Mary lives in an informal settlement in downtown Kampala, where she pieces together a variety of insecure jobs every week to get by. The pay is never enough, and her contracts are only ever short and verbal. Her work is always precarious. I have seen her wash people's clothes and cook for the

builders at a building site close to her home. She was recently promised work as a domestic worker at a nearby home in an affluent neighbourhood. This job promises a bit more consistency and slightly better pay, but that has not materialized yet. For the past few days, while recovering from her injuries, she has not been able to work, making the prospect of purchasing the antibiotics she needs unlikely. She worries that while injured she could go days without any job offers.

Conclusion

Spending quality time with people like Harriet, Mzee Byenkya and Mary allows us to understand and document the everyday realities of health, farming, and urban work, and to learn how antibiotics fit in these spaces. The story of Harriet shows us that unlike the narratives from the reports written thousands of miles away that state that 'people are eating antibiotics like sweets', that rather these medicines are substances for Harriet and her family that are woven into the care she is responsible for providing to herself and to her family, amidst acute uncertainty and chronic precarity. Mzee Byenkya's reliance on an antibiotic to fix the illness that threatens to interfere with his poultry production business indicates that the traditional roles of antibiotic medicines are revolutionizing everyday life. With precarious livelihoods in quick farming, antibiotics offer a crucial sense of stability and continuity of farms without which financial investments and livelihoods are at risk. Just like Mary, many other people we studied are in unstable economic standing, engaged in precarious employment and most of the time unable to afford their basic needs, let alone a full course of antibiotics. Her experience demonstrates the complexity of a singular act of taking medicine and shows how antibiotic use can be influenced by many things happening in the background. The vignettes challenge the narrative of "irrational" medicine use, instead bringing to the fore how individuals may find themselves in situations where-antibiotics are tightly entangled in daily functioning and survival even when it involves taking an incomplete dose of antibiotics.

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Case study 3.3: Understanding the social lives of antibiotics in the informal sector in Bangladesh

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Introduction

In the context of the global emerging crisis of Antimicrobial Resistance (AMR), Bangladesh is particularly vulnerable due to the unregulated use of drugs within the large informal health sector. It is impossible to ignore the informal health sector in South Asia, therefore in-depth understanding of it is unavoidable (Nahar *et al.*, 2017). Here we provide a case study from Bangladesh of social science approaches to AMR. These findings are based on in-depth interviews with 48 healthcare providers ranging from fully qualified medical doctors and veterinarians to unqualified drug shop owners in the human and animal sector. Full details of the study and research methods are reported elsewhere (Rousham *et al.*, 2019; Lucas *et al.*, 2019).

In Bangladesh, the informal sector makes up a quarter of private-sector healthcare provision. There are an estimated one hundred thousand licensed and a similar number of unlicensed retail drug shops. Unqualified health providers supplement the shortage of qualified health workforce, especially among the poor and in disadvantaged areas. Regulatory enforcement is relatively weak due to the limitations in human, technical and logistic capacity. The presence of a high number of retail outlets, unregulated drug shops, over-the-counter sales, and a "pluralistic" health system –where people use different types of health systems in parallel – compounds the complexity of AMR.

Although the mechanisms which lead to antimicrobial resistance are biological, the conditions promoting, or influencing these biological mechanisms are profoundly social. Therefore, both the problems and solutions of AMR are viewed as social issues, which need to be understood through social practice (Chandler and Hutchison, 2016). Given this context, we conducted a study to explore the pathways of use of antibiotics for humans and animals in Bangladesh using a medical anthropological conceptual framework established as "Social Lives of Medicines". This framework considers medicines as "things" that have active social lives in today's world through their dissemination (Whyte, van der Geest and Hardon, 2002). Medicines move from one meaningful setting to another; they are commodities with political and economic significance. The idea of "Social Lives of Medicines" is more concerned with medicine's social uses and consequences than with their chemical structure and biological effects. "Social Lives of Medicines" focuses on medicine's production and marketing, its prescription, its distribution through intertwined formal and informal channels, its "death" through one or another form of consumption, and finally its "death" in the form of efficacy in modifying bodies (Whyte, van der Geest and Hardon, 1996). This framework helps us to understand some of the social factors affecting the AMR crisis in Bangladesh since it focusses less on individual behaviours, and more on the structural processes that drive inappropriate

antibiotic use with the potential to identify future interventions (Whyte, van der Geest and Hardon, 2002). This conceptual framework also hinges on the concept of the "socialisation" of antibiotics, meaning the framework explains how antibiotic integrates and forms social bonds within local communities and wider society. Our study explores the understanding of antibiotic provision by tracing the product through its various stages of socialisation—in particular at moments of production, distribution, marketing, prescription, knowledge and awareness, and consumption—among qualified, semi-qualified and unqualified health practitioners in rural and urban Bangladesh.

Following are the brief presentation of the results. These sections are based on four upcoming papers, which are either under review or under preparation (Nahar and Rousham, Paper in progress a, b, c; Nahar and Rousham, under review).

Production

The production of antibiotics has some special features in Bangladesh. In the early 1980s a radical national drug policy restricted the expansion of multinational pharmaceutical companies in Bangladesh and strengthened the growth of local Bangladeshi pharmaceuticals (Reich, 1994). This gave rise to successful home-grown pharmaceutical companies, many of which went on to become multinational companies themselves. In parallel, however, other pharmaceutical companies producing low-quality drugs also mushroomed. This happened because the drug regulation policy and the application were and are still weak. Bangladeshi people are therefore at risk of AMR by consuming substandard antibiotics (Nahar and Rousham, paper in progress a,b).

Distribution

In Bangladesh, there are multiple channels for drug distribution including government distribution channels, channels from big to small companies, and from large retail markets to small drug shops. Because there are no uniform distribution channels, monitoring the ways antibiotics enter into society from the factory is very difficult. The informal health sector and availability of over-the-counter medicines provide a major outlet for companies producing low-quality antibiotics in Bangladesh (Nahar and Rousham, paper in progress a,b).

Marketing

The antibiotic needs to reach the society of the consumers to have a 'social life'. In Bangladesh, this socialization of antibiotics takes place through a robust marketing process. We observed that certain forceful socialisation processes take place for antibiotics through robust marketing. In Bangladesh, medicine advertisement is not allowed in the media. As a result, special "marketing personnel" have emerged in the form of "Medical Representatives" (MR). The pharmaceutical companies employ MRs to promote their medical products. In the context of competitive markets, the companies set targets for prescription generation for each representative through a Prescription Potential Index. In order to fulfil their target of antibiotic prescription generation, MRs influence doctors to prescribe antibiotics through cash or various other innovative, in-kind incentives. They also monitor the prescription patterns of doctors by taking snapshots of the prescriptions and reinforce the marketing where needed. This profit-making mechanism promotes over-prescribing and unnecessary dispensing and consumption of antibiotics which increases the risk of AMR (Nahar and Rousham, paper in progress a,b).

Prescription

If we track the pathways of the social lives of antibiotics, prescription it is the final phase of its socialisation. It is through a prescription that the antibiotics reach the hand of the patients. In addition to the formal written prescriptions by the doctors, there are various informal forms of prescriptions in Bangladesh. These informal prescriptions include verbal prescriptions, which are verbal instructions or advice about antibiotics given by the unqualified or semi-qualified providers instead of a written medium; reuse of prescriptions, where the same prescription, originally issued by a certain doctor, is used repeatedly by the dispenser for multiple different patients with similar complaints, and finally, self-prescription, where the patients themselves demand an antibiotic. It implies different kinds of socialization of antibiotics, as well as different forms of prescription, and will denote different kinds of social bonds with the community (Nahar and Rousham, paper in progress c).

Knowledge and awareness

Unqualified drug sellers have a significant role in the social lives of antibiotics in Bangladesh. The drug sellers' misunderstandings about antibiotics, therefore, can contribute to the rise of AMR. Knowledge about antibiotics among the unqualified drug sellers ranges from gross ignorance and promotion of irrational use to relatively well-informed knowledge and practice. Most drug sellers understand drug resistance as a "side effect" of antibiotics. However, many semi- and unqualified providers have a misconception regarding the functions of antibiotics (Nahar and Rousham, under review).

Consumption

The social life of antibiotics comes to an end when it is consumed by the patients or are disposed of. In Bangladesh, the end of life of an antibiotic will depend on local beliefs and practices. Purchasers and clients have various misconceptions about antibiotics, but as they want a quick recovery, they frequently buy antibiotics (Nahar and Rousham, paper in progress c).

Conclusion

This exploration of the social lives of antibiotics in Bangladesh reveals that there are challenges within all stages of life for antibiotics from production to consumption. To prevent the misuse of antibiotics, we believe the approach taken here, based on the work of the social lives of medicine, helps to understand the different stages antibiotics go through to "socialise" into the world. This perspective provides an entry into detailing monitoring mechanisms at these various stages. It is also important to standardise the training of providers and raise awareness among purchasers of antibiotics.

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4 SYSTEMS AND ENVIRONMENTS

Markets, food production, place, water, sanitation, healthcare systems, industry

Summary: This module provides insights in the dynamics and interactions related to the relevant systems that surround AMR, including the healthcare system, the pharmaceutical system, and the food system. Also, internal (e.g. economic incentives) and external (e.g. biophysical and environmental) influences upon these AMR related systems will be discussed.

Length: 1 day

Aims/objectives:

- Understand that there is a "system" which has its own rules and drive practices of people; not only their individual responsibility, but also context and systems which drive their behaviour
- Learn to define the relevant systems - e.g. healthcare system, pharmaceutical system, food system – and the (non-) human actors – stakeholders, regulatory mechanisms, economic incentives/markets, etc. - within these systems
- Understand the dynamics of these relevant systems – social movement? Formal and informal systems?
- Show how these systems are connected and interact
- Understand ways in which food production, health systems (hospital, clinic), and pharmaceutical industry influence AMR
- Recognize the role of biophysical and environmental influences

Content:

4.1 Introduction to systems

People are part of systems and environments. Systems not only enable but also constrain access. Often, technologies create enabling conditions. With respect to AMR, we distinguish three connected systems through which pharmaceuticals are circulating: healthcare systems, pharmaceutical systems, and food systems.

Note, however, that from an STS perspective, systems are also artificial. What is the boundary of one system and where does the other begin? Does it not depend on the position of the person analysing what the system "is"? Here again the notion of infrastructure introduced in Module "People and Publics" can be used. Philosophically, theory on systems must begin with an appeal to difference, as Luhmann (2006) has argued, specifically the difference between system and environment. Therefore, systems theory does not begin with a unity, a cosmology, a concept of the world or of being, or anything comparable. Instead, it begins with a difference; the system versus the environment. Furthermore, in social science, criticism has been voiced against "systems thinking", because systems have come to be associated with the highly

rationalized technological and institutional systems of the late twentieth century, and the concept of system has become synonymous with control and totalization (see Criticism of Systems).

4.2 Causalities

🎓 **Guest speaker / discussion**: To illustrate, identify actors in publics that are part of systems and environments in the infrastructures created/traced previously (Module 3). Invite a non-social scientist who has a position at the "system level". For instance, someone from a professional organization, like a general practitioner's (GP) association or an association representing farming industry. A panel discussion may be helpful here: "What are the priorities in AMR. How does your organization fit into AMR reduction? Things that go wrong and their complaints."

- **Food system**
  - 🔍 Stephanie Begemann. UK retail industry guidelines to farmers (food). Downstream industry is ruling the upstream: e.g. retail is posing standards of what farmers are doing. **[Case study 4.1]**
  - 🔍 Ellen Silbergeld. Chickenizing farms and food (2016) & Community-Associated MRSA: Sources and Pathways of Exposure (2011)
  - 🔍 Animals waste integrated into soils. Antimicrobial resistance in toxic waste: Blanchette, A. (2019), Living Waste and the Labor of Toxic Health on American Factory Farms. *Medical Anthropology Quarterly 33*, 80-100.

- **Healthcare system -** Ethnography of hospital units/ health facilities, including social and professional roles related to hygiene management (nosocomial infections):
  - 🔍 Hospital hierarchy **[Case study 4.2]**: Hospital culture and context, driven by power and hierarchy, shape the ability of healthcare workers to implement AMR interventions and policies.
    - 🕮 Charani, E., Ahmad, R., Rawson, T.M., Castro-Sanchèz, E., Tarrant, C., and Holmes, A.H. (2019). The Differences in Antibiotic Decision-making Between Acute Surgical and Acute Medical Teams: An Ethnographic Study of Culture and Team Dynamics. *Clinical Infectious Diseases 69(1),* 12-20.
    - 🕮 Chen, M., Kadetz, P., Cabral, C., and Lambert H. (n.d.). Prescribing antibiotics in rural China: the influence of capital on clinical realities. *Frontiers of Sociology.*
  - 🔍 Differences in antibiotic governance in professional healthcare between doctors, nurses, and pharmacists.
    - 🕮 Broom, A., Plage, S., Broom, J., Kirby, E., and Adams, J. (2015). A qualitative study of hospital pharmacists and antibiotic governance: negotiating interprofessional responsibilities, expertise and resource constraints. *BMC Health Serv Res 16*, 43.

- **Pharmaceutical system**
  - Research and development (R&D): R&D strategies are based upon profit profiles of products and define antibiotic pipelines.
  - Rebate schemes: pharmaceutical companies send sale representatives to veterinary practices to promote products and sell package deals. In most countries, veterinary practices are able to make deals with pharmaceutical companies in which sales of their products are rewarded. Some pharmaceutical companies make better deals on antibiotics than on, for example, vaccines, making it more attractive for veterinary practices to buy antibiotics than vaccines.
    - Kirchelle, C., Roberts, A., and Singer, A. (2018). Big Pharma has failed: the antibiotic pipeline needs to be taken under public ownership. Retrieved from: https://theconversation.com/big-pharma-has-failed-the-antibiotic-pipeline-needs-to-be-taken-under-public-ownership-126058
    - **Discussion:** Is this a "system" in this context?
      - According to the SIAPS (Systems for Improved Access to Pharmaceuticals and Services Program, 2014, p. v): "A pharmaceutical system consists of all structures, people, resources, processes, and their interactions within the broader health system that aim to ensure equitable and timely access to safe, effective, quality pharmaceutical products and related services that promote their appropriate and cost-effective use to improve health outcomes."

- **Economic incentives that keep the systems in place [Case study 4.3]:**
  Combatting AMR also calls for a trade-off between various economic interests. The fight against antimicrobial resistance will be lost without the right economic incentives, the right instruments for research and the right instruments for trade. Developing new drugs is a long-term process that needs long-term financial commitment. The majority of generic antibiotics are inexpensive, and the undervaluation of new antibiotics adds to the difficulties of justifying investment in antibiotics. Clearly, there are economic incentives that keep systems in place:
  - The economic incentives for instance underpin healthcare access and use of antimicrobials, as well as influence animal feed, Tetracycline, and crop sprays usage.
  - Including "perverse incentives" leading healthcare providers to prescribe, including for instance patient satisfaction (when the patients believe they are receiving "effective" treatment) or profits (e.g. in China intravenous antibiotics are prescribed to be able to charge for clinical services while the health facility cannot mark up the price of drugs)

- In some low-income countries, antibiotics are not cheap for those who need it, while they cost relatively little for consumers in high income countries
- Issues of generic versus non-generics
- Interdependence of the formal and informal system
  - 🕮 Van der Geest, S. (1988). The Articulation of Formal and Informal Medicine Distribution in South Cameroon. In S., Van der Geest & S.R. Whyte (Eds.). *The Context of Medicines in Developing Countries: Studies in Pharmaceutical Anthropology* (pp. 131-148). Dordrecht: Kluwer Academic Publishers.
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  - 🕮 Sciarretta, K., Røttingen, J., Opalska, A., Van Hengel, A.J., and Larsen, J. (2016). Economic Incentives for Antibacterial Drug Development: Literature Review and Considerations From the Transatlantic Task Force on Antimicrobial Resistance. *Clinical Infectious Diseases* 63(11), pp. 1470–74.

4.3 Geography and movement

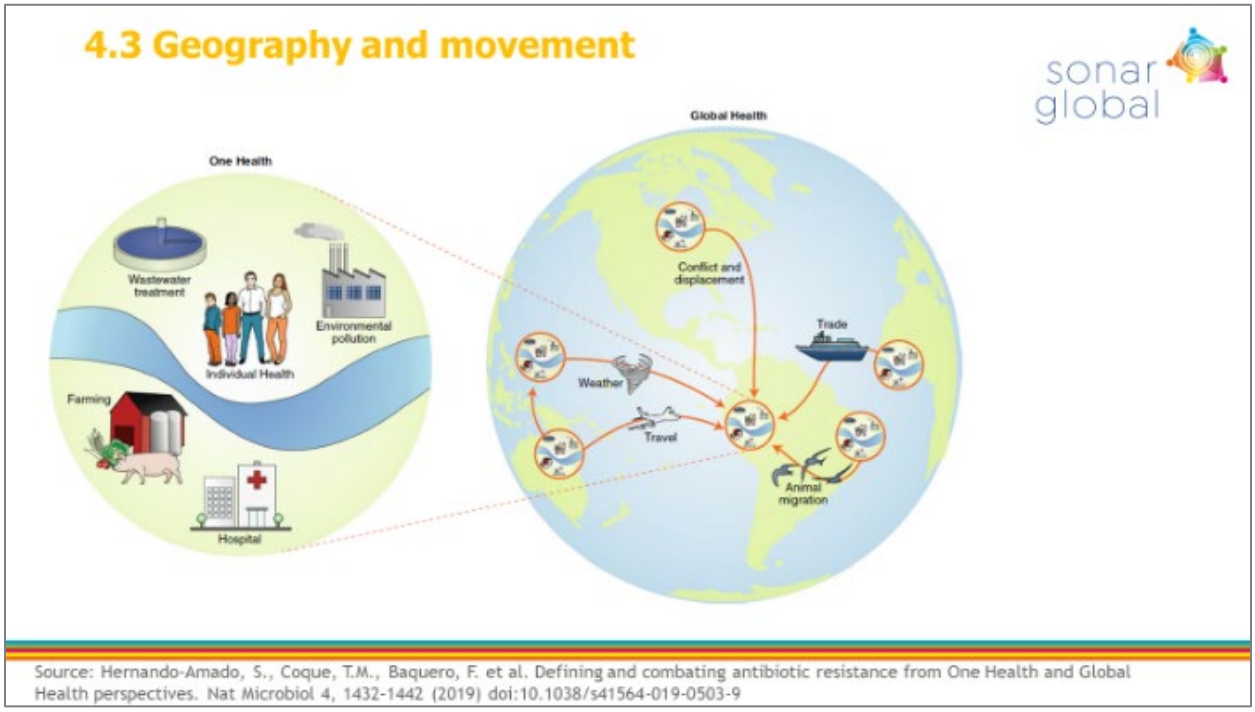
🎓 **Group work:** Have students reflect on how their own locality (system & environment) influences their understanding, possibly as part of their project. As trainer, try to bring out information about the contexts of the students.

- **Differences between countries** – regional/local context (inequalities)
  - Number of deaths due to AMR **[slide 3]**
  - Economic status and AMR **[slide 4]**
  - Antibiotic usage
    - 🕮 Charani, E., *et al.* (2019). Investigating the cultural and contextual determinants of antimicrobial stewardship programmes across low-, middle- and high-income countries—A qualitative study. *PLoS One 14(1),* e0209847.
    - 🌐 Special Eurobarometer 478: Antimicrobial Resistance (in the EU). The European Commission has conducted a Special Eurobarometer presenting EU citizens' awareness on antibiotics and how these are used by the citizens and in agriculture. While the results show a decrease of the use over the last 10 years, one-fifth of the population still takes antibiotics for the wrong purpose. Roughly 85% of Europeans are aware that unnecessary use makes them become ineffective.
      - 🎓 Students can use this to reflect on their own usage of antibiotics and compare with other countries. "If you have the flu, can you get better taking an antibiotic?" What is the general population knowledge on AMR? Why may

some countries do well, and others do poorly? Sweden and Finland typically do well. This is about numbers too; how facts are made and what thin reality they present.

- **Global transmission** - e.g. trade, migration
    - The One Health and global health axes of antibiotic resistance **[slide 19]**: "The transmission of AMR occurs at the local level across the borders between different ecosystems, such as farms, hospitals, wastewater treatment plants, and natural environments. This is a One Health problem, where the health of any of these ecosystems may affect the health of the others, including human health. One Health can therefore be understood as a "local version" of Global Health, which addresses communication among local ecosystems and the global conditions that facilitate the worldwide spread of AMR. This may occur through the global interchange of goods by human travellers migrating animals and even through the help of natural phenomena such as El Niño, which can expand the area for interchange among geographical areas. Corridors and bridges therefore exist that promote the globalization of gene spread, encouraging the appearance of similar microbial communities wherever the same processes occur." (Hernando *et al.*, 2019).
        - 🕮 Hernando-Amado, S., Coque, T.M., Baquero, F., and Martínez, J.L. (2019). Defining and combating antibiotic resistance from One Health and Global Health perspectives. *Nature Microbiol 4,* 1432–1442.
    - 🔍 McKenna, M. (2013). Antibiotic resistance: The last resort. *Nature 499,* doi:10.1038/499394a. "Health officials are watching in horror as bacteria become resistant to powerful carbapenem antibiotics — one of the last drugs on the shelf."

- **Physical environment** – antimicrobials end up in soil, water, and air, because of usage and production (waste)
    - 🔍 Taneja N., and Sharma M. (2019). Antimicrobial resistance in the environment: The Indian scenario. *The Indian Journal of Medical Research 149(2)*. "India has one of the highest rates of resistance to antimicrobial agents used both in humans and food animals. The environment, especially the water bodies, have also reported the presence of resistant organisms or their genes. Specific socio-economic and cultural factors prevalent in India make the containment of resistance more challenging."



Slide 19 trade and migration (partially identical to slide 13)

Pedagogical considerations:

- The previous module is very hands-on. There is a need to balance the previous module, so this module is more teacher oriented with less student involvement. It is important for the trainer to be clear about the shifts in level of analysis.
- Time for project development needs to be calculated into this module.

Reference:

- Luhmann, N. (2006). System as Difference. *Organization* 13(1), pp. 37–57.

Case study 4.1: Responsible antibiotic use in the United Kingdom dairy industry

Author

- Stephanie Begemann BVSc MVSc MSc – Post doc researcher University of Wageningen and former PhD researcher at the NIHR Health Protection Research Unit in Emerging and Zoonotic Infections, Institute of infection and Global Health, University of Liverpool.

Introduction

In this case study, I will present a summary of a chapter of my PhD thesis, discussing the UK's dairy supply chain governance of responsible antibiotic use.

In the United Kingdom (UK), the livestock sectors are expected to drive and standardise responsible antibiotic use across farmers in accordance with national and international guidelines (Department of Health, 2016). According to latest antibiotic sales data published by the UK's Veterinary Medicine Directorate (VMD) (UK-VARSS, 2019), the UK is reducing their antibiotic sales of food-producing species and is one of the better performers in the EU (Figure 1).

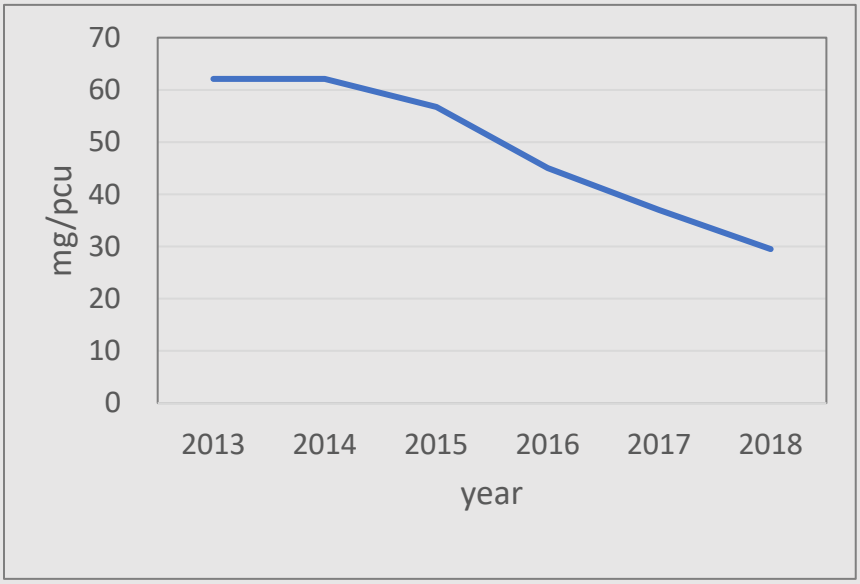


Figure 1: The UK's veterinary antimicrobial sales in mg/PCU 2010-2017 (UK-VARSS 2019)

In contrast with the pig and poultry industry, the UK dairy sector has only recently started to engage with responsible antibiotic-use activities. One explanation for this difference between livestock sectors is that according to the UK-VARSS reports published over the last decade, the dairy and other food producing sectors use significantly less antibiotics than the pig and poultry industry. The British media have also played an important role in shaping the debate (Morris, Helliwell, and Raman, 2016). The "factory farms" in the pig and poultry industry were framed as the most drugged-up food animal sectors (Fenton, 2016; Levitt, 2016). Less intensive farming sectors escaped public scrutiny, which allowed those sectors to continue with their antibiotic practices. However, the O'Neill reports of 2015 and 2016 and the UK Government policy response to O'Neill (2016) made all livestock sectors and their food supply chains responsible to govern responsible antibiotic use and to produce evidence of these activities. The aim of my study was to analyse how responsible antibiotic use was

rolled out in the UK dairy sector (Begemann *et al.*, 2019). For the purpose of this case-study, I confine the analysis to UK dairy supply chain actions.

Methodology

Using a constructionist approach (Green and Thorogood, 2004), I analysed how the UK's dairy supply chains developed antibiotic policies in accordance with their own concerns, interests, knowledges, and supply chain activities. A multi-sited ethnography was used to tackle the bounded territories of single-sited ethnographies (Marcus, 1995). This methodological approach enabled me to study how dairy antibiotics as "ethnographic objects of interest" were governed *across* dairy supply chain contexts: e.g. retailers, milk processors, farmers, farm assurance systems, dairy lobby groups, veterinarians (Latour, 2005). Ethnographers often employ a variety of qualitative methods, tailored to the demands of the research site(s) (Barbour, 2001). In this study, methods were used in a flexible manner in accordance with the sites of a multi-sited ethnography. This meant that in some sites I requested documents, interviews, observations, focus groups or a combination of these.

During the initial stage of fieldwork, my first research participant turned out to be a key informant, shaping the next steps I took in my research. This was a veterinary surgeon specialised in dairy herd health with links to a large retailer. Although the interview started off as a semi-structured interview with some key topics, we ended up talking about a variety of issues in the UK dairy industry that concern dairy antibiotic use. I learned about the complexities involved with regulating dairy antibiotic use, and the vet provided me with important actors, such as milk contracts, milk residues, milk prices, retailers, and milk processors. This key informant introduced me to other dairy supply chain stakeholders, such as a retailer, a dairy processor, a pharmaceutical representative and two lobby group representatives in his network. Through "snowball sampling", these participants introduced me again to other dairy supply chain stakeholders in their network who were willing to participate in my study. The same processed happened after recruiting three veterinarians through the University of Liverpool, via whom I was able to recruit more veterinarians (19), veterinary consultants (2), and veterinary practices across the country for fieldwork observation (for more information on the methodological approach see Begemann et al. 2019).

Responsible antibiotic use in the UK's dairy supply chains

In the UK, private food supply chain standards – the Dairy Red Tractor Farm Assurance Scheme*, milk processor milk contracts (75% of UK farmer population) and retailers milk contracts (25% of UK farmer population) – play a central role in definitions, expectations, and farmer practices of milk safety and quality. These private-led standards also include responsible antibiotic use standards, to be executed by farmers. Fieldwork data reveal that responsible antibiotic use standards and their practices are tailored to economic concerns in dairy supply chain contexts, rather than addressing concerns about AMR *per se.*

Milk processors concerns: milk residues

When medicines are used in food animals, they can leave residues in animal derived products that could pose potential harm to consumers. To protect human health against antibiotic residues in animal products, antibiotic withdrawal periods have been established for each antibiotic product (Council of the European Union, 1996). The antibiotic withdrawal period is the statutory period that should elapse between the last day of antibiotic treatment and the point at which the food-producing animal or its products enter into the food supply chain (FSA, 2016). Inside this statutory withdrawal period, food-producing animals or their products cannot be used for human

consumption. The main responsibility for antibiotic residue management in dairy lies with the milk processors (and is as such industry-led). Milk processors need to ensure as such that their milk is "safe" from medicine residues to keep the trust of official authorities (FSA) and the retailers they supply (FSA, 2015).

A representative of a dairy lobby group expressed that milk processors are since 2016 under pressure from the UK Food Safety Authority to improve their milk residue management. To milk processors, farmers are considered as the biggest risk to antibiotic milk residues. To improve responsible antibiotic use by farmers and to reduce the risk of antibiotic residues entering in dairy supply chains, milk processors started to implement antibiotic workshops, antibiotic training schemes, video's, and protocols. Some of the milk processors also incentivise the use of antibiotic self-test kits by their contracted farmers or use milk price penalising systems to make antibiotic use less attractive. Most of the UK's milk processors mainly rely on the Dairy Red Tractor Scheme to improve animal health and welfare. As such, economic concerns around antibiotic milk residues drive the focus of antibiotic policies instead of milk processors tackling structural problems on their contracted farms in the first place.

Evaluating how farmers implemented milk processor antibiotic policies, farmers identified the differences between artificial workshop settings and farm realities. While artificial "classroom" settings fostered communication and knowledge exchange between farmers it did not reflect the reality of working on a farm. As one farmer argued, "you need to get mud on the boots and get out there" when learning new farming practices. The milk processor SDCT protocols/workshops fail to address these farm complexities as they reduce antibiotic use into a technical performance. Equally, veterinarians argued how knowledge transfer tools such as protocols, training, and videos were not always adopted by farmers as expected by industry policymakers. Some vets argued how farmers simply refuse to change practices and find "all sorts of critique" to the teaching videos. Problematically, the findings of my fieldwork illustrate that the Dairy Red Tractor Scheme is a paper reality, rather than reflecting true practice. Most dairy supply chain actors require farmers to be Dairy Red Tractor farm assured, but farmers do not get financially rewarded in return. Consequently, farmers see the Red Tractor Scheme as a tick box exercise to get them milk contracts, rather than a mechanism they can use to innovate their farms. Finally, farmers might dispose of more milk in the environment rather than let milk residues enter the food chains, although the environmental AMR burden of this practice is yet, unknown. So, although milk processor policies might result in less antibiotic residues in the food chain, irresponsible antibiotic practices on the dairy farm continue with unknown veterinary/public health and environmental effects.

Retailer concerns: consumer profiles

To reduce media and consumer concerns, retailers need produce "evidence" of "responsible antibiotic use" activities in their supply chains. Importantly, there is a difference in consumer profiles between retailers: quality sensitive consumer profiles expect high milk quality standards and are willing to pay more for their milk, price sensitive consumer profiles prefer affordable priced milk. Each retailer has a certain consumer profile to which they adjust their products. With the issue of responsible antibiotic use, fieldwork data reveal how UK retailers align their responsible antibiotic use standards to their consumer profiles, rather than collectively addressing the issue. Due to media pressure (Harvey, 2017), most of the UK retailers were at the time of my fieldwork either designing or already implementing antibiotic surveillance systems. Retailers with quality sensitive consumer profiles were implementing *additional* antibiotic standards, which was supposed to increase

"responsible antibiotic use" and consequently, herd health (less use of antibiotics on farms means "healthier" herds). Similar as to milk processors, retailer economic concerns around dairy antibiotics drive the content of antibiotics standards.

During fieldwork observations and interviews, it became clear how industry stakeholders were aware of farmers "off the record" use of antibiotics. Farmers themselves revealed that farmers, as a group, have access to prescription drugs through their secret stocks, black markets, neighbours, and double milk contracts. Some of the farmers falsify records, as they are either afraid to lose their milk contract with retailers or as they want to belong to the best performers of the group. One farmer reported that he had seen a farmer losing his milk contract when he raised his opinion during a retailer meeting. The fear of losing their milk contract potentially pushes farmers to find ways to get antibiotics without prescription and recording. Problematically, the reliance of retailers on antibiotic surveillance data creates ignorance to practices outside the reality of data. At the same time, although antibiotic training and workshops were popular methods to inform policy, industry, and supply chain actors about policies, farmers saw attendance as an obligation associated with their milk contract. Farmers are evaluated whether they attend retailer meeting and workshops. As such, farmers will take the effort to show up at meetings. But instead of engaging with the knowledge-transfer programmes, some farmers see the retailer farmer meetings as a nuisance that disrupts their day. Although retailers then believe they have successfully transferred their policies through interactive sessions, farmers will continue with their daily routine practices. Finally, industry stakeholders were arguing how retailers use antibiotic standards to differentiate from each other, rather than unifying approaches. Fragmented farmer antibiotic practices with large differences in herd health performances across the country are the result.

Conclusion

The multi-sited approach of this study revealed how antibiotic policies and their practices differ across dairy supply chains sites. Rather than imposing knowledge upon the research field, I led research subjects (documents, sites, people) define their concerns and actions around dairy antibiotics. Fieldwork data shows how different antibiotic concerns of retailers and milk processors, situated in market interest, translates in a different policy focus. Consequently, this segregates the dairy farmer landscape in their antibiotic practices rather than unifying it. The different content and practices of antibiotic policies across the dairy supply chain can potentially impact how AMR develops and travels across systems. Even though there is awareness across the dairy supply chain that farmers very often do different things to what they say they do, antibiotic surveillance data of retailers and the latest annual UK-VARSS report of 2018 shows progress is being made and knowledge exchange programmes have been successful. This leaves structural problems in the agricultural networks of farmers that contribute to antibiotics to be unexplored.

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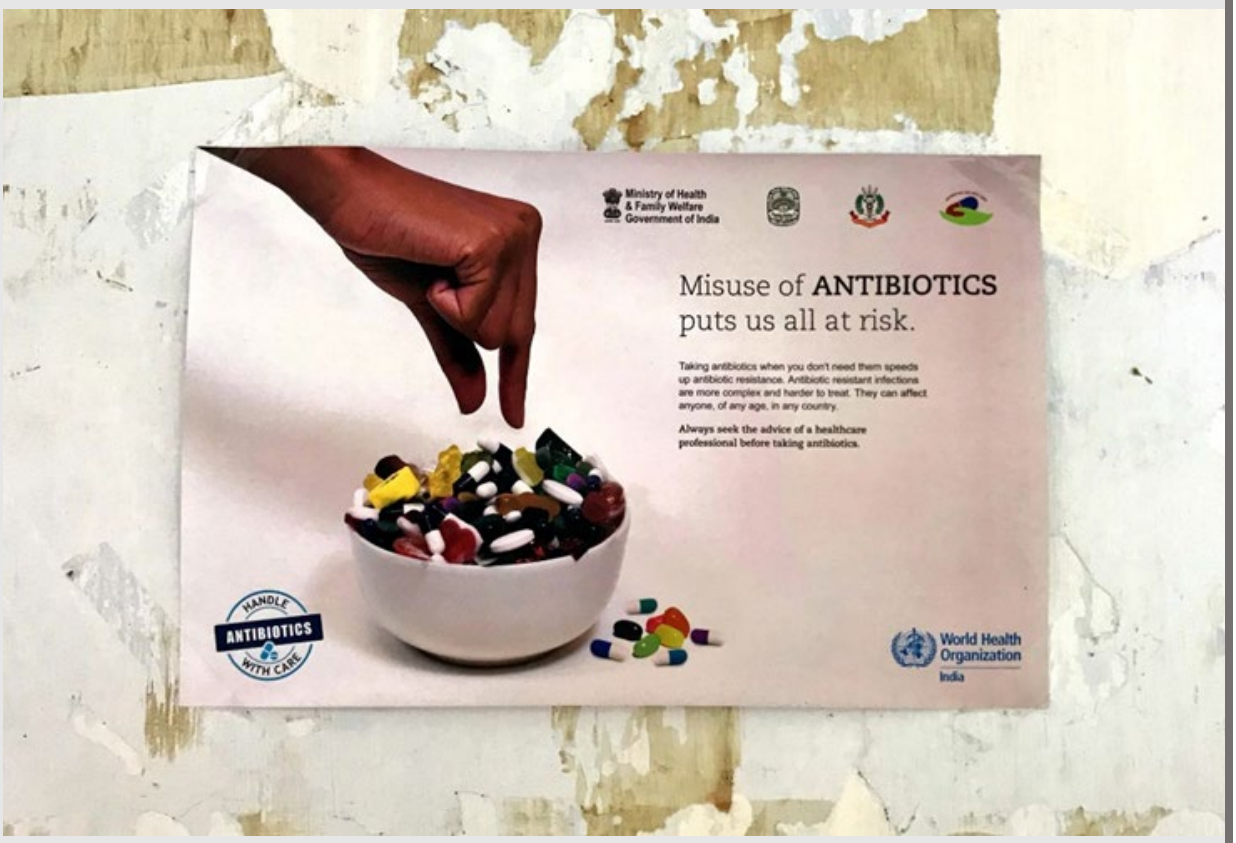
* To unify transparency across Farm Assurance Schemes, the British food industry introduced in 2000 the "British Farm Standard" known as the Red Tractor symbol. The Red Tractor standards are species- or product-specific and stand for production standards covering the harmonisation of animal welfare, food safety, traceability, and environmental protection across food producers (Red Tractor 2020). The Red Tractor Farm Assurance Scheme is voluntary which means farmers are not financially rewarded if they commit to the standards. In the UK dairy supply chains, farmers are required to be Dairy Red Tractor Farm Assured.

Case study 4.2: Why context and culture matter in antibiotic prescribing



WHO antibiotic awareness poster in Thiruvananthapuram Government Medical College Hospital, Kerala. (photo by Esmita Charani ©)

Author

- Esmita Charani PhD MSc MPharm - Lead Research Pharmacist at NIHR Health Protection Research Unit, Healthcare Associated Infections and Antimicrobial Resistance of the Imperial College London

Introduction

This case study reflects the outcomes of an in-depth ethnographic investigation on the influence of culture across the medical and surgical specialties on antibiotic prescribing behaviours in one hospital in London. Using ethnography and face to face interviews provided fresh perspectives on how culture and team dynamics influence antibiotic decision making across different healthcare settings and specialties. This animation summarises the findings of our study which opened opportunities for us to further investigate antibiotic use across surgical pathways in different settings. This ethnographic investigation coincided with a larger programme of studies investigating the influence of culture and team dynamics on antibiotic prescribing behaviours across different healthcare economies and cultures. This study took place in England, India, Norway, France, and Burkina Faso and investigates the challenges that healthcare professionals face across different resource settings when optimising antibiotic use in hospitals.

Identified problem

Interviews with stakeholders in 49 hospitals across 5 countries showed that optimising antibiotic use in surgery is seen as a challenge across the different professions and countries. This is reflected in the quotes below:

> *"The problem with the surgical approach is that daily input is required. It gives us opportunity as infection specialists to build rapport with the junior doctors and nurses in the surgical teams but the surgeons don't care about that. Infections in surgery are usually healthcare acquired, and so the surgical teams are happy for us to manage the infections for them. What I would like to see is the surgeons taking more responsibility for the infections."* Infection specialist – France

> *"People find it difficult to question the surgeons, and they also find it difficult to argue [with them], so this has come up a lot …that even if the therapy may not be appropriate, and there may not be any evidence of infection but the patient's improving, how can they argue against that?"* Infection specialist – England

> *"I think there is huge irrational antibiotic use in surgery, because I find most surgeons feel it is my patient which is at stake so I must treat him irrespective of cost or whatever stakes that are there, I really don't care about tomorrow. It's just like global warming isn't it? Like let me use it now, I don't know if this is going to come a million years later, we don't realise that some of those effects are for our children."* Surgeon – India

Aiming to describe and share the findings of the qualitative research with a wider community of people, we developed an animation. Using an animation as a platform to share the study findings was an exercise in highlighting the gaps in the language that we use to discuss antimicrobial resistance. This is critical, as even amongst healthcare professionals the concept of antimicrobial stewardship may not be well recognised. Whilst presenting our research to an audience of surgeons in Jaipur, India, only three out of the 40 individuals in the room had heard of the term antimicrobial stewardship. Therefore, in the animation we refrained from using such terms, trying instead to describe the problem through simpler language.

Proposed interventions

Throughout our research we have always had much interest in the qualitative approach to study decision-making across surgical and medical teams, and different healthcare professionals in different countries. The doctors, surgeons, pharmacists, and nurses have much to say about their experiences with antibiotic prescribing practices across different specialties, sharing with us the different challenges and resource limitations that they face. Despite the differences in workforce capacity, financial resources, and infrastructure across all the participating countries, a conscious effort is being made to improve antibiotic use in hospitals and to prevent infections. The interventions employed are diverse and include removing shoes before entering intensive care units (India – see picture below), or providing a standard uniform for all staff to wear in clinical areas (Norway), or develop local antibiotic prescribing policies (England). We set out to investigate the influence of different cultures across these countries on clinical practices. We found however, that culture can also be influential across professional and specialty boundaries.

Visitor and staff shoes outside the adult intensive care unit of the Amrita Institute of Medical Sciences, Kochi, Kerala. (photo by Esmita Charani ©)

Despite the availability of evidence-based guidelines and policy, anecdotally and historically, surgeons are considered the most difficult to reach specialty when it comes to infection management and antibiotic use. While guidelines and recommendations provide a road map to how and what needs to be done, they do not always address the complexity that is inherent in healthcare. Different healthcare professionals and teams are often working to different policies, targets, and end goals. It is important therefore to understand and accept that there are no universal solutions to the challenges encountered in complex healthcare systems. Culture is about the shared norms, values, and assumptions amongst groups of people and a better understanding of culture can help explain healthcare behaviours in the context in which they are observed. Our social science focused research has identified that non-interference with the prescribing decisions of others, acceptance of non-compliance to policy and hierarchy of prescribing whereby junior doctors prescribe are the overriding characteristic of antibiotic prescribing in hospitals. It is the senior members of the team, however, who decide what is to be prescribed for patients. Understanding culture and context is highly relevant when trying to understand how and why interventions and policies fail to be implemented as expected.

Conclusion

Through investigating antibiotic prescribing across surgical teams using intensive direct observations in England and India, we have identified that antibiotic management in surgery is complex. This is not

because there is less attention to infection management in surgical teams, but rather because of the different way in which surgical teams prioritise the care of their patients. Antibiotic prescribing in surgery is driven by a need to prevent infections following a surgical intervention. The surgical teams are divided between the very different environments of the operating theatre, outpatient clinics and inpatient wards. This dynamic is universal for surgical teams anywhere in the world. This requirement to be in different places means that often antibiotic prescribing decisions are delegated to other healthcare professionals. Additionally, effective antibiotic management is frustrated by diffusion of responsibility. The surgical teams, also because of the nature of their schedules and divided teamwork, are less likely to have the time to be able to engage with other healthcare professionals. What was compelling was the common theme in the way that surgical teams operate across different countries and settings. The findings allude to a common culture across medical practice that transcends geographical boundaries and is entrenched in the medical training of healthcare professionals and how patient care and well-being is prioritised across different specialties.

Further reading

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Case study 4.3: Antimicrobial resistance and externalities

Author

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Introduction

In economics antimicrobial resistance (AMR) is considered to be an externality which implies that the costs and benefits associated with the consumption of an antibiotic are unlikely to be felt directly by either the consumer or the supplier of the antibiotics, but has an impact on the overall welfare of the society.

In a free market, with no externalities, social cost is equal to private cost and social benefit is equal to private benefit. In this situation, social welfare is maximised when demand equals supply. However, in the case of antibiotics, consumption creates a situation where social cost and benefits would not be equal to private costs and benefits. This results in a welfare loss to society since the consumers and suppliers of antibiotics do not face the true cost of consumption. For example, although AMR impacts the current generation, its major effects are likely to be incurred by future generations. These future generations cannot influence the policy decisions which are taken in the present and so form an "inter-generational" externality. From a societal perspective, there are positive consequences from consumption of antibiotics e.g. it makes the patient feel better, reduces the risk of infection etc. However, it also has negative consequences in terms of the development of AMR. As a result of this, there is the need for a balance between meeting the present needs of patients for antibiotic treatment and preserving the effectiveness of antibiotics for sustained use in the future. Some of the economic and policy solutions for dealing with externalities associated with AMR include:

Taxes

Taxes are a tool that can help deal with the excess consumption of antibiotics by nudging the quantity consumed by society down in order to get back to the optimal levels. When a tax is imposed, the price of antibiotics would increase, and people would consume less of it. If the tax is set to the level of the externality in the market, it will offset the externality and the welfare of society is maximised. Theoretically, a tax is expected to reduce the consumption of antibiotics. However, this would depend on how high the tax is, how much money people have, and also whether there is an alternative which may be cheaper or more expensive. Other issues with taxes relate to how to set the tax at the right level and who will pay for the tax (patient, government etc.). In addition, demand for health may be inelastic (unresponsive to price changes) which implies that a very high tax would have to be placed on antibiotics for the quantity consumed to fall. Taxes may also lead to equity issues since poorer members of society may be priced out as a result of their inability to pay.

Permits

Permits are another mechanism that can be used to reduce the consumption/demand for antibiotics. With this approach, rules are set in order to limit the quantity that can be consumed for a particular period e.g. a year, a month etc. For example, geographical regions in a country could be allocated a certain number of permits based on factors such as population and underlying healthcare needs. Permits could be organised in such a way that doctors or hospitals could be incentivized to reduce antibiotic prescriptions to a regulated optimum level. There are also some challenges associated with

permits such as the possibility of buying and selling permits. In addition, permits do not directly address the problem associated with inappropriate use of antibiotics and there is also the added difficulty associated with monitoring and policing the permits.

Education of the public and influencing prescribing behaviour

One of the mechanisms that can be used to reduce consumption of antibiotics to optimal levels would be massive educational campaigns which would involve informing the public about when it is appropriate and when it is not appropriate to use an antibiotic. Such campaigns involve convincing the public not to demand antibiotics from their doctors or purchase them over the counter. It is believed that this policy would help tackle the unnecessary use of antibiotic e.g. in cases where the infections are viral or self-limiting and could help reduce consumption to optimal levels. Campaigns that are aimed at influencing prescribing behaviour through interventions which provide social norms such as prescribing levels that are socially acceptable could also help reduce the consumption of antibiotics to the optimal levels.

Conclusion

In economics antimicrobial resistance is considered to be a negative externality which results from the consumption of antibiotics and as a result, economic policies such as taxation and permits could be used to help reduce the overconsumption of antibiotics. However, the main issue is how best to design these policies for them to be effective. Theoretically, taxes and permits may be an effective option, but the question is how much the tax should be and who bears the burden. Also, there are issues relating to how to monitor and police the permits. In designing effective strategies for dealing with the problem of antimicrobial resistance, a lot can be learnt from how other similar challenges such as climate change have been dealt with. Economics offers a range of potential solutions to the externalities that arise from the overconsumption of antibiotics and there is the opportunity for future research into how economics can best contribute to the debate on controlling antimicrobial resistance.

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5 INSTITUTIONS AND POLICIES

Procedures, governance, and regulation of AMR

Summary: This module explains how AMR policies are made and implemented by different types of actors and institutions at various levels. It explores AMR policymaking at the local level (e.g. in a hospital and in the food production sector), at the national level (e.g. in governmental bodies), and at the global level (e.g. in international and global institutional settings, such as in the fora of WHO, FAO, and OIE). The module puts emphasis on how the framing of AMR as a "problem", a "risk" or sometimes a "threat" informs the subsequent policy response.

Length: ½ day

Aims/objectives:

- Review and contextualise AMR policies and policymakers at regional, national, and global levels in the field of AMR
- Give an overview of the ongoing debates around the potential of governance for solving the AMR problem
- Understand the importance and implications of how AMR is framed
- Highlight power relations, both in terms of "global governance" or at more local levels when we analyse dynamics in hospitals (e.g. stewardship).

Content:

5.1 History of antimicrobial (resistance) regulation

History of regulation for instance in terms of access to medicines across human and animal sectors, including regulations for surveillance:

- 🕮 Kirchhelle, C. (2018). Swann Song: Antibiotic Regulation in British Livestock Production (1953 – 2006). *Bulletin of the History of Medicine 92(2),* 1–51.
- 🕮 Podolsky, S.H. (2018). The evolving response to antibiotic resistance (1945-2018). *Palgrave Communications 4*, doi:10.1057/s41599-018-0181-x
- 🕮 Bækkeskov, E., Rubin, O., Munkholm, L., and Zaman, A.W. (2020). Antimicrobial Resistance as a Global Health Crisis. In E. Stern (ed.) *Oxford Encyclopedia of Crisis Analysis*.

5.2 Global policies – the potential of global governance to regulate AMR

Many governments have developed national AMR action plans, but most have not yet implemented policy interventions to tackle AMR (including the reduction of antimicrobial "overuse"). Need for multisectoral/intersectoral coordination is desired. **[Case study 5]**

- Explanation of tripartite WHO/FAO/OIE

- Identify other supra-national networks: World Trade Organisation (WTO), private – public sector partnerships, etc.
    - 🌐 The World Health Organization (2015). Global Action Plan for AMR. Geneva: WHO Press. At the sixty-eight World Health Assembly in May 2015, the World Health Assembly endorsed a global action plan to tackle antimicrobial resistance, including antibiotic resistance, the most urgent drug resistance trend.
    - 🌐 Global open-access tripartite antimicrobial resistance database. This database provides access to information on the status of countries' regarding the implementation of the global action plan and actions to address antimicrobial resistance across all sectors.
    - 🕮 Rodgers van Katwyk, S., Grimshaw, J.M., Nkangu, M., Nagi, R., Mendelson, M., Taljaard, M., and Hoffman, S.J. (2019). Government policy interventions to reduce human antimicrobial use: A systematic review and evidence map. *PLoS medicine 16(6),* e1002819.
    - 🕮 Rubin, O. (2019). The glocalization of antimicrobial stewardship. *Globalization and Health 15*, 54. This brief commentary argues that "glocal" governance introduces a fruitful new perspective to the global governance debate of AMR, and cautions against too strict a focus on establishing globally binding governance regimes for curbing AMR.

5.3 National policies

- How do global policy ideas about AMR transfer to countries? How do national policies shift into context? The **transfer of policy ideas** across countries and political systems is common. However, when we think of such policy transfer or diffusion, there is not a perfect rationality of actors. There is often a lack of stability of governance scales and ideas potentially change during their journey into new contexts. These dynamics can be theoretically approached as the process of policy translation (Callon, Lascoumes, and Barthes, 2009).
    - 🔍 Lambert, H. (PI). Regulating resistance, resisting regulation: New regimes to tackle drug-resistant infections in European and Asian healthcare systems. Comparative case study to understand the social and systemic implications of regulation and the effects of regulatory change on the recording and reporting of official data used to assess the effects of such change.
- Practices of **national policies**: e.g. cultures of resistance, implementation constraints, discourse & framing, community engagement, and the influence of collective actions and social movements. National action plans follow the global governance plan, but the translation is very difficult and largely top-down and donor driven which usually does not cohere with the national/local needs.
    - 🕮 Begemann, S., Perkins, E., Van Hoyweghen, I., Christley, R., and Watkins, F. (2018). How political cultures produce different antibiotic policies in

agriculture: a historical comparative case study between the UK and Sweden. *Sociologica Ruralis 58(4),* 765–785.

- 🕮 Landers, T.F., Cohen, B., Wittum, T.E., and Larson, E.L. (2012). A review of antibiotic use in food animals: perspective, policy, and potential. *Public Health Reports 127(1),* 4-22.
- 🔍 Case study of successful program: A core strategy for controlling resistance is to coordinate efforts through a national action plan. In Sweden, such a plan was first developed in 2000. It built on the work of the Swedish strategic programme against antibiotic resistance, known as Strama, a nationwide structured and continuously evolving collaboration against antibiotic resistance that has been in place since 1995. This led to massive reduction in usage.
- Sonar-global is planning **community engagement** activities in Bangladesh and Ukraine, updates on these activities and community engagement tools can be found here.

5.4 Local policies

- **Hospital level** – stewardship models
  - 📹 Esmita Charani explores the use of animation to promote the role of social science research as a tool for engagement with healthcare professionals on antimicrobial stewardship.
  - 🕮 Smith, R.D., Coast, J., Millar M.R., Wilton, P., and Karcher, A.M. (2001). Interventions against antimicrobial resistance: A review of the literature and exploration of modelling cost effectiveness. Geneva: Global Forum for Health Research.
- **Veterinarian/farmer level** – regulation of food production?
  - 🕮 Fynbo, L. (2018). My Life as a Pig: MRSA and the Control of Life in Contemporary Pig Production. In C.S. Jensen, S.B. Nielsen, and L. Fynbo, (eds). *Risking Antimicrobial Resistance.* London: Palgrave Macmillan.
  - 🕮 Jensen, C.S., et al. (2018). Social Stigmatization of Pig Farmers: Medical Perspectives on Modern Pig Farming. In C.S. Jensen, S.B. Nielsen, and L. Fynbo, (eds). *Risking Antimicrobial Resistance.* London: Palgrave Macmillan.
  - 🕮 Van Dijk, L., *et al.* (2016). Participatory Policy Making by Dairy Producers to Reduce Anti-Microbial Use on Farms. *Zoonoses Public Health* 64(6), pp. 476-484.

5.5 Framing of AMR

- Explain **AMR framing** as the way individuals, groups, and societies think about origins, importance, and the unfolding of AMR, which indirectly also defines the communication and agenda setting around this topic. A *frame* defines the packaging of an element of rhetoric in such a way as to encourage certain interpretations and to discourage others. For *political* purposes, *framing* often

presents facts in such a way that implicates a problem that is in need of a solution. This is usually defined by the relation between knowledge, policy, and power. AMR has been framed in several ways - ranging from a healthcare, to a development, an innovation, a security or a One Health issue - depending on the views, values, interests, and goals of the stakeholders or disciplines that push them forward. These frames highlight different explanations and causes of the AMR problem and subsequently also shape different ways to intervene. In order to support policy progress, it seems beneficial to integrate these different frames and to strive for overarching, multi-sectorial management (Wernli *et al.,* 2017; Khan *et al.,* 2019).

- 🕮 Wernli, D., *et al.* (2017). Mapping global policy discourse on antimicrobial resistance. *BMJ Global Health* 2, e000378.
- 🕮 Khan, M. S., Durrance-Bagale, A., Legido-Quigley, H., Mateus, A., Hasan, R., Spencer, J., & Hanefeld, J. (2019). 'LMICs as reservoirs of AMR': a comparative analysis of policy discourse on antimicrobial resistance with reference to Pakistan. *Health policy and planning*, 34(3), 178-187.

- Discuss **discursive power of global language**: to problematize epidemics and subsequently summon into existence an "imaginary" consensus how to govern them. AB "misuse and overuse" across human and agricultural settings is widely accepted today as the main human driver that could potentially accelerate AMR in organisms and the environment (WHO, 2015). With nations collectively agreeing on this risk narrative, it is made governable, nationally, and globally (Leach and Dry, 2010). This is supposed to foster a coordinated approach to face the chaotic and disorganised landscape of AMR by prioritising policies that tackle livestock AB "overuse and misuse".
  - 🕮 The World Health Organization (2015). Global Action Plan for AMR. Geneva: WHO Press.
  - 🕮 Leach, M., and Dry, S. (2010). Epidemics Science, Governance and Social Justice. London and New York: Earthscan.

- Analyse the **political framing** of selected AMR frameworks/actors:
  - World Trade Organization (WTO)
  - R&D/ Public-private partnerships (PPPs) /private sector
  - Tripartite WHO/FAO/OIE
  - European Centre for Disease Prevention and Control (epidemiological)

🎓 **Group work:** Analyse the political framing of actors in the chosen infrastructure case studies from the Module People & Publics.

Pedagogical considerations:

- **Group work:** This exercise should emphasise that policies are developed at various levels and are not only translated top-down. In order to let that come across it is advised to divide sections 5.2, 5.3, and 5.4 amongst three smaller groups that each will look at the suggested resources of their section and present the following questions in a presentation to the rest of the group: Who are making policies? What is the scope? What are the objectives? How are they being implemented? By whom? And with what results? Section 5.1 will then serve as an introduction and the last section (5.5) on framing can be used as a wrap-up.
- **Motivate:** It is also important to acknowledge and problematize different perspectives, instead of pushing one over the other. For example, is "global governance" the way forward? What about unintended consequences (e.g. antibiotic policies and practices that "co-produce" new social and natural orders of AMR – such as farmers that meet standards on paper, but do not change their practice - which potentially produce new public health risks)? Show the potential of social sciences to contribute knowledge in the discussion (e.g. by taking antibiotics as centres of interest and by studying their ethnographic trajectories). Students are not here to govern, but to get inspired to use social sciences to contribute to policy questions.

Reference:

- Callon, M., Lascoumes, P., and Barthes, Y. (2009). *Acting in an Uncertain World: An Essay on Technical Democracy.* Cambridge, MA: MIT Press.

Case study 5: Taking Global Action to Reduce Antimicrobial Resistance

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Introduction

Biological and epidemiological sciences have studied microbes' development of resistance to antimicrobial agents since the early part of the twentieth century. Yet, global governance responses to antimicrobial resistance (AMR) only began to gain momentum much later. In his authoritative historical account of AMR, Scott Podolsky (2018) identifies the period from 2013 to the present as particularly important in setting the issue on the global agenda for political action. A handful of countries began from the 1970s and onward to make policies to restrict and regulate antibiotic use, as well as to raise healthcare professionals' and public awareness about appropriate uses of such medications. But while highly successful in curbing AMR, these efforts were mostly made by small to medium-sized states in Northern Europe. The intervening decades have seen growing agreement among public health experts and professionals that mitigating AMR requires coordinated and collective global action. While the need for global coordination to fight AMR might seem obvious, it is, however, very difficult to achieve. Indeed, the latest report from the Interagency Coordination Group on AMR to the UN Secretary General makes clear that AMR is faced with inadequate political commitment and that existing global efforts "are currently too slow and must be accelerated" (IAGC, 2019, p. 6). The complexity of AMR impedes a strong global governance regime and current (as of 2020) global initiatives consist mostly of broad aims and guidelines rather than formal treaties with binding obligations and quantifiable targets. In legal terms, they constitute soft international law rather than hard law instruments, and these softer approaches have been argued to cause little political commitment and progress when it comes to fighting AMR.

The Global Action Plan on AMR

The Global Action Plan (GAP) on AMR illustrates one of the current efforts of establishing global concerted action aimed to reduce the emergence and transmission of AMR. The GAP was recommended in September 2013 by the World Health Organization (WHO) Strategic Technical Advisory Group on AMR, and the recommendation was subsequently adopted in May 2014 as a World Health Assembly resolution. Hence, the WHO started drafting the GAP together with the Food and Agriculture Organization of the United Nations (FAO) and the World Organization for Animal Health (OIE). The GAP was endorsed in May 2015 by the WHO's 194 member states which were urged to develop and implement national action plans (NAPs) on AMR by 2017 modelled by the GAP's guidelines. The GAP presents five strategic objectives. These include:

1. Improving awareness and understanding of AMR through effective communication, education, and training
2. Strengthening situational information through surveillance, and research
3. Reducing infection incidences through infection control and hygiene measures
4. Better and more appropriate use of antimicrobials
5. Developing sustainable investment in new medicines, diagnostic tools, vaccines together with other interventions (WHO, FAO, & OIE, 2015)

National Action Plans on AMR

As of 31 January 2020, 135 countries report to have developed national action plans (NAPs) to combat AMR, while 50 countries are still in the process of developing one (WHO, 2020). We conducted a systematic content analysis of existing NAPs to explore levels of alignment, both vertically and horizontally (Munkholm and Rubin, forthcoming). Vertical alignment was measured by the extent to which each NAP overlaps with the GAP. Horizontal alignment was explored by measuring the degree to which NAPs overlap within regions and income groups. We found clear income patterns. For instance, low-income countries (LICs) and lower-and-middle-income countries (LMICs) show promising patterns of participation with a very high degree of alignment between their NAPs and the GAP. In comparison, several upper-middle-income countries (UMICs) and high-income countries (HICs) have produced NAPs with much more limited reference to the policy initiatives called for in the GAP. Thus, the poorer the country, the more it seems to share syntax and content with the GAP. One reason for this might be that the GAP has been produced for LICs and LMICs to push forward activities for mitigating AMR challenges in these countries. However, the pace in which the vast majority of NAPs have been produced combined with the breadth of participating member states establish the conditions for what can be called *isomorphic mimicry* where agenda conformity is preferred over actual action (Andrews, Pritchett and Woolcock, 2017). In fact, very few countries have implemented their NAPs (WHO, FAO, & OIE, 2020), most likely because of different types of capability traps and/or conflicting political concerns. For instance, for many LICs and LMICs, access to antibiotics is a bigger societal problem than AMR (Rochford *et al.*, 2018).

Conclusion

There is a need for new strategies that allow countries to formulate and implement AMR policies that respond to their specific challenges. One way forward is to strengthen political commitment by supplementing the international guidelines of the GAP with binding international agreements. It has been suggested to get inspiration from recent climate agreements such as the Paris Climate Agreement which represents a type of legally binding agreement with "individualized responsibilities" allowing each country to commit to individualized targets and actions determined at the national level but informed by a common global goal (Van Katwyk *et al*., 2020). It is vital that the AMR policy process does not merely lead to nationally "routinized responses in the form of tick-the-box activities that are designed to produce surface compliance" (Guinn and Straussman, 2019, p. 1725). Next steps for global action to reduce AMR must aim for strengthening the policy process by developing new governance tools rather than focusing more narrowly on pushing forward national implementation of the GAP, which could risk reinforcing a regime of agenda conformity where policies are mainly developed for the consumption of international organizations.

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6 TRANSFORMATIONS

Interventions, changes, impact, dissemination, problem solving, tools

Summary: This module starts to integrate lessons learned from the previous modules. It works towards practical applications. Students are invited to look at different levels of transition and discuss the roles of social scientists in design and evaluation of AMR research or interventions. Also, the collaboration between social scientist and non-social scientist will be covered. This will be done by critically looking at different examples in order to analyse challenges and opportunities.

Length: ½ day

Aims/objectives:

- Understand how social science approaches can contribute to transformation and change in relation to the AMR challenge
- Students are encouraged to work through a scenario, think out of the box, and start developing a vision regarding their own future engagement with the topic

Content:

6.1 Levels/types of transformation

The complexity of AMR means that transformations have to be multilevel. In this curriculum we have deepened our learning by looking at four levels of analysis:

- Microbes & Resistance level– the level of bacterial evolution
- People & Publics level – this level is dominated by behavioural change, individualistic intervention models
- Systems & Environments level – food/health/pharmaceutical systems
- Institutional level – policy
  - 🎓 A question for further **discussion** is to think about how these levels are intertwined when we look at specific AMR challenges, such as prescription levels.

6.2 What does social science bring to the design/ implementation/ evaluation of interventions that is new?

🎓 List various roles social scientists can take; become part of a team that does applied work. **Discuss** roles, boundaries, and tensions between preferred/instrumental role and issues of power.

- **Social science methods and research designs** relevant to AMR, including models for costs effectiveness. What has been used, what works best?
  - 🕮 Smith, R.D., Coast, J., Millar, M.R., Wilton, P., and Karcher, A.M. (2001). Appendix E Interventions against antimicrobial resistance: A review of the

literature and exploration of modelling cost effectiveness. Geneva: Global Forum for Health Research.

- **Implementation science or operational science [Case study 6]** - is the study of methods to promote the adoption and integration of evidence-based practices, interventions, and policies into routine healthcare and public health settings. What is needed to bring about *transformation* in the domain of AMR?
- Point of **discussion:** Implementation science is also a label that "technifies" applied social science work as if they are engineers for community engagement or health communication. The extent to which this is beneficial to social sciences could be a point of critical discussion.

6.3 Collaborations with social and non-social scientists

Interdisciplinarity – what is it? How to bring in other disciplines outside of social science to solve the AMR problem? How to overcome issues of language, epistemological, and ontological differences between disciplines, different scholarly networks, and publication venues. Trends towards interdisciplinarity in general.

- **Point of discussion:** how can social scientists contribute to the communication/dissemination of research findings or intervention outcomes among different disciplinary audiences?
  - Roadmap H2020 project: promotion of prudent antimicrobial use in animals by engaging animal health professionals, stakeholders, and policymakers to develop tailored strategies for change.

Pedagogical considerations:

- Case studies as examples of the topics to describe the contribution of social sciences (6.2) and to analyse the collaboration (6.3.). For example:
  - It may be of interest to look at historical cases of transformation that did not include social sciences. For example, the AWaRe campaign.
  - Example of social science contributing to potential change through innovative stakeholder engagement project: Hinchliffe, S., Butcher, A., and Rahman, M.M. (2018). The AMR problem: demanding economies, biological margins, and co-producing alternative strategies. *Palgrave Communications 4*, 142. doi:10.1057/s41599-018-0195-4
- Work on own project – built in transformation scenarios

Case study 6: Non-prudent use of antibiotics in the European Union – turning research into action using *a multidisciplinary approach*

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Introduction

Antimicrobial resistance (AMR) is an increasing worldwide public health problem with important implications for the European Union (EU). When antibiotics become ineffective, bacterial infections lead to increased use of healthcare, morbidity, mortality, and costs. Globally, estimates suggest that AMR leads to 700 000 deaths per annum (O'Neil, 2016). For the EU, the European Centre for Disease Prevention and Control (ECDC) has estimated that AMR currently causes 25 000 deaths annually and losses of at least EUR 1.5 billion per annum in extra healthcare costs and productivity (ECDC/EMEA, 2009).

An important driving force behind AMR is the non-prudent use of antimicrobial agents in both humans and animals. Several reports have been published in recent years (O'Neil, 2016; Paget, 2017; WHO 2015; United Nations, 2019) that outline measures to reduce the consumption of antibiotics and a variety of actions have been proposed, including global awareness campaigns, increasing financial resources for infectious diseases in the healthcare sector, the development of new antibiotics, and policies aimed at the reduction of antibiotic use in both humans and animal.

Considering the nature of the problem, the European Commission funded the ARNA project (**A**ntimicrobial **R**esistance and causes of **N**on-prudent use of **A**ntibiotics in human medicine in the EU) and requested a mixed methods study that was implemented by social scientists. The core ARNA team at Nivel included two sociologists, an epidemiologist with a social science background, and a general practitioner.

Problem setting in the European Union

Worldwide, the focus of research and policy actions has been on prescribed antibiotics, with much less attention paid to the human use of antibiotics without a prescription. The use of antibiotics without a prescription represents a non-prudent use of antibiotics because of its lack of medical guidance leading to inappropriate use and antibiotic resistance.

Data from the 2013, 2016, and 2018 Eurobarometer surveys (Eurobarometer, 2018) suggest that the proportion of antibiotics that were used without a prescription increased from 5% of all antibiotics used in 2013 to 7% in 2016. This proportion remained stable at 7% in 2018. However, rates varied across EU Member States. The highest rates were found in Romania (20%, 2016), Greece (16%), and Cyprus (10%), both in 2013 and in 2016. In 2018 Romania was still the country with the highest proportion of self-obtained antibiotics, but the proportion decreased to 15%. Austria and Bulgaria completed the 2018 top 3 (15% and 14% respectively). The proportion of antibiotics without a prescription decreased in Greece and Cyprus. The two prevailing sources of antibiotics without a prescription were over-the-counter (OTC) selling in pharmacies and the use of leftover antibiotics.

The NIVEL ARNA project was established to:

1. Identify key factors that drive the sales and non-prudent use of antibiotics in human medicine obtained without a prescription
2. Assess the level of enforcement of the legislation regarding "prescription-only" use of antimicrobial agents in the EU
3. Document good practices aimed at strengthening more prudent use of antibiotics
4. Develop policy options for more prudent use of antibiotics

The focus of the ARNA study was the following seven EU Member States: Cyprus, Estonia, Greece, Hungary, Italy, Romania, and Spain. These were countries with high levels of use of antibiotics without a prescription at the time the ARNA project was conducted.

ARNA: a social science assessment of non-prudent use of antibiotics

We devised a mixed method approach to assess the non-prudent use of antibiotics in Europe (Paget *et al.*, 2017):

A. Knowledge, attitude, and behaviour surveys. These were developed by NIVEL and implemented in all seven Member States to obtain detailed information about the non-prudent use of antibiotics among:
   - General population, including detailed interviews of patients who used antibiotics without a prescription
   - Healthcare workers: general practitioners (GPs) and pharmacists.

B. Online survey of the key stakeholders. This survey was carried out in all EU Member States:
   - An online survey among Ministries of Health and national experts to describe policy measures that EU Member States have taken on a healthcare-system level to enhance the prudent use of antibiotics. The survey also included information on measures and interventions not described in the literature.

C. Literature review on the determinants of antibiotic use without a prescription in the ambulatory care setting (Lescure *et al.*, 2018).

D. Expert meetings and consensus statements
   - An expert meeting with a group of 20 experts was organized to review and discuss the interventions that EU Member States could use to reduce the non-prudent use of antibiotics.
   - An international conference was organized to present and discuss the results. The conference was held on 17 June 2016 and a Conference Statement was published.

E. Country-dialogue meetings to engage with national stakeholders and prepare action plans. These meetings were held in six EU Member States (Cyprus, Greece, Hungary, Italy, Romania, and Spain). Each Member State had a local organizer and all the relevant stakeholders were represented at the meetings.

The Country-dialogue meetings typically lasted one day and were organized in a dynamic, pro-active manner. There were presentations by the ARNA team, break-out group discussions and presentations by the local stakeholders.

In countries where there was a National Plan to address AMR (like Spain), non-prudent use of antibiotics was discussed within the context of the plan, whilst in countries with no plan (e.g. Hungary and Italy), participants were asked to start developing a national plan to address the non-prudent use of antibiotics. On most occasions, it was the first time the stakeholders had gathered to discuss the issue of non-prudent use of antibiotics and formulate a multi-disciplinary plan for their country.

Conclusions

AMR and the non-prudent use of antibiotics are complex issues that can only be addressed via a multidisciplinary approach, including input from social scientists (e.g. to study the healthcare system, to assess behaviours and devise interventions and to assess the legal framework of antibiotic use). The ARNA project addressed the problem of non-prudent use of antibiotics from a social scientist perspective and generally approached the problem from three levels: a) the healthcare system level, b) the healthcare-professional level, and c) the patient level.

Policy recommendations were developed and then discussed in the country-dialogue meetings where all national stakeholders were present, including the Ministries of Health. The country-dialogue meetings were a moment where solutions for the problem were discussed by key stakeholders and a plan was developed for the next steps. Importantly, WHO Euro has adopted the ARNA approach and is now applying it in non-EU countries (e.g. Turkey, Ukraine, and Russia) where the non-prudent use of antibiotics is a much bigger problem than in the EU.

The ARNA project shows that social scientists can play an important role in addressing a medical public health problem. Importantly, we found that to develop a multidisciplinary approach that aims to have a long-term impact, one needs co-ordination at a national and/or regional level, and that this can be achieved via a multisector and multidisciplinary National AMR Plan.

Ideally, one would like to integrate a "learning cycle" into the process, something similar to the Quality Improvement Collaboratives (QIC). This would require continued funding of the ARNA project and collaboration with the selected countries over multiple years. Progress with the different policies could then be monitored over time, lessons could be learnt and shared, and long-term structural changes related to AMR could probably be achieved.

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7 FUTURE STEPS

Summary: This module provides future steps to take to facilitate the integration of the social sciences in AMR. Furthermore, on an individual basis it will be discussed how to move forward within the field. Suggestions are given for research themes, research centres/networks, and resources that can be explored.

Length: ½ day

Aims/objectives:

- Develop a research question and draft proposal
- Provide preliminary readings and keep them up to date (where to find essential readings)
- Adapt to the audience at hand

Content:

7.1 How to move forward with AMR

- What is the goal of your intended project, either research and/or intervention?
- What key funders and funding mechanisms may be relevant?
- What added value does your project provide?
- What methodology will you use for your project? Who is the target audience? Are there any ethical considerations?
- How do you integrate the need for interdisciplinarity?
- How to disseminate your findings to your audience(s)?

7.2 What research themes remain to be explored

- **Consolidation of AMR social science research**: Review bringing together findings from across the social research field on AMR to be able to learn what issues are pertinent across settings and to see what gaps remain in terms of knowledge.
- **Drivers of AMR transmission:** Understanding the complex "drivers" of transmission from a social science point of view (e.g. in infection control, WASH), including social science research on microbial relations and its emergence via the multispecies dimensions.
- **Alternatives to antibiotics (including diagnostic tests):** Develop better insight into alternative practices. This can for example be guided by a "social lives of medicines" approach that sees medicines as social and cultural phenomena with more than just biological effects on an individual body.
- **International pharmaceutical markets and regulation:** Insights in AMR related global trade and the circulation of medicines, generic antibiotics and "fake"

drugs, the outsourcing of production, and industry mediated access to medicines.

- **The relationship with infectious disease outbreaks:** Transmission of disease outbreaks have implications for AMR. How such outbreaks facilitate AMR, and what we can learn from outbreaks to address AMR.
- **Environmental/ecological dimensions:** To complement the attention to human healthcare, professional/patient behaviour, farmers and veterinarians, social science research is needed that looks at human practices/interactions in the environmental and ecological dimensions (e.g. related to WASH).
- **Linking AMR and environmental pollution:** Empirical studies on how antimicrobial waste is managed by different actors in healthcare, pharmaceutical industries, and food production to inform debates about linkages between environmental pollution and rising levels of AMR.
- **National regulatory approaches of antibiotic consumption:** Comparative studies of national regulatory approaches to the consumption of antibiotics in human, animal, and agricultural sectors.
- **Implementation of NAPs:** To complement self-assessment monitoring of National Action Plans (NAP), there is a need for externally evaluated single or comparative case studies on the implementation of (specific elements of) national action plans (NAPs) on AMR.
- **Transition pathways:** Develop more robust insights from transition studies that could guide reflections on change, transformation, and interventions related to AMR.
- **AMR social science interventions:** Describe and pilot social science interventions related to AMR (as described in Module 6).

7.3 How to keep up to date

Mapping of research centres and networks

- https://www.who.int/antimicrobial-resistance/news/newsletter/en/
- https://www.amr-insights.eu/category/news/
- https://amrcountryprogress.org/
- https://www.reactgroup.org
- https://amr.cgiar.org
- https://cddep.org/research-area/antibiotic-resistance/
- https://www.bristol.ac.uk/amr/
- https://www.southampton.ac.uk/namrip/index.page
- https://blogs.helsinki.fi/culturesofcultures/
- https://marginalizationandthemicrobe.org
- https://www.uac.uu.se/the-amr-studio/
- https://www.antimicrobialsinsociety.org
- https://www.lshtm.ac.uk/research/centres/amr/
- https://ce4amr.leeds.ac.uk/
- https://www.roadmap-h2020.eu/

- **Mapping** of resources
  - Article selection with most recent social science work: https://www.nature.com/collections/egehbdefja
  - Public database for social science of AMR research: www.amagri.eu
  - Public database for social science of AMR research: https://ritme.hypotheses.org/4275 (link at the end of the presentation)
  - Database for social science of key AMR-related research: https://www.antimicrobialsinsociety.org/essential-readings/
  - Database with trainings on social science related to infectious threats (incl. AMR): https://www.sonar-global.eu/areaofinterest/antimicrobial-resistance/
  - Food and Agriculture Organization of the United Nations (FAO) videos: http://www.fao.org/news/video-at-fao/en/

Pedagogical considerations:

- **Homework** - preliminary readings
- Presentation of own research project