

# Antimicrobial Resistance and the One Health Approach: Nine National Action Plans in the EU

Leonie Eilers

Maastricht University  
leonie.eilers@gmail.com

## ABSTRACT

Antimicrobial resistance (AMR) presents a major threat to global public health and economic development. Therefore, countries were required to have an action plan on AMR implemented by mid-2017. The research objective of this thesis is to explore whether the action plans of nine EU member states incorporated the One Health approach (human and animal health and the environment are interlinked). Only five plans were identified to include the components of the One Health concept sufficiently. To conclude, all countries must develop a holistic national action plan and ensure its effective implementation in order to fight AMR.

## Keywords

Antimicrobial Resistance, One Health approach, Action Plan, European Union, infectious diseases, SDG 3.

## INTRODUCTION

Trends are showing an increase in incidences of infections resistant to multidrug therapies, presenting serious threats for humans, animals, and the environment (ECDC, 2017). The number of resulting deaths within the EU is estimated to increase from 25,000 persons in 2007 up to 392,000 in 2050 unless the situation changes soon (European Commission, 2017a). In addition, multidrug-resistant bacteria present a high economic burden in terms of healthcare expenditure and cause deficits for trade and the agricultural sector. In the EU alone, extra healthcare expenditure and productivity losses cost around 1.5 billion euro (European Commission, 2017a). Therefore, AMR also hinders the achievement of the Sustainable Development Goals, in particular, the third goal.

Antimicrobial resistance is a cross-border health threat and is, therefore, extremely relevant for Europe and the globe. The prevalence of AMR is generally higher in Southern and Eastern European compared to Northern countries. These differences may be explained by different patterns in consumption of antibiotics, different practices regarding surveillance, prevention, diagnostics and healthcare utilisation, and the extent to which effective national policies are implemented (ECDC, 2017a).

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Member states are responsible to develop and implement health policies and regulations. Therefore, legally-binding policies and activities against AMR are still heterogeneous across the member states of the EU, despite frequent attempts to influence the political agenda and harmonise the response of individual countries in the fight against AMR. At the global level, the *Global Action Plan on Antimicrobial Resistance* by the WHO and the *European One Health Action Plan against Antimicrobial Resistance* by the European Commission serve as the global blueprint for AMR activities and both follow the One Health approach (European Commission, 2017).

One Health, an approach embracing interlinkages between human health, animal health and the environment, has received considerable attention and is advocated on an international agenda. However, the evaluation of the concept received much less attention, as little evidence was collected to assess the effectiveness of the One Health approach, particularly in tackling AMR. Nonetheless, there is a common understanding that a multisectoral response is needed to effectively tackle antimicrobial resistance due to the various transmission dynamics of AMR.

Accordingly, at the World Health Assembly in 2015, countries agreed to have a multisectoral national action plan against AMR in place before mid-2017 (WHO, 2015). It is crucial to monitor the countries' commitment in order to timely identify gaps and to learn from best-practice examples. Therefore, this thesis intends:

*To identify national action plans against AMR within the EU and to discuss to what extent the action plans are following the One Health approach.*

## THEORETICAL FRAMEWORK

### Definition of terms

Microorganisms have the ability to change their genetic composition over time. The development of AMR, therefore, is a natural process that can take place when microorganisms change after exposure to antimicrobial drugs (such as antibiotics, antifungals, antivirals, antimalarials and anthelmintic). Misuse and overuse of antibiotics for people and animals, inadequate infection control and sanitary conditions, as well as inappropriate food handling, accelerate the process of the development of AMR (WHO, 2017). After a microorganism develops a resistance to certain antibiotics, the treatment of infections with these antibiotics becomes ineffective. Consequently, the risk of persisting infections and the risk of transmitting the infection to people and animals is increased (ECDC, 2017a; WHO, 2017).

The general objective of an action plan is to efficiently reach a goal within a certain timeframe. Therefore, milestones and a completion date should be defined while considering training and resources. Furthermore, an action plan needs to define clear actions, responsible actors, and

targets that confirm that the step is completed. Ownership must be allocated in order to ensure accountability, facilitate more effective communication between actors at the national level, and information on the progress.

### Theoretical model

It is generally accepted that a multi-sectoral approach is needed to combat AMR in an effective, efficient, and sustainable way. A current major focus in policies against AMR is addressing the intersectoral transmission dynamics involving animals, humans, contaminated food, and the environment. Figure 1 is a graphical display that attempts to demonstrate the One Health concept (One Health, n.d.). The components of the model are global context, culture, economics, social determinants of health, ecosystem, animal, human, prevention, detection, and response. The aim of including the One Health model in the analysis is to structure the results and determine whether the action plans are holistic.



Figure 1. One Health approach

### METHODOLOGY

This thesis aims to strategically identify countries with a national action plan against AMR using a literature review. Therefore, online databases of the WHO, ECDC, and the European Commission were searched. Eligibility criteria for inclusion are:

- Title of policy documents includes the terms “action plan”, “strategy” or “roadmap”
- National plan from a member state of the EU
- Designed to combat AMR/ antibiotic resistance
- Available in German or English
- Current (timeline includes the year 2018)
- Multi-sectoral (sectoral action plans are excluded, e.g. action plans that tackle AMR in the human OR veterinary sector only).

Each admissible action plan is then examined with regard to 1) the overarching goal and timeframe; 2) objectives, actions, and targets; 3) ownership, roles, and responsibilities; 4) global context; 5) economics and resources; 6) culture; 7) Social determinants of health; 8) Human, animal, and ecosystem; and 9) prevention, detection, and response.

### RESULTS

#### Main findings: National Action Plans

In total, 60 national action plans (including duplicates) from 20 different countries were identified. No information on national action plans has been identified

in Bulgaria, Croatia, Estonia, Hungary, Latvia, Malta, Slovakia, and Slovenia. After applying the exclusion criteria, the action plans of nine (predominantly Northern and Western) countries are included in this thesis: Austria (AT), Denmark (DK), Finland (FI), France (FR), Germany (DE), Ireland (IE), Spain (ES), Sweden (SE), and the United Kingdom (UK).

### General characteristics of the action plans

#### Overarching goal and timeframe

The most recent plans were released in 2018 by Austria and in 2017 by Denmark, Finland, and Ireland. France and Sweden released their strategies in 2016, Germany and Spain in 2015, and the United Kingdom in 2013. All nine national action plans mention the plan’s overarching goal, which was either defined to prevent the spread of AMR (DE, IE, ES, UK), maintain the effectiveness of antibiotics (FI and SE), or both (AT, DK, FR). A temporary framework is included in six countries: UK (2013-2018), Spain (2014-2018), Germany (2015-2020), Sweden (2016-2020), Ireland (2017-2020), and Finland (2017-2021). Additionally, Denmark announces the evaluation of the action plan in 2019.

#### Objectives, actions and targets

In addition, all action plans include more specific goals, objectives, themes, priorities, or aims to achieve the goal. Most action plans (except DK and SE) further identify next steps, measures, interventions, actions, or activities. However, only three countries include the date of commencement (IE) or implementation (AT and FR) of each action or measure. Most of the analysed action plans do not include measurable targets for reducing either antimicrobial consumption or occurrence of AMR except for France.

#### Ownership, roles and responsibilities

In summary, all action plans specify the institutions or working groups that were responsible for the development of the action plan. Seven of the action plans (AT, FI, FR, DE, IE, ES, and the UK) mention the bodies that are responsible for the implementation and coordination of the national action plan in general. However, only around half of the action plans (AT, FI, FR, IE, and the UK) assign responsible bodies to each activity.

### One Health characteristics of the national action plan

#### Global context

Encouragingly, all nine action plans highlight the crucial role that the global context plays in the fight against AMR. Furthermore, all action plans place emphasis on strengthening international partnerships and collaborations and sharing of knowledge and best practice examples at the global level and at the EU-level. The governments of five countries highlight their role as an international leader in the fight against AMR (DK, FR, DE, SW, and UK).

Seven countries include the 2015 Global Action Plan on Antimicrobial Resistance from WHO (AT, DK, FI, FR, DE, IE, SE). All the countries incorporate actions and legislation at the EU level in their action plans. The European One Health Action Plan from 2017 is mentioned by three countries (AT, DK, and IE). Each action plan includes data comparisons to other EU member states. Furthermore, the countries support the harmonisation of data, indicators, and monitoring systems across Europe. The importance of EU (co-)funded research projects and

initiatives under the framework programmes and Horizon 2020 are also highlighted in the national action plans (AT, FI, FR, DE, ES, IE, SW, and UK).

#### *Economics and resources*

In four countries, experts from the economic field were involved in developing the action plan (AT, FI, FR, and ES). The national action plans commonly highlight resources, such as institutions, infrastructure data, policies and platforms that are already in place in the countries, which will be used to achieve the overall goal. Human resources, such as health professionals or administrative staff, are less amplified upon. None of the action plans mentions whether additional staff is required for the implementation of the action plan although the training and education of physicians and nurses is an often-mentioned aspect.

Although most national action plans describe the cost-effectiveness of reducing AMR, only a few consider the financial resources that are needed for the implementation. France and the UK are the only countries that provide financial considerations for each planned activity. The remaining plans either included few and fragmented details on financing mechanisms (AT, FI, DE, IE, SP) or no budget considerations (DK and SE).

#### *Culture*

The national Ministry dealing with culture was involved in the development of three national action plans (FI, FR and ES). First, the nine national action plans acknowledge the link between AMR, inappropriate prescribing, and consumption of antimicrobials in the human and veterinary sector. Five action plans (AT, DK, DE, SE, and the UK) raise the issue that patients themselves demand prescriptions which in return influences the physicians to prescribe (unnecessary) antibiotics. Only the German strategy mentions that animal owners tend to influence decision-making as well. Two plans report on the incorrect disposal of antimicrobials (DE and IE); for example, in the toilet. Most solutions which tackle inappropriate prescribing and consumption do so by antimicrobial stewardship (AT, DE, IE, UK), awareness-raising, and education.

#### *Social determinants of health*

Social determinants of health are the conditions that influence and shape people's lives. Analysing the action plans for each of these factors is, however, outside the scope of the thesis. Ministries or bodies dealing with social affairs were consulted in most national action plans (AT, FI, FR, DE, IE, and ES). As healthcare and social care are often intertwined, the action plans of Finland, Sweden, Spain and the UK, therefore, address the social care sphere likewise. The impacts of social determinants of health on antimicrobial resistance are less-often addressed than the consequences of AMR (DK, IE, SE, ES, and the UK).

#### *Human, animal, and ecosystem*

One Health action plans need to address the human, animal, and the ecosystem to tackle AMR. The nine national action plans were developed from experts in various sectors including the human, animal, and environmental sector. Furthermore, all nine plans have actions planned or in place involving the human and animal sector. Although all of them mention the environment as an important part in the fight against

AMR, only six countries (AT, FI, FR, DE, IE and SE) have planned concrete actions in the environmental sector.

#### *Prevention, detection, and response*

Firstly, all nine action plans cover the primary prevention of infections in humans and animals. Hygiene measures are commonly mentioned, especially in the hospital environment. Similarly, good animal husbandry also plays a role in the action plan as a mean to reduce infections in the veterinary sector. Vaccines play an important part in all plans. In the Austrian plan, however, vaccines are mentioned only in the context of a research project.

All the action plans highlight the need for better and cheaper diagnostics procedures and the need for continuously strengthening and improving national surveillance of antimicrobial consumption and AMR in both human and animals. Rapid Diagnostic Tests are mentioned in seven plans (AT, FI, FR, DE, IE, ES and the UK). All the action plans highlight the need to expand students' and professionals' education and training. Antimicrobial Stewardship Programmes, an interdisciplinary strategy to improve rational antibiotic therapies in humans, are mentioned in five action plans (AT, FI, DE, IE, and the UK).

## **CONCLUSION**

In summary, 20 countries with a national action plan or a similar initiative were identified on the websites of WHO, ECDC, and the European Commission. This thesis analyses nine action plans (AT, DK, FR, IE, SE, DE, ES, FR, UK), which vary in their content, scope, and purpose. All action plans clearly state their overarching goal, specific objectives, and the body responsible for the development of the action plan. Most action plans include actions (except DK and SE), a timeframe (except AT, DK, and FR), actors responsible for the implementation (except DK and SE), and actors responsible for each action (except DK, DE, ES, SE). None of the action plans includes measurable targets.

The One Health model proved to be useful to structure the results and to explore whether the action plans are holistic. The action plans include the global context and, to some extent, social and cultural determinants. To conclude, only five action plans are identified which cover, at least partly, all the components of the One Health model (AT, FI, FR, DE, UK).

There are several limitations to this thesis. First, no complete picture of action plans at a European or global level has been established since some action plans may not have been identified or were excluded from the analysis. Second, the development of AMR is a natural and unpredictable process that will always accompany antibiotics and AMR may still occur despite a "perfectly holistic" action plan. Last, a policy solely reflects the plans and expectations of the parties responsible for its development; thus, there may be a divide between proposed actions and implementation in practice.

## **Recommendations**

Antimicrobial resistance is a threat to public health, as it jeopardises the effectiveness of antimicrobials and, thereby, the achievement of the SDGs. It is important to ensure that national, European, and global efforts are

aligned to diminish cross-border threats. More guidance, funding, and cooperation are needed, in addition to research efforts into the transmission dynamics between sectors and the role of socioeconomic and cultural factors as well.

The EU and international actors should increase the pressure on the member states which have not yet published their multi-sectoral action plan. Measurable targets at the European and national level and mechanisms to ensure the implementation and continuous evaluation of the action plan are needed. The EU can show their added value in combating AMR by providing support in terms of financial and policy instruments to the member states.

Countries need to develop a national action plan, continuously improve and update their action plans, and ensure its implementation. Environmental, cultural, and social sectors, as well as financial considerations, need to be addressed more extensively. Furthermore, measurable targets, a time frame, and an evaluation should be included. Responsible actors should be identified for each action, for the coordination, and for the implementation of the action plan. Relevant ministries and various stakeholder representing One Health should be included in the development and realisation of the national action plan. Furthermore, it would be beneficial if the policies were translated into English, which would enable comparisons and the sharing of best practices.

The action plans of both the UK and Spain are ending in 2018, which presents an opportunity for the development of an improved plan. Several tools are currently available which can help the member states in developing a One Health action plan, such as manuals and action plans from international organisations. In addition, best practice examples exist at the national level of the EU (e.g., FI and FR) and outside the EU, for example in Norway (Norwegian Ministry of Health and Care Services, 2015). AMR is one of the major problems in today's society. National and international efforts, including the development and implementation of national action plans, are needed more than ever to stop the rise of AMR and ensure a safe and healthy life for the next generations.

#### **ROLE OF THE STUDENT**

Leonie Eilers was a Bachelor student working under the supervision of Dr Kasia Czabanowska when the research was conducted. At the time, the student was doing a placement at the European Public Health Alliance under the supervision of Sascha Marschang. The research question was proposed by the student and further developed together with the supervisors. The methodology, the processing of the results as well as the formulation of the conclusions and the writing were done by the student. Insightful feedback was provided by both supervisors.

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