TRANSLATING POLITICAL COMMITMENTS INTO ACTION

The development and implementation of National Action Plans on antimicrobial resistance in Europe

Study

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Executive Summary

The last two decades have witnessed several global, European and national initiatives to combat antimicrobial resistance (AMR). At the World Health Assembly in 2015, all UN Member States endorsed the Global Action Plan on AMR and adopted a Resolution, recognising the importance of tackling AMR through a "One Health" approach, involving different actors and sectors, and committing to **develop by 2017, national action plans (NAPs) on AMR aligned with the Global Action Plan**. Council Conclusions on a One Health approach to combat AMR, adopted in June 2016, reiterated this commitment and elaborated on some aspects which NAPs on AMR, adapted to national contexts, could include.

In spite of the recent momentum, enhanced political will and strengthened policy commitment towards a more coordinated and multisectoral approach to addressing AMR, progress on the development and more importantly, the implementation of national plans at local level has not been optimal.

Although the **ambitious target of adopting NAPs worldwide by 2017 has not been reached**, at a global level, the tripartite organisations (the World Health Organization, Food and Agriculture Organization of the United Nations and the World Organization for Animal Health) recognise that there has been **sustained progress in the development of NAPs to address AMR since 2016**. The tripartite global database for AMR includes a recent overview of country progress on AMR based on country self-assessment. To date, 60.4% of reporting countries worldwide have developed NAPs on AMR and among those countries that have not yet developed a NAP, 33 % of countries reported that a plan is currently under development.

Despite the fact that all EU and EFTA Member States surveyed reported the implementation, publication or development of a NAP, the database demonstrates significant variation in the stages of development of NAPs in these countries. This is also the case across the WHO European region, where 22% of countries reported having developed a NAP on AMR, 30% reported having an operational NAP, approved by government and aligned with the Global Action Plan and 16% of countries reported developing and implementing a NAP across various sectors with the identification of funding sources and the inclusion of evaluation mechanisms.

Coherent and robust policies are crucial to effectively combat AMR. **A national action plan serves as a guiding policy framework in the fight against AMR, whereby different multi-sectoral actions are aligned and coordinated.** A complete overview of which countries have developed an action plan is necessary to compare actions and measures, learn from best-practice examples and overcome common challenges.

Therefore, **this paper aims to provide an overview of the development and implementation of NAPs on AMR or similar initiatives (policy paper, strategy, programme, roadmap) in the 28 EU Member**

States and Iceland, Norway, and Switzerland.

Through the scrutiny of different data sources which record the development and/or implementation of a NAP in the countries in question, based on country self-reporting, a disparity in the number of countries which reportedly have developed or implemented a NAP was identified. Therefore, **the European Public Health Alliance (EPHA) has undertaken a thorough independent mapping exercise of NAPs and similar initiatives in 31 European countries.** The country analysis seeks to shed light on the current European situation, focusing on actions taken to combat AMR by governments and which aspects of AMR are given the most importance in policy-making. Based on the analysis, some examples of NAPs have been evaluated according to **four thematic areas**:

- encompassing a One Health approach;
- including financing estimates and identification of funding sources;
- integrating implementation and evaluation mechanisms;
- identifying clear measurable goals.

Across the 31 European countries studied in this paper, good practice examples co-exist alongside poor practices and inaction. Most countries do have a NAP in place or have initiated the process for its development. In fact, of the 31 countries analysed in this paper, **74% have developed and/or implemented a NAP or a similar initiative to tackle AMR**.

However, **Member States are at very different stages in terms of developing and implementing NAPs or similar initiatives to combat AMR**. It is striking that most One Health NAPs are found in Northern and Central Europe, where AMR prevalence is generally lower than the rates observed in Eastern and Southern European countries, which often face considerable healthcare systems challenges and lack of sustained financing.

There are also considerable variations with regard to the comprehensiveness and the One Health approach reflected in the NAPs in place. In fact, at the time of this analysis, **only 51% of the countries analysed could be considered as having action plans or national programmes or strategies that follow a One Health approach.** In fact, whilst acknowledging the One Health concept, some NAPs do not appear to follow a truly One Health approach and still address AMR in different fields separately.
It is often unclear whether certain national policies would qualify as formal national plans. Indeed, some plans appear to be rather fragmented comprising of a main strategy accompanied by other secondary documentation or separate strategies targeting one sector in particular. Therefore, there remains considerable scope to **streamline the multiple strategies on AMR present in some countries and to incorporate them into a single, coordinated One Health NAP.** This may require better coordination and communication among different government Ministries and agencies, ensuring that all relevant actors understand the importance of adopting a multisectoral approach.

Interestingly, irrespective of whether NAPs were released recently, certain elements laid out in the 2016 Council Conclusions on AMR, such as infection prevention, promoting prudent use of antimicrobials, surveillance and monitoring of consumption and resistance of antimicrobials; awareness-raising and education feature predominantly as common overarching goals or priorities in most NAPs which are currently in place.

However, the identification of measurable targets covering both the human and the veterinary sector, the integration of monitoring and evaluation mechanisms as well as the inclusion of estimates of required financial resources or a delineation of dedicated funds available for NAP implementation, is not a common occurrence in the plans and strategies of most of the countries analysed, which may hamper effective implementation of the proposed actions.

Effective implementation of actions in the spirit of a One Health approach may be cumbersome, particularly if the national structures in place, such as coordination committees, do not ensure true representation of stakeholders from all sectors. Moreover, if funding is not clearly indicated and provided, responsible actors may face difficulties in accessing funds in order to realise projects set out in the plans. In fact, resource mobilisation and integrating sustainable financing mechanisms into NAPs is also essential for the implementation of wider AMR stewardship.

The analysis carried out in **this paper also sheds light on possible initiation and implementation challenges Member States could be facing in the process of developing or executing their NAPs.** The good news is that policy solutions exist and the paper discusses a number of opportunities that could provide support to MS in their endeavours.

What role can the EU and other actors play to counter the challenges faced by Member States? How can countries which are struggling to meet their commitments benefit from both technical and financial support?

As Member States do not seem to possess sufficient resources to develop and implement comprehensive national AMR strategies, **dedicated European funding could be made available to assist Member States**. They should also continue to benefit from expert assistance and any supporting tools at their disposal in the further development and implementation of their national policies for tackling AMR.

In this spirit, the paper puts forward the following **recommendations directed towards both national governments and the EU institutions.**

EPHA Recommendations

Towards the European Commission:

- Identify specific barriers hampering the development and implementation of NAPs in some countries and provide sustained technical assistance
- Allocate adequate EU funding (possibly a dedicated European AMR fund) to support countries' implementation of AMR policies, especially those currently struggling to meet their NAP commitments
- Facilitate and strengthen civil society engagement within the EU AMR One Health Network, involving the AMR stakeholder network of the EU Health Policy Platform and giving it a more formalised role in order to be able to better contribute to policy-making at EU level
- Enhance the work of the AMR One Health Network to better address the environmental dimension, as this will encourage a similar approach nationally
- Adopt an EU strategic approach to pharmaceuticals in the environment as soon as possible
- Set minimum criteria to be included in NAPs, aligned with the Global Action Plan, which could be adapted to national contexts and needs
- Propose a regulatory framework to harmonise antibiotic prescription practices, limiting the sale and consumption of antibiotics across the EU
- Leverage country-to-country learning, coordination and best practice exchange which is valuable for informing future national actions, beyond what is already being done through the EU Joint Action (EU-JAMRAI)
- Strengthen EU engagement on addressing AMR, leading by example in the promotion of antibiotic stewardship and working to provide technical assistance to Member States
- Mainstream funding (which is often fragmented, disease-specific and research-focused) for AMR at European level
- Communicate the importance of AMR stewardship in the EU's interaction with major global trading partners, ensuring that bilateral agreements are aligned with a One Health approach to fight AMR.

Towards EU Member States:

- Implement national policies and actions on AMR following a One Health approach; bringing together policy-makers and experts from different sectors (human health, animal health, environment, food safety, agriculture) as well as ensuring the involvement of all relevant bodies throughout the development, implementation and evaluation of NAPs
- Incorporate measurable targets in NAPs, following the harmonised outcome indicators proposed by ECDC, EFSA and EMA, to facilitate the monitoring of progress in reducing the use of antimicrobials and AMR in both humans and food-producing animals
- Identify funding sources and budget estimates for the execution of proposed actions and activities

- Mobilise appropriate human and financial resources to ensure effective implementation of NAPs
- Incorporate evaluation mechanisms and reporting arrangements in NAPs to monitor progress in the reduction of antibiotic use and AMR, adjusted accordingly to take account of national requirements and emerging priorities
- Ensure that national antibiotic councils and coordinating committees reflect a diversity of stakeholders, from multiple sectors
- Introduce and enforce policies aimed at regulating antibiotic prescriptions for humans and animals, to tackle high consumption rates at source.
- Scale up and mainstream multiple strategic plans and activities on AMR into one, single, coordinated One Health NAP which includes actions in different sectors
- Ensure that professionals and aspiring physicians, nurses, veterinarians, pharmacists and the entire health workforce are adequately trained to manage AMR challenges
- Invest in adequate healthcare infrastructure which is conducive to the delivery of quality and safe care alongside infection prevention and control measures
- Improve surveillance and data collection methods and undertake research to better study the effects of foodborne AMR and environmental antimicrobial pollution
- Allow for better engagement of Member States experiencing difficulties in developing their NAPs in the EU-JAMRAI
- Involve countries facing considerable healthcare and AMR challenges in research and development programmes in order to develop innovative and affordable tools or alternatives, while at the same time, meeting the needs of countries with high AMR prevalence.

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ABBREVIATIONS

AMR	Antimicrobial Resistance
CIA	Critically Important Antimicrobial
DDD	Defined Daily Dose
ECDC	European Centre for Disease Prevention and Control
EC	European Commission
EEA	European Economic Area
EFTA	European Free Trade Association
EMA	European Medicines Agency
EU	European Union
EU- JAMRAI	European Union Joint Action on Antimicrobial Resistance and Healthcare-Associated Infections
FAO	Food and Agriculture Organization of the United Nations
HCAI	Healthcare- Associated Infection
IACG	Interagency Coordination Group of UN agencies and individual experts
IPC	Infection Prevention and Control
MS	Member States
NAP	National Action Plan
OIE	World Organisation for Animal Health
OECD	Organisation for Economic Co-operation and Development
OJ	Official Journal of the European Union
SDGs	Sustainable Development Goals
UN	United Nations
WHO	World Health Organization
WHA	World Health Assembly

COUNTRY CODES

Belgium	BE	Greece	EL	Lithuania	LT	Portugal	PT
Bulgaria	BG	Spain	ES	Luxembourg	LU	Romania	RO
Czech Republic	CZ	France	FR	Hungary	HU	Slovenia	SI
Denmark	DK	Croatia	HR	Malta	MT	Slovakia	SK
Germany	DE	Italy	IT	Netherlands	NL	Finland	FI
Estonia	EE	Cyprus	CY	Austria	AT	Sweden	SE
Ireland	IE	Latvia	LV	Poland	PL	United Kingdom	UK
Iceland	IS	Norway	NO				
Switzerland	CH						

1. INTRODUCTION

> *"Despite the political prioritisation of antimicrobial resistance as a threat to public health and the availability of evidence-based guidance for antimicrobial stewardship and infection prevention and control, high levels of resistance remain in the EU/EEA".*
>
> European Centre for Disease Prevention and Control (ECDC, 2018a)

Antimicrobial Resistance (AMR) is a multi-faceted public health challenge which jeopardises human and animal health, presents a burden to the sustainability of healthcare systems as well as significant risks to an effective response to communicable diseases. Ever-increasing resistance to antibiotics continues to pose an urgent threat to public health. The treatment of resistant infections has not only become extremely complex but in some cases last-line antibiotics have started to become ineffective in the treatment of persistent "superbugs".

AMR also has a significant impact on the economy. The environmental and cross-border dimension to AMR should also not be overlooked. Moreover, as it has been widely recognised, AMR threatens the attainment of the 2030 Agenda and the achievement of the Sustainable Development Goals (SDGs), particularly Goal 3.8 on universal health coverage.

1.1 The scale of the problem

AMR prevalence differs across countries. Globally, the total number of deaths caused by AMR is highest in Africa and Asia. Within the European Union (EU), the prevalence of AMR is generally higher in Southern and Eastern European countries in comparison to countries in Northern Europe (ECDC, 2017a).

Country variations are due to various factors, including differences in antibiotic consumption, prescription practices, public awareness on antibiotics, surveillance systems, animal husbandry practices, quality of healthcare facilities and hygiene practices. Governance and national policies may also impact trends in the use of antibiotics and the occurrence of AMR which, requires concerted action and a multipronged response.

According to the latest European surveillance data, collated by the ECDC and the Burden of AMR Collaborative Group, AMR continues to be a serious threat and wide variations continue to be observed per geographic region. In fact, for several bacterial species–antimicrobial group combinations, a north-to-south and west-to-east gradient is evident (Cassini et al., 2018). Moreover, the high levels of resistance for certain antimicrobial groups reported in several European countries, is a patient safety concern (ECDC, 2018a).

As the contribution of various antibiotic-resistant bacteria to the overall burden of disease varies greatly between countries, prevention and control strategies should be tailored according to the needs of each EU/

EEA country (Cassini et al., 2018). In addition, the fact that 75% of the burden of disease is due to healthcare-associated infections (HCAIs), highlights the importance of ensuring adequate infection prevention and control (IPC) measures in addressing AMR in healthcare settings (ECDC, 2018a).

According to a new Eurobarometer study on public knowledge of antibiotics and overall trends in their use, published in November 2018, around one third (32%) of EU citizens claimed that they have taken antibiotics during the last year, demonstrating substantial variations between Member States. A rather worrisome finding is that many of these antibiotics were taken unnecessarily, with 20% of antibiotics consumed for the purpose of alleviating cold or flu symptoms (European Commission, 2018b).

Despite some encouraging trends in the decrease of antibiotic consumption observed in several EU MS, increases have been noted in two EU MS in the most recent data available (ECDC, 2018b). These disparities in antibiotic use are also echoed globally in a report by the World Health Organization (WHO), signalling the importance of improving national surveillance of antimicrobial consumption, ensuring equitable access while curbing overuse and misuse (WHO, 2018).

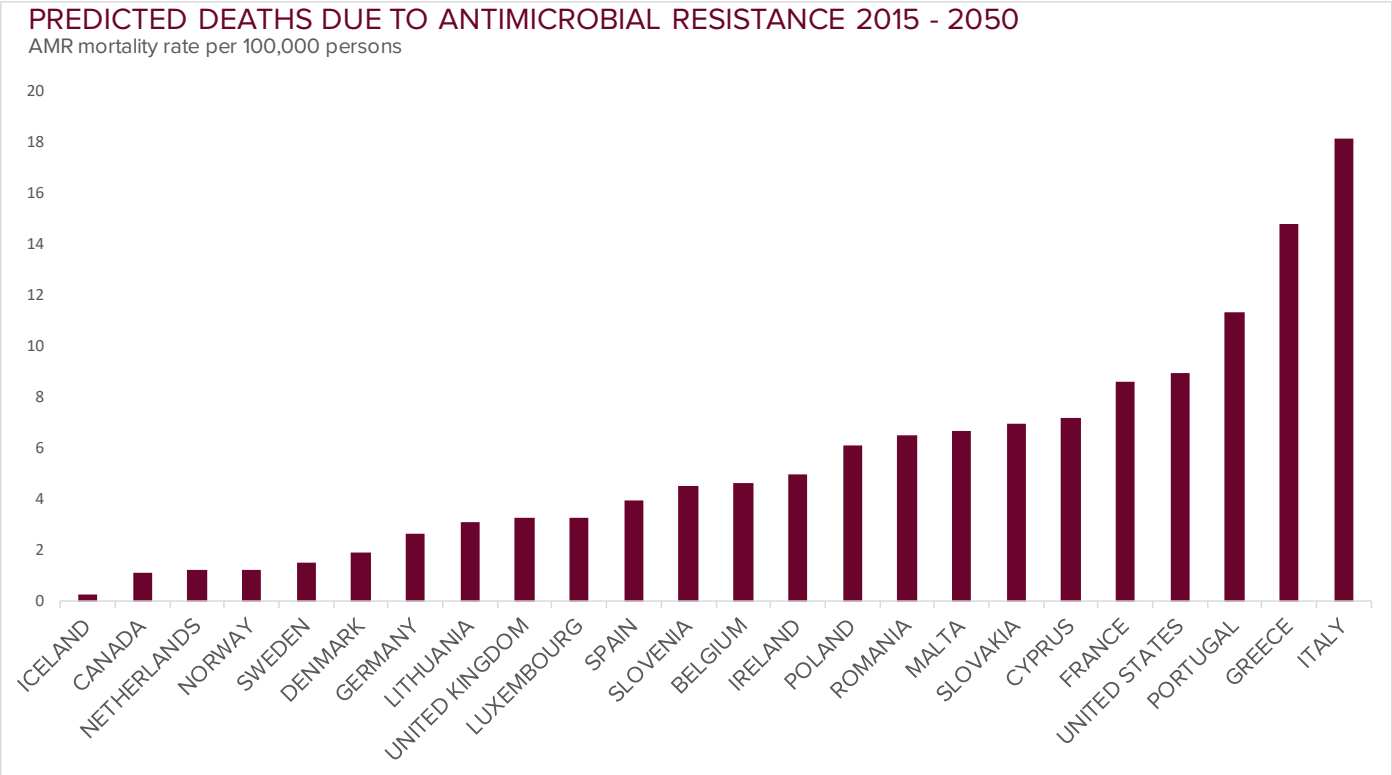

Figure 1: The annual number of predicted deaths as a result of AMR by 2050 per 100,000 persons

Source: Stemming the Superbug Tide: Just A Few Dollars More. Organisation for Economic Co-operation and Development (OECD, 2018a).

A recent study by the Organisation for Economic Co-operation and Development (OECD), demonstrates that AMR rates have increased relentlessly across OECD countries between 2005 and 2015. In 2015 in Greece, it was recorded that approximately 35% of infections already showed resistance to several high-priority antibiotic-bacterium combinations, 7 times higher than the rates observed in IS, NL and NO. Of serious concern is the projected increase of resistance to second and third-line antibiotics in OECD countries including EU countries, for which resistance is set to double between 2005 until 2030. Southern and Eastern European countries risk being particularly affected.

As depicted in Figure 1, Southern European countries namely IT, EL and PT are forecast to top the list of OECD countries with the highest mortality rates from AMR by 2050 (OECD, 2018a).

1.2 Global action to address AMR

Global initiatives to address AMR have been proposed by the WHO for several years. In fact, the first World Health Assembly (WHA) Resolution on AMR dates back to 1998. AMR was already recognised as a serious public health threat and countries were encouraged to train professionals on the issue and implement actions to monitor and curb AMR prevalence including sustainable national policies for rational antimicrobial use (WHO, 1998). In addition, in 2001, the WHO Global Strategy on the containment of antimicrobial resistance included a series of recommendations aimed at enabling countries to define and implement national policies in response to AMR (WHO, 2001).

The adoption of the **Global Action Plan on AMR** by all WHO Member States at the WHA in 2015 is particularly important. Considered to be an important political step, it recognised the importance of a "One Health" approach to tackle AMR, involving different actors and sectors. It also urged Member States:

> ***"...to have in place, by the Seventieth World Health Assembly [2017], national action plans on antimicrobial resistance that are aligned with the global action plan on antimicrobial resistance and with standards and guidelines established by relevant intergovernmental bodies [such as the Codex Alimentarius Commission, FAO and OIE]"***
>
> ***(WHO, 2015a)***

The Global Action Plan also acknowledged the slow progress in combatting AMR in previous years, partly due to insufficient monitoring and reporting at national, regional and global levels as well as inadequate recognition by all stakeholders of the necessity to take action in their respective areas (WHO, 2015b). Thus, the plan accepts that reducing AMR will not only require political will and overarching strategic frameworks but operational and multisectoral action plans implemented at national level, which will provide the basis for an assessment of the resources needed to address AMR and take into account national and regional contexts and priorities.

The Global Action Plan outlines five strategic objectives and sets out actions to be undertaken by MS, the WHO Secretariat and other international and national partners. In addition, it underscores that National Action Plans (NAPs) on AMR should reflect the following principles and recommendations:

1. A WHOLE-OF-SOCIETY ENGAGEMENT IN THE SPIRIT OF THE ONE HEALTH APPROACH

Therefore, it is important that sectors beyond human health are addressed, namely, animal health, agriculture, food safety and economic development, and that relevant stakeholders from all sectors are engaged in the implementation of the action plans.

2. A PRIMARY FOCUS ON PREVENTION

Therefore, NAPs should consider the importance and cost-effectiveness of infection prevention and control (IPC) whereby improved sanitation and hygiene practices could reduce the need for antibiotics and the development and spread of difficult-to-treat antibiotic-resistant infections.

3. EQUITABLE ACCESS TO TREATMENT OF INFECTIONS

Therefore, the effective implementation of NAPs is dependent on access to health facilities, health care professionals, veterinarians, preventive technologies, diagnostic tools as well as to adequate information and education on antibiotics use and resistance.

4. SUSTAINABILITY

Therefore, the implementation of NAPs will require long-term investment in various fields such as surveillance, research, education and training as well as enacting appropriate regulatory/legislative frameworks to guide concrete actions. Dedicated funding and technical resources are also needed for effective development and implementation of the plans.

5. DEVELOPMENT OF INCREMENTAL TARGETS FOR IMPLEMENTATION

Therefore, in order to enable countries to make progress and achieve maximum impact through the implementation of their NAPs, flexibility will be built into the monitoring and reporting arrangements in order to allow countries to determine the priority actions that are needed as well as their gradual implementation that would meet both national needs and global priorities, addressing relevant national and local governance arrangements (WHO, 2015b).

The high-level meeting of the United Nations General Assembly (UNGA) on antimicrobial resistance of 21 September 2016, reaffirmed the Global Action Plan on AMR as the blueprint for tackling drug-resistant infections.

The **Political Declaration on AMR**, approved by Heads of State and adopted at the 71st session of the UNGA in October 2016, reiterated the commitment of UN Member States to support the implementation of the Global Action Plan at all levels. MS also committed to the development of multisectoral NAPs, in line with a One Health approach and the overarching objectives of the Global Action Plan; and to mobilise sustained funding and resources to support the implementation of these plans (United Nations, 2016), signalling increased political will and a global policy commitment towards a more coordinated and multisectoral approach to addressing AMR.

More recently, at the Group of Twenty (G20) meeting of Health Ministers which took place on 4 October 2018, Ministers of Health commended the progress made in developing One Health action plans on AMR and agreed to reinforce their efforts in implementing their NAPs through inter-sectoral collaboration, the involvement of all stakeholders and the allocation of resources, as appropriate (G20 Argentina, 2018).

1.3 The EU's response to the AMR challenge

During the last 20 years the EU has taken several initiatives and actions to promote the prudent use of antimicrobials, improve surveillance of AMR, boost research and innovation and encourage the prevention and control of healthcare associated infections.

The focus on the concept of the One Health approach is not a recent phenomenon. The Council Conclusions on the impact of AMR in the human health and veterinary sector, adopted in June 2012 under the Danish Council Presidency, already underlined the need for a holistic approach based on a One Health perspective, with the aim of reducing antimicrobials use through coordinated efforts between the human and animal health sectors. In addition, the Conclusions called upon the European Commission to implement a comprehensive approach against AMR at both EU and national level, taking the One Health perspective into consideration (OJ, 2012).

In 2016, the **Council Conclusions on combatting AMR through a One Health approach**, adopted under the Dutch Presidency, recognised that fighting the AMR threat requires strong MS collaboration and is largely dependent on the commitment and willingness of governments to act and ensure effective implementation of One Health initiatives thus, encompassing human health, animal health and the environment (OJ, 2016).

The Conclusions also reiterated that MS should put in place, by mid-2017, NAPs to tackle AMR, based on the One Health approach, adapted to national contexts and aligned with the objectives of the WHO Global Action Plan. The Conclusions go a step further and even elaborate on the aspects NAPs on AMR are expected to have, namely, ensuring that:

- actions in the different domains take into account the public health concerns of AMR;
- NAP development and implementation is carried out through inter-Ministerial cooperation and multi-stakeholder cooperation;
- measurable goals are set with regard to preventing infections and reducing the use of antimicrobials and AMR in all domains;
- measures to reduce the risk of AMR and promote the prudent use of antimicrobials in veterinary and human medicine are included, covering actions to tackle preventive use of veterinary antimicrobials, in particular critically important antimicrobials, thus encouraging the use of antimicrobial susceptibility testing;
- a mechanism for NAP implementation and monitoring of progress is integrated, including possible ways to improve surveillance and AMR reporting in all domains;
- national legislation relevant to AMR is enforced;
- education programmes and targeted awareness-raising campaigns are considered.

It is also worth noting that the Conclusions called upon the European Commission (EC) to facilitate and support MS in the development and implementation of NAPs and consider providing financial support within existing frameworks. Moreover, they called for a new and comprehensive action plan on AMR based on a One Health approach which would contain measurable goals and concrete actions and measures in order to achieve these goals (OJ, 2016).

A year following the adoption of these Conclusions, the EC issued an **EU One Health Action Plan against AMR**, which builds on the 2011-2016 action plan to fight AMR and the outcomes of its evaluation with 12 key actions. It defines and encompasses more than 75 concrete activities with clear EU added value, to develop a more comprehensive, integrated and effective approach to tackling AMR (European Commission, 2017a).

In addition, the action plan reiterates the importance of developing One Health NAPs on AMR, defining One Health as:

"*a principle which recognises that human and animal health are interconnected, that diseases are transmitted from humans to animals and vice versa and must therefore be tackled in both. The One Health approach also encompasses the environment, another link between humans and animals and likewise a potential source of new resistant microorganisms*"

(European Commission, 2017a).

This multi-sectoral approach is crucial in addressing AMR because it recognises the different transmission dynamics of AMR and the importance of coordinating joint actions across the human, veterinary, agriculture and environment sectors.

The EC issues progress reports on the

implementation of the Action Plan including ongoing or completed deliverables for each concrete activity identified. A recent update covering the third quarter of 2018 highlights the bi-annual meetings of the AMR One Health Network launched in 2017, which inform MS and AMR experts of developments at EU and MS level as part of the overall objective of improving MS' coordination of One Health responses to AMR. The Network, requested by the Council in the 2016 Conclusions, seeks to reinforce MS coordination and best practice exchange and provide a platform for discussion on the development, progress and implementation of the EU Action Plan. Joint EC and ECDC One Health visits to MS have also taken place upon MS' request, with the aim of supporting the implementation of NAPs (European Commission, 2018a).

Other actions laid out in the EU Action Plan include the establishment of a European Joint Action on antimicrobial resistance and health-care associated infections in order to foster synergies among MS in their activities and policy developments. The Joint Action (EU-JAMRAI) was launched in September 2017 and one of its aims is to support MS in the development and implementation of One Health NAPs. The EU-JAMRAI, co-funded by the EU Health Programme, has produced guidelines to improve the management of AMR and HCAIs at national and local levels and has brought together different experts and policy-makers to share knowledge and good practices in the field (EU-JAMRAI, 2018b).

In September 2018, the European Parliament adopted a non-binding **Resolution on AMR**, signalling continued commitment to tackle the growing concerns around AMR. The Resolution welcomes further measures to be taken to curb AMR through a 'One Health' approach and calls on the EC and MS to develop public health messages to raise public awareness on the use of antibiotics and urges the Commission to conduct a mid-term and ex-post evaluation of the One Health Action Plan, involving all relevant stakeholders in the process. The Resolution also stresses that MS do not equally possess sufficient resources to develop and implement comprehensive national AMR strategies and, more dedicated funding should be made available (European Parliament, 2018a).

Considerable action has also been taken to curb AMR within the **animal health** field. A number of legislative and non-legislative measures have already been adopted at EU level to facilitate coordination and ensure a common EU approach. The revised EU Veterinary Medicinal Products and Medicated Feed Regulations, adopted in December 2018, further highlight the need for more responsible use of antibiotics in animals to limit the growing risk of AMR (OJ, 2019). Under the new rules, the preventative use of antimicrobials (prophylactic use) will be limited to single animals and permitted only upon justification of a veterinarian, in cases of high infection risk. In addition, collective treatments (metaphylactic use) should be used as a last resort and only in cases where suitable alternatives do not exist and after appropriate justification by a veterinarian (European Parliament, 2018b).

Moreover, recent data published by the

European Medicines Agency (EMA) shows that the overall sales of veterinary antibiotics across Europe have decreased by more than 20% between 2011 and 2016. It appears that the EU's guidance and national campaigns promoting the implementation of more prudent use of antibiotics in food-producing animals to fight AMR, have contributed to this downward trend (EMA, ESVAC 2018).

1.4. Aims and objectives

In light of the current AMR global, European and national context, this paper aims to take stock of the development of NAPs in the 28 EU MS, Iceland, Norway, and Switzerland. The paper provides the following:

- an overview of different data sources which record the development and/or implementation of a NAP in the countries in question, mainly based on country self-reporting
- a detailed independent analysis of NAPs, programmes and strategies addressing AMR in 28 EU and 3 EFTA countries which can be found in the annex. Based on this analysis, certain NAPs are showcased according to four thematic areas:
    - encompassing a One Health approach;
    - financing estimates and identification of funding sources;
    - integration of implementation and evaluation mechanisms; and
    - identification of clear measurable goals.
- a discussion of the next steps and the potential opportunities for countries to scale up their efforts in addressing AMR through best practice exchange and enhanced coordination, focusing on how the EU and other key actors could enhance the assistance offered to countries struggling to realise their commitments
- a set of recommendations addressed to EU institutions and national MS.

2. MAPPING THE DEVELOPMENT OF NATIONAL ACTION PLANS ON AMR IN EUROPE

> *"Antimicrobial resistance has the potential to kill millions each year and become a massive burden on health systems across the world... Having accurate information will make sure the right resources are deployed at the right time, in the right place, to make the maximum impact."*
>
> Chief Medical Officer Professor Dame Sally Davies (Department of Health & Social Care, 2016)

Findings of a survey undertaken by the European Commission in 2015 as part of a reporting exercise aimed at assessing MS' implementation of the Council Recommendation on the Prudent Use of Antimicrobial Agents in Human Medicine (2002/77/EC), demonstrate that 21 EU/EEA countries reported having an AMR action plan

and 2 countries reported that a strategy or action plan was under preparation. 12 out of 21 countries with an action plan in place reported adopting or updating the plan in the last 2 years. In most countries, action plans included measures related to surveillance, prudent use of antimicrobial agents as well as information provision and education. Detection and control of outbreaks and research were addressed in 16 and 14 action plans respectively and indicators were used to assess the implementation and/or the impact/outcomes of the NAPs in 18 countries. An intersectoral coordinating mechanism (ICM) including representatives of human health, animal health or agriculture sectors was in place in 25 countries and was established by regulation or governmental decision in 15 countries. Moreover, a dedicated budget for implementation of the AMR action plan or strategy was identified in 10 countries, while 5 countries reported that funding for AMR control activities was included in health authorities/agencies' budgets (European Commission, 2016a).

While these results, dating back a few years, may appear promising, they show wide differences between countries in their methods of governance and the scope of their national strategies and action plans, and in the ways in which measures were implemented and assessed.

A report produced by the Antimicrobial Resistance and the Causes of Non-Prudent Use of Antibiotics (ARNA) project, showed that by June 2016, only 14 EU MS had a national antibiotic plan or plan to combat AMR. Nevertheless, 26 EU MS had activities to enhance the prudent use of antibiotic use including surveillance systems in place addressing both antibiotic use and AMR. The study also showed clear differences between practices and strategies implemented in the 6 ARNA project members (CY, EL, ES, IT and RO) and other EU MS. In fact, only two ARNA members reported having an action plan in place (European Commission, 2017b). Surprisingly, these figures are lower than those reported in the above-mentioned survey carried out in 2015.

Additionally, a mapping exercise conducted by the fifth work package of the EU-JAMRAI, assessed the implementation of One Health national strategies and national action plans for AMR including 18 European countries. Findings suggest that 15 out of the 18 countries reported having a One Health NAP endorsed by a competent authority by the end of 2017. Most countries assessed involved different relevant Ministers in the development of their plans as well as other stakeholders. However, measurable goals were more commonly set for antibiotics use rather than reduction of infections; enforcement was focused on the veterinary sector; few actions were taken to address the environmental dimension of AMR; and a majority of countries reported a lack of sufficient financial and human resources to develop or implement their NAPs (EU-JAMRAI, 2018a; EU-JAMRAI, 2018c).

Following the mapping and self-assessments of NAPs and AMR strategies, a country-to-country peer review assessment system will be carried out as part of the EU-JAMRAI 5th work package (EU-JAMRAI, 2018c), which

was already identified in the 2016 Council Conclusions. The country-to-country visits involve MS' evaluations of other MS' NAPs, providing recommendations for improvement. This review system is complementary to other existing activities, such as the country visits performed by the ECDC and detailed results of such visits with regard to NAP implementation are yet to be presented.

2.1 Country progress on the development and implementation of the Global Action Plan on AMR, including the development of NAPs

The UN tripartite organisations (WHO, OIE, FAO) have also attempted to gather information to assess the state of play and the status of NAPs on AMR. Their open-access global database includes a recent overview of country progress on AMR based on self-assessment. Information captured in the database is a result of country self-assessment questionnaires. Countries were asked to assess their progress in developing their AMR NAPs; working with multiple sectors; and implementing key actions to address AMR (WHO, FAO, OIE, 2018). The database currently contains data from WHO countries for the reporting years 2016-17 and 2017-18. With regard to EU MS, no information was submitted by MT and PL (WHO, FAO, OIE, 2017a).

Although the ambitious target of adopting NAPs worldwide by 2017 has not been reached at a global level, the tripartite organisations recognise that there has been sustained progress in the development of NAPs to address AMR since 2016. To date, more than half of responding countries worldwide (60.4%) have developed NAPs on AMR and among those countries that have not yet developed a NAP, 33% of countries reported that a plan is currently under development (WHO, FAO, OIE, 2018).

In the WHO European Region, 22% of countries reported having achieved Level 3 of the below classification; 30% reported having achieved Level 4, and 16% of countries reported having reached Level 5 (WHO, FAO, OIE, 2018).

LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5
No AMR National Action Plan	AMR National Action Plan under development	AMR National Action Plan developed	AMR National Action Plan is approved by government, reflects Global Action Plan objectives and includes an operational plan and monitoring arrangements	AMR National Action Plan identifies funding sources, is being implemented, relevant sectors are involved and a defined monitoring and evaluation process is in place

Figure 2: Different stages of NAP development used by the WHO, FAO and OIE tripartite survey to assess country progress on AMR

Source: Monitoring global progress on addressing antimicrobial resistance: analysis report of the second round of results of AMR country self-assessment survey 2018 (WHO, FAO, OIE, 2018).

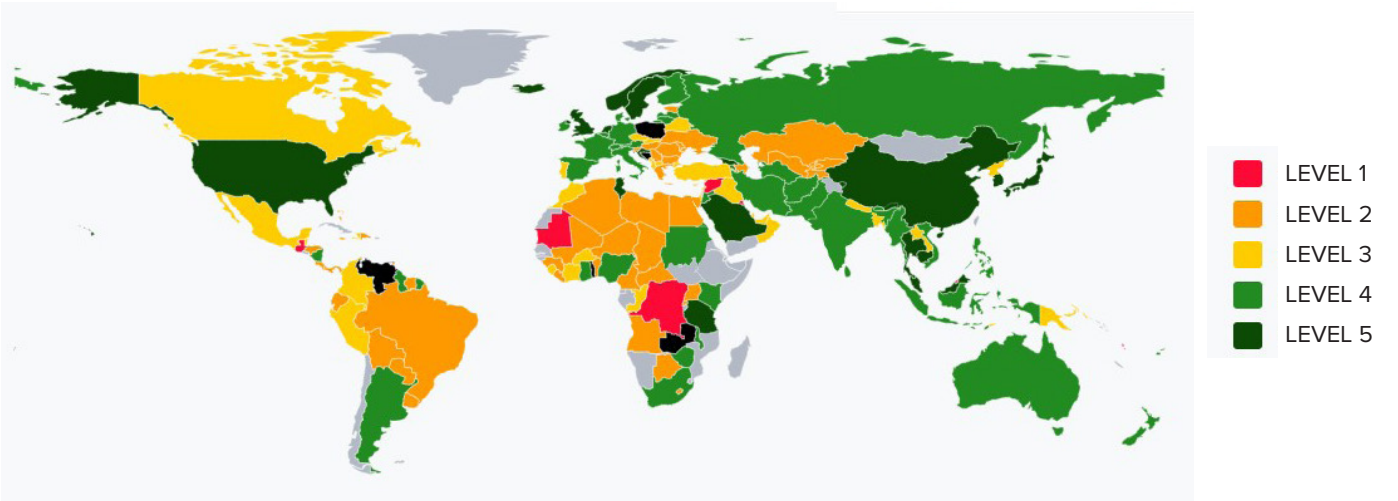

Figure 3: A global snapshot of the development of NAPs on AMR, as one of the implementation aspects of the Global Action Plan on AMR

Source: WHO, FAO and OIE database for antimicrobial resistance country self-assessment – Country progress with regard to the development of a national action plan on AMR (WHO, FAO, OIE, 2017a).

Despite the fact that all EU and EFTA MS reported the implementation, publication or development of a NAP, the database demonstrates that their stages of development vary significantly (WHO, FAO, OIE, 2017b).

7 countries (IS, HR, LU, NL, NO, SE and the UK) reported having a NAP in place which is being implemented with the involvement of relevant sectors. Their NAPs also include defined monitoring and evaluation processes and identify funding sources.

12 countries (AT, BE, CH, DE, DK, ES, FR, FI, IE, IT, LT, and LV) reported having a NAP on AMR approved by the government that reflects the objectives of the Global Action Plan, including an operational plan and monitoring arrangements.

4 countries (CZ, CY, PT and SK) reported having developed a NAP.

6 countries (BG, EE, EL, HU, RO and SI) reported having a NAP under development (WHO, FAO, OIE, 2017a).

2.1.1 Multi-sectoral One Health coordination

The database also highlights that there are wide variations concerning the levels of collaboration on AMR through a multi-sectoral 'One Health' approach. This collaboration ranges from comprehensive and integrated approaches used to implement the national AMR action plans in PT, UK, HR, NL, DE, FR, SE, NO, CZ, AT and IS to the absence of

formal multi-sectoral governance or existing coordination mechanisms reported in EE, RO and BG.

Moreover, some countries (DK, FI and EL) reported working jointly on issues including an agreement on common objectives and the restriction of using Critically Important Antimicrobials (CIAs). Others (IT, ES, HU, SI and CH) reported having functional multi-sectoral working group(s) in place with clear terms of reference; holding regular meetings and including dedicated funding with clearly defined activities; reporting; and the presence of accountability arrangements. The establishment of government-led multi-sectoral working group(s) or coordination committees on AMR was also reported in BE, CY, IE, LT, LV, and SK (WHO, FAO, OIE, 2017a).

In addition, despite lack of data, the environmental sector was often found to be underrepresented in AMR multisectoral working groups established in many countries.

2.1.2 AMR and environmental pollution

The environmental dimension of AMR does not seem to have gained sufficient importance and the current level of regulation in this sector is considered insufficient to protect the environment from antimicrobial production hazards (WHO, FAO, OIE, 2018). This is not only the case in Europe as across the globe, the tripartite organisations consider that further progress on animal, agricultural and environmental surveillance is required in order to ensure that a true One Health approach is pursued and research and policy efforts to combat AMR are not jeopardised by lack of data in non-human health sectors (WHO, FAO, OIE, 2018).

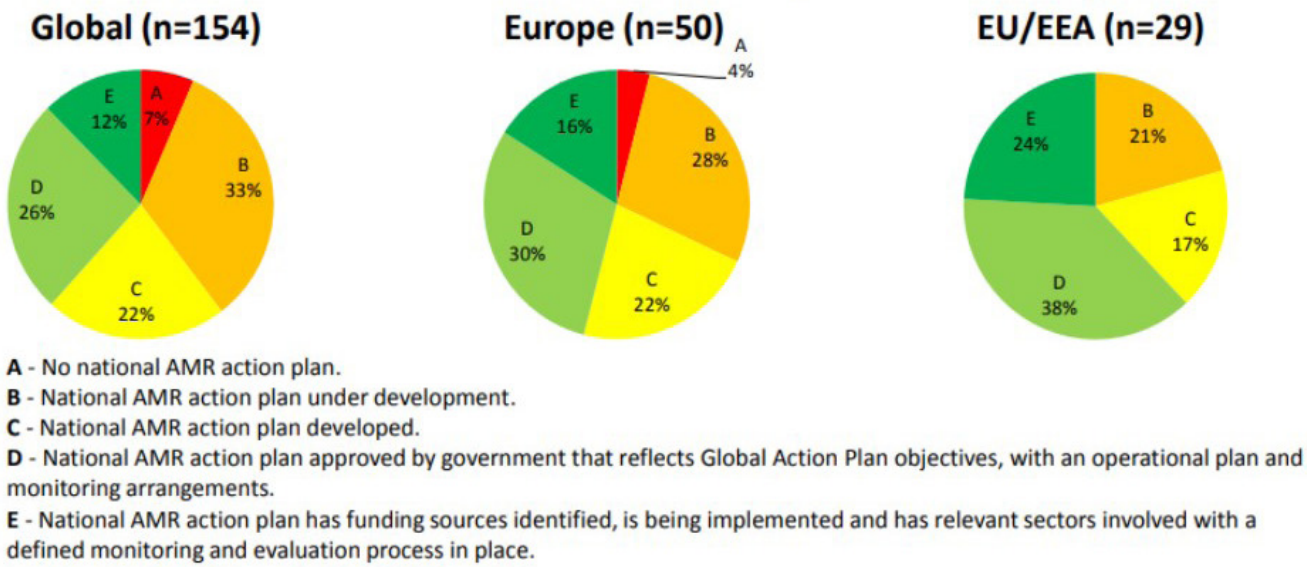

Figure 4: State of play of NAP development progress in EU/EEA countries in relation to the wider European region and worldwide

Source: Outcome of the FAO/OIE/WHO survey conducted in the context of the monitoring of the Global Action Plan on AMR, Presentation by Dr Danilo Lo Fo Wong, Programme Manager for Control of Antimicrobial Resistance, at the EU AMR One Health Network meeting of 26 October 2018 (WHO Europe, 2018).

Norway stands out as the only European country out of the 31 countries studied in this paper, to have a compliance monitoring system in place regulating environmental contamination of antimicrobials. This includes policies limiting the discharge of antimicrobial residues into the environment, covering municipal and pharmaceutical industry waste and wastewater development. Other countries reported having legislation in place to prevent environmental contamination more generally, encompassing the release of some types of waste such as sewage, discharge of wastewater from health facilities, manure from intensive animal production, and industrial effluent to the environment, but do not target antimicrobial residues specifically (WHO, FAO, OIE, 2017a).

2.1.3 AMR within the wider communicable diseases' framework

Only two EU countries seem to have linked their NAP to existing national action plans, strategies or targets related to HIV and TB, unlike other non-EU WHO European region countries, where this is more commonly the case (WHO, FAO, OIE, 2017a).

2.1.4 Implementation of NAP actions

Generally, recently adopted plans appear to be more robust and comprehensive, with more countries putting in place monitoring and financing arrangements to facilitate their effective implementation. However, there has been concern that despite progress with regard to the development of NAPs, the implementation phase is more cumbersome and challenging.

In an attempt to calculate the level of implementation of NAPs globally, it was found that only 3 countries (AT, NO and NL) reported implementation across all the main domains assessed in the tripartite survey and 4 European countries (FI, DK, ES and SE) were among the 7 countries worldwide that reported implementing actions in 15 out of the 16 key human and non-human NAP indicators (WHO, FAO, OIE, 2018). Therefore, although EU/EFTA countries appear to be moving in the right direction, the European region does not excel in all aspects assessed by the survey, in comparison to other regions worldwide.

2.1.5 Country self-reporting

A complete overview of the countries which have developed an action plan is necessary to assess actions and measures, learn from best-practice examples and overcome common challenges. However, common to all the assessments and findings presented in this section is that they are based on country self-reporting as part of questionnaires completed by respondents of EU/EFTA countries. Therefore, cautious interpretation of such findings is necessary as questions may have been interpreted in different ways by respondents, reflecting the variety of national situations and practices or questionnaires may have been returned incomplete with missing information which could possibly distort the overall picture. Moreover, beyond the principles set out in the Global Action Plan, what constitutes a NAP is not clearly defined. This may create difficulties when making comparisons among European countries.

Therefore, from various self-reporting and country assessment sources, it is clear that

Member States are at very different stages in terms of developing and implementing NAPs or similar initiatives (policy paper, strategy, programme, roadmap) to combat AMR.

According to the publicly available WHO library of NAPs 16 EU MS and Norway and Switzerland have a NAP in place (WHO, 2018b). In addition, the ECDC lists on its website the NAPs or strategies that apply to human health in 19 EU MS (AT, CY, CZ, DE, DK, EL, ES, FI, FR, HR, IE, IT, LT, LU, NL, PL, PT, SE, UK) and Norway, Iceland and Switzerland (ECDC, 2018c). On the other hand, the European Commission considers that 17 EU countries (AT, BE, CY, DE, DK, ES, FI, FR, IE, IT, LT, LU, NL, PL, RO, SE, UK) have a NAP or strategy in place (European Commission, 2018c).

It appears that the ambiguity of the information retrieved may not only be due to different self-reporting but varying interpretations as to which strategies would qualify as a NAP.

2.2 An in-depth analysis of European NAPs and strategies

Taking into account the above findings according to different sources, EPHA undertook a thorough independent assessment of AMR NAPs and strategies in place in the EU MS and Iceland, Norway and Switzerland. An in-depth account of national AMR action plans or similar initiatives in EU MS and EFTA countries can be found in the annex.

At first glance, EPHA's analysis suggests that most countries have a NAP in place or have initiated the process for its development. In fact, out of the 31 countries analysed in this paper, it is estimated that **74% have developed and/or implemented a NAP or a similar initiative to tackle AMR.**

However, it is not often clear whether certain national policies would qualify as formal national plans, for example, the policy paper issued by the Belgian Antibiotic Policy Coordination Commission. In addition, some plans appear to be rather fragmented comprising of a main strategy accompanied by other secondary documentation or separate strategies targeting one sector in particular. For example, the Danish and Norwegian NAPs are accompanied by a specific strategy dedicated to human healthcare. Furthermore, a veterinary strategy is in place in Romania, whereas Poland appears to have a programme only covering the human health dimension of AMR. Therefore, it is questionable whether these could be considered comprehensive AMR NAPs, in the spirit of a One Health approach.

From the 22 actions plans or programmes addressing AMR that have been identified in the 31 countries analysed in this paper, 19 are still valid and cover the period until 2018 (see below). Although the most recent NAPs have been released in 2018, the majority of NAPs in place have been issued in 2017, with a notable increase in the number of NAPs in place since 2015. In addition, it worth noting that those countries which do not have a NAP in place, have a NAP which is no longer valid or have reported that a NAP is currently under development, appear to be mainly located in Southern and Eastern Europe.

Austria (2018)
National Action Plan on Antimicrobial resistance NAP-AMR

Luxembourg (2018 – 2022)
National Antibiotics Plan

Croatia (2017 – 2021)
National programme for the control of antibiotic-resistant bacteria

Finland (2017 – 2021)
National Action Plan on Antimicrobial Resistance

Denmark (2017)
One Health Strategy against Antibiotic Resistance

Lithuania (2017 – 2020)
Action Plan for the prevention and control of the spread of micro-organisms resistant to antimicrobial agents

Italy (2017 – 2020)
National Plan against Antimicrobial Resistance (PNCAR)

Ireland (2017 – 2020)
National Action Plan on Antimicrobial Resistance (iNAP)

Portugal (2017)
Programme for the Prevention and Control of Infections and Resistance to Antimicrobials

France (2016)
Interministerial Roadmap for Controlling Antimicrobial Resistance

Poland (2016 – 2020)
National Antibiotic Protection Programme

Sweden (2016 – 2020)
Revised intersectoral action plan against antibiotic resistance 2018-2020 – basis for continued work of the collaborative group

Netherlands (2015 – 2019)
Letter to parliament about the approach to antibiotic resistance

Norway (2015 – 2020)
National strategy against antibiotic resistance

Germany (2015)
DART 2020 Strategy - fighting antibiotic resistance for the good of humans and animals

Switzerland (2015)
Strategy on Antibiotic Resistance Switzerland (StAR)

Belgium (2014 – 2019)
Belgian Antibiotic Policy Coordination Committee (BAPCOC) policy paper

Spain (2014 – 2018)
Strategic Action Plan to reduce the risk of selection and dissemination of AMR

United Kingdom (2013 – 2018)
Five-Year Antimicrobial Resistance Strategy 2013-2018

Moreover, as a number of NAPs in place pre-date the adoption of the 2015 Global Action Plan on AMR and the 2016 Council Conclusions on combatting AMR (see sections 1.2 and 1.3), the question remains, **to what extent do the NAP's in place reflect the One Health perspective and the primary goals of AMR NAPs as provided in the Global Action Plan?**

A number of recently adopted NAPs including those of DE, DK, FI, FR, IE, IT, HR, NL and LT make clear reference to the objectives of the Global Action Plan on AMR and other European initiatives, emphasising inter-sectoral governance and cooperation also within an international context. The Croatian and Finnish plans identified priority areas and goals which are fully aligned to the strategic objectives of the Global Action Plan (Ministry of Health of Croatia, 2017; Hakanen et al., 2017). The Dutch example also puts a focus on strengthening EU-wide cooperation (Ministry of Health, Welfare and Sport, 2015a). Moreover, several NAPs also refer to the 2011 European Action Plan Against the Rising Threats from AMR or the 2016 Council Conclusions on AMR, signalling that such initiatives could provide a basis for initiating action and have had some degree of influence on the development of NAPs and their target areas.

Irrespective of whether NAPs were released prior to 2015, certain elements laid out in the Global Action Plan and the 2016 Council Conclusions feature predominantly in most NAPs which are currently in place. These are:

- infection prevention;
- promoting prudent use of antimicrobials;
- surveillance and monitoring of consumption and resistance of antimicrobials;
- awareness-raising and education.

In fact, around 60% of action plans and strategies analysed, have identified infection prevention and control and awareness-raising among professionals and the general public, as common overarching goals, priorities or pillars.

Moreover, despite the fact that most strategies also include research and innovation as a focus area, several NAPs seem to place an emphasis on stimulating the development of new antibiotics, diagnostic tools and alternative therapies. This is particularly the case for the UK, FR and DE.

The theme of infection prevention through enhancing vaccinations coverage and the development of new vaccines currently features in 4 AMR strategies, namely, those of IE, FI, FR, NO and CH. For example, the Swiss National Strategy on AMR includes vaccination promotion as a measure under the objective of infection prevention whereby, targeted preventive measures are intended to reduce the need to resort to antibiotics. Measures to support vaccination campaigns aimed at particular target groups and individuals at risk of specific diseases are also identified as well as the promotion of research on antibiotic alternatives, such as complementary medicines (Federal Council, 2015).

2.2.1 Thematic areas: analysis

The following sections explore and showcase some examples of NAPs according to four

thematic areas: coverage of a One Health approach; identification of funding sources and budget estimates; implementation and integration of evaluation and progress monitoring mechanisms, and inclusion of measurable targets.

1. COVERAGE OF A ONE HEALTH APPROACH

How well do the NAPs currently in place cover a One Health approach, encompassing all relevant sectors?

At the time of the analysis (December 2018), only 51% of the countries analysed have action plans or national programmes/strategies covering the period until 2018, that follow a One Health approach. However, there are considerable variations among countries with regard to the comprehensiveness of their plans and the extent to which different dimensions of AMR are reflected.

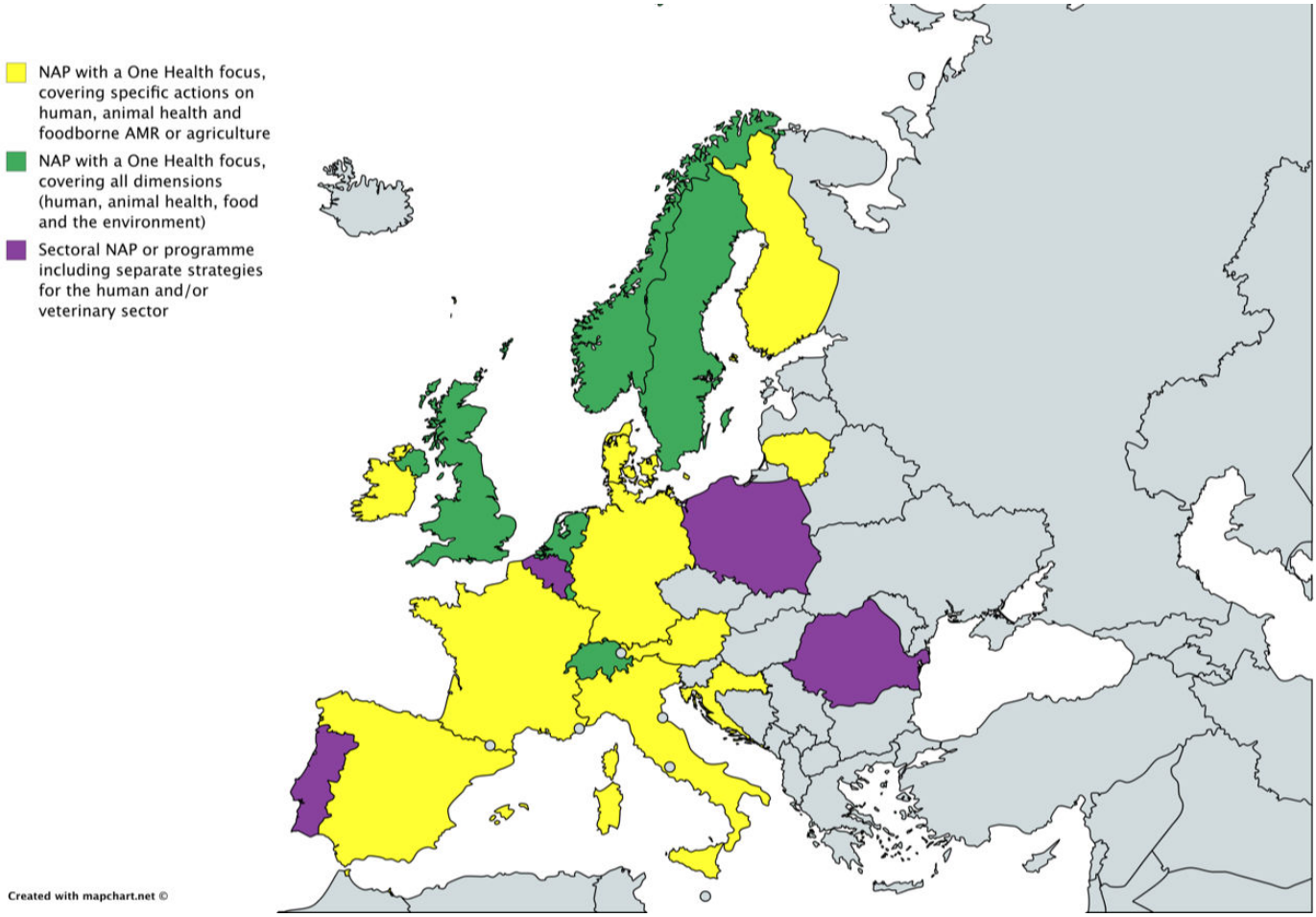

Figure 5: A closer look at the coverage of a One Health approach in National Action Plans or similar programmes in place in EU MS and EFTA countries

Source: EPHA's analysis based on information derived from national plans and strategies on AMR

It is worth nothing that in addition to the adoption of One Health AMR plans, separate strategies focusing on one sector in particular have been issued in FR, DK, NO and the NL. For example, following the publication of the French inter-ministerial roadmap for controlling AMR, a second national action plan was released in 2017 on the reduction of AMR in veterinary medicine. Similarly, complementary to its overarching AMR NAP, DK has issued a specific NAP on antibiotics in human healthcare and an action plan focusing on livestock-associated MRSA. Moreover, the letter to the Dutch Parliament concerning the approach to address AMR currently serves as the NAP. The letter is accompanied by administrative agreements and other documentation setting out activities to be implemented across various sectors (Ministry of Health, Welfare and Sport, 2015b).

Whilst acknowledging the One Health concept, **some NAPs do not appear to follow a true One Health approach and still address AMR in different fields separately**. This is the case of BE, which has two separate strategies for the human and veterinary sector. In fact, an ECDC country visit report recommended the development of a comprehensive and inter-sectoral NAP based on BE's current strategic policy paper (ECDC, 2018c). In the case of PT, the national programme for the prevention and control of infections and AMR covers human health with a complementary NAP for the reduction of antibiotic use in animals.

Therefore, although separate plans are seen as mutually reinforcing, it is clear that in several countries, there remains considerable scope to explore possibilities of integrating and incorporating multiple plans and programmes into a single, comprehensive One Health NAP. Moreover, the development of One Health plans cannot necessarily be equated to inter-sectoral implementation. Some strategies do not detail the manner in which actors from multiple sectors will collaborate to fulfil the planned activities.

Although all One Health NAPs include actions to be undertaken in the human and veterinary sector, it is only a few which go even further and identify actions relevant to the agriculture, food safety and environment sectors. The Italian, Swedish, Luxembourgish and the Norwegian plans highlight the food safety aspect and tackling foodborne AMR particularly with regard foods of animal origin. Nonetheless, the environment sector receives the least attention. In general, recent action plans make more reference to the environmental and agricultural dimension of AMR compared to action plans released several years ago. This may reflect positive developments that more research into non-traditional dimensions of AMR has been undertaken or that international initiatives emphasising the importance of the three sectors influencing AMR have been well-received.

Despite the fact that some strategies, for example those from Luxembourg and Sweden, recognise the environmental component, most of the proposed interventions included in NAPs which aim to reach strategic or specific objectives, are generally identified in the human or veterinary sectors.

Therefore, even in NAPs which recognise the importance of a One Health approach and claim to have a focus across all sectors, **not all the dimensions of AMR are treated equally**. It is evident that NAPs developed and implemented across EU MS lack a focus on the environmental aspect of AMR. In fact, only the Norwegian and Swiss strategies truly place considerable emphasis to addressing the environmental dimension of AMR. The Norwegian Strategy notes that surveillance and increased scientific understanding of antibiotics use and AMR should also cover the environmental sector (Ministry of Health and Care Services, 2015). In the case of Switzerland, measures identified for each field of activity are to be carried out across relevant sectors including agriculture and the environment, noting the possibility of bringing out multiple synergies. Its strategy also includes measures examining the impact of antibiotic use on the environment and the role of the environment in spreading AMR (Federal Council, 2015).

In addition, the Swiss strategy recognises that AMR could be reduced through the implementation of measures aimed at eliminating substance traces in waste water purification facilities. This is a novel approach which is not featured in other EU MS' action plans. The strategy also includes an action to study the extent to which existing measures aimed at eliminating antibiotics and other substance traces from waste water are also suitable for eliminating antibiotic-resistant organisms, and whether there are more economical and effective alternatives available (Federal Council, 2015).

2. IDENTIFICATION OF BUDGETS AND FUNDING SOURCES

Identifying the required human and financial resources and funding sources may assist Member States in the oversight of the costs of planned actions in order to implement their NAPs and achieve maximum impact. Therefore, it is beneficial for governments to clearly list resources and envisaged funding streams in their plans which could facilitate implementation and the achievement of set objectives.

Estimates of required financial resources or a delineation of dedicated funds available for the implementation of action plans are not a frequent occurrence in the NAPs of countries analysed in this paper. However, there are a number of countries which either provide a general estimate of financial resources needed for the entire implementation of the plan or calculate budgets to be drawn from selected funds for each planning action underlined in the plan.

For example, the UK strategy is accompanied by a detailed Impact Assessment, which includes a thorough economic assessment (Department of Health, 2013), identifying cost estimates, cost-benefits of implementing actions specific to each of the key areas of action and the impact of the strategy in comparison to inaction.

Another good example is the Swiss plan which provides an estimate of the required financial resources and identifies funding streams. An economic assessment was carried out to

produce an initial estimate of the one-off and recurring costs to be incurred from public funds and private stakeholders. However, the assessment only covered the cost implications of those measures for which implementation procedures are clearly defined and envisaged (Federal Council, 2015).

In addition, the Lithuanian NAP identifies funding sources and is expected to be financed from the national budget as well as budgets of municipalities and institutions responsible for implementation of measures, EU and other structural funds, international programmes and other relevant funds (Ministry of Health of Lithuania, 2017). Estimates of governmental funds that are needed for the implementation of planned activities are provided in the Croatian action plan (Ministry of Health of Croatia, 2017). The Czech programme also provides a brief indication of funding options and in some instances, refers to the possibility of co-funding from the European Regional Development Fund (ERDF) (Ministry of Health of Czech Republic, 2011).

The Danish action plan provides that actions undertaken to achieve the set goals will be financed from within the current financial framework (Ministry of Health, Ministry of Environment and Food of Denmark, 2017). Similarly, the Norwegian strategy points out that measures identified will be implemented within applicable budgetary frameworks (Ministry of Health and Care Services, 2015).

3. IMPLEMENTATION AND EVALUATION OF NAPS

Some countries include timelines for implementation of actions in their NAPs, while other NAPs are also accompanied by an implementation plan, including indicators or evaluation criteria used to monitor progress and the achievement of set targets. This is the case of HR and LT, whereby interim progress reporting or annual reporting by implementing bodies is also foreseen. This demonstrates that multiple actors are involved in the monitoring and evaluation of the NAPs implementation and objectives and actions can be refocused according to needs.

The Swiss Strategy refers to periodic monitoring of the efficacy, suitability and affordability of the proposed measures as well as an evaluation of the overall strategy. An interim report within five years of the strategy's adoption is also foreseen which will allow the possibility to make any required changes to the implementation process and envisaged funding (Federal Council, 2015).

Indicators for monitoring are listed in the Portuguese programme for the prevention and control of AMR (Ministry of Health of Portugal, 2017). For evaluation purposes, the Luxembourgish plan also identifies performance indicators and methods for the presentation of outcomes for each proposed intervention (Ministry of Health and Ministry of Agriculture, Viticulture and Consumer Protection, 2018).

Despite the identification of responsible actors

and bodies tasked with the implementation of specific actions and measures outlined in the NAPs, estimates of additional human resources needed for the implementation of actions seem to be missing. However, the Austrian action plan does call for more hygiene teams, infectiologists and multidisciplinary teams in hospitals.

4. INCLUSION OF MEASURABLE TARGETS

Setting quantitative and measurable targets appear to be an effective way to achieve goals related to the prevention and reduction of AMR within a specified time frame. The Global Action Plan on AMR also highlights the importance of including incremental implementation targets, in order to achieve maximum impact (WHO, 2015b).

Out of the 31 countries analysed, a few countries have identified measurable targets in their AMR action plans and strategies or accompanying documentation.

BELGIUM

The Belgian Antibiotic Policy Coordination Committee (BAPCOC) set out several objectives, indicators and targets for human medicine in its policy paper for the 2014-2019 term.

On hospitals, the following three targets were identified, to be achieved by 2019:

1. The choice of therapeutic antibiotics and surgical antibiotic prophylaxis to follow local instructions in at least 90% of cases;
2. An indication statement of antibiotic therapy in the medical record is stated in at least 90% of cases;
3. The duration of surgical antibiotic prophylaxis to follow local instructions in at least 90% of cases.

On outpatient care, targets focus on the reduction of prescriptions and consumption of antibiotics such as:

1. decreasing total antibiotic consumption, from more than 800 prescriptions per 1,000 inhabitants per year to 600 prescriptions by 2020 and 400 prescriptions by 2025;
2. decreasing the consumption of quinolones, a newer class of broad-spectrum antibiotics, from about 10% of the total antibiotic use to 5% by 2018 (Balligand et al., 2014).

On veterinary medicine, the Centre of Expertise in Antimicrobial Consumption and Resistance in Animals (AMCRA) published the AMCRA 2020 Strategy Plan, which was approved by the BAPCOC Veterinary Medicine Working Group. The ambitious plan defines the guidelines for national policy on antibiotic use and resistance in animals and identifies two clear targets to be achieved by 2020, with 2011 as reference year:

1. A 50% reduction in antibiotic consumption by 2020. Progress has already been made in this regard as there is a marked and sustained reduction of 25.9% from 2011 to 2017;
2. A 75% reduction in the use of the most critically important antibiotics by 2020.

From 2011 until 2017, there has been a cumulative reduction of 84.4%. The greatest decrease recorded was between 2016 – 2017.

A further target to achieve a 50% reduction in the use of medicated premixes containing antibiotics by 2017, has already been reached as there has been a marked cumulative reduction of 53% from 2011 until 2017 (AMCRA, 2014).

DENMARK

Three measurable targets for the reduction of antibiotic consumption in humans by 2020, taking 2016 as a baseline year, were introduced in the Danish National Action Plan on Antibiotics in Human Healthcare:

1. reducing the number of redeemed prescriptions for antibiotics in the primary healthcare sector from 460 prescriptions per 1000 inhabitants per year in 2016 to 350 prescriptions in 2020;
2. increasing the use of narrow-spectrum antibiotics (as opposed to broad-spectrum antibiotics), whereby the use of Penicillin V would increase from approx. 31% in 2016 to 36% of the total antibiotic use in the primary healthcare sector in 2020, measured by the number of prescriptions per 1000 inhabitants;
3. reducing the consumption of critically important antibiotics by 10% by 2020 measured by Defined Daily Dose (DDD)/100 bed days for hospitalised patients (Ministry of Health of Denmark, 2017)

One target for the veterinary sector has been outlined in the national action plan for the control of livestock-associated MRSA, stating that the use of antibiotics in pigs should be reduced by 15% from 2015 to 2018 (Ministry of Food, Agriculture and Fisheries, 2015).

ITALY

Several measurable targets are defined in the Italian National Action Plan on Antimicrobial Resistance (PNCAR) 2017-2020, to be achieved by 2020, taking 2016 as a reference year. In the human sector, targets have been identified:

1. reducing the consumption of systemic antibiotics by more than 10% at local level and reducing the consumption of systemic antibiotics by more than 5% in hospitals;
2. reducing the consumption of fluoroquinolones, a class of broad-spectrum antibiotics, by more than 10% at local level and reducing the consumption of fluoroquinolones by more than 5% in hospitals;
3. reducing the prevalence of Methicillin-resistant S.aureus (MRSA), a contagious bacteria resistant to many antibiotics, in blood isolates by more than 10%;
4. reducing the prevalence of Carbapenemase-producing Enterobacteriaceae (CPE), bacteria which have become resistant to powerful antibiotics such as carbapenems, in blood isolates by more than 10%.

Targets focusing on the reduction of antimicrobial consumption in the veterinary sector have also been identified:

1. reducing the consumption of antibiotics

by more than 30%;
2. reducing the consumption of CIAs by more than 10%;
3. reducing colistin consumption to a level of 5 mg/PCU;
4. reducing the consumption of orally administered antibiotics by more than 30% (Ministry of Health of Italy, 2017).

The WHO defines a critically important antimicrobial to be an antibiotic which is critically important for human health and its use should be restricted, especially within the veterinary sector.

THE NETHERLANDS

Targets are laid down in the letter to the Dutch Parliament concerning the approach to addressing AMR. During the period 2015-2020, the Netherlands aims to significantly reduce the incidence and spread of AMR as well the number of infections and deaths caused by AMR. More tangible targets in the human health sector include the reduction of avoidable health-care associated infections by 50% and the reduction of the use of incorrectly prescribed antibiotics across the entire healthcare chain by at least 50%, by 2020. The baseline year for these targets is not specified and is to be defined by relevant actors.

For veterinary sector, although the use of critical antibiotics has been reduced to almost zero in animal farming, a 70% reduction of antibiotic use in animals was envisaged by the end of 2018, compared with 2009 (Ministry of Health, Welfare and Sport, 2015).

NORWAY

Specific and measurable targets to be achieved by 2020 are identified in the Norwegian National Strategy against AMR.

Regarding the human health sector, targets, measured in DDD per 1,000 inhabitants per day, are listed as follows:

1. reduce antibiotic use by 30%, compared with 2012;
2. make Norway one of the three European countries that uses the least antibiotics in humans;
3. reduce the prescription of antibiotics from an average of 450 prescriptions per 1000 inhabitants per year to 250 prescriptions per 1000 inhabitants per year;
4. reduce the prescription of antibiotics for respiratory infections by 20%, compared to 2012 (Ministry for Health and Care Services, 2015).

In the veterinary and fisheries sector, the following measurable targets are defined:

1. livestock-associated methicillin resistant Staphylococcus aureus (LA-MRSA) will not be established in the Norwegian pig population;
2. reduce the use of antibiotics in terrestrial animals used for food production by at least 10%, compared with 2013;
3. reduce the use of antibiotics in household pets by at least 30%, compared with 2013;
4. Narasin and other anticoccidial drugs will be phased out in poultry production (subject to certain conditions);
5. total antibiotic use in fish farming will

be equal to or lower than for the period 2004-2014 (measured in total kilograms of antibiotics)
(Ministry for Health and Care Services, 2015).

PORTUGAL

Four targets on AMR and HCAI to be achieved by 2020, are identified in the Portuguese Programme for the Prevention and Control of Infections and Resistance to Antimicrobials and other national health programmes.

The targets are as follows:

1. reduce antibiotic intake in the community to below 19 DDD per 1,000 inhabitants;
2. keep the rate of carbapenem-resistant Klebsiella pneumonia below 6%;
3. reduce HCAI in hospitals to less than 8%;
4. reduce HCAI in long-term care settings to less than 10% (Ministry of Health of Portugal, 2017).

3. DISCUSSION

> *"...There is a need for clear leadership in all EU Member States... [regarding the] development and implementation of national plans to combat AMR...Better collaboration is also needed on the local, national, European and global levels."*
>
> **European Commission (EC, 2017b)**

The development and implementation of NAPs can be considered as an important first step towards effective policy responses to fight AMR in Europe and globally. Although the ambitious target of adopting NAPs worldwide by 2017 has not been reached, at a global level, there has been sustained progress in the development of NAPs to address AMR.

According to the tripartite organisations global database for AMR, which includes a recent overview of country progress on the implementation of the Global Action Plan and the development of NAPs, all EU MS, Norway, Iceland and Switzerland, reported the implementation, publication or development of a NAP. However, the stages and comprehensiveness of the development and implementation of NAPs in European countries vary significantly. Variations on the levels of multi-sectoral coordination following a One Health approach are also apparent, ranging from comprehensive and integrated approaches used to implement national AMR action plans and setting up of functional multi-sectoral working groups or coordination committees to the absence of formal multi-sectoral governance or existing coordination mechanisms (WHO, 2017b). The establishment of multidisciplinary professional networks, like the Swedish Strategic Programme for the Rational Use of Antimicrobial Agents and Surveillance of Resistance (STRAMA) in Sweden, BAPCOC in Belgium and the Working Party on Antibiotic Policy (SWAB) in the Netherlands, is a step in the right direction as such structures support and reinforce national interventions (European Commission, 2017b).

Based on the thorough independent assessment undertaken of AMR national

action plans and strategies in place in the EU MS and Iceland, Norway and Switzerland, it is unequivocal that most countries have a NAP in place or have initiated the process for its development. In fact, of the 31 countries analysed in this paper, **74% have developed and/or implemented a NAP or a similar initiative to tackle AMR**. The most recent NAPs were released by AT and LU in 2018, followed by HR, DK, FI, IE, IT, PT and LT in 2017. Other countries publishing an action plan or strategy include FR, PL and SE in 2016; DE, NL, NO and CH in 2015; BE and ES in 2014; the UK in 2013; CY in 2012; CZ in 2011 and EL in 2008. Of these 22 actions plans or programmes, 19 are still valid and cover the period until 2018.

Given that nearly 40% of the countries analysed published their NAP after 2015, with the majority of NAPs released in 2017, is it possible to conclude that the increasing political momentum round AMR and the 2017 EU Action Plan on AMR may have had an impact in stimulating and reinforcing action from the part of MS to live up to their previous international commitments?

Recent plans appear to be more robust and take into account a One Health approach with more countries putting in place monitoring and financing arrangements to ensure their effective implementation. Those countries which do not have a NAP in place or have reported that a NAP is currently under development, appear to be located mainly in Eastern Europe.

However, it is not often clear whether certain national policies would qualify as formal national plans and some plans appear to be rather fragmented comprising of a main strategy accompanied by other secondary documentation or separate strategies targeting one sector in particular. Therefore, it is questionable whether these could be considered comprehensive AMR NAPs.

At the time of this analysis, only **51% of the countries analysed have action plans or national programmes/strategies that follow a One Health approach**. Whilst acknowledging the One Health concept, **some NAPs do not appear to follow a truly One Health approach and still address AMR in different fields separately**. Therefore, in several countries, there remains considerable scope to explore possibilities of integrating and incorporating multiple plans and programmes into a single, comprehensive One Health NAP. This may require better coordination and communication among different government Ministries and agencies and ensuring that all relevant actors understand the importance of adopting a multi-sectoral approach.

All One Health NAPs include actions to be undertaken in the human and veterinary sector. However, both globally and within the EU, the **environmental aspect of AMR** receives the least attention. Despite the fact that some action plans recognise the environmental component, proposed interventions aimed at reaching national strategic objectives are only identified in the human or veterinary sectors. It is only the Norwegian and Swiss strategies which truly integrate the environmental dimension into their NAP and include the environment among the sectors within which actions are to be undertaken.

EPHA considers a multi-sectoral One Health approach as crucial in addressing AMR because it recognises the different transmission dynamics of AMR and the importance of coordinating joint actions across the human, veterinary, agriculture and environment sectors.

It is important that NAPs are aligned to the WHO Global Action Plan and are consistent with the main pillars of the EU Action Plan. However, a number of NAPs in place pre-date the objectives set out in the Global Action Plan and the Council Conclusions on combatting AMR of June 2016 (which lists several components that should be included in a NAP).

To what extent, then, do the NAPs in place reflect the One Health perspective and the primary goals of the Global Action Plan on AMR?

A number of recently adopted NAPs including those of IE, IT, FI, DK, NL, DE, FR, LT and HR make clear reference to the objectives of the Global Action Plan on AMR and other European initiatives, emphasising inter-sectoral governance and cooperation also within an international context. In the case of HR and FI, identified priority areas and goals are fully aligned to the **strategic objectives of the Global Action Plan**, i.e. focusing on infection prevention and control practices; ensuring equitable access to antibiotics and treatment and appropriate use of antibiotics; ensuring adequate surveillance and monitoring of the emergence and spread of AMR; achieving a One Health approach through multi-stakeholder and multi-sectoral engagement; and raising awareness on antibiotics use and AMR.

Irrespective of whether NAPs were released prior to 2015, certain elements laid out in the Council Conclusions, such as infection prevention, promoting prudent use of antimicrobials, surveillance and monitoring of consumption and resistance of antimicrobials; and awareness-raising and education, feature predominantly in most NAPs which are currently in place. In fact, around 60% of action plans and strategies analysed have identified **infection prevention and control and awareness-raising among professionals and the general public**, as common overarching goals, priorities or pillars.

However, MS seem to be performing less well with respect to other important elements referred to in the Global Action Plan, such as the development of incremental targets for implementation; monitoring and reporting arrangements; dedicated funding and technical resources needed for effective implementation and focusing on priority areas first and dealing with others in the long-term, allowing for flexibility for priorities to be adjusted according to national needs. Similarly, the Council Conclusions of 2016 also affirmed that implementation and progress monitoring should be integrated in NAPs.

Estimates of required financial resources or a delineation of dedicated funds available for the implementation of action plans are often missing in the NAPs of countries analysed in this paper. However, some countries either provide a general estimation

of financial resources needed for the entire implementation of the plan or calculate budgets to be drawn from selected funds for each planning action underlined in the plan. For example, the UK strategy is accompanied by a detailed Impact Assessment, which includes a thorough economic assessment, identifying cost estimates, cost-benefits of implementing actions specific to each of the key areas of action and the impact of the strategy in comparison to inaction (Department of Health, 2013). Another good example is the Swiss plan which provides an estimate of the required financial resources and identifies funding streams. An economic assessment was also carried out to produce an initial estimate of the one-off and recurring costs to be incurred from public funds and private stakeholders (Federal Council, 2015).

Only **a handful of countries incorporate monitoring for evaluation purposes into their NAP**. For example, the Croatian and Lithuanian strategies are accompanied by an implementation plan, including indicators or evaluation criteria used to monitor progress and the achievement of set targets. In addition, an interim progress report or annual reporting by implementing bodies are foreseen. The Swiss and the UK examples also include periodic monitoring and interim reporting. Indicators for monitoring are also listed in the Portuguese programme for the prevention and control of AMR and the Luxembourgish plan identifies performance indicators and methods for the presentation of outcomes for each proposed intervention.

Moreover, less than 10 countries out of the 31 countries analysed have **identified targets in the human and veterinary sectors** which are quantitative and measurable to achieve goals related to the prevention and reduction of AMR within a specified time frame.

3.1 Challenges and support for Member States in the development and implementation of NAPs

This analysis sheds light on possible initiation and implementation challenges MS could be facing in the process of developing or executing their NAPs. Implementing actions in the spirit of a One Health approach may be cumbersome, particularly if national structures in place, such as coordination committees, do not have a truly represent all relevant sectors. Moreover, if funding is not clearly indicated and provided, responsible actors may face difficulties in accessing funds in order to realise projects set out in the plans. In fact, resource mobilisation and integrating sustainable financing mechanisms into NAPs is also essential for the implementation of wider AMR stewardship.

It appears that some of the challenges and recommendations outlined by the WHO in its policy package to combat AMR in 2011 may still be valid. The package highlighted the critical actions to be taken by governments with the involvement of all stakeholders to make progress on AMR.

At the time, national AMR programmes were considered fragmented and incomprehensive and several challenges were highlighted, namely, the lack of government commitment

and scientific data; fragmented healthcare services and the lack of access and affordability of medicines; poor infection prevention and control practices; inappropriate prescription practices, insufficient training of personnel, lack of access to rapid diagnostics and lack of legal frameworks in place to regulate the use of antimicrobials.

In response to these common challenges, the **WHO identified policy actions to be taken by governments**, including reaffirming governmental commitments to comprehensive and financed national plans which are accountable and involve the engagement of civil society (Leung et al., 2011).
In March 2017, an Interagency Coordination Group of UN agencies and individual experts (IACG) was launched. The group, called upon by UN Member States in the political declaration on AMR of September 2018, seeks to offer advice and practical guidance on how to address AMR and improve coordination actions across sectors and countries in view of the implementation of the Global Action Plan. At the 7th meeting of the ad-hoc IACG in May 2018, the subgroup dedicated to NAPs presented the key challenges in implementing NAPs namely: awareness and political will; financing; coordination; monitoring, and technical capacity. Three areas for developing recommendations were also identified:

- Mainstreaming – *mainstreaming AMR action across health, agricultural and environmental projects and programmes increasing the likelihood of achieving sustained action;*
- Financing – *integrating NAP implementation into national and local budgets and planning cycles ensuring sustainability;*
- Regional cooperation – *improving the*

- **Commit** to a comprehensive, financed national plan with accountability and civil society engagement
- **Strengthen** surveillance and laboratory capacity
- **Ensure** uninterrupted access to essential medicines of assured quality
- **Regulate** and promote rational use of medicines, including in animal husbandry, and ensure proper patient care
- **Enhance** infection prevention and control
- **Foster** innovations and research and development for new tools

Figure 6: The WHO's policy package to combat antimicrobial resistance
Source: The WHO policy package to combat antimicrobial resistance. Bulletin of the World Health Organization, 89(5), 390–2. (Leung et al., 2011).

efficiency and effectiveness of NAP implementation through cooperation and by ensuring that lack of action in one area does not undermine progress in other areas (IACG, 2018).

Parallels could be drawn between the abovementioned challenges and recommendations and the findings of this paper. In addition, the following sub-sections outline a number of suggestions on how countries could be further supported in their endeavours.

3.1.1 Supporting tools for Member States

The WHO in collaboration with the tripartite organisations has been leading multiple initiatives to address AMR and promote best practices. In the spirit of a One Health approach, the tripartite organisations have also been working closely with interested bodies to provide technical support and assistance to countries to develop their AMR plans and strengthen their surveillance systems to prevent and manage AMR.

In 2016, the WHO published a manual for developing NAPs and a set of accompanying supporting tools. This was requested by the WHA to provide assistance to countries during the initial phase of developing new, or refining existing, NAPs in line with the five strategic objectives of the Global Action Plan.

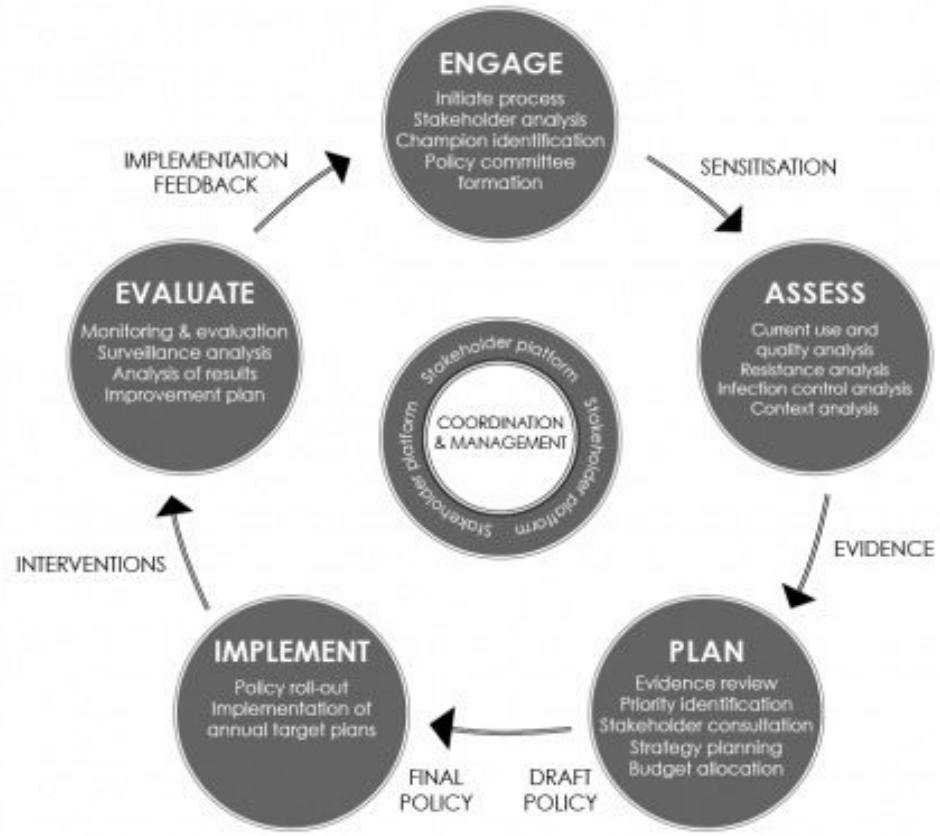

Figure 7: The 5-step national policy development process from the ReAct Toolbox
Source: ReAct (ReAct, 2018b)

It proposes an incremental approach which countries can adapt to their specific needs, national contexts and available resources (WHO, FAO, OIE, 2016).

The supporting tools developed by WHO, in collaboration with FAO and OIE, include a sample terms of reference for suggested coordination mechanisms, a generic template for a NAP and a sample plan for monitoring and evaluation.

The tripartite organisations have also agreed, as a priority, to continue to support the development, implementation, monitoring and evaluation, of NAPs, particularly in the African and Eastern Mediterranean regions (WHO, FAO, OIE, OECD, 2017).

Moreover, ReAct, an international network working on AMR and its drivers, has developed a Toolbox containing supportive and practical measures which could be considered by countries in the process of developing and implementing coordinated AMR policies. The Toolbox, a web-based resource, includes a guide for developing and implementing NAPs as well as material suggesting different policy elements and components which could be incorporated in NAPs, including resources and tools for NAP implementation (ReAct, 2018a).

In order to support actors involved in the development and implementation of the NAPs, a 5-step cycle was developed to highlight the possible life-cycle of a NAP. The cycle covers key areas including, engaging stakeholders, assessing the current situation, planning the work and developing the plan, as well as implementing the plan and evaluating progress (ReAct, 2018b).

3.1.2 Funding opportunities to assist Member States and the cost-effectiveness of taking action

NAP implementation requires financial resources and capacity building through long-term investment into operational research, laboratories, competent regulatory capacities, prevention practices, and professional education and training, across different sectors. Setting concrete goals will also facilitate earmarking of funding, which is of utmost importance for the timely implementation of NAPs.

The costs of implementing simple yet effective strategies and activities would outweigh the economic consequences of the increase in resistance and significant economic losses as a result of the effects of AMR on healthcare systems, exports and productivity losses. Therefore, action to fight AMR should be rather seen as an investment.

Recently published estimates by the OECD provide an insight into the economic burden of antibiotic resistance, as well as the cost-effectiveness of national policies in reducing AMR. The growing threat of AMR is expected to increase by 2050, posing a significant risk to the health of populations and to economies. However, the high and ever-increasing healthcare services costs of AMR as a result of growing resistance rates may be curbed through simple, yet meaningful public health interventions such as those aimed

at promoting the prudent use of antibiotics, ending over-prescription of antibiotics and enhancing infection control through better hygiene practices in hospitals (OECD, 2018a).

The EP in its recent Resolution on AMR stressed that MS do not equally possess sufficient resources to develop and implement comprehensive national AMR strategies and therefore, more dedicated funding should be made available (European Parliament, 2018a). In response to an IACG discussion paper on NAPs open for public consultation, the Antibiotic Resistance Coalition (ARC), made up of international organisations and civil society, also emphasised the lack of sustained financing of NAPs and that governments may require dedicated support in the prioritisation of national resources (ARC, 2018).

The Global Action Plan on AMR recognises that while the WHO Secretariat will facilitate and support countries in the development, implementation and monitoring of their NAPs and collaborate with the World Bank to estimate the level of investment needed to implement the plans, MS are expected to assess the resources needed for the implementation of NAPs and develop plans to secure and execute the required financing (WHO, 2015b).

Similarly, one of the concrete activities listed in the EU One Health Action Plan against AMR is co-funding through the EU Health Programme, and collaborating with the WHO European Region on activities to assist EU MS in developing and implementing national One Health action plans against AMR (European Commission, 2017a). However, it seems that this potential opportunity has not been fully explored to date (European Commission, 2018a). Therefore, more could be done to provide targeted support to MS to fulfil their commitments and ensure that actions to tackle AMR are undertaken in all EU MS, of utmost importance given the cross-border dimension of the AMR threat.

In addition, funding opportunities could make a significant difference in the implementation of NAPs as demonstrated by the successes of the Fleming Fund, initiated by the UK Government, where 31 NAPs have been developed with the Fund's support in low and middle-income countries worldwide (Fleming Fund, 2018).

3.1.3 Expert knowledge and advice

Joint ECDC/EC country visits are one of the many initiatives set out in the EU Action Plan against AMR. Following and official invitation from MS, dedicated teams conduct visits and meetings to discuss AMR issues in a country to provide an assessment of the situation regarding the prevention and control of AMR as well as to suggest potential opportunities to enhance the effectiveness of current national efforts (European Commission, 2017a). This is another opportunity that MS could seize in order to benefit from expert assistance in the further development and implementation of their national policies for tackling AMR, in line with a One Health approach.

The visit in January 2017 to Italy seems to have been directly beneficial. Further to the recommendations proposed in the ECDC country visit to discuss antimicrobial resistance

issues to finalise a NAP including actions, indicators and targets, with measurable outcomes and shorter deadlines for its operational implementation, Italy released its comprehensive action plan in October 2017, identifying key performance indicators and targets for AMR, including short-term and long-term planning. Although an estimate of resource allocation and costs for activities at both national and regional level are not ultimately reflected in the NAP, the ECDC report notes from the outset that financial deficits should not impede NAP implementation, as investment in antibiotic stewardship and infection prevention and control has proven to be cost-effective and will result in considerable long-term savings (ECDC, 2017b).

3.2 Limitations

Since the initial phase of the mapping exercise undertaken in this paper consisted of a literature review, using secondary sources, the information may not be exhaustive due to various factors including limitations in the search strategy. Moreover, it is important to cautiously interpret findings derived from sources based on country self-reporting as questions may have been interpreted in different ways by respondents, reflecting the variety of national situations and practices. Questionnaires may have also been returned incomplete with missing information which could possibly distort the overall picture.

As part of EPHA's independent assessment of NAPs and similar initiatives, information available in each country was gathered and analysed, often in different languages, which were translated into English. Careful consideration was given to ensure that the most recent documentation was retrieved concerning national action plans and programmes currently in place. However, for those countries whose NAP is still under development, information which would allow for an elaboration of the different stages of development and possible insight into foreseen publication of NAPs was limited.

In conclusion, it is worth noting that a NAP is a policy document which may not always translate into the implementation of effective actions. Therefore, countries with an extensive action plan may still be ineffectively prepared in the fight against AMR, while a country may be relatively well-equipped despite an incomplete plan or the absence of a comprehensive NAP.

4. CONCLUSIONS AND RECOMMENDATIONS

> *"Rising rates of antimicrobial resistance...will become a growing concern unless governments embrace a more robust response to the threat"*
>
> **Organisation for Economic Co-operation and Development (OECD, 2018b)**

Coherent and robust policies and actions are crucial to effectively combat AMR. A NAP provides a guiding policy framework in the fight against AMR, whereby different multi-sectoral actions are aligned and coordinated.

NAPs should seek to address AMR challenges within a country's context and needs. There is no one-size-fits-all approach and NAPs should be tailored accordingly to respond effectively to specific aspects of AMR.

A well-structured and robust action plan defines concrete actions, assigns roles and responsibilities, and earmarks funds accordingly. The objectives and goals of the plan should be clarified, while indicators and targets ascertain whether the goals have been fulfilled within a defined time frame. These factors facilitate coordination between different actors at national and local level and an accompanying adequate infrastructure is essential to ensure effective implementation of actions set out in the core strategy.

This paper aimed to provide an overview of the development of NAPs or similar initiatives to tackle AMR in the 28 EU MS and Iceland, Norway, and Switzerland. The country analysis undertaken seeks to shed light on the current European situation regarding actions taken to combat AMR and identify gaps as well as opportunities to improve policy responses. Therefore, rating existing plans is outside the scope of the paper.

Scrutiny of different data sources recording the development and/or implementation of a NAP in the countries in question, based on country self-reporting, identified a disparity in the number of countries which reportedly have developed or implemented a NAP. In addition to other factors, these variations could be due to different interpretations as to which strategies or plans qualify as a NAP on AMR.

Therefore, a thorough independent analysis of NAPs and similar initiatives in 31 European countries was carried out and can be found in the annex of this paper. Based on the analysis, some examples of NAPs were showcased according to four thematic areas: encompassing a One Health approach; including financing estimates and identification of funding sources; integrating implementation and evaluation mechanisms, and identifying clear measurable goals.

While the majority of countries analysed have AMR plans or strategies in place, there are considerable variations regarding the comprehensiveness and the extent of a One Health approach reflected in NAPs. Moreover, there is considerable scope for streamlining multiple strategies on AMR present in some countries and incorporating them into one single, coordinated and multi-sectoral NAP.

Furthermore, the identification of measurable targets covering both the human and the veterinary sector and the integration of funding sources and monitoring and evaluation mechanisms into action plans is not common practice in most of the countries analysed, which may hamper effective implementation of proposed actions. In this regard, EPHA would welcome an incorporation of measurable targets in NAPs, following the jointly proposed harmonised outcome indicators by ECDC, EFSA and EMA, which aim to assist MS to assess their progress in reducing the use of antimicrobials and AMR in both humans and food-producing animals (ECDC, EFSA BIOHAZ, CVMP, 2017).

Across European countries, good practice examples co-exist alongside poor practices and inaction. It is striking that the most comprehensive NAPs are found in Northern and Central Europe, where AMR prevalence is generally lower than the rates observed in Eastern and Southern European countries, which often face considerable healthcare systems challenges and lack of sustained financing. The particular challenges facing some countries are highlighted in an EPHA report entitled "In the Red Zone" (EPHA, 2017), which focuses on a Romanian case study.

However, such inter-country variations in the development and execution of NAPs indicate that that there is scope to make better use of good practice exchange, translated into broad and more targeted suggestions which could be incorporated by MS according to their national context. In addition, countries with comprehensive One Health NAPs which have engaged different Ministries, agencies and other relevant bodies in the establishment and implementation of their plans could support those countries lagging behind.

According to a Special Eurobarometer report on antimicrobial resistance published in April 2016, Europeans support action against AMR to be taken at all levels, with 35% supporting action at global and EU level and 28% favouring action to be taken at national/regional level (European Commission, 2016b).

Have twenty years of global and EU actions and initiatives on prudent use of antibiotics, prevention and control of HCAI's and AMR had an impact at national and local level?

The tripartite organisations have noted that sustained progress has been made on the development of national programmes to tackle AMR worldwide. However, despite positive developments following the global and European political momentum on AMR, challenges remain in translating commitments into collective action that will ensure that all countries are able to address the complexity of AMR at national and local levels. Adopting a more 'GLOCAL' approach could be the new narrative, focusing on the local implementation of actions taken at global level.

Political commitment at the highest levels acknowledges the need for global action to address the root causes of AMR across the human health, animal health, agricultural and environmental sectors. However, it is time to bridge the gap between these political declarations and concrete actions as well between the development and publication of policies and their actual implementation at national, regional and local levels.

This country analysis highlights that many European countries are pioneers while others are novices, still in the process of developing their national strategies. Therefore, for the EU to truly become a best practice region (one of the pillars of the EU One Health Action Plan), it is crucial to reduce the wide disparities among and within countries which remain pronounced, and consider providing targeted support to those countries which need it most. This will allow the EU to move from achieving isolated success and best practices in a few countries to good standard practices in all countries, with antibiotic stewardship evenly

distributed across the EU.

At the 68th WHA in 2015, MS committed to having NAPs in place by mid-2017, a commitment reiterated by the European One Health Action Plan. However, it appears that countries require sustained support in engaging relevant bodies, communities and civil society in the development and implementation of their plans to effectively combat AMR.

Civil society and grassroots organisations have an important role to play in addressing AMR. They can support the development and implementation of NAPs by bringing unique knowledge and experience that could help shape plans and proposed actions, particularly by raising awareness on the scope of the problem and by educating the general public on the rational use of antibiotics.

The EPHA-led EU Health Policy Platform's Call to Action on AMR, which gathered the support of over 40 signatories, also recognises the importance of civil society involvement in AMR policy-making at a European level and puts forward a list of actions which remain valid to date (EPHA, 2018). Despite the creation of a dedicated AMR stakeholder network, within the EU Health Policy Platform, there is no formal involvement of stakeholders in the context of the AMR One Health Network of experts hosted by the EC. Therefore, there are currently limited opportunities for civil society to contribute to ongoing policy discussions and processes on AMR.

Policy and practice expertise across the different sectors of AMR could be maximized considerably through multi-stakeholder exchanges. Ensuring a whole-of-society approach to tackling AMR will not only facilitate antimicrobial stewardship and inter-sectoral collaboration but the very implementation of national policies at regional and local levels.

EPHA RECOMMENDATIONS

TO THE EUROPEAN COMMISSION

1. **Identify** specific barriers hampering the development and implementation of NAPs in some countries and provide sustained technical assistance
2. **Allocate** adequate EU funding (possibly a dedicated European AMR fund) to support countries' implementation of AMR policies, especially those currently struggling to meet their NAP commitments
3. **Facilitate** and strengthen civil society engagement within the EU AMR One Health Network, involving the AMR stakeholder network of the EU Health Policy Platform and giving it a more formalised role in order to be able to better contribute to policy-making at EU level
4. **Enhance** the work of the AMR One Health Network to better address the environmental dimension, as this will encourage a similar approach nationally
5. **Adopt** an EU strategic approach to pharmaceuticals in the environment as soon as possible
6. **Set** minimum criteria to be included in NAPs, aligned with the Global Action Plan, which could be adapted to national contexts and needs
7. **Propose** a regulatory framework to harmonise antibiotic prescription practices, limiting the sale and consumption of antibiotics across the EU
8. **Leverage** country-to-country learning, coordination and best practice exchange which is valuable for informing future national actions, beyond what is already being done through the EU Joint Action (EU-JAMRAI)
9. **Strengthen** EU engagement on addressing AMR, leading by example in the promotion of antibiotic stewardship and working to provide technical assistance to Member States
10. **Mainstream** funding (which is often fragmented, disease-specific and research-focused) for AMR at European level
11. **Communicate** the importance of AMR stewardship in the EU's interaction with major global trading partners, ensuring that bilateral agreements are aligned with a One Health approach to fight AMR.

EPHA RECOMMENDATIONS

TO EUROPEAN MEMBER STATES

1. **Implement** national policies and actions on AMR following a One Health approach; bringing together policy-makers and experts from different sectors (human health, animal health, environment, food safety, agriculture) as well as ensuring the involvement of all relevant bodies throughout the development, implementation and evaluation of NAPs
2. **Incorporate** measurable targets in NAPs, following the harmonised outcome indicators proposed by ECDC, EFSA and EMA, to facilitate the monitoring of progress in reducing the use of antimicrobials and AMR in both humans and food-producing animals
3. **Identify** funding sources and budget estimates for the execution of proposed actions and activities
4. **Mobilise** appropriate human and financial resources to ensure effective implementation of NAPs
5. **Incorporate** evaluation mechanisms and reporting arrangements in NAPs to monitor progress in the reduction of antibiotic use and AMR, adjusted accordingly to take account of national requirements and emerging priorities
6. **Ensure** that national antibiotic councils and coordinating committees reflect a diversity of stakeholders, from multiple sectors
7. **Introduce** and enforce policies aimed at regulating antibiotic prescriptions for humans and animals, to tackle high consumption rates at source.
8. **Scale up** and mainstream multiple strategic plans and activities on AMR into one, single, coordinated One Health NAP which includes actions in different sectors
9. **Ensure** that professionals and aspiring physicians, nurses, veterinarians, pharmacists and the entire health workforce are adequately trained to manage AMR challenges
10. **Invest** in adequate healthcare infrastructure which is conducive to the delivery of quality and safe care alongside infection prevention and control measures
11. **Improve** surveillance and data collection methods and undertake research to better study the effects of foodborne AMR and environmental antimicrobial pollution
12. **Allow** for better engagement of Member States experiencing difficulties in developing their NAPs in the EU-JAMRAI
13. **Involve** countries facing considerable healthcare and AMR challenges in research and development programmes in order to develop innovative and affordable tools or alternatives, while at the same time, meeting the needs of countries with high AMR prevalence.

5. ANNEX: COUNTRY PROFILES

An overview of national action plans, programmes and strategies addressing AMR in EU Member States, Iceland, Norway and Switzerland.

AUSTRIA

National Action Plan on Antimicrobial resistance NAP-AMR (2018) (German)

The Austrian National Action Plan on AMR (NAP-AMR, 2018) was released in 2018 by the newly established Ministry for Labour, Social Affairs, Health and Consumer Protection. The action plan comprises of a human medicine, veterinary medicine and an environmental component, making it a clear One Health plan. The EU One Health Action Plan against AMR is also annexed to the plan. Within the human dimension, surveillance and antimicrobial stewardship are covered and expert groups from various institutions and organisations provided input.

Although funding sources and specific targets do not seem to be identified in the plan, some indications of available funds for research purposes are provided. A detailed account of the different national scientific projects Austria is funding within the area of antibiotics and AMR R&D as well as EU funded projects in which Austria is participating, such as the EU-JAMRAI and other Horizon2020 initiatives, is also included (Ministry for Labour, Social Affairs, Health and Consumer Protection, 2018).

BELGIUM

Guidelines for anti-infective treatment in hospitals (2017) (Dutch)
Policy Paper for the 2014-2019 term (2014) (Dutch)
AMCRA Vision 2020 plan (2014) (French/Dutch)

Belgium has undertaken several actions to contain the threat of AMR. The Belgian Antibiotic Policy Coordination Committee (BAPCOC) published a policy paper for the 2014-2019 term and clinical guidelines for anti-infective treatment in hospitals, drawn up by the Belgian Society for Infectiology and Clinical Microbiology (BVIKM) in 2017. Based on the initiative of BAPCOC and the Federal Public Service for Public Health, Food Chain Safety and the Environment, with the support of the National Institute for Health and Disability Insurance (RIZIV), a public awareness campaign was also launched aiming to address appropriate use of antibiotics.

The detailed strategic policy paper sets out specific objectives, indicators and targets concerning human and animal health and acknowledges the One Health concept (Balligand et al., 2004) but puts little emphasis on environmental aspects of AMR.

With the publication of the AMCRA 2020 Strategy Plan in 2014, three clear reduction targets for the veterinary sector to be achieved by 2017 and 2020 were identified to address the veterinary dimension of AMR. The plan promotes rational use of antibiotics in animals to prevent the increase and spread of AMR (AMCRA, 2014). Although funding sources have not been identified, according to a June 2018 progress report, two out of three reduction targets were met in 2017. These are significant and encouraging results demonstrating the efficacy of actions taken (AMCRA and FASFC, 2018).

Whilst the long-established BAPCOC provides an extensive inter-sectoral coordinating mechanism for national AMR policies and national surveillance of healthcare-associated infections (HAIs), Belgium does not appear to have a truly One Health AMR NAP and still addresses AMR in different fields separately. This has been confirmed by an ECDC country visit to Belgium which aimed to assist Belgium in the implementation of its national policies and strategies based on a One Health approach. In fact, one of the recommendations presented in the country visit report is the development of a comprehensive and multi-disciplinary NAP, elaborating on the BAPCOC policy paper and ensuring collaboration among relevant sectors by increasing the executive role of the relevant ministries. There is considerable potential for the current BAPCOC policy paper to be transformed into a comprehensive NAP following the One Health approach and incorporating tailored and sector-specific activities, namely, a core compulsory set of AMR and HAI indicators and IPC targets, which are currently missing. Moreover, once approved, it is recommended that the NAP is provided with the necessary resources for its implementation, preferably earmarked for each activity (ECDC, 2018d).

CROATIA

National programme for the control of antibiotic-resistant bacteria 2017–2021 (2017) (Croatian)

Following the release of national clinical practice guidelines on the use of antimicrobials in human medicine, issued by the Croatian Intersectoral Coordination Mechanism for the Control of Antimicrobial Resistance (ISKRA), in 2017, the Ministry of Health published a national programme for the control of antibiotic-resistant bacteria covering the period 2017–2021.

The implementation of the programme is clearly delineated, covering an array of action areas including surveillance and monitoring of antimicrobial consumption and the prevalence of AMR in the field of human medicine, veterinary medicine as well as in foods of animal origin. It also covers infection prevention and control; supporting research in the field; enhancing the uptake of new innovative drugs and rapid microbiocidal diagnostics; awareness raising and education on the rational use of antimicrobials for aspiring professionals; and activities to promote responsible and prudent use of antimicrobials (Ministry of Health of Croatia, 2017).

Each priority action area identified includes goals, adapted to the national context and needs, and in accordance with the five main objectives defined in the Global Action Plan on AMR. It is also stated that goals are aligned with EU and OIE guidelines.

The programme outlines the anticipated development of planned concrete activities and the amount of government funds needed for its implementation, including the involvement of responsible and collaborating bodies in the realisation of each objective. The implementation plan goes as far as including implementation indicators in some cases, namely, an external quality control report or an annual report as well as performance indicators such as a reduction in antibiotic consumption (Ministry of Health of Croatia, 2017).

CZECH REPUBLIC

Action Plan of the National Antibiotic Programme for the period 2011-2013 (2011) (Czech)

The current National Antibiotic Programme Action Plan, drawn up by the Central Coordination Group NAP in cooperation with the Ministry of Health, builds on the principles declared in the EU Council Recommendation on Prudent Use Antimicrobial Agents in Medicine (2002/77/EC) and the EU Council Recommendation on Patient Safety, including the prevention and control of healthcare associated infections (2009/C151/01).

The plan identifies 11 priority areas, including surveillance of antibiotic consumption and AMR in both the human and veterinary field; relevant training for the healthcare workforce on prudent use of antibiotics and AMR; improving rational antibiotic prescribing practices; and enhancing awareness and co-responsibility among the general public to maintain antibiotic efficacy and reduce the spread of AMR. Specific objectives are also listed per priority area and actions to achieve these objectives are outlined. A brief indication of timelines and funding options is also provided. In some cases, co-funding from the European Regional Development Fund (ERDF) was envisaged (Ministry of Health of Czech Republic, 2011).

Building on the new EU Action Plan and Global Action Plan on AMR, the Czech Ministry of Health, in cooperation with the Ministry of Agriculture, have begun to jointly prepare a new National Antibiotic Programme covering 2018-2030, which will be aligned to the One Health concept. The action plan will be submitted to the Government upon completion (Ministry of Health of Czech Republic, 2018).

CYPRUS

National Strategy for the treatment of Antimicrobial Resistance (2012) (Greek)

Cyprus published a National Strategy to tackle Antimicrobial Resistance in 2012. The strategy aims to preserve the availability of effective antimicrobial therapy for humans and animals and makes reference to international and EU policy initiatives, including the 2011 EU Action Plan against the rising threats from AMR and the 2012 Council Conclusions. It notes that cross-sectoral cooperation is necessary to tackle AMR across the fields of human medicine, veterinary, livestock and agriculture (Ministry of Health of Cyprus, 2012).

Its primary objective is the development and implementation of actions to reduce AMR in Cyprus and covers aspects of surveillance, antibiotic consumption, the use of antibiotics in animal husbandry and the prevalence of hospital-acquired infections. It provides a detailed overview of available data to highlight the situation in Cyprus and the areas on which work needs to be done (Ministry of Health of Cyprus, 2012).

In addition, following the setting up of a national system of surveillance of AMR in 2012, the Cypriot National Antibiotics Committee has produced a number of annual reports analysing surveillance data (National Antibiotics Committee, 2014).

DENMARK

One Health Strategy against Antibiotic Resistance (2017) (English)
National Action Plan on Antibiotics in Human Healthcare (2017) (English)
National Action Plan for the control of livestock-associated MRSA (2015) (Danish)
Joint Antibiotics and Resistance Action Plan (2010) (English)

Following the 2010 Joint Antibiotics and Resistance Action Plan developed by the Ministry of Health and the Ministry of Food, the Ministry of Health and the Ministry of Environment and Food published a One Health Strategy Against Antibiotic Resistance in 2017. The Strategy provides a framework, and briefly outlines five main goals, for the reduction of antibiotic use and the prevention of AMR in humans and animals: namely prudent use of antibiotics; infection prevention and facilitating the use of antibiotic alternatives; enhanced knowledge, awareness and information provision on resistance and transmission; as well as strong international cooperation to minimise development of AMR (Ministry of Health, Ministry of Environment and Food of Denmark, 2017).

In the same year, the Ministry of Health released a more detailed NAP on Antibiotics in Human Healthcare, which included three measurable goals to reduce antibiotic consumption by 2020, to be financed within the current national financial framework. Each goal is defined and examples of national and local initiatives that can facilitate the achievement of the goal are delineated. In some cases, a focus on specific target groups is also included. The plan appears to have considerable focus on current achievements and supports a continuation of ongoing initiatives and measures to reduce antibiotic use, AMR and to prevent hospital-acquired infections (Ministry of Health of Denmark, 2017).

The mandate and structure of the One Health National Antibiotic Council was also strengthened in 2017. It now contributes to improved knowledge-sharing and the implementation of national goals. Several Council members are also part of a working group tasked to follow-up and monitor progress in the achievement of the goals set out in the NAP (Ministry of Health of Denmark, 2017).

Regarding the animal health dimension of AMR, the Ministry of Environment and Food released a national action plan for controlling livestock-associated Methicillin resistant Staphylococcus aureus (MRSA) for the period 2015 – 2018, based on recommendations from an interdisciplinary expert group. The plan contains several initiatives and measures to prevent the contamination and spread of livestock-associated MRSA and is evaluated annually (Ministry of Food, Agriculture and Fisheries, 2015).

FINLAND

National Action Plan on Antimicrobial resistance 2017 – 2021 (2017) (English)
National Action Plan on Antimicrobial resistance 2017 – 2021 (2017) (Finnish)

The National Action Plan on Antimicrobial Resistance for the period 2017-2021 was published by the Ministry of Social Affairs and Health in 2017. Various inter-sectoral experts were involved in its development and the Action Plan features a clear One Health approach. It acknowledges that action should be taken in human and veterinary medicine, infection prevention, the detection and control of the spread of AMR and on antimicrobial stewardship. The plan also notes that antimicrobial use in plant production is also an issue of global concern and since AMR is a global cross-border health threat, continuous preparedness is essential. The plan takes the recommendations of various global and European initiatives into account in the identification of its strategic objectives and actions, including the WHO Global Action Plan, the FAO Action Plan on AMR 2016-2020, Codex Alimentarius texts on foodborne AMR, the EU Action Plan against AMR 2011-2016, the OIE Strategy on AMR and the Prudent Use of Antimicrobials 2016, and the Nordic Council initiatives (Hakanen et al., 2017).

The Action Plan comprises of six operative areas, crucial for the control of AMR, including: training of professionals and public education; coordinated One Health surveillance of antimicrobials use and AMR; infection prevention and control; guidance for the use of antimicrobials; and research. The Action Plan describes the current situation and measures taken in all the areas of operation, sets objectives and outlines concrete actions to be undertaken to achieve the objectives. Additionally, responsible parties are assigned to each proposed action and a model for the follow-up and implementation of actions is presented (Hakanen et al., 2017). However, despite a comprehensive plan, funding sources and specific targets are not identified.

FRANCE

ECOANTIBIO2 - National plan for the reduction of antimicrobial resistance risks in veterinary medicine 2017-2021 (2017) (French)
Interministerial Roadmap for Controlling Antimicrobial Resistance – 13 overarching Interministerial measures, 40 actions (2016) (English)
National Antibiotic Alert Plan 2011-2016 (2011) (French)

In 2011, the French Ministry of Health adopted a National Antibiotic Alert Plan covering the period 2011- 2016, which was based on three strategic objectives of improving patient care efficiency, preserving antibiotics' effectiveness and promoting research. It outlined 21 operational actions to be undertaken, listing concrete activities for each action, the bodies involved in their implementation as well as performance indicators (Ministry of Health of France, 2011).

However, in 2016, an Inter-ministerial Roadmap for Controlling Antimicrobial Resistance was released. As the name suggests, numerous ministries and agencies were involved in its development and its One Health approach is evident. The roadmap is structured around five cross-cutting pillars, covering public and health professionals' awareness-raising, research and innovation, surveillance and the development of new indicators and inter-sectoral governance within an international context (Interministerial Committee on Health, 2016).

It proposes 13 overarching measures in line with the five main pillars identified and lists concrete actions for each measure, including the strategic and operational bodies concerned, the anticipated budget, indicators and the provisional implementation timetable.

Additionally, in 2017, the Ministry of Agriculture and Food published the second national plan for the reduction of Antimicrobial Resistance risks in veterinary medicine for the period 2017-2021. The veterinary action plan includes targets and should be considered as complementary to the inter-ministerial roadmap for the control of AMR (Ministry of Agriculture, Agri-food and Forestry, 2017).

GERMANY

DART 2020 - fighting antibiotic resistance for the good of both humans and animals (2015) (English)

In 2015, the German Federal Government published the second German Antimicrobial Resistance Strategy 2020 (DART 2020), outlining six main goals to be achieved by 2020. DART is a joint initiative of the Federal Ministry of Health (BMG), the Federal Ministry of Food and Agriculture (BMEL) and the Federal Ministry of Education and Research (BMBF) and was developed by several interested bodies, building on the outcomes and evaluation of the previous 2008 DART Strategy.

The new Strategy adopts a One Health approach and covers human and animal health, as well as the environmental aspects of AMR. However, despite separate measures being proposed for human and veterinary medicine, the previous Strategy had already highlighted the importance of adopting a One Health approach. In fact, an inter-ministerial working group on AMR (IMAG AMR) was set up in 2008 (German Federal Government, 2015).

DART 2020 covers awareness-raising of AMR; supporting research and development; infection prevention and early detection; improving antimicrobial therapies; as well as strengthening One Health coordination at a national and international level, in line with the WHO Global Action Plan. While it refers to achievements in several sectors to date, it does not indicate concrete activities or measurable targets in order to achieve the proposed goals (German Federal Government, 2015).

GREECE

National Action Plan "Procrustes" (2010) (Greek)
National Action Plan to Address Microbial Resistance to Antibiotics and Infections in Healthcare Facilities 2008 – 2012 (2008) (Greek)

Greece is one of the EU countries whose AMR plan pre-dates the adoption of the Global Action Plan on AMR. In 2008, the Hellenic Center for Disease Control and Prevention (HCDCP) issued a NAP to address AMR and healthcare-associated infections, covering the period 2008 – 2012 (HCDCP, 2008).

In 2010, the "Procrustes" National Action Plan was also published with the aim of combating significant healthcare associated infections (HAIs) following multi-drug resistant Gram-negative pathogens present in Greek hospitals (Kontopidou, 2016). The initiative sought to focus on enhancing surveillance and monitoring, ensuring that surveillance data on the extent of the spread of certain strains is adequately collected and processed. The plan was implemented in three phases, 2010-2012, 2012-2014 and post-2014 (HCDCP, 2010).

ICELAND

Report of a working group on measures to reduce the spread of antibiotic-resistant bacteria in Iceland (2017) (Icelandic)

In 2017, a working group, made up of experts from both human and veterinary medicine, released a report on measures to reduce the spread of antibiotic-resistant bacteria in Iceland. Set up in 2016, the working group's role, is to put forward proposals for measures aimed at reducing AMR, especially foodborne AMR.

The report outlines the measures that have been undertaken in Iceland to evaluate and control antibiotic antibodies and the spread of AMR in humans, animals and foodstuffs. A set of recommendations to address AMR are also proposed, including aspects concerning prevention, monitoring and response, to be undertaken by the Ministry of Welfare, the Ministry of Employment and Innovation, and the Environment and the Ministry of Natural Resources, working together in a multidisciplinary fashion. Moreover, some surveillance measures particularly on foodborne AMR as well as research on the presence of AMR in the environment are also proposed (Daðadóttir, Fridriksdóttir and Guðnason, 2017).

IRELAND

Ireland's National Action Plan on Antimicrobial Resistance 2017-2020 (iNAP) (2017) (English)

Ireland's National Action Plan on Antimicrobial Resistance for the period 2017-2020 was published in 2017 by the Department of Health. As members of the high-level National Interdepartmental AMR Consultative Committee, set up in 2014, the Department of Health and the Department of Agriculture, Food and the Marine, provided guidance in relation to the development of the NAP in line with a One Health approach and the five strategic objectives established in the Global Action Plan on AMR.

The NAP outlines five overarching objectives, namely, improving awareness and knowledge of AMR; enhancing AMR surveillance; infection prevention and control measures; optimising the use of antibiotics in human and animal health through the development and implementation of antimicrobial stewardship programmes; and promoting research and sustainable investment in new medicines, diagnostic tools, and vaccines (Department of Health of Ireland, 2017).

Situational analyses and assessment in the human, animal and environmental sector are followed by a detailed presentation of strategic and sector-specific interventions and concrete activities, to be undertaken to achieve each strategic objective. Timelines and the prioritisation of activities are also included in the NAP as well as the bodies and parties responsible for the implementation of each activity (Department of Health of Ireland, 2017).

ITALY

National Plan against Antimicrobial Resistance (PNCAR) 2017-2020 (2017) (Italian)
National Plan against Antimicrobial Resistance (PNCAR) 2017-2020 leaflet (2017) (English)

The Ministry of Health published the Italian National Action Plan on Antimicrobial Resistance 2017-2020 (PNCAR) in October 2017. The plan outlines the current situation in Italy regarding AMR in the human, veterinary and food safety sectors and the Italian commitment and participation in several projects and activities to combat AMR. It also makes detailed reference to the One Health approach and global and European initiatives on tackling AMR such as the WHO Global Action Plan, FAO and OIE strategies, Codex Alimentarius texts in relation to foodborne AMR and the EU One Health Action Plan on AMR.

The plan starts from the premise that in order to combat AMR effectively, coordinated multi-sectoral action is required at different levels (national, regional and local). Therefore, interventions listed throughout the plan are to be implemented with the contribution of all relevant actions, through a One Health approach. However, despite an inter-disciplinary focus encompassing the human and veterinary sectors, the plan does not address the environmental aspects of AMR (Ministry of Health of Italy, 2017).

The plan comprises of a general overarching goal of reducing the frequency of HCAI infections and AMR and identifies specific objectives related to surveillance of antibiotic consumption and AMR in humans and animals; infection prevention and control including the prevention of zoonoses; appropriate use of antimicrobials in the human and veterinary field; research and innovation as well as training and education of professionals and the public, including antimicrobial stewardship programmes. The plan also contains several measurable targets in the human and veterinary sector (Ministry of Health of Italy, 2017).

To achieve these objectives, specific short-term and more long-term actions are defined for implementation at national and regional/local level and a number of responsible institutions and bodies are identified. Moreover, in order to allow for timely monitoring of progress in achieving the strategic objectives, a number of indicators are listed, notably, in the field of surveillance of antibiotic consumption and infections in the human and veterinary sectors.

LITHUANIA

Action Plan for the prevention and control of the spread of micro-organisms resistant to antimicrobial agents for the period 2017-2021 (2017) (Lithuanian)

The Action Plan for the prevention and control of the spread of micro-organisms resistant to antimicrobial agents for the period 2017-2020, approved by the Ministry of Health, entered into force on 14 July 2017.

The Action Plan notes that its objectives and tasks are in line with several international and EU actions and initiatives, namely, the European Action Plan on the fight against AMR Threats 2011-2016, Council Conclusions on the Follow-up to the Joint Health Framework to combat Antimicrobial Resistance and the EU Council Recommendation on Patient Safety and on the Prevention and Control of Healthcare-Associated Infections.

The plan aims to develop and implement cross-sectoral cooperation; expand and improve monitoring systems on the use of antimicrobials, hospital infections and AMR; ensure proper use of antimicrobials in human and veterinary medicine; reduce the incidence of hospital infections through hygiene and infection prevention measures; increase public awareness and understanding of AMR including effective training and development of professionals as well as conduct research on the use of antimicrobials and AMR and evaluate effective measures proven to reduce antibiotics use and AMR (Ministry of Health of Lithuania, 2017).

An implementation action plan is annexed to the plan, identifying concrete measures and actions for each objective, specifying the year(s) of implementation and the actors responsible. Implementation and evaluation criteria are also listed and annexed and implementing authorities are expected to submit an annual report on the implementation of measures provided in the plan to the Ministry of Health.

The Action Plan also identifies funding sources and is expected to be financed from the national budget as well as budgets of municipalities and institutions responsible for implementation of measures, EU and other structural funds, international programmes and other relevant funds (Ministry of Health of Lithuania, 2017).

The NAP is in the form of a legal text and although it features a One Health concept, it remains unclear whether stakeholders from sectors other than the Ministry of Health were involved in its development. Nonetheless, prior to the adoption of the plan, regional AMR management groups with representatives from different sectors, were established.

LUXEMBOURG

National Antibiotics Plan 2018- 2022 (2018) (French)

In February 2018, the first National Antibiotics Plan (NAP) 2018-2022 was approved by the Luxembourgish government. A joint effort of the Ministry of Health and the Ministry of Agriculture, Viticulture and Consumer Protection, the plan follows a One Health approach by including all three sectors, with the main aim of reducing the emergence, development and transmission of AMR in Luxembourg.

The NAP is centred around five goals comprising of governance; treatment and diagnostics including prudent use of antibiotics in human and animal health; awareness-raising through effective communication, education and training; AMR surveillance and monitoring of HCAI, and research. Although measurable targets are not defined, strategic objectives and specific measures and activities targeted for the human and veterinary sector are identified for each overarching goal. Moreover, timelines, performance indicators and methods for the presentation of outcomes and evaluations are identified for each proposed intervention (Ministry of Health and Ministry of Agriculture, Viticulture and Consumer Protection, 2018).

The plan notes that the National Antibiotics Committee will oversee the planned activities and annually develop or update the budgetary planning and allocation of required resources. Working groups will also be established to support the Committee's work and could make funding proposals for the establishment of long-term activities (Ministry of Health and Ministry of Agriculture, Viticulture and Consumer Protection, 2018).

MALTA

A Strategy and Action Plan for the Prevention and Containment of Antimicrobial Resistance in Malta 2018 – 2025 – A One Health response to the threat of AMR (2018) (English)

The Maltese Ministry for Health and the Ministry for the Environment, Sustainable Development and Climate Change have recently issued a Strategy and Action Plan for the Prevention and Containment of Antimicrobial Resistance in Malta for the period 2018 – 2025, following a One Health approach.

The Strategy was drawn up by an inter-sectoral team under the stewardship of the Superintendence of Public Health through the National Antibiotic Committee and was open for public consultation until 9 December 2018. It seeks to provide a framework to guide actions on AMR and the use of antibiotics, building on current strengths and addressing areas where deficits have been identified. Its implementation and evaluation will be supported by an Implementation Plan which details specific actions, targets, timeframes and indicators, yet to be developed in consultation with stakeholders. It is foreseen that the implementation and action plan will take a staged approach over the period 2018–2025 (Ministry for Health and the Ministry for the Environment, Sustainable Development and Climate Change, 2018).

The Strategy identifies a number of objectives and action areas, including: ensuring an adequate legislative framework as a basis for taking action on AMR; implementing effective antimicrobial stewardship practices across human and animal health that would ensure appropriate and prudent prescribing, dispensing, administering and disposal of antimicrobials; strengthening antibiotic use and AMR surveillance in the human, veterinary and environmental sectors; improving infection prevention and control measures; education and awareness-raising of AMR as well as continuous professional development of stakeholders and professionals; enhancing research initiatives; and strengthening partnerships and collaboration at international, European and regional level (Ministry for Health and the Ministry for the Environment, Sustainable Development and Climate Change, 2018).

A review and update of legislation relevant to antimicrobial use and AMR and its enforcement is foreseen including the development of a regulatory framework for a One Health Approach in implementing the Strategy.

NETHERLANDS

Letter to parliament about the approach to antibiotic resistance (2015) (English)
Appendix 1 of the letter to parliament on the approach to antibiotic resistance (2015) (English)
Appendix 2 of the letter to parliament on the approach to antibiotic resistance (2015) (English)
Administrative arrangements on antibiotic resistance in healthcare (2015) (English)
Multi-annual agenda on antibiotic resistance in healthcare (2015) (English)
Factsheet: Tackling Antibiotic resistance – the Dutch approach (2015) (English)

A letter to the Parliament concerning the approach to address antibiotic resistance issued by the Ministry of Public Health, Welfare and Sports in 2015, currently serves as the Dutch AMR NAP for the period 2015 – 2019. The letter addresses all domains in which human health is threatened by AMR, including the food system and the environment. The letter, co-signed by the Secretary for Economic Affairs and the Secretary for Infrastructure and the Environment, features a clear and integrated One Health approach. However, despite the identification of targets in the human and animal health sectors, there is little information on funding sources and required resources to achieve such goals (Ministry of Health, Welfare and Sport of Netherlands, 2015a).

The letter recognises that effective implementation of the WHO Global Action Plan on AMR is crucial and notes that the National Institute for Public Health and the Environment (RIVM) will be engaged in providing technical support to WHO States in creating and strengthening surveillance of resistant bacteria, following the Dutch model. In addition, specific initiatives undertaken at international, European and national level are outlined in Appendix 1 of the letter, under each of the following themes: healthcare; animals; food safety; environment and innovation (Ministry of Health, Welfare and Sport of Netherlands, 2015b).

The actions defined in the letter build on previous Council Conclusions on antibiotic resistance adopted under the Danish Council Presidency of 2012 and it is argued that a revised EU Antimicrobial Action Plan has clear EU added-value and may act as a starting point for debate towards reaching further agreements in the future.

It is worth noting that the letter was closely related to the work of the Dutch Presidency of the Council of the EU which took place in the first half of 2016, whereby the Ministries of Health, Welfare and Sport and Economic Affairs indicated that antibiotic resistance is a shared priority. In order to emphasise the importance of a One Health approach, the Dutch Presidency held a high-level conference on AMR and led subsequent Council Conclusions which called for a revised EU Action Plan on AMR and also urged the European Commission to initiate a Joint Action, whereby key policy developments in the AMR domain may be further exchanged and strengthened among EU MS (OJ, 2016).

Regarding the veterinary aspect of AMR and in the context of the European Regulation on veterinary medicines, the letter outlines the Dutch commitment to reduce the use of critical antibiotics in animals and pursue measures that will contribute towards achieving a general ban on the use of last line antibiotics in animals.

The letter is accompanied by administrative agreements on AMR in healthcare and a multi-annual agenda for AMR in healthcare, setting out activities to be initiated at national, regional and local level (Ministry of Health, Welfare and Sport of Netherlands, 2015c). A multi-annual communication strategy targeting both the public and professionals is also foreseen with the aim of increasing public awareness of the use of antibiotics and AMR.

NORWAY

Action Plan Against Antibiotic Resistance in Healthcare (2016) (Norwegian)
National Strategy against Antibiotic Resistance 2015-2020 (2015) (English)

In 2015, the Norwegian Ministry of Health and Care Service published the National Strategy against Antibiotic Resistance 2015-2020, which was developed jointly with the Ministry of Fisheries and Coastal Affairs, Ministry of Agriculture and Food, and the Ministry of Climate and Environment. The Strategy has a strong One Health approach and includes 14 sector-specific goals identified in the areas of health, food-producing animals and household pets, fish, and climate and the environment, some of which could be considered as measurable targets (Ministry of Health and Care Services, 2015). Although, estimates of required financial resources are not included, it is stated that measures identified are able to be implemented within applicable budget frameworks.

The Strategy sets out overarching goals for the period 2015–2020, including the reduction in the total use of antibiotics; more appropriate use of antibiotics; improved knowledge of the drivers behind the development and spread of antibiotic resistance as well as leading work on improving access, responsible use, and development of new antibiotics, vaccines and better diagnostic tools. In addition, actions are defined with regard to surveillance and increased scientific understanding of antibiotics use and AMR in humans, food, animals and the environment, infection prevention and control including the potential value of vaccines, improving prescribing practices, and contributing to strengthened international collaboration on AMR for a long-lasting response, including through Norway's collaboration via the Nordic Council of Ministers (Ministry of Health and Care Services, 2015).

Additionally, an Action Plan Against Antibiotic Resistance in Healthcare was developed in 2016. The action plan illustrates the measures needed through raising public awareness, curbing misuse of antibiotics and reducing antibiotics prescriptions, aiming to achieve a 30% reduction of antibiotic consumption in the human health sector by the end of 2020 (Ministry of Health and Care Services, 2016).

POLAND

National Antibiotic Protection Programme 2016 – 2020 (2016) (Polish)

In 2016, the Ministry of Health published the National Antibiotic Protection Programme for the period 2016-2020. The detailed programme aims to reduce the abuse of antibiotics in human medicine, thus slowing the rise of drug resistance in Poland. It is a continuation of, among others, the National Antibiotic Protection Programme (2011-2015) and seeks to improve the safety of patients exposed to infections resistant to many types of antibiotics and difficult-to-treat community-acquired invasive bacterial infections (Ministry of Health of Poland, 2016).

The programme defines budget and funding sources but only covers the human medicine aspect of AMR.

PORTUGAL

Programme for the Prevention and Control of Infections and Resistance to Antimicrobials (2017) (Portuguese)
National Action Plan for the Reduction of Antibiotic Use in Animals 2014-2019 (2013) (Portuguese)

Several programmes have been developed in Portugal to address AMR. However, it seems that a truly One Health plan is still lacking. In 2017, the Directorate-General for Health published a Programme for the Prevention and Control of Infections and Resistance to Antimicrobials which includes goals and targets on AMR to be achieved by 2020. It is assumed that the new programme follows on the previous programme on infection prevention and control and AMR, issued in 2013.

The current programme presents the situation regarding HCAI and antibiotics use in Portugal and outlines the activities performed in 2016 and 2017 on the surveillance of antibiotic consumption and AMR as well as planned activities until 2020. It sets out three overarching objectives, namely: improving the quality of antibiotic prescriptions; improving infection prevention and control in health facilities; and controlling resistance rates of Klebsiella pneumoniae, a pathogen commonly resistant to last-line antimicrobial drugs such as carbapenems. Indicators to be used for monitoring purposes are also listed (Ministry of Health of Portugal, 2017).

Moreover, in 2017, two more general health programmes were released, outlining a series of health goals to be achieved by 2020, covering several health matters and diseases, including AMR.

Regarding the veterinary sector, a National Action Plan for the Reduction of Antibiotic Use in Animals for the period 2014-2019 was published in 2013, which includes 33 operational objectives and corresponding measures to be undertaken. A number of objectives cover research and innovation; education and professional training; prudent use of antibiotics for animals, in sustainable livestock production as well as for household pets; improved prescribing practices; rapid diagnosis and research of alternative treatments proven to reduce the use of antibiotics; and research and development of vaccines including herd vaccines (Directorate-General for Food and Veterinary, Ministry of Agriculture and Maritime, 2013).

ROMANIA

National Veterinary and Food Safety Authority Strategy for Combating Antimicrobial Resistance in Veterinary Medicine (2016-2018) (2016) (Romanian)

The Romanian National Sanitary Veterinary and Food Safety Authority (ANSVSA) released a National Veterinary and Food Safety Authority Strategy for Combating Antimicrobial Resistance in Veterinary Medicine for the period 2016-2018. The brief Strategy is in table form and lists specific objectives to be achieved and corresponding targeted actions (ANSVSA, 2016) but does not identify funding sources.

The ECDC visited Romania to assess the situation regarding the prevention and control of AMR. The country visit report recommendeds that Romania designates AMR as a national public health threat and prioritises the issue accordingly. A One Health NAP to tackle AMR should also be developed, considering specific national needs to be addressed in relation to diagnosis, surveillance, prevention and control of multi-drug resistant organisms (ECDC, 2018e).

At the Employment, Social Policy, Health and Consumer Affairs (EPSCO) Council of 7 December 2018, the incoming Romanian Presidency of the Council (January-June 2019) presented its work programme in the area of health, including AMR as one of the Presidency's health priorities. A high-level conference on AMR is scheduled to be held on 1 March 2019, followed by the subsequent proposal of Council Conclusions on AMR, with a focus on infection prevention and control.

In addition, in a recent press release, the Ministry of Health welcomed the Government Decision to establish the National Committee for Limiting Resistance to Antimicrobials (CNLRA). The Committee aims to develop and monitor the implementation of a national strategy on the prudent use of antibiotics, preventing the spread and limiting the increase of AMR in humans and animals.

The inter-ministerial CNLRA will ensure collaboration among the human, veterinary, and animal husbandry sectors and will be responsible for developing and updating the current national strategy, as well as a holistic national action plan to combat AMR. CNLRA is also expected to issue recommendations on the training of human health and veterinary staff on the use of antibiotics, AMR testing and reporting as well as activities aimed at educating the general public.

Although the CNLRA will be coordinated by the Ministry of Health, it will be composed of representatives from 8 Ministries, national agencies, health professionals' representatives including dentists and pharmacists, human and veterinary medical professional organizations, NGOs and patient associations (Ministry of Health of Romania, 2018).

SPAIN

Strategic Action Plan to reduce the risk of selection and dissemination of antibiotic resistance (2014) (English)

The National Plan against Resistance to Antibiotics (PRAN) for the period 2014-2018, published in 2014 by the Spanish Agency of Medicines and Medical Devices (AEMPS), is a Strategic Action Plan to reduce the risk and spread of antibiotic resistance in humans and animals and sustainably preserve the effectiveness of existing antibiotics.

To achieve its overarching objective, the NAP proposes six strategic priority areas for human and animal health, namely: surveillance of antibiotic consumption and AMR; resistance control; identification and promotion of alternative, complementary measures for prevention and treatment; definition of research priorities; training of health professionals and awareness-raising and education for the general public. Each strategic area includes corresponding measures which are further subdivided into specific actions for human and animal health. However, measurable targets and funding sources or budget allocations are not identified (AEMPS, 2014).

The PRAN was drawn up in response to the 2011 European Commission Action Plan on AMR, as well as the 2012 Council Conclusions, which called for a joint approach to address AMR and developed jointly by a technical coordination group and other participating institutions and bodies including six ministries (Health, Agriculture, Economy, Education, Interior and Defence). Therefore, the plan's One Health approach is also reflected through the diversity of stakeholders involved. However, despite this inter-sectoral approach, the challenge may lie in the action plan's implementation which involves 17 different regional healthcare systems which comprise the Spanish National Healthcare System, each with different funding and management schemes.

More recently, on the occasion of the European Antibiotic Awareness Day, the Spanish Minister of Health, Consumer Affairs and Social Welfare presented the priority areas of the new PRAN for the period 2019-2021, which is currently in its approval phase. It was also noted that the current strategic action plan has resulted in considerable reductions in human consumption of antibiotics between 2016 and 2017, representing a change in the upward trend registered since 2012. Moreover, similar successes have also been registered in the veterinary sector (Ministry of Health, Consumer Affairs and Social Welfare of Spain, 2018).

SWEDEN

Revised intersectoral action plan against antibiotic resistance 2018-2020 – basis for continued work of the collaborative group (2017) (Swedish)
Swedish Strategy to combat antibiotic resistance (2016) (English)

The Swedish strategic programme against AMR has been in place for the past two decades and a number of action plans and initiatives to combat AMR have already been implemented. For instance, back in 1986, Sweden was the first country in the world to ban antibiotics in animal growth promotion.

An updated National Strategy to combat antibiotic resistance was released in 2016. It follows a clear One Health approach and has an overall goal of preserving effective treatment of bacterial infections in humans and animals. The Strategy comprises of several target areas, including: prevention; responsible use of antibiotics: knowledge and education on the prevention and control of bacterial infections and AMR with new methods: leadership within the EU and in an international context (Government Offices of Sweden, 2016).

Based on the Strategy, in 2017, the Public Health Agency of Sweden and the Swedish Board of Agriculture together with 20 national authorities and organisations, jointly developed a revised NAP against AMR with a renewed focus on cross-sectoral cooperation, highlighting an inter-sectoral approach (Public Health Agency of Sweden, Swedish Board of Agriculture, 2017).

The action plan addresses human and animal health, food, the environment and research at local, regional, national and international level covering the period until 2020. However, no specific targets or funding sources are included.

SWITZERLAND

Strategy on Antibiotic Resistance Switzerland (StAR) (2015) (English)

In 2015, the Swiss Federal Council published a Strategy on Antibiotic Resistance with the primary objective of ensuring the long-term efficacy of antibiotics in preserving human and animal health. The comprehensive strategy features a clear One Health focus and defines a number of inter-sectoral strategic objectives and corresponding targeted measures as well as identifying the parties responsible for reaching the goals and implementing the proposed measures.

The objectives were defined by a number of stakeholders in light of the areas which require action and cover surveillance of the use of antibiotics and the spread of AMR in humans, animals, agriculture and the environment; targeted infection prevention and encouraging effective alternatives; rules for appropriate use of antibiotics; control of AMR transmission and spread; research and development including development of cost-effective diagnostics; One Health multi-stakeholder cooperation at national and international level; and knowledge and education of AMR among experts and the general public (Federal Council, 2015).

The AMR strategy also provides an estimate of the required financial resources and delineates funding streams. Although specific timelines for the implementation of measures are not identified, the Federal Council commits to periodically monitor the efficacy, suitability and affordability of the proposed measures as well as evaluate the overall strategy. To this end, an interim report is foreseen within five years of the strategy's adoption which will allow any required changes to the implementation process and funding to be made (Federal Council, 2015).

UNITED KINGDOM

Five-Year Antimicrobial Resistance Strategy 2013-2018 - Annual progress report (2016)
Government response to the Review on Antimicrobial Resistance by Lord O'Neill (September 2016)
Five-Year Antimicrobial Resistance Strategy 2013-2018 - Measuring success (2014)
Five-Year Antimicrobial Resistance Strategy 2013-2018 (2013)
Strategy Impact Assessment

In 2013, the Department of Health and the Department for Environment, Food and Rural Affairs jointly published a Five-Year Antimicrobial Resistance Strategy 2013-2018. The Strategy follows a One Health approach, covering human and animal health, agriculture and the wider environment. Its overarching goal is to reduce the development and spread of AMR and activities are centred around three strategic aims: improving the knowledge and understanding of AMR; conserving the effectiveness of existing treatments; and stimulating the development of new antibiotics, diagnostics and novel therapies (Department of Health, Department for Environment, Food and Rural Affairs, 2013).

The aims are underpinned by specific actions covering a number of key areas, in line with the 2011 European Commission's AMR Action Plan, namely, improving infection prevention and control practices in human and animal health; optimising prescribing practices through antimicrobial stewardship programmes and making better use of existing and new rapid diagnostics; improving professional education; training and public engagement; developing new drugs, treatments and diagnostics; ensuring better access to and use of surveillance data in human and animal sectors; better identification and prioritisation of AMR research focus; and strengthening international collaboration through working with governmental and non-governmental organisations, and international regulatory bodies to influence opinion, galvanise support, and mobilise action.

The Strategy provides a number of examples of actions which have already been taken in the UK, Scotland and Northern Ireland to improve prescribing practices and tackle AMR and includes an element of continuity of future actions. It also illustrates the UK's commitment in shaping action at an international level, including the UK's support to the WHO's global leadership role in addressing AMR. Although the Strategy lacks the identification of measurable targets, it sets out detailed outcome measurements and aspects ensuring inter-sectoral implementation of actions.

However, in the third annual progress report, which describes the 2016 activities and achievements, it is stated that for the remaining two years of the 5-year strategy, the UK AMR programme has been restructured around 4 core goals with a view to delivering the ambitions set out in the UK government's response to the O'Neill Review (Global and Public Health Group, 2017). 3 out of the 4

goals include measurable targets to be achieved by 2018 and 2020/2021:

-reducing healthcare associated Gram-negative bloodstream infections in England by 50% by the years 2020/21
-reducing inappropriate antibiotic prescribing by 50% with the aim of being a world leader in reducing antibiotic prescribing by the years 2020/21.
-reducing the use of antibiotics in livestock and fish farming to an average of 50mg/kg by 2018.

The strategy is accompanied by an Impact Assessment which includes a thorough economic assessment identifying cost estimates and cost-benefits of implementing actions specific to each of the key areas of action and the impact of the strategy in comparison to inaction (Department of Health, 2013).

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