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Evaluation of the Action Plan against the rising threats from antimicrobial resistance

Contents

1. INTRODUCTION

1.1 Purpose of the evaluation

The purpose of the present evaluation is to produce an evidence-based report, assessing impacts of implemented actions under the Commission's Communication to the European Parliament and the Council on the Action Plan against the rising threats from Antimicrobial Resistance[1] ("the Action Plan"). More specifically, the evaluation analyses whether the 12 key strategic actions contained in the Action Plan were the most appropriate actions to be taken to combat Antimicrobial Resistance (AMR), if the objectives of the Action Plan are still relevant to the current needs in tackling AMR and if the approach was appropriately involving all sectors (One Health approach) and aspects of AMR (human medicine, veterinary medicine, animal husbandry, agricultural, research, environment and trade). The evaluation addresses the following evaluation criteria: relevance, effectiveness, efficiency, internal and external coherence and EU added value. The evaluation questions are listed in Annex 2.

As the Action Plan will expire in 2016, the results of this evaluation, which draws on the findings and conclusions of the RAND report[2], will provide the basis for future work in the European Union and globally.

1.2 Scope of the evaluation

The scope covers all the actions contained in the Action Plan plus the role of the Commission, the Member States and all stakeholders involved in the Action Plan implementation. Geographically, the study covered the EU Member States and some third countries namely: Norway, Switzerland, Iceland and Serbia. It also assessed the views of international bodies such as the Food and Agricultural Organization of the United Nations (FAO), Transatlantic Taskforce on Antimicrobial Resistance (TATFAR), Organisation for Economic Co-operation and Development (OECD), World Health Organisation (WHO), and the views of independent experts, research and innovation stakeholders, see Annex 3 for a complete overview.

2. BACKGROUND

2.1 Policy context of the initiative and its objectives

Since the introduction of penicillin in the 1940s antimicrobial medicines, such as antibiotics, have become essential for the treatment of many microbial infections in humans and animals. AMR is the resistance of micro-organisms to antimicrobial drugs so that their use in treatments become ineffective and infections persist which increases the risk of spread. The direct consequences of infection with resistant micro-organisms can be severe, including longer illnesses, increased mortality, prolonged stays in hospital and increased costs. Furthermore, the problem is exacerbated, because use of antimicrobials has become an essential element of modern healthcare to reduce the risk of complications in relation to complex medical interventions, such as hip replacements, organ transplants and cancer chemotherapy[3].

[1] COM (2011) 748
[2] RAND Europe. 2016. Evaluation of the EC Action Plan against the rising threats from antimicrobial resistance
[3] Smith and Coast (2013), "The true cost of antimicrobial resistance", BMJ 2013;346:f1493

AMR is a growing global burden and marks a grave societal and economic challenge, with cost of inaction projected to result in over 25,000 deaths a year and to have incurred over 1.5 billion euros of healthcare and productivity losses in Europe in 2009[4].

AMR is not only causing substantial increases in illnesses, deaths and societal costs but it's also reducing the ability to safeguard animal health and welfare, with possible repercussions for public health, food safety and food security. Lack of effective antimicrobials due to AMR can negatively affect animal health and welfare, with consequent economic losses in animal production and increased costs in production of food.

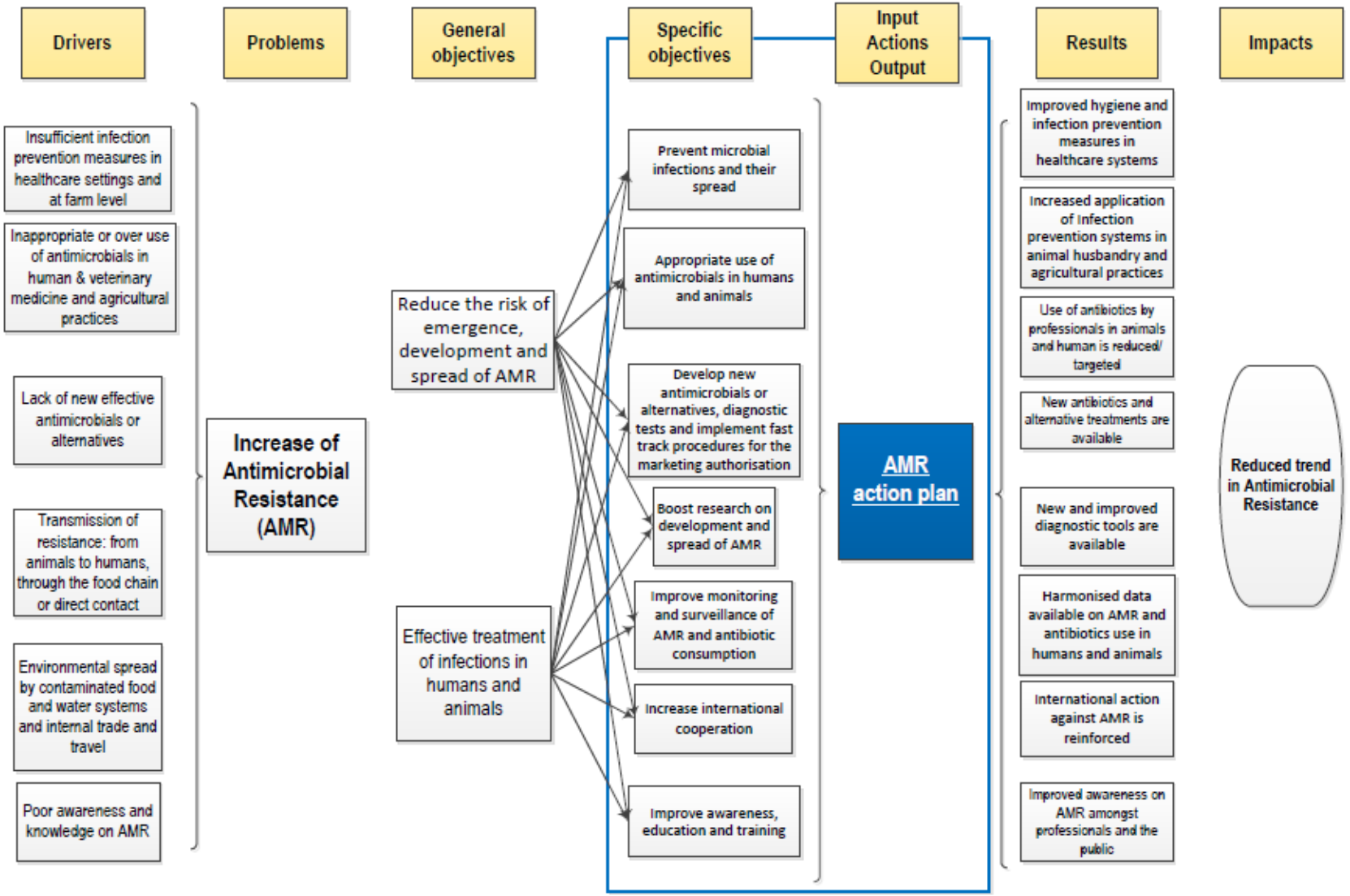
According to FAO[5], AMR represents an increasing global concern for the agriculture sector. The microbes that cause infections and disease are becoming resistant to antimicrobial drugs because of overuse, misuse and counterfeiting. The prudent use of antimicrobials in livestock and aquaculture sector is essential in light of the increased demand for animal proteins by a rapidly growing world population expected to exceed 9.6 billion by 2050. Intensifying production means additional challenges in disease management and even higher risk for increased AMR.

The 2001 Community Strategy against Antimicrobial Resistance[6] provided a first policy instrument to address the problem of AMR at a European level in four distinct areas: surveillance, prevention and control, research and product development and international cooperation. This commitment was renewed in 2011 with the Action Plan against the rising threats from Antimicrobial Resistance in response to calls from the Council[7] and the European Parliament[8].

The Action Plan took a 'One Health' approach across multiple sectors, covering both human and veterinary aspects to protect both human and animal health, AMR is a European and global societal problem, involving many different sectors, such as human medicine, veterinary medicine, animal husbandry, agricultural, research, environment and trade. The Treaty gives a different degree of competence to the Union level, so that the Commission has more possibilities to act on animal health than on human health. This is reflected in the Action Plan and in the fact that in the veterinary field the Commission has put forward legislative proposals, while in the human area the EU actions are limited to supporting activities. The Action Plan on AMR covers a five-year period; it expires in 2016. No specific funding was associated with the Action Plan.

[4] ECDC/EMA (2009), Joint technical report: "The bacterial challenge, time to react". Stockholm: European Centre for Disease Prevention and Control.
[5] http://www.fao.org/antimicrobial-resistance/en
[6] COM (2001) 333 final
[7] Council Conclusions on antimicrobial resistance, 10th June 2008 (9637/08) and
Council Conclusions on innovative incentives for effective antibiotics, 1st December 2009 (OJ C 302,12.12.2009)
[8] European Parliament Resolution on antibiotic resistance, 12th May 2011 (P7_TA(2011)0238)

Figure 1: Intervention logic



The main aim of the Action Plan is to combat the increasing threats from AMR by reducing resistant micro-organisms and the number of infections caused by them (Figure 1). The emergence and spread of resistant bacteria is a natural biological phenomenon but this is amplified and accelerated by a variety of factors (drivers), namely:

- Poor hygiene and infection prevention measures in healthcare settings and at farm level;
- Inappropriate or over use of antimicrobials in human and veterinary medicine;
- Lack of new effective antimicrobials or alternatives
- Transmission of resistant bacteria from animals to humans through the food chain or direct contact;
- Spread caused by contaminated food, via the environment and international trade and travel;
- Poor awareness and knowledge on AMR of professionals and the general public.

2.2 Actions put forward in the Action Plan

AMR seriously jeopardized the effectiveness of antimicrobial medicines. The developed Action Plan had the objective to tackle the drivers behind AMR by:

1. Putting in place effective ways to prevent microbial infections and their spread.
2. Mitigating the risk of developing AMR in humans from the use of antimicrobials both in humans and animals by effectively ensuring across the EU their appropriate use, and promoting microbiological diagnosis as the means to determine, to the extent possible, the need for antimicrobials.
3. Developing new effective antimicrobials or alternatives for treatment of human and animal infections.
4. Reinforcing research to develop the scientific basis and innovative means to combat AMR including better understanding of the transmission of resistant bacteria and the development of diagnostic tools, vaccines and other preventive measures.
5. Improving awareness by communication, education and training.
6. Improving monitoring and surveillance of AMR and antimicrobial consumption.
7. Joining forces with international partners to contain the risks of spreading AMR from international trade and travel and via the environment.

To achieve these seven objectives, the Action Plan set out 12 actions related to human and animal health.

<u>1. Prevention of microbial infections and their spread in humans and animals</u>

Action 4 deals with strengthening infection prevention and control in healthcare settings by monitoring and evaluating the 2009 Council Recommendation on patient safety[9] and Action 5 is about the application of a new Animal Health Regulation with focus on better prevention and control of listed diseases.

<u>2. Appropriate use of antimicrobials in humans and animals</u>

Action 1 is about strengthening the promotion of the appropriate use of antimicrobials in all Member States by monitoring and evaluating the 2002 Council Recommendation on the prudent use of antimicrobial agents in human medicine.[10] Action 2 deals with strengthening the regulatory framework on veterinary medicines and on medicated feed and Action 3 with Commission guidelines for prudent use of antimicrobials in veterinary medicine.

[9] Council Recommendation on patient safety, including the prevention and control of healthcare associated infections, of 9th June 2009 (2009 C151/01)

[10] Council Recommendation on the prudent use of antimicrobial agents in human medicine, of 15th November 2001 (2002/77/EC)

3. The development of new effective antimicrobials or alternatives for treatment

Action 6 promotes Research and Development (R&D) to bring new antimicrobials to patients. This includes also research into incentives to trigger investment in developing new innovative antimicrobials (market authorisation process, new business models). Action 7 promotes efforts to analyse the need for new antimicrobials into veterinary medicine.

4. Reinforcing research to develop the scientific basis and innovative means to combat AMR

Action 11 focused on reinforcement of research and coordination of efforts through the launch of a Joint Programming Initiative on AMR (JPIAMR) to better understand antimicrobial resistance and host-pathogenic interaction, the development of diagnostic tools for quick and accurate identification of pathogenic micro-organisms and/or for determining their sensitivity to antimicrobials, vaccines and other preventive measures.

5. Communication, education and training

Education and training of professionals in human and animal health was addressed in Actions 1, 2, 3, 4 and 5, where action 12 focusses on education of citizens by assessing the knowledge about and use of antimicrobials by citizens.

6. Strengthen the monitoring and surveillance systems in the human and veterinary field

Actions 9 and 10 strengthened the monitoring and surveillance systems in the human and veterinary field and established harmonisation between human and veterinary surveillance to allow comparison of data.

7. Global aspects of AMR

Action 8 focuses on the development and/or strengthening multilateral (WHO, World Organisation for Animal Health (OIE)) and bilateral (TATFAR) commitments for the prevention and control of AMR in all sectors

2.3 Baseline

The baseline for this evaluation is the situation in the Member States of the EU in 2011. This section describes the baseline for the main objective of the Action Plan, namely to combat the threats of AMR and each of the seven general objectives. Furthermore, it presents an overview of the Member States activities undertaken to combat the threats of AMR.

Antimicrobial Resistance up to 2011

The ECDC report 'Antimicrobial resistance surveillance in Europe 2011[11] presents antimicrobial resistance data for seven microorganisms of major public health importance in 29 EU/EEA Member States[12]. The results show a general Europe-wide increase of antimicrobial resistance in the gram-negative pathogens under surveillance[13], whereas the occurrence of resistance in the gram-positive pathogens appears to be stabilising[14] or even decreasing[15] in some States.

[11] ECDC, 2012. Antimicrobial resistance surveillance in Europe, 2011. Stockholm: European Centre for Disease Prevention and Control.
http://ecdc.europa.eu/en/publications/Publications/antimicrobial-resistance-surveillance-europe-2011.pdf

[12] 27 EU Member States and two EEA non-EU countries (Iceland and Norway)

[13] *Escherichia coli*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*

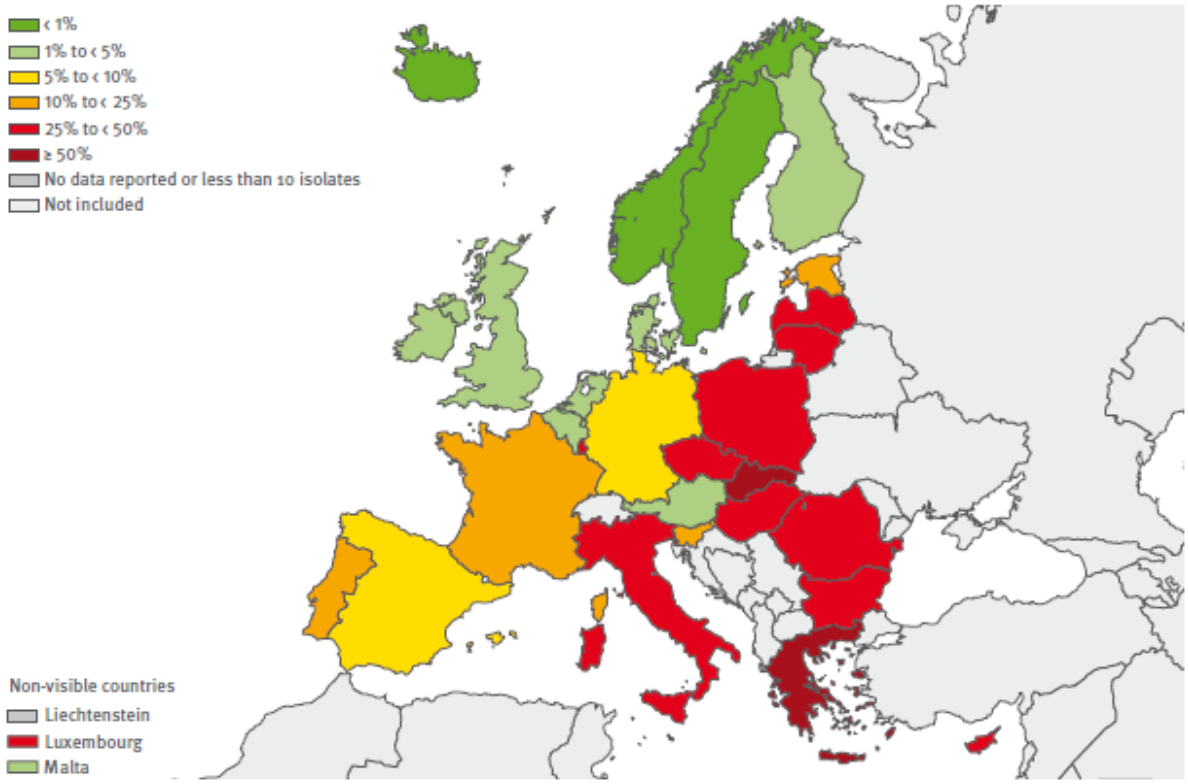
[14] *Streptococcus pneumoniae, Enterococcus faecium and Enterococcus faecalis*

[15] Methicillin-resistant *Staphylococcus aureus* (MRSA)

In 2011, the most alarming evidence of increasing antimicrobial resistance in Europe came from data on combined resistance to antimicrobial substances[16] in the pathogens *E. coli* and in *K. pneumoniae*. For both of these pathogens, more than one third of the reporting States had significantly increasing trends of combined resistance to these so-called 'last resort antimicrobials' over the last four years. The high and increasing percentage of combined resistance observed for *K. pneumonia* means that for some patients with life-threatening infections only a few therapeutic options remain available.

In general, lower resistance percentages are reported in the north and higher percentages in the south of Europe, see Figure 2.

Figure 2: *Klebsiella pneumoniae*: percentage (%) of invasive isolates with combined resistance (resistance to third generation cephalosporins, fluoroquinolones and aminoglycosides), by country, 2011



Source: ECDC, 2012. Antimicrobial resistance surveillance in Europe, 2011. Stockholm: European Centre for Disease Prevention and Control.

Microbial infection up to 2011

The main guideline for infection prevention in human health was the Council Recommendation on patient safety, including healthcare associated infections[17] adopted in 2009. This Council Recommendation recommends that Member States adopt and implement a strategy at the appropriate level for the prevention and control of healthcare associated infections, pursuing the following objectives: implement prevention and control measures at national or regional level to support the containment of healthcare associated infections,

[16] Resistance to third-generation cephalosporins, fluoroquinolones and aminoglycosides

[17] Council Recommendation on patient safety, including the prevention and control of healthcare associated infections, of 9th June 2009 (2009 C151/01)

enhance infection prevention and control at the level of the healthcare institutions, establish or strengthen active surveillance systems and foster education and training of healthcare workers.

The ECDC reported on surgical site infections[18], which are among the most common healthcare-associated infections, and are associated with longer post-operative hospital stays, additional surgical procedures, treatment in an intensive care unit, and often higher mortality. The trends of surgical site infections for seven types of operations[19] were analysed for the period 2008–2011 for 15 EU Member States[20] and Norway. The incidence of surgical site infections increased in some cases (e.g. knee operations) and remained stable or decreased in other cases, making it difficult to draw general conclusions. Inter-country comparison of the cumulative incidence of surgical site infections should be made with caution, because of differences in treatments, patient mix and assessment methodology applied[21].

The EFSA and the ECDC publishes annually a report on zoonoses[22] and food-borne outbreaks in the European Union, which illustrates the evolving situation in Europe regarding the presence of zoonotic micro-organisms in the food chain and the prevalence of animal and human infection as well as disease outbreaks caused by consuming contaminated food. The report of 2011[23], to which all Member States contributed, shows that Campylobacteriosis was the most commonly reported zoonosis with 220,209 confirmed human cases[24]. The occurrence of *Campylobacter* continued to be high in broiler meat at EU level. The decreasing trend in confirmed salmonellosis cases[25] in humans continued with a total of 95,548 cases in 2011. Most Member States met their *Salmonella* reduction targets for poultry, and *Salmonella* is declining in these populations.

Antimicrobial consumption up to 2011 in the human sector

The ECDC reports annually on the consumption of antimicrobials in the community (that is outside the hospital) and in hospitals. In 2011, the consumption in the **community** (outside the hospital) was reported by 29 EU/EEA Member States[26] and varied by a factor 3.1 between the highest consumption in Greece (35.1 defined daily doses (DDD) per 1 000 inhabitants) and the lowest in The Netherlands (11.4 DDD per 1 000 inhabitants). The median consumption was 19.5 DDD per 1 000 inhabitants.

In 2011, an overall increase of 1.0 DDD per 1 000 inhabitants in the median consumption of antibacterials for systemic use (which is a subgroup of antimicrobials) was observed compared with 2010. The largest increase in consumption of antibacterials for systemic use in the community was seen in Ireland, from 20.3 in 2010, to 22.6 in 2011. Luxembourg reported the largest decrease in consumption from 28.6 in 2010 to 27.6 in 2011.

[18] ECDC, 2013a. Surveillance of surgical site infections in Europe, 2010–2011. Stockholm: European Centre for Disease Prevention and Control.
http://ecdc.europa.eu/en/publications/Publications/SSI-in-europe-2010-2011.pdf

[19] coronary artery bypass graft (CABG), cholecystectomy (CHOL), colon surgery (COLO), caesarean section (CSEC), hip prosthesis (HPRO), knee prosthesis (KPRO) and laminectomy (LAM)

[20] Austria, Czech Republic, Finland, France, Germany, Hungary, Italy, Lithuania, Malta, Netherlands, Portugal, Romania, Slovakia, Spain, United Kingdom.

[21] Differences in post-discharge surveillance methods, differences in the length of post-operative stay, differences in the mix of hospitals that participate each year, differences in patient case mix.

[22] Zoonoses or zoonotic diseases are infections and diseases that are transmissible directly or indirectly between animals and humans, for instance by consuming contaminated foodstuffs or contact with infected animals

[23] EFSA, 2013. The European Union Summary Report on Trends and Sources of Zoonoses, Zoonotic Agents and Food-borne Outbreaks in 2011, EFSA Journal 201 013;11(4):3129.
http://www.efsa.europa.eu/sites/default/files/scientific_output/files/main_documents/2090.pdf

[24] This is a 2.6-fold increase compared with 2010.

[25] The number of salmonellosis cases in humans decreased by 5.4 % compared with 2010 and by as much as 37.9 % compared with 2007.

[26] 27 EU Member States and two EEA non-EU countries (Iceland and Norway)

A trend analysis performed on data on consumption of antibacterials, which are a sub-group of antimicrobials, for systemic use for the period 2007–2011 and including 22 EU/EEA Member States, showed a significant increase for three States (Belgium, Malta and the United Kingdom). No significant decrease was observed.

In the **hospital sector**, consumption of antibacterials for systemic use in the 18 EU/EEA Member States that reported 2011 data varied from 1.0 DDD per 1 000 inhabitants in the Netherlands, to 3.2 in Romania. In 2011, the median consumption of antibacterials for systemic use was 1.8 and did not change between 2010 and 2011. Among 11 States reporting data for the period 2007–2011 and included in the trend analysis, consumption in the hospital sector did not differ significantly for the whole group of antibacterials for systemic use.

In 2010 for the first time a (EU-wide) survey was undertaken assessing antimicrobial consumption and healthcare-associated infections in **long-term care facilities**[27]. All the countries among the 27 EU Member States, three EEA countries and three candidate countries were invited and encouraged to participate[28]. Data were collected from 25 countries[29] and a total of 722 long-term care facilities participated. This showed that on the day of the point prevalence survey 2 679 out of 61 932 residents received at least one antimicrobial agent. The majority of these residents (94.5%) received one antimicrobial agent, while 4.9% received two agents. Four residents (0.1%) received three. The ECDC acknowledged that the data cannot be considered as representative for Europe nor for the participating countries. Large differences in participation rates between countries were observed. Most countries selected long-term care facilities on a convenience sample (e.g. proximity to the national coordinating centre, public institutions, and voluntary participation).

Antimicrobial consumption up to 2011 in the veterinary sector

Over the period 2010-2011, there was overall a decline in the sales of veterinary antimicrobials in the 25 EU/EEA Member States studied[30], although there was a large variability between States. The prescribing patterns of the various veterinary antimicrobial classes varied substantially between the States. Notable variations were observed between the different States in the proportion accounted for by those critically important antimicrobials with highest priority for human medicine[31]. Another important finding was that the total sales of veterinary antimicrobial agents in the 25 EU/EEA Member States were mainly accounted for by pharmaceutical forms applicable for mass treatment or group treatment. The sales volumes and sales patterns of the various classes and sub-classes of veterinary antimicrobial agents intended for food-producing species, including horses are shown in Figure 3 below.

[27] ECDC. 2014. Point prevalence survey of healthcare associated infections and antimicrobial use in European long-term care facilities, May-September 2010. Stockholm: European Centre for Disease Prevention and Control. http://ecdc.europa.eu/en/publications/Publications/healthcare-associated-infections-antimicrobial consumption-point-prevalence-survey-long-term-care-facilities-2010.pdf

[28] A minimum enrolment of two long-term care facilities was required for participation and the point prevalence survey had to be performed between May and September 2010.

[29] The point prevalence survey was coordinated by the national representatives of the participating countries: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Lithuania, Luxembourg, Malta, The Netherlands, Poland, Portugal, Slovenia, Spain, Sweden, United Kingdom.

[30] K. Grave *et al.* (2014), "Variations in the sales and sales patterns of veterinary antimicrobial agents in 25 European countries", JAC 2014/04/16. http://jac.oxfordjournals.org/content/early/2014/04/16/jac.dku106.full.pdf

[31] Third- and fourth-generation cephalosporins, fluoroquinolones and macrolides

Figure 3: Sales, in (metric) tonnes of active ingredient, of veterinary antimicrobial agents marketed mainly for food-producing animals, including horses, PCU and sales in mg/PCU, by country, for 2010 and 2011

	Sales (metric tonnes) for food-producing animals		Percentage change in sales	PCU (1000 metric tonnes)		Percentage change in PCU	mg/PCU		Percentage change in mg/PCU
Country	2010	2011	2010–11	2010	2011	2010–11	2010	2011	2010–11
Austria	63	53	−15%	994	977	−1.8%	63	54	−13%
Belgium	299	297	−1%	1660	1695	2.1%	180	175	−3%
Bulgaria		42			399			104	
Cyprus		52			127			408	
Czech Republic	71	61	−14%	755	732	−3.1%	94	83	−12%
Denmark	119	106	−11%	2503	2479	−1.0%	47	43	−10%
Estonia	7.6	7.5	−2%	115	114	−1.1%	66	66	−0.4%
Finland	13	12	−3%	517	520	0.6%	25	24	−4%
France	997	896	−10%	7538	7643	1.4%	132	117	−11%
Germany		1819			8600			211	
Hungary	206	147	−28%	768	767	−0.2%	268	192	−28%
Iceland	0.9	0.7	−12%	113	114	0.8%	7.2	6.3	−13%
Ireland	96	87	−9%	1779	1770	−0.5%	54	49	−9%
Italy	1928	1663	−14%	4514	4497	−0.4%	427	370	−13%
Latvia	6.6	6.0	−9%	165	171	3.7%	40	35	−12%
Lithuania	16	14	−15%	342	337	−1.5%	48	42	−14%
Netherlands	461	363	−21%	3155	3186	1.0%	146	114	−22%
Norway	6.3	6.2	−3%	1537	1680	9.3%	4.1	3.7	−11%
Poland		471			3929			120	
Portugal	181	164	−10%	1020	1016	−0.3%	178	161	−9%
Slovakia		11			247			44	
Slovenia	8.4	7.8	0.02%	181	182	1.0%	46	43	−6.0%
Spain[c]	1746	1779	2%	7248	7135	−1.6%	241	249	3.5%
Sweden	13	11	−11%	832	835	0.3%	15.2	13.6	−11%
UK	456	344	−25%	6714	6724	0.2%	68	51	−25%

[a]For Denmark and Sweden data are prescription data; for Slovenia data are purchase data; some premix data are purchase data.
[b]Tablets excluded as they are almost solely used in companion animals; injectable antimicrobial VMPs can also be used in companion animals. A few other products may solely be used in companion animals, but as the proportional use is minor, these are included in the sales for food-producing animals.
[c]One of the major MAHs failed to report sales data for 2010, resulting in an underestimate.

Source: K. Grave *et al.* (2014), "Variations in the sales and sales patterns of veterinary antimicrobial agents in 25 European countries", JAC 2014/04/16.

New effective antimicrobials or alternatives and diagnostic tools

Before the launch of the Action Plan, AMR collaborative research was supported via the 7th Framework Programme for Research and Technological Development (FP7). This programme also provided public funding for the Innovative Medicines Initiative (IMI), a joint undertaking between the European Union and the pharmaceutical industry association EFPIA and the world's biggest Public Private Partnership in the life sciences area, which was created in 2008. But, IMI did not extend into the area of AMR between 2008 and 2011.

Around the year 2000, numerous pharmaceutical companies withdrew from antimicrobial development with only 4-5 large pharmaceutical companies remaining active in the field. R&D financing mechanisms taking into account the specific funding gaps hampering the development of novel interventions in the area of AMR were lacking. Furthermore, national research efforts to combat AMR were fragmented and coordination of Member States activities in this area was lacking.

Transmission of resistant bacteria from animals to humans through the food chain or direct contact;

The information collected by the EMA, ECDC and EFSA[32], and the available scientific evidence, were in 2011 still insufficient to allow a clear identification and quantification of the risk of developing and spreading AMR through food.

Environmental spread caused by contaminated food and water systems

Some publications were available dealing with certain environmental aspects of AMR but overall, the pollution levels with antimicrobials as well as the presence of resistant microorganisms in the environment and their impact on development and spread of AMR in the environment was still considered as a knowledge gap.

Awareness on AMR

In 2010, the first Eurobarometer on Antimicrobial Resistance[33] was published. This Eurobarometer is based on a representative sample[34] of residents aged 15 years and over of the 27 Member States. According to the results 83% of the people were aware that the unnecessary use of antibiotics[35] makes them ineffective. However, 47% of the people surveyed wrongly believed that "antibiotics are effective against cold and flu" and only one third received information on not to take antibiotics. Around a third of the respondents who had received information say that their views were changed by the information they received. Furthermore, it was found that the respondents who are the most knowledgeable about antibiotics seem to behave more responsibly. The knowledge of the surveyed persons concerning antibiotics varied considerably, not only from one Member State to another, but also from one socio-demographic profile to another.

Monitoring and Surveillance

The monitoring and surveillance systems are coordinated by the agencies of the Commission in the area of health, food and pharmaceuticals (ECDC, EFSA and EMA). The data regarding antimicrobial consumption by humans is coordinated by the University of Antwerp[36]. In 2011 all Member States and Iceland and Norway delivered data on antimicrobial consumption.

Data regarding AMR are gathered through the European Antimicrobial Resistance Surveillance Network (EARS-Net) for seven microorganisms of major public health importance. This is a European wide network of national surveillance systems, in which all Member States and Iceland and Norway participate. A report is published each year in November. Since 2010, the network is coordinated and funded by the ECDC. Annually a report is published by the ECDC.

The Scientific Network for Zoonoses Monitoring Data[37] coordinated by the EFSA takes care of monitoring antimicrobial resistance in food-producing animals and food. The Network consists of a pan-European network of national representatives and international organisations that assist EFSA by gathering and sharing

[32] EFSA, 2009. Joint opinion on antimicrobial resistance focused on zoonotic infections, EFSA Journal 2009, 7(11):1372

[33] Special Eurobarometer 338. Antimicrobial resistance, November-December 2009. Brussels, TNS Opinion & Social 2010. http://ec.europa.eu/health/antimicrobial_resistance/docs/ebs_338_en.pdf

[34] In each of the Member States, a number of sampling points was drawn with probability proportional to population. In total 26.761 people of the total population of 406.827.648 were interviewed.

[35] Antibiotics are a subgroup of antimicrobials. Antimicrobials include all agents that act against all types of microorganisms – bacteria (antibacterial(antibiotics)), viruses (antiviral), fungi (antifungal) and protozoa (antiprotozoal).

[36] The European Surveillance of Antimicrobial Consumption (ESAC) project started in November 2001 and was funded by two successive grants provided by the European Commission, Directorate-General Health & Consumers (SANCO) to the University of Antwerp, Belgium. From 2007-2011, ESAC was funded through a grant provided by the European Centre for Disease Prevention and Control (ECDC) (Grant Agreement GRANT/2007/001) to the University of Antwerp.

[37] Network members: 28 EU Member States, Iceland, Norway and Switzerland

information on zoonoses in their respective countries. EFSA uses this data to monitor and analyse the situation with regard to zoonoses, antimicrobial resistance and food-borne outbreaks across Europe.

Data regarding the use of antimicrobials in animals are gathered through the European Surveillance of Veterinary Antimicrobial Consumption (ESVAC). The ESVAC project was launched by the EMA in 2010 in respond to a Commission request to harmonise the collection and reporting of data on the use of antimicrobials in animals. In 2011 in total 23 Member States and Iceland and Norway submitted data. The EMA publishes an annual report on Veterinary antimicrobial consumption.

Data on Hospital Associated Infections are collected through the Healthcare Associated Infections-Network, which is coordinated by the ECDC since 2008. In 2011 data were received from 15 Member States and Norway. Point-surveillance studies are presented by the ECDC.

In 2004 the Commission established a European Reference Laboratory for AMR (EURL-AMR). The main purpose of the EURL-AMR is to ensure the quality of antimicrobial susceptibility testing in the Member States, including the use of the most optimal detection methods for antimicrobial resistance and to harmonise the procedures and methodologies used.

International activities

AMR is a global problem, international trade in and transport/travel of animals as well as travelling activities of humans can contribute to the spread of AMR. AMR is both a problem of developed countries and of less developed countries.

In developing countries AMR is a major threat for treating diseases, such as TB, malaria and HIV. Therefore, the Partnership for Pharmaceutical Policy was implemented from 2004 to 2010 in all the 78 African, Caribbean and Pacific countries, for EUR 25 million with the WHO and the African, Caribbean and Pacific Group of States (ACP) Secretariat, aiming to support the development and implementation of essential medicines strategies. Another programme of EUR 3.5 million was launched aiming at ensuring a quality pharmaceutical response to malaria. This program was implemented by WHO in six African countries until end 2011.

The EU started a bilateral cooperation with the USA on AMR in 2009. In 2011 the TATFAR was created with the objective of improving cooperation between the US and the EU in three key areas: appropriate therapeutic use of antimicrobial drugs in medical and veterinary communities, prevention of healthcare- and community-associated drug-resistant infections, and strategies for improving the pipeline of new antimicrobial drugs.

The Commission was working with WHO, who issued the Global Strategy for Containment of Antimicrobial Resistance in 2001 among others, to encourage other WHO regions to take into account the approach of WHO's European region, to ensure continuous consistency with work of the WHO Advisory Group on Integrated Surveillance of Antimicrobial Resistance.

In 2011, the WHO Regional Office for Europe developed a regional strategy on antibiotic resistance. It pursued the overall goal of reducing the morbidity and mortality associated with antibiotic resistance through seven strategic objectives: strengthening national multisectoral coordination for the containment of antibiotic resistance; strengthening national surveillance of antibiotic resistance; promoting national strategies for the rational use of antibiotics and strengthen national surveillance of antibiotic consumption; strengthening infection control and surveillance of antibiotic resistance in health care settings; preventing and controlling the development and spread of antibiotic resistance in the food-chain; promoting innovation and research on new drugs and technology; and improving awareness, patient safety and partnership.

In addition, the European Reference Laboratory for AMR (EURL-AMR) is actively collaborating with WHO supporting activities of the Global foodborne Infections Network and the Advisory Group in surveillance of Antimicrobial Resistance which has the aim to develop global standards for monitoring of antimicrobial

resistance. Furthermore, the EURL-AMR supports capacity building for AMR monitoring in the food chain in member countries of the WHO/Europe region.

Furthermore, the Commission contributed to the Codex Alimentarius or "Food Code", which was established by FAO and the World Health Organization, by representing the EU and contributing expertise to the process of the development of international food standards on AMR. The guidelines provide science-based guidance on processes and methodology for risk analysis of foodborne antimicrobial resistance.

The Commission also contributed to the OIE *ad* hoc group AMR and in particular on the development of Health Codes regarding AMR and animal health lead by the OIE by coordinating the contribution of Member States and delivering expertise to the process.

Member State activities

In 2002 Member States adopted the Council Recommendation on the prudent use of antimicrobial agents in human medicine[38], which called for putting in place national strategies to contain the problem of antimicrobial resistance.

In 2010 the second report on the implementation of the Council Recommendation[39], showed that most EU/EEA Member States[40] had, or were about to put in place, a national strategy to contain the problem of antimicrobial resistance in 2008. In 2008 there were eight additional Member States with an action plan in place compared to 2003. In total 15 Member States had a strategy, translated into an action plan, eight Member States said that the strategy was under preparation and four Member States replied that they did not have a strategy or national action plan, nor were they preparing one. All Member States had implemented a surveillance system for antimicrobial resistance. In total eight Member States had an action plan covering all the topics listed in the Council Recommendation: surveillance of antimicrobial resistance, detection and control of outbreaks, prevention policy, education and training of health professionals, general public information, and research.

3. METHOD

This evaluation is partly based on the results of the study performed by an external contractor[41]. The overall approach to the evaluation was a multi-method study to identify quantitative and qualitative findings across the actions. An evaluation matrix (see Annex 4.1) was developed, presenting judgement criteria and indicators covering each evaluation question. Data sources were identified for each indicator, which required the collection of primary quantitative and qualitative information and review of secondary data. A stakeholder mapping exercise (see Annex 4.2) was undertaken to ensure that all relevant stakeholders were consulted for the evaluation.

3.1 Primary data collection

Primary data collection included workshops, open public consultation, a Member State survey, a stakeholder survey and in-depth interviews. A summary of the data collection methods and the targeted and actual number of participants for each method are provided in Annex 3.

[38] Council Recommendation on the prudent use of antimicrobial agents in human medicine, of 15th November 2001 (2002/77/EC)

[39] European Commission. Second report from the commission to the council on the basis of member states' reports on the implementation of the council recommendation (2002/77/EC) on the prudent use of antimicrobial agents in human medicine. http://ec.europa.eu/health/antimicrobial_resistance/docs/amr_report2_en.pdf

[40] The Commission received 28 responses: 27 EU Member States and Norway

[41] RAND Europe. 2016. Evaluation of the Action Plan against the rising threats from antimicrobial resistance

Stakeholder workshops

Two stakeholder workshops were conducted as part of the evaluation. The first workshop was designed to inform stakeholders about the evaluation, explain how they could be involved and generate interest in further participation. The workshop also obtained evidence from stakeholders regarding observed changes in AMR-related issues and the Action Plan. The second workshop served as an opportunity to discuss the evaluation outcomes for the purpose of validating the findings and recommendations. The findings were summarised in reports[42] that were circulated to participants for their comment and validation following each workshop.

Public consultation and targeted surveys

An online open consultation in English was held using a questionnaire, which covered all mandatory evaluation criteria (relevance, effectiveness, efficiency, coherence and added value). The consultation gathered views and opinions from any member of the public as well as stakeholders who wished to participate. There were 64 responses of which 34 from self-identified members. The other 30 responses were routed to the targeted surveys (3 Member States, 27 stakeholders).

Online surveys targeting public sector representatives in the EU-28 Member States and stakeholders (see Annex 3 for the targeted stakeholders) were undertaken using four separate questionnaires, targeting human health and animal health experts in Member States and amongst stakeholders. The surveys were covering the mandatory evaluation criteria. In total 26 MS replied to the survey and 4 non-MS (Iceland, Norway, Switzerland and Serbia) replied to the survey.

In general, it can be concluded that the results of the Member States survey, stakeholder survey and the Public Consultation are in line with each other, although the response of Member States regarding the Action Plan was in general more positive than that from stakeholders and the general public.

Interviews

In-depth interviews were conducted to collect qualitative information to complement the survey data. These interviews targeted representatives of international bodies such as the FAO, TATFAR, OECD, WHO, independent and third country experts and research and innovation stakeholders, see Annex 4.3. The contractor has not provided detailed information about the interviews, but integrated the interview results in the report.

3.2 Secondary data analysis and synthesis

Desk research

Desk research was undertaken to collect data and information to design the consultation tools (such as interview protocols and surveys) and to answer the evaluation questions. The types of sources consulted included legislative documents, scientific guidelines, surveillance reports, and surveillance data relating to animal and human health, public surveys, stakeholder reports, academic literature and evaluations. The secondary data and information used in the evaluation differed by evaluation question. The resulting evaluation matrix identifies the indicators that rely on secondary information and the main sources of this information.

Case Studies

Eight case studies were conducted, focusing on AMR-related issues in specific countries. The objective of the case studies was to test assumptions about the impacts of the Action Plan including similarities and differences in countries' approaches to the tackling AMR, and the link between actions on AMR issues and the role of Action Plan.

[42] RAND Europe. 2016. Evaluation of the Action Plan against the rising threats from antimicrobial resistance

Final synthesis and triangulation

Primary and secondary data were brought together through synthesis of the evidence by indicator, aggregated up to judgement criteria and assessed as a whole in relation to each evaluation question. Triangulation was three-fold: first, to ensure that different data sources are aligned, or their differences were explained. Finally, the available data came from different sources and this was taken into account in the preparation of findings and conclusions.

3.3 Validity and limitations

Scope of the evaluation in relation to the time and resources available

At the start, a stakeholder mapping exercise was completed to ensure that all relevant stakeholders were consulted for the evaluation. The contractor performed a stakeholder and a Member State survey and carried out a public consultation. The evaluation covered 28 Member States and Iceland, Norway, Serbia and Switzerland. More details can be found in Annex 3.

Attribution

It should be kept in mind that certain actions at EU and at national level that are related to the Action Plan were already ongoing when the Action plan was adopted and published. Therefore contribution of the Action plan to achievement of these actions is difficult to assess.

Timeframe

Another issue for the evaluation was the timing of the analysis in the lifecycle of the Action Plan and its activities. The main challenge was to measure and evaluate the impact of AMR policy on the resistance and use of antimicrobials and the spread of infections in humans and animals due to the short lifecycle of the Action Plan. The same would apply to R&D initiatives which will only deliver results in the medium and longer term. In addition, some initiatives, such as the Commission guidelines on prudent use of antimicrobials in veterinary medicine, published in September 2015, and the Animal Health Regulation[43], adopted in March 2016, are in their infancy as regards implementation. Others, such as the Commission proposals for revised legislation on veterinary medicines and on medicated feed, are still in the process of adoption through the ordinary legislative procedure. To overcome this problem, the surveys asked the respondents for each of these initiatives, if they have a potential to be effective.

3.4 Assessment of the evaluation performed by the contractor

The evaluation fully covered the scope for time period, geographical areas and target groups. The stakeholder mapping ensured that all relevant stakeholders were addressed. The methodology design was appropriate for addressing the evaluation objectives and combined several approaches (surveys, in-depth interviews, case studies, desk research). The analysis was carried out in a systematic way following established evaluation criteria. The conclusions are based on the evidence provided through the analysis. The Commission services found the gathered survey data by the contractor robust, but had to perform additional desk research and had to strengthen the analysis, synthesis and triangulation.

4. THE STATE OF PLAY OF THE ACTION PLAN IMPLEMENTATION

In 2016 AMR is still a growing global burden and marks a grave societal and economic challenge in terms of deaths and economic costs with impact of inaction projected to result in 10 million deaths globally each year

[43] Regulation (EU) 2016/429 of the European Parliament and of the Council of 9 March 2016 on transmissible animal diseases and amending and repealing certain acts in the area of animal health ('Animal Health Regulation'), (OJ L 84, 31.3.2016, p. 1)

from 700.000 now and a cumulative loss of over EUR 88 trillion to the world economy by 2050[44]. This section pays attention to the progress in the actions undertaken to combat the rising threat of AMR.

4.1 Progress 2011-2015 for each action

The Action Plan had seven core objectives and set out 12 actions in human and veterinary medicine to achieve these objectives. The Action Plan was managed by the Commission with support of its agencies in the area of health, food and pharmaceuticals (the European Centre for Disease Prevention and Control (ECDC), the European Food Safety Authority (EFSA) and European Medicines Agency (EMA)). To implement the Action Plan, the Commission has compiled a Roadmap[45] (updated on November 2015) containing the 12 actions covered by the Action Plan. There was one overarching inter-service working group and for each specific action, there was one fixed contact point within the Commission.

Based on the progress report published in 2015[46] which describes in detail the progress made till March 2015 for each action, and the Roadmap, it can be concluded that the majority of actions have been implemented. At this moment, the following actions are still being undertaken:

- Action 1: the development of guidelines on prudent use of antimicrobials in human medicine by ECDC,
- Action 2: the implementation of legislative proposals on veterinary medicines and on medicated feed (still in the process of adoption through the ordinary legislative procedure),
- Action 3: Fact-finding missions by the Commission on the prudent use of antimicrobials in animals (2016).

The table below summarises the main findings of the Progress report and the main activities undertaken after the publication of the Progress report for each action.

Implementation state of play

Action	Output
1. Strengthen the promotion of the appropriate use of antimicrobials in human medicine	Report on the implementation of the Council Recommendation on the prudent use of antimicrobial agents in human medicine (2016). Still to come: Guidelines on prudent use of antimicrobials in human medicine.
2. Strengthen the regulatory framework on veterinary medicines and on medicated feed	The Commission adopted proposals on veterinary medicinal products and medicated feed in 2014 (still in the process of adoption through the ordinary legislative procedure)
3. Introduce recommendations for prudent use in veterinary medicine	The Commission introduced guidelines on the prudent use of antimicrobials in veterinary medicine in September 2015. Fact-finding missions on the prudent use of antimicrobials in animals (2016).
4. Strengthen infection prevention and control in healthcare settings	Report on the implementation of the Council Recommendation on Patient Safety (2012). Europe-wide point prevalence survey on Hospital Associated Infections.
5. Adoption of a proposal for an EU	The Animal Health Regulation has been adopted by co-legislators in March

[44] O'Neill Review 2016. 'Tackling drug-resistant infections globally: final report and recommendations.' Review on Antimicrobial resistance. London.
[45] http://ec.europa.eu/health/antimicrobial_resistance/docs/roadmap_amr_en.pdf
[46] SWD (2015) 59 final

Animal Health Regulation	2016
6. To promote, in a staged approach, unprecedented collaborative research and development efforts to bring new antibiotics to patients	The New Drugs for Bad Bugs public-private programme has been launched in May 2012 to spur the development of new antibiotics along the value chain from basic science to new business models. The existing regulatory framework has been considered "fit for purpose" to bring new antibiotics to patients (EMA Workshop 2013).
7. Promote efforts to analyse the need for new antibiotics into veterinary medicine	The proposal on veterinary medicinal products provides incentives for the development of new types of veterinary antimicrobials. The EMA (Antimicrobial Advice Ad Hoc Expert Group) scientific advice, including on new veterinary antimicrobials, was delivered in 2014. A follow-up workshop to analyse this advice was organised by the Commission in 2015.
8. Develop and/or strengthen multilateral and bilateral commitments for the prevention and control of AMR in all sectors including initiating cooperation on reduction of the environmental pollution by antimicrobial medicines particularly from production facilities	EU contributed to the WHO Global Action Plan, the Global Foodborne Infections Network, OIE standards, Guidelines for Risk Analysis of Foodborne AMR (part of the Codex Alimentarius), TATFAR and work with the OECD on economic impact. The Commission is developing a strategic approach to the pharmaceuticals in the environment.
9. Strengthen surveillance systems on AMR and antimicrobial consumption in human medicine	The coverage and scope of data collected for the European Surveillance of Antimicrobial Consumption and the European Antimicrobial Resistance Surveillance Network as part of ECDC surveillance have been improved.
10. Strengthen surveillance systems on AMR and antimicrobial consumption in veterinary medicine	The coverage and scope of data collected for the European Surveillance of Veterinary Antimicrobial Consumption have been improved. Decision 2013/652/EC on monitoring and reporting of AMR has extended the coverage and scope of data collected in zoonotic and commensal bacteria (in food-producing animals and certain food) EFSA, EMA and ECDC report on a first integrated analysis of antimicrobial consumption by and resistance in humans and animals (2015). The proposal on veterinary medicinal products provides for compulsory collection of data on sales and use of veterinary antimicrobials.
11. Reinforce and coordinate research efforts	A Joint Programming Initiative aimed at coordinating national research activities related to AMR has been set up. Commission supported research activities include projects focussing on diagnostic tools, vaccines and alternative treatments and the understanding of antimicrobial resistance
12. Communication, education and training	European Antibiotic Awareness Day Eurobarometer on public knowledge about antibiotics (2013 and 2016)

4.2 Progress 2011-2015 for each objective

This section describes the progress regarding the overall objective of the Action Plan to combat AMR and the seven general objectives. Furthermore, it presents an overview of the Member States activities undertaken to combat AMR.

Antimicrobial Resistance 2011-2015

The ECDC report 'Antimicrobial resistance surveillance in Europe 2014[47], which presents antimicrobial resistance data for seven microorganisms of major public health importance in 29 EU/EEA Member States[48], shows that the situation is still worrying for gram-negative pathogens[49], with high and, in many cases, increasing resistance percentages reported from many parts of Europe. Resistance trends in gram-positive pathogens[50] showed a more diverse pattern across Europe than in 2011[51].

Furthermore, in line with the results from previous years, combined resistance to antimicrobial substances[52] was very common in the pathogens *E. coli and K. pneumonia.* Increasing resistance trends were noted for individual EU/EEA Member States with both low and high resistance percentages.

Given the diverse pattern across Europe and across different pathogens, it was not possible to identify clear trends in the level of AMR for the EU overall during the period 2011-2014. The increasing resistance in some antimicrobial groups is, according to the ECDC, an indication of the further loss of effective treatment options and a threat to patient safety.

Microbial infection 2011-2015

The ECDC has no updated information regarding the trend on **surgical site infections**, which are among the most common healthcare associated infections. Therefore, there is no evidence if the decreasing trend observed over the period 2008–2011 has been continued.

The third implementation report of the Council Recommendation on prudent use of antimicrobial agents in human medicine[53] showed that most EU/EEA Member States implemented a combination of actions to prevent and control infections. In 2012[54] in total 13 Member States reported that the adoption of the Council Recommendation had triggered initiatives on healthcare associated infections, in particular on implementation of inter-sectoral mechanisms, on monitoring and assessing strategies to prevent and control infections, and on strengthening information campaigns towards healthcare workers.

According to the third implementation report in 2016, representing the survey results of 29 EU/EEA Member States, all States had national guidelines for infection prevention and control, 19 States reported having legal requirements or professional guidelines for the number of infection control/hygiene professionals in hospitals, 11 States reported national requirements to communicate on the infection status of a patient in case of a cross-border transfer and 22 States had assessed the compliance of healthcare workers with the guidelines for hand hygiene. Only 13 States had assessed the impact of required infection control and hospital hygiene measures on the incidence of some infections in hospitals and six had carried out such assessments in nursing homes and other long-term care facilities.

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[47] ECDC 2015. Antimicrobial resistance surveillance in Europe 2014. Stockholm: European Centre for Disease Prevention and Control.
http://ecdc.europa.eu/en/publications/Publications/antimicrobial-resistance-europe-2014.pdf

[48] 28 EU Member States with exception of Poland, Iceland and Norway

[49] *Escherichia coli*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*

[50] *Streptococcus pneumoniae, Enterococcus faecium and Enterococcus faecalis,* Methicillin-resistant *Staphylococcus aureus* (MRSA)

[51] For instance, for methicillin-resistant Staphylococcus aureus (MRSA) has continued to decrease over the last four years, from 18.6 % in 2011 to 17.4 % in 2014 and for Streptococcus pneumoniae, resistance percentages were generally stable during the period 2011-2014.

[52] Resistance to third-generation cephalosporins, fluoroquinolones and aminoglycosides

[54] Second report from the Commission to the Council on the basis of the Member States' reports on the implementation of the Council recommendation (2002//77/EC) on the prudent use of antimicrobial agents in human medicine.
http://ec.europa.eu/health/antimicrobial_resistance/docs/amr_report2_en.pdf

According to the European Union summary report on trends and sources of zoonoses, zoonotic agents and food-borne outbreaks in 2014[55] illustrates that Campylobacteriosis was still the most commonly reported zoonosis with an increase in confirmed human cases in the European Union (EU) since 2008. In food the occurrence of *Campylobacter* remained high in broiler meat. The decreasing EU trend for confirmed human salmonellosis cases since 2008 continued. Most Member States continued to meet their *Salmonella* reduction targets for poultry.

Antimicrobial consumption 2011-2015 in the human sector

According to the ECDC[56] the consumption of antibacterials (subgroup of antimicrobials) in the **community** (outside hospital) was stable over the period 2009-2012. The consumption of antimicrobials in humans has also been stable in the **hospital** sector for the period 2007-2012. Furthermore, there was also no change in average antimicrobial consumption in EU **long-term care facilities** over the period 2010-2013[57]. However, there has been a large variability across the EU/EEA Member States[58]. Furthermore, there has been a shift towards use of broad spectrum relative to narrow spectrum antimicrobials from a ratio of 7.7 in 2011 to 9.5 in 2012, before stabilising at 11.3 in 2013 and 11.2 in 2014. This increase was mainly driven by a worsening in the performance of the States which already had a high ratio of broad spectrum use, see Annex 5.

Antimicrobial consumption 2011-2015 in the veterinary sector

The sales of veterinary antimicrobials in the EU decreased further over the period 2011-2013[59] and high levels of variation persist between EU/EEA Member States, see Figure 4.

[55] EFSA, 2015. The European Union summary report on trends and sources of zoonoses, zoonotic agents and food-borne outbreaks in 2014. EFSA Journal 2015, 4329
https://www.efsa.europa.eu/sites/default/files/scientific_output/files/main_documents/4329.pdf

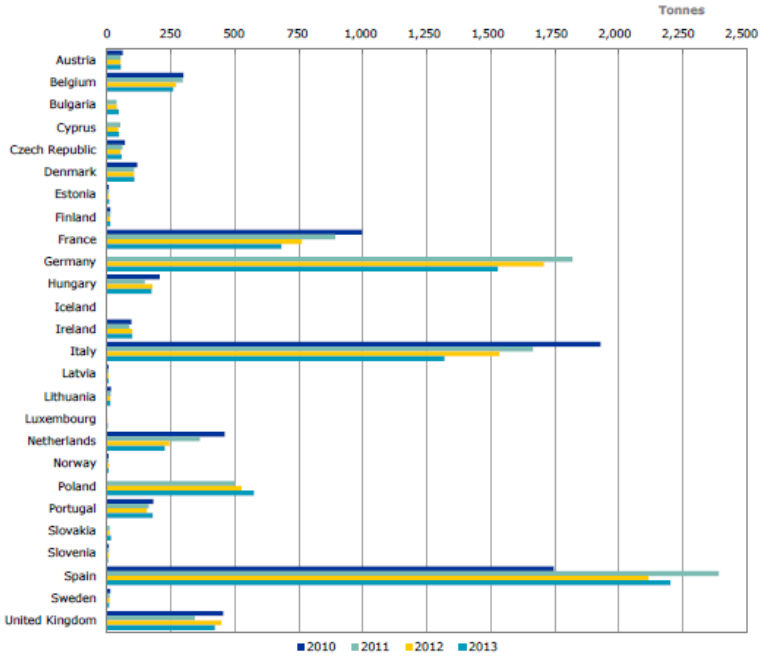
[56] ECDC. 2014. Surveillance of antimicrobial consumption in Europe, 2012. Stockholm: European Centre for Disease Prevention and Control.
http://ecdc.europa.eu/en/publications/Publications/healthcare-associated-infections-point-prevalence-survey-long-term-care-facilities-2013.pdf

[57] ECDC. 2014. Point prevalence survey of healthcare associated infections and antimicrobial use in European long-term care facilities, April–May 2013. Stockholm: European Centre for Disease Prevention and Control.
http://ecdc.europa.eu/en/publications/Publications/healthcare-associated-infections-point-prevalence-survey-long-term-care-facilities-2013.pdf

[58] 28 EU Member States and two EEA non-EU countries (Iceland and Norway)

[59] EMA (European Medicines Agency). 2015. Sales of veterinary antimicrobial agents in 26 EU/EEA countries in 2013.
http://www.ema.europa.eu/docs/en_GB/document_library/Report/2015/10/WC500195687.pdf

Figure 4: Sales, in tonnes of active ingredients, of veterinary antimicrobials for food-producing animals, including horses, during 2010 to 2013, for 26 countries



[1] Correction of sales data published in ESVAC 2012 report is described in chapter 1.6. [2] Under-reported for Bulgaria for 2011 and 2012 as several wholesalers failed to report data. [3] Strength reported as base for most VMPs for 2010 –2012 for the Czech Republic; for 2013, strength reported as in the names of the VMPs. [4] Strength reported as base for some VMPs for 2010–2012 for the Netherlands; for 2013, strength reported as in the names of the VMPs. [5] For Slovakia, for 2011 and 2012 the data represents only imported antimicrobial VMPs by wholesalers; for 2013, data represents all sales from wholesalers to end-users (veterinarians, pharmacies, producers of medicated feeding stuffs and farmers, obtained by import and from national manufacturers. [6] For Spain, under-reporting for 2010 as one MAH failed to report data; for 2011 and 2012, the number of packages sold were corrected for some products. For more details see chapter 2.8.2.

Source: EMA (European Medicines Agency). 2015. Sales of veterinary antimicrobial agents in 26 EU/EEA countries in 2013.

New effective antimicrobials or alternatives and diagnostics tools

The R&D support for new effective antimicrobials or alternatives was achieved through the FP7 and Horizon 2020 framework. AMR became one of the twelve priorities of the public-private Innovative Medicines Initiative (IMI). In May 2012, within the IMI, the **New Drugs for Bad Bugs (ND4BB)**[60] programme was launched to spur the development of new antibiotics along the value chain from basic science to new business models and created conditions for open data sharing. ND4BB was the first and by far the biggest existing Public Private Partnership worldwide to combat antibiotic resistance by tackling the scientific, regulatory, and business challenges that are hampering the development of new antibiotics. ND4BB has brought the pharmaceutical industry back to the field of AMR R&D with an increase from 4 to now 11 big EFPIA companies being involved in projects in ND4BB. Seven projects with a total allocated budget of about EUR 650 million have been initiated so far that have five principal objectives: 1) To create a sustainable European clinical investigator and laboratory network with the capacity to run large-scale antibiotic clinical trials; 2) To use that network for improved and more efficient clinical development of new antibiotic drug candidates; 3) To advance our understanding of the underlying science, notably penetration barriers and efflux mechanisms in Gram-negative bacteria; 4) To progress promising novel hit or lead molecules into early clinical development; and 5) To develop options for novel economic models of antibiotic R&D and responsible use of antibiotics.

[60] http://www.imi.europa.eu/content/nd4bb

To date, the ND4BB projects are in early stages and progressing well. They have already established a network of more than 700 hospitals and 500 laboratories, through which new antibiotics for treatment and prevention of infections caused by antibiotic-resistant bacteria can be rapidly evaluated. Three clinical trials have started within this network with more to follow. In addition to this a drug discovery platform was set up for testing and optimising future drug candidates identified as the most likely ones to succeed in the clinic. The platform actively investigates such compounds coming from universities and small businesses to enable their further development. The programme will continue to explore and define incentives for industry to invest more in this area while reconciling this with responsible use by de-linking revenues from sales. It is currently consulting with many stakeholders to develop and test new business and stewardship models for antibiotic development which have the potential to influence in this sector.

In 2014 the **IMI2** started and built on and extended IMI. IMI2 will run for ten years. The goal of the IMI2, programme which will build on the progress made in the ND4BB programme, is to develop next generation vaccines, medicines and treatments, such as new antimicrobials. IMI2's expected research targets (to be achieved by 2024) are a pipeline of promising new agents for tackling antibiotic-resistant bacterial infections; tools required to support the new generation of therapeutic and preventative approaches, and the optimisation of clinical trials supported by a fit for purpose regulatory and Health Technology Assessment framework. IMI 2 aims to deliver at least two new medicines which include new antimicrobials.

Over the period 2012-2015 there were five antibiotics (subgroup of antimicrobials)[61] containing new active substances that were authorised via the centralised procedure. Furthermore, three antituberculotics for Multi Drug Resistant -TB[62] were authorised for rare diseases. The recently authorised antibiotics remain those of known classes and more breakthrough antibacterial active substances with new mechanisms of actions are needed.

In June 2015, a new financing instrument for infectious diseases, "**InnovFin ID[63]**", was launched by the Commission and the European Investment Bank under the InnovFin set of financial instruments. InnovFin ID is a specific financial instrument with an initial budget of EUR 200 million to facilitate the development of novel interventions for infectious diseases. It provides loans between EUR 7.5 million and EUR 75 million to innovative players active in developing vaccines, medicines including antibiotics, medical and diagnostic devices (for instance devices to analyse the type of infection: viral versus bacterial, which type of bacterial), and research infrastructures for combatting infectious diseases.

The "InnovFin ID" Pilot has attracted much attention and interest in its starting phase. Since the launch of this new financial facility, three loans with a size of EUR 10, EUR 20 and EUR 15 million were granted to a Swedish Small Medium-sized Enterprise, a French biopharmaceutical company and a Finnish molecular diagnostics company. Further 43 proposals have been submitted of which 36 are currently undergoing further evaluation. After its successful start, the "InnovFin ID" pilot will be upscaled by mobilising the European Fund for Strategic Investment. The impact of such scaling-up of the "InnovFin ID" pilot will be a significant increase in the funds available to infectious disease research and innovation. The "InnovFin ID" pilot is expected to unlock and accelerate progress in the provision of innovative drugs, vaccines, medical and diagnostic devices, and infrastructures for ID, but it is too early yet to estimate the benefits in the area of AMR.

In February 2015 an innovative **inducement prize on the 'Better use of antibiotics'** was launched as one of the first prizes under Horizon 2020 to stimulate the development of diagnostic tools for patients with upper respiratory tract. This prize of EUR 1 million will be awarded for a rapid test to identify, at the point of care,

[61] Orbactiv, Sivextro, Zinforo, Zerbaxa and Xydalba
[62] Deltyba, Sirturo and Granupas
[63] http://www.eib.org/products/blending/innovfin/

patients with upper respiratory tract infections that can be treated safely without antibiotics. The selection of this topic for the prize was facilitated by the existence of the Action Plan.

To stimulate the development of new antimicrobials in veterinary medicine, the **legislative proposal on veterinary medicinal products** introduces incentives for the development of new veterinary antimicrobials, which once adopted and implemented should speed up the availability of antimicrobials for veterinary use.

Transmission of resistant bacteria from animals to humans through the food chain or direct contact;

The role of AMR in the environment and the risk this poses to human health was addressed in FP7 research projects like "Evolution and Transfer of Antibiotic Resistance" (EvoTAR)[64] and "Ecology from Farm to Fork Of microbial drug Resistance and Transmission" (EFFORT)[65]. EvoTAR was running from 2011 till 2015 and has provided insight into the understanding of the evolution and spread of antibiotic resistance in human pathogens. This information is anticipated to enable the prediction of future resistance trends[66]. EFFORT was launched in 2013 and runs till 2018. It aims to provide scientific evidence about the consequences of AMR in the food chain including understanding of the relative contribution of the exposure routes of antimicrobial resistance from animals to humans.

In January 2016 the JPIAMR (Joint Programming Initiative on AMR) launched a research call that is co-funded by the EC. The call topic "To unravel the dynamics of transmission and selection of AMR antimicrobial resistance (AMR) at genetic, bacterial, animal, human, societal, and environmental levels, in order to design and evaluate preventive and intervening measures for controlling resistance." This is expected to lead to more research addressing transmission aspects.

Environmental spread caused by contaminated food and water systems

The Commission is developing its strategic approach to pharmaceuticals in the environment (including antimicrobials and AMR) in the framework of Directive 2013/39/EU. An external study to support this development is ongoing.

Awareness on AMR

According to the third report on implementation of the Council Recommendation on Prudent use of antimicrobial agents in human medicine of Dumartin[67], awareness raising campaigns had been carried out in more EU/EEA Member States in 2015 than reported in 2008 (24 versus 17) and in some States, these campaigns had been fostered by the launch in 2008 of the annual European Antibiotic Awareness Day (EAAD). Earnshaw *et al.*[68] evaluated the success of the EAAD and stated that the number of participating countries grew from 32 in 2008 to 43 in 2013. According to Earnshaw *et al*. the EAAD has provided a platform for pre-existing national campaigns and encouraged similar campaigns to develop in other countries where neither political support had been secured, nor financial support been available. This finding is in line with the findings of the ECDC. According to the ECDC, in 2013, 22 countries reported in an annual evaluation

[64] http://www.evotar.eu/

[65] http://www.effort-against-amr.eu/

[66] The results of eh EvoTAR project are published at http://cordis.europa.eu/project/rcn/100088_en.html

[67] Dumartin, 2016. Prudent use of antimicrobial agents in human medicine: third report on implementation of the Council Recommendation. Publication Office of the European Union, Luxembourg, ISBN 978-92-79-57568-6.

[68] Earnshaw, Sarah, G. Mancarella, A. Mendez, B. Todorova, A.P. Magiorakos, E. Possenti, M. Stryk, S. Gilbro, H. Goossens, B. Albiger & D.L. Monnet, on behalf of the European Antibiotic Awareness Day Technical Advisory Committee, on behalf of the European Antibiotic Awareness Day Collaborative Group. 2014. 'European Antibiotic Awareness Day: a five-year perspective of Europe-wide actions to promote prudent use of antibiotics.' Eurosurveillance 19 (41). As of 21 December 2015: http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=20928

questionnaire that there had been a change in their country that could be attributed to the momentum created by EAAD.

The recently published EU-wide survey (Eurobarometer) regarding public use of and knowledge about antimicrobials[69,70] shows approximately the same results as in 2010. Nowadays still most surveyed persons are aware that unnecessary use of antibiotics makes them become ineffective (84% in 2016 versus 83% in 2010) and that you should only stop taking antibiotics after taking all of the prescribed dose (82% in 2016, this was a new question). The number of people that is aware that antibiotics are ineffective against colds and flu is slightly increased (56% in 2013 versus 47% in 2010). Furthermore, still a third of respondents say that they received information about the unnecessary use of antibiotics and around a third of the respondents say that their views were changed by the information they received (approximately the same proportion as in 2010). Also the result of 2010 was reconfirmed that the respondents who are the most knowledgeable about antibiotics seem to behave more responsibly. The results still vary considerably from one Member State to another, and also between socio-demographic profiles.

Monitoring and Surveillance

The monitoring and surveillance has been improved (scope and coverage) in the human and in the veterinary field.

In the human field, with the transfer of the ESAC-Net from the University of Anvers to ECDC in 2012, the ECDC is now in charge of all data collections related to AMR: the EARS-Net, the ESAC-Net, the HAI-Net and the FDW-Net.

The methodology of identifying **healthcare associated infections** in long-term care facilities was changed between the survey in 2010 and in 2013. During the analysis of the point-prevalence survey of healthcare-associated infections and antimicrobial use in long-term care facilities, it became clear that the methodology should be adopted from collecting data on any sign and/or symptom of infection to a case definition, because 40.4% of the infections reported could not be confirmed to a case. The Decision regarding the implementation of the newly adopted measures on new case definitions for antimicrobial resistance and healthcare associated infections was adopted in 2012.[71] As a result no information is available yet on the trend of healthcare associated infections.

To improve the data collection on the veterinary side, it was decided to extend the legal basis for data collection and to harmonise the data collected and the manner in which they are collected between Member States. The legislative proposal on veterinary medicines reinforces a legal basis for collection of data regarding antimicrobials. Furthermore, the Animal Health Regulation, adopted in March 2016, provides a legal basis for the surveillance and monitoring of the occurrence of non-zoonotic pathogens in animals. Decision 2013/652/EU on monitoring and reporting of AMR has extended the coverage and scope ((e.g. species and substances) of data collected in zoonotic and commensal bacteria in food producing animals and certain food. As a result of this decision, data are since 2014 more specific, much easier to compare between Member States and across sectors, and the scope of the monitoring is larger.

[69] Special Eurobarometer 445, Antimicrobial Resistance 2016, April-June 2016. Brussels, TNS Opinion&Social 2016.

[70] This survey is based on a representative sample of residents aged 15 years and over in each of the Member States In each of the 28 Member States, a number of sampling points was drawn with probability proportional to population. In total 27.969 people of the total population of 424.491.772 were interviewed.

[71] Commission Implementing Decisions 2012/506/EU of August 2012 under Decision No 2119/98/EC of the European Parliament and of the Council
http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L:2012:262:FULL&from=EN

A result of the further cooperation between the EU agencies EFSA, EMA and ECDC is the report on the first integrated analysis of antimicrobial consumption by and resistance in humans and animals.

The coverage of the following monitoring and surveillance systems has been improved:

- Antimicrobial resistance in zoonotic and indicator bacteria from humans, animals and food:
  - 26 Member States in 2011
  - 28 Member States in 2014
- Human antimicrobial consumption (ESAC):
  - 27 Member States and Iceland and Norway in 2011
  - all EU Member States except Poland and Iceland and Norway in 2014
- Veterinary antimicrobial consumption (ESVAC)
  - 23 Member States and Iceland and Norway in 2011
  - 24 Member States and Iceland and Norway in 2013.

International activities

The EU/African, Caribbean and Pacific Group of States (ACP) /WHO Renewed Partnership (2012-2016) with some EUR 10 million from the Commission supports strengthening pharmaceutical systems and improving access to quality essential medicines. The Partnership contributes to improved cost effective health care and better patient outcomes through improved availability, affordability and use of safe effective and quality assured medicines in 15 African ACP countries. Within the Work Area: 'Improved medicines selection, prescribing, dispensing and use and strengthening capacity of health care providers', a number of countries have prioritized implementation of key interventions to combat antimicrobial resistance. The objective is to have consumption and use data on antimicrobials for Burundi, the Democratic Republic of the Congo (DRC), the Republic of Congo, Ghana, Mozambique, Tanzania, Zambia and Zimbabwe.

The TATFAR, which was created in 2011, began with 17 recommendations for future collaborations between the U.S. and the EU in three key areas: appropriate therapeutic use of antimicrobial drugs in medical and veterinary communities, prevention of healthcare- and community- associated drug-resistant infections, and strategies for improving the pipeline of new antimicrobial drugs. Its first mandate, running from 2011 to 2013, focused on the implementation of the agreed recommendations. At the end of this period, following assessment on the progress achieved and remaining needs, the mandate of TATFAR was extended for an additional two-year term. Over the course of the second mandate TATFAR continued to address 15 recommendations, but discontinued work on two previous recommendations. The new mandate also led to the creation of a new recommendation for collaboration to identify gaps in understanding the impact of antimicrobial use in animals and the risks of AMR for humans. The TATFAR has been extended with Canada and Norway and the collaboration has led to increased information exchange, understanding of best approaches and practices and development of peer relationships, see for more detailed information the progress report on the Action Plan.

In 2015, WHO launched the Global Action Plan on antimicrobial resistance. This plan sets out five strategic objectives: improve awareness and understanding of antimicrobial resistance; strengthen knowledge through surveillance and research; reduce the incidence of infection; optimize the use of antimicrobial agents; and develop the economic case for sustainable investment that takes account of the needs of all countries, and increase investment in new medicines, diagnostic tools, vaccines and other interventions.

The Commission continued contributing to the Codex Alimentarius or "Food Code", which was established by FAO and the World Health Organization, by representing the EU and contributing expertise to the process of the development of international food standards on AMR.

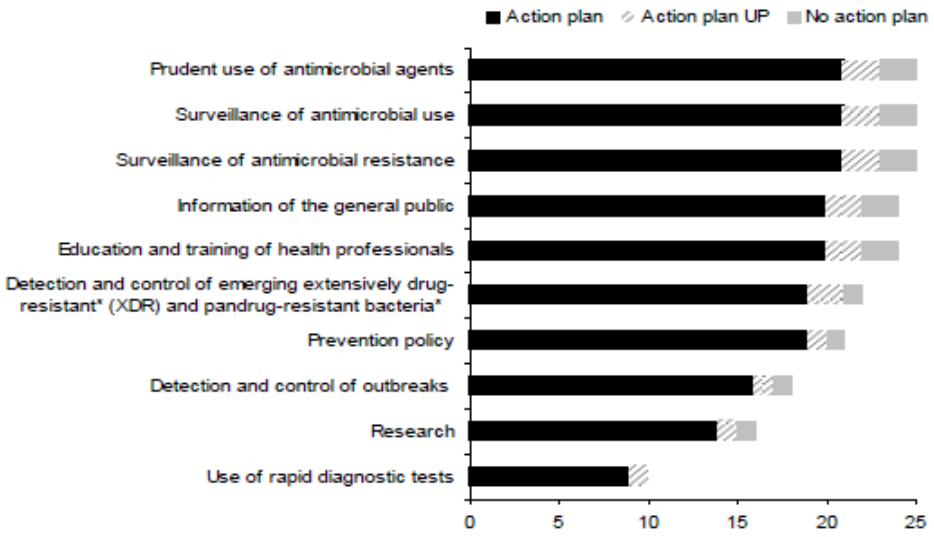
Furthermore, the Commission continued contributing to the OIE activities in general and in particular to the OIE *ad* hoc group AMR which is setting up a global database on the use of antimicrobial agents in animals the development by coordinating the contribution of Member States and delivering expertise to the process.

Member State activities

The Commission guidelines for the prudent use of antimicrobials in veterinary medicine published in 2015 call for 'One health' strategies and/or action plans to be put in place instead of national action plans just focussed on the human health side. Furthermore, the WHO Global Action Plan on antimicrobial resistance calls upon members to have a nation action plan in place in mid-2017.

Most Member States have a national action plan on human health. According to Dumartin's evaluation[72] of the Council Recommendation on the prudent use of antimicrobial agents in human medicine and the Council Recommendation on patient safety (Action 1 and 3), in total 21 EU/EEA Member States had a national action plan instead of 15 in 2008 and in two Member States a national action plan was under preparation. National action plans covered a wide range of topics. A half of the EU/EEA Member States with a national action plan had either launched or updated such plans within the two previous years (2014-2015). All national action plans included activities regarding prudent use of antimicrobial agents, surveillance of AMR and surveillance of antimicrobial use. All action plans with the exception of one addressed education and training of health professionals and information to the general public. Figure 5 shows the topics covered by the national action plans in 2008 and in 2015.

Figure 5: Topics covered by the national action plan in 25 countries



° of which two countries with action plans under preparation (UP) and two with no formal action plan

Source: Dumartin, 2016. Prudent use of antimicrobial agents in human medicine: third report on implementation of the Council Recommendation. Publication Office of the European Union, Luxembourg, ISBN 978-92-79-57568-6.

[72] Dumartin, 2016. Prudent use of antimicrobial agents in human medicine: third report on implementation of the Council Recommendation. Publication Office of the European Union, Luxembourg, ISBN 978-92-79-57568-6.

Furthermore, Dumartin mentions that recent concerns regarding emerging Multidrug-Resistant and Extensively-Drug resistant bacteria are addressed in most EU/EEA Member States, which might in her view reflect mobilisation of decision-makers to tackle AMR. However, she also stresses that there are still huge differences between Member States. She states new initiatives are needed to promote change of behaviour, attitude and practice among healthcare professionals and the general public regarding prudent use of antimicrobials, such as update of the Council Recommendation, support to Member States and further research.

5. ANSWERS TO THE EVALUATION QUESTIONS

The objectives of the evaluation were to address the relevance, effectiveness, efficiency, internal and external coherence and EU added value of the Commission's Communication to the European Parliament and the Council on the Action Plan against the rising threats from Antimicrobial Resistance published in 2011. The Commission services found the gathered survey data by the contractor robust, but had to perform additional desk research and had to strengthen the synthesis and triangulation to answer the objectives of the evaluation. The results of the analysis performed by the Commission are compared with the results of the contractor in section 5.6.

5.1 Relevance of actions

5.1.1 To what extent do the objectives of the Action Plan address the problems identified in 2011? How well do these objectives still correspond to the current needs of tackling AMR within the EU?

The overall objective of the 2011 Action Plan was to tackle rising threats from AMR. The emergence and spread of AMR is driven by a variety of drivers, such as: poor hygiene and infection, inappropriate use of antimicrobials, lack of new antimicrobials and other effective treatments, transfer of resistant microbes from animals to humans through the food chain or direct contact, dissemination of resistant microorganisms via the environment, international trade and travel, and poor awareness and knowledge on AMR. To tackle these factors, the 2011 Action Plan provided for seven specific objectives, all directly related to the main drivers. In order to achieve these objectives, the 2011 Action Plan set out 12 concrete actions related to both human and animal health within a 'One Health' approach and addressing the problems identified in 2011.

Despite all those efforts undertaken under the umbrella of the 2011 Action Plan, AMR is still a significant issue in 2015 as shown by several publications. The 2014 ECDC report on Antimicrobial Resistance in Europe[73] showed that combined resistance to antimicrobial substances is still growing in the pathogens *E. coli* and *K. pneumonia* in different EU Member States (see section 4.2), which indicates a further loss of effective treatment options and a threat for patient safety. Furthermore, O'Neill[74] states that AMR is a growing global threat with cost of inaction projected to result in 10 million deaths globally each year from 700.000 now and a cumulative loss of over EUR 88 trillion to the world economy by 2050. Since the factors behind AMR in 2015 are however still the same as those identified in 2011, the originally formulated objectives remain relevant.

In addition, the Member States survey, the stakeholder survey and the public consultation conducted during the evaluation confirmed that the Action Plan addressed the problems identified in 2011 and that these problems are still relevant today. For instance, regarding prudent use in veterinary medicine, 91% of the Member States, 77% of the stakeholders and 78% of the public consultation respondents confirmed that this was a pertinent

[73] ECDC 2015. Antimicrobial resistance surveillance in Europe 2014. Stockholm: European Centre for Disease Prevention and Control.
http://ecdc.europa.eu/en/publications/Publications/antimicrobial-resistance-europe-2014.pdf

[74] O'Neill Review 2016. 'Tackling drug-resistant infections globally: final report and recommendations.' Review on Antimicrobial resistance. London.

topic in 2011 and respectively 94% of the Member States and 87% of the stakeholders confirm that this topic is still relevant in 2015 (see Annex 3 for a full overview).

Conclusion

The objectives of the 2011 Action Plan addressed the identified problems in 2011 which are still very relevant in 2015 due to the increasing threat of AMR. Despite substantial progress made at EU level in addressing problems identified in 2011, the AMR problem is persisting and continued action is needed to combat it.

5.1.2 Are the areas for EU action appropriate in view of the distribution of EU and national competences?

Increasing global trade and travel facilitates the spread of antimicrobial resistance between countries and continents. Therefore, antimicrobial resistance is a public health concern which cannot be handled by Member States if they work in isolation. This calls for coordinated national responses. Furthermore, the scale and scope of the problem, covering both human medicine and animal health, with environmental as well as macro-economic implications, requires a critical mass of countries cooperating at EU and global level, and effective monitoring instruments to facilitate evidence-based policy-making. Coordinated EU action against AMR is therefore justified.

The EU has clearly more possibilities to act in the animal sector than in the area of human health due to the different level of competence that is given to the Union through the Treaty in this area. This is reflected in the Action Plan where in the veterinary field the Commission has put forward legislative proposals, while on the human health side the EU actions are mainly focussed on supporting activities. The appropriateness of task distribution is acknowledged by all survey respondent groups, of which the majority (strongly) agreed (84%)[75] that the Action Plan identified actions best dealt with at EU level.

Conclusion

In view of the increasing global public health concerns, a coordinated EU action against AMR is justified and the areas for EU action under the 2011 Action Plan were therefore appropriate and are still relevant in view of the distribution of EU and national competences.

5.2 Effectiveness of actions

5.2.1 To what extent have the actions been effective at improving treatment of infections in humans and animals?

To improve the treatment of infections in humans and animals, antimicrobials have to remain effective and should therefore to be used appropriately.

Appropriate use of antimicrobials in human health

Under Action 1 of the 2011 Action Plan ("Strengthen the promotion of the appropriate use of antimicrobials in humans in all Member States"), implementation of the Council Recommendation on the prudent use of antimicrobial agents in human medicine has been evaluated by Dumartin[76]: in total 21 EU/EEA Member States of the 29, who replied to the survey, have national action plans[77] and all those with an action plan have activities regarding prudent use of antimicrobial agents, surveillance of AMR and surveillance of antimicrobial use; all but one addressed education and training of health professionals and information to the general public

[75] 84% (114/135): 91% (59/65) according to the Member State survey, 79% (55/70) according to the stakeholder survey. There was no similar question in the Public Consultation

[76] Dumartin, 2016. Prudent use of antimicrobial agents in human medicine: third report on implementation of the Council Recommendation. Publication Office of the European Union, Luxembourg, ISBN 978-92-79-57568-6.

[77] The following countries have a national action plan: AT, BE, CY, CZ, DE, DK, EL, ES, FR, HU, IE, IS, LT, LV, NL, No, PT, SE, SI, SK, UK

in relation to prudent use in their national action plans. The report highlights the need to strengthen prudent use of antimicrobials through the use of mechanisms to ensure compliance with guidelines and the need for further action on antimicrobial stewardship including in primary and long term care. At present guidelines are being developed by the ECDC to contribute towards change of behaviour, attitude and practice among healthcare professionals and the general public, regarding prudent use of antimicrobials.

With respect to Action 12 (communication, education and training of the general public), according to Dumartin, the number of EU/EEA Member States with awareness campaigns has risen from 17 in 2011 to 24 in 2015. Earnshaw *et al.*[78] demonstrated that the annual European Antibiotic Awareness Day (EEAD) had an increased outreach from 32 countries participating in the EAAD in 2008 to 43 in 2013 and has provided a platform for pre-existing national campaigns and encouraged the development of similar campaigns to develop in other countries where neither political support had been secured, nor financial support been available.

It is still too early to be able to determine the results from the actions put in place and to draw firm conclusions on the effectiveness of the activities regarding prudent use in human health. Also according to the surveys, it is hard to attribute the trend in the appropriate use of antimicrobials in humans, wholly or in part, to the Action Plan[79]. Although the data available show that antimicrobial consumption in human healthcare outside hospitals (2009-2012), in hospitals (2007-2012), and also in long-term care facilities (2010-2013) has been stable, there is large variation in the consumption of antimicrobials between EU/EEA Member States. Furthermore, there is a worrying shift towards use of broad spectrum relative compared to narrow spectrum antimicrobials (section 4.2), even though prudent use would mean that infections are preferably treated with targeted narrow spectrum antimicrobials. According to the ECDC[80] more detailed information on national programmes and campaigns on the prudent use of antimicrobials is needed to identify the factors and reasons behind these consumption patterns.

Furthermore, despite the increasing number of awareness campaigns targeted to the general public, the EU-wide survey regarding public use and knowledge about antimicrobials[81] shows that although in 2016 in total 84% of the people in 2016 are aware that the unnecessary use of antibiotics makes them ineffective or less stable, at the same time, only 56% of the public is aware that antibiotics are ineffective against colds and flu. This EU-wide survey also shows that there is a link between knowledge and use of antibiotics: those with greater knowledge are less likely to use them. Therefore, providing more information to those who currently are least well informed might be expected to improve the overall appropriate use of antibiotics. According to the MS and SH participants of the workshop organised to discuss the evaluation outcomes (workshop 2) there is a need for greater focus on collaboration and communication between doctors and patients, and veterinarians and farmers. In particular, primary care doctors have an important role in discussing AMR and appropriate usage of antibiotics with their patients, as do veterinarians with farmers.

[78] Earnshaw, Sarah, G. Mancarella, A. Mendez, B. Todorova, A.P. Magiorakos, E. Possenti, M. Stryk, S. Gilbro, H. Goossens, B. Albiger & D.L. Monnet, on behalf of the European Antibiotic Awareness Day Technical Advisory Committee, on behalf of the European Antibiotic Awareness Day Collaborative Group. 2014. 'European Antibiotic Awareness Day: a five-year perspective of Europe-wide actions to promote prudent use of antibiotics.' Eurosurveillance 19 (41). As of 21 December 2015: http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=20928

[79] 34% (21/62) do not know, 34% (21/62) attribute trend, wholly or in part, to the Action Plan, 33% (20/62) attribute trend not to the Action Plan.

[80] ECDC. 2014. Surveillance of antimicrobial consumption in Europe, 2012. Stockholm: European Centre for Disease Prevention and Control.
http://ecdc.europa.eu/en/publications/Publications/healthcare-associated-infections-point-prevalence-survey-long-term-care-facilities-2013.pdf

[81] Special Eurobarometer 445, Antimicrobial Resistance 2016, April-June 2016. Brussels, TNS Opinion&Social 2016.

Appropriate use of antimicrobials in veterinary medicine

The appropriate use of antimicrobials in veterinary medicine was covered under Action 2 and 3 of the Action Plan. The Commission proposed in September 2014 a new regulatory framework on veterinary medicines and on medicated feed, which deals, among other things, with appropriate use. This new framework addresses, inter alia AMR-related issues that include ensuring appropriate warnings and guidance on the labels of veterinary antimicrobials, considering restrictions on the regular or the off-label use in the veterinary sector of certain new or critically important antimicrobials for humans, the rules for the advertisement of veterinary antimicrobials and a review of the authorisation requirements in order to sufficiently address the risks and benefits of antimicrobial medicines. In addition the Commission published in September 2015 guidelines for prudent use in veterinary medicine.

Under the new Animal Health Regulation[82] (Action 5) clear obligations have been imposed on keepers of animals as regards the responsible use of veterinary medicines as from 2021.

It is too early to draw any conclusions on the impact of Actions 2 and 3 on the appropriate use of antimicrobials, because the two legislative proposals are still in the process of adoption through the ordinary legislative procedure and the Commission guidelines for prudent use in veterinary medicine have been too recently published However, both the legislative proposals and the Commission guidelines are designed to promote appropriate use of veterinary antimicrobials. The EMA[83] has already reported positive impacts of national guidelines regarding appropriate use implemented by Member States. According to the EMA, the reduction in the use of critically important antimicrobials has a direct impact on human health. Indeed, the EMA states that countries (Scandinavian countries and the Netherlands) where such policies have been actively implemented showed reductions in the occurrence of resistance to such antimicrobials. Furthermore, 62%[84] of the survey respondents think that the Commission guidelines on the prudent use of antimicrobials in veterinary medicine have the potential to be effective in stimulating an appropriate use in animals.

Available data shows decreases in sales of antimicrobials in the veterinary sector over the period of 2010-2013[85] but at the same time there are large differences in the consumption rates between EU/EEA Member States (section 4.2). According to EMA decrease in consumption can be partly attributed to restrictions on use, but other factors could also play a role such as: increased awareness about AMR, the presence of national campaigns to encourage responsible use and shifts in animal demographics (species, age class and production type). The survey results show that it is hard to attribute the trend in the consumption of antimicrobials in animals, wholly or in part, to the Action Plan[86].

In the context of Action 2 and 3, it should be noted that at present the Commission is conducting fact-finding missions[87]. The objectives of these missions are to gather further information on the practical implementation of any measures aimed at tackling the issues concerning antimicrobial resistance relating to the use of

[82] Regulation (EU) 2016/429 of the European Parliament and of the Council of 9 March 2016 on transmissible animal diseases and amending and repealing certain acts in the area of animal health ('Animal Health Regulation'), (OJ L 84, 31.3.2016, p. 1)

[83] EMA. 2014. Answers to the requests for scientific advice on the impact on public health and animal health of the use of antibiotics in animals (EMA/381884/2014).
http://www.ema.europa.eu/docs/en_GB/document_library/Other/2014/07/WC500170253.pdf

[84] 62% (54/87): 74% (31/42) according to the Member States survey and 51% (23/45) according to the stakeholder survey.

[85] EMA (European Medicines Agency). 2015. Sales of veterinary antimicrobial agents in 26 EU/EEA countries in 2013.
http://www.ema.europa.eu/docs/en_GB/document_library/Report/2015/10/WC500195687.pdf

[86] 35% (29/82) do not know, 38% (31/82) attribute trend, wholly or in part, to the Action Plan, 27% (22/82) attribute trend not to the Action Plan.

[87] In 2016 fact-finding missions (will) have taken place to: Cyprus, Czech, Denmark, Finland, Germany, Romenia, Slovenia, Spain, The Netherlands

veterinary medicines and to identify those best practices currently applied in Member States which could be helpful to other Member States in addressing this issue.

Research initiatives

Action 6 deals with R&D efforts to bring **new antibiotics** to patients and Action 7 with the analysis of the need for new antibiotics into veterinary medicine. Regarding Action 6, the New Drugs for Bad Bugs (ND4BB)[88] programme was launched in May 2012 within the Innovative Medicines Initiative (IMI) to spur the development of new antibiotics in human health has been launched (section 4.2). In average; it takes 10-15 years for a new medicine to go from the start of initial research to marketable product[89], therefore it is too early to draw final conclusions on the effectiveness of the R&D funded programmes. But, it is noteworthy that considerable progress has been made up till now (section 4.2). The programme is continuing under IMI2, which started in 2014 and that builds on and extends IMI. One of the aims of IMI2 is to deliver at least two new medicines which could be new antibiotics.

Furthermore, in June 2015, a new financing instrument for infectious diseases, "InnovFin ID"[90], was launched by the Commission and the European Investment Bank under the InnovFin set of financial instruments. "InnovFin ID" is a specific financial instrument with an initial budget of EUR 200 million to facilitate development of novel interventions for infectious diseases. It provides loans between EUR 7.5 million and EUR 75 million to innovative players active in developing vaccines, drugs, medical and diagnostic devices, and research infrastructures for combatting infectious diseases (section 4.2).

The legislative proposal on veterinary medicinal products also introduces incentives for the development of new veterinary antimicrobials, which once adopted and implemented should speed up the availability of antimicrobials for veterinary use.

Conclusion

It is too early to assess the effectiveness of the actions regarding treatment of infections in humans and animals, because some actions are still being developed and others have just been implemented. The legislative proposals currently under discussion are however designed to promote appropriate use of veterinary antimicrobials and 62% of the survey respondents think that the 2015 Commission guidelines on the prudent use of antimicrobials in veterinary medicine have potential to be effective in stimulating appropriate use in animals. Regarding the R&D initiatives to develop new antimicrobials or alternative treatments, it is also too early to judge their effectiveness as R&D is a lengthy process and no final results are available yet. As for communication and awareness, the EU-wide survey on the knowledge and use of antibiotics highlights that there are still knowledge gaps on antibiotics amongst citizens.

At present, considerable disparities between EU/EEA Member States in antimicrobial consumption in humans and animals remain with potential negative impact on the development of antimicrobial resistance. Research is needed to identify the underlying factors and reasons behind the current consumption patterns and observed differences. Up to now Member States didn’t receive support and assistance to address these disparities. The MS and SH participants of the workshop organised to discuss the evaluation outcomes (workshop 2) recommended that more needs to be done to ensure progress across Member States and to ensure that antibiotics are used appropriate. Furthermore, there is still a challenge to increase citizens' knowledge-base on the appropriate use of antimicrobials and AMR.

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[88] http://www.imi.europa.eu/content/nd4bb

[89] I. Torjesen, 'Drug development: the journey of a medicine from lab to shelf.' The Pharmaceutical Journal, PJ March 2015 online:' http://www.pharmaceutical-journal.com/publications/tomorrows-pharmacist/drug-development-the-journey-of-a-medicine-from-lab-to-shelf/20068196.article

[90] http://www.eib.org/products/blending/innovfin/

5.2.2 To what extent have the actions aimed at containing the risks of spreading AMR been effective?

Available data show that the situation in 2015 is as alarming as it was in 2011. AMR is still growing in the pathogens *E. coli* and *K. pneumonia* in different EU Member States (section 4.2). It is therefore of the utmost importance to contain the risk of spreading AMR and to prevent and control infection in human and animal health. As increasing global trade and travel facilitates the spread of antimicrobial resistance between countries and continents, there is also a need for agreement and cooperation at international level. These measures have to be underpinned by effective monitoring and surveillance systems which allow the identification trends in the emergence of resistance and the occurrence of specific patterns of resistance in regions, Member States or sectors.

In human health, Action 4 deals with the implementation of the Council Recommendation on **patient safety, including the prevention and control of healthcare associated infections**. To support this implementation, the ECDC has provided guidance documents and reports to support Member States to prevent and control healthcare associated infections (section 4.2). In 2012[91] a total of 13 Member States reported that the adoption of the Council Recommendation had triggered initiatives on healthcare associated infections, in particular on implementation of inter-sectorial mechanisms, on monitoring and assessing strategies to prevent and control infections, and on strengthening information campaigns towards healthcare workers.

The third implementation report of the Council Recommendation on prudent use of antimicrobial agents in human medicine[92], which also took into account the implementation of the Council Recommendation on patient safety, shows that most EU/EEA Member States implemented a combination of actions to prevent and control infections. According to this third report, representing the survey results of 29 EU/EEA Member States, all Member States had national guidelines for infection prevention and control, 19 States reported having legal requirements or professional guidelines for the number of infection control/hygiene professionals in hospitals, 11 Member States reported national requirements to communicate on the infection status of a patient in case of a cross-border transfer and 22 Member States had assessed the compliance of healthcare workers with the guidelines for hand hygiene. However, only 13 Member States had assessed the impact of required infection control and hospital hygiene measures on the incidence of some infections in hospitals and six had carried out such assessments in nursing homes and other long-term care facilities. Overall, most Member States had implemented several measures in accordance with the Council Recommendation. Compared to the previous survey, improvements had occurred in several areas, including surveillance systems, the use of indicators and awareness campaigns. However, there are huge differences between EU/EEA Member States in the governance and the scope of national strategies and action plans, and in the way measures were implemented and assessed.

There is no recent data available regarding surgical site infections, which are among the most common healthcare associated infections. Therefore, there is no data to assess if the decreasing trend observed by ECDC for such infections over the period 2008-2011[93] has been continued and if this can be attributed to the Council Recommendation on patient safety. The report of Dumartin mentions that areas for further activities could, among other topics, enhance: establishment of clear governance of national strategies and national action plans

[91] COM (2012) 366 final, Report from the Commission to the Council on the basis of the Member States' reports on the implementation of the Council recommendation (2009/C151/01) on patient safety, including the prevention and control of healthcare associated infections.
http://ec.europa.eu/health/patient_safety/docs/council_2009_report_en.pdf

[92] Dumartin, 2016. Prudent use of antimicrobial agents in human medicine: third report on implementation of the Council Recommendation. Publication Office of the European Union, Luxembourg, ISBN 978-92-79-57568-6.

[93] ECDC, 2013a. Surveillance of surgical site infections in Europe, 2010–2011. Stockholm: European Centre for Disease Prevention and Control.
http://ecdc.europa.eu/en/publications/Publications/SSI-in-europe-2010-2011.pdf

to contain AMR in all countries, education of healthcare professionals and reinforcement of surveillance and evaluation systems, among other subjects, regarding the assessment of the implementation of the national action plans and of their effectiveness.

As regards the veterinary sector, the **Animal Health Regulation**[94] adopted in March 2016 (Action 5), which focusses on better prevention and control of listed animal diseases strengthens existing EU animal health rules by providing a legal basis for the harmonised monitoring of animal pathogens, including monitoring of their resistance to antimicrobials. As from 2021 it will allow for EU interventions (e.g. notification, eradication, trade measures etc.) on animal pathogens that show antimicrobial resistance and fulfilling certain criteria. It also is expected to contribute to a better health status of animals by introducing measures for the prevention of transmissible animal diseases in general, such as clear responsibilities of the animal keepers for the health of their animals and for responsible use of veterinary medicines. All these complement already existing EU rules (for instance the monitoring of zoonotic agents[95]) and will be further completed through EU rules on veterinary medicines and medicated feed. They are intended to lead to better understanding of how the spread amongst animals and from animals to humans and the other way around occur, and how it can be reduced and possibly to reduce the use of veterinary medicines including antimicrobial agents, either directly or indirectly. Given the long transitional period for application of the provisions of the Animal Health Regulation and that the rules to be set out via new legislation on veterinary medicines and medicated feed are not yet even adopted, the various components can only produce results as from 2021 onwards (at the earliest). Impacts can only be expected to be seen several years later. In total 73%[96] of the survey respondents think that the Animal Health Regulation has (some) potential to be effective for tackling AMR.

In view of the global nature of AMR, **international cooperation** is needed to contain the risk of spreading AMR. Therefore, Action 8 focusses on international cooperation to expand global awareness, to encourage trading partners to align their measures against AMR (e.g. TATFAR), and to take global measures such as WHO implementing policies and development of OIE standards. It is difficult to judge the effectiveness of international cooperation, but it can be concluded that international cooperation has been further intensified and that policies are further aligned. For instance, there is technical collaboration between WHO Regional Office for Europe and ECDC regarding surveillance of AMR and the Commission continued contributing to OIE activities such as the new global database on the use of antimicrobial agents in animals. The Commission renewed its partnership with WHO and the African, Caribbean and Pacific Islands, to strengthen pharmaceutical systems and improve access to quality essential medicines (section 4.2). However, according to O'Neill[97], the global problem of AMR might increase from 700.000 deaths now to 10 million deaths globally each year by 2050 if further action is not taken. In order to further strengthen international cooperation, the Commission should in the years to come, besides the already ongoing initiatives, further contribute to international cooperation by supporting Member States ensuring the implementation of their national action plans in the context of the WHO Global Action Plan on AMR, by raising the presence of AMR in the agenda of the UN General Assembly, OIE General Session and other international institutions such as G7 and G20, by continuing cooperation with low and middle income countries and by promoting EU best-practices.

Action 9 and 10 deal with strengthening **monitoring and surveillance systems** in humans and in animals within the EU in order to have a better picture of the situation and to assess progress. Since 2012, the ECDC is

[94] Regulation (EU) 2016/429 of the European Parliament and of the Council of 9 March 2016 on transmissible animal diseases and amending and repealing certain acts in the area of animal health ('Animal Health Regulation'), *OJ L 84, 31.3.2016, p. 1–208*

[95] Directive 2003/99/EC of the European Parliament and of the Council of 17 November 2003 on the monitoring of zoonoses and zoonotic agents.

[96] 73% (65/89): 80% (36/45) according to the Member States survey and 66% (29/44) according to the stakeholder survey

[97] O'Neill Review 2016. 'Tackling drug-resistant infections globally: final report and recommendations.' Review on Antimicrobial resistance. London.

coordinating all monitoring and surveillance systems in human health, which facilitating alignment and strengthen of these systems. As mentioned above, there is only limited knowledge regarding the impact of required infection control and hospital hygiene measures on the incidence of infections.

To improve the data collection on the veterinary side, it was decided to extend the legal requirements for data collection and to harmonise the data collected and the manner in which they are collected between Member States. The legislative proposal on veterinary medicines reinforces the legal basis for collection of data regarding antimicrobials. The 2016 Animal Health Regulation provides a legal basis for the surveillance and monitoring of the occurrence of non-zoonotic pathogens in animals. Decision 2013/652/EU on monitoring and reporting of AMR has extended the coverage and scope (for instance species and substances) of data collected in zoonotic and commensal bacteria in food producing animals and certain food. As a result of this Decision, data since 2014 are more specific, easier to compare between Member States and across sectors, and the scope of the monitoring is larger. Consequently, it is now possible to get better insight in the spread of AMR at a more detailed level such as by species or substances. In total 88%[98] of the survey respondents indicate that this Decision might be (partly) effective for helping to tackle AMR.

The role of AMR in the environment and the risk this poses to human health was addressed in FP7 research projects like "Evolution and Transfer of Antibiotic Resistance" (EvoTAR) which was running from 2011 till 2015. It provided insight into the understanding of the evolution and spread of antibiotic resistance in human pathogens enabling to predict future resistance trends.

According to the MS and SH participants of the workshop organised to discuss the evaluation outcomes (workshop 2) the Commission should continue on improving monitoring and surveillance data within the EU and data should be considered in light of the contextual information that could help explain why certain usage patterns occurred.

Conclusion

With regards to human health most Member States implemented a combination of actions to prevent and control infections. Compared to the previous survey, improvements had occurred in several areas, including surveillance systems, the use of indicators and awareness campaigns. However, there are huge differences between EU/EEA Member States in the governance and the scope of national strategies and action plans, and in the way measures were implemented and assessed. On the animal health side, the recently adopted Animal Health Regulation, which focusses on better prevention and control of listed animal diseases and provides a legal basis for the surveillance and monitoring, could be effective for tackling AMR according to 73% of the survey respondents. The EU voice at international level and the monitoring and surveillance systems have been reinforced. To get more insight in the effectiveness of AMR policies, reinforcement of surveillance by developing expertise on methodologies, solid indicators and instruments to monitor trends in (resistant) infections is needed as well as the assessment of the implementation of the national action plans and of their effectiveness. Results of the provisions put in place through the Action Plan can only be expected within some years from now and their effectiveness in containing the risk of spreading AMR would need to be assessed then. The available data show that, although some actions are still ongoing, the overall objective of the Action Plan – i.e. to contain the rising threats from AMR - has been only partially met. AMR is still growing in the pathogens *E. coli* and *K. pneumonia* in different EU Member States. If no action is undertaken; the global problem might increase from 700.000 deaths now to 10 million deaths globally each year by 2050.

[98] 88% (45/50): 91% (41/45) according to the Member State survey, 80% (4/5) according to the stakeholder survey.

5.2.3 To what extent has the European Commission been effective in capturing the holistic approach and in delivering results?

In order to succeed, a 'One Health' approach is and will continue to be needed. AMR is a major European and global societal problem, involving many different sectors e.g. human medicine, veterinary medicine, animal husbandry, agriculture, environment and trade. It cannot be successfully tackled through isolated, sectorial efforts. Food and direct contact with animals may serve as a vehicle for the transmission of AMR from animals to humans emphasizing the link between human and veterinary medicine. The fact that resistance may spread from country to country when people and animals travel or when food, feed and other possible vehicles of AMR are traded, reinforces the need for coordinated efforts across borders. In total 98%[99] of the survey respondents agree with the need of a holistic approach and 93% of the Public Consultation respondents.

The Commission with the support of its executive agencies in the area of health, food and pharmaceuticals (ECDC, EFSA, EMA) worked closely together with all Directorates-General with responsibilities for AMR. In total 63%[100] of the MS and SH survey respondents replied that the Action Plan captured a holistic approach and 36%[101] of the Public Consultation respondents. According to some participants in the workshop organised to discuss the evaluation outcomes (workshop 2), the Action Plan could reinforce a 'One Health' approach by paying more attention to the transmission of resistant bacteria via the environment (see also sections 5.3 and 5.4).

Although the Action Plan had a 'One Health' approach, it was sector specific in its implementation. With exception of the actions on international cooperation (Action 8), R&D (Action 11) and communication, education and training (Action 12), all actions are split in an action in human medicine with a parallel action in veterinary medicine. In 2016 the EU-wide survey regarding public use and knowledge contained for the first time questions regarding animal health.

Conclusion

On the basis of the above, it can be concluded that the Action Plan has from its outset captured a 'One Health' approach, but was too sector specific in its implementation. More attention should be paid to the transmission of resistant bacteria through the environment.

5.3 Efficiency of actions

Has the EU budget been efficiently used to address the objectives of the Action Plan?

There was no specific funding associated with the Action Plan. However, under FP7 and Horizon 2020 EU funds could be employed for future research on AMR. For now, most results from the funded multi-annual research projects are not yet available. Therefore, this section focusses on whether the R&D funds have been spent in line with the Action Plan objectives. In total 77%[102] of the survey respondents are not aware of any ways in which the allocation of EU spending on AMR has been inappropriate or inefficient[103].

In FP7, as a direct response to the action plan, 15 research projects were launched in 2013 with a budget of more than EUR 90 million. This included 8 projects on better management of available antibiotics, 7 projects on novel antibiotics, vaccines or alternative treatments and antibiotic resistance within the food chain. Since

[99] 98% (143/146): 99% (68/69) according to the Member States survey, 97% (75/77) according to the stakeholder survey.
[100] 63% (90/143): 78% (53/68) according to the Member States survey, 49% (37/75) according to the stakeholder survey.
[101] 36% (9/25) Action Plan captured holistic approach, 24% (6/25) no holistic approach, 40% (10/25) do not know/unsure.
[102] 77% (103/134): 84% (54/64) according to the Member States survey, 70% (49/70) according to the stakeholder survey.
[103] Inappropriate and inefficient spending would include spending on unnecessary activities, spending on areas that may be of a lower priority than others that did not receive funding, and spending on activities that are unlikely to help EU efforts to tackle AMR.

the start of Horizon 2020 in 2014, in total 145 projects on AMR have so far been selected for funding with a cumulative budget of EUR 316 million[104].

To accomplish **the objective of appropriate use** the Commission funded several projects, such as: Antimicrobial Resistance and causes of Non-prudent use of Antibiotics in human medicine (ARNA)[105], the findings of which are expected to provide the basis for developing policy options to promote a more prudent use.

To achieve **the objective of developing new antimicrobials or alternative treatments**, a public-private collaboration programme for research on new antibiotics was launched under the Innovative Medicines Initiative (IMI) within the FP7 framework: New Drugs for Bad Bugs[106]. This programme has the objective to spur the development of new antibiotics along the value chain from basic science **to new business models**. In 2014 the IMI2[107] started under the Horizon 2020 framework which will build on the progress made in the New Drugs for Bad Bugs programme. IMI2's expected research targets (to be achieved by 2024) are a pipeline of promising new agents for tackling antibiotic-resistant bacterial infections; tools required to support the new generation of therapeutic and preventive approaches, and the optimisation of clinical trials. The aim is to deliver at least two new medicines which include new antimicrobials, (section 4.2).

To achieve **the objective of reinforcing research to get better understanding of transmission of resistant bacteria including the role of the environment**, two projects have been launched under FP7. The project "Evolution and Transfer of Antibiotic Resistance" (EvoTAR) [108] has provided insight into the understanding of the evolution and spread of antibiotic resistance in human pathogens. This information is anticipated to enable the prediction of future resistance trends[109]. The project "Ecology from Farm to Fork Of microbial drug resistance and Transmission (EFFORT)[110] has the objective to provide scientific evidence on the consequences of AMR in the food chain including understanding of the relative contribution of the exposure routes of AMR from animals to humans. In January 2016 the JPIAMR launched a research call on the topic "To unravel the dynamics of transmission and selection of AMR at genetic, bacterial, animal, human, societal and environmental levels, in order to design and evaluate preventive and intervening measures for controlling resistance." This is expected to lead to more research addressing transmission including environmental aspects.

Furthermore a **Joint Programming Initiative (JPI)** was launched in 2014 aiming to coordinate national research activities related to AMR. The JPIAMR was established in December 2011, one month after the launch of the Action Plan. Since this launch, their membership expanded and now includes 22 countries[111]. Since 2012 the JPIAMR was supported by the Commission via a Coordination and Support Action grant. The Commission support has led to the delivery of a strategic research agenda[112], which provides for the first time a framework for future investment and research priorities regarding AMR. The importance of this document has been recognised by the WHO in its global action plan that mentions that this strategic research agenda will form the basis of a global research agenda for AMR. Additional financing for JPIAMR from the Commission is foreseen before the end of 2016, via a second Coordination and Support Action grant. Activities to be

[104] http://cordis.europa.eu/projects/home_en.html
[105] The ARNA project runs from 2014-2016, more information at https://www.nivel.nl/en/arna
[106] The programme is still running under IMI2 and results aren't available yet. The total funding under IMI (2013-2015) was EUR 314 million.
[107] http://www.horizon2020.lu/Other-opportunities/IMI-Innovative-Medicines-Initiative
[108] The EvoTAR project runs from 2011-2015, more information at http://www.evotar.eu/index.php
[109] The results of eh EvoTAR project are published at http://cordis.europa.eu/project/rcn/100088_en.html
[110] The EFFORT project runs from 2013-2018, more information at http://www.effort-against-amr.eu/
[111] The countries included are: BE, CH, CZ, DE, DK, EE, ES, FI, FR, GR, IL, IT, NL, NO, PL, RO, SE, TK, UK, Canada, Argentina and Japan.
[112] http://www.jpiamr.eu/download/JPIAMR%20SRA1_.pdf

supported with such Commission support include the expansion of JPIAMR with new members, a further globalisation of this initiative, upgrading the strategic research agenda to a strategic research and innovation agenda, as well as moving towards sustainability. Furthermore, JPIAMR is expected to be mentioned as a major tool for the coordination of research efforts in the national action plans of every JPIAMR member state by mid-2017.

JPIAMR supported a systematic analysis of antibacterial research funding across the 19 JPIAMR countries and at EU-level over the period 2007-2013 (Kelly *et al.* 2015)[113]. This study identified 1243 antibacterial resistance research projects, with a total public investment of EUR 1.3 billion across 19 countries and at EU level, including public investment in the IMI. Projects were classified under the six priority topics of the JPIAMR: 63% of projects were within the area of therapeutics, 15% in transmission, 11% in diagnostics, 4% in interventions, and only 3% in environment and 3% in surveillance. Kelly *et al.* recommends that to determine the future direction of JPIAMR a clear picture of the funding landscape across Europe and Canada is needed. Furthermore, Kelly *et al.* recommends that countries should work together to increase the effect of research funding by strengthening national and international coordination and collaborations, harmonising research activities, and collectively pooling resources to fund multidisciplinary projects. Kelly *et al.* stresses that the JPIAMR has developed a publicly available database to document the antibacterial resistance research collected and that this database can be used as a baseline to analyse funding from 2014 onwards.

According to some participants in the workshop organised to discuss the evaluation outcomes (workshop 2), Stakeholder, the JPIAMR had positively contributed to the coordination and collaboration in AMR research. At the same time, however, it was acknowledged that some gaps need to be filled in. Furthermore a longer timescale is needed to achieve progress.

Conclusion

Based on the above findings, it can be concluded that the research expenditures have been in line with the Action Plan and that Commission activities and the JPIAMR contributed to the coordination and collaboration in AMR research in the area of new antimicrobials, alternative treatments, new business models, diagnostics and appropriate use. At the same time, however, it should be recognised that to increase R&D efficiency a continued coordination and collaboration on AMR research is needed, such that R&D programmes are aligned and gaps in R&D are filled in. For instance, according to Kelly *et al.* only a limited number of projects have been launched regarding the transmission and environment on AMR (15% respectively 3% of the projects over the period 2007-2013).

5.4 Coherence of actions

5.4.1 To what extent is the Action Plan coherent with Member States' relevant national (or regional) strategies and action plans and with similar initiatives at the international level?

The Action Plan has contributed to:

- shaping an overall framework (Legislation[114], Council recommendation[115], EU guidelines[116]) of specific activities which have to be implemented at national level through national coordinated actions.

[113] Kelly, R., G. Zoubiane, D. Walsh, R. Ward, H. Goossens. 2015. Public funding for research on antibacterial resistance in the JPIAMR countries, the European Commission, and related European Union agencies: a systematic observational analysis. The Lancet.

[114] Action 2: Legislation on veterinary medicines and on medicated feed, Action 5: New Animal Health Regulation

[115] Action 1: Implementation Council recommendation on Prudent use, Action 4: Implementation Council Recommendation on Patient Safety, including the prevention and control of healthcare associated infections.

[116] Action 1: Guidelines on prudent use in human medicine, Action 3: Commission guidelines on prudent use in veterinary medicine

- coordinating activities on research[117], monitoring and surveillance[118] and awareness campaigns (national campaigns under the banner of European Antibiotic Awareness Day[119]).
- strengthening international cooperation activities[120] with WHO, OIE and FAO, deepening cooperation with TATFAR and low and middle income countries (African, Caribbean and Pacific Islands), sharing of Commission expertise to the process (for instance Codex Alimentarius). The Commission ensures that its activities are complementary to the Member States international activities and are coherent with other international activities.

The survey results confirm the above findings. In total 86%[121] of the Member States respondents replied that the Action Plan had a similar or broader scope than their National Plan. Furthermore, for instance, regarding prudent use in human medicine, 73% of the Member State and stakeholder survey respondents said that the Action Plan complement national plans completely and 15% that the Action Plan complements national plans partly. Regarding prudent use in veterinary medicine, this is 61% and 24% respectively and for international cooperation this is 53% and 31% respectively. For a detailed overview, see Annex 3.

Conclusion

Based on the above, it can be concluded that the activities of the Commission and the Member States and other international organisations and countries are complementary and re-enforce each other without overlapping each other. Therefore, the conclusion can be drawn that the Action Plan is coherent with Member States and international initiatives.

5.4.2 To what extent are the actions contained in the Action Plan coherent with other EU policies on the environment, human health, animal health and welfare, food safety, agriculture, research, competitiveness, Small Medium-sized Enterprises?

AMR is a global problem, involving many different sectors, such as human medicine, veterinary medicine, animal husbandry, agriculture and environment. Therefore, the Action Plan took a 'One Health' approach across multiple sectors, covering both human and veterinary aspects to protect both human and animal health. To achieve this 'One Health' approach the different initiatives of the different EU services and EU agencies with respect to AMR have been bundled in the Action Plan. To guarantee a 'One Health' approach during the implementation of the Action Plan a detailed roadmap was compiled with a contact point for each action and an inter-service working group. When the Action Plan was adopted in 2011, the activities regarding the transmission of AMR via the environment were limited. As a consequence, this area received less attention in the Action Plan.

The positive impact of the inter-service cooperation is reflected in the outcome of the survey. According to the survey respondents the EU AMR policies complemented or reinforced existing EU policies in the following areas: human health 78%, animal health and welfare 80%, food safety 75%, research 77%. These survey results also reflect the fact that the transmission of AMR through the food chain or through direct contact between humans and animals and the role of the environment on AMR were less addressed, namely only 59% of the survey respondents agreed that the EU AMR policies complemented or reinforced agricultural policy and only 56% that it complements or reinforces environmental policies[122]. This finding is also in line with the

[117] Action 6,7 (new antimicrobials and alternative treatment and Action 11: Joining research efforts
[118] Action 9 and 10: Strengthening monitoring and surveillance in human and veterinary medicine
[119] Action 12: Communication, education and awareness
[120] Action 8: Joining forces with international partners
[121] 86% (44/51) of the Member States respondents. This question was only in the Member States survey.
[122] The numbers depicted are the results of the Member States and stakeholder survey. The Public Consultation shows similar results: human health 86%, animal health and welfare 71%, food safety 76%, research 73%, agricultural policy 74% and environment 57%.

conclusion in section 5.3 on efficiency that only a limited number of research projects were dealing with transmission and the role of the environment on AMR.

Conclusion

Based on the above findings, it can be concluded that the actions contained in the Action Plan are coherent and reinforce other EU policies, although the EU AMR policies could be further aligned with the EU agricultural and environmental policies. The current reflections of a strategic approach to pharmaceuticals including antimicrobials and AMR in the environment (including antimicrobials and AMR) in the framework of Directive 2013/39/EU are a first step in this direction.

5.5 EU added value of actions

5.5.1 What is the added value resulting from the Action Plan compared with what could be achieved by Member States at national and/or regional levels? Did the Action Plan identify the actions which should be best dealt with at EU level?

Based on the findings discussed in previous sections it can be concluded that the Action Plan delivered added value in the following ways:

- The Action Plan acted as a symbol of EU political commitment to carry out the 12 defined actions in the Action Plan within a five year timeframe. As stated in section 4.1, all actions have been implemented or will be implemented in the near future.
- The Action Plan stimulated actions within Member States, for instance, under the banner of the EAAD national campaigns to inform about prudent antibiotic use took place in 43 European countries in 2012 (section 4.2).
- The Action Plan strengthened public-private collaboration to boost the development of new antibiotics (section 4.2)
- The Action Plan strengthened international cooperation with international organisations, such as the WHO and OIE and other countries (TATFAR) (section 4.2).
- The Action Plan provided a framework to guide and coordinate international activities on AMR, enabling those activities to be more effective than they would have been otherwise. Areas that clearly benefitted from improved international coordination were research and innovation (JPIAMR) (section 5.3), and monitoring and surveillance (for instance through joint analysis of animal and human consumption and resistance data and through full harmonisation in the veterinary field) (section 4.2).

The participants of the workshop organised to discuss the evaluation outcomes (workshop 2) the Action Plan had no comments on the headline finding of the contractor that the Action Plan was important as a symbol of political commitment to tackling AMR. In total 56% of the Member States respondents said that there national policy was influenced by the Action Plan.

It can be concluded that the actions were appropriate in view of the distribution of EU and national competence and thus identified the actions best dealt with at EU level, which was confirmed by 84% of the survey respondents (section 5.1). Analysis in section 5.1 has also shown that the problems addressed in the Action Plan corresponded to the needs in 2011 and still correspond to the current needs. The evidence collected up today on the role of the environment in the transmission of AMR justifies further efforts in the role of the environment (section 5.4).

5.5.2 To what extent can improvements in the situation on AMR (outcomes and other changes identified in the previous questions) be attributed to the development and implementation of the Action Plan?

As discussed in section 5.1 the threat of AMR is still rising. A main factor for the lack of visible impact of the Action Plan is the short timeframe as discussed in section 5.2. As a result of the Action Plan, there was coordination in the area of monitoring and surveillance (action 9 and 10). Consequently, there is now full

harmonisation of monitoring in the veterinary field (section 5.2). There was also coordination on R&D as well as unprecedented public-private cooperation, which has contributed to the efficiency of R&D spending (section 5.3). In addition, the Action Plan directly led to the development of EU policies and guidance that address AMR, including the EU guidelines on prudent use in human health (still to come) (Action 1), the revision of the veterinary medicinal products and medicated feed regulatory framework (Action 2), the Commission guidelines on prudent use in veterinary medicine (Action 3) and the new Animal Health Regulation (Action 5). The Action Plan also provided coordination of and stimulated actions at international level, EU level and within Member States (Action 8). This is also reflected in the outcome of the survey. A majority (78%)[123] of the survey respondents agreed that the Action Plan helped bring improvement in AMR that would not have happened otherwise.

5.6 Summary of answers to the evaluation questions

On the whole, the evaluation findings support continued action at the EU level. The evaluation performed by the Commission shows that there is a clear need **to support and assist Member States** in developing and implementing national action plans to reduce differences between them in the use of antimicrobials and prevalence of infections, to foster collaboration across sectors, to improve knowledge of citizens and to **strengthen monitoring and surveillance** systems by developing expertise on methodologies, solid indicators and instruments. The evaluation demonstrates the need of continuing coordination and collaboration on AMR **research** on developing new antimicrobials, rapid diagnostic tests, vaccines and alternative treatments, and new business models to sustain investment and increase the knowledge on the **transmission of AMR including the environment** for a better understanding of the mechanisms causing resistance. Furthermore, given the cross-border nature of AMR, a strong EU voice at **international level** remains necessary, to raise awareness, to encourage countries to consider their own measures against AMR and to take global measures such as WHO implementing policies and the development of OIE standards.

These findings are in line with the findings and the recommendations of the contractor. The contractor concludes that the topics identified were **relevant** and the areas of action were appropriate in view of the distribution of EU and national competences. The Action Plan partially addressed needs in the areas: environment, development of national action plans and international cooperation. Furthermore the contractor draws the conclusion that it was too early to link the Action Plan to observed patterns of resistance and antimicrobial usage and to draw firm conclusions on **effectiveness and efficiency** of the Action Plan. The Action Plan helped to strengthen monitoring and surveillance systems, develop and fulfil bilateral and multilateral commitments, and raise public awareness about AMR. With respect to research, the contractor stresses that this support would likely not have been provided by other sources The Action Plan was **holistic** in its content, but it appeared to be more sector-specific in its implementation. Furthermore, differences between Member States were observed. According to the contractor, the Action Plan was **coherent** with action plans and strategies at national level within the EU and internationally, although it could have been more coherent if it had covered environmental issues more broadly. The contractor concludes that the Action Plan had a clear **added value** and symbolised political commitment to AMR, stimulated action within the EU and globally and helped guide and coordinate national actions, especially in research and innovation and in monitoring and surveillance.

According to the contractor the EU should build on progress already made and continue to play an active role in the area of AMR. The contractor recommends that additional coordinated **support should be provided to Member States** to encourage and support them in the development and implementation of national action plans and to encourage regional collaboration. Furthermore, it is recommended that the **monitoring** of AMR is taking a more holistic approach, linking data on resistance to and usage of antimicrobials to prescribing trends

[123] 88% (104/134): 85% (55/65) according to the Member States survey, 71% (49/69) according to the stakeholder survey.

and other factors: better tracking AMR-related costs and benefits; considering the use of targets and related indicators, including, as appropriate, country-specific targets and indicators; and continuing to monitor public awareness. The contractor also stresses the importance of sustaining support for AMR **research** and innovation activities and recommends considering, in collaboration with the JPIAMR, the focus of the AMR research portfolio. Furthermore, according to the contractor, **the scope of environmental action** should be expanded and the EU should also continue **international cooperation,** in particular with the WHO, to determine the potential for a global approach and to improve the monitoring and surveillance across the European region. The contractor ends with the recommendation that the Commission institutions and agencies could better **communicate** their efforts to stakeholders and the wider public to increase awareness about their cross-sectorial work and other activities and to enable other countries and organisations to learn from the EU's example.

6. CONCLUSION

AMR is a growing global burden and marks a grave societal and economic challenge with cost of inaction projected to result in 10 million deaths globally each year from 700.000 now and a cumulative loss of over EUR 88 trillion to the world economy by 2050.

The present evaluation assesses the impact of the AMR Action Plan which covers the period 2011-2016. Specifically, the evaluation assesses whether the 12 actions contained in the Action Plan were: relevant to address the problems identified in 2011 and are still relevant, and if these actions were effective, efficient, coherent with other EU policies in combatting AMR and whether added value was provided by EU action.

The objectives of the Action Plan were all directly related to the main drivers of AMR, were **relevant** to address the problems identified in 2011 and are still relevant today. The Commission actions were appropriate in view of the EU and national competence. All actions envisaged in the Action Plan have been implemented or will be implemented in the near future. However, the AMR problem is persisting and continued action is needed to tackle it.

The Action Plan took a 'One Health' approach across multiple sectors, covering both human and veterinary aspects to protect both human and animal health. To achieve this 'One Health' approach, the, initiatives of the relevant Commission services and EU agencies with respect to AMR have been bundled in the 2011 Action Plan. A detailed roadmap was compiled with a contact point for each action and an inter-service working group was established. The implementation of the roadmap was, however, too sector specific. When the Action Plan was adopted, the initiatives regarding the transmission of AMR via the environment were limited. As a consequence, this area received less attention in the Action Plan.

While, it is too early to judge the overall **effectiveness** of the Action Plan, because some actions are still processing through the ordinary legislative procedure, others have just been implemented, and others are still being developed, the expected impact of some actions can only be estimated. On the animal side, the legislative proposals on veterinary medicines and medicated feed are widely expected to promote appropriate use of veterinary antimicrobials. The majority of the Member States and stakeholder respondents to the survey also think that the new Animal Health Regulation and the Commission guidelines on the prudent use of antimicrobials in veterinary medicine have potential to be effective (73% and 62%). At this moment, there still exist considerable disparities between antimicrobial consumption and spread of AMR in animals between Member States.

On the human health side most Member States have implemented a combination of actions. However, there are huge differences between Member States in the governance and the scope of national strategies and action plans, and in the way measures were implemented and assessed. As a consequence, there are also huge differences in antimicrobial consumption and resistance in humans between Member States. Therefore, further

support of Member States and understanding of the effectiveness of AMR policies is needed to develop effective AMR policies.

To gain more insight in (resistant) infections, consumption patterns and effective AMR policies, in humans and animals strengthening of monitoring and surveillance systems is still needed and of paramount importance.

The EU-wide survey on use and knowledge of antibiotics among citizens shows still a lack of knowledge of citizens, only 56% are aware that antibiotics are ineffective against colds and the flu. Therefore, there is still a challenge in increasing the knowledge of citizens.

Although some actions are still ongoing, the overall objective of the Action Plan – i.e. to contain the rising threats from AMR - has been only partially met. AMR is still growing in the pathogens *E. coli* and *K. pneumonia* in different EU Member States.

With respect to the **efficiency**, the evaluation concludes that the R&D expenditures have been in line with the Action Plan and have been spent on the development of new antimicrobials or alternative treatments, new business models, diagnostics and on appropriate use. The JPIAMR contributed to the coordination and collaboration in AMR research and should be continued, so that R&D programmes are aligned and gaps in R&D, such as in the area of transmission of AMR, can be filled in.

The Action Plan has been **coherent** with other Commission activities and with Member States' and international activities. It has shaped an overall framework to guide Member States through legislation, Council Recommendations and Commission guidelines and to coordinate R&D (e.g. via JPIAMR), monitoring and surveillance activities and awareness campaigns. Furthermore, it strengthened international cooperation with WHO, OIE and FAO (WHO Global Action Plan, Codex Alimentarius) and deepened the transatlantic cooperation (TATFAR) and cooperation with low and middle income countries (African, Caribbean and Pacific Islands). The EU AMR policies could be further aligned with the EU agricultural and environmental policies.

This evaluation also concludes that the Action Plan had clear **added value**. It acted as a symbol of political commitment, stimulated actions within Member States, strengthened international cooperation and provided a framework to guide and coordinate activities on AMR at international level in the area of monitoring and surveillance and on R&D (ND4BB and JPIAMR).

On the whole, therefore, the evaluation findings support continued action at the EU level. The evaluation shows that there is a clear need **to support and assist Member States** in developing and implementing national action plans to reduce differences between them in the use of antimicrobials and prevalence of infections, to foster collaboration across sectors, to improve knowledge of citizens and to strengthen monitoring and surveillance systems by developing expertise on methodologies, solid indicators and instruments. The evaluation demonstrates the need of continuing **coordination and collaboration on AMR research** on developing new antimicrobials, rapid diagnostic tests, vaccines and alternative treatments, and new business models to sustain investment and increase the knowledge on the transmission of AMR for a better understanding of the mechanisms causing resistance. Furthermore, given the cross-border nature of AMR, a strong **EU voice at international level** remains necessary, to raise awareness, to encourage countries to consider their own measures against AMR and to take global measures such as WHO implementing policies and the development of OIE standards.

ABBREVIATIONS

AMR	Antimicrobial Resistance
DDD	Defined Daily Doses
EAAD	European Antibiotic Awareness Day
EARS-Net	European Antimicrobial Resistance Surveillance Network
ECDC	European Centre for Disease Prevention and Control
EFFORT	Ecology from Farm to Fork Of microbial drug Resistance and Transmission
EvoTAR	Evolution and Transfer of Antibiotic Resistance
EFSA	European Food Safety Authority
EMA	European Medicines Agency
ERA	Environmental Risk Assessment
ESAC	European Surveillance of Antimicrobial Consumption
ESVAC	European Surveillance of Veterinary Antimicrobial Consumption
FAO	Food and Agricultural Organization of the United Nations
FP7	Seventh Programme for Research and Technological Development
FWD	Food- and Waterborne Diseases and Zoonoses
IMI	Innovative Medicines Initiative
JPIAMR	Joint Programming Initiative on AMR
ND4BB	New Drugs for Bad Bugs
OECD	Organisation for Economic Co-operation and Development
OIE	World Organisation for Animal Health
R&D	Research and Development
TATFAR	Transatlantic Taskforce on Antimicrobial Resistance
WHO	World Health Organisation

ANNEXES

ANNEX 1 – PROCEDURAL INFORMATION

DG SANTE (unit G4) is the lead DG for this evaluation. The evaluation was outsourced to RAND following use of DG SANTE framework contract. The contract was signed on 21 August 2015 with Final Report to be completed in March 2016.

An Inter-Service-Steering Group (ISG) was set up in September 2015 to oversee the evaluation work. Following DGs were represented: DG SANTE, DG AGRI, DEVCO, DG GROWTH, DG MARE, DG RTD, SG. Its mandate was to support the evaluation work, monitor the progress of the evaluation, provide comments and assure the quality and objectivity of the evaluation report and finally analyse the results of the evaluation in view of the subsequent follow-up.

The ISG members met on:

- 10 September 2015: ISG kick-off meeting
- 9 October 2015: discussion interim report and progress report
- 11 January 2016: discussion interim report and progress report
- 25 March 2016: discussion interim report and progress report

The Final Report was transmitted to ISG members on 18 April 2016 for final comments as well as the quality check assessment. The Final Report was forwarded to the COM services on 22 July 2016.

ANNEX 2 – EVALUATION QUESTIONS

The evaluation questions are displayed in Table 1.

Table 1: Evaluation criteria and related questions

Criteria	Evaluation Question (EQ)	
Relevance	EQ1	To what extent do the objectives of the Action Plan address the problems identified in 2011? How well do these objectives still correspond to the current needs of tackling AMR within the EU?
	EQ2	Are the areas for EU action appropriate in view of the distribution of EU and national competences?
Effectiveness	EQ3	To what extent have the actions been effective at *improving treatment* of infections in humans and animals?
	EQ4	To what extent have the actions aimed at *containing the risks of spreading AMR* been effective?
	EQ5	To what extent has the European Commission been effective in capturing the holistic approach and in delivering results?
Efficiency	EQ6	Has the EU budget been efficiently used to address the objectives of the Action Plan?
Coherence	EQ7	To what extent is the Action Plan coherent with Member States' relevant national (or regional) strategies and action plans and with similar initiatives at the international level?
	EQ8	To what extent are the actions contained in the Action Plan coherent with other EU policies on the environment, human health, animal health and welfare, food safety, agriculture, research, competitiveness, Small Medium-sized Enterprises?
EU added value	EQ9	What is the added value resulting from the Action Plan compared with what could be achieved by Member States at national and/or regional levels? Did the Action Plan identify the actions which should be best dealt with at EU level?
	EQ10	To what extent can improvements in the situation on AMR (outcomes and other changes identified in the previous EQs) be attributed to the development and implementation of the Action Plan?

ANNEX 3 – SYNOPSIS REPORT

Consultation activities

The evaluation encompassed an on-line survey to get insight in the opinion on the Action Plan (relevance, effectiveness, efficiency, coherence, EU added value) of the general public, Member States and other stakeholders. To validate the evaluation outcomes a number of targeted interviews and workshops have taken place. Table 1 depicts the purpose of each evaluation activity, the targeted number of respondents and the actual number of respondents.

The on-line survey included a:

- Public consultation: 12 weeks online from 30 October 2015 to 22 January 2016
  - Respondents answering as citizens/private individuals were invited to continue with the general questionnaire.
  - Respondents answering as representatives of national authorities were redirected to the targeted questionnaire for Member State representatives.
  - Respondents answering as representatives of other organisations were redirected to the targeted questionnaire for stakeholders.
- Member States consultation: 9 weeks online from 9 November to 11 January 2016
- Stakeholder consultation: 9 weeks online from 9 November to 11 January 2016

Table 1: Data collection methods and participation

Method	Purpose	Target no. of participants	Actual no. of participants
Workshop 1	Inform stakeholders about the evaluation and obtain evaluation evidence	25	29 (representing 23 organisations)
Public consultation	Evidence from any member of the public who wishes to participate	n/a	34**
Member States survey	Evidence from Member States representatives on animal and public health issues and the role of the Action Plan	56*	70** (representing 26 Member States, Iceland, Norway, Serbia, and Switzerland)
Stakeholder survey	Evidence from targeted stakeholders on animal and human health issues and the role of the Action Plan	50	81**
Interviews	Qualitative information to complement the surveys and other data collection methods	25	37
Workshop 2	Discuss and validate evaluation outcomes	25	38 (representing 36 organisations)

* The target represents the number of Member State respondents on each issue (28 Member States, with at least one respondent each representing human and animal health issues). Some Member States provided one, coordinated response in each area (human and animal health) while in others, two or more responses were received.
** 64 responses were received for the public consultation, of which 34 were from self-identified members of the public (of these, two were emailed responses that did not answer the questions in the questionnaire), three were Member State responses routed to the targeted Member State survey and 27 were stakeholder responses routed to the targeted stakeholder survey.

Stakeholder groups involved

In total 47% of the respondents of the **Public consultation** were female, 41% were male and 13% unknown. The respondents were equally divided over the age groups: 6% was between 15-24, 38% between 25-39, 22% between 40-54 and 28% older than 55. In total 6% preferred to keep their age unknown. The respondents were from the following countries of origin: Belgium, Croatia, Estonia, France, Germany, Greece, Ireland, Italy, Poland, Spain, Sweden, United Kingdom, Nigeria, Switzerland and the USA.

The **Member States survey** was targeting public sector representatives in 28 Member States and Iceland, Norway, Serbia and Switzerland. In total, there were 70 respondents, some of them covering more than one affiliation. Some of these representatives were also affiliated to EU agencies, such as ECDC, EMA and EFSA.

Table 2: Member State representatives – survey responses

Affiliation	No. of responses*
Government ministry	25
Public health authority	25
Food safety authority	22
Veterinary authority	25
Research organization	7
ECDC Coordinating Competent Bodies	7
EARS-Net national participating institutions	12
EMA National Competent Authorities	9
EFSA Focal Points	2
Other institutions involved in AMR strategies	7

* The total number of respondents was 70. Some respondents had more than one affiliation.

The **stakeholder survey** targeted those with experience in areas related to: animal health, farming and food; human health; and research and innovation. A stakeholder mapping exercise was performed (see Annex 4.2) to ensure that all relevant stakeholders were targeted. The stakeholder representatives included NGO's, industry, healthcare providers, research organisations and consultancies.

Table 3: Stakeholder representatives – survey responses

Affiliation	No. of responses*
NGO	19
Industrial or trade association	17
Health care, hospital, health institution	10
Academic or research centre	8
Private company	6
Consultancy	2
'Other' or not indicated	19

* The total number of respondents was 81.

The main results of the surveys are depicted in Table 4 below. PC refers to Public Consultation, MS to Member States survey and SH to Stakeholder Survey. The PC was covering fewer topics than the MS and SH survey, if available, the results of the PC are presented in the table.

In general, it can be concluded that the opinion of the public consultation and the MS and SH surveys are in line with each other. For instance, the topic of prudent use in human medicine was (very) relevant according to 100% MS, 85% of the SH and 87% of the PC respondents, although it can be noticed that in general the response of the Member States representatives regarding the Action Plan was more positive than from stakeholders and the general public. There is one major exception with regards the holistic approach of the Action Plan. Only 36% of the respondents of the PC, and 49% of the SH believed that the Action Plan captured a holistic approach versus 78% from the MS survey.

Below the main results for criteria addressed by the evaluation (relevance, effectiveness, efficiency, internal and external coherence and EU added value) are summarized.

To what extent do the objectives of the Action Plan address the problems identified in 2011? How well do these objectives still correspond to the current needs of tackling AMR within the EU?

The Member States survey, the stakeholder survey and the public consultation conducted during the evaluation confirmed that the Action Plan addressed the problems identified in 2011 and that these problems are still relevant today. For instance, regarding prudent use in veterinary medicine 91% of the Member States, 77% of the stakeholders and 78% of the public consultation respondents confirmed that this was a pertinent topic in 2011 and respectively 94% of the Member States and 87% of the stakeholders confirmed that this topic is still relevant in 2015. There was no similar question in the PC regarding 2015.

Are the areas for EU action appropriate in view of the distribution of EU and national competences?

The appropriateness of task distribution is acknowledged by the MS and SH survey respondent groups, of which 84% (91%MS, 79%SH) (strongly) agreed that the Action Plan identified actions best dealt with at EU level. There was no similar question in the PC.

To what extent have the actions been effective at improving treatment of infections in humans and animals?

This question isn't included in the PC.

According to the MS and SH surveys, it is hard to attribute the trend in the appropriate use of antimicrobials in humans and animals, wholly or in part, to the Action Plan[124, 125].

Furthermore, 62%[126] of the MS and SH survey respondents think that the Commission guidelines on the prudent use of antimicrobials in veterinary medicine have the potential to be effective in stimulating an appropriate use in animals.

[124] 34% (21/62) do not know, 34% (21/62) attribute trend, wholly or in part, to the Action Plan, 33% (20/62) attribute trend not to the Action Plan with respect to the appropriate use of antimicrobials in humans.

[125] 35% (29/82) do not know, 38% (31/82) attribute trend, wholly or in part, to the Action Plan, 27% (22/82) attribute trend not to the Action Plan with respect to the consumption of antimicrobials in animals.

[126] 62% (54/87): 74% (31/42) according to the Member States survey and 51% (23/45) according to the stakeholder survey.

At present, considerable disparities between EU/EEA Member States in antimicrobial consumption in humans and animals remain with potential negative impact on the development of antimicrobial resistance. The MS and SH participants of the workshop organised to discuss the evaluation outcomes (workshop 2) recommended that more needs to be done to ensure progress across Member States and to ensure that antibiotics are used appropriate. Furthermore, there is, according to the MS and SH participants, a need for greater focus on collaboration and communication between doctors and patients, and veterinarians and farmers. In particular, primary care doctors have an important role in discussing AMR and appropriate usage of antibiotics with their patients, as do veterinarians with farmers.

To what extent have the actions aimed at containing the risks of spreading AMR been effective?

This question isn't included in the PC.

In total 73%[127] of the MS and SH survey respondents think that the Animal Health Regulation has (some) potential to be effective for tackling AMR.

In total 88%[128] of the MS and SH survey respondents indicate that Decision 2013/652/EU on monitoring and reporting of AMR might be (partly) effective for helping to tackle AMR. This Decision has extended the coverage and scope (for instance species and substances) of data collected in zoonotic and commensal bacteria in food producing animals and certain food. As a result of this Decision, data since 2014 are more specific, easier to compare between Member States and across sectors, and the scope of the monitoring is larger. Consequently, it is now possible to get better insight in the spread of AMR at a more detailed level such as by species or substances.

According to the MS and SH participants of the workshop organised to discuss the evaluation outcomes (workshop 2) the Commission should continue on improving monitoring and surveillance data within the EU and data should be considered in light of the contextual information that could help explain why certain usage patterns occurred.

To what extent has the European Commission been effective in capturing the holistic approach and in delivering results?

In total 98%[129] of the MS and SH survey respondents agree with the need of a holistic approach and 93% of the PC. In total 63%[130] of the MS and SH survey respondents replied that the Action Plan captured a holistic approach and 36%[131] of the PC.

According to some participants in the workshop organised to discuss the evaluation outcomes (workshop 2), the Action Plan could reinforce a 'One Health' approach by paying more attention to the transmission of resistant bacteria via the environment

[127] 73% (65/89): 80% (36/45) according to the Member States survey and 66% (29/44) according to the stakeholder survey

[128] 88% (45/50): 91% (41/45) according to the Member State survey, 80% (4/5) according to the stakeholder survey.

[129] 98% (143/146): 99% (68/69) according to the Member States survey, 97% (75/77) according to the stakeholder survey.

[130] 63% (90/143): 78% (53/68) according to the Member States survey, 49% (37/75) according to the stakeholder survey.

[131] 36% (9/25) Action Plan captured holistic approach, 24% (6/25) no holistic approach, 40% (10/25) do not know/unsure

Has the EU budget been efficiently used to address the objectives of the Action Plan?

In total 77%[132] of the MS and SH survey respondents are not aware of any ways in which the allocation of EU spending on AMR has been inappropriate or inefficient[133]. There was no similar question in the PC.

According to some participants in the workshop organised to discuss the evaluation outcomes (workshop 2), Stakeholder, the JPIAMR had positively contributed to the coordination and collaboration in AMR research. At the same time, however, it was acknowledged that some gaps need to be filled in. Furthermore a longer timescale is needed to achieve progress.

To what extent is the Action Plan coherent with Member States' relevant national (or regional) strategies and action plans and with similar initiatives at the international level?

The MS and SH survey results confirm that the Action Plan is coherent with Member States' and international initiatives. In total 86%[134] of the Member States respondents replied that the Action Plan had a similar or broader scope than their National Plan. Furthermore, for instance, regarding prudent use in human medicine, 73% of the Member States and stakeholder survey respondents said that the Action Plan complement national plans completely and 15% that the Action Plan complements national plans partly. Regarding prudent use in veterinary medicine, this is 61% and 24% respectively and for international cooperation this is 53% and 31% respectively. There is no similar question in the PC.

To what extent are the actions contained in the Action Plan coherent with other EU policies on the environment, human health, animal health and welfare, food safety, agriculture, research, competitiveness, Small Medium-sized Enterprises?

According to the MS and SH survey respondents the EU AMR policies complemented or reinforced existing EU policies in the following areas: human health 78% (86% PC), animal health and welfare 80% (71% PC), food safety 75% (76% PC), research 77% (73% PC). These survey results also reflect the fact that the transmission of AMR through the food chain or through direct contact between humans and animals and the role of the environment on AMR were less addressed, namely only 59% (74% PC) of the MS and SH survey respondents agreed that the EU AMR policies complemented or reinforced agricultural policy and only 56% (57% PC) that it complements or reinforces environmental policies.

What is the added value resulting from the Action Plan compared with what could be achieved by Member States at national and/or regional levels? Did the Action Plan identify the actions which should be best dealt with at EU level?

The participants of the workshop organised to discuss the evaluation outcomes (workshop 2) the Action Plan had no comments on the headline finding of the contractor that the Action Plan was important as a symbol of political commitment to tackling AMR.

In total 56% of the MS respondents said that there national policy was influenced by the Action Plan. It can be concluded that the actions were appropriate in view of the distribution of EU and national competence and thus identified the actions best dealt with at EU level,

[132] 77% (103/134): 84% (54/64) according to the Member States survey, 70% (49/70) according to the stakeholder survey.

[133] Inappropriate and inefficient spending would include spending on unnecessary activities, spending on areas that may be of a lower priority than others that did not receive funding, and spending on activities that are unlikely to help EU efforts to tackle AMR.

[134] 86% (44/51) of the Member States respondents. This question was only in the Member States survey.

which was confirmed by 84% of the MS and SH survey respondents. There was no similar question in the PC.

To what extent can improvements in the situation on AMR (outcomes and other changes identified in the previous questions) be attributed to the development and implementation of the Action Plan?

A majority (78%)[135] of the MS and SH survey respondents agreed that the Action Plan helped bring improvement in AMR that would not have happened otherwise. There was no similar question in the PC.

Ad hoc contributions

The contractor received two emails, which were not based on the consultation questionnaire so they were not analyzed with the other responses. One e-mail was about the effectiveness of steam disinfection. The other e-mail is of a stakeholder organization who expresses that they have a broad range of expertise in AMR and would be happy to be further engaged in EU policy on AMR.

Feedback on how the results of the consultation have fed into policy making

The results of the surveys have been incorporated in the final synthesis and triangulation performed by the Commission (Chapter 5).

[135] 88% (104/134): 85% (55/65) according to the Member States survey, 71% (49/69) according to the stakeholder survey.

Table 4	Relevance		Effectiveness			Efficiency	Coherence		EU added value	
Action Plan (AP) 50% very familiar AP 46% somewhat familiar (MS and SH) 71% PC is aware AP	Q1 Address problem 2011 and 2015	Q2 Appropriateness EU actions given competence	Q3 Improving treatment of infections	Q4 Containing risk of spreading	Q5 Holistic approach	Q6 EU budget been efficiently used	Q7 Coherence MS and EU initiatives	Q8 Coherence other EU policies	Q9 Added value compared MS level	Q10 Improvement AMR due to Action Plan
		84% (91%MS,79%SH) (strongly) agree that the AP identifies actions best dealt with by EU	Too early		98% agree need holistic approach 99%MS/97%SH PC 93% 63% EU (78%MS/49%SH) PC: 36% Action Plan captured holistic approach	77% (84%MS/70%SH) Are not aware of any ways in which the allocation of EU spending on AMR has been inefficient or inappropriate	86% AP similar or broader scope	Improvement environment	In total 56% of the MS respondents said that there national policy was influenced by the AP.	78% (91%MS,79%SH) (strongly) agree that AP helped bring improvement AMR
Appropriate use								The EU AMR policies were complementing or reinforcing existing EU policies in the following areas: human health (78%) (83%MS, 74%SH) (PC 86%) animal health and welfare (80%) (94%MS,67%SH) (PC 71%) food safety (75%) (88%MS/64%SH) (PC 76%) research (77%) (83%MS, 71%SH) (PC 73%) agricultural (59%) (70%MS/49%SH) (PC 74%)		
1. Human prudent use	Relevance topic in 2011/2015 91% / 91% 100%/97%MS 85%/88%SH Very relevant PC: 87%	Appropriate distribution actions between the EU and MS 60% Yes 66%MS/57%SH	Trend appropriate use in humans be attributed to AP wholly/ partially: 34% 17%MS/44%SH Trend consumption in animals be attributed to AP wholly/ partially: 38% 28%MS/49%SH Potential Commission guideline prudent use animals being effective? 62% 74%MS/51%SH				AP complement National Plans completely 73%, partly 15%			
2. Legislation VMP and medicated feed										Achievements contributed to Action Plan 51% 55%MS/48%SH
3. Veterinary prudent use	Relevance topic in 2011/2015 84% / 90% 91% /94%MS 77% SH//87%SH Very relevant PC: 78%	Appropriate distribution actions between the EU and MS 52% Yes 59%MS/46%SH					AP complement National Plans completely 61%, partly 24%			

Prevent infections and their spread								environment (56%) (63%MS,50%SH) (PC 57%)		
4. Healthcare settings	Relevance topic in 2011/2015 81% / 82% 94%MS/87%MS 74%SH/78%SH Very relevant PC 71%	Appropriate distribution actions between the EU and MS 61% Yes 75%MS/53%SH		Too early to say anything about trends and to attribute developments to the Action Plan Animal Health Regulation has (some) potential to be effective 73% yes 80%MS/66%SH			AP complement National Plans completely 68%, partly 16%			
5. EU Animal Health Regulation	Relevance topic in 2011/2015 73% / 80% 84%/84%MS 62%/76%SH Very relevant PC 77%	Appropriate distribution actions between the EU and MS 58% Yes 66%MS/51%SH					AP complement National Plans completely 55%, partly 30%			
R&D	Relevance topic new antibiotics in 2011/2015 54%/57% 60%/57%MS 49%/57%SH PC 59%	Appropriate distribution actions between the EU and MS 41% Yes 44%MS/38%SH					AP complement National Plans completely 31%, partly 17%			
6. Patients: new antibiotics			Too early to say anything about trends and to attribute developments to the Action Plan			Too early to say				
7. Vet: new antibiotics										
International cooperation										
8. International cooperation	Relevance topic in 2011/2015 77% / 81% 82%/85%MS 73%/78%SH Very relevant PC 68%	Appropriate distribution actions between the EU and MS 56% yes 65%MS/49%SH					AP complement National Plans completely 53%, partly 31%			

Monitoring and surveillance	Relevance topic monitoring resistance in 2011/2015 82%/84% 91%/88%MS 73%/79%SH PC 91%	Appropriate distribution actions between the EU and MS monitoring resistance 63% Yes 76%MS/53%SH					AP complement National Plans Monitoring resistance completely 76%, partly 16%			
9. Human	Relevance topic monitoring consumption in 2011/2015 83% / 84% 97%/87%MS 75%/82%SH Very relevant PC 86%	Appropriate distribution actions between the EU and MS monitoring consumption 65% Yes 83%MS/55%SH					AP complement National Plans Monitoring use in humans completely 77%, partly 12%			Monitoring developments use can be attributed to the AP 52% 54%MS/51%SH Monitoring developments resistance can be attributed to the AP 51% 59%MS/46%SH
10. Veterinary	Relevance topic monitoring consumption in 2011/2015 81% / 85% 89%/89%MS 74%/80%SH Very relevant PC 91%	Appropriate distribution actions between the EU and MS monitoring consumption 61% Yes 71%MS/52%SH		Decision has potential to be effective 88% yes91%MS/80%SH			AP complement National Plans Monitoring use in animals completely 73%, partly 20%			Monitoring developments use can be attributed to the AP 61% 66%MS/55SH Monitoring developments resistance can be attributed to the AP 57% 69%MS/44%SH

Additional R&D										
11. Reinforce and coordinate R&D efforts	Relevance topic in 2011/2015 Cause AMR 67%/67% 78%/75%MS 58%/60%SH PC 68% Impact prudent use 77%/78% 85%/84%MS 70%/72%SH Very relevant PC 73%	Appropriate distribution actions between the EU and MS Cause AMR 48% 50%MS/46%SH Impact prudent use 48% 50%MS/46%SH	JPI Too early to say 31% 37%MS/26%SH (Partly) effective 31% 35%MS/26%SH			Too early EU Research funding support unlikely to have been made available otherwise.	AP complement National Plans Cause AMR completely 41%, partly 34% Impact prudent use AMR completely 43%, partly 28%			
Communication, education, training										
Public= General public H prof = Health professional A prof = Animal professional	Relevance topic in 2011/2015 67%/77%Public 74%/82%MS 61%/73%SH 83% / 86% H prof 97%/97%MS 75%/80%SH 74% / 74% A prof 80%/80%MS 70%/70%SH Very relevant PC 86% Public 68% H prof 73% A prof	Appropriate distribution actions between the EU and MS 51% Public 61%MS/43%SH 55% H prof 72%MS/44%SH 56% A prof 64%MS/47%SH		(Somewhat) effective 74% 76%MS/71%SH Public			AP complement National Plans completely Public 63% H Prof 65% A Prof 62% Partly Public 24% H prof 23% A prof 31%			

ANNEX 4 – METHODOLOGY

ANNEX 4.1 Evaluation Matrix

EQ = Evaluation Question; JC = Judgement Criteria; MS = Member State; SH = stakeholder; PC = public consultation; AP= Action Plan

EQ = Evaluation Question; JC = Judgement Criteria; MS = Member State; SH = stakeholder; PC = public consultation; AP= Action Plan

Summary of methods	
Groups to approach	**Methods of involvement**
General public	Open public consultation
Private groups active in animal health, human health, farming and food: industry and professional associations, public interest groups	• Participation in two stakeholder workshops • Targeted surveys[136] (to be distributed to members of groups) • (Public consultation option) • Phone interviews if appropriate
Research stakeholders (researchers, scientific societies and academies, IMI representatives, research-active SMEs, Efpia)	Phone interviews
Policymakers from Member States	MS Surveys (tailored to focus on animal or human health)
International bodies (e.g. WHO)	Phone interviews
Independent experts on AMR issues	Phone interviews
Commission and other EU public bodies (e.g. ECDC)	Phone interviews

[136] These surveys are a means for groups to obtain feedback from their members, to ensure a high level of representation. Some of the questions will be consistent across all or most surveys, but some will be specific to particular groups.

Table 2:Evaluation Matrix

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 1 (Relevance)	*Original: To what extent do the objectives of the action plan ~~still~~ address the problems identified in 2011? How well do these objectives still correspond to the current needs of tackling AMR within the EU?* Revised: **To what extent do the objectives of the action plan address the problems identified in 2011? How well do these objectives still correspond to the current needs of tackling AMR within the EU?**		
All	JC 1.1 Problems identified in 2011 are addressed by the objectives	1. AP objectives addressed the problems identified (before and during 2011)	MS and SH surveys, interviews, workshops • EU documents/reports from 2008-2011 (particularly those referenced in the AP)[137] • Reports and strategies from other bodies (e.g. WHO, US, UK, CDDEP) published in 2008-2011[138] • Academic reviews discussing AMR and policy needs, data from ECDC, etc.	SH-A, H 13, 17 MS-A, H 13, 17 Interviews: R1

[137] E.g. ECDC/EMEA Joint Technical Report. The bacterial challenge: time to react. http://www.ema.europa.eu/docs/en_GB/document_library/Report/2009/11/WC500008770.pdf; Second Report from the Commission to the Council on the Basis of Member States' Reports on the Implementation of the Council Recommendation (2002/77/EC) on the Prudent Use of Antimicrobial Agents in Human Medicine. Technical annex: http://ec.europa.eu/health/antimicrobial_resistance/docs/cswd_technicalannex_en.pdf

[138] e.g. WHO world health day 2011 materials, French national plan 2011

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 1 (Relevance)	*Original: To what extent do the objectives of the action plan ~~still~~ address the problems identified in 2011? How well do these objectives still correspond to the current needs of tackling AMR within the EU?* Revised: **To what extent do the objectives of the action plan address the problems identified in 2011? How well do these objectives still correspond to the current needs of tackling AMR within the EU?**		
All	JC 1.2 Problems identified as relevant currently are addressed by the objectives	1. AP objectives still correspond to current EU needs	MS and SH surveys, interviews, public consultation, workshop • EU documents/reports psot-2011 • Reports and strategies from other bodies (e.g. WHO, US[139], UK[140], CDDEP[141]) from 2011-15. • Other policy reports and strategies published post-2011. • Academic reviews discussing AMR and policy needs, data from ECDC, etc. • Data reviewed under EQ3-EQ4 Synthesis of key messages from all EQ	PC 14, 15, 16, 17 SH-A, H 14, 15, 16, 17 MS-A, H 14, 15, 16, 17 Interviews: R2

[139] https://www.whitehouse.gov/sites/default/files/docs/national_action_plan_for_combating_antibotic-resistant_bacteria.pdf
[140] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/385733/UK_AMR_annual_report.pdf
[141] http://cddep.org/publications/state_worlds_antibiotics_2015

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 2 (Relevance)	**Are the areas for EU action appropriate in view of the distribution of EU and national competences?**		
All	JC 2.1 Areas for action are distributed in line with EU and MS competencies.	1. Appropriate allocation of areas of action	MS and SH surveys, interviews Policy documents that outline distribution of responsibilities[142]	SH-A,H 18, 19 MS-A,H 18, 19 Interviews: R1, 3

[142] E.g. Action Plan, Guidance on prudent use of antimicrobial agents in humans and animals

Action	EQ / JC	Indicators	Data sources	Survey / Interview
	EQ 3 (Effectiveness)	**To what extent have the actions been effective at improving treatment of infections in humans and animals?**		
1	JC 3.1 Reduction or no increase in total antimicrobial consumption for use in humans.	1. Decrease or no increase in the volume of antimicrobials sold annually in the EU[143] since 2011[144]	Case study 1 • ESAC-Net: human consumption of antimicrobials, 2005-2013 • Relevant academic studies (supporting information)	N/a
		2. Decrease or no increase in the antimicrobials prescribed to patients since 2011	• APRES[145] data from primary care patient records • Relevant academic studies (supporting information)	N/a
		3. Decrease or no increase in total antimicrobial consumption in humans linked to the Action Plan (reference years 2011-15)	MS and SH surveys, interviews, workshops, case study 1	SH-H 23, 24 MS-H 23, 24 Interviews: E1, E2

[143] Trends at EU-level over time as compared with international data; sub-group trends may include: community (i.e. non-hospital) and hospital settings, commonly prescribed antibacterials (e.g. penicillin with beta-lactamase inhibitors), age, gender, prescriber type

[144] Analysis of all indicators will include consideration of the time period before the Action Plan was implemented with reference to changes since 2011. The pre-2011 period of analysis will vary by indicator depending on available information, but will include at least the two previous years and up to five years.

[145] Data from individual patient records in primary care across 9 member states (to validate and explore trends identified in ESAC-Net data)

Action	EQ / JC	Indicators	Data sources	Survey / Interview
	EQ 3 (Effectiveness)	**To what extent have the actions been effective at improving treatment of infections in humans and animals?**		
1	JC3.2 Appropriate use of antimicrobials in humans.	1. Reduction or no increase in consumption of antimicrobials in the primary care sector since 2011	ESAC-Net data on consumption of antibacterials for systemic use trends in EU MS (via sales and/or reimbursement information) covering period 2011-2014. (DDD/1000 inhabitants/day)	N/a
		2. Decrease or no increase in sales of antimicrobials without prescription since 2011	Policy reports and academic literature on sales of antimicrobials without prescription	N/a
		3. Decrease in the ratio of broad to narrow spectrum antimicrobials since 2011	• ESAC-Net: human consumption of antimicrobials, 2005-2013 • Relevant academic studies (supporting information)	N/a
		4. Increase in appropriate use is considered to be linked to the AP (reference years 2011-15)	MS and SH surveys, interviews	SH-H 25, 26 MS-H 25, 26 Interviews: E3, E4

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 3 (Effectiveness)	**To what extent have the actions been effective at improving treatment of infections in humans and animals?**		
1&4	JC 3.3 Improvement in approaches to treating infections in humans	1. Increased implementation by MS of the prescription-only requirements for antimicrobial agents (reference years 2011-15)	MS and SH surveys, interviews, workshops • Commission reports on promoting prudent use of antimicrobials[146],[147] • Other documentation or data from MS	SH-H 29 MS-H 29 Interviews: E5
		2. Decrease or no increase in health care associated infections in EU long-term care facilities since 2011	ECDC Surveillance Report of health care associated infections and antimicrobial use in European long-term care facilities[148]	N/a
		3. Decrease or no increase in antimicrobial use in EU long-term care facilities since 2011	ECDC Surveillance Report of health care associated infections and antimicrobial use in European long-term care facilities	N/a
		4. Increased implementation of control measures against AMR in nursing homes and long-term health facilities	MS and SH surveys, interviews, workshops HALT project report on national performance indicators for antimicrobial stewardship and infection control in Europe (2010 data)[149]	SH-H 29 MS-H 29 Interviews: E5

[146] 2nd report (and detailed analysis) on implementation of 2002 Recommendation (http://ec.europa.eu/health/antimicrobial_resistance/docs/amr_report2_en.pdf); First report was published in 2005, second in 2010; publication of third report anticipated in 2015 (according to Action Plan and Action Plan Progress Report). http://ecdc.europa.eu/en/healthtopics/antimicrobial_resistance/antimicrobial-resistance-healthcare-associated-infections-programme/Pages/ARHAI.aspx

[147] Figures for Europe also summarised in the WHO's Response to AMR report (April 2015). http://apps.who.int/iris/bitstream/10665/163468/1/9789241564946_eng.pdf?ua=1

[148] Reports on long-term care facilities cover 2010 and 2013 http://ecdc.europa.eu/en/publications/surveillance_reports/arhai/Pages/arhai.aspx

[149] B. Cookson, D. MacKenzie, et al. (2013), 'Development and assessment of national performance indicators for infection prevention and control and antimicrobial stewardship in European long-term care facilities,' Journal of Hospital Infection, Volume 85, Issue 1, September 2013, Pages 45-53.

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 3 (Effectiveness)	**To what extent have the actions been effective at improving treatment of infections in humans and animals?**		
		5. Increased number of new training courses on AMR for healthcare workers (reference years 2011-15)	MS and SH surveys, interviews, workshops, case study 4 ECDC Core competencies for infection control and hospital hygiene professionals in the EU (2013) Figures from Commission's CSWD detailed analysis on country reports (published in 2010) on implementation of 2002 Recommendation	SH-H 29 MS-H 29 Interviews: E5
		6. Updated national strategies and control measures on AMR to account for new information (reference years 2011-15)	MS and SH surveys, interviews, workshops National AMR strategies	SH-H 29 MS-H 29 Interviews: E5
		7. Improvements considered to be linked to the AP and align with effective implementation by MS of 2002 Council Recommendation (AP Action 1) (reference years 2011-15)	MS and SH surveys, interviews, workshops, case study 4 2002 Council Recommendation on the prudent use of antimicrobial agents in human medicines (supporting document)	SH-H 29, 30 MS-H 29, 30 Interviews: E5, 6

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 3 (Effectiveness)	**To what extent have the actions been effective at improving treatment of infections in humans and animals?**		
2	JC3.4 Reduction or no increase in antimicrobial consumption for use in animals.	1. Decrease or no increase in the volume of antimicrobials sold annually in the EU since 2011	Case study 5 ESVAC: data on veterinary antimicrobial consumption (2010-2012); 5th ESVAC report (publication expected October 2015)	N/a
		2. Observed decrease or no increase in total antimicrobial consumption in animals linked to the Action Plan (reference years 2011-15)	MS and SH surveys, interviews, case study 5	SH-A 23, 24 MS-A 23, 24 Interviews: E10

Action	EQ / JC	Indicators	Data sources	Survey / Interview
	EQ 3 (Effectiveness)	**To what extent have the actions been effective at improving treatment of infections in humans and animals?**		
2&3	JC3.5 Improvements in the prudent use of antimicrobials in veterinary medicine	1. Improvements in prudent use in veterinary medicine since 2011	MS and SH surveys, interviews, workshops, case study 6 Supporting documents: • Reports from EMA and CVMP as listed in progress report[150] • Information on updating of marketing authorisations[151] • Report (with FVO) on ability of national labs to monitor residues[152] • EFFORT data (if available)[153]	SH-A 27, 28 MS-A 27, 28 Interviews: E11, E12, E13
		2. Improvements in the prudent use of antimicrobials are aligned with the principles outlined in the Guidelines for the prudent use of antimicrobials in veterinary medicine (2015) (particularly justified prescription and use, avoidance of routine prophylaxis, avoiding use of medication for a full herd/flock)	Interviews, workshops, case study 6 Commission Notice: Guidelines for the prudent use of antimicrobials in veterinary medicine (Sept 2015)[154]	Interviews: E11, E12, E13

[150] Listed in Annex 1 of progress report: http://ec.europa.eu/health/antimicrobial_resistance/docs/2015_amr_progress_report_en.pdf
[151] Listed in Annex 2 of progress report: http://ec.europa.eu/health/antimicrobial_resistance/docs/2015_amr_progress_report_en.pdf
[152] FVO report 2015-7211, available at http://ec.europa.eu/food/fvo/overview_reports/details.cfm?rep_id=77
[153] Ecology from Farm to Fork Of microbial drug Resistance and Transmission, http://www.effort-against-amr.eu/, in particular, WP5: relationship between farming practices, antimicrobial usage, animal health and resistance; WP6: intervention studies aiming at reducing antimicrobial usage and resistance in pig and poultry production; WP7: quantification of exposure to antimicrobial resistance through different transmission routes from animals to humans
[154] http://ec.europa.eu/health/antimicrobial_resistance/docs/2015_prudent_use_guidelines_en.pdf
Annex: http://ec.europa.eu/health/antimicrobial_resistance/docs/2015_prudent_use_guidelines_annex_en.pdf

Action	EQ / JC	Indicators	Data sources	Survey / Interview
	EQ 3 (Effectiveness)	**To what extent have the actions been effective at improving treatment of infections in humans and animals?**		
		3. Observed improvements are considered to be linked to the AP (reference years 2011-15)	MS and SH surveys, interviews, workshops, case study 6	SH-A 27, 28 MS-A 27, 28 Interviews: E11, E12, E13

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 3 (Effectiveness)	**To what extent have the actions been effective at improving treatment of infections in humans and animals?**		
2	JC3.6 Improvements in the rules, guidance and authorisation requirements for veterinary medicines and medicated feed.	1. Provision made for appropriate warnings and guidance on labels of veterinary antimicrobials in new legislative proposal under discussion	Interviews • Documentation for proposals on veterinary medicinal products and medicated feed (specific aspects related to addressing AMR)[155],[156] • Academic studies and policy reports (where available)	Interviews: E14
		2. Restrictions have been considered on regular or off-label use of certain new or critically important antimicrobials for humans in the veterinary sector since 2011	MS and SH surveys, interviews • Documentation for proposals on veterinary medicinal products and medicated feed (specific aspects related to addressing AMR)[157],[158] • Academic studies and policy reports (where available)	SH-A 25, 26 MS-A 25, 26 Interviews: E14

[155] Adopted by Commission in 2014. Background information: http://ec.europa.eu/health/veterinary-use/rev_frame_index_en.htm
[156] Further info on status of proposals on VMPs and medicated feed may be required from Commission representatives
[157] Adopted by Commission in 2014. Background information: http://ec.europa.eu/health/veterinary-use/rev_frame_index_en.htm
[158] Further info on status of proposals on VMPs and medicated feed may be required from Commission representatives

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 3 (Effectiveness)	**To what extent have the actions been effective at improving treatment of infections in humans and animals?**		
		3. Consideration given to amending the rules for advertisement of veterinary antimicrobials[159] since 2011	MS and SH surveys, interviews • Documentation for proposals on veterinary medicinal products and medicated feed (specific aspects related to addressing AMR)[160],[161] • Academic studies and policy reports (where available)	SH-A 25, 26 MS-A 25, 26 Interviews: E14
		4. Authorisation requirements revisited to sufficiently address risks and benefits of antimicrobial medicines (reference years 2011-15)	MS and SH surveys, interviews • Documentation for proposals on veterinary medicinal products and medicated feed (specific aspects related to addressing AMR)[162],[163] • Academic studies and policy reports (where available)	SH-A 25, 26 MS-A 25, 26 Interviews: E14

[160] Adopted by Commission in 2014. Background information: http://ec.europa.eu/health/veterinary-use/rev_frame_index_en.htm
[161] Further info on status of proposals on VMPs and medicated feed may be required from Commission representatives
[162] Adopted by Commission in 2014. Background information: http://ec.europa.eu/health/veterinary-use/rev_frame_index_en.htm
[163] Further info on status of proposals on VMPs and medicated feed may be required from Commission representatives

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 3 (Effectiveness)	**To what extent have the actions been effective at improving treatment of infections in humans and animals?**		
		5. Observed or considered improvements in rules, guidance and authorisation requirements are linked to AP (reference years 2011-15)	Interviews • Documentation for proposals on veterinary medicinal products and medicated feed (specific aspects related to addressing AMR)[164],[165] • Academic studies and policy reports (where available)	Interviews: E14, 15

[164] Adopted by Commission in 2014. Background information: http://ec.europa.eu/health/veterinary-use/rev_frame_index_en.htm
[165] Further info on status of proposals on VMPs and medicated feed may be required from Commission representatives

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 3 (Effectiveness)	**To what extent have the actions been effective at improving treatment of infections in humans and animals?**		
	JC3.7 Increased support for collaborative research and development efforts to bring new antibiotics to patients	1. Introduction of fast-track procedures for the marketing authorisation of new antimicrobials	Interviews, workshops • EMA Annual Reports and work programmes[166] and medicines database • Secondary publications on the antimicrobial pipeline[167]	Interviews: E22
		2. Introduction of fast-track procedures for marketing new antimicrobials is linked to the AP (reference years 2011-15)	Interviews, workshops	Interviews: E19
6		3. Number of new projects to support R&D that address the needs and challenges of antibiotic development (reference years 2011-15)	Interviews, workshops Relevant documentation pertaining to EU projects, focusing on IMI/IMI2, and FP7 and Horizon 2020 Documentation of New Drugs for Bad Bugs Programme (ND4BB)	Interviews: E22

[166] http://www.ema.europa.eu/ema/index.jsp?curl=pages/about_us/document_listing/document_listing_000208.jsp&mid=WC0b01ac058002933a [last accessed 3 November 2015]
[167] http://www.ema.europa.eu/ema/index.jsp?curl=pages/includes/medicines/medicines_landing_page.jsp [last accessed 3 November 2015]

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 3 (Effectiveness)	**To what extent have the actions been effective at improving treatment of infections in humans and animals?**		
		4. Budget data indicate resources mobilised to support antibiotic R&D since 2011	Relevant documentation pertaining to EU funding,[168] including IMI,[169] IMI2,[170] FP7[171] and Horizon 2020[172] Documentation of New Drugs for Bad Bugs Programme (ND4BB)[173]	N/a

[168] For instance, EU communication on new research projects: http://europa.eu/rapid/press-release_MEMO-13-996_en.htm?locale=en [last accessed 3 November 2015]

[169] IMI (N.d.) Budgets and Annual Accounts. Available from http://www.imi.europa.eu/content/documents#budget_accounts [last accessed 3 November 2015]. IMI (N.d.) Annual Activity Reports. Available from http://www.imi.europa.eu/content/documents#activity_reports [last accessed 3 November 2015]

[170] IMI2 (2014) The right prevention and treatment for the right patient at the right time: Strategic Research Agenda for Innovative Medicines Initiative 2. Available from http://www.imi.europa.eu/sites/default/files/uploads/documents/IMI2_SRA_March2014.pdf [last accessed 3 November 2015]. IMI2 (N.d.) Budgetary control. Available from http://www.imi.europa.eu/content/budgetary-control [last accessed 3 November 2015].

[171] For instance FP7 monitoring reports. Available from https://ec.europa.eu/research/evaluations/index_en.cfm?pg=fp7-monitoring [last accessed 3 November 2015]

[172] For example, first Horizon 2020 Work Programme update. Available from http://europa.eu/rapid/press-release_MEMO-14-492_en.htm [last accessed 3 November 2015]. Horizon 2020 2014-2015 Work Programme in the area of Health, demographic change and wellbeing. Available from http://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/main/h2020-wp1415-health_en.pdf#page=99 [last accessed 3 November 2015]

[173] http://www.imi.europa.eu/content/nd4bb

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 3 (Effectiveness)	**To what extent have the actions been effective at improving treatment of infections in humans and animals?**		
		5. Establishment of adequate market and pricing conditions for new antibiotics since 2011	MS and SH surveys, interviews • Available review and summary documentation and commentaries on EU research and development into new antimicrobials[174] • EMA guidelines and other documentation for private sector pertaining to new drug development[175]	SH-H 33, 34, 35, 36 MS-H 33, 34, 35, 36 Interviews: E19

[174] For instance, Rex, JH (2014) ND4BB: addressing the antimicrobial resistance crisis. Nature Reviews Microbiology 12:231–232. Roca, I, Akova, M, Baquero, F et al. (2015) The global threat of antimicrobial resistance: science for intervention. New Microbes and New Infections 6:22-29. Payne, DJ, Miller, LF, Findlay, D et al. (2015) Time for a change: addressing R&D and commercialization challenges for antibacterials. Philosophical Transactions of the Royal Society of London B: Biological Sciences, 370(1670). Eichberg, MJ (2015) Public funding of clinical-stage antibiotic development in the United States and European Union. Health security 13(3):156-165. Geoghegan-Quinn, M (2014) Funding for antimicrobial resistance research in Europe. The Lancet 384(9949):1186.

[175] Examples include Guidelines on the evaluation of medicinal products indicated for treatment of bacterial infections (available from http://www.ema.europa.eu/docs/en_GB/document_library/Scientific_guideline/2009/09/WC500003417.pdf [last accessed 3 November 2015]), an addendum to the guidelines (available from http://www.ema.europa.eu/docs/en_GB/document_library/Scientific_guideline/2013/11/WC500153953.pdf [last accessed 3 November 2015), and materials related to a workshop on regulatory options for approval of new antibacterials for human use (available from http://www.ema.europa.eu/ema/index.jsp?curl=pages/news_and_events/events/2013/09/event_detail_000781.jsp&mid=WC0b01ac058004d5c3 [last accessed 3 November 2015].

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 3 (Effectiveness)	**To what extent have the actions been effective at improving treatment of infections in humans and animals?**		
		6. Improved R&D efficiency is linked to the AP (esp. the launch of programme for research on new antibiotics with EFPIA and within the IMI-Joint Undertaking, and related to efforts to enable joint sharing of knowledge) (reference years 2011-15)	MS and SH surveys, interviews Documentation pertaining to IMI research programmes such as COMBACTE (incl. CARE and MAGNET),[176] TRANSLOCATION,[177] ENABLE[178] and DRIVE-AB,[179] and IMI2 research[180]	SH-H 31, 32 MS-H 31, 32 E18
		7. Improvements in public-private collaboration for antibiotic R&D, linked to the establishment of a framework agreement with the industry, defining objectives, commitments, priorities, principles and modes of action for public-private collaboration in a longer term perspective (AP Action 6) (reference years 2011-15)	Interviews, workshops	Interviews: E21

[176] http://www.combacte.com/
[177] http://www.nd4bb.eu/index.php/myarticles/2-translocation
[178] http://www.nd4bb-enable.eu/
[179] http://drive-ab.eu/
[180] IMI2 (2014) The right prevention and treatment for the right patient at the right time: Strategic Research Agenda for Innovative Medicines Initiative 2. Available from http://www.imi.europa.eu/sites/default/files/uploads/documents/IMI2_SRA_March2014.pdf [last accessed 3 November 2015]. IMI2 (N.d.) Budgetary control. Available from http://www.imi.europa.eu/content/budgetary-control [last accessed 3 November 2015].

	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 3 (Effectiveness)	**To what extent have the actions been effective at improving treatment of infections in humans and animals?**		
7	JC3.8 Improvement in the conditions for the introduction of new veterinary antimicrobials	1. Progress in incentivising innovation in veterinary medicine, and reduction of related barriers since 2011	MS and SH surveys, interviews, workshops	SH-A 30 MS-A 30 Interviews: E23
		2. Inclusion of incentives in new legislation on veterinary medicinal products to support the development of veterinary medicine innovations, and reduction of related barriers since 2011	Documentation for proposals on veterinary medicinal products and medicated feed (specific aspects related to addressing AMR)[181]	N/a
		3. Improved understanding of the need for new antibiotics in veterinary medicine (AP Action 7) and the need to offer incentives/ reduce barriers, linked to the AP since 2011	MS and SH surveys, interviews, workshops • Documentation of Commission request to EMA for scientific advice[182] • Information related to AP Action 2	SH-A 29 MS-A 29 Interviews: E24

[181] Adopted by Commission in 2014. Background information: http://ec.europa.eu/health/veterinary-use/rev_frame_index_en.htm

[182] [Electronic Version unavailable as of 23 Sept 2015] EMA. 2014. Request for scientific advice on the impact on public health and animal health of the use of antibiotics in animals - Answer to the second, third and fourth request from the European Commission. http://www.ema.europa.eu/docs/en_GB/document_library/Other/2014/07/WC500170253.pdf.http://www.ema.europa.eu/docs/en_GB/document_library/Other/2014/07/WC500170253.pdf

Request for advice: http://www.ema.europa.eu/docs/en_GB/document_library/Other/2013/04/WC500142070.pdf

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 3 (Effectiveness)	**To what extent have the actions been effective at improving treatment of infections in humans and animals?**		
11	JC3.9 Reinforcement and increased coordination of research efforts	1. Increases in budget allocations to further research aimed at better understanding of antimicrobial resistance and pathogenic-host interactions, and the development of diagnostic tools, vaccines and other preventive measures since 2011	Documentation pertaining to EU funding, including FP7 and Horizon 2020[183]	N/a
		2. Number of programmes launched and outcomes of these programmes (where outcomes available) have increased further research in these areas since 2011	Documentation for FP7 an Horizon2020	N/a
		3. Pipeline data on diagnostics, vaccines, etc. confirm further research on treatments since 2011	Pipeline data on diagnostics, vaccines, etc.	N/a
		4. Budget allocations, programme development, and pipeline developments in these areas are linked to the AP (reference years 2011-15)	MS and SH surveys, interviews	SH-A 31, 32 SH-H 37, 38 MS-A 31, 32 MS-H 37, 38 Interviews: E25

[183] For example, EU communication on new research projects: http://europa.eu/rapid/press-release_MEMO-13-996_en.htm?locale=en [last accessed 3 November 2015]; FP7 monitoring reports. Available from https://ec.europa.eu/research/evaluations/index_en.cfm?pg=fp7-monitoring [last accessed 3 November 2015]; First Horizon 2020 Work Programme update. Available from http://europa.eu/rapid/press-release_MEMO-14-492_en.htm [last accessed 3 November 2015]. Horizon 2020 2014-2015 Work Programme in the area of Health, demographic change and wellbeing. Available from http://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/main/h2020-wp1415-health_en.pdf#page=99 [last accessed 3 November 2015]

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 3 (Effectiveness)	**To what extent have the actions been effective at improving treatment of infections in humans and animals?**		
		5. JPI on coordinating national research activities related to AMR has affected national funding decisions, with increase budget allocations going to this issue (reference years 2011-15)	Interviews	Interviews: E25
		6. Activities under the AP to reinforce and increase coordination on research are considered to have led to positive changes in treatments for infections (reference years 2011-15)	MS and SH surveys, interviews	SH-A 31, 32 SH-H 37, 38 MS-A 31, 32 MS-H 37, 38 Interviews: E25

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 4 (Effectiveness)	**To what extent have the actions aimed at containing the risks of spreading AMR been effective?**		

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 4 (Effectiveness)	**To what extent have the actions aimed at containing the risks of spreading AMR been effective?**		
4	JC4.1 Improvements or no changes have occurred in country-level indicators of resistance in microorganisms	1. Reduction in antimicrobial resistance[184] over time for the EU overall and MS[185] since 2011	Case study 2 • EARS-Net data[186] • Gonococcal antimicrobial susceptibility surveillance data[187] • Relevant academic literature on AMR[188] • EFSA and ECDC data and reports on zoonoses[189]	N/a

[184] Defined as a resistance percentage, weighted by the population coverage in each country and the size of the country relative to rest of EU

[185] Where sufficient data is available: EARS-Net guidance is not to report if <10 isolates were reported for a specific organism–antimicrobial agent combination in a country

[186] Data is on resistance to eight key bacteria pathogens of public health importance, 2005-2013 (and 2014 if available)

[187] Annual data, e.g. Gonococcal antimicrobial susceptibility surveillance in Europe 2011. ECDC, 2013. http://www.ecdc.europa.eu/en/publications/publications/gonococcal-antimicrobialsusceptibility-surveillance-27-mar-2013.pdf

[188] Livestock-associated methicillin-resistant Staphylococcus aureus in humans, Europe. Emerg Infect Dis 2011;17(3):502-5. http://wwwnc.cdc.gov/eid/article/17/3/pdfs/10-1036.pdf ; New Delhi metallo-beta-lactamase 1-producing Enterobacteriaceae: emergence and response in Europe. 2010. Eurosurveillance 2010;15(46). pii: 19716. http://www.eurosurveillance.org/images/dynamic/EE/V15N46/art19716.pdf

[189] EFSA and ECDC (2014) The European Union Summary Report on Trends and Sources of Zoonoses, Zoonotic Agents and Food-borne Outbreaks in 2012. EFSA Journal 12(3):3590-3904; EFSA and ECDC (2013) The European Union Summary Report on Trends and Sources of Zoonoses, Zoonotic Agents and Food-borne Outbreaks in 2011. EFSA Journal 11(4):3129-3378; EFSA and ECDC (2012) The European Union Summary Report on antimicrobial resistance in zoonotic and indicator bacteria from humans, animals and food in 2010. EFSA Journal 10(3):2598-2830; EFSA and ECDC (2011) The European Union Summary Report on antimicrobial resistance in zoonotic and indicator bacteria from humans, animals and food in the European Union in 2009.EFSA Journal 9(7):2154-2474; EFSA and ECDC (2010) The Community Summary Report on antimicrobial resistance in zoonotic and indicator bacteria from animals and food in the European Union in 2008. EFSA Journal 8(7):1658-1918; EFSA and ECDC (2010) The Community Summary Report on antimicrobial resistance in zoonotic and indicator bacteria from animals and food in the European Union in 2004-2007. EFSA Journal 2010; 8(4):1309-1614.

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 4 (Effectiveness)	**To what extent have the actions aimed at containing the risks of spreading AMR been effective?**		
		2. Decrease or no increase in the occurrence of HAIs in the EU overall over time and across MS since 2011	Case study 2 and 3 • Patient safety and HAIs progress report[190] • ECDC Core competencies for infection control and hospital hygiene professionals in the EU (2013). • ECDC surgical site infection reports • ECDC HAIs surveillance report[191] • Academic literature on HAIs[192] and • APRES study[193]	N/a
		3. Observed improvements or no changes in country-level indicators of resistance are linked to the AP (reference years 2011-15)	MS and SH surveys, interviews, workshops, case study 2 and 3	SH-H 27, 28 MS-H 27, 28 Interviews: E7, 8, 9

[190] Patient Safety and HAIs, report from the Commission to the Council, June 2014, http://ec.europa.eu/health/patient_safety/docs/ec_2ndreport_ps_implementation_en.pdf

[191] Report was published most recently in 2013, with point prevalence data of HAIs in a survey of individual acute care hospitals (>1,000 hospitals in 29 European countries)

[192] E.g. ECDC pilot point prevalence survey of healthcare-associated infections and antimicrobial use. Eurosurveillance 2012;17(46). pii: 20316. http://www.eurosurveillance.org/images/dynamic/EE/V17N46/art20316.pdf; Clostridium difficile infection in Europe: a hospital-based survey. Lancet 2011;377(9759):63-73. http://www.ecdc.europa.eu/en/activities/sciadvice/_layouts/forms/Review_DispForm.aspx?ID=633&List=a3216f4c-f040-4f51-9f77-a96046dbfd72 ; Update of Clostridium difficile-associated disease due to PCR ribotype 027 in Europe, 2008. Eurosurveillance 2008;13(31). pii: 18942. http://www.eurosurveillance.org/images/dynamic/EE/V13N31/art18942.pdf ; Update of Clostridium difficile-associated disease due to PCR ribotype 027 in Europe. Eurosurveillance 2007;12(3-6):163-6. http://www.eurosurveillance.org/images/dynamic/EQ/v07n02/v07n02.pdf

[193] Antibiotic resistance patterns in 9 European countries

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 4 (Effectiveness)	**To what extent have the actions aimed at containing the risks of spreading AMR been effective?**		
		4. Improvements in the organisation and delivery of health services (human) that are aimed at reducing spread and risks of AMR (AP Action 4) (reference years 2011-15), including: - Development of/updates to guidance on infection prevention in Member States; - Increased surveillance; - Greater numbers of Member States providing and requiring training for healthcare workers in patient safety and HAIs	Interviews, workshops 2009 Council Recommendations on patient safety including prevention and control of HAIs, and 2012 progress reports, and the report Patient Safety and Healthcare-Associated Infections (report from the Commission to the Council, June 2014) (supporting documents) Level of coverage of HAI-Net point prevalence surveys	Interviews: E7

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 4 (Effectiveness)	**To what extent have the actions aimed at containing the risks of spreading AMR been effective?**		
12	JC4.2 Awareness of AMR amongst the general public and health practitioners has improved or is not decreasing.	1. Improvements or no decrease in awareness of AMR and appropriate antimicrobial usage among public health practitioners since 2011	Interviews, workshops, case study 4 and 7	Interviews: E5
		2. Increase or no decrease in awareness of AMR and appropriate antimicrobial usage among the general public since 2011	MS and SH surveys, interviews, public consultation, workshops, case study 4 and 7	PC 8, 9, 10, 11, 12, 13 SH-A 36, 37 SH-H 39, 40 MS-A 36, 37 MS-H 39, 40 Interviews: E34

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 4 (Effectiveness)	**To what extent have the actions aimed at containing the risks of spreading AMR been effective?**		
		3. Available documentation supports consultation findings that there have been improvements or no decrease in awareness of AMR and appropriate use among public health practitioners and the general public since 2011	Case study 4 and 7 • Documentation of MS campaigns and assessment • Hand hygiene reports[194] • Impact assessment of national and EU awareness campaigns on AMR[195] • Eurobarometer survey reports (2009, 2013)[196] • European AMR Awareness Day report[197] • Documentation of MS campaigns and assessment	N/a
		4. Increase or no decrease in awareness is linked to the AP (reference years 2011-15)	MS and SH surveys, interviews, workshops, case study 4 and 7	SH-A 38 SH-H 41 MS-A 38 MS-H 41 Interviews: E35

[194] The role and utilisation of public health evaluations in Europe: A case study of national hand hygiene campaigns. BMC Public Health 2014;14:131. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3931350/pdf/1471-2458-14-131.pdf
National hand hygiene campaigns in Europe, 2000-2009. Eurosurveillance 2009;14(17). pii: 19190. http://www.eurosurveillance.org/images/dynamic/EE/V14N17/art19190.pdf
Pathways to clean hands: highlights of successful hand hygiene implementation strategies in Europe. *Eurosurveillance* 2010;15(18). pii: 19560. http://www.eurosurveillance.org/images/dynamic/EE/V15N18/art19560.pdf
[195] If additional data available related to AP Action 12 has been reported (beyond the 2013 Eurobarometer)
[196] On patterns of antibiotic usage, understanding of appropriate use, and AMR awareness.
[197] Earnshaw et al. (2014), *Eurosurveillance*

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 4 (Effectiveness)	**To what extent have the actions aimed at containing the risks of spreading AMR been effective?**		
5	JC4.3 Improvements in the legal basis and guidance for containing the risks of spreading AMR	1. Discussions on the introduction of the new Animal Health Regulation includes a focus on disease prevention and the inclusion of a legal basis for monitoring AMR in animal pathogens (AP Action 5)	MS and SH surveys, interviews, workshops Supporting documents to the Animal Health Regulation[198]	SH-A 33, 34, 35 MS-A 33, 34, 35 Interview: E16, 17, 29
		2. Anticipated improvements in efforts to reduce the spread and risks of AMR are linked to the AP (reference years 2011-15)	MS and SH surveys, interviews, workshops Supporting documents to the Animal Health Regulation[199]	SH-A 33, 34, 35 MS-A 33, 34, 35 Interview: E16, 17, 29

[198] http://ec.europa.eu/food/animal/animal-health-proposal-2013_en.htm
[199] http://ec.europa.eu/food/animal/animal-health-proposal-2013_en.htm

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 4 (Effectiveness)	**To what extent have the actions aimed at containing the risks of spreading AMR been effective?**		
8	JC4.4 Strengthened multilateral and bilateral commitments for the prevention and control of AMR in all sectors	1. New or strengthened commitment mechanisms for the prevention and control of AMR have been concluded on a bilateral and/or multilateral basis since 2011	MS and SH surveys, interviews, workshops Documentation of initiatives as listed in progress report, e.g. work on Codex Alimentarius products,[200] collaboration with the WHO,[201] OIE,[202] US (TATFAR),[203] and countries in the Joint Programming Initiative on AMR (JPIAMR)	SH-A 39 SH-H 42 MS-A 39 MS-H 42 Interviews: C4
		2. Strengthened and newly developed multi- and bilateral commitments are linked to the AP (AP Action 8) (reference years 2011-15)	MS and SH surveys, interviews, workshops	SH-A 40, 41 SH-H 43, 44 MS-A 40, 41 MS-H 43, 44 Interviews: C5

[200] For instance, guidelines for risk analysis of foodborne antimicrobial resistance
[201] For instance, implementation of the WHO European strategic action plan on antibiotic resistance, the Global Foodborne Infections Network (GFN) and the Advisory Group in surveillance of Antimicrobial resistance (AGISAR).
[202] For instance, the development of the OIE standards on antimicrobial resistance and collaboration in the ad hoc group AMR
[203] See, for instance, TATFAR's progress report: http://www.cdc.gov/drugresistance/tatfar/report.html

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 4 (Effectiveness)	**To what extent have the actions aimed at containing the risks of spreading AMR been effective?**		
9	JC4.5 Strengthened surveillance systems on AMR and antimicrobial consumption	1. Data on usage for humans have become more accessible at local/regional/hospital levels since 2011	MS and SH surveys, interviews, workshops, case study 5 Supporting documentation: • ESAC-Net	SH-H 45, 46, 47, 49 MS-H 45, 46, 47, 49 Interviews: E30
10		2. Improvements have been made in the collection of harmonised data on usage per animal species and by production categories, and for indications across MS since 2011 (supported by documentation)	MS and SH surveys, interviews, workshops, case study 5 Supporting documentation: • EFSA Summary report on AMR in zoonotic and indicator bacteria (2013)[204] • Completeness of ESVAC surveillance data	SH-A 42, 43, 44, 46 MS-A 42, 43, 44, 46 Interviews: E26, 27
		3. Improvements have been made in surveillance through the AMR review of monitoring in zoonotic bacteria since 2011	MS and SH surveys, interviews, workshops, case study 5 Supporting documentation: • EFSA Summary report on AMR in zoonotic and indicator bacteria (2013)[205] • Completeness of ESVAC surveillance data	SH-A 42, 43, 44, 46 MS-A 42, 43, 44, 46 Interviews: E26, 27

[204] http://www.efsa.europa.eu/en/efsajournal/pub/4036
[205] http://www.efsa.europa.eu/en/efsajournal/pub/4036

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 4 (Effectiveness)	**To what extent have the actions aimed at containing the risks of spreading AMR been effective?**		
9&10		4. Evidence that strengthened systems are linked to the AP (reference years 2011-15), including: • Improvements in access to data on AMR at all levels (regional, local, hospitals) • Improved sustainability of the ESAC project through transfer to ECDC • Support and monitoring of ARPEC • Improvement in harmonisation established between human and veterinary surveillance to enable comparative analysis	MS and SH surveys, interviews, workshops, case study 5	SH-A 43, 45, 47 SH-H 46, 48, 50 MS-A 43, 45, 47 MS-H 46, 48, 50 Interviews: E28, 29, 31, 32, 33

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 5 (Effectiveness)	**To what extent has the coverage of actions across different services (DGs) within the European Commission been effective in capturing the holistic approach and in delivering results?**		
All	JC5.1 AMR-related actions are being carried out across the relevant DGs in	1. Actions identified in the AP cover the areas required for taking a holistic approach (reference years 2011-15)	MS and SH surveys, interviews, public consultation, workshops, case study 8	PC 18, 19, 20 SH-A, H 20, 21, 22 MS-A, H 20, 21, 22 Interviews: R4

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 5 (Effectiveness)	**To what extent has the coverage of actions across different services (DGs) within the European Commission been effective in capturing the holistic approach and in delivering results?**		
	accordance with the One Health approach, and are joined-up and coherent, with communication occurring across DGs.	2. Responsibility for actions in the AP have been allocated to appropriate DGs, with no gaps identified	Interviews, case study 8 Relevant EC policies (supporting documentation)	Interviews: R5
		3. Evidence that DGs have successfully carried out the AP actions in their remit.	Interviews, case study 8	Interviews: R6
		4. Evidence indicates that AP actions support the 'One Health' concept.	Interviews, case study 8 • EMA One Health report[206] • Council conclusions on the impact of AMR in the human health sector and in the veterinary sector – a "One Health" perspective (2012) • Other literature on One Health[207]	Interviews: R4

[206] http://animalhealthmedia.com/wp-content/uploads/2015/03/04.-One-Health-The-Regulation....pdf

[207] E.g. FAO-OIE-WHO Tripartite Concept Note (2010); Gibbs, E. P. J. (2014). The evolution of One Health: a decade of progress and challenges for the future. Veterinary Record, 174(4), 85-91.

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 5 (Effectiveness)	**To what extent has the coverage of actions across different services (DGs) within the European Commission been effective in capturing the holistic approach and in delivering results?**		
All	JC5.2 The holistic approach has been effective in helping to achieve the core objectives of the Action Plan.	1. More progress is considered to have been made than could have been achieved in the absence of a holistic approach (reference years 2011-15)	Interviews, workshops, case study 8 Synthesis of information gathered for other EQs	Interviews: A3

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 6 (Efficiency)	**Has the EU budget been efficiently used to address the objectives of the Action Plan?**		
All	JC6.1 EU budget allocated and spent for the Action Plan is consistent with AP objectives	1. Budget resources are aligned with AP objectives (reference years 2011-15)	Budget documents from EC agencies (e.g. ESVAC, Ears-Net) and DGs[208]	N/a
		2. Appropriate allocation of resources according to priority (reference years 2011-15)	MS and SH surveys, interviews, public consultation Budget documents from EC agencies (e.g. ESVAC, Ears-Net) and DGs[209]	PC 21, 22 SH-A 48, 49, 50 SH-H 51, 52, 53 MS-A 48, 49, 50, 58, 59 MS-H 51, 52, 53, 61, 62 Interviews: Ey2, Ey3
		3. Budget allocations are linked to Action Plan objectives (reference years 2011-15)	MS and SH surveys, public consultation	PC 22 SH-A 50 SH-H 53 MS-A 50 MS-H 53

[208] i.e. related to monitoring and surveillance in human and animal health, research, Eurobarometer and awareness-raising initiatives.
[209] i.e. related to monitoring and surveillance in human and animal health, research, Eurobarometer and awareness-raising initiatives.

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 6 (Efficiency)	**Has the EU budget been efficiently used to address the objectives of the Action Plan?**		
	JC6.2 Expenditure on the Action Plan is justified because it helped towards achieving objectives of the Action Plan and funding would not have been made available otherwise	1. Activities funded would not have occurred in the absence of EU funds, or would have occurred more slowly or to a lesser extent (reference years 2011-15)	MS and SH surveys, interviews, public consultation Documents/data on effectiveness (EQ3-4) Assessments of impact/efficiency[210]	PC 30, 31 SH-A 61, 62 SH-H 64, 65 MS-A 70, 71 MS-H 73, 74 Interviews: Ey4
		2. Activities supported contributed towards achieving AP objectives (reference years 2011-15)	Comparison of funded activities with objectives.	N/a

[210] One example is a report on European AMR Awareness Day (Earnshaw et al. (2014), *Eurosurveillance*)

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ7 (Coherence)	**To what extent is the Action Plan coherent with Member States' relevant national (or regional) strategies and action plans and with similar initiatives at the international level?**		
All	JC7.1 The *actions* set out in the EU Action Plan complement and/or reinforce those in national and international strategies and the *objectives* are consistent with those of other strategies (MS, regional	1. National actions plans and strategies complement and cohere with AP objectives and actions (reference years 2011-15)	National action plans[211]	N/a
		2. International initiatives complement and cohere with AP objectives and actions (reference years 2011-15)	Documentation from international bodies,[212]	N/a
		3. National plans/strategies cohere with AP objectives and actions (reference years 2011-15)	MS and SH surveys, interviews, public consultation, workshops	PC 23, 24 SH-A 51, 52 SH-H 54, 55 MS-A 55, 56, 57, 60, 63 MS-H 58, 59, 60, 63, 66 Interviews: C3, 6, 7

[211] National plans: Austria, France, Germany, Greece, Ireland, Netherlands, Spain, Sweden, United Kingdom (as listed at http://ecdc.europa.eu/en/healthtopics/Healthcare-associated_infections/guidance-infection-prevention-control/Pages/antimicrobial-resistance-strategies-action-plans.aspx)
International bodies/initiatives: WHO Global Action Plan, TATFAR, WHO, OIE, FAO, Codex Alimentarius.

[212] Note: According to lists compiled by the ECDC and WHO, there are no regional strategies/activities that cover Europe except TATFAR recommendations. (WHO list: http://www.who.int/drugresistance/global_action_plan/General_and_national_plans_amr_Dec_2014.pdf)

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ7 (Coherence)	**To what extent is the Action Plan coherent with Member States' relevant national (or regional) strategies and action plans and with similar initiatives at the international level?**		
	and international).	4. International initiatives complement and cohere with AP objectives and actions (reference years 2011-15)	MS and SH surveys, interviews, public consultation, workshops	PC 27, 28, 29 SH-A 55, 56, 57 SH-H 58, 59, 60 MS-A 64, 65, 66 MS-H 67, 68, 69

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ8 (Coherence)	**To what extent are the actions contained in the Action Plan coherent with other EU policies on the environment, human health, animal health and welfare, food safety, agriculture, research, competitiveness and SMEs?**		
All	JC8.1 The actions set out in the EU Action Plan are coherent with those set out in other relevant EU policies, and are aligned with respective competencies.	1. Consistency between AP objectives and those in other policies and no conflicts, gaps or duplication of efforts (reference years 2011-15)	MS and SH surveys, public consultation, interviews, workshops Relevant EU policies[213] Synthesis of findings on effectiveness and relevance	PC 25, 26 SH-A 53, 54 SH-H 56, 57 MS-A 51, 52, 53, 54, 55 , 61, 62, 63 MS-H 54, 55, 56, 57, 58, 64, 65, 66 Interviews: C1, 2

[213] Identified with support of steering group and/or DG representatives interviewed

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 9 (EU Added Value)	**What is the added value resulting from the EU Action Plan compared with what could be achieved by Member States at national and/or regional levels? Did the EU Action Plan identify the actions which should be best dealt with at EU level?**		
All	JC9.1 The Action Plan has led to results beyond what could be achieved by Member State or regional actions alone.	1. Evidence that discontinuation of actions under the AP may have had negative consequences for the situation on AMR in the EU (reference years 2011-15)	MS and SH surveys, interviews	Added-value survey question synthesis Interviews: A2
		2. Improvements cannot be viewed as a result of MS efforts and initiative alone, i.e. MS took actions as a result of the Action Plan that would otherwise not have taken place, or would have occurred more slowly or to a lesser extent (reference years 2011-15)	MS and SH surveys, interviews	SH-A 60 SH-H 63 MS-A 54, 69 MS-H 57, 72 Interviews: A1
		3. Evidence that there was no detrimental impact on existing MS actions for tackling AMR (i.e. the Action Plan did not disrupt or slow existing activity that was already planned) (reference years 2011-15)	Interviews	Interviews: A1

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 9 (EU Added Value)	**What is the added value resulting from the EU Action Plan compared with what could be achieved by Member States at national and/or regional levels? Did the EU Action Plan identify the actions which should be best dealt with at EU level?**		
All	JC9.2 The Action Plan identifies actions best dealt with at EU level.	1. There is a clear link between the characteristics of the AMR challenge and the need for action at the EU level (reference years 2011-15)	MS and SH surveys, interviews Review and synthesis of information gathered for EQ2 and EQ9 above	SH-A 58, 59 SH-H 61, 62 MS-A 67, 68 MS-H 70, 71 Interviews: R3
		2. Areas for EU action are appropriate in view of EU and national competencies (as assessed in EQ2) (reference years 2011-15)	MS and SH surveys, interviews Review and synthesis of information gathered for EQ2 and EQ9 above	SH-H 61, 62 MS-H 70, 71 SH-A 58, 59 MS-A 67, 68 Interviews: R3

Action	EQ / JC	Indicators	Data sources	Survey / Interview questions
	EQ 10 (EU Added Value)	**Original: To what extent can any observed improvements in the situation on AMR in the EU be associated with the development and implementation of the EU Action Plan?** **Revised: *To what extent can improvements in the situation on AMR (outcomes and other changes identified in the previous EQs) be associated with the development and implementation of the EU Action Plan?***		
All	JC 10.1 There is observable progress or no negative changes in relation to the objectives of the Action Plan.	1. Evidence of effective support being provided for research and innovation related to AMR (reference years 2011-15)	MS and SH surveys, interviews, public consultation, workshops Documents and data gathered in EQ1-8	PC, all MS and SH surveys; questions that identify attribution of improvements with the AP
		2. Evidence of effective support for international collaboration and coordination (reference years 2011-15)	Review and synthesis of data gathered under JC 3.7, 3.8, 3.9	N/a
		3. Evidence of effective improvement in policies and guidance relevant to AMR (prevention of infections and spread of AMR) since 2011	Review and synthesis of data gathered under JC 4.4 and coherence indicators	N/a
		4. Improvements can be associated with the AP / the AP is not linked to any negative outcomes (reference years 2011-15)	Review and synthesis of data gathered under JC 3.2, 3.5, 3.6, 4.3	N/a

ANNEX 4.2: Stakeholder mapping

Note: EU-level interest groups are listed under the stakeholder workshops invitee list (Appendix 5). MS-level interest groups consulted will be those that are members of the EU-level interest groups.

Table 3: EU-level public actors

EU body	Relevant sub-bodies	Area of interest
European Centre for Disease Prevention and Control	Antimicrobial Resistance and Healthcare-Associated Infections (ARHAI) Programme	**Monitoring**
	EARS-Net - European AMR Surveillance Network	
	ESAC-Net	
European Medicines Agency	Committee for Medicinal Products for Human Use	**Human health**
	Infectious Disease Working Party	
	Scientific Advisory Group on Anti-infectives	
	Antimicrobials Working Party	**Animal health**
	Committee for Medicinal Products for Veterinary Use	
European Food Safety Authority	Panel on Biological Hazards (BIOHAZ)	**Food**
	Panel on Additives and Products or Substances used in Animal Feed (FEEDAP)	
	Taskforce on Zoonoses Data Collection	
DG SANTE	Evaluation steering group	**Monitoring**
	Advisory Group on the Food Chain and Animal and Plant Health	**Food Animal health**
	Standing Committee on Plants, Animals, Food and Feed	
	Scientific Committee on Health and Environmental Risks (SCHER)	**Monitoring**
	Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR)	**Monitoring**
	Food and Veterinary Office	**Food Animal health**
DG AGRI	Directorate B - multilateral relations, quality policy	**Food Farming animal health**
	Directorate E - Economic analysis, perspectives and evaluation; communication	

EU body	Relevant sub-bodies	Area of interest
	Directorate C - economics and analysis of agricultual markets	**Farming**
	Directorate H - General aspects of rural development and research	**Research and innovation**
DG GROW	Directorate D - Consumer, Environmental and Health Technologies	**Food**
		Human health
DG RTD	Infectious Diseases and Public Health Unit	**Research and innovation**
Heads of Medicines Agency		**Human health**
Consumers, Health, Agriculture and Food Executive Agency (Chafea)		**Human health**

Table 4: Country-level European public bodies

Country	Organisation	Primary interest	AMR activities
Austria	Austrian Agency for Health and Food Safety	Human health	EMA National Competent Authority; EFSA focal point
	Ministry of Health	Human health	EARS-Net national participating institution; ECDC Coordinating Competent Body
Belgium	Federal Agency for Medicines and Health Products	Human health	EMA National Competent Authority
	Federal Public Service for Health, Food Chain Safety and Environment	Food	EFSA focal point; Hosts Belgian Antibiotic Policy Coordination Committee

Country	Organisation	Primary interest	AMR activities
	Scientific Institute of Public Health	Monitoring	EARS-Net national participating institution; ECDC Coordinating Competent Body
Bulgaria	Bulgarian Drug Agency	Human health	EMA National Competent Authority (human)
	National Veterinary Service	Animal health	EMA National Competent Authority (veterinary)
	National Center of Infectious and Parasitic Diseases	Monitoring	EARS-Net national participating institution; ECDC Coordinating Competent Body
	Bulgarian Food Safety Agency	Food	EFSA focal point
Croatia	Agency for medicinal products and medical devices of Croatia	Human health	EMA National Competent Authority (human)
	Croatian National Institute of Public Health	Human health	ECDC Coordinating Competent Body
	Ministry of Agriculture - Veterinary and food safety directorate	Animal health	EMA National Competent Authority (veterinary)
	Ministry of Health	Human health	EARS-Net national participating institution
	Croatian Food Agency (HAH)	Food	EFSA focal point
Cyprus	Ministry of Health - Pharmaceutical Services	Human health	EMA National Competent Authority (human)
	Veterinary Services, Ministry of Agriculture, Natural Resources and Environment	Animal health	EMA National Competent Authority (veterinary)
	Directorate of Medical and Public	Human health	ECDC Coordinating

Country	Organisation	Primary interest	AMR activities
	Health Services		Competent Body
	Ministry of Health - The State General Laboratory	Monitoring	EFSA focal point
Czech Republic	State Institute for Drug Control	Monitoring	EMA National Competent Authority (human)
	Institute for State Control of Veterinary Biologicals and Medicines	Drugs regulation	EMA National Competent Authority (veterinary)
	National Institute of Public Health	Research and innovatin	EARS-Net national participating institution; ECDC Coordinating Competent Body
	Ministry of Agriculture - Food Safety Department	Food	EFSA focal point
	Veterinary Medicinal Agency	Drugs regulation	
Denmark	Danish Health and Medicines Authority	Drugs regulation	EMA National Competent Authority; ECDC Coordinating Competent Authority
	Ministry of Food, Agriculture and Fisheries	Food	Produced national action plan
	Danish Integrated Antimicrobial Resistance Monitoring and Research Programme (DANMAP)	Monitoring	EARS-Net national participating institution
	National Food Institute	Food	EFSA focal point
	Danish Veterinary and Food Administration	Animal health	
Estonia	State Agency of Medicines	Drugs regulation	EMA National Competent Authority
	Health Board		EARS-Net national participating institution; ECDC Coordinating Competent Body

Country	Organisation	Primary interest	AMR activities
	Ministry of Agriculture - Food Safety Department	Food	EFSA focal point
Finland	Finnish Medicines Agency	Drugs regulation	EMA National Competent Authority
	National Institute for Health and Welfare	Research and innovation	EARS-Net national participating institution; ECDC Coordinating Competent Body
	Finnish Food Safety Authority (Evira)	Food	EFSA focal point
France	National Agency for the Safety of Medicines and Health Products	Drugs regulation	EMA National Competent Authority (human)
	National Veterinary Medicines Agency	Drugs regulation	EMA National Competent Authority (veterinary)
	Ministry of Social Affairs, Health and Women's Rights	Human health	Produced national action plan
	National Institute for Public Health Surveillance	Monitoring	EARS-Net national participating institution; ECDC Coordinating Competent Body
	French National Observatory for the Epidemiology of Bacterial Resistance to Antimicrobials (ONERBA)	Monitoring	EARS-Net national participating institution
	French Agency for Food, Environmental and Occupational Health Safety (ANSES)	Food	EFSA focal point
	Ministry of Agriculture	Farming	
Germany	Health Ministry	Human health	Produced German Antimicrobial Resistance Strategy (2007, being updated 2015)
	Federal Ministry of Food and	Food	Collaborated on

Country	Organisation	Primary interest	AMR activities
	Agriculture		German Antimicrobial Resistance Strategy
	Federal Ministry of Education and Research	Research and innovation	Collaborated on German Antimicrobial Resistance Strategy
	Federal Institute for Drugs and Medical Devices	Drugs regulation	EMA National Competent Authority (human)
	Paul Ehrlich Institute	Drugs regulation	EMA National Competent Authority
	Federal Office of Consumer Protection and Food Safety	Food	EMA National Competent Authority (veterinary)
	Robert Koch Institute	Monitoring	EARS-Net national participating institution; ECDC Coordinating Competent Body
	Federal Institute for Risk Assessment (BfR)	Food	EFSA focal point
Greece	National Organization for Medicines	Drugs regulation	EMA National Competent Authority
	Hellenic Food Authority (EFET)	Food	EFSA focal point
	Hellenic Centre for Disease Control and Prevention	Monitoring	Produced national action plan; ECDC Coordinating Competent Body
Hungary	National Institute of Pharmacy	Drugs regulation	EMA National Competent Authority (human)
	Directorate of Veterinary Medicinal Products	Drugs regulation	EMA National Competent Authority (veterinary)
	National Centre for Epidemiology	Monitoring	EARS-Net national participating institution; ECDC Coordinating Competent Body

Country	Organisation	Primary interest	AMR activities
	National Food Chain Safety Office Directorate for Food Safety Risk Assessment	Food	EFSA focal point
Ireland	Health Products Regulatory Authority	Drugs regulation	Produces guidelines on use of antibiotics
	Health and Safety Executive	Human health	
	National Interdepartmental Antimicrobial Resistance Consultative Committee	Human health	Joint committee between Department of Health and Department of Agriculture, Food and the Marine
	Health Products Regulatory Authority (HPRA)	Drugs regulation	EMA National Competent Authority (human)
	Department of Agriculture, Food and the Marine	Food	EMA National Competent Authority (veterinary)
	Health Protection Surveillance Centre (HPSC)	Monitoring	EARS-Net national participating institution; ECDC Coordinating Competent Body
	Food Safety Authority of Ireland (FSAI)	Food	EFSA focal point
Italy	Italian Medicines Agency	Drugs regulation	EMA National Competent Authority
	Ministry of Health	Human health	ECDC Coordinating Competent Body
	National Institute of Health	Research and innovation	EARS-Net national participating institution; EFSA focal point
Latvia	State Agency of Medicines	Drugs regulation	EMA National Competent Authority (human)
	Food and Veterinary Service	Food	EMA National Competent Authority

Country	Organisation	Primary interest	AMR activities
			(veterinary)
	State Agency Infectology Centre of Latvia	Monitoring	EARS-Net national participating institution
	Centre for Disease Prevention and Control	Monitoring	ECDC Coordinating Competent Body
	Institute of Food Safety, Animal Health and Environment "BIOR"	Food	EFSA focal point
Lithuania	State Medicines Control Agency	Drugs regulation	EMA National Competent Authority (human)
	Ministry of Health	Monitoring	ECDC Coordinating Competent Body
	State Food and Veterinary Service	Food	EMA National Competent Authority (veterinary); EFSA focal point
	National Food and Veterinary Risk Assessment Institute	Food	EMA National Competent Authority (veterinary)
	National Public Health Surveillance Laboratory	Monitoring	EARS-Net national participating institution
	Institute of Hygiene	Monitoring	EARS-Net national participating institution
Luxembourg	Ministry of Health	Human health	EMA National Competent Authority; EFSA focal point; ECDC Coordinating Competent Body
	Ministry of Agriculture	Food	EFSA focal point
	National Health Laboratory	Monitoring	EARS-Net national participating institution
Malta	Medicines Authority	Drugs regulation	EMA National Competent Authority

Country	Organisation	Primary interest	AMR activities
	Malta Competition and Consumer Affairs Authority	Food	EFSA focal point
	Superintendence of Public Health	Monitoring	ECDC Coordinating Competent Body
	Ministry for Energy and Health	Human health	Working on national strategy; produced guidelines on antibiotic use
Netherlands	Medicines Evaluation Board	Drugs regulation	EMA National Competent Authority
	Healthcare Inspectorate	Drugs regulation	EMA National Competent Authority
	National Institute for Public Health and the Environment	Monitoring	EARS-Net national participating institution; ECDC Coordinating Competent Body
	Food and Consumer Product Safety Authority (VWA)	Food	EFSA focal point
	Ministry of Health, Welfare and Sport	Human health	Produced national strategy
	Ministry of Economic Affairs	Human health	Produced national strategy
	Health Council of the Netherlands	Human health	Produced guidelines on AMR
Norway	Norwegian Medicines Agency	Drugs regulation	EMA National Competent Authority
	Norwegian Institute of Public Health	Monitoring	EARS-Net national participating institution
	Norwegian Surveillance System for Healthcare-associated Infections and Antibiotic Use	Monitoring	
	Norwegian Scientific Committee for Food Safety (VKM)	Food	EFSA focal point

Country	Organisation	Primary interest	AMR activities
Poland	Office for Registration of Medicinal Products, Medical Devices and Biocidal Products	Drugs regulation	EMA National Competent Authority
	Main Pharmaceutical Inspectorate	Drugs regulation	EMA National Competent Authority
	National Medicines Institute	Monitoring	EARS-Net national participating institution
	National Institute of Public Health - National Institute of Hygiene	Monitoring	ECDC Coordinating Competent Body
	National Reference Centre for Antimicrobial Resistance and Surveillance	Monitoring	EARS-Net national participating institution
	Chief Sanitary Inspectorate	Food	EFSA focal point
Portugal	National Authority of Medicines and Health Products	Drugs regulation	EMA National Competent Authority (human)
	National Authority for Animal Health	Drugs regulation	EMA National Competent Authority (veterinary)
	National Institute of Health	Monitoring	EARS-Net national participating institution
	Directorate General of Health	Monitoring	ECDC Coordinating Competent Body
	Ministry of Health	Monitoring	EARS-Net national participating institution
	Portuguese Economy and Food Safety Authority (ASAE)	Food	EFSA focal point
Romania	National Medicines Agency	Drugs regulation	EMA National Competent Authority (human)
	Institute for Control of Biological Products and Veterinary Medicines	Drugs regulation	EMA National Competent Authority (veterinary)

Country	Organisation	Primary interest	AMR activities
	National Institute of Research and Development for Microbiology and Immunology	Monitoring	EARS-Net national participating institution
	Institute of Public Health	Monitoring	EARS-Net national participating institution; ECDC Coordinating Competent Body
	National Sanitary Veterinary and Food Safety Authority	Food	EFSA focal point
Slovakia	State Institute for Drug Control	Drugs regulation	EMA National Competent Authority (human)
	Institute for State Control of Veterinary Biologicals and Medicaments	Drugs regulation	EMA National Competent Authority (veterinary)
	National Reference Centre for Antimicrobial Resistance	Monitoring	EARS-Net national participating institution
	Public Health Authority of Slovakia	Monitoring	EARS-Net national participating institution; ECDC Coordinating Competent Body
	Ministry of Agriculture and Rural Development	Food	EFSA focal point
Slovenia	Agency for Medicinal Products and Medical Devices of the Republic of Slovenia	Drugs regulation	EMA National Competent Authority
	National Institute of Public Health	Monitoring	EARS-Net national participating institution; ECDC Coordinating Competent Body
	Ministry of Agriculture Forestry and Food	Food	EFSA focal point
Spain	Spanish Agency for Medicines and Health Products	Drugs regulation	EMA National Competent Authority; collaborated on

Country	Organisation	Primary interest	AMR activities
			national action plan
	Ministry of Health, Social Services and Equality	Human health	Collaborated on national action plan, ECDC Coordinating Competent Body
	Ministry of Agriculture, Food and Environment	Food	Collaborated on national action plan
	Health Institute Carlos lll	Monitoring	EARS-Net national participating institution
	National Centre of Microbiology	Monitoring	EARS-Net national participating institution
	The Spanish Agency for Consumer Affairs, Food Safety and Nutrition (AECOSAN)	Food	EFSA focal point
Sweden	Medical Products Agency	Drugs regulation	EMA National Competent Authority
	Ministry of Health and Social Affairs	Human health	Produced national strategy
	National Board of Health and Welfare	Human health	Involved in update of national strategy
	Swedish Board of Agriculture	Farming	Involved in update of national strategy
	Public Health Agency of Sweden	Human health	Involved in update of national strategy; ECDC Coordinating Competent Body
	National Veterinary Institute	Animal health	Involved in update of national strategy
	National Food Agency	Food	EFSA focal point; involved in update of national strategy
	Swedish strategic programme against antibiotic resistance (Strama.se)	Human health	Strama.se for a long period served as the "one-stop-shop" for antibiotic resistance

Country	Organisation	Primary interest	AMR activities
			(ABR) issues
	Swedish International Development Cooperation Agency (SIDA)	Awareness and education	
	Swedish Institute for Infectious Disease Control	Monitoring	
	Swedish Reference Group for Antibiotics (SRGA)	Drugs regulation	
	Swedish Institute for Communicable Disease Control (Public Health Agency)	Monitoring	EARS-Net national participating institution
	Department of Health	Human health	
	Department for Environment, Food and Rural Affairs	Food	Collaborated on UK Five Year Antimicrobial Resistance Strategy 2013 to 2018
	Veterinary Medicines Directorate	Drugs regulation	EMA National Competent Authority (veterinary)
	Public Health England	Human health	EARS-Net national participating institution;
UK	Interdepartmental High-Level Steering Group on AMR		Implementation of AMR Strategy 2013-2018.
	Medicines and Healthcare Products Regulatory Agency	Drugs regulation	EMA National Competent Authority (human)
	Office for Life Sciences	Research and innovation	Supports work on Accelerated Access to Medicines
	Advisory Committee on Antimicrobial Resistance and Healthcare Associated Infections (ARHAI)	Monitoring	
	All Party Parliamentary Group on	Awareness and	

Country	Organisation	Primary interest	AMR activities
	Antibiotics APPG-A	education	
	Department for Environment, Food and Rural Affairs	Food	
	UK Food Standards Agency (FSA)	Food	EFSA focal point
Switzerland	Swiss Tropical and Public Health Institute	Human health	
	Federal Office of Public Health	Human health	
	Swiss Conference of the Cantonal Ministers of Public Health	Human health	
	Swiss Federal Veterinary Office (SFO)	Animal health	
	Federal Food Safety and Veterinary Office	Animal health	
	Swissmedic - The Swiss Agency for Therapeutic products	Drugs regulation	Commented on EMA advice re animal AM use

Table 5: Global bodies and other relevant organisations

Organisation	Relevant sub-bodies	Area of interest
WHO	WHO Euro	Human health
	Strategic and Technical Advisory Group on AMR	
World Organisation for Animal Health	Sub-Regional Representative in Brussels	Animal health
	Scientific and Technical Department	
FAO (Food and Agriculture Organization of the UN)	Regional Office for Europe and Central Asia	Food, farming
	Veterinary Public Health	Animal health
Codex Alimentarius	FAO/WHO Coordinating Committee for Europe	Food
Transatlantic Taskforce on Antimicrobial Resistance (TAFTAR)		Human and animal health, Research
REaCT	REaCT Europe	Awareness and education

4.2.1 Private stakeholders at the European level

Table Animal health

Organisation	Commission Group Membership	Organisation type	High level of engagement	Registrant for Workshop 1
Animals Angels - Animal Welfare Association	Advisory Group on the Food Chain and Animal and Plant Health			
Association of Veterinary Consultants	Advisory Group on the Food Chain and Animal and Plant Health	Professional association	✓	✓
Eurogroup for Animals		NGO	✓	
European Board of Veterinary Specialisation (EBVS)		Umbrella group of professional associations	✓	
European College of Bovine Health Management		Professional association	✓	
European College of Porcine Health Management		Professional association	✓	
European College of Poultry Veterinary Science		Professional association	✓	
European College of Small Ruminant health Management		Professional association	✓	

Organisation	Commission Group Membership	Organisation type	High level of engagement	Registrant for Workshop 1
European College of Veterinary Pharmacology and Toxicology		Professional association	✓	
European College of Veterinary Public Health		Professional association	✓	
European Federation for Animal Health and Sanitary Security (FESASS)	Advisory Group on the Food Chain and Animal and Plant Health	Animal health network	✓	✓
European Federation of Animal Health (FEDESA)		Industry association	✓	✓
European Feed Manufacturers' Federation (FEFAC)	Advisory Group on the Food Chain and Animal and Plant Health	Industry association	✓	
European Group for Generic Veterinary Products (EGGVP)		Industry association	✓	✓
European Platform for the Responsible Use of Medicines in Animals (EPRUMA)	Advisory Group on the Food Chain and Animal and Plant Health	Multi-stakeholder platform	✓	
European Surveillance on Veterinary Antimicrobial Consumption (ESVAC)			✓	
Federation of Veterinarians of Europe (FVE)	Advisory Group on the Food Chain and Animal and Plant Health	Professional association	✓	✓

Organisation	Commission Group Membership	Organisation type	High level of engagement	Registrant for Workshop 1
IFAH-Europe - International Federation for Animal Health Europe		Professional association	✓	✓

Table Human health

Organisation	Commission Group Membership	Organisation type	High level of engagement	Registrant for Workshop 1
Association of European Cancer Leagues (ECL)	EU Health Forum	NGO		
Council of European Dentists (CED)	EU Health Forum	Professional association	✓	✓
EUCOMED	EU Health Forum	Industry association	✓	
EUROHEALTHNET	EU Health Forum	NGO	✓	
European Association of Hospital Pharmacists		Professional association	✓	✓
European Cancer Patient	EU Health Forum	Patients organisation		

Organisation	Commission Group Membership	Organisation type	High level of engagement	Registrant for Workshop 1
Coalition (ECPC)				
European Confederation of Care Home Organisation (ECHO)	EU Health Forum	Professional association	✓	
European Coordination Committee of the Radiological, Electromedical and healthcare IT Industry (COCIR)	EU Health Forum	Industry association		
European Diagnostic Manufacturers Association (EDMA)	EU Health Forum	Industry association		
European Federation for Complementary and Alternative Medicine (EFCAM)	EU Health Forum	Professional association		
European Federation of Associations of Families of People with mental illness (EUFAMI)	EU Health Forum	Patients organisation		
European Federation of Nurses Associations (EFN)	EU Health Forum	Professional association	✓	✓
European Federation of Psychologists Associations (EFPA)	EU Health Forum	Professional association		

Organisation	Commission Group Membership	Organisation type	High level of engagement	Registrant for Workshop 1
European Federation of Public Services Unions (EPSU)	EU Health Forum	Professional association		
European Generic and Biosimilar Medicines Association (EGA)	EU Health Forum	Industry association	✓	✓
European Health Management Association (EHMA)	EU Health Forum	Multi-stakeholder platform	✓	
European Health Telematics Association (EHTEL)	EU Health Forum	Multi-stakeholder platform		
European Hospital and Healthcare Federation (HOPE)	EU Health Forum	NGO	✓	✓
Europe International Diabetes Federation - European Region (IDF)	EU Health Forum	Patients organisation		
European Medical Association		Professional association	✓	
European Midwives Association (EMA)	EU Health Forum	Professional association		
European Organisation for Rare Diseases (EURORDIS)	EU Health Forum	Patients organisation		

Organisation	Commission Group Membership	Organisation type	High level of engagement	Registrant for Workshop 1
European Patients' Forum (EPF)	EU Health Forum	patients organisation	✓	✓
European Pharma Group		Industry group	✓	
European Public Health Alliance (EPHA)	EU Health Forum	NGO	✓	✓
European Public Health Association (EUPHA)	EU Health Forum	Multi-stakeholder platform	✓	
European Regional and Local Health Authorities Network (EUREGHA)	EU Health Forum	Network of public authorities	✓	
ER-WCPT European Region of the World Confederation for Physical Therapy	EU Health Forum	Professional association		
European Social Insurance Partners Association (ESIP)	EU Health Forum	National social insurance network		
European Union of Medical Specialists (UEMS)	EU Health Forum	Professional association		
European Union of Private Hospitals (UEHP)	EU Health Forum	Professional association		

Organisation	Commission Group Membership	Organisation type	High level of engagement	Registrant for Workshop 1
European Wound Management Association (EWMA)		Professional association	✓	✓
Health First Europe (HFE)		Multi-stakeholder platform	✓	
International Alliance of Patients' Organizations (IAPO)	EU Health Forum	Patients organisation	✓	
International Association of Mutual Benefits Societies (AIM)	EU Health Forum	health insurance body		
International Federation of Medical Students' Associations (IFMSA)	EU Health Forum	Students association		
Medtech Europe		Industry	✓	✓
MHE-SME Mental Health Europe	EU Health Forum	Multi-stakeholder platform		

Organisation	Commission Group Membership	Organisation type	High level of engagement	Registrant for Workshop 1
Pharmaceutical Group of the European Union (PGEU)	EU Health Forum	Professional association	✓	✓
Standing Committee of European Doctors (CPME)	EU Health Forum	Professional association	✓	✓
The European Society for Quality in Healthcare (ESQH)	EU Health Forum	NGO	✓	

Table Food safety and agriculture

Organisation	Commission Group Membership	Organisation type	High level of engagement	Registrant for Workshop 1
Association of Poultry Processors and Poultry Trade in the EU countries (AVEC)	Advisory Group on the Food Chain and Animal and Plant Health	Industry association	✓	✓
Compassion in World Farming		NGO	✓	
COPA (Committee of Professional Agricultural Organisations) and COGECA (General Committee for Agricultural Cooperation in the European Union)	Advisory Group on the Food Chain and Animal and Plant Health	Professional association	✓	✓
Eurocommerce - European Representation of Retail, Wholesale and International Trade	Advisory Group on the Food Chain and Animal and Plant Health	Professional association	✓	✓
EUROCOOP - European Community of Consumer Cooperatives	Advisory Group on the Food Chain and Animal and Plant Health	Network of consumer cooperatives	✓	
European Association of Agricultural Economists		Professional association		
European Conservation Agriculture Federation		Professional association		

Organisation	Commission Group Membership	Organisation type	High level of engagement	Registrant for Workshop 1
European Consumer Organisation (BEUC)	Advisory Group on the Food Chain and Animal and Plant Health; EU Health Forum	Consumers organisation		✓
European Dairy Association (EDA)	Advisory Group on the Food Chain and Animal and Plant Health	Industry association		
European Feed Manufacturers' Federation (FEFAC)	Advisory Group on the Food Chain and Animal and Plant Health	Industry association	✓	
European Live Poultry and Poultry Hatching Egg Association		Industry association	✓	✓
European Livestock and Meat Trades Union (UECBV)		Industry association	✓	✓
European Modern Restaurant Association (EMRA)		Professional association	✓	
European Pet Food Industry (FEDIAF)	Advisory Group on the Food Chain and Animal and Plant Health	Industry association		

Organisation	Commission Group Membership	Organisation type	High level of engagement	Registrant for Workshop 1
FoodDrinkEurope	Advisory Group on the Food Chain and Animal and Plant Health	Industry association		
IFOAM-EU GROUP - International Federation of Organic Agriculture Movements — European Union Regional Group	Advisory Group on the Food Chain and Animal and Plant Health	Multi-stakeholder platform		
Primary Food Processors (PFP)	Advisory Group on the Food Chain and Animal and Plant Health	Industry association		
Slow Food Associazione Internazionale	Advisory Group on the Food Chain and Animal and Plant Health	NGO		

Table Research and innovation

Organisation	Commission Group Membership	Organisation type	High level of engagement	Registrant for Workshop 1
BEAM alliance		Industry association (European SMEs active in AMR)	✓	
EuropaBio - The European Association for bio-industries	Advisory Group on the Food Chain and Animal and Plant Health; EU Health Forum	Industry association		
European academies Science Advisory Council (EASAC)		Research organisation	✓	✓
European Association of Craft, Small and Medium Enterprises (UEAPME)	Advisory Group on the Food Chain and Animal and Plant Health	Professional association		

European federation of animal science		Multi-stakeholder platform	✓	
European Federation of Pharmaceutical Industries and Associations (EFPIA)	EU Health Forum	Industry association	✓	
European Society of Clinical Microbiology and Infectious Diseases (ESCMID)		Scientists association	✓	
Federation of European Microbiological Societies (FEMS)		Scientists association	✓	✓
Global Allergy and Asthma European Network (GA2LEN)	EU Health Forum	Research organisations network		
Innovative Medicines Initiatives (IMI)		Public-private research initiative	✓	
League of European Research Universities		Research organisation		
Science Europe		Research organisation	✓	

Table Awareness and Education

Organisation	Membership	Organisation type	High level of engagement
Active Citizenship Network-Cittadinanzattiva (ACN)	EU Health Forum	Civic organisation	
Aids Action Europe (AAE)	EU Health Forum	NGO	
Associations of Schools of Public Health in the EU Region (ASPHER)	EU Health Forum	Professional association	
European Heart Network (EHN)	EU Health Forum	NGO	
European Network for Smoking Prevention (ENSP)	EU Health Forum	NGO	
European Older People's Platform (AGE)	EU Health Forum	Citizens association	
European Youth Forum (YFJ)	EU Health Forum	Citizens association	
International Union for Health Promotion and Education (IUHPE)	EU Health Forum	Professional association	
Smoke Free Partnership (SFP)	EU Health Forum	NGO	
The European Alcohol Policy Alliance (EUROCARE)	EU Health Forum	NGO	

4.2.2 Private stakeholders at the Member State level

Table Animal health

Organisation	Country	Membership	Organisation type
Österreichische Tierärztekammer	Austria	Federation of Veterinarians of Europe	Professional association
Union Professionnelle Vétérinaire (UPV)	Belgium	Federation of Veterinarians of Europe	Professional association
Bulgarian Veterinary Union (BVU)	Bulgaria	Federation of Veterinarians of Europe	Professional association
Animal Friends	Croatia	Eurogroup for Animals	Charity
Croatian Veterinary Chamber/Hrvatska Veterinarska Komora	Croatia	Federation of Veterinarians of Europe	Professional association
Pancyprian Veterinary Association	Cyprus	Federation of Veterinarians of Europe	Professional association
Danish Veterinary Association	Denmartk	Federation of Veterinarians of Europe	Professional association
Ordre des Vétérinaires Conseil Supérieur		Federation of Veterinarians of Europe	Professional association
Protection Mondiale des Animaux de Ferme – WELFARM	France	Eurogroup for Animals	Charity

German Veterinary Federation	Germany	Federation of Veterinarians of Europe	Professional association
Animal Welfare Foundation	Germany	Eurogroup for Animals	Charity
Animal Action	Greece	Eurogroup for Animals	Charity
Hellenic Veterinary Association	Greece	Federation of Veterinarians of Europe	Professional association
Association des Médecins Vétérinaires du Grand-Duché de Luxembourg	Luxembourg	Federation of Veterinarians of Europe	Professional association
LNPA – Ligue nationale pour la protection des animaux	Luxembourg	Eurogroup for Animals	Charity
Animal Guardians Malta	Malta	Eurogroup for Animals	Charity
The Royal Veterinary Association of the Netherlands	The Netherlands	Federation of Veterinarians of Europe	Professional association
Otwarte Klatki	Poland	Eurogroup for Animals	Charity
Ordem dos Médicos Veterinários	Portugal	Federation of Veterinarians of Europe	Professional association
Consejo General de Colegios Veterinarios de España (CGCVE)	Spain	Federation of Veterinarians of Europe	Professional association
Sveriges Veterinärförbund (SVF)	Sweden	Federation of Veterinarians of Europe	Professional association
British Veterinary Association	UK	Federation of Veterinarians of Europe	Professional association

The British Small Animal Veterinary Association (BSAVA)	UK	-	Professional association
RSPCA - Royal Society for the Prevention of Cruelty to Animals	UK	Eurogroup for Animals	Charity

Table Human health

Organisation	Country	Membership	Organisation type
Austrian Health Promotion Foundation (FGOE)	Austria	Eurohealthnet	National association
ÖGPH Gesellschaftssekretariat	Austria	European Public Health Association (EUPHA)	Professional association
Belgian Association of Public Health	Belgium	European Public Health Association (EUPHA)	Scientific organisation
Bulgarian Public Health Association	Bulgaria	European Public Health Association (EUPHA)	Professional association
Croatian Public Health Association	Croatia	European Public Health Association (EUPHA)	Professional association
Czech Society of Public Health and Management of Health Services	Czech Republic	European Public Health Association (EUPHA)	Professional association
Danish Society of Public Health	Denmark	European Public Health Association (EUPHA)	Professional association
Health Promotion Union of Estonia	Estonia	European Public Health Association (EUPHA)	Professional association

Society for Social Medicine in Finland	Finland	European Public Health Association (EUPHA)	Professional association
National Institute for Prevention and Health Education (INPES)	France	Eurohealthnet	National institute
Société Française de Santé Publique	France	European Public Health Association (EUPHA)	Professional association
German Association for Public Health	Germany	European Public Health Association (EUPHA)	Professional association
National Institute for Health Development (NEFI)	Hungary	Eurohealthnet	National institute
Institute of Public Health in Ireland (IPH)	Ireland	Eurohealthnet	National institute
Federsanita ANCI	Italy	Eurohealthnet	National association
National Institute for Public Health and the Environment (RIVM)	The Netherlands	Eurohealthnet	National institute
National Institute of Public Health - National Institute of Hygiene	Poland	Eurohealthnet	National institute
National Institute of Health Doutor Ricardo Jorge	Portugal	Eurohealthnet	National institute
Ministry of Health, Social Services and Equality	Spain	Eurohealthnet	Government department
SAVEZ - Slovak Public Health Association	Slovakia	European Public Health Association (EUPHA)	Professional association

National Institute of Public Health (NIJZ)	Slovenia	Eurohealthnet	National institute
Slovenian Medical Society - Slovenian Preventive Medicine Society	Slovenia	European Public Health Association (EUPHA)	Professional association
Public Health Agency of Sweden	Sweden	Eurohealthnet	National institute
Swedish Association of Social Medicine	Sweden	European Public Health Association (EUPHA)	Professional association
Antibiotic action	UK		NGO
The British Society for Antimicrobial Chemotherapy (BSAC)	UK		Professional and scientists association
Association of the British Pharmaceutical Industry	UK		Industry association

Table Food safety and agriculture

Organisation	Country	Membership	Organisation type
Austrian Chamber of Agriculture	Austria	COPA-COGECA	Professional association
Association Professionnelle des Fabricants d'Aliments Composés pour Animaux	Belgium	European Feed Manufacturers' Federation (FEFAC)	Industry association
AVEVE/Boerenbond - BB (Belgian Farmers' Union)	Belgium	COPA-COGECA	Professional association
Test-Achats	Belgium	European Consumer Organisation (BEUC)	Consumers association
Fédération Wallonne de l'Agriculture (FWA)	Belgium	COPA-COGECA	Professional association
Bulgarian national association active consumers - BNAAC	Bulgaria	COPA-COGECA	Consumers association
Croatian Chamber of Agriculture	Croatia	COPA-COGECA	Professional association
Croatian Feed Industry Association	Croatia	European Feed Manufacturers' Federation (FEFAC)	Industry association
CAFM Cyprus Association of Feed Manufacturers	Cyprus	European Feed Manufacturers' Federation (FEFAC)	Industry association

Panagrotikos Farmers' Union (PANAGROTIKOS)	Cyprus	COPA-COGECA	Professional association
Pancyprian farmers union	Cyprus	COPA-COGECA	Professional association
Agricultural Association of the Czech Republic	Czech Republic	COPA-COGECA	Professional association
DAKOFO	Denmark	European Feed Manufacturers' Federation (FEFAC)	Industry association
Estonian consumers union - Eesti tarbijakaitse LIIT	Estonia	European Consumer Organisation (BEUC)	Consumers association
UFC-Que choisir	France	European Consumer Organisation (BEUC)	Consumers association
The German Farmers' Association	Germany	COPA-COGECA	Professional association
The German Poultry Association	Germany	Association of Poultry Processors and Poultry Trade in the EU countries (AVEC)	Industry association
Consumers' Protection Centre – KEPKA	Greece	European Consumer Organisation (BEUC)	Consumers association
Panhellenic Confederation of Agricultural Co-operative Unions (PASEGES)	Greece	COPA-COGECA	Professional association
Irish Farmer's Association (IFA)	Ireland	COPA-COGECA	Professional association
Irish Grain & Feed Association	Ireland	European Feed Manufacturers' Federation (FEFAC)	Industry association

Altroconsumo	Italy	European Consumer Organisation (BEUC)	Consumers association
Confederazione Generale dell'Agricoltura Italiana (CONFAGRICOLTURA)	Italy	COPA-COGECA	Professional association
Latvian Agricultural Organization Cooperation Council - LAOCC (LOSP)	Latvia	COPA-COGECA	Professional association
Chamber of Agriculture of the Republic of Lithuania	Lithuania	COPA-COGECA	Professional association
Lithuanian Grain Processors Association	Lithuania	European Feed Manufacturers' Federation (FEFAC)	Industry association
Centrale Paysanne Luxembourgeoise - CPL (Luxemburg Farmers' Union)	Luxembourg	COPA-COGECA	Professional association
Union Luxembourgeoise des Consommateurs - ULC	Luxembourg	European Consumer Organisation (BEUC)	Consumers association
Land- en Tuinbouw Organisatie Nederland - LTO - Nederland	The Netherlands	COPA-COGECA	Professional association
Association of Polish Consumers – SKP	Poland	European Consumer Organisation (BEUC)	Consumers association
Federation of Agricultural Producers Union	Poland	COPA-COGECA	Professional association
Associaçao Portuguesa dos Industriais de Alimentos Compostos para Animais	Portugal	European Feed Manufacturers' Federation (FEFAC)	Industry association

Confederaçao dos Agricultores de Portugal (CAP)	Portugal	COPA-COGECA	Professional association
Association for consumers' protection – APC	Romania	European Consumer Organisation (BEUC)	Consumers association
Slovak Agricultural and Food Chamber	Slovakia	COPA-COGECA	Professional association
The Association of Feed Producers, Warehouse-keepers and Trade Companies	Slovakia	European Feed Manufacturers' Federation (FEFAC)	Industry association
Chamber for Agriculture and Forestry of Slovenia	Slovenia	COPA-COGECA	Professional association
Asociacion Agraria - Jovenes Agricultores (ASAJA)	Spain	COPA-COGECA	Professional association
Confederacion Espanola de Fabricantes de Alimentos Compuestos para Animales	Spain	European Feed Manufacturers' Federation (FEFAC)	Industry association
Föreningen Foder och Spanmal	Sweden	European Feed Manufacturers' Federation (FEFAC)	Industry association
Lantbrukarnas Riksförbund (LRF)	Sweden	COPA-COGECA	Professional association
Soil Association	UK		Charity
Red Tractor Quality Assurance scheme	UK		Non-for-profit company

National Farmers' Union of England and Wales (NFU)	UK	COPA-COGECA	Professional association
UK Advisory Committee on the Microbiological Safety of Food	UK		Public authority
British Poultry Council	UK	Association of Poultry Processors and Poultry Trade in the EU countries (AVEC)	Industry association
Responsible use of medicines in agriculture alliance (RUMA)	UK		

Table Research and innovation

Organisation	Country	Membership	Organisation type
FWF - Austrian Science Fund	Austria	Science Europe	National research agency
F.R.S – FNRS – Fund for Scientific Research	Belgium	Science Europe	National research agency
FWO – Fonds Welend	Belgium	Science Europe	National research agency
KU Leuven	Belgium	League of European Research Universities	Higher education institution
The Bulgarian Academy of Sciences	Bulgaria	Science Europe	National research agency

GACR - Czech Science Foundation	Czech Republic	Science Europe	National research agency
DG - Danish National Research Foundation	Denmark	Science Europe	National research agency
ETAG - Estonian Research Council	Estonia	Science Europe	National research agency
AKA - Academy of Finland	Finland	Science Europe	National research agency
University of Helsinki	Finland	League of European Research Universities	Higher education institution
ANR - Agence Nationale de la Recherche/French National Research Agency	France	Science Europe	Public research agency
CNRS - Centre Nationale de la Recherche Scientifique/National Centre for Scientific Research	France	Science Europe	Public research agency
Institut Pasteur	France		Research institute
DFG - German Research Foundation	Germany	Science Europe	National research agency
German Society of Medical Sociology	Germany		Professional association
OTKA - Hungarian Scientific Research Fund	Hungary	Science Europe	National research agency

HRB - Health Research Board	Ireland	Science Europe	National research agency
CNR - National Research Council	Italy	Science Europe	National research agency
Italian Society of Hygiene, Preventive Medicine and Public Health	Italy		Scientific organisation
Italian Federation of Public Health Scientific Societies (FISPEOS)	Italy		Professional association
LZP - Latvian Science Council	Latvia	Science Europe	National research agency
LMT - Research Council of Lithuania	Lithuania	Science Europe	National research agency
University of Milan	Italy	League of European Research Universities	Higher education institution
NWO - Netherlands Organisation for Scientific Research	The Netherlands	Science Europe	National research agency
NCN - National Science Centre	Poland	Science Europe	National research agency
APVV - Slovak Research and Development Agency	Slovakia	Science Europe	National research agency
ARRS - Slovenian Research Agency	Slovenia	Science Europe	National research agency
CSIC - Spanish National Research Council	Spain	Science Europe	National research agency

VR - Swedish Research Council	Sweden	Science Europe	National research agency
MRC - Medical Research Council	UK	Science Europe	National research agency

Table Selected individual researchers and AMR experts

Name	Position	Organisation	Organisation type	AMR engagement activities
Hans Peder Graversen	Medical Director, Head of Department	AC-fuldmægtig		Commented on the EMA's 'scientific advice on the impact on public health and animal health of the use of antibiotics in animals'
Kevin Outterson	Professor of Health Law, Bioethics & Human Rights	Boston University	University	- Specialist in global pharmaceutical markets, particularly in antibiotics and other antimicrobials - Leads an interdisciplinary project on the legal ecology of antimicrobial resistance - Faculty affiliate at the Harvard Center for Communicable Disease Dynamics and an appointed member of the Antimicrobial Resistance Working Group at the CDC.
Charles Clift	Senior Consulting Fellow, Centre on Global Health Security	Chatham House, The Royal Institute of International Affairs	Research center	Researcher on antimicrobial resistance.
David Heymann	Head and Senior Fellow Centre on Global Health Security	Chatham House, The Royal Institute of International Affairs	Research center	- Professor of Infectious Disease Epidemiology, London School of Hygiene and Tropical Medicine - Research on antimicrobial resistance
Matthias Bonk	Consultant		Independent	Report on the 'Response to the Antimicrobial ResistanceThreat' published by the Federal Office of Public Health, Switzerland, 2015

Annette Cleveland Nielsen	Chief Veterinary Advisor	Danish Veterinary and Food Administration	Public agency	- Presented at several conferences on antimicrobial resistance; - Involved in the National Antibiotic Council and the Councils strategy and planning group - Participated in the Danish EU presidency on antimicrobial resistance - DANMAP data on antibiotic consumption in production animals

4.2.3 Third Countries and international organisations

Table Third country public authorities and private organisations

Organisation	Country	Membership	Area of interest	Organisation type
Den Norske Veterinærforening (DNV)	Norway	Federation of Veterinarians of Europe	Animal health	Professional association
Norwegian Directorate of Health	Norway	Eurohealthnet	Human health	Public authority
Norwegian institute of Public Health	Norway		Human health	National public agency
Norwegian Medical association	Norway		Human health	Professional association
NORM - Norwegian Surveillance System for Antimicrobial Drug Resistance	Norway		Monitoring	National public agency
RAVN - Resistance Surveillance of Virus in Norway	Norway		Monitoring	National public agency
Animalfree Research	Switzerland		Animal health	Charity
Swiss Society for Microbiology (SSM)	Switzerland		Research and innovation	Professional association
Swiss National Science Foundation (SNF)	Switzerland		Research and innovation	Research organisation

Swiss Centre for Antibiotic resistance	Switzerland	Monitoring	
Swiss Society of Public Health Administration and Hospital Pharmacists	Switzerland	Human health	Professional association
Swiss Society of Pharmacists	Switzerland	Human health	Professional association
Swiss Society for Infectious Diseases	Switzerland	Awareness and education	NGO
Alliance for the prudent use of antibiotics	United States	Human health	NGO
Food Animal Concern Trust	United States	Animal health	NGO
Centre for Drugs evaluation and research	United States	Human health	National research agency
National Institute of Food and Agriculture (NIFA)	United States	Food and farming	National public agency
National Institutes of Health (NIH)	United States	Human health	Public research funder
United States Department of Agriculture	United States	Food and farming	Public authority
U.S. Centers for Disease Control and Prevention (CDC)	United States	Monitoring	National public agency
Coalition for animal health	United States	Food and farming, Animal health	Industry and professional association (umbrella group)

Table International bodies and organisations

Organisation	Relevant sub-bodies	Area of interest	Organisation type	High level of engagement
Central Asian and Eastern European Surveillance of Antimicrobial Resistance (CAESAR)		Human health	International organisation	✓
Codex Alimentarius	FAO/WHO Coordinating Committee for Europe	Food safety	International organisation	✓
Food and Agriculture Organization of the United Nations (FAO)	Regional Office for Europe and Central Asia Veterinary Public Health	Food safety and farming Animal health	International organisation	✓
Organisation for Economic Cooperation and Development (OECD)	Directorate for Employment, Labour & Social Affairs (ELS)	Human health Farming and food	International organisation	✓
Transatlantic Taskforce on Antimicrobial Resistance (TAFTAR)		Human health	International organisation	✓
World Health Organisation (WHO)	WHO Europe Regional Office Strategic and Technical Advisory Group on AMR	Human health	International organisation	✓
World Organisation for Animal Health (OIE)	Sub-Regional Representative in Brussels; Scientific and Technical Departement	Animal health	International organisation	✓
Alliance for the prudent use of antibiotics		Human health	NGO	
Compassion in World Farming		Animal health	NGO	✓

Organisation	Relevant sub-bodies	Area of interest	Organisation type	High level of engagement
Drugs for Neglected Diseases Initiative		Research & innovation	Research organisation	
International Federation of Agricultural Producers (IFAP),		Farming	Professional association	
International Poultry Council (IPC)		Food safety and farming	Industry association	✓
International Union of Microbiological Societies		Research & innovation	Scientific association	✓
'Medecins sans Frontieres' Access Campaign		Awareness and education	NGO	
ReAct	ReAct Europe ReAct North America	Awareness and education	NGO	✓
World Federation of Animal Health Industry (COMISA).		Animal health	Industry association	✓
World's Poultry Science Association		Research & innovation	Professional association	✓
World Veterinary Association (WVA)		Animal health	Professional association	✓
World Veterinary Poultry Association		Animal health	Professional association	✓

ANNEX 4.3: List of interviewees for the Evaluation of the Action Plan against the rising threats from antimicrobial resistance

Group (total)		Interviewee name	Country	Affiliation	Comment
EU DGs/ Agencies (8)		Koen van Dyck	BE	DG SANTE	
		Charles Price	LU	DG SANTE	
		Horacio Cappellaro, Gebhard Seiwald	BE	DG AGRI	Both interviewed together
		Arjon van Hengel	BE	DG RTD	
		Interviewee		ECDC	
		David Mackay	UK	EMA	
		Lina Cavaco	DK	EU Reference Lab for AMR	Written response
International bodies (4)		Michele Cecchini	FR	OECD	
		Juan Lubroth	IT	FAO	
		Jordi Torren	UK (EU)	EMA/TATFAR	
		Danilo Lo Fo Wong		WHO EURO	
Independent and third country experts (5)		Otto Cars	SE	REACT network	
		Richard Bax	UK	Transcrip Partners (expertise in infectious disease, biotech industry)	
		John-Arne Rottingen	NO	Norway: public health representative	
		Katharina Stärk	CH	Safoso (Consultant, veterinarian)	
		Manica Balasegaram	CH	Médecins Sans Frontières	
Research and innovation stakeholders (7)		James Anderson	UK	GSK	
		Virginia Acha	UK	Association of the British Pharmaceutical Industry	
		Brendan Barnes, Elizabeth Kuiper	BE	Efpia	Both interviewed together
		Marc Lemmonier	FR	Antabio, BEAM Alliance	SME
		Stephan Harbarth	CH	Hôpitaux Universitaires de Genève	FP7 SATURN project
		Anne Horan	UK	Royal Society of Chemistry	Written response
Case studies (13)	3: TARGET toolkit	Elizabeth Beech	UK	Nursing directorate, NHS England	
	4: ESVAC	Nico Bondt,	NL	Wageningen University and Research Centre,	Written responses
		Marian Bos,	NL	Utrecht University,	
		Dick Heederik,	NL	Utrecht University,	

	Roswitha Merle	DE	Free University of Berlin	
5: Salmonella	Interviewee 1	SE	Vet, industrial farming	
	Interviewee 2	UK	Animal welfare organisation	
	Interviewee 3	--	International health agency	
6: French awareness campaigns	Olivier Debaere	FR	French Min. of Agriculture	
	Gerard Moulin	FR	Anses - Agence nationale du médicament vétérinaire	
	Jean-Michel Azanowsky	FR	French Ministry of Health	Interviewees 3 and 4 were interviewed together.
	Jean-Baptiste Rouffet	FR	French Ministry of Health	
7: Aquaculture	Interviewee	NO	Norwegian Veterinary Institute	

Note 1: Unless otherwise indicated, all interviews were conducted by telephone.

Note 2: Names have been redacted in cases where interviewees did not consent to their name being shared. Where names appear, the interviewees consented to their name being shared *only* within the RAND Europe study team and the unit organising the consultation inside the DG, as per the following text (used in the interview privacy statement):

ANNEX 5 -- RATIO OF THE CONSUMPTION OF BROAD-SPECTRUM TO THE CONSUMPTION OF NARROW-SPECTRUM ANTIBACTERIALS (ENACOMPASSING PENICILLINS, CEPHALOSPORINS AND MACROLIDES)

Country	2011	2012	2013	2014
Austria	7.79	8.09	8.25	8.17
Belgium	64.32	79.17	80.12	79.92
Bulgaria	8.01	10.07	11.83	17.7
Croatia	6.05	8.15	7.89	8.75
Cyprus**	29.74	28.45	36.87	37.87
Czech Republic	4.03	5.43	4.79	5.11
Denmark	0.53	0.59	0.62	0.63
Estonia	9.98	10.54	11.6	11.9
Finland	0.88	0.82	0.73	0.73
France	46.03	50.63	47.64	40.21
Germany	5.01	4.94	5.66	5.62
Greece	133.58	258.32	318.32	606.81
Hungary	19.66	21.71	25.74	37.55
Iceland**	1.76	1.68	2.08	1.99
Ireland	6.26	6.46	5.68	5.07
Italy	140.15	158.44	171.64	184.26
Latvia	7.66	11.5	11.75	12.35
Lithuania	4.72	10.54	11.69	10.49
Luxembourg	38.23	47.38	53.42	52.42
Malta	142.7	162.07	153.27	180.36
Netherlands	7.4	7.82	7.84	7.77
Norway	0.21	0.23	0.23	0.21
Poland	57.63	36.93	34.87	29.02
Portugal	32.26	34.85	34.26	37.88
Romania**	6.45	8.39	11.03	11.88

Slovakia	8.77	8.85	9.84	10.33
Slovenia	3.36	3.22	3.54	3.96
Spain	63.1	65.69	74.68	76.13
Sweden	0.17	0.17	0.2	0.37
United Kingdom	1.15	1.35	1.5	1.64

Note: Table shows the ratio of the consumption of broad-spectrum (J01(CR+DC+DD+(F-FA01))) to the consumption of narrow-spectrum penicillins, cephalosporins and macrolides (J01(CE+DB+FA01)).
* Denominator for relative consumption;
** Country provided only total care data
Source: ESAC database http://ecdc.europa.eu/en/healthtopics/antimicrobial_resistance/esac-net-database