



Berne, July 2018

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## **Relevance of Antimicrobial Stewardship planning for the Swiss StAR strategy - Report on National Action Plans for 10 comparator countries**

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## Background

The Swiss Antibiotic Resistance Strategy StAR was adopted by the Federal Council in November 2015, and describes how Switzerland will address the development and emergence of antimicrobial resistance. StAR takes a one-health approach based on a broad network of politicians, experts and other stakeholders. The strategy has a matrix design with activities in four pillars (Human, Animal, Agriculture and Environment) and across eight fields of activity. It specifies that as part of the field of activity “general conditions” the introduction of comprehensive targeted programmes for the appropriate use of antibiotics will be considered, in particular in primary and secondary healthcare settings.

In late 2016, the National Center for Infection Control Swissnoso was tasked with developing an implementation approach for the StAR strategy relevant to human health and focusing primarily on the hospital sector. As part of this mandate, in 2017 Swissnoso proposed to aggregate data on Antimicrobial Stewardship (AS) planning from several comparator countries to assess the relevance and applicability of any identified approaches and activities to the Swiss context.

## Methods

Comparator countries were selected based on the “Mirror, Mirror 2017” report published in July 2017. This report is published by The Commonwealth Fund to compare the healthcare system performance of the United States with that of ten other high-income countries (Box 1). As the analysis relies to a large degree on publicly accessible data through the reports of the Organization for Economic Cooperation and Development (OECD), the European Observatory on Health Systems and Policies, and the World Health Organization (WHO), it was decided to opt for inclusion of the same countries for this analysis.

### Box 1: Countries included in “The Commonwealth Fund Mirror, Mirror 2017 report”

1. Australia (WHO Western Pacific Region)
2. Canada (WHO Region of the Americas)
3. France (WHO European Region, Member of the European Centre for Disease Prevention and Control ECDC)
4. Germany (WHO European Region, Member of ECDC)
5. Netherlands (WHO European Region, Member of ECDC)
6. New Zealand (WHO Western Pacific Region)
7. Norway (WHO European Region)
8. Sweden (WHO European Region, Member of ECDC)
9. Switzerland (WHO European Region)
10. United Kingdom (WHO European Region, Member of ECDC)
11. United States (WHO Region of the Americas)

Information on AS planning for the above comparator countries was extract from the WHO library of National Action Plans (NAPs) on antimicrobial resistance. The library was searched in the third quarter of 2017 and the most recent available NAP (with relevant appendices) downloaded for the countries of interest.

For each NAP the following data were recorded systematically: country, title, authorship, month and year of

publication and targeted timeframe. Due to the variability in structure of the NAPs, relevant data on AS planning were extracted in a narrative form and are reproduced in the same way. For each country, a short assessment is included on the relevance of the identified information for the Swiss context.

Additional background information on various healthcare indicators was obtained from OECD Health Statistics 2017 database. Where relevant, direct reference is provided to the International Health Care System Profiles compiled by The Commonwealth Fund for each of the countries of interest. These profiles include information on the structure of the healthcare systems, key demographics and health risk factors as well as health system statistics and financing.

## Results

A NAP was identified for each of the comparator countries of interest (Table 2).

Country	Title	Date of publication	Time frame
Australia	Responding to the threat of antimicrobial resistance	June 2015	2015-2019
Canada	Antimicrobial Resistance and Use in Canada	October 2014	ns
France	Plan national d'alerte sur les antibiotiques	November 2011	2011-2016
Germany	DART 2020	May 2015	ns (2020)
Netherlands	Approach to antibiotic resistance	June 2015	2015-2019
New Zealand	New Zealand Antimicrobial Resistance Action Plan	August 2017	ns (5 years)
Norway	National Strategy against Antibiotic Resistance	June 2015	2015-2020
Sweden	Swedish strategy to combat antibiotic resistance	April 2016	ns (2020)
United Kingdom	UK Five Year Antimicrobial Resistance Strategy	September 2013	2013-2018
United States	National Action Plan for Combating Antibiotic-Resistant Bacteria	March 2015	ns (2020)

ns=not specified

Overall, most NAPs targeted a time span of about 5 years with a time frame up to 2019 or 2020 in most cases.

Planning of AS was specifically mentioned only in the NAPs from English-speaking countries (Australia, Canada, New Zealand, United Kingdom and United States). Three countries explicitly described AS as mandatory for hospitals (Australia, Netherlands and Norway), with an additional four countries indicating that certain aspects of AS would be considered mandatory (France, Germany, Sweden, United States).



Specific targets to be achieved through implementing activities described in the NAPs and relevant to the hospital sector were listed by five countries (Table 2).

Country	Specific target(s)
France	25 % reduction of antibiotic consumption over 5 years
Netherlands	50% or greater reduction of incorrect use of antibiotics across entire healthcare chain over 5 years
Norway	30% reduction of antibiotic use in DDD/1000 inhabitants/day compared to 2012 Reduction of antibiotic prescriptions from 450/1000/y to 250/1000/y on average 20% reduction of prescriptions for RTI in DDD/1000 inhabitants/day compared to 2012 Be one of the bottom 3 European AB using countries
United Kingdom	Provide estimates of total antibiotic consumption and total carbapenem consumption per annum*
United States	50% reduction of the incidence of overall <i>C. difficile</i> infection compared to 2011 20% reduction of inappropriate antibiotic use in inpatient settings by 2020

\*A specification of secondary care quality measures for antimicrobial prescribing was published in a document separate to the NAP for the United Kingdom: 1% per annum reduction of total antimicrobial consumption for 5 years from 2014 and a 20-25% reduction of total carbapenem consumption to previous levels of 5 years ago from 2014.

## Australia

Title	Responding of the threat of antimicrobial resistance. Australia's First National Antimicrobial Resistance Strategy 2015-2019
Authorship	Australian Government, Department of Health, Department of Agriculture
Date of publication	June 2015
Time frame	2015-2019

The overall goal of the NAP is to minimize development and spread of antimicrobial resistance and to ensure the continued availability of effective treatment. AS planning is represented by the specific objective "Implement effective antimicrobial stewardship practices across human health and animal care settings to ensure the appropriate and judicious prescribing, dispensing and administering of antimicrobials".

Current AS activities are described as patchy across settings in which antibiotics may be used and inherently reliant on available evidence-based guidelines and resources.

Hospital-based AS was integrated into the national quality management system for healthcare in 2013, and further roll-out is envisaged as a mandatory requirement for inpatient and surgical daycare settings.

Five key areas are described:

1) Availability of tailored evidence-based antibiotic prescribing guidelines

This area is to include

- regular review of antimicrobials identified as highly important in human healthcare, and therefore important targets of AS;
- nationally applicable guidance on selection, dosing, duration, delivery (route) and timing of initiation through guidelines and formulary;
- analysis of barriers to use of existing resources for better use of antimicrobials.

2) Establishment of evidence-based, best-practice and nationally consistent approaches to AS

This area is to include

- establishment of a coordinating national antimicrobial stewardship advisory committee to support national quality assurance;
- establishment of a national antimicrobial stewardship network (provider representation);
- resource development to support hospitals on AS programmes and their implementation within the Australian context;
- implementation strategy for non-hospital settings.

3) Development of resources to support AS implementation mainly focusing on available evidence base and required structures

4) Integration of AS into existing accreditation and quality assurance programmes

This area is to include

- mandatory requirement for hospital AS development and implementation including monitoring of antibiotic use;
- focus on AS effectiveness evaluation and improvement;
- focus on right drug, dose, delivery (route), duration and timing;
- voluntary implementation of AS in primary and long-term care and non-human healthcare as well as livestock industries.

#### 5) Strengthening of existing measures and infrastructure

This area is to include

- availability of relevant IT infrastructure;
- identification and implementation of evidence-based decision support tools;
- incentives to reduce unnecessary and unnecessarily untargeted antimicrobial use;
- showcasing of best practice examples;
- review of regulations governing access to antibiotics and exact dispensing.

Overall, the NAP stresses the importance of a nationally consistent approach building on leadership and management support, and including the central role that IT measures and resources play in enabling implementation of AS in the inpatient and wider settings.

#### Background information

Indicator	Year	Raw data
Total population (in 1000 persons)	2016	24127
Number of live births (in 1000s)	2014	230
Births, crude rate/1000 population	2014	12.8
Life expectancy at birth (in years)	2015	82.5
Life expectancy at 65 (men, in years)	2015	19.5
Infant mortality (deaths/1000 live births)	2015	3.2
Maternal mortality (deaths/100'000 live births)	2015	2.6
Hospitals (number)	2014	1322
Hospitals (per million population)	2014	56
Hospital beds (number)	2014	89019

## Canada

<b>Title</b>	<b>Antimicrobial Resistance and Use in Canada A Federal Framework for Action</b>
<b>Authorship</b>	Government of Canada, Public Health Agency of Canada
<b>Date of publication</b>	October 2014
<b>Time frame</b>	Not specified

The overall goal of the NAP is to protect Canadians from the health risks related to antimicrobial resistance, and this is to be achieved by focusing on three pillars: Surveillance, Stewardship and Innovation. Pillar two is entirely focused on conserving the effectiveness of existing treatments through infection prevention and control guidelines, education and awareness, regulations, and oversight. The stewardship pillar encompasses the whole spectrum of implementation means from regulations on antimicrobial use through guidance and development and dissemination of information.

Two specific actions are being proposed with the second of these focusing on the veterinary sector. For human medicine, appropriate use of antimicrobials is to be enforced and promoted. To achieve this, existing guidelines, educational initiatives and tools and resources will be improved and expanded. This is to include industry-sponsored or industry-linked initiatives. Particular emphasis is laid on the collaboration with professional organizations to develop and support tools and approaches towards more responsible antimicrobial use.

Overall, the integration of infection prevention and control with AS is stressed. This will encompass regulations to generate consistency in practices which are critical or of high importance to human health, safe-guarding and opening of learning opportunities by federal government departments and other partners, and public awareness activities including widespread hand hygiene promotion.

Specific AS activities within the inpatient sector are not outlined in the NAP.

### Background information

Indicator	Year	Raw data
Total population (in 1000 persons)	2016	36286
Number of live births (in 1000s)	2014	389
Births, crude rate/1000 population	2014	10.9
Life expectancy at birth (in years)	2013	81.7
Life expectancy at 65 (men, in years)	2013	19.0
Infant mortality (deaths/1000 live births)	2012	4.8
Maternal mortality (deaths/100'000 live births)	2012	5.7
Hospitals (number)	2015	719
Hospitals (per million population)	2015	20
Hospital beds (number)	2016	93599

## France

Title	Plan national d'alerte sur les antibiotiques
Authorship	Ministère du travail, de l'emploi et de la santé
Date of publication	November 2011
Time frame	2011-2016

The overall goal of the NAP is to achieve better, meaning more judicious use of antibiotics within the French healthcare system. This will be achieved by pursuing the specific aim of reducing antibiotic consumption by 25% over the time frame of the NAP (5 years). Three axes are specified to aid achievement of the specific aim: Better effectiveness of patient care, preservation of the effectiveness of antibiotics and promotion of research. Axis one describes some elements of AS while axis two is solely dedicated to AS activities.

### Better effectiveness of patient care

Axis one comprises the following elements relevant to AS in the hospital setting:

- Formal recommendations and guidelines for prescribing
- Development of supporting tools such as decision support systems and online information
- Promotion of the use of rapid diagnostic tests, where relevant
- Provision of structured expert advice to prescribers on antibiotic use at all levels of the healthcare system
- Information and on-going professional development of providers, including through professional societies and regulatory/legal frameworks
- On-going evaluation of antimicrobial use ("profile personnel de prescription")
- Establishment of quality indicators for antibiotic prescribing
- Promotion of regular audits in the inpatient care sector

### Preservation of the effectiveness of antibiotics

Axis two comprises the following elements of AS:

- Strengthened surveillance of antibiotic consumption and antimicrobial resistance by regional agencies
- Reduced consumption of antibiotic with particular focus on antibiotics with high potential to select resistant pathogens and those considered antibiotics of last resort
- Increased use of pre-authorisation approaches for the dispensing of certain antibiotics (locally defined)
- Mandatory reevaluation of treatment at 48-72 hours and 7-10 days demonstrated by audit and feedback

The strong link with infection prevention and control activities, including the importance of preventing transmission of resistant organisms in hospital, is emphasized. Detailed specific



information is also provided on the scope, approaches and future evaluation of AS activities.

Evaluation of presence of guidelines will occur by determining what percentage of medical specialties provide evidence-based reference guidelines to the national health authority. The development of structured audits for hospital prescribers will be supported to provide ward/specialty level feedback in hospital. A reference network of experts for antibiotic therapy will be established and its availability across different regions and parts of the healthcare system assessed. This network will support efforts to define a list of antibiotics with a high propensity towards resistance selection and will advise on how to implement specific monitoring of their consumption and associated resistances. A list of antibiotics of last resort will be compiled nationally and options for limiting their utilization explored.

Various additional assessments and monitoring activities are described, such as

- reviewing the access frequency for national online training materials,
- determining the availability of validated decision support tools for antibiotic prescribing at hospitals,
- screening the content of regional or local educational activities on antibiotic use,
- collecting data on the number and type of consults relevant to antibiotic use,
- measuring the number of hospitals monitoring antibiotic consumption,
- requiring hospitals to provide a list of restricted antibiotics together with recommendations on monitoring their use,
- evaluating the adherence of hospitals to reevaluation of antibiotics at 48-72 hours.

Overall, the NAP focuses largely on AS with a number of mandatory elements and complementary monitoring activities being recommended.

### Background information

Indicator	Year	Raw data
Total population (in 1000 persons)	2016	66760
Number of live births (in 1000s)	2013	780
Births, crude rate/1000 population	2013	11.9
Life expectancy at birth (in years)	2015	82.4
Life expectancy at 65 (men, in years)	2015	19.4
Infant mortality (deaths/1000 live births)	2015	3.3
Maternal mortality (deaths/100'000 live births)	2014	5.1
Hospitals (number)	2015	3089
Hospitals (per million population)	2015	46
Hospital beds (number)	2015	408245

## Germany

<b>Title</b>	<b>DART 2020</b>
<b>Authorship</b>	Federal Ministry of Health, Federal Ministry of Food and Agriculture, Federal Ministry of Education and Research
<b>Date of publication</b>	May 2015
<b>Time frame</b>	Not specified (2020)

The overall goal of the NAP is to recognize, avert and combat antibiotic resistance in Germany. This will be achieved by pursuing six goals:

- 1) Strengthening the One Health approach nationally and internationally
- 2) Recognising changes in resistance at an early stage
- 3) Retaining and improving therapy options
- 4) Breaking chains of infection early and avoiding infections
- 5) Raising awareness and strengthening skills
- 6) Supporting research and development

Goal 3 and goal 5 contain elements classically described to be part of AS.

### Goal 3: Retaining and improving therapy options

Currently monitoring of antibiotic consumption in the inpatient setting is being set up through the ADKA-if-RKI Project. Participation is voluntary and data are not thought to be representative. It is planned that on the basis of the Infection Protection Act this and other initiatives will be linked and expanded to collate representative data. These in turn will be used to provide reference information to the specialist public. Data will also be used to identify areas where antibiotic use can be improved together with possible interventions at a national level. This is reliant on improved feedback of antibiotic consumption data.

The AWMF will be used to compile recommendations for diagnosis and therapy. A pilot project to finance the development of prescribing guidelines and recommendations will be initiated. Furthermore, concepts for the preparation and application of local guidelines and recommendations will be developed.

### Goal 5: Raising awareness and strengthening skills

Currently, advanced training in rational antibiotic therapy developed by the German Infectious Diseases Society (DGI) is being rolled out. Insufficient training places are available. As for prescribing guidelines, the AWMF is set to support development of a guideline on "Strategies to ensure the rational use of antibiotics in hospitals".

Future plans include development of consultation checklist defining communication strategies for discussion the subject of antibiotics with patients. An online "Antibiotic Resistance" platform for healthcare providers will be developed, and continuing professional development in the area of antimicrobial resistance is to be made mandatory. The certified professional development programmes to train experts in antibiotic prescribing will be transferred as a structured curricular advanced training programme to the chambers of physicians.



Overall, the NAP emphasizes the need for national advanced training in rational antibiotic therapy and mandatory continuous professional development to embed AS in the healthcare sector workforce. Consideration is being given to the translation of national activities to local inpatient settings.

### Background information

Indicator	Year	Raw data
Total population (in 1000 persons)	2016	82176
Number of live births (in 1000s)	2015	738
Births, crude rate/1000 population	2015	9
Life expectancy at birth (in years)	2015	80.7
Life expectancy at 65 (men, in years)	2015	17.9
Infant mortality (deaths/1000 live births)	2015	3.3
Maternal mortality (deaths/100'000 live births)	2015	3.3
Hospitals (number)	2015	3108
Hospitals (per million population)	2015	38
Hospital beds (number)	2015	664364

## Netherlands

Title	Approach to antibiotic resistance
Authorship	Ministry of Health, Welfare and Sport, Secretariat for Economic Affairs, Secretariat for Infrastructure and the Environment
Date of publication	June 2015
Time frame	2015-2019

The NAP takes the format of an Open Letter to the Dutch House of Representatives. In this letter a joint mission of several One Health actors is formulated:

“Avoidable harm and mortality among patients due to infections caused by resistant bacteria must be prevented wherever possible. To this end, the further development and spread of (multi)resistance must be managed as much as possible, in order to ensure that effective treatment of infections with antibiotics remains possible in future.”

This will be achieved through the pursuit of six goals:

- 1) Reduction in the emergence and spread of multiresistant bacteria in healthcare (time frame of five years);
- 2) Early detection and swift response to resistant bacteria and other infectious threats to maintain a low number of carriers of resistant bacteria and deaths from infections/related to antibiotic resistance;
- 3) Increased international cooperation to enable joint management of activities to tackle emergence and spread of antimicrobial resistance;
- 4) Fifty percent reduction in the number of healthcare-associated infections over five years (baseline to be defined);
- 5) Avoidance of loss of effective treatments for bacterial infection (including resistant bacteria, time frame of five years);
- 6) At least fifty percent reduction in the use of incorrectly prescribed antibiotics (time frame of five years).

A description of the key areas across the healthcare sector is provided. This details the focus on widespread participation in regional surveillance with the aim of ensuring the highest possible transparency and providing additional incentives to achieve the highest quality of care. The importance of generating a uniform and reproducible reporting approach for antibiotic consumption in relation to disease is emphasized. Data on antibiotic use and antimicrobial resistance should be widely accessible at all institutions involved in patient care. To support this the healthcare inspectorate should be involved in the evaluation of AS activities in the inpatient sector based on a transparent inspection plan and jointly agreed evaluation parameters. All healthcare sectors are considered a single network with designated responsibilities and accountabilities at all levels. Continuing professional development is to involve physicians but also nurses, paramedics and other healthcare providers as well as those in healthcare training.

This concept underpins a multi-annual healthcare agenda that focuses on specific targets in all areas relevant to AS: carriage of multiresistant organisms, infection caused by multiresistant organisms, avoidable hospital-acquired infections, correct use of antibiotics and avoidance of loss for effective treatment for multiresistant bacterial infections.

Overall, the NAP stresses the network concept of embedding AS in the healthcare system both between inpatient providers and between them and other healthcare providers. This network, which jointly agrees benchmarks and monitoring approaches, is seen to be able to support a nationally endorsed performance profile for hospitals.

### Background information

Indicator	Year	Raw data
Total population (in 1000 persons)	2016	16979
Number of live births (in 1000s)	2015	171
Births, crude rate/1000 population	2015	10.1
Life expectancy at birth (in years)	2015	81.6
Life expectancy at 65 (men, in years)	2015	18.4
Infant mortality (deaths/1000 live births)	2015	3.3
Maternal mortality (deaths/100'000 live births)	2015	3.5
Hospitals (number)	2014	505
Hospitals (per million population)	2014	30
Hospital beds (number)	2013	70310

## New Zealand

Title	New Zealand Antimicrobial Resistance Action Plan
Authorship	Ministry of Health, Ministry for Primary Industries
Date of publication	August 2015
Time frame	Not specified (to be implemented over 5 years)

The overall goal of the NAP is to serve the vision outlined at the outset:

“New Zealand is a society that manages antimicrobials as a valuable shared resource and maintains their efficacy so they can be used to treat infections in humans, as well as to manage diseases in animals and plants.”

Two goals are formulated:

- 1) To ensure that antimicrobials continue to be effective and available through prudent and responsible use
- 2) To improve knowledge on drivers of emergence and spread of antimicrobial resistance, and to use this to counteract trends towards increasing resistance.

In addition to the two goals five specific objectives are

- 1) Awareness and understanding
- 2) Surveillance and research
- 3) Infection prevention and control
- 4) Antimicrobial Stewardship
- 5) Governance, collaboration and investment

Activities relevant to AS are listed under objectives one, two, four and five.

### Awareness and understanding

Relevant AS activities include

- development and implementation of projects and resources to support and inform appropriate prescribing in human medicines;
- development of prescriber targets and mechanisms to improve prescriber access to resources and guidance
- inclusion of relevant material in all pre-registration courses and continuing professional development

### Surveillance and research

Relevant AS activities include

- definition and regular review of priority antibiotics for surveillance and reporting

- development of a nationally standardized cross-sector methodology, system and data repository for measuring and reporting on antibiotic use
- identification of prescriber types from antibiotic dispensing data to develop and target interventions
- review of workforce capacity, capability and training for surveillance implementation

## Antimicrobial Stewardship

### Relevant AS activities include

- integration of AS considerations in antimicrobial funding decisions
- support of development of regional antimicrobial treatment guidance and consider development of national guidelines
- investigation of inequities in antibiotic prescribing
- identification of options and resource requirements for increased access to AS guidance including through suitable technological means
- support of a standardized system for hospital measurement and reporting of appropriateness of antibiotic use
- consideration of the implementation of national benchmarks (short term = one year; medium term = three years) on antibiotic consumption and appropriate prescribing
- development of national antimicrobial treatment guidelines
- establishment of appropriate feedback mechanisms and wide-ranging prescriber access to overviews, benchmarking and surveillance data
- access to AS services, advice and support at a national level

The NAP is the only one to consider issues of equity in access to antibiotics.

## Background information

Indicator	Year	Raw data
Total population (in 1000 persons)	2016	4693
Number of live births (in 1000s)	2014	57
Births, crude rate/1000 population	2014	12.7
Life expectancy at birth (in years)	2015	81.7
Life expectancy at 65 (men, in years)	2015	19.3
Infant mortality (deaths/1000 live births)	2013	5.0
Maternal mortality (deaths/100'000 live births)	2013	16.8
Hospitals (number)	2016	159
Hospitals (per million population)	2016	34
Hospital beds (number)	2016	12821

## Norway

Title	National Strategy against Antibiotic Resistance 2015-2020
Authorship	Ministry of Health and Care Services, Ministry of Fisheries, Ministry of Agriculture and Food, Ministry of Climate and Environment
Date of publication	June 2015
Time frame	2015-2020

The main goal of the NAP is to reduce the total use of antibiotics in Norway and to assure responsible use of antibiotics in all sectors, to increase the body of scientific knowledge, and to be an international mobilizer against antibiotic resistance.

This goal will be achieved by reducing the total use of antibiotics, ensuring more appropriate use of antibiotics, improving the knowledge of what drives emergence and spread of resistance and being an international advocate and driver for AS activities.

Several highly specific targets are listed in the NAP (see above). These will be reached with the help of specific measures to be taken by the government.

County by county conferences that include technical guidance on antibiotic prescribing as well as the requirement for employers in the healthcare sector to train employees will improve the level of understanding and competence regarding antibiotic use among all prescribers.

Prescription registers, which integrate information on diagnosis and indication for antibiotic prescribing will be established and maintained. Furthermore timely and accurate information on antibiotic use and antimicrobial resistance will be included in on-going professional education and training. This will improve prescribing practices.

The introduction of professional association reviews of individual prescribing practices, for example through peer assessment, will be considered. Guidelines will be regularly updated to include both national and international relevant data, and strict adherence to these guidelines will be expected.

Infections caused by resistant bacteria will be treated and eradicated aggressively. As part of this, the necessity of including pathogens other than methicillin-resistant *S. aureus* will be explored.

Normative international collaboration will be intensified to strengthen and extend standardized approaches to the global monitoring of antibiotic use and antimicrobial resistance.

Overall the NAP provides clear indications that employers in the healthcare sector will be held accountable for AS activities at their institutions. This will include providing clear evidence of training opportunities and uptake as well as remedial action taken in the case of “problem prescribers” or wards/hospital areas non-compliant with national guidance.





## Background information

Indicator	Year	Raw data
Total population (in 1000 persons)	2016	5211
Number of live births (in 1000s)	2015	59
Births, crude rate/1000 population	2015	11.3
Life expectancy at birth (in years)	2015	82.4
Life expectancy at 65 (men, in years)	2015	18.9
Infant mortality (deaths/1000 live births)	2015	2.3
Maternal mortality (deaths/100'000 live births)	2015	0
Hospitals (number)	Not available	
Hospitals (per million population)	Not available	
Hospital beds (number)	2015	19519

## Sweden

Title	Swedish strategy to combat antibiotic resistance
Authorship	Ministry for Health Care, Public Health and Sport, Ministry for Rural Affairs, Ministry for Higher Education and Research
Date of publication	April 2016
Time frame	Until 2020

The overarching goal of the NAP is to preserve effective treatment of bacterial infections in people and animals. This will be achieved through pursuing seven objectives.

- 1) Increased knowledge through enhanced surveillance
- 2) Continuous strong preventive measures
- 3) Responsible use of antibiotics
- 4) Increased knowledge for preventing and managing bacterial infections and antibiotic resistance with new methods
- 5) Improved awareness and understanding in society about antibiotic resistance and countermeasures
- 6) Supporting structures and systems
- 7) Leadership within the European Union and in international cooperation

While objective three directly refers to a topic representing AS, relevant activities are also described for objectives one, four and five.

### Objective 1: Increased knowledge through enhanced surveillance

Relevant AS activities mainly relate to surveillance data including reasons for prescription (indication) and compliance with treatment recommendations. These data are to be available in all sectors with feedback to relevant services to support responsible use of antibiotics.

### Objective 3: Responsible use of antibiotics

Relevant AS activities include

- Complete enforcement of antibiotic use only following a prescription of a competent and authorized professional
- Development of local, regional or national guidelines on diagnostic approaches and management of common infections with maximal harmonization between settings and implementation of guidance in daily clinical practice
- Accessibility of data on compliance with treatment recommendations to all prescribers as well as other stakeholders and the public
- Standardisation of use of quality-assured microbiological diagnostics with minimal turn-over times
- Guaranteed access to both new and older antibiotics across the Swedish market
- Increased knowledge about the availability and approach to use of new and older antibiotics

### Objective 4: Increased knowledge for preventing and managing bacterial infection and antibiotic

resistance with new methods

Relevant AS activities mainly relate to research in the area of antibiotic resistance and optimal antibiotic use and investigations into the consequences of antibiotic resistance economically and for society.

Objective 5: Improved awareness and understanding in society about antibiotic resistance and countermeasures

Relevant AS activities focus on good knowledge of all healthcare providers of the One Health concept, antibiotics and antibiotic use as well as all relevant associated concepts.

Overall the NAP uniquely includes a focus on access to old antibiotics with a lower potential for emergence of antibiotic resistance.

### Background information

Indicator	Year	Raw data
Total population (in 1000 persons)	2016	9851
Number of live births (in 1000s)	2015	115
Births, crude rate/1000 population	2015	11.7
Life expectancy at birth (in years)	2015	82.3
Life expectancy at 65 (men, in years)	2015	18.9
Infant mortality (deaths/1000 live births)	2015	2.5
Maternal mortality (deaths/100'000 live births)	2015	0.9
Hospitals (number)	Not available	
Hospitals (per million population)	Not available	
Hospital beds (number)	2015	23885

## United Kingdom

Title	UK Five Year Antimicrobial Resistance Strategy
Authorship	Department of Health, Department for Environment, Food and Rural Affairs
Date of publication	2013
Time frame	2013-2018

The overarching goal of the NAP is to slow the development and spread of antimicrobial resistance through pursuing three strategic aims:

- 1) Improving the knowledge and understanding of antimicrobial resistance
- 2) Conservation and stewardship of effective existing treatments
- 3) Stimulation of development of new antibiotics, diagnostics and novel therapies.

These strategic aims will be achieved through work in seven key areas:

- 1) Improving infection prevention and control
- 2) Optimizing prescribing practice
- 3) Improving professional education, training and public engagement
- 4) Developing new drugs, treatments and diagnostics
- 5) Better access to and use of surveillance data
- 6) Better identification and prioritization of antimicrobial resistance research needs
- 7) Strengthened international collaboration

The NAP describes the current status of antimicrobial stewardship in inpatient settings, mainly building on multi-professional specialist teams as well as national resources such as “Start Smart, then Focus”.

The main focus for AS activities is key area 2. This describes that antibiotic prescribing mainly occurs in the absence of adequate information and therefore rational decisions on right drug, dose, timing and duration are not possible. Key actions outlined include:

- Development of enhanced education and training for prescribers, but also those administering antibiotics
- Identification of optimal arrangements for recording and reporting data on antibiotic use
- Improved quality and standardization of routine antibiotic susceptibility testing and interpretation of these results
- Evaluation of the potential of increased heterogeneity of local antibiotic prescribing policies on usage, resistance rates and outcomes
- System-wide embedding of regular local audits as a means of monitoring the impact of AS activities

Key area 3 also includes AS activities focusing on building clinical capacity to deliver effective AS and on ensuring availability of and access to continuing professional development for effective

AS.

The NAP defines specific targets for antibiotic use measurement which have been further extended in subsequent documents. Overall, the NAP addresses a wide range of players including, for example, nursing and pharmacy staff but also microbiologists. The integration of activities across infection prevention and control and AS as well as across primary and secondary care is emphasized. Behaviour change is identified as a key means of improved antibiotic use in the inpatient setting, relevant to better adherence to evidence-based guidance and to the design of tools facilitating such change.

### Background information

Indicator	Year	Raw data
Total population (in 1000 persons)	2016	65383
Number of live births (in 1000s)	2015	777
Births, crude rate/1000 population	2015	11.9
Life expectancy at birth (in years)	2015	81.0
Life expectancy at 65 (men, in years)	2015	18.6
Infant mortality (deaths/1000 live births)	2013	5.0
Maternal mortality (deaths/100'000 live births)	2013	16.8
Hospitals (number)	2015	1896
Hospitals (per million population)	2015	29
Hospital beds (number)	2015	169995

## United States

Title	National Action Plan for Combating Antibiotic-Resistant Bacteria
Authorship	The White House
Date of publication	March 2015
Time frame	Not specified, implementation by 2010

The overall goal of the NAP is to serve the vision outlined at the outset:

“The United States will work domestically and internationally to prevent, detect, and control illness and death related to infections caused by antibiotic-resistant bacteria by implementing measures to mitigate the emergence and spread of antibiotic-resistance and ensuring the continued availability of therapeutics for the treatment of bacterial infections.”

This vision will be realized by pursuing 5 goals:

- 1) Slow the Emergence of Resistant Bacteria and Prevent the Spread of Resistant Infections. (Antibiotic stewardship)
- 2) Strengthen National One-Health Surveillance Efforts to Combat Resistance. (Monitoring antibiotic sales)
- 3) Advance Development and Use of Rapid and Innovative Diagnostic Tests for Identification and Characterization of Resistant Bacteria.
- 4) Accelerate Basic and Applied Research and Development for New Antibiotics, Other Therapeutics, and Vaccines.
- 5) Improve International Collaboration and Capacities for Antibiotic-resistance Prevention, Surveillance, Control, and Antibiotic Research and Development.

The key goals associated with AS activities are goals 1) and 2).

### Goal 1: Antibiotic Stewardship

Relevant AS aspects are:

- Establishment of AS programs in all acute care hospitals and improved AS across all healthcare settings
- Establishment of statewide programmes to monitor regionally important multiresistant bacteria and to provide feedback and technical support to healthcare facilities.
- National standardization of AS programmes and activities including surveillance and reporting
- Expert clinician support for prescribing decisions and identification of facilities with high antibiotic prescribing rates
- Proposal for expanded quality measures for antibiotic prescribing
- Expansion of training and support to improve inpatient AS
- Expansion of participation in national surveillance of antibiotic use including establishment of feedback loops for healthcare facilities

### Goal 2: Monitoring antibiotic sales

Relevant AS aspects are:

- Integration of measures for hospital-level reporting of data on antibiotic use in national quality assurance programmes
- Public access to available data on antibiotic use
- Finalisation of support tools for software developers tasked with implementing systems for recording and submitting antibiotic use data
- Standardisation of file format to accelerate hospital-level reporting of antibiotic use

Overall, the NAP provides great detail on specific targets and on monitoring of AS implementation nationally. Standardization across states is regarded as central and implementation of AS activities as a condition for receipt of federal funds discussed at least for governmental and military health institutions.

### Background information

Indicator	Year	Raw data
Total population (in 1000 persons)	2016	323128
Number of live births (in 1000s)	2014	3988
Births, crude rate/1000 population	2014	12.5
Life expectancy at birth (in years)	2015	78.8
Life expectancy at 65 (men, in years)	2015	18.0
Infant mortality (deaths/1000 live births)	2014	5.8
Maternal mortality (deaths/100'000 live births)	Not available	
Hospitals (number)	2014	5627
Hospitals (per million population)	2014	18
Hospital beds (number)	2014	902202

## Background information for Switzerland

Indicator	Year	Raw data
Total population (in 1000 persons)	2016	8327
Number of live births (in 1000s)	2015	87
Births, crude rate/1000 population	2015	10.5
Life expectancy at birth (in years)	2015	83.0
Life expectancy at 65 (men, in years)	2015	19.4
Infant mortality (deaths/1000 live births)	2015	3.9
Maternal mortality (deaths/100'000 live births)	2013	2.4
Hospitals (number)	2015	288
Hospitals (per million population)	2015	35
Hospital beds (number)	2015	37965



## **Interpretation of reviewed National Action Plans in the context of the Swiss StAR strategy**

The considered countries pursue individualized approaches to AS development and implementation specific to the context of their healthcare system and on-going national activities in this area. Nonetheless some broad areas relevant across national boundaries emerge.

### **Mandatory versus voluntary national AS**

A national consensus must be sought to determine whether AS development and implementation are to be a mandatory or voluntary. Generally speaking, countries opting for mandatory AS often have healthcare systems that are also regulated centrally in other areas of healthcare. Alternatively, there may be the opportunity to incorporate strong positive or negative incentives for AS, such as for example in the United States.

### **Specification of targets**

Mandatory AS is often linked to the specification of clear targets to be achieved as result of AS. These can be process-focused (implementation of certain activities), outcome-focused (achievement of reductions or shifts in antibiotic use) or incorporate both elements.

### **National cohesion in AS**

Most NAPs emphasize the importance of nationally consistent approaches to enable benchmarking and progress tracking. National cohesion can be achieved through top-down approaches, such as the Dutch approach of hospital inspection through the healthcare inspectorate, or bottom-up approaches, for example the Australian National Antimicrobial Stewardship Network or the availability of structured expert advice in France.

### **National support for IT infrastructure and surveillance**

Virtually all NAPs acknowledge the importance of facilitating appropriate information technology approaches to enable adequate surveillance and the incorporation of decision support tools. In contrast to this, there is little agreement on exact indicators to be tracked as these appear to be highly related to on-going data collection and approaches to healthcare provision and funding.

### **Continuing professional development and expertise**

Similarly, education and continuing professional development to support AS is discussed in most NAPs. Approaches to embedding this are varied, ranging from national online material and local efforts to mandatory training provided, supervised and tracked by healthcare sector employers.

For hospital sector AS in the context of the StAR strategy, it will be possible to draw on several of the concepts and approaches described in this document. However, in all cases careful consideration needs to be given to the best method of implementation that is suitable and feasible in the context of the Swiss healthcare system.