



Icelandic National Action Plan
on Antimicrobial Resistance 2025–2029

Monitoring and Evaluation

Government of Iceland
Ministry of Health



Ministry of Health

Síðumúli 24 — 108 Reykjavík

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Foreword

Antimicrobial resistance (AMR) is one of the greatest health threats facing the world today, and it continues to increase each year. If the current trend persists, we may reach a point where many infections can no longer be treated with antimicrobials, resulting in serious health and economic consequences. It is therefore crucial to act as soon as possible, before the spread becomes uncontrollable.

The first official Icelandic National Action Plan (NAP) on AMR was published in August 2024. The plan focuses on antibiotic resistance and addresses its key risk factors in the spirit of the “One Health” approach. Effective implementation and long-term sustainability are essential to achieving the plan’s objectives.

An interdisciplinary working group, appointed by the Minister of Health, presents here a detailed plan for how the progress of the NAP’s activities will be monitored and how its outcomes will be evaluated. This is essential to maximising the plan’s effectiveness and ensuring its cost-efficiency.

A framework for monitoring progress and evaluating outcomes is therefore an integral part of the action plan itself and will play a crucial role in the fight against the spread of antimicrobial resistance.



Alma D. Möller
Minister of Health



Hanna Katrín Friðriksson
Minister of Industries



Jóhann Páll Jóhannsson
Minister of the
Environment, Energy
and Climate



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Abbreviations and Definitions



AMEG classification	Antimicrobial advise ad hoc Expert Group. Classification by the European Medicines Agency of antibiotics based on potential public health consequences of increased resistance when these drugs are used in animals and the need for these drugs in veterinary medicine.
AMR	Antimicrobial resistance, synonymous with the term antibiotic resistance which is mainly used in the Icelandic National Action Plan.
ATC	Anatomical Therapeutic Chemical. Classification of drugs by organ systems.
ATRN	Ministry of Industries (former Ministry of Food, Agriculture and Fisheries).
AWaRe classification	WHO classification according to the prioritisation of antibiotics (“Access, Watch, Reserve”).
DID	Defined daily dosage/1000/day. Standardised daily doses per 1,000 inhabitants per day.
<i>E. coli</i>	<i>Escherichia coli</i> .
ECDC	European Centre for Disease Prevention and Control.
EFSA	European Food Safety Authority.
EMA	European Medicines Agency.
EL	The Directorate of Health in Iceland.
ESBL	Extended-spectrum beta-lactamases.
EU	European Union.
EUCAST	The European Committee on Antimicrobial Susceptibility Testing.
EURL-AR	EU Reference Laboratory for antimicrobial resistance.
<i>H. influenzae</i>	<i>Haemophilus influenzae</i> .

Heilsuvera	An official website on various common and individual health information.
HH	Primary Health Care of the Capital Area.
HRN	Ministry of Health.
LSH	Landspítali, the National University Hospital of Iceland.
MAST	Icelandic Food and Veterinary Authority.
MRSA	Methicillin Resistant Staphylococcus aureus.
ME plan	Monitoring and evaluation plan.
NRL-AR	National Reference Laboratory for antimicrobial resistance.
NAP	National action plan.
OECD	Organisation for Economic Cooperation and Development.
One Health	Approach integrating human, animal, food and environmental health.
PCU	Population Correction Unit. Estimated weight of livestock in the country each year.
SVL	Chief Epidemiologist.
Sýklalyfjaávisun	Prescription of antibiotics and medical orders for out-patients and inpatients at hospitals or nursing homes.
UN	United Nations.
URN	Ministry of the Environment, Energy and Climate.
UOS	The Icelandic Environment and Energy Agency (former Environment Agency).
WGS	Whole genome sequencing.
WHO	World Health Organization.
WOAH	World Organisation for Animal Health (former OIE).
ÞÍH	Development Centre of the Icelandic Primary Health Care.

Introduction



Many international organisations—including the United Nations (UN), the World Health Organization (WHO), the World Organisation for Animal Health (WOAH), the European Centre for Disease Prevention and Control (ECDC), the Organisation for Economic Co-operation and Development (OECD), and the European Food Safety Authority (EFSA)—have, in recent years, urged countries worldwide to take immediate action to limit the spread of antimicrobial resistance (AMR) by developing National Action Plans (NAPs) before the situation becomes uncontrollable. In addition, countries are encouraged to create plans for monitoring the implementation and progress of their NAPs and for evaluating their effectiveness—commonly referred to as Monitoring and Evaluation (ME) Plans.

AMR refers to resistance to all types of antimicrobial agents, including antibiotics (against bacteria), antivirals (against viruses), antiparasitics (against parasites), and antifungals (against fungi). The first Icelandic AMR-NAP was published in 2024, with a primary focus on antibiotic resistance. In that plan, the terms “antibiotic” and “anti-microbial” were used interchangeably—an approach that will also be applied in the current plan.

The Icelandic AMR-NAP consists of six actions, 24 objectives, and 75 activities. These activities are prioritised, with responsible stakeholders and annual costs estimated.

Action six of the NAP emphasises the importance of establishing strong coordination and management of the plan’s implementation for the future. It states that a multidisciplinary working group should be formed to oversee the implementation and progress of the plan’s activities and to recommend adjustments when needed. The group is also tasked with monitoring cost estimates in collaboration with responsible stakeholders and evaluating the plan’s overall success.

In 2024, the Minister of Health appointed a multidisciplinary working group, which now presents this plan outlining how the progress of individual activities within the NAP will be monitored and how the plan’s success will be evaluated (ME Plan).

With a comprehensive NAP, supported by an effective ME plan, it will be possible to maximise success in combating the spread of AMR.



Interdisciplinary Working Group



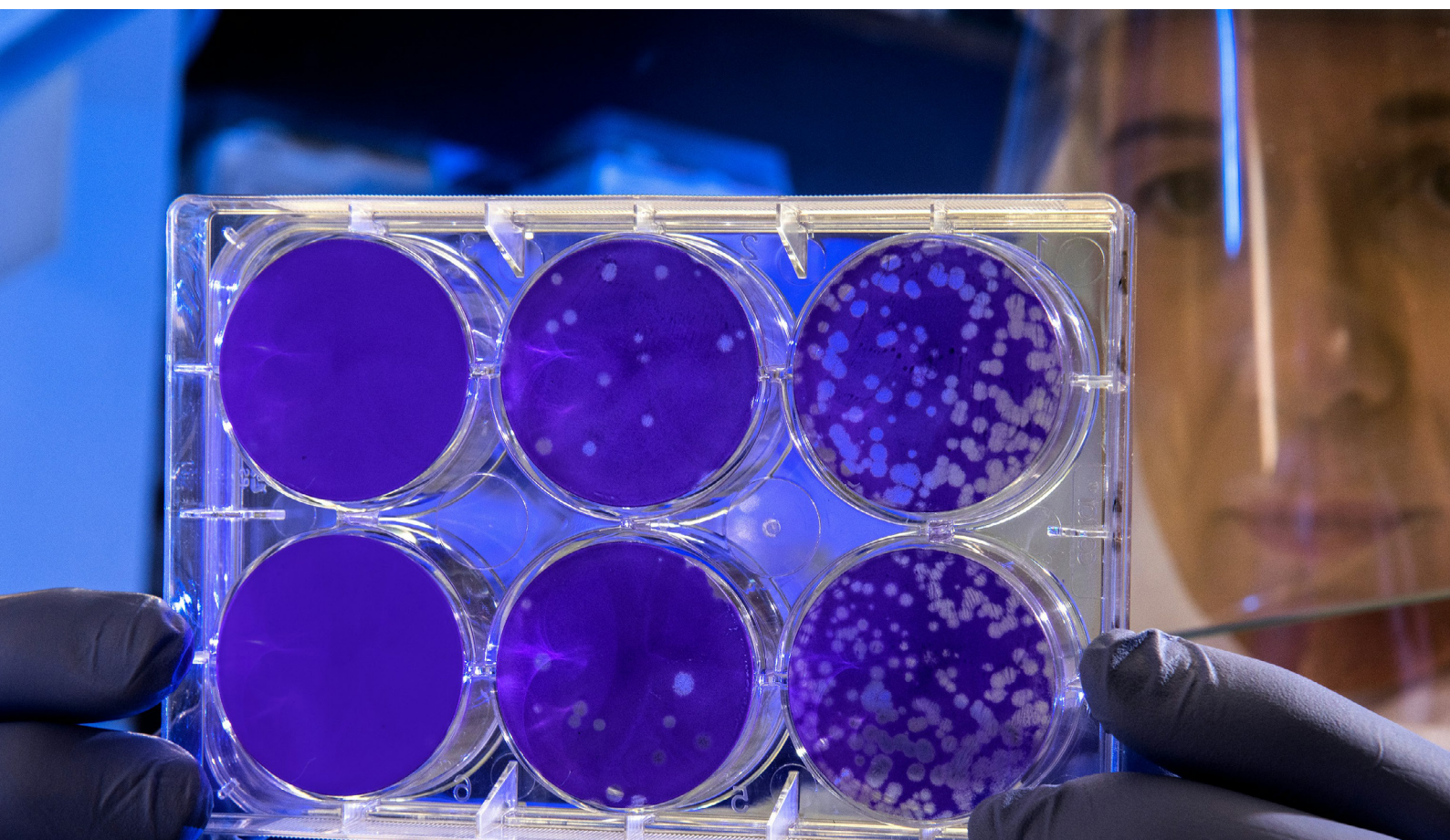
An interdisciplinary working group was appointed by the Minister of Health in September 2024 to monitor the implementation and progress of the activities outlined in the NAP and to evaluate its overall success. The group’s mandate currently extends until December 1, 2026. However, it is important for that the working group operates over a longer period to ensure the successful implementation of the NAP.

A. Members of the Interdisciplinary Working Group

Andreas Ströberg	<i>appointed by The Icelandic Environment and Energy Agency</i>
Anna Margrét Halldórsdóttir	<i>appointed by the Chief Epidemiologist</i>
Guðlín Steinsdóttir	<i>appointed by the Ministry of Health</i>
Jón Steinar Jónsson	<i>appointed by the Primary Health Care of the Capital Area and the Development Centre of the Icelandic Primary Health Care</i>
Karl Gústaf Kristinsson	<i>appointed by Landspítali the University Hospital</i>
Vigdís Tryggvadóttir	<i>appointed by the Icelandic Food and Veterinary Authority</i>
Þórólfur Guðnason	<i>chairman appointed by the Ministry of Health</i>
Þórunn Rafnar Þorsteinsdóttir	<i>appointed by Keldur Institute for Experimental Pathology, University of Iceland</i>

B. Tasks of the Working Group

-
- Develop a comprehensive plan outlining how the progress of the action plan's activities will be monitored and how its overall success will be evaluated.
-
- Monitor the implementation and progress of the activities included in the action plan.
-
- Track activity costs to ensure alignment with the approved cost plan.
-
- Evaluate the outcomes of the individual actions as well as the action plan overall.
-
- Publish annual progress reports summarising the results of implementation monitoring, the status of activities, and an assessment of progress achieved.
-
- Propose revisions to the action plan as necessary, based on monitoring and evaluation findings.
-



Monitoring and Evaluation of the AMR-NAP



Monitoring of the AMR-NAP involves regular follow-up by the working group to track the progress of individual activities within the plan, in collaboration with the responsible stakeholders. This ongoing monitoring is a critical prerequisite for evaluating whether the plan is progressing as intended. The results of these evaluations may, in turn, lead to proposals for modifications to the action plan itself.

A. Monitoring the Implementation and Progress of Activities

The AMR-NAP is structured around six actions, comprising 75 prioritised activities. Ten responsible stakeholders have been designated to implement these activities.

The working group will conduct annual monitoring of the activities based on standardised information provided by the responsible stakeholders. The goal is for all required information to be submitted by May 1st each year.

The standardised reporting from responsible stakeholders should address the following key questions:

- Has funding been secured for the implementation and execution of the activities, and is it consistent with the cost plan?
- Are the costs of the activities aligned with the cost plan?
- Are there any deviations or issues affecting the execution of the activities?
- Is the execution of the activities proceeding within the defined timeframes?
- Are the activities prioritised in accordance with the action plan?
- Is it likely that the outcomes of the activities will align with the defined deliverables of the action plan?

B. Evaluation of the success of the NAP

The working group evaluates the success of the NAP based on the results of annual monitoring. **Output indicators** are used to assess whether the objectives of individual actions are likely to be achieved, while **outcome indicators** are used to evaluate the overall success of the NAP.

1. Annual Evaluation of Individual Action Outputs

The NAP outlines 24 objectives, aligned with the six actions on which it is based. The outputs of these objectives will be evaluated annually using specific indicators detailed in Appendix II. These evaluations will assess whether the established benchmarks are on track to be achieved by 2029.

As part of the annual evaluation of the success of individual actions, the following questions will be considered:

-
- **Is the progress of the activities sufficient to achieve the established benchmarks by 2029?**
-
- **Are the output indicators of the objectives appropriate and realistic measures of the success of individual actions?**
-
- **Is it necessary to modify any procedures or activities within the NAP to ensure that the benchmarks will be met?**
-

2. Evaluation of the Overall Success of the NAP

The overall success of the NAP will be evaluated annually using defined outcome indicators and goals to be achieved by 2029 (see Appendix III).

The outcome indicators include the proportion of specific antibiotic-resistant bacteria found in humans, animals, and food, antibiotic usage in humans and animals, and vaccination participation rates among humans for selected immunisations.

During the annual evaluation, the following questions will be addressed:

-
- **Is it likely that the goals of the NAP will be achieved by 2029?**
-
- **Are the outcome indicators appropriate and realistic measures of the overall success of the action plan?**
-
- **Is it necessary to make changes to the action plan to ensure the achievement of its goals?**
-

Data Collection



As part of the annual monitoring process, the working group will request the necessary information and data by May 1st each year. All submitted data will be stored at the Ministry of Health.

Information and data for the annual monitoring and evaluation will primarily be obtained from the following sources:

- 1 Responsible stakeholders for individual activities within the action plan.
- 2 The Directorate of Health/Chief Epidemiologist regarding the use and sale of antibiotics in humans and participation in vaccinations.
- 3 The Icelandic Food and Veterinary Authority regarding the use and sale of antibiotics in animals.
- 4 Laboratories conducting microbiological diagnostics and antimicrobial susceptibility testing.



Progress Reports



Annual progress reports will be compiled by the working group and submitted by July 1st each year. These reports will be sent to the Ministry of Health, the Ministry of Industries, the Ministry of the Environment, Energy and Climate, as well as to the responsible stakeholders for individual activities. This schedule allows for the timely submission of recommendations to the relevant authorities regarding potential changes to the NAP and cost plan for the following year. The ministries will determine the further distribution and publication of the reports.

The progress reports will include standardised information on the status of individual activities, an evaluation of the outputs of individual actions and an assessment of the overall success of the NAP. Additionally, it will include recommendations for modifications to the action plan, as deemed necessary.

Progress reports will play a crucial role in supporting the effective and cost-efficient implementation of the NAP and in ensuring continued success in the fight against the spread of AMR.



Appendix I. Activities, Deliverables, and Responsible Stakeholders

Activities	Deliverables	Responsible stakeholders
1.1.1 The proportion of antibiotic prescriptions in humans recorded in central databases. Information is accessible and published in monitoring reports.	Electronic recording of antibiotic prescriptions in all hospitals established, and data is transferred electronically to central databases at EL.	EL
1.1.2 Improve the recording of indications for antibiotic prescriptions in the electronic databases of hospitals, and transfer the information to central databases at EL.	Indications for antibiotic prescriptions accessible in the electronic systems of hospitals/institutions and in the central database at EL.	EL
1.1.3 Set up a dashboard/data visualisation for antibiotic prescriptions for doctors in the electronic systems of hospitals.	Dashboard/data visualisation for antibiotic prescriptions available in hospital electronic systems.	EL
1.1.4 Implement and introduce electronic recording of antibiotic prescriptions in all nursing homes. Data on prescriptions transferred to the central databases at EL.	Electronic recording of antibiotic prescriptions in all nursing homes implemented, and prescription information transferred to the medication database at the EL.	EL
1.1.5 Start recording indications for antibiotic prescriptions in the electronic systems of nursing homes, and transfer the information to the central databases at the EL.	Recording of indications implemented in the electronic systems of nursing homes, and the information accessible centrally at the EL.	EL
1.1.6 Set up a dashboard/data visualisation for antibiotic prescriptions for doctors in nursing homes.	Dashboard/data visualisation for antibiotic prescriptions available in all nursing homes.	EL
1.1.7 Improve the recording of indications for antibiotic prescriptions in the prescription database of primary healthcare with detailed classification. Information transferred to the central databases at the EL.	Improved recording of antibiotic prescriptions in primary healthcare.	ÞÍH
1.1.8 Develop further interactive presentation of statistics on antibiotic prescriptions.	Interactive presentation of drug statistics established for all antibiotic prescriptions.	EL
1.1.9 Develop further the annual report by the SVL and other stakeholders on antibiotic use.	Establish the annual publication and institutional collaboration.	SVL

Activities	Deliverables	Responsible stakeholders
1.2.1 Enhance the development and promotion of guidelines on antimicrobial use and stewardship at larger hospitals.	Antibiotic stewardship implemented at all major hospitals.	LSH
1.2.2 Enhance the development and dissemination of guidelines on nursing homes on antibiotic use and stewardship.	Guidelines on antibiotic use in all nursing homes in place.	ÞÍH
1.2.3 Firmly establish the Strama project within the primary care and continue its development.	ÞÍH will be entrusted the responsibility for the activity to the future.	ÞÍH
1.2.4 Encourage the development of guidelines for antibiotic use among the groups of specialists outside hospitals who prescribe antibiotics the most.	Guidelines in place for defined groups of specialists outside hospitals who prescribe antibiotics the most.	SVL
1.3.1 Implement and introduce electronic recording of antibiotic prescriptions in animals, and transfer prescription information to central databases.	Central database implemented and usage introduced.	MAST
1.3.2 Amend the regulation to mandate all records of antibiotic prescriptions to be logged into the database in the future.	The regulation on the obligation of recording and implementation has taken effect.	ATRN
1.3.3 Enhance monitoring by recording antibiotic prescriptions for animals in a central database.	Information on antibiotic prescriptions for animals available.	MAST
1.3.4 Set up a dashboard/data visualisation for regulatory authorities (MAST).	Dashboard/data visualisation functional.	MAST
1.4.1 Prepare guidelines on antibiotic use in animals.	Guidelines available.	MAST
1.4.2 Implement regulations on restrictions regarding veterinarians' authority to prescribe antibiotics.	A new regulation has come into effect.	HRN
1.4.3 Set up a dashboard/ data visualisation in databases for veterinarians.	The dashboard/data visualisation has been implemented.	MAST
1.4.4 Increase monitoring of prescriptions and use of certain antibiotics (Category B in the AMEG classification) and clarify veterinarians' exemptions to dispense antibiotics.	Monitoring firmly established.	MAST
1.4.5 Increase dialogue between regulatory authorities (MAST) and veterinarians through regular formal and informational meetings.	Regular informational meetings, at least annually.	MAST

Activities	Deliverables	Responsible stakeholders
2.1.1 Conduct regular surveys on public knowledge of antibiotic resistance, antibiotic use, and infection prevention, and assess the need for increased education.	Regular surveys conducted.	SVL
2.1.2 Increase education and information dissemination in the media and on social media, based on survey results (see 2.1.1). Share information with other institutions such as the EL, MAST, UST, and Heilsuvera.	Widespread, coordinated, and accessible information available.	SVL
2.1.3 Enhance education in connection with the annual awareness campaign of WHO, FAO, WOA, and ECDC during the week of November 18–24.	Information in Iceland coordinated with information from WHO, FAO, WOA, and ECDC. Annual media and social media campaign (television, online media).	SVL
2.1.4 Increase education for parents in infant health care and enhance access to educational materials for day care and parents.	Standardised education available and actively disseminated.	ÞÍH
2.1.5 Develop educational materials for tourists about the uniqueness of Iceland regarding antibiotic resistance and animal diseases.	Proposals for an educational project for foreign tourists available.	MAST
2.1.6 Increase public education on the importance of origin of food, proper food preparation and handling.	Increased availability of educational materials, including social media.	MAST
2.1.7 Education for the public on antibiotic use, infection prevention, antibiotic resistance, and the risk of infection during international travel.	Education for those traveling abroad, e.g., on Heilsuvera (in connection with travel vaccinations), is available.	HH
2.1.8 Introduce education on infection prevention and antibiotic resistance in primary and secondary schools.	Formal education in place in primary and secondary schools.	HRN
2.2.1 Conduct a survey to assess the knowledge of healthcare professionals and welfare service staff on antibiotic resistance, antibiotic use, and infection prevention, and map out the need for increased education.	A survey conducted.	SVL
2.2.2 Encourage increased education and formal training, for healthcare professionals and welfare service staff according to the results of the survey (see 2.2.1).	Quality documents and guidelines for healthcare professionals and nursing home staff updated and/or developed by the relevant institutions.	SVL
2.2.3 Annual awareness campaign in connection with the annual awareness campaigns of WHO and ECDC during the week of November 18–24.	Information coordinated information from WHO and ECDC. Annual symposium by the SVL on antibiotic resistance. Healthcare institutions publish news and content on their own platforms.	SVL
2.2.4 Analyse the education curriculum for healthcare professionals on antibiotic resistance, antibiotic use, and infection prevention, and provide recommendations for improvements.	Analysis, implementation, and recommendations for improved education in place.	HRN

Activities	Deliverables	Responsible stakeholders
2.3.1 Conduct a survey to assess the knowledge of veterinarians on antibiotic resistance, antibiotic use, and infection prevention, and map out the need for increased education.	Survey been conducted.	MAST
2.3.2 Increase education for veterinarians based on the survey results (see 2.3.1).	Educational materials, guidelines, and quality documents for veterinarians available.	MAST
2.4.1 Conduct a survey to assess the knowledge of food producers and companies on antibiotic resistance, antibiotic use, and infection prevention, and map out the need for increased education.	Survey been conducted.	MAST
2.4.2 Increase education for food producers and companies based on the survey results (see 2.4.1).	Educational materials available and targeted education provided.	MAST
2.5.1 Improve/maintain participation of children and adults in vaccinations against pneumococci, H. influenzae b, and influenza, as well as vaccinations against other respiratory infections. Ensure access to the best vaccines available at any given time.	Improved participation in vaccinations and ensured access to the best vaccines.	SVL
2.5.2 Explore the possibility of increasing sick leave rights for parents/guardians due to children's illnesses.	Increased sick leave rights for parents/guardians due to children's illnesses.	HRN



Activities	Deliverables	Responsible stakeholders
3.1.1 Examine whether Regulation No. 221/2012 needs to be revised regarding which antibiotic resistant bacteria in humans should be subject to mandatory reporting and which bacteria should be subject to mandatory recording.	A new and updated regulation comes into effect.	HRN
3.1.2 Harmonise the notification and recording requirements for resistant bacteria identified in humans, animals, food, feed, and the environment.	Harmonised notification and recording requirements.	ATRN
3.2.1 Ensure standardised procedures/guidelines for the detection of antibiotic resistant bacteria in laboratories. Summary reports should be sent at least annually to the SVL.	Laboratories performing susceptibility testing use the same procedures (EUCAST) and send results on resistance rates to SVL.	LSH
3.2.2 Update and harmonise guidelines on screening for resistant bacteria in healthcare institutions, hospitals, nursing homes, and private clinics. Results of susceptibility tests for specified bacteria are recorded electronically and information sent electronically to the SVL.	Updated and harmonised guidelines on screenings are available. Analyses of resistant bacteria from all laboratories recorded electronically and sent to SVL. The spread of resistant bacteria in healthcare institutions, hospitals, and nursing homes known.	SVL
3.2.3 Update harmonised guidelines on screening resistant bacteria in employees of production facilities.	New and updated guidelines for employees in primary production.	MAST
3.2.4 Develop a plan for sentinel screening for antibiotic resistant bacteria in the community.	Plan on sentinel screening in place and implemented.	SVL
3.2.5 Update guidelines on screenings of immigrants and asylum seekers.	Guidelines updated.	SVL
3.3.1 Ensure the enforcement of current Regulation No. 1000/2018 on monitoring of antibiotic resistance in food and animals.	Regulations enforced.	ATRN
3.3.2 Introduce MRSA monitoring in pigs in regulations.	Implemented into regulation.	ATRN
3.3.3 Publish regulations on monitoring of ESBL/AmpC and indicator bacteria in lambs.	Regulation implemented.	ATRN
3.3.4 Publish guidelines on screening for antibiotic resistant bacteria in other foods, such as vegetables and seafood.	Guidelines in place.	MAST
3.4.1 Publish guidelines on screening and monitoring of antibiotic resistant bacteria in the environment and at certain hot spots.	Guidelines in place.	UOS
3.4.2 Monitoring of antibiotic resistant bacteria in the environment.	Regular screenings on the spread of resistance in the environment have begun, both related to company operating licenses and official monitoring.	UOS
3.4.3 Monitoring of antibiotic residues in the environment (watchlist monitoring).	Monitoring plan published and increased screening initiated.	UOS

Activities	Deliverables	Responsible stakeholders
3.5.1 Establish the antibiotic resistance fund with secure financing and encourage scientists to conduct research on antibiotic resistance.	The antibiotic resistance fund has secured financing for the future.	ATRN
3.6.1 Establish an official and harmonised policy for WGS of antibiotic resistant bacteria in humans, animals, food and the environment, and secure funding.	Strategic guidelines and prioritisation in place. Costs for sequencing secured.	HRN
3.6.2 Implement WGS in monitoring, according to EU Regulations 1000/2018.	Procedures for WGS on antibiotic resistant bacteria implemented.	ATRN
4.1.1 Update and expand guidelines on eradication treatment, disinfection, and contact tracing both within and outside healthcare institutions, hospitals, and nursing homes for specific resistant bacteria.	Harmonised guidelines on intervention measures both within and outside healthcare institutions, hospitals, and nursing homes.	SVL
4.2.1 Develop guidelines on the treatment of pets identified with specific resistant bacteria. This includes disinfection and contact tracing.	Guidelines published.	MAST
4.2.2 Develop guidelines on the treatment of food producing animals identified with specific resistant bacteria. This includes disinfection and contact tracing.	Guidelines published for defined animal species.	MAST
4.3.1 Develop guidelines on the handling of food and other consumer goods when certain resistant bacteria are detected, including disinfection and contact tracing.	Guidelines published.	MAST
4.4.1 Wastewater treatment in Iceland complies with the provisions of laws and regulations.	The 30 largest urban areas in the country have initiated measures to improve wastewater treatment.	URN
4.5.1 Develop guidelines on actions when resistant bacteria are detected in wastewater/environment.	Guidelines published.	UOS
4.5.2 Develop guidelines on actions when antibiotic residues are detected in the environment.	Guidelines published.	UOS

Activities	Deliverables	Responsible stakeholders
5.1.1 Maintain and strengthen cooperation with ECDC on antibiotic use and resistance.	Cooperation and participation satisfactory. Information distributed to relevant domestic stakeholders.	SVL
5.1.2 Increase Iceland's participation in various collaborative projects, such as Joint Action projects on antibiotic resistance and use.	Additional funding obtained for actions related to antibiotic resistance. Increased knowledge and more effective monitoring and measures against antibiotic resistance.	HRN
5.1.3 Strengthen cooperation with EMA, especially regarding the ensured supply of antibiotics and access to new antibiotics.	Cooperation and participation satisfactory. Ensured supply of common antibiotics in Iceland and good access to new antibiotics.	HRN
5.1.4 Maintain and strengthen cooperation with EFSA.	Cooperation and participation satisfactory. Information distributed to relevant domestic stakeholders.	MAST
5.1.5 Maintain the competence of National Reference Laboratory for Antimicrobial Resistance (NRL-AR) and cooperation with the EU Reference Laboratory for Antimicrobial Resistance (EURL-AR).	Cooperation and participation satisfactory. Information distributed to relevant domestic stakeholders.	ATRN
5.1.6 Strengthen cooperation with EU DG-SANTE (Health and Food Safety) - AMR One Health Network.	More active participation in this forum.	HRN
5.2.1 Maintain and strengthen cooperation with WHO on antibiotic resistance and antibiotic use.	Cooperation and participation increased. Information distributed to relevant stakeholders.	SVL
5.2.2 Maintain and strengthen cooperation with WOH.	Cooperation and participation satisfactory. Information distributed to relevant domestic stakeholders.	MAST
5.3.1 Ensure participation in expert and strategy groups of the Nordic Council of Ministers on actions against antibiotic resistance in the spirit of One Health.	Increased knowledge about antibiotic resistance and joint research projects in place.	SVL
5.3.2 Strengthen joint procurement of antibiotics in the Nordic countries.	Joint procurement increased.	HRN
6.1.1 A multidisciplinary group of experts should be appointed to oversee the implementation of the activities against antibiotic resistance and to reassess individual projects in the future.	Active policy making interdisciplinary group in place which reviews the government actions against antibiotic resistance.	HRN

Appendix II. Objectives of Actions, Output Indicators and Benchmarks

Objectives	Output indicators	Benchmarks 2029
1.1 Enhance and develop electronic records and monitoring of antibiotic prescriptions in humans.	The proportion of antibiotic prescriptions in humans recorded in central databases. Information accessible and published in monitoring reports.	>90% of all antibiotic prescriptions in humans are recorded in the central database, and data accessible.
1.2 Promote reduced and prudent use of antibiotics in humans through enhanced quality development and creation of guidelines.	The proportion of defined target groups with specified guidelines. The proportion of health institutions with active antibiotic stewardship programs.	>95% of defined target groups with guidelines. >95% of health institutions with active antibiotic stewardship programs.
1.3 Enhance and develop electronic recording and monitoring of antibiotic prescriptions in animals.	The proportion of antibiotic prescriptions in animals recorded in central databases. Information accessible and published in monitoring reports.	>90% of antibiotic prescriptions recorded in the central database, and data accessible.
1.4 Promote prudent use of antibiotics in animals through enhanced quality development and guidelines.	Percentage of defined target groups with specified guidelines.	>95% of defined target groups with guidelines.
2.1 Increase public knowledge about antibiotic resistance, the use of antibiotics and infection prevention.	Level of public knowledge on antibiotic resistance, the use of antibiotics, and infection prevention.	Significant increase in knowledge.
2.2 Increase the knowledge of healthcare workers and welfare service staff about antibiotic resistance, the use of antibiotics, and infection prevention.	Level of knowledge among healthcare professionals and welfare service staff on antibiotic resistance, antibiotic use, and infection prevention.	Significant increase in knowledge by the year 2029.
2.3 Increase the knowledge of veterinarians about antibiotic resistance, the use of antibiotics, and infection prevention.	The level of knowledge among veterinarians on antibiotic resistance, antibiotic use, and infection prevention.	Significant increase in knowledge by the year 2029.
2.4 Increase the knowledge of food producers and other food companies on antibiotic resistance, the use of antibiotics, and infection prevention.	The level of knowledge among food producers and food companies on antibiotic resistance, antibiotic use, and infection prevention.	Significant increase in knowledge by the year 2029.
2.5 Reduce the likelihood of infections among the public in the community.	Epidemiology of specified infections known.	Significant reduction in specified infections.

Objectives	Output indicators	Benchmarks 2029
3.1 Harmonise the notification and registration requirements for all antibiotic resistant bacteria according to One Health approach.	The status of recordings on specified antibiotic resistant bacteria	Recordings of specified bacteria fully harmonised.
3.2 Improve knowledge of the spread of antibiotic resistant bacteria in humans.	The spread of antibiotic-resistant bacteria among specified groups of humans.	The spread of antibiotic resistant bacteria known among all specified groups.
3.3 Improve knowledge of the spread of antibiotic resistant bacteria in animals and food.	The spread of antibiotic resistant bacteria among specified groups of animals and in food in summary reports.	The spread of antibiotic resistant bacteria among all specified groups of animals and in food known.
3.4 Improve knowledge on the spread of antibiotic resistant bacteria and antibiotic residues in the environment.	Information on the spread of specific antibiotic-resistant bacteria and antibiotic residues in the environment.	Not relevant.
3.5 Strengthen basic research on antibiotic resistance according to One Health approach.	The number of published peer-reviewed articles from Iceland on antibiotic-resistance.	Not relevant.
3.6 Enhance and coordinate whole genome sequencing of antibiotic resistant bacteria.	The proportion of WGS on selected antibiotic-resistant bacteria carried out in Iceland in Iceland.	All WGS of antibiotic resistant bacteria performed in Iceland.
4.1 Ensure appropriate responses when certain resistant bacteria in humans are detected.	The proportion of defined target groups with specified guidelines.	>95% of defined target groups with guidelines.
4.2 Ensure appropriate responses when certain resistant bacteria in animals are detected.	The proportion of defined target groups with specified guidelines.	>95% of defined target groups with guidelines by the year 2029.
4.3 Ensure appropriate responses when certain resistant bacteria in food are detected.	The proportion of defined target groups with specified guidelines.	>95% of defined target groups with guidelines.
4.4 Treat wastewater appropriately to minimise the spread of certain antibiotic resistant bacteria.	The proportion of defined urban areas that have initiated measures to improve wastewater treatment.	>95% of defined urban areas have initiated measures by the year 2029.
4.5 Ensure appropriate responses when certain resistant bacteria or antibiotic residues are detected in the environment.	The proportion of defined target groups with specified guidelines.	>95% of defined target groups with guidelines.

Objectives	Output indicators	Benchmarks 2029
5.1 Strengthen cooperation with institutions of the European Union.	Measurement and assessment of Iceland's participation in international cooperation. The proportion of projects and groups related to antibiotic resistance in which Iceland participates.	Full participation in projects and groups related to antibiotic resistance.
5.2 Strengthen cooperation with international organisations.	Measurement and assessment of Iceland's participation in international cooperation/ The proportion of projects and groups related to antibiotic resistance in which Iceland participates.	Full participation in projects and groups related to antibiotic resistance.
5.3 Strengthen Nordic cooperation.	Measurement and assessment of Iceland's participation in international cooperation/ The proportion of projects and groups related to antibiotic resistance in which Iceland participates.	Full participation in projects and groups related to antibiotic resistance.
6.1 Ensure the implementation and execution of activities against antibiotic resistance in the near future.	Multidisciplinary group established and annual reports published.	>90% of activities implemented.

Appendix III. Outcome Indicators and Goals

Table 1. Proportion of selected antibiotic resistant bacteria (%) in humans in 2022 and goals for 2029.

Bacteria	Resistance	Samples	2022	2029
<i>Staphylococcus aureus</i>	Methicillin (MRSA)	Invasive	1,1%	<2%
<i>E. coli</i>	ESBL	Invasive	9,8%	<15%**
	Carbapenemase producing	All samples	0,0%	0%
<i>Klebsiella pneumoniae</i>	Carbapenemase producing	All samples	0,0%	0%
<i>Streptococcus pneumoniae</i>	Penicillin resistance (R**)	Invasive	28,6%	<20%
	Penicillin <u>and</u> erythromycin resistance	Invasive	28,6%	<20%
	Reduced penicillin resistance (I***+R)	All samples	41,0%	<25%
<i>H. influenzae</i>	Resistance for amoxicillin+ clavulanic	All samples	23,0%	<20%

* ESBL resistance has been increasing in recent years. Therefore, 20% reduction is unlikely as proposed by the EUL.

**Resistant

***Intermediate resistance

Table 2. Antibiotic use in humans (DID) in 2022 and goals for 2029.

Antibiotic use in humans	2022	2029
Total ATC J01 (sales)	19,5	15
Total ATC J01 community (prescriptions)	17,6	14
Total ATC J01 hospitals/institutions (sales)	1,1	1
Proportion of antibiotics in „Access“ group WHO („AWaRe“)	>80%	>80%
Tetracyclines community (ATC J01A) (prescriptions)	4,5	2,5
Third generation cephalosporins hospitals/institutions (ATC J01DD) (sales)	0,18	0,15

Table 3. Proportion of humans fully vaccinated (%) in 2022 and goals for 2029.

Vaccinations	2022	2029
Pneumococci - children	92%	92%
Pneumococci - 60+ years	35%	70%
Influenza - 60+ years	55%	70%
COVID-19 - 60+ years	73%	70%
Influenza - children	30%	70%

Table 4. Proportion of selected antibiotic resistant bacteria (%) in animals and food in 2022 and goals for 2029.

Bacteria	Resistance	Samples	2022	2029
Staphylococcus aureus	Methicillin (MRSA)	Pigs, swab samples at slaughtering	0%	0%
E. coli	ESBL/AmpC producing (except up-regulated chromosomal AmpC)	All samples	<1%	<1%
	Carbapenemase producing	All samples	0%	0%

Table 5. Antibiotic use in animals (mg/PCU) in 2022 and goals for 2029.

Antibiotic use in animals	2022	2029
Total (tablets) (sales)	5,3**	<4
Group B (AMEG group)	0,1%	<0,5%
Group D (AMEG group)	>82%	>90%

*According to the EMA report on the sale of antibiotics for animals in 2022, the recorded sale was about 0.6 tons of active substances (including tablets), and the PCU was 140.2. This gives about 4.8 mg/PCU. However, it has been found that the actual sale was closer to 0.75 tons of active substances, making the real figure 5.3 mg/PCU

