Rialtas na hÉireann
Government of Ireland

iNAP2
OBAIR LE CHÉILE CHUN ÁBHAIR FHRITHMHIOCRÓBACHA A CHOSAINT DON TODHCHAÍ
WORKING TOGETHER TO PROTECT ANTIMICROBIALS FOR THE FUTURE

Ireland's Second **One Health** National Action Plan on Antimicrobial Resistance

2021-2025

iNAP2

OBAIR LE CHÉILE CHUN ÁBHAIR FHRITHMHIOCRÓBACHA A CHOSAINT DON TODHCHAÍ

WORKING TOGETHER TO PROTECT ANTIMICROBIALS FOR THE FUTURE

Acknowledgement:
All contributors from across the sectors are acknowledged in the preparation of this National Action Plan for their input and role in continuing to advance Ireland's One Health response to Antimicrobial Resistance.

Published by:
The Department of Agriculture, Food and the Marine
Agriculture House
Kildare Street
Dublin, DO2 WK12
Ireland
Tel: +353 (1) 607 2000
www.agriculture.gov.ie

The Department of Health
Block 1, Miesian Plaza
50 - 58 Lower Baggot Street
Dublin, D02 XW14
Ireland
Tel: +353 (1) 635 4000
www.health.gov.ie

November 2021

Citation text
Government of Ireland (2021). Ireland's One Health National Action Plan on Antimicrobial Resistance 2021 – 2025 (known as iNAP2).
Available at https://www.gov.ie/en/publication/d72f1-joint-action-on-antimicrobial-resistance/
www.gov.ie/amr

In text citation
(Government of Ireland 2021)

"Antimicrobial resistance is one of the greatest health challenges of our time, and we cannot leave it for our children to solve."

Dr Tedros Adhanom Ghebreyesus
WHO Director-General
(November 2020)

Table of Contents

Table of Contents

Table of Contents

List of Figures

Table of Contents

List of Tables

Ministerial Foreword

Mr Stephen Donnelly T.D.
Minister for Health

Mr Charlie McConalogue T.D.
Minister for Agriculture, Food & the Marine

As Ministers for Health, and Agriculture, Food & the Marine, we welcome the publication of this, Ireland's second One Health National Action Plan on Antimicrobial Resistance 2021-2025 (iNAP2). This Plan provides a strategic roadmap for continued action to address the serious global public health challenge presented by antimicrobial resistance (AMR).

This second action plan builds on the achievements of Ireland's first National Action Plan on Antimicrobial Resistance 2017-2020 (iNAP1) and is aligned with the Programme for Government: Our Shared Future (2020). Given that AMR is a One Health issue that impacts human health, animal health and welfare and also our shared environment, this new plan continues the multi-stakeholder collaborative process across the three sectors.

Preventing AMR is central to ensuring healthy lives and promoting well-being at all ages. AMR has implications for global health, food sustainability and security, environmental wellbeing, socio-economic development whilst also representing a significant financial burden. The 2015 WHO Global Action Plan on AMR and the UN Interagency Coordination Group have stressed that AMR is a global challenge requiring a global response. The 2017 European Union AMR Action Plan also emphasises the need for European cooperation to tackle AMR. iNAP2 strengthens Ireland's commitment to the international One Health approach for AMR and provides an ambitious framework for action to 2025 to drive change for citizens.

The 'One Health One Welfare' concept promotes a "whole of society" approach which recognises that the health and well-being of people is connected to the health and welfare of animals, biodiversity, and the environment.

The goal of the 'One Health One Welfare' concept is to encourage multidisciplinary collaborative efforts across different sectors such as health, agriculture and the environment to achieve the best health outcomes for people and animals. Our last National Action Plan has provided a very successful platform to implement policies and actions to prevent, monitor and combat AMR across the health, agricultural and environmental sectors underpinned by the One Health approach.

We thank the National Interdepartmental Consultative Committee for their leadership, and all stakeholders and agencies for their collaboration, contributions, and continued commitment. It is action taken together that strengthen Ireland's response in addressing the challenges of AMR through the One Health lens. We look forward to working with stakeholders in delivering the desired outputs and outcomes of this next phase in Ireland's journey.

Mr Stephen Donnelly T.D.

Mr Charlie McConalogue T.D.

Departmental Foreword

Dr Tony Holohan
Chief Medical Officer

Ms Rachel Kenna
Chief Nursing Officer

Dr Martin Blake
Chief Veterinary Officer

Antimicrobial Resistance (AMR) is a challenge of our time, affecting people, animals and the environment. Ireland is committed to using the internally recognised One Health approach, which acknowledges that human, animal and environmental health are all interconnected.

This Second One Health National Action Plan (iNAP2) was developed in consultation with a broad range of stakeholders across different sectors and disciplines. It includes 15 One Health actions to support our human and animal health security by improving coordination, collaboration and communication at the human-animal-environment interface.

iNAP2 further develops the actions taken from 2017 to date under Ireland's first National Action Plan on AMR (iNAP1). Under iNAP1, achievements have included raising awareness about AMR, providing leadership, strengthening governance, building specialist capacity and enhancing surveillance. In addition, we have forged networks for change to address AMR within and between the human, animal and environmental systems. Considerable progress has been made, but this is really just the beginning, and iNAP2 offers us all the next opportunity to maintain momentum and take action.

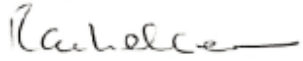
Progress under iNAP1 was tangible as part of the health service response to the COVID-19 pandemic when it emerged in early 2020. The infection prevention and control (IPC) capacity and structures established under iNAP1, and their subsequent enhancement, has allowed IPC to continue to support the delivery of health and social care service throughout the pandemic.

The principles and actions contained in iNAP2 align well with a number of government policies including Ireland's National Farmed Animal Biosecurity Strategy, Ireland's Animal Welfare Strategy and Ireland's National Farmed Animal Health Strategy, with one of its key enabling principles being 'Prevention is Better than Cure'". iNAP2 will support Ireland's ambitions to become a world leader in Sustainable Food Systems over the next decade, in line with DAFM's Food Vision 2030 strategy. In relation to protecting animal health and welfare, the actions in iNAP2 continue to support the five strategic objectives in their overall mission to address the development and spread of AMR.

iNAP2 continues the ambitious approach taken in INAP1. It has a clear focus on measurable outcomes, so progress can be measured in a more tangible way. A proactive, science and evidence-based approach will continue to inform effective integrated policy measures and provide assurance to society at large.

iNAP2 is our continued commitment to action. It outlines Ireland's path towards 2025. There are undoubtedly challenges ahead and we must all continue to take action to protect the health and welfare of the patients and public that use our health and social services, our citizens, our animals, and our environment. iNAP2 provides the framework to continue the positive cross-sectoral engagement and leadership into the future, as we all seek to tackle the evolving challenges of AMR and work together to protect antimicrobials for the future.

Dr Tony Holohan

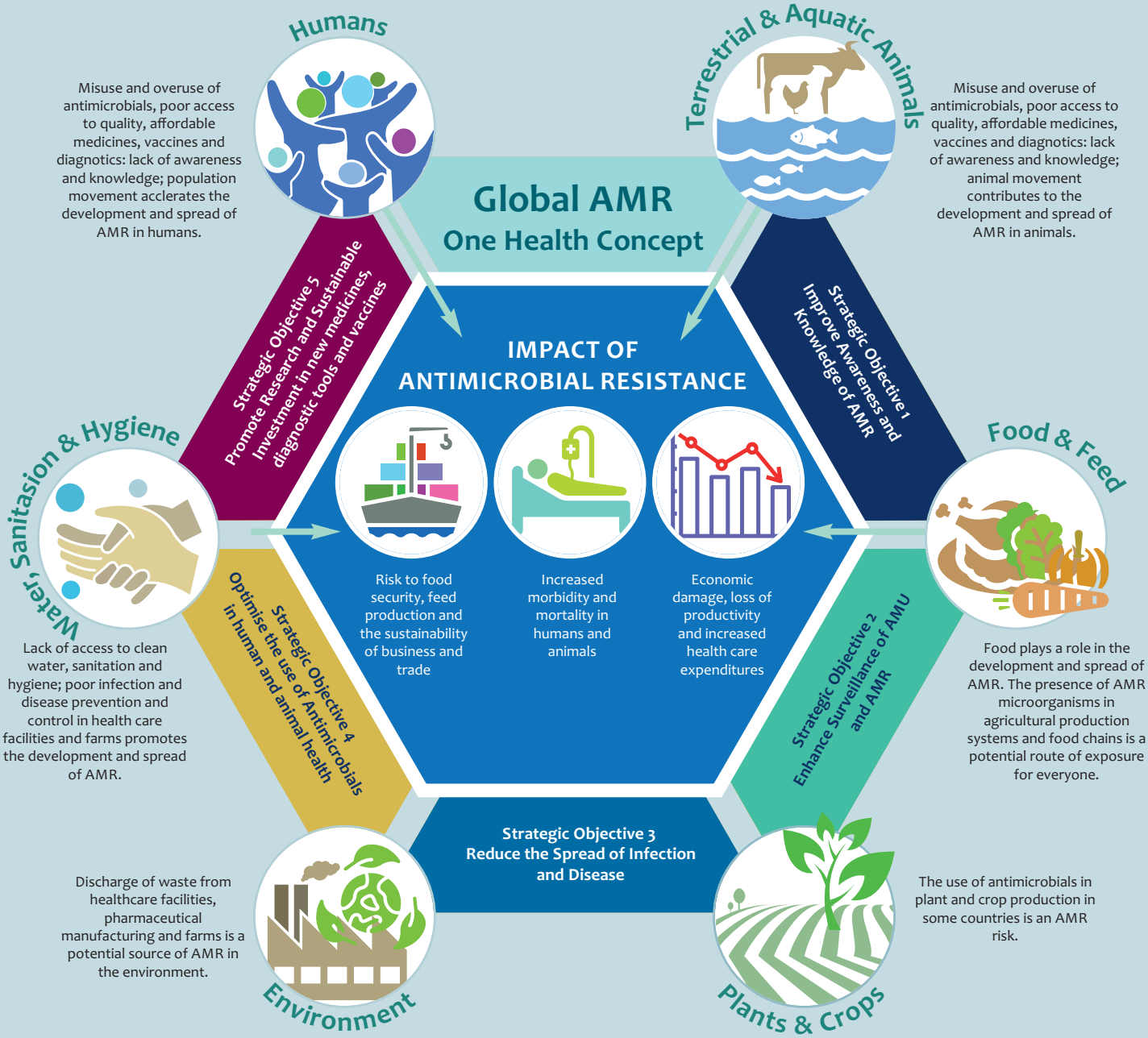


Ms Rachel Kenna

Dr Martin Blake

Figure 1: A One Health Response at a Global level is Critical To Address the Challenge of Antimicrobial Resistance

The fact that humans and animals share the same environment, are exposed to the same general families of bacteria, are treated with the same suite of antibiotics, and bacteria can pass from animals to humans and vice versa with the environment acting as a potential reservoir of resistant bacteria underlines the need for a One Health approach.



Adapted from IACG report 2019.

Part 1: Ireland's One Health Approach

1.1 One Health – Our Way Forward

Antimicrobials are the foundation of modern medicine and since their discovery, have been pivotal in saving countless lives. The WHO have estimated antimicrobials add approximately 20 years to life expectancy globally. They are essential disease treatments in human and animal health in order to protect the health and welfare of people and animals. Antimicrobials are important tools in food producing animals and play an important role in ensuring food security at a national and global level. In human health, antimicrobials are essential to the practice of modern medicine, enabling sophisticated medical interventions and treatments, such as chemotherapy and organ transplants.

Antimicrobials are medicines used to treat infections or disease and are essential in both human and animal health. Antimicrobial resistance occurs when an antimicrobial that was previously effective, is no longer effective to treat an infection or disease caused by a microorganism. The development of resistance among microorganisms or 'superbugs' is a natural phenomenon that will inevitably occur when antimicrobials are used to treat disease.

Antimicrobial resistance (AMR) has been recognised as one of the greatest potential threats to human health over the last decade. The Covid-19 global pandemic is a stark reminder of the fragility of human life when there is no effective medicine available to prescribe or cure disease.

It has been acknowledged globally that a One Health approach is the most effective way to address the global challenge that is AMR. It promotes a "whole of society" approach, recognising that the health of people is connected to the health of animals and the environment. The goal of the One Health concept is to encourage multidisciplinary collaborative efforts across different sectors such as human health, animal health, agriculture, and the environment to achieve the optimal health outcomes for people and animals. The One Health approach recognises the interconnection between people, animals, plants, and their shared environment.

AMR is recognised as a global threat to health, livelihoods, food security and the achievement of many of the United Nations Sustainable Development Goals (SDGs). In particular, due to reduced treatment options for infections by resistant pathogens, AMR is recognised as likely to impact the achievement of many of the SDG targets listed under Goal 3: Ensure healthy lives and promote well-being for all at all ages.

1.2 Ireland's iNAP Journey

Following on from the World Health Organization (WHO) Global Action Plan on AMR (2015) and the European Action Plan on AMR (2017), Ireland published its first National Action Plan on Antimicrobial Resistance 2017 – 2020, known as iNAP, in October 2017. Some key milestones in Ireland's One Health iNAP journey are presented in the figure below.

Figure 2: An overview of some key milestones in Ireland's One Health journey on AMR

This second One Health National Action Plan on Antimicrobial Resistance 2021 – 2025 (iNAP2) builds on the progress made under iNAP1. It aims to protect the health of humans, animals and the environment through minimising the development and spread of AMR while continuing to have effective antimicrobials available.

iNAP's Intersectoral Coordination Mechanism – National Interdepartmental AMR Consultative Committee

The National Interdepartmental AMR Consultative Committee was established in 2014 and is co-chaired by the Chief Medical Officer (CMO), DOH and the Chief Veterinary Officer (CVO), DAFM. The AMR committee aims to meet at least twice annually. The establishment of the National Interdepartmental AMR Consultative Committee meets Ireland's requirements to have an intersectoral co-ordinating mechanism for addressing AMR at European and Global level. Since the launch of iNAP1, this committee has served as an AMR One Health committee.

Further detail on Terms of Reference and membership is provided in Appendix A.

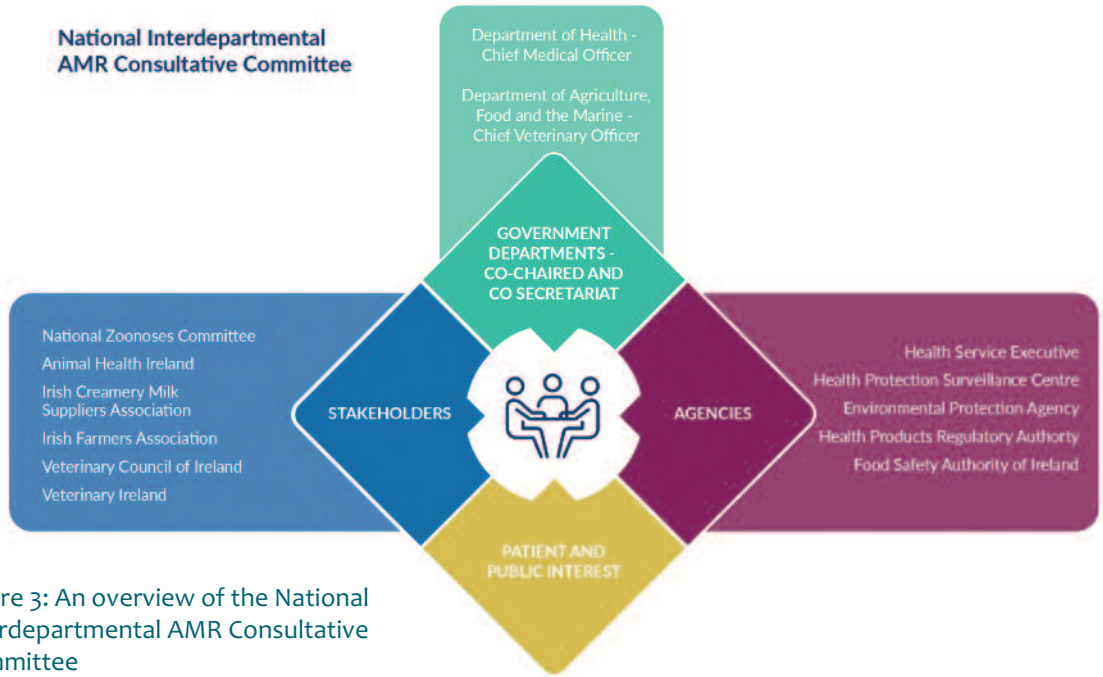


Figure 3: An overview of the National Interdepartmental AMR Consultative Committee

iNAP1 Publication and Launch, October 2017

iNAP1 was developed jointly by Department of Health and Department of Agriculture, Food and the Marine (DAFM) and used a One Health approach. It was launched in October 2017.

Figure 4: Chief Veterinary Officer, Dr Martin Blake with Chief Medical Officer, Dr Tony Holohan at the launch of iNAP1

One Health Events 2018 to 2020

During the iNAP1 cycle, the following One Health events were held:

Figure 5: One Health events 2018 to 2020

One Health Surveillance Report 2019

Ireland's first *One Health Report on Antimicrobial Use and Antimicrobial Resistance* was published in January 2019 covering data mainly from 2016. As an overview of the antimicrobial use (AMU) and AMR surveillance data in both humans and food-producing animals in Ireland, it is an essential mechanism to highlight the importance of scientific evidence to better inform and drive policy decisions to reduce AMU.

Work is underway to publish a second One Health Surveillance Report covering data from 2017, 2018 and 2019 and establish a sustainable regular reporting process as part of the commitment to One Health surveillance in AMR.

1.3 Aims & Objectives of iNAP2

This National Action Plan provides for a coordinated cross-sectorial response to the very real dangers posed by AMR. As with iNAP1, iNAP2 aims to ensure, for as long as possible, the availability of effective antimicrobial treatment options for both human and animal populations. This plan also aims to protect and optimise the health of humans, animals and the environment though minimising the development and spread of AMR. There is an increased emphasis in iNAP2 on infection prevention and control, and also on addressing the development and spread of AMR in companion animals.

The framework of iNAP2 aligns to the five Strategic Objectives as outlined in the WHO Global Action Plan (2015):

1. Improve awareness and knowledge.
2. Enhance surveillance of antibiotic resistance and antibiotic use.
3. Reduce the spread of infection and disease.
4. Optimise the use of antimicrobials in human and animal health.
5. Promote research and sustainable investment in new medicines, diagnostic tools, vaccines, and other interventions.

iNAP2 represents the collective expert views of stakeholders, from across governments and the animal and human health, environment, and agriculture, on how best to combat AMR. It builds on the One Health approach to the implementation of iNAP1 and to emphasise this, the name iNAP2 has been updated and it is called a One Health National Action Plan for AMR.

AMR has been included in the National Risk Assessment, compiled by the Department of the Taoiseach since 2014. The *National Risk Assessment for Ireland 2020*, published by Department of Defence, also recognises the emergence of antimicrobial resistant microorganisms as an increasing national risk. The current draft National Risk Assessment 2021-2022 includes AMR after pandemics as an environmental risk.

The DAFM Statement of Strategy 2021-2024 acknowledges the animal health risk of AMR, and the implementation of iNAP2 supports other animal health strategies. AMR is referenced under the strategic objective of safeguarding public health, food safety and food authenticity. Addressing the risk of AMR is included within the DAFM goal of promoting and safeguarding public, animal and plant health for the benefit of producers, the economy and wider society.

From a human health perspective, the COVID-19 Pandemic has had a monumental impact on all aspects of our health and social care service and wider society, but most importantly the loss of life and health for those who have been impacted by the disease. In addition, it has put a strain on our health and social care services never before experienced. Given the seismic impact that the COVID-19 Pandemic has had on the health and social care service to date, and the fact that this impact will not be fully comprehended for some time, a mid-term review of the human health actions in iNAP2 is planned in Q1 2023.

With regard to the health actions, wider societal issues may also impact on the delivery of iNAP2 and require mitigation as the implementation is progressed over the coming years. These include:

- The evolution of COVID-19 as a global Pandemic and its impact on the health and wellbeing of people in Ireland.
- Complex multi-annual work programmes and externalities which may directly affect delivery of the iNAP2 actions.
- The National economic outlook and the availability of resources, including to the health service as we emerge from the Pandemic to a changed economic, business, and societal landscape, underlining the importance of sustainability and value for money.
- Other wider societal risks, as outlined in the National Risk Assessments.

It remains important that learning, both from the COVID-19 Pandemic response and from the changes in the delivery of healthcare and societal infection prevention and control (IPC) practices and attitudes to infection continue to inform the priorities in addressing AMR and are harnessed to prevent and minimise infection. Therefore, the iNAP2 programme of work is designed to be flexible so it can be delivered taking account of ongoing risk assessment and management. AMR and IPC are also a priority in the DOH Statement of Strategy 2021 – 2023.

1.4 Ireland's One Health International Engagement

UN Sustainable Development Goals

As the WHO has declared AMR as one of the top 10 global public health threats facing humanity, it is clear that global responses are essential. Indeed, AMR is recognised as an increasingly serious threat to the gains made in health and development and for the attainment of the Sustainable Development Goals (SDGs).

EU & International Level One Health Engagement on AMR

Ireland plays an active role at EU and international level and with colleagues in Northern Ireland and Britain in seeking to address the global challenge that is AMR. This iNAP2 plan recognises that it is only through a One Health approach nationally, and an unswerving commitment to collaboration and a One Health approach internationally that we make progress in tackling the threat of AMR.

Figure 6: Overview of EU and international One Health engagement on AMR

Engagement with Northern Ireland on AMR

In line with the One Health approach, Ireland engages with its nearest neighbours to share learning and promote best practice in dealing with AMR. Recognising the strength and value of this cooperation in addressing AMR, it is recognised as a One Health action in this iNAP2 action plan.

- In 2019, the DOH contributed as part of a stakeholder workshop to inform Northern Ireland's AMR action plan.
- In October 2019, DOH and HSE presented to Northern Ireland's Strategic Antimicrobial Resistance & Healthcare Associated Infection (SAMHRAI) committee on Ireland's experiences of the Public Health Emergency on CPE.
- In 2020, A One Island Animal Health AMR communication group was formed, comprising DAFM and Central Veterinary Research Laboratory (CVRL) colleagues in the Department of Agriculture, Environment, Rural Affairs (DAERA) and Agri-Food and Biosciences Institute (AFBI) in Northern Ireland to strengthen AMR cooperation, share progress on respective AMR action plans, activities, and initiatives.

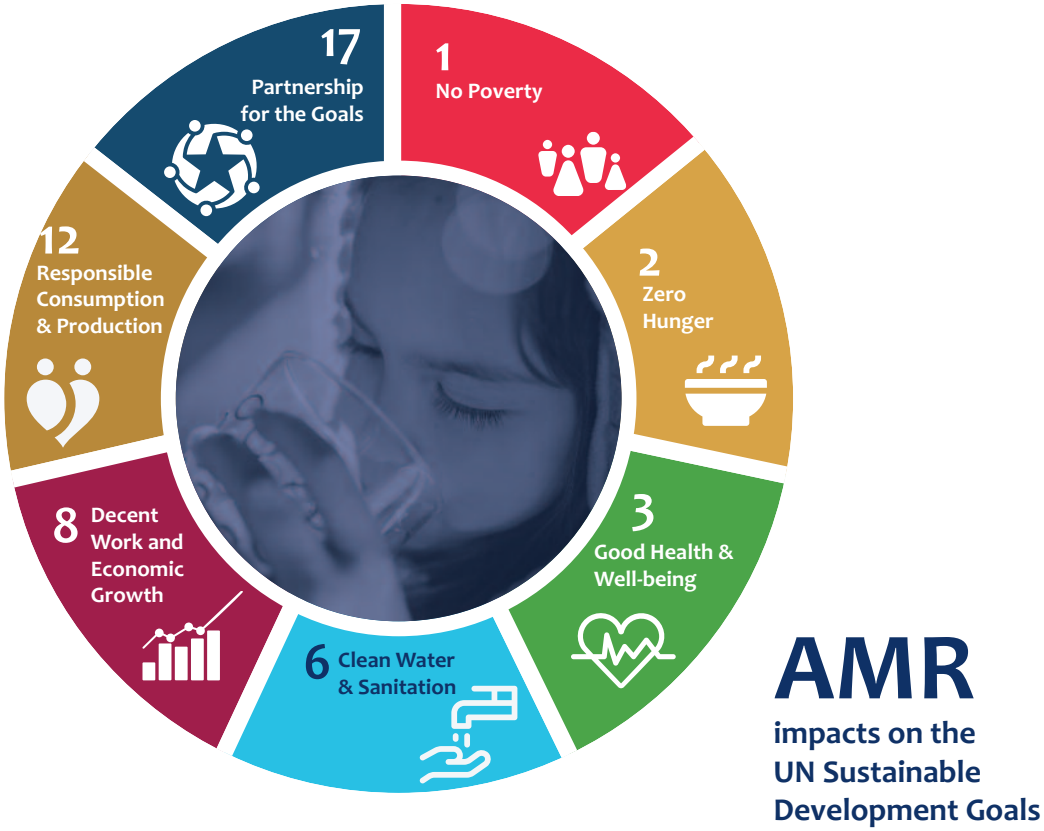


Figure 7: AMR Impacts on the UN Sustainable Development Goals (SDGs)

Part 2: iNAP1 Reflections & Current Situation

2.1 The iNAP journey in human health

Ireland's first National Action Plan on Antimicrobial Resistance 2017-2020, iNAP1, was an ambitious plan that set out a comprehensive roadmap for Ireland in relation to AMR over the three years 2017 to 2020. iNAP1 was the continuation of work already underway across the health service to address healthcare associated infections (HCAIs) and AMR; its publication gave a clear outline of priorities and tasks for progressing during the lifetime of the plan and into subsequent years.

Over the period from 2017 to 2020, iNAP1 provided an essential roadmap for the Irish health and social care service to respond to major public health threats in both AMR and IPC. It proved to be more than just a normal plan, it provided a bedrock which was flexible and supported the responses to two public health emergencies: firstly, the Public Health Emergency on Carbapenemase Producing Enterobacterales (CPE) and secondly, the Public Health Emergency on COVID-19, the most serious public health emergency to have affected the Irish health service and indeed Irish society in living memory.

Responding to an Infection affected by Antimicrobial Resistance - Carbapenemase Producing Enterobacterales (CPE)

Carbapenemase Producing *Enterobacterales* (CPE), then known as Carbapenemase Producing *Enterobacteriaceae*, was first reported in Ireland in 2009. Initially, this drug-resistant infection related to the organism remained relatively localised to one region.

The national CPE reference laboratory service (NCPERLS) was established in 2012. During 2016, the incidence of newly detected CPE increased rapidly, with several CPE outbreaks notified. From January 2017, a mandatory CPE enhanced surveillance scheme was launched, with all microbiological laboratories required to report information on newly detected CPE cases to the Health Protection Surveillance Centre (HPSC).

In light of the rising incidence, on 25th October 2017 (the same day as iNAP1 was published), the then Minister for Health declared a Public Health Emergency in response. The National Public Health Emergency Team on CPE (NPHET-CPE) was established, chaired by the Chief Medical Officer, and the first meeting held on 2nd November 2017. The NPHET-CPE was supported by specialist input and expertise by the CPE Reference Group, chaired by Prof Hilary Humphries.

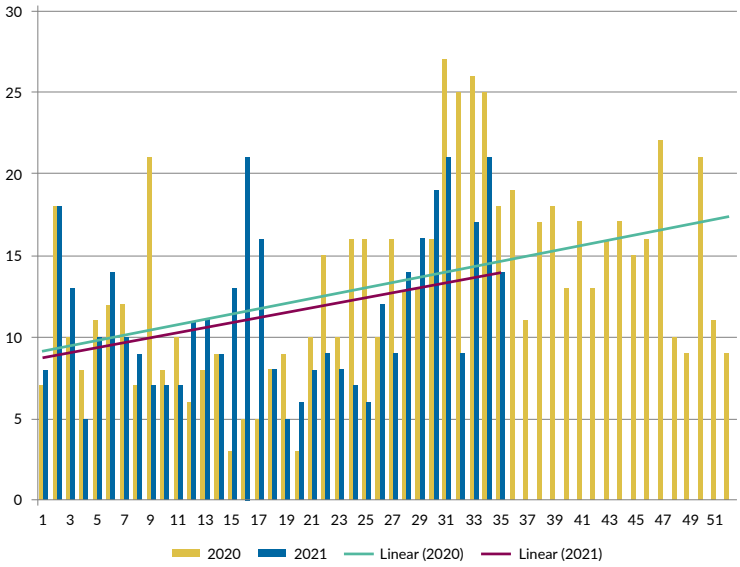
The NPHET-CPE provides advice, guidance, support and direction on:
- the surveillance and management of CPE at national level,
- the development and implementation of a strategy to contain CPE,
- oversight and assurance of the above.

An amendment to the regulation of the Infectious Diseases Act, 1981 was completed in December 2018. This amendment adds CPE and other novel or rare antimicrobial-resistant organisms to the statutory list of notifiable diseases, which physicians are legally required to submit information to the HSE HPSC when a case is identified. This enables more accurate and timely data to be compiled at a national level.

Enhanced surveillance, clinical guidance, provision of screening and allocation of targeted resources were operationalised in 2018 and 2019 in response to this emergency. These initiatives, together with the collaborative work of the NPHET-CPE, DOH, HSE AMRIC, HPSC and the professional healthcare community have led to incidence of CPE stabilising across 2019, 2020 and 2021.

The most recent CPE figures show:
- There were 66 new CPE patients identified in August 2021.
- 28,603 CPE surveillance samples were reported tested in HSE laboratories in July 2021. This remains far above the 25,000 screens monthly target.
- The provisional total of new patients for the first 35 weeks of 2021 is 398. The total for the corresponding period in 2020 was 436.

Number of newly detected patients with CPE by NCPERL per week



This figure represents the total number of people newly detected with CPE each week in 2020 (orange/yellow) and 2021 (blue). The blue line represents the trend in weekly numbers through 2020 and the red line represents the trend in weekly numbers through 2021.

Figure 8: Graph of newly detected patients with CPE by NCPERL per week for 2020 and up to week 25 of 2021. (Note: Q2 2020 coincided with a reduction in hospital admissions during the forst wave of the COVID-19 pandemic).
Source: HSE Summary Report on Carbapenemase Producing *Enterobacterales* (CPE), August 2021.

Newly detected CPE patients by year in NCPERL and Invasive CPE infections notified to Public Health

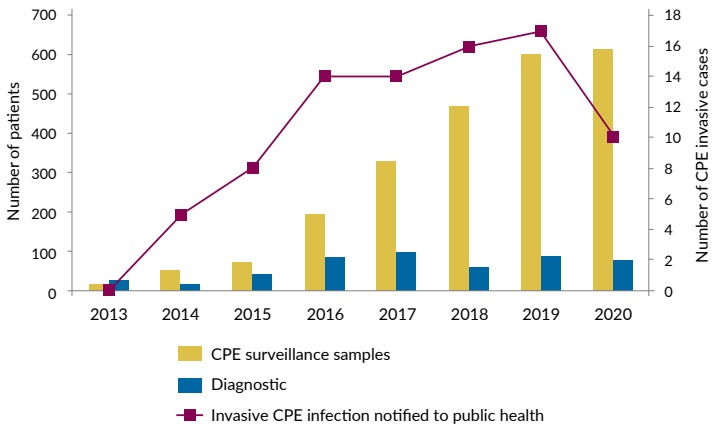


Figure 9: Number of CPE patients by year by sample site (& Number of invasive CPE cases notified to Public Health Note: The data on invasive CPE infection notified to public health are provisional and are subject to change).
Source: HSE Summary Report on Carbapenemase Producing *Enterobacterales* (CPE), August 2021.

The surveillance, screening, monitoring and management of CPE is now integrated into the day-to-day operations of the health service. Further detail is in part 3. The CPE Reference Group was now become part of the clinical advisory structures to guide the HSE National AMRIC Programme. Since February 2020, work has focused on the COVID-19 pandemic, which in some incidences have changed how health and social care is delivered. A further meeting of the NPHET-CPE will be held in due course to consider the stepping down. Meanwhile, the public health emergency on CPE has been kept under review and remains in place.

Learnings from the response to the CPE public health emergency have been key in the development and prioritisation of the actions under iNAP2. In particular, the experience with CPE have demonstrated the importance of good capital infrastructure in supporting safe care and best practice in IPC.

Infection Prevention and Control as an enabler of the delivery of health and social care – COVID-19

The novel human coronavirus disease 2019 (COVID-19) caused by the SARS-CoV-2 virus emerged in late 2019. It was declared a Public Health Emergency of International Concern on the 30th of January 2020 by the WHO. The first confirmed case of COVID-19 in Ireland was reported on 29th February 2020. Prior to this, on 27th January 2020, the National Public Health Emergency Team for COVID-19 (NPHET COVID-19) was established chaired by the Chief Medical Officer. The NPHET COVID-19 provides evidence-based advice to the Minister for Health on the public health aspects of what is a cross-Government strategic response to COVID-19 in Ireland.

IPC was a core Strategic Objective of iNAP1 and this follows on into iNAP2. The COVID-19 pandemic has required a multi-faceted approach and IPC is one of the many components of this. Throughout the response in Ireland, IPC has been and continues to be a key enabler of the resumption and maintenance of both COVID-19 and non-COVID-19 health and social care. The role of IPC was acknowledged in key Government documents including the National Action Plan in Response to COVID-19 (March 2020) and Resilience & Recovery 2020-21: Plan for Living with COVID-19 (September 2020). The path of the pandemic continues to evolve as seen in the figures demonstrating the pattern of cases, hospitalisations and deaths since March 2020 and is influenced by many factors.

The work prior in 2018 and 2019, under iNAP1, to build capacity and expertise in IPC led to the establishment of the AMRIC National Team and associated governance structures within the HSE, as well as an increase in specialist multi-disciplinary IPC posts. This provided a foundation on which to further build IPC initiatives and supports in response to the challenge COVID-19 presented. Further funding was allocated in 2020 and 2021 to accelerate the building of IPC capacity, address immediate prioritised needs and further develop multi-disciplinary teams in an integrated way across acute and community services and in line with national, regional and local governance. In total, over 200 posts were funded across 2020 and 2021. Other IPC supports for the pandemic response include education and training and provision of timely guidance and resources to support healthcare workers and care providers.

The continued provision of COVID-19 and non-COVID-19 health and social care services remains a core priority for Ireland's national response to the ongoing pandemic. In line with the evolving situation, the iNAP2 approach includes a mid-term review, scheduled for 2023, so that the actions agreed under the Plan can be refined as needed to take account of the context at that time. This is also to ensure implementation of the human health actions over the later part of the iNAP2 cycle are responsive to the needs of patients and service users that receive care through our health and social care services.

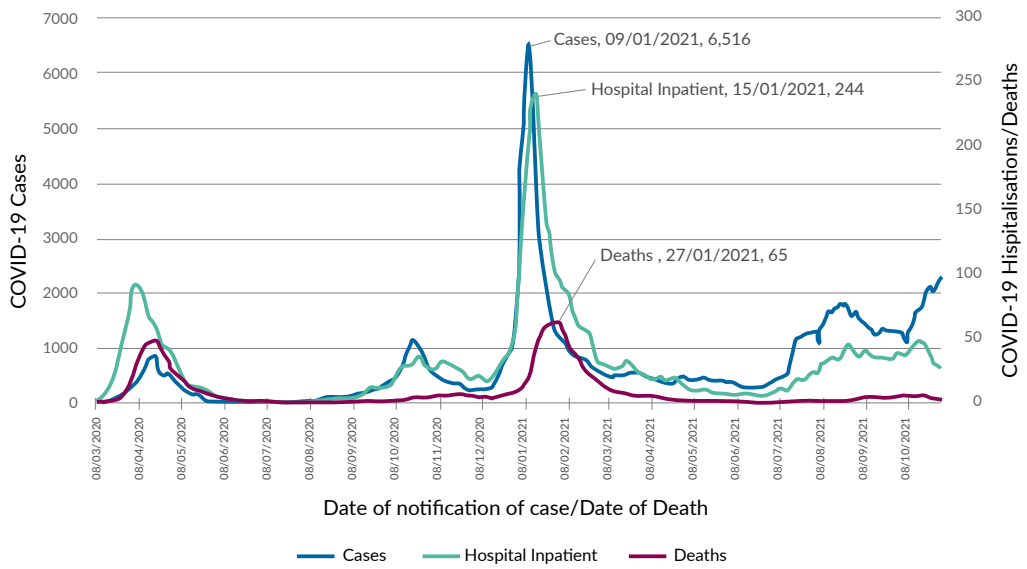


Figure 10: Graph of the 7 Day Moving Average for Confirmed Cases of Covid-19, Confirmed Cases of COVID-19 in Hospitals and Confirmed, Possible and Probable Deaths from Covid-19 up to the end of October 2021

(Notes: Case ascertainment in the first wave was limited by test availability. Data on cases and hospitalisations are displayed by date of case notification to CIDR and Deaths are plotted according to Date of Death.)

Source: Health Protection Surveillance Centre, HPSC

2.2 Overview of iNAP1 Achievements in Human Health

A principal aim of iNAP1 was to provide solutions to reduce the inappropriate use of antibiotics, along with the prevention of the transmission of infections and disease. In addition to providing the foundation for responding to two major public health emergencies, there has also been significant progress in the human health sector on the One Health agenda. The key areas of progress achieved during the iNAP1 lifecycle is set below under five key pillars: health policy; service delivery; regulation; surveillance and evidence-based practice; and communications.

Figure 11: 5 Pillars of progress in human health under iNAP1 lifecycle

Pillar 1: Leading a One Health Approach in Health and Social Care Policy

Over the lifetime of iNAP1, the DOH has worked closely with the Health Service Executive (HSE), health service agencies, stakeholders and participants across health and social care services to drive a coherent One Health approach to AMR and IPC policy.Together with the Department, across the Irish health and social care service, we have been working to manage AMR and prevent and minimise infection, including HCAIs through progressing sustainable initiatives, adopting integrated, multi-disciplinary approaches, focussed on quality improvement, while always seeking to achieve the best outcomes for patients.

Over the duration of iNAP1, to support this approach and our public health system's capacity to tackle AMR, IPC, AMS and HCAIs in acute and community services at all levels, the DOH has provided substantial targeted funding to the HSE. Within the health and social care service, iNAP Plans are funded according to the annual Estimates and service planning processes.

The funding approach taken since 2017 has been designed to ensure that each investment allocation builds on the previous allocations to embed a consistent, multi-disciplinary approach nationally and across different care settings. Initial funding under iNAP1 focussed on building capacity and addressing prioritised deficits in AMS and IPC, as well as surveillance. Investment in 2018 and 2019 also considered the requirements identified to respond to the Public Health Emergency on CPE.

Investment has allowed recruitment of specialist IPC and AMS staff for acute and community services, expansion of the national team to provide leadership, direction and support, established governance structures, allowed an integrated approach across services, provided for education and training, enhanced surveillance of infections, provided minor capital improvements and enabled a number of initiatives, including enhanced communications and dedicated campaigns.

The IPC and AMS structures, capacity and resources across health and social care services that had been built up over the period from 2017 to 2019 by virtue of the iNAP investment were invaluable when our health service was faced with responding to the COVID-19 Pandemic. While the scale of the Public Health Emergency on COVID-19 was beyond anything previously experienced, the existing Antimicrobial Resistance and Infection Control (AMRIC) structures across public health services provided a bedrock upon which to drive IPC responses, identify further resource and 'build out' additional capacity. Building on this foundation, an integrated approach to IPC in response to the COVID-19 Pandemic has been taken. This allows for shared learning and multi-disciplinary synergies across the acute hospital and community sectors to be harnessed and ensures IPC sits within an overarching governance structure.

During 2020 and 2021 investment has been focussed on meeting the requirements identified to deal with the COVID-19 Pandemic. Significant funding has been provided to enhance the health service's IPC responses in an integrated way across acute and community services. For 2022, a focus was maintained on the recruitment of clinical care positions and the consolidation and expansion of the services which provided proven benefit. An overview of funding allocations is provided below:

Table 1: Overview of funding allocations for AMR and IPC

Year	€	Funding Type
2018	€2.0m	New Development funding
2019	€4.7m €1.85m	New Development funding Once-off Project funding
2020	€3.9m	2020 COVID-19 New Development funding
2021	€7.5m €6.5m	2021 COVID-19 New Development funding Budget 2021 for New Development funding
2022	€2.1m	New Development funding

It is also important to note that infrastructure and equipment resources play a key role in IPC best practice, and this continues to be a feature in capital projects and is recognised in the National Development Plan 2021-2030.

Pillar 2: Delivering a One Health Approach in Health and Social Care Services

During the lifetime of iNAP1, major progress has been achieved in advancing a One Health approach in health and social care services through the establishment in early 2019 of the HSE's Antimicrobial Resistance and Infection Control Division (AMRIC). AMRIC is led by a National Clinical Lead and the AMRIC Oversight Group is chaired by the HSE Chief Clinical Officer and membership includes the HSE National Directors for Community and Acute Operations.

AMRIC's establishment also provided a structure which has enabled effective responses to both the CPE Public Health Emergency and the COVID-19 Pandemic. The CPE National Response Team/Implementation Team was established in 2018. This structure was established to respond to the CPE Public Health Emergency. In December 2018, the former HCAI Task Force was stood down and the CPE National Response Team/Implementation Team was replaced with AMRIC Oversight and AMRIC Implementation Team, this updated governance structure was tasked with the wider remit to include AMR and IPC. This structure was enhanced with further membership to support the COVID-19 response in April 2020.

The core work of the AMRIC Team is focused on making services safer for patients and the public and supporting the sustainability of healthcare services by control of AMR. From its establishment, the HSE AMRIC Division's strategic objectives have been closely aligned with iNAP in seeking to provide IPC and AMS leadership across the HSE health and social care services to–

- build IPC/AMS capacity through multidisciplinary integrated teams across health and social care services,
- provide access to IPC/AMS advice, support, education, and training for healthcare workers to drive implementation of National IPC Standards and Guidelines,
- implement information systems to support HCAI and AMR surveillance systems, and
- develop Key Performance Indicators (KPIs) for IPC and AMS for public health and social care services.

Since 2019, the HSE AMRIC team has increased staffing levels and skill mix and has developed and expanded its role to provide multidisciplinary organisational leadership relating to AMRIC activities including microbiology, infectious diseases, general practice, public health, pharmacy, nursing, surveillance, epidemiology, communications, programme management, project management and administrative support.

The AMRIC Team also supports health service colleagues to address and improve IPC in the planning and delivery of health and social care services and to improve antibiotic prescribing across all settings. We also seek to support patients and service users and their advocates by empowering them with accessible information. In addition to its communications activities which are referred to later, the AMRIC Team provided specialist support to the IPC COVID-19 response and for the planning and implementation of the COVID-19 vaccination service.

The HSE actions under iNAP1 were all further supported by the HSE AMRIC Implementation Plans across 2019, 2020 and 2021. These are fully aligned to iNAP1 and 2 objectives and the relevant National Standards. A governance structure is in place between AMRIC and the DOH to support implementation. The implementation of the actions under iNAP1 and initiatives to support AMS and IPC have been included in 2018 to 2021 HSE annual National Service Plans and the HSE 2021 Winter Plan (Winter Planning within the COVID-19 Pandemic, October 2020-April 2021) emphasising the role of IPC as an enabler for the provision of safe care in the context of the COVID-19 Pandemic.

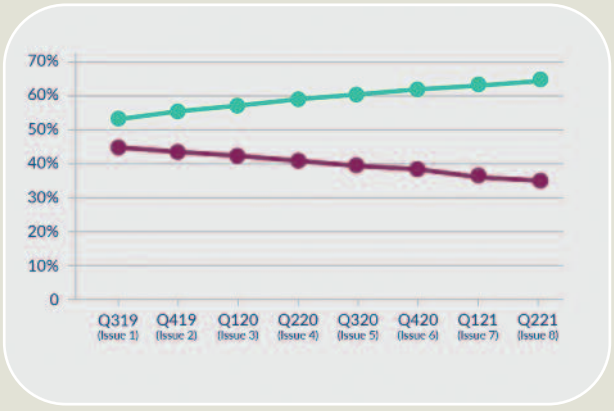
CASE STUDY:
Green/ Red List Antibiotic Prescribing

The HSE Medicines Management Programme (MMP) together with the Antimicrobial Resistance and Infection Control (AMRIC) team have developed a Preferred Antibiotics Initiative commonly referred to as the Green/Red antibiotic list.

The antimicrobial guidelines for community prescribers on www.antibioticprescribing.ie recommend the preferred use of "green" agents which are effective, have fewer side effects and are less likely to lead to resistant infections than "red" agents. This list is communicated to GPs & community pharmacists to assist in antibiotic decision making/ review at the point of prescribing /dispensing.

AMRIC and the HSE Primary Care Reimbursement Service (PCRS) have also been collaborating to build on this Green/Red Initiative, focussed on supporting good practice. Quarterly since September 2019 over 3,000 GPs receive an individualised report on their antibiotic prescribing for a rolling 12-month period. The report details the percentage of green list and red list antibiotics prescribed, and each GP's own prescribing rate is shown within a national quartile of low, midrange or high. PCRS data reports only reflect prescribing for patients with medical cards however significant improvements are noted also in the quality of antibiotic prescribing for non-medical card patients.

The Graph demonstrates the positive change in antibiotic prescribing for medical card patients in the community, an increase in the use of green agents with a decrease in the use of red agents.



Pillar 3: One Health in Health Service Regulation

Thirdly, progress in AMR and IPC across the health service is evidenced by the embedding of IPC through effective health service regulation. The Health Information and Quality Authority (HIQA) has a long-established monitoring programme to assess compliance against the *National Standards for the Prevention and Control of Healthcare Associated Infections in healthcare settings*, which were first published and mandated in 2009. The standards cover key areas of infection prevention and control and antimicrobial stewardship. These standards were reviewed and replaced in 2017 by *The National Standards for IPC of healthcare-associated infections in acute healthcare services* and in 2018 by the *National Standards for IPC in Community Services.*

Indeed, the second Irish National Adverse Event Study (INAES-2) which was a study of inpatient adverse event rates in Irish publicly funded hospitals published in 2021 (involving a retrospective chart review of 1605 admissions to eight Irish hospitals in 2015) found that the implementation of the HIQA's National Standards, coupled with the HSE's National Clinical Programme for Healthcare-Associated Infections (now replaced with the HSE National AMRIC Programme) and the National Clinical Guidelines targeting *Clostridium difficile* and Methicillin-Resistant *Staphylococcus aureus* may have resulted in a decline in hospital associated infection related patient harm.

In light of the ongoing global pandemic of COVID-19 and its impact on the quality and safety of patient care, HIQA has been undertaking a robust monitoring programme of public acute hospital and rehabilitation and community inpatient healthcare services' compliance against the HIQA National Standards for IPC in Community Services. The standards provide a framework for service providers to assess and improve the service they provide, particularly during an outbreak of infection, including COVID-19. HIQA's IPC monitoring programme has been revised in 2021 and a new programme to cover disability services has also been designed and is due to commence.

Pillar 4: Improving health through One Health Surveillance, Intelligence and Evidence-based Practice

The fourth pillar of progress in the health service has been in the area of AMR and IPC is health surveillance, intelligence, and evidence-based practice. Surveillance is an essential tool to inform AMR policies and IPC responses. Enhanced surveillance systems provide information in relation to the prevalence and pattern of resistant organisms and initiatives underpinned by evidence-based practice drive responsible antimicrobial use for the benefit of patients.

Over the timeframe of iNAP1, a number of health surveillance and evidence-based practice initiatives have been implemented and demonstrated their value in our health service. Experience in the Public Health Emergency on CPE and, more recently on COVID-19, has shown how essential it is to have rigorous and reliable data and reporting underpinned by clear governance and supported by high quality clinical guidance in order to be able to implement appropriate responses.

Surveillance systems and evidence-based practice initiatives which proved essential during iNAP1 and which will be maintained and expanded over the lifecycle of iNAP2 include:

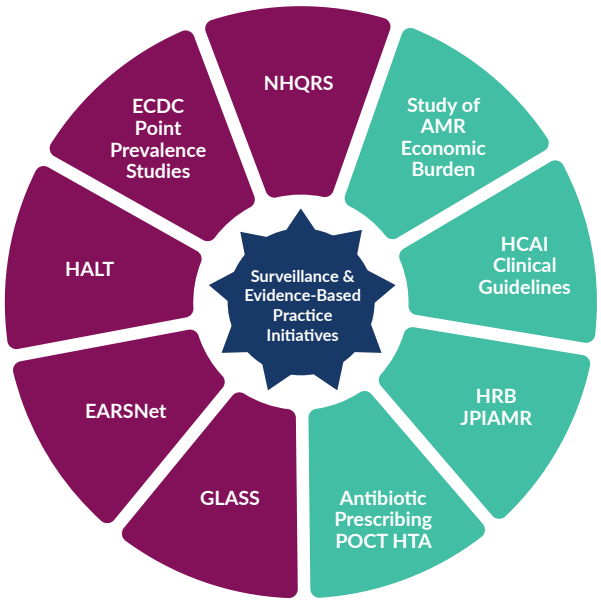
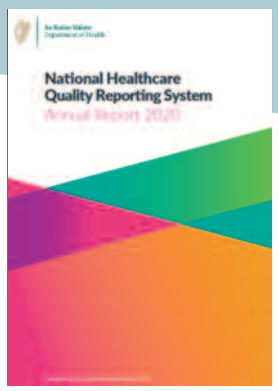


Figure 12: Overview of surveillance and evidence based practice initiatives in human health



National Healthcare Quality Reporting System (NHQRS)

The National Healthcare Quality Reporting System (NHQRS) is the Irish healthcare quality indicator framework which has been published by the Department of Health since 2015. It reports on quality in Ireland's healthcare system compared against international standards or best practice and provides data and information on quality to patients, health service providers and policy makers.

Domain 5: *Treating and caring for people in a safe environment* includes indicators on healthcare associated infection rates and antibiotic consumption rates. The 2020 report covered data up to the end of 2019 (i.e. pre-the COVID-19 Pandemic). Some key findings were:

- The MRSA rate per 1,000 bed days used has decreased annually since 2011. In 2018, in Ireland 12.4% of *S. aureus* bloodstream infections were methicillin resistant; this is as compared with 2011 when 23.8% of these infections were methicillin resistant, however, in 2018 Ireland still ranked 17th out of 30 countries who participate in EARS-Net.
- Other key findings include an increase in antibiotic usage in Irish hospitals over the previous decade.

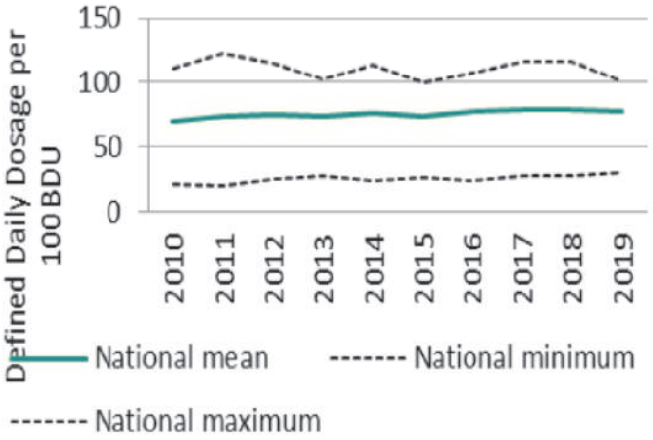


Figure 13: Total in-hospital antibiotic consumption, expressed in DDD per 100 bed days used (BDU), 2010-2019

Source: Health Protection Surveillance Centre (HPSC)

Notes: i) 2019 data is provisional to the end of Q4 2019 and subject to change. ii) This data is based on the ATC/DDD calculation method which was updated in 2019. The HPSC has applied these methodological changes to data for previous years. Therefore, figures for previous years in this report will be different from previous NHQRS reports, which predated these methodological changes. iii) Starting from 2017, returned items to the dispensary are subtracted from the overall consumption rates. For the 2017 Q1 and Q2 data, this has resulted in a decrease of the overall rate by 1.5-2% for the mean and median values of the major classes of drugs, with decreases to the total anti-bacterial consumption for individual hospitals ranging from 0% to 9%. Additional stewardship or minor methodological changes may have also occurred.

ECDC Point Prevalence Studies (published 2019)

The European Centre for Disease Prevention and Control (ECDC) co-ordinate and oversee European wide surveys of point prevalence of HCAI and antimicrobial use in acute care hospitals. Ireland participated in the 2nd ECDC Point Prevalence Survey (PPS) of Hospital-Acquired Infections and Antimicrobial Use in European Acute Care Hospitals: May 2017, published by the Health Protection Surveillance Centre (HPSC) in April 2019.

This was a point prevalence study, i.e., a snapshot of hospital-acquired infections and antibiotic use across participating hospitals on a single day across 28 EEA countries. Ireland's survey assessed hospital acquired infections and antimicrobial use in over 10,000 patients on nearly 600 wards in 60 acute Irish hospitals (46 public and 14 private) on a single day in May 2017. Improvements observed in Ireland included: an increase in the number of participating hospitals; an increase in hospitals that reported having an IPC nurse; a reduction in the proportion of infections associated with indwelling devices; and an improvement in the proportion of antibiotic prescriptions that were in accordance with the local guidelines.

Healthcare Associated Infection in Long Term Care (HALT) (published 2017)

Ireland has participated in the EU-wide HALT PPS Surveys of antibiotic use and infection in Long Term Care Facilities (LTCF) since this programme's inception in 2010. In 2017, the fourth European HALT PPS was published involved over 10,000 residents across 224 LTCFs. Preparations for a fifth survey in 2020/2021 has been delayed due to COVID-19. The study found that:

- just under one-in-twenty residents had a LTCF-acquired infection, the most common types of infections were: Respiratory tract infections; Urinary tract infections; Skin or wound infections,
- about one-in-ten residents were taking an antibiotic. The majority of antimicrobials were prescribed within the LTCF (83%),
- overall, 59% of antimicrobials were prescribed to treat infection. However, antimicrobial prophylaxis (prescription of antibiotics to prevent infection) accounted for the majority of prescriptions in intellectually disabled LTCF (54%). Most antibiotic prophylaxis was prescribed to prevent UTI.

HSE Survey of Nursing Homes

A Point Prevalence Survey of Antimicrobial Use in HSE Older Persons Residential Care Facilities was conducted by the HSE AMRIC Antimicrobial Pharmacists in five of the eight Community Healthcare Organisations (CHO) between October and December 2020 with a total of 3082 residents included. Key issues emerging included the antimicrobial prescription for prophylaxis of urinary tract infections; the practice of routine use of urinary dipsticks; *Pneumococcal* vaccination status; and electronic laboratory access. The study found that:

- Although remaining the most common agent used for treatment of infection, the use of co-amoxiclav (a 'red' antimicrobial) had reduced from 38% of therapeutic prescriptions as seen in HALT 2016 to 17% of therapeutic prescriptions in this PPS.
- The use of clarithromycin (a 'red' antimicrobial) had reduced, dropping out of the top five agents used for treatment of infection in HALT 2016, to position eight; with use of nitrofurantoin (a 'green' agent) now taking its place in the top five agents used.

The results for every facility surveyed were returned to each individual facility, with direct engagement from the CHO Antimicrobial Pharmacist to provide feedback, support and education where necessary. Each CHO also received a CHO-level report of findings for facilities within their organisation. The results of the survey show that improvements are necessary to make sure that antimicrobial use in HSE Older Persons facilities is optimised. This in turn, will improve the safety of residents in terms of adverse effects, *Clostridioides difficile* infection, minimise development of antibiotic resistant bacteria.

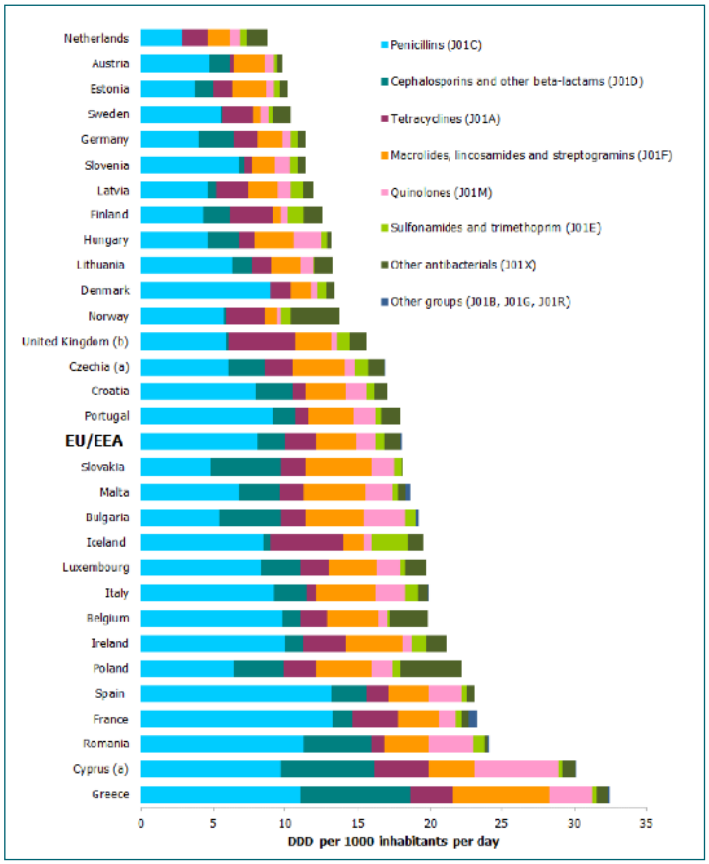


Figure 14: Consumption of anitbacterials for systemic use in the community, by country and ATC group level 3, EU/EEA, 2019

Source: Antimicrobial consumption in the EU and EEA: Annual Epidemiological Report

European Antimicrobial Resistance Surveillance Network (EARS-Net)

Ireland has reported to the European Antimicrobial Resistance Surveillance System (EARSS), known as EARS-Net since 2006. EARS-Net collects comparable, representative and accurate AMR data from across the EU, it provides analysis of trends in AMR within Europe, thereby providing timely data for policy decisions.

Global Antimicrobial Resistance and Use Surveillance System (GLASS)

In October 2015, WHO launched the Global Antimicrobial Resistance and Use Surveillance System (GLASS), the first global collaborative effort to standardise AMR surveillance. GLASS provides a standardised approach to the collection, analysis, interpretation and sharing of data by countries and seeks to support capacity building and monitor the status of existing and new national surveillance systems. Furthermore, GLASS promotes a shift from surveillance approaches based solely on laboratory data to a system that includes epidemiological, clinical, and population-level data. Since May 2021, 109 countries and territories worldwide have enrolled and Ireland actively participates in GLASS.

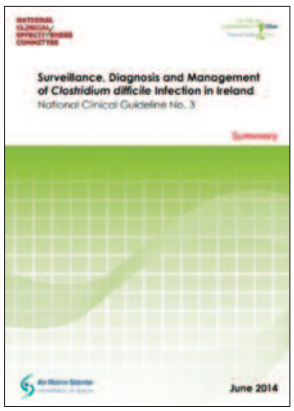
Economic Burden Study of AMR

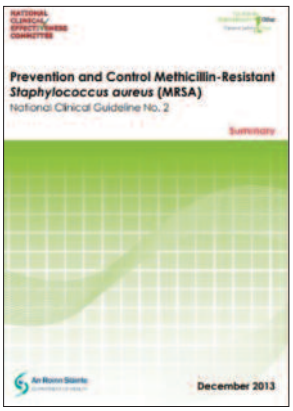
In July 2021, the E*conomic burden of antimicrobial resistance: An analysis of additional costs associated with resistant infections* was published. This study was conducted by the Health Research Board – Collaboration for Clinical Effectiveness in Ireland (HRB-CICER), a collaboration between HIQA and the Royal College of Surgeons in Ireland (RCSI). The study was commissioned by DOH under Strategic Objective 5 of iNAP1 and examined the economic burden of AMR on the Irish public health system. The study methodology was aligned to the Organization for Economic Co-operation and Development (OECD) strategic public health planning for antimicrobial resistance (SPHeP-AMR) model outlined in their 2018 report Stemming the Superbug Tide: Just *A Few Dollars More* and was adapted as the data collection phase coincided with the first wave of the COVID-19 Pandemic.

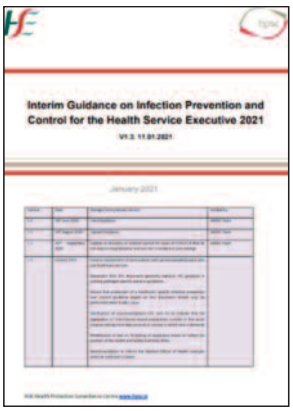
The study's key findings were:

- In 2019, over 7,400 resistant infections occurred across all 50 public acute hospitals in Ireland, resulting in an estimated 215 deaths and nearly 5,000 Disability-Adjusted Life Years (DALYs represent a description for the years of healthy life lost).
- Treatment of these infections resulted in €12m in additional costs to the HSE across the 16 infections studied, however, there was substantial uncertainty with this estimate ranging from €4.9m to €23.3m (95% confidence interval).

The study concluded that a continued focus on AMR in the public acute hospitals is warranted and particularly regarding the economic burden of AMR. Actions to follow on from study findings are included in this Plan.







National HCAI Clinical Guidelines

In 2020 during the COVID-19 Pandemic, *Interim Guidance on Infection Prevention and Control for the Health Service Executive* was developed to ensure availability of the most up to date evidence to guide patient care as part of the Pandemic response. This was updated in January 2021.

National Clinical Guidelines are systematically developed evidence-based recommendations on how health professionals should care for people with specific conditions. The National Clinical Effectiveness Committee (NCEC) was established by the Minister for Health in 2010 and has developed a framework to quality assure and endorse clinical guidelines at national level for the Irish health service.

The NCEC National Clinical Guideline No. 2 on the *Prevention and Control of Methicillin-Resistant Staphylococcus aureus (MRSA)* (2013) and *NCEC National Clinical Guideline No. 3 on Clostridium difficile* (2014) are currently being updated and have been composited into a new *Draft Guidance on Infection Prevention and Control* by the HSE National AMRIC Team. This new guideline when completed will be submitted for NCEC quality assurance and Ministerial endorsement. This is included as an action in this Plan.

Also of relevance is the *NCEC National Clinical Guideline No. 26 Sepsis Management for Adults (including maternity)*, which was published in October 2021. The guideline includes specific recommendations on appropriate and timely antimicrobial therapy.

Health Research Board Joint Programming Initiative on AMR (HRB JPIAMR)

The Joint Programming Initiative (JPIAMR) coordinates national public investments and funds transnational research. JPIAMR seeks and supports solutions to decrease transmissions of resistant bacteria, and to lessen the burden of AMR on a global scale. The Health Research Board (HRB) is represented on the JPIAMR Management Board and funds research calls that align with the HRB strategy.

Since joining JPIAMR in 2017, Irish researchers have been partners in four transnational projects and eight Networks funded via JPIAMR, in the areas of transmission, surveillance and the environment, across five separate funding calls. In addition to projects focussed on human health supported by HRB, projects in the areas of animal health and environment have been supported by DAFM and the EPA. This has been possible as HRB, DAFM and EPA are partners in ERA NET Co-Funds committing funding for relevant joint calls, to enable Irish researchers to participate in the competitive process.

HIQA Health Technology Assessment on Point of Care Testing to guide Antibiotic Prescribing

In May 2019, A Health Technology Assessment (HTA) of C-reactive protein (CRP) point-of-care testing (POCT) to guide antibiotic prescribing for acute respiratory tract infections (RTIs) in primary care settings was published by the HTA Division in HIQA as part of Strategic Objective 5 of iNAP1. The purpose of the HTA was to inform a decision as to whether CRP POCT should be used to support antibiotic prescribing in this patient cohort. In parallel to the HTA, a relative effectiveness assessment of the evidence for CRP POCT was conducted by HIQA and made available to other EU Member States through the HTA network, EUnetHTA.

The HTA report found that the estimated economic impact is subject to substantial uncertainty due to the lack of longer-term follow-up data and the challenges in encompassing all costs associated with quality assurance and governance. The report concluded that, in light of the uncertainty regarding the longer-term sustainability and effectiveness gains from CRP POCT over time, a carefully managed and monitored pilot programme or partial roll-out of CRP POCT may offer the best prospect to evaluate a CRP POCT programme and establish whether a national roll-out of the technology is advisable. This is included as an iNAP2 action.

Pillar 5: Communicating a One Health Approach through AMR/IPC Education and Communications

Joint website on AMR Policy

As part of the One Health approach, in August 2021 the DOH and DAFM established a joint website on AMR. The purpose of the website is to further enhance the One Health communications approach. The website can be accessed at: www.gov.ie/amr

Efforts to communicate, educate and build awareness amongst staff and the public regarding AMR & IPC

Education and communications have key roles to play in progressing societal understanding of AMR for all stakeholders, including patients and their families, healthcare workers and all personnel involved in the provision of health services.

The AMRIC Team provide leadership for this in the health sector. They develop and publish AMRIC clinical guidance, in collaboration with stakeholders; provide education, training and resources to implement this guidance; and provide specialist advice and support to services on AMRIC related issues. The team also prepares information leaflets in a variety of languages and engages with a variety of media channels to communicate with policy makers and the wider public. Since 2018, 17 CPE guidance documents and 15 AMRIC guidance documents have been published.

To support the COVID-19 Pandemic response, 270 AMRIC COVID-19 publications have been developed in collaboration with stakeholders and make available for patient and client care, since February 2020. These are supported by a programme of 55 webinars tailored to the relevant stakeholder audience and the needs of the sector to help people with implementation of the guidance. Further developments in education and training by AMRIC include initiatives such as the IPC Link Practitioner Programme and development of a suite of eLearning modules for health and social care staff.

There are also a number of recognised awareness days in the calendar that Ireland seeks to use as a platform to promote messaging on appropriate antimicrobial use. These include:

- World Hand Hygiene Day – 5th May
- European Antibiotic Awareness Day – 18th November
- World Antimicrobial Awareness Week – 18th to 24th November.

CASE STUDY:
RESIST Communications Initiative

RESIST is a HSE communications initiative that incorporates AMR and hand hygiene communications programmes aimed at health and social care workers. The communications programmes support the existing initiatives in HSE services to reduce infection and antimicrobial resistance in our health facilities.

The language of RESIST is built around people forming a movement to resist an oppressive enemy - Superbugs. RESIST is used as a way to talk to staff about their role in improving hand hygiene, about how we use antibiotics, and how we care for the health and social care environment and keep it clean, ultimately for the benefit of patients. In staff areas, the awareness programme recruits staff to 'join the resistance' as they are the people who can make improvements. Staff who are 'recruited' as trainers help colleagues to change their behaviour around hand hygiene and AMR.

The RESIST programme provides quality training materials and communications resources to assist local health services to drive hand hygiene and AMS messaging.

The Programmes also uses social media and press and PR to raise awareness among the public around appropriate antibiotic usage and hand hygiene so the public understand the behaviour change taking place in our health services. Having a single brand that incorporates both hand hygiene/infection prevention and AMS provides staff with a focus for local initiatives to drive behavioural change.

RESIST
Antimicrobial Resistance and Infection Control Team

Summary of Key Achievements in the Human Health Sector from 2017 to date

An overview of some key achievements in the human health sector from 2017 to date is presented in the table below.

Table 2: Overview table of some key achievements in the human health sector 2017 to date

Strategic Objective 1:

Improve Awareness and knowledge of antimicrobial resistance: through information campaigns, education, intelligence and data

- The HSE National AMRIC Team Client Director drives the awareness and communications agenda.
- The NPSO Learning Zone eLearning platform has an iNAP1 module.
- DOH co-hosted with DAFM the One Health event for Healthcare & Veterinary prescribers and to mark European Antibiotic Awareness Day 2018.
- Specific communications approach to support the NPHET-CPE process, which included regular press releases and updates and a dedicated webpage on the DOH website.
- Antibiotic questions included in the latest wave of the Healthy Ireland Survey.
- The HSE has also developed the suite of eLearning modules on IPC and AMS for HSELanD and the IPC Link Practitioner Programme.
- DOH continue to link with key stakeholders on AMR on policy and other fora.

Strategic Objective 2:

Enhance surveillance of antibiotic resistance and antibiotic use: through surveillance systems that facilitate greater standardisation of data collection, data linkage and sharing of real time information

- The first One Health Surveillance Report was published in January 2019.
- Amendment to the Notifiable Diseases Regulations was signed into law in December 2018 to include CPE colonisation. (Statutory Instrument 390/1981 – Infectious Diseases Regulations (1981)).
- The Hospital Patient Safety Indicator Reports, published monthly, and the HSE Performance profiles each include HCAI items.
- Enhanced reporting on CPE has been implemented following CPE public health emergency.
- Addition of a KPI on Hospital acquired COVID-19 to the indicator suite.
- CPE was included for the first time in the 5th National Healthcare Quality Reporting System.

Strategic Objective 3:

Reduce the spread of infection and disease: through infection and disease prevention and control measures, including national guidelines and standards in relation to hygiene and biosecurity practices

- The HSE established an updated governance and accountability structure for HCAIs/AMR with a National Oversight Group, chaired by the HSE Chief Clinical Officer. This model was updated as needed to support the COVID-19 Pandemic response.
- The work of the HSE National AMRIC Team continues, and implementation leads are in place for acute hospital and community operations.
- The ongoing thematic monitoring programme on IPC by HIQA in acute hospitals continued and made provision to include CPE.
- The HIQA thematic monitoring programme on IPC in community and rehabilitation services commenced in 2020 and preparations are complete for expansion to disability services in 2021.
- Suite of national guidance documents updated and developed by the CPE Expert Group were published by the HSE to support the response to CPE.
- Suite of national guidance documents updated and developed by the HSE AMRIC Team and the HPSC were published by the HSE to support the COVID-19 Pandemic response.
- The HSE Community IPC Strategy has been developed.
- The National Reference Laboratory for C. difficile is under establishment and will commence in 2021.
- The HSE IPC information technology project has commenced.
- Ongoing work on vaccination.

Strategic Objective 4:

Optimise the use of antibiotics in human and animal health: through development and implementation of antimicrobial stewardship programmes, promotion of prudent prescribing practices and access to rapid diagnostics

- Workforce planning and service development based on an integrated multi-disciplinary approach to expand front line specialities IPC and AMS teams across acute and community services in a consistent way.
- HSE National AMRIC Team have identified and prioritised AMS and IPC human key resource requirements over the lifetime of iNAP1 and beyond into 2022.
- All new posts include a responsibility to implement the activities of iNAP1 and subsequent plans and to support clinical guidelines, policies and procedures in relation to HCAIs/AMR.
- The HSE AMRIC National Team includes approved posts for a Chief Pharmacist, Senior Scientists, Surveillance Scientists, Antimicrobial Pharmacists and an Epidemiologist which provides capability in relation to antibiotic and medicines management for HCAIs and AMS.
- The prescribing guidelines on www.antibioticprescribing.ie continue to be developed and expanded to encourage appropriate prescribing of antimicrobials.

Strategic Objective 5:

Promote research and sustainable investment in new medicines, diagnostic tool, vaccines and other interventions: through measuring evaluable costs of HCAI/AMR, identifying research opportunities and working with key stakeholders to develop alternative disease treatment tools

- A Health Technology Assessment on Point of Care Testing to guide antimicrobial prescribing in the community was published by HIQA in May 2019. This also included collaboration at European level through the EU HTA Network. The recommendation is an Irish pilot project.
- A study on the Economic Burden on HCAIs/AMR was published by HRB-CICER in July 2021.
- The HSE GP Out of Hours project in Cork has shown increased compliance with prescribing guidelines and a decrease in unnecessary antibiotic use and is being expanded.
- DOH engaged with relevant stakeholders, including the HRB, who are the lead in Ireland for the JPIAMR.
- Practice research continues.

Conclusion

When iNAP1 was launched in October 2017, it was clear that CPE had become an issue and iNAP1 went on to be the framework within which to consider and manage the spread of this drug-resistant infection under the Public Health Emergency declared on the same day. This generated learning and required an immediate prioritisation within the actions of iNAP1. What was not envisaged, however, was the emergence of a novel and highly contagious virus that would fundamentally change all our lives. The arrival of COVID-19 in Ireland in early 2020, with all the challenges in response, was another opportunity to test our approach in iNAP1. Again, it offered a framework that has proven helpful and supportive as the response expanded and in some cases continues to develop.

Significant achievements and progress have been made during the cycle of iNAP1. There is now specialist multi-disciplinary expertise at national, regional and local levels. IPC and AMS teams are part of the way services are delivered for patients and their families. There is improved awareness and understanding of the issue of AMR and IPC both in healthcare workers and the general public. The value of evidence-based practice and clinical guidance for AMS and IPC is now firmly established with a vast suite of resources now available publicly. Research and evidence synthesis-informed new developments and expanded knowledge available for prioritisation decision. Education and training have become a key focus to ensure all staff integrate best practice into the delivery of day-to-day care. All of these has occurred on the basis of iNAP1, while retaining the flexibility to respond to emerging issues, including the Public Health Emergencies on CPE and COVID-19.

Importantly the progress since 2017 has also been supported by significant investment and capacity building. This is required to provide a sustainable resource for the Irish health and social care system to continue to manage and respond to the challenge of AMR. Evaluation and monitoring are essential elements to the progression of this and return on investment remains a key consideration as we move into the implementation of the iNAP2 cycle over the coming years.

2.3 The iNAP Journey in Animal Health

Ireland's first National Action Plan on AMR has set the scene and provided a strong framework for continued future progress around tackling the complex One health challenge that is AMR. In order to deliver the actions attributed to the animal health sector under iNAP1 the Animal Health Implementation Committee (AHIC) was established in January 2018. The role of this committee is to provide a mechanism to guide and co-ordinate actions to address AMR in the animal health sector. The Committee also serves to provide a forum for the sharing of information so that all animal health stakeholders are aware of actions being carried out across the sector. In addition, the AHIC also continues to have a role to provide a mechanism to identify any new or emerging issues, synergies, research gaps and opportunities, and to develop innovative solutions to address issues that arise.

Although the Animal Health Implementation Committee was established to deliver solutions to AMR challenges specifically in the animal health and agri-food sector, it has from its initiation included representation from the environment sector. This committee has fostered synergies between all the members, and across both sectors whilst undertaking concrete steps to strengthen the implementation of evidence based One Health policies to tackle AMR. All members of the AHIC have shown proactive engagement and leadership, and a willingness to work in a collaborative way to deliver the many actions that were included in this first action plan.

A key mission of iNAP1 was to address the development and spread of AMR in the human health, animal health and environmental sectors. In order to address the challenge of AMR in animal health, the focus of iNAP1 (2017-2020) was to optimise animal health and promote prudent use of antimicrobials. Actions taken to improve animal health, and prevent disease, are key to reducing the use of antibiotics, and effectively tackling AMR. These actions align well with Ireland's National Farmed Animal Health Strategy with one of the key enabling principles being 'Prevention is Better than Cure''. Sustained optimal animal health is critical to the future profitability and sustainability of our farming and processing industries, and to the protection of public health and of our shared environment. In terms of optimising use of antibiotics in animal health, there was considerable engagement and collaboration by stakeholders and members of the AHIC work to develop and publish guidance on antimicrobial stewardship, both at prescriber level and also for farmers.

Over the last 3 years (2017 - 2020), stakeholders of the AHIC have delivered many concrete outcomes as well as operational proposals for further action. In terms of addressing AMR in the animal health sector two indicators of progress are reductions in antimicrobial use and also levels of resistance in animals and food. Continued analysis of both sales and use of antibiotics, in conjunction with trends in the development and spread of AMR are key measures to address the challenge of AMR. Due to actions completed under iNAP1 the range of data available continues to expand which will enhance progress from a policy implementation and outcomes perspective.

CASE STUDY:

Case study of A Pig Farmer who has Reduced his Antibiotic Use

John Hanrahan runs a 1400 sow farrow-to-finish pig unit in County Limerick and has managed to dramatically reduce his level of antibiotic usage to almost zero since 2018. As well as removing all in feed antibiotics at all stages of production, he has also seen better growth rates and performance in his pigs, along with a reduction in the overall workload on his unit.

John has implemented a series of management and biosecurity practices that have helped improve pig health, performance and sustainability of the family farm enabling:

- Control of most of the endemic disease issues on farm.
- A reduction in the use of antibiotics by 98%.
- Removal of zinc from pig diets.

John worked in partnership with his veterinary practitioner, Teagasc advisor and nutritionist to identify animal health issues and areas for improvement on farm. He focused on improving internal biosecurity by ensuring staff were working in dedicated areas that meant they did not crossover into different ages of pigs. He removed his hospital pen and moved to an 'all in – all out' avoiding mixing pigs of different age groups. His stocking density reduced as the pigs were growing better, which further reduced the disease challenge.

A vaccination programme has been an integral element in the success achieved and although his medication cost has now been replaced with the cost of the vaccines, his enterprise is still more profitable. John took a leap of faith to remove antibiotics from his production system, and it was six months or more before the benefits became visible. He emphasises the importance of a holistic collaborative approach with his vet, Teasgasc advisor and nutritionist team. John managed to successfully change the behaviour on his farm with regard to antibiotic use, whilst delivering a very positive outcome for animal health and the economic sustainability of his family business. John has participated in the DAFM funded research PathSurvPigs and AMURAP projects and his story is a positive example of how DAFM funded research is being translated to farms on the ground and having a positive effect.

Sales of Antimicrobials for Use in Animals

Since 2009, the Health Products Regulatory Authority (HPRA) has been collating data on antibiotic sales for the previous year provided to the HPRA by the marketing authorisation holders (MAHs) who market veterinary antibiotics. This data is reported to the European Medicines Agency as part of the European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) project. The EMA publishes an annual ESVAC report on sales of veterinary antibiotics which serves to highlight trends in sales of veterinary antibiotics throughout Europe over time. There are many limitations to the interpretation of sales data, including the fact that not all antibiotics bought may be used in the same year, and many antimicrobial veterinary medicinal products are licensed across several different species. Thus, it is very challenging to use sales data alone to decipher what sectors the antimicrobials (AMs) are being used in, apart from intramammaries used in the dairy sector and premixes which are predominantly used in pigs. Over the past number of years, sales of antimicrobials in Ireland have fluctuated marginally however the most recently published HPRA report showed a significant reduction in sales of antibiotics in 2019 with a 10.7% drop in sales compared to 2018 levels.

Table 3: Sales (tonnes sold) of veterinary antibiotics for the years 2013 – 2019 (source HPRA report 2019)

	2013	2014	2015	2016	2017	2018	2019
Tonnes sold	99.1	89.4	96.9	103.4	99.7	99.4	88.8

According to the latest ESVAC report (2018 data) sales of antibiotics used in animals throughout the European Union (EU) fell by more than 34% between 2011 and 2018. The overall amounts of antibiotics sold in Ireland, corrected for the size of the animal population (the population correction unit or PCU) was 46 mg/PCU in 2018 (Figure 15). This places Ireland 11th lowest out of 31 countries in the European Economic Area including Switzerland participating in ESVAC for antibiotic sales on a mg/PCU basis. The PCU figure is a proxy for the size of the food animal population (including horses) at risk of treatment with antimicrobials. Country level differences when using the mg/PCU metric for measuring AMU need to be interpreted with caution as results will be influenced by the size of each production system in terms of biomass as well as the volume of AMs used in each production sector (More 2020).

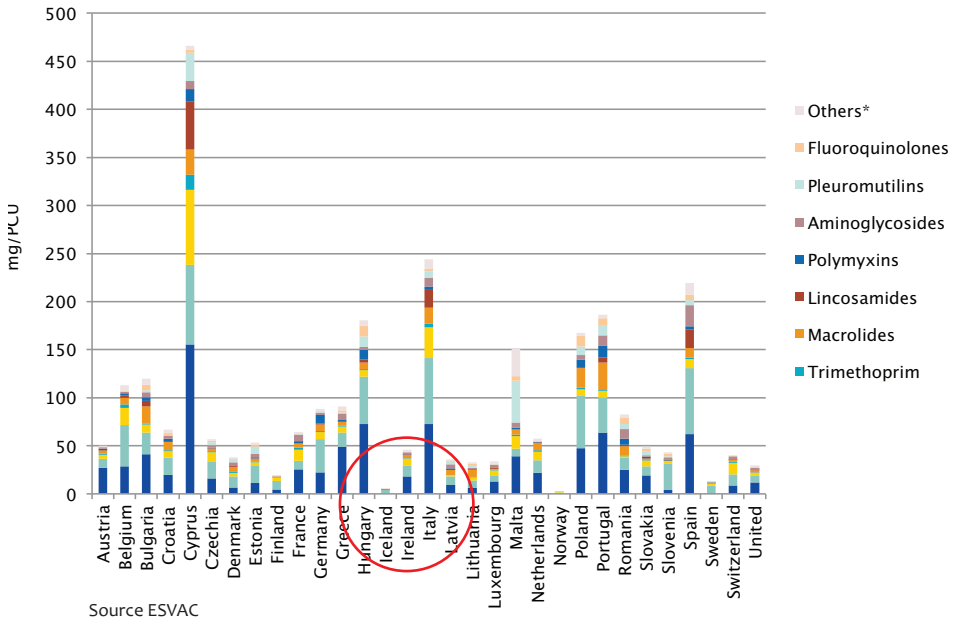


Figure 15: Sales for food-producing species, in mg/PCU, of the various veterinary antimicrobial classes, for 31 European countries, in 2018

Differences between countries can be partly explained by differences in animal demographics, in the selection of antimicrobial agents, in dosage regimes, in the type of data sources, and veterinarians' prescribing habits.

The sales trends do not indicate a huge fluctuation in overall sales despite an increase in the size of the national dairy herd since 2015 with the lifting of milk quotas. The data does show a downward trend in overall sales (Table 3). The most significant decrease in sales was seen in 2019, which suggests positive progress with regard to usage of antimicrobials in animals.

Table 4: ESVAC Trend Line of antimicrobial (AM) sales in mg/PCU in Ireland 2010-2018

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018
AM sales in mg/PCU	51.5	46.5	55	55.9	47.6	51	52.1	46.6	46

According to the latest HPRA Report more than 70% of antibiotics sold are in the form of oral medications for use in feed and water. In feed medication is mostly used in pigs and accounts for around 40% of the total use. The European Medicines Agency's' Antimicrobial Advice AdHoc Expert Group (AMEG) considered the role of route of administration of antimicrobials when categorising the risk of selection for AMR arising from treatment of animals with antimicrobials. Oral medications were considered to have the greatest impact on the selection of AMR.

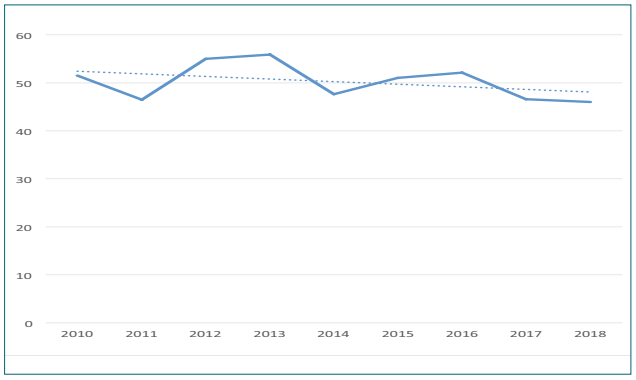
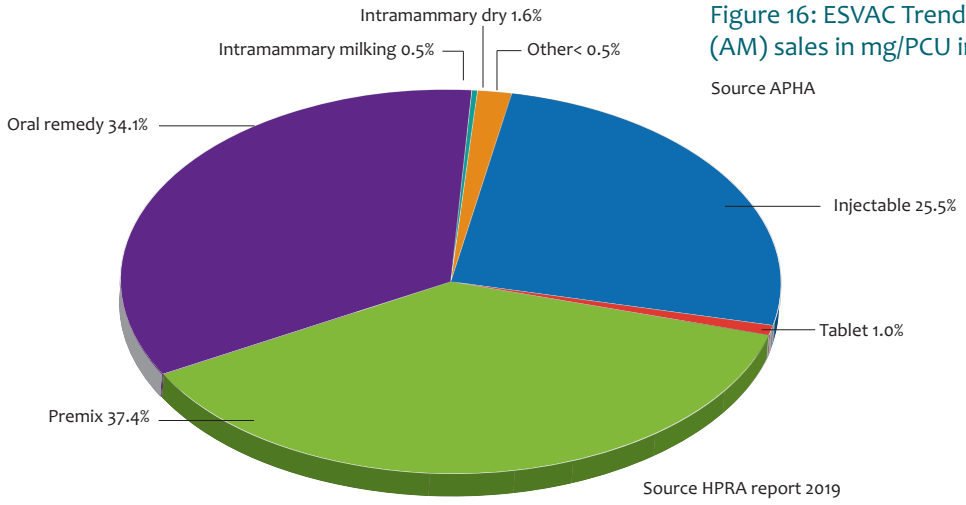


Figure 16: ESVAC Trend Line of antimicrobial (AM) sales in mg/PCU in Ireland 2010-2018

Source APHA



Source HPRA report 2019

Figure 17: Pharmaceutical form breakdown of veterinary antibiotics sold in 2019 in Ireland

There was also a noticeable reduction in sales of Highest-Priority Critically Important Antimicrobials (HPCIAs) (Table 5) which may be an indicator that initiatives undertaken under iNAP1, such as the publication of DAFM's Policy Document on the Use of Highest Priority Critically Important Antimicrobials, are promoting more prudent use of antimicrobials. This policy document recognised the importance of certain classes of antimicrobials as 'drugs of last resort' in human medicine and provided guidance on their prudent use in veterinary medicine.

Table 5: Sales (tonnes sold) of HPCIAs (3rd & 4th generation cephalosporins, fluoroquinolones and macrolides) for the years 2013 – 2019 (Source HPRA report 2019)

	2013	2014	2015	2016	2017	2018	2019
3rd & 4th gen. cephalosporins	0.17	0.24	0.22	0.25	0.30	0.33	0.21
Fluoroquinolones	0.89	0.69	0.79	0.94	0.85	0.84	0.74
Macrolides	6.25	6.26	5.58	6.58	7.17	7.07	5.60

AMR Surveillance 2014-2020

Official surveillance of AMR in zoonotic and commensal bacteria was carried out in accordance with Commission Implementing Decision 2013/652/EU between 2014 and 2020. Under the National AMR Surveillance Programme, annual monitoring and surveillance is aimed at establishing AMR levels, detecting trends, and new and emerging resistance patterns. The results of the official testing carried out by the National Reference Laboratory for AMR in food, feed and animal health, are collated and transmitted to EFSA annually, where they are included in the EU summary report on AMR in zoonotic and indicator bacteria from humans, animals and food. The monitoring programme focused on AMR in bacteria derived from either poultry (2014, 2016, 2018, 2020) or pigs and cattle (2015, 2017, 2019), with sampling of these populations taking place on alternate years. Samples were collected on farm, at slaughter or in retail outlets (Figure 18).

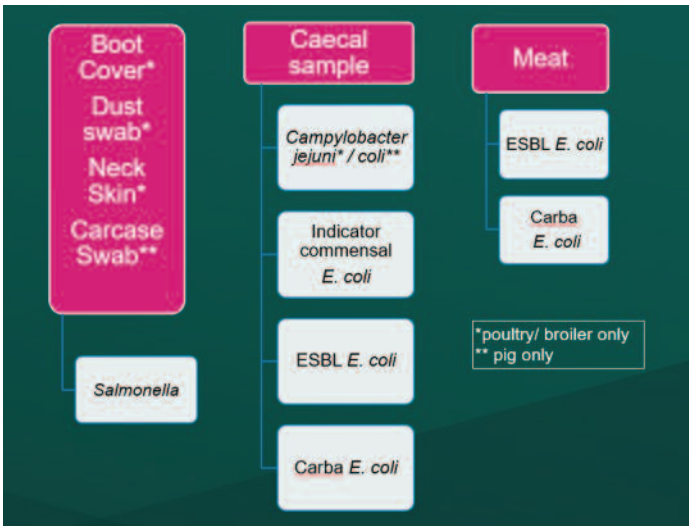


Figure 18: Bacterial isolation workflow for official AMR samples

The bacteria tested included pathogens (*Salmonella* and *Campylobacter*), which can cause disease in humans (zoonoses) and indicator commensal bacteria *(E. coli*), which are a normal component of human and animal gut flora. Bacteria were screened for resistance to 14 antimicrobials, including compounds that are used in both human and animal medicine, as well antimicrobials reserved for use in humans which were included for surveillance purposes.

The programme also includes targeted surveillance of particular resistance patterns in *E.coli* that are significant from a One health standpoint.

Campylobacter

Campylobacter was the most commonly reported zoonosis in the EU in 2019 and *C. jejuni* from **broiler caecal** (intestinal content) samples was included in the surveillance programme in 2014, 2016, 2018 and 2020.

C. jejuni isolates were most frequently resistant to tetracycline and ciprofloxacin the latter being a critically important antimicrobial (CIA) in the treatment of human *Campylobacter* infections. However, resistance to both antimicrobials in Irish isolates was less than 40% of the EU average each year (2020 figures not yet available). Resistance to gentamicin and to erythromycin, another CIA, was not observed

Salmonella

Each year isolates of *Salmonella* derived from pig carcase swabs were screened for AMR. As in other member states, the highest levels of resistance observed every year were to ampicillin, sulphamethoxazole and tetracycline, which are amongst the most prescribed antimicrobials in agriculture (Figure 19).

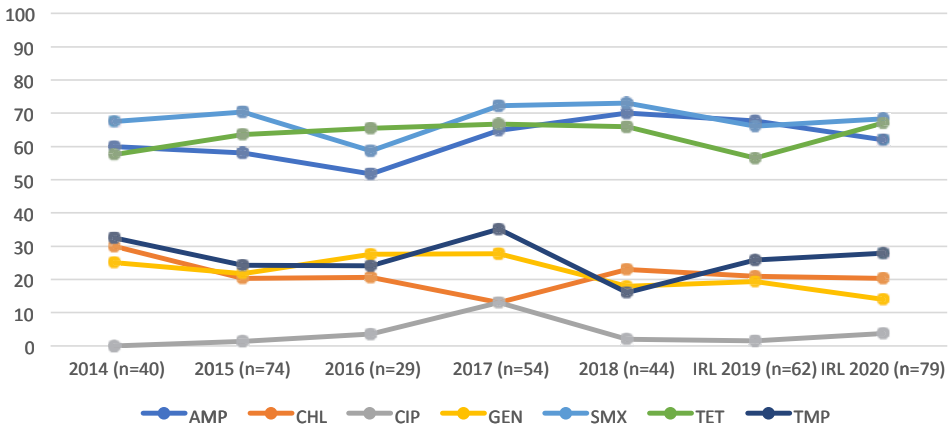


Figure 19: Resistance in *Salmonella* from pig carcase swabs in Ireland, 2014- 2020. (AMP- ampicillin, CHL- chloramphenicol, CIP- ciprofloxacin, GEN- gentamicin, SMX- sulphamethoxazole, TET- tetracycline)

However, the levels of resistance to some antimicrobials, in particular ampicillin, gentamicin and sulphamethoxazole, were significantly (12-22%) above the EU average each year they were published. *Salmonella* from these samples also displayed high levels of multi drug resistance (MDR). These findings were due to a high proportion of *S. Typhimurium*, a *Salmonella* sub-type that is associated with high levels of resistance and frequently causes disease in humans.

The low prevalence of *Salmonella* in Irish poultry flocks (broiler chickens, hens and turkeys) limited the number of isolates available for antimicrobial susceptibility testing (AST). AMR was absent or seen at very low levels in *Salmonella* from poultry.

While the National Control Plan for *Salmonella* has demonstrated a low prevalence of *Salmonella* in Irish poultry flocks, further work is needed to reduce the incidence of *Salmonella* in pig herds and an action under Strategic Objective 3 of iNAP2 will seek to introduce improvements in the current programme.

"Indicator" commensal *E. coli*

"Indicator" commensal *E. coli* are part of the normal intestinal flora of healthy humans and animals. Resistance is monitored in these bacteria because they can develop resistance in response to antimicrobial treatment and act as a potential reservoir of resistance genes which can be transmitted to pathogenic bacteria of humans or animals.

Resistance in commensal *E. coli* from Irish pigs and broilers followed similar trends to those reported elsewhere in Europe and tended to be most resistant to ampicillin, sulphamethoxazole, tetracycline and trimethoprim, which are commonly used in veterinary medicine. Resistance to ciprofloxacin, a CIA, in *E. coli* from broilers decreased from 41.3% to 17.1% between 2014 and 2020.

Multi- drug resistance (resistance to 3/ more antimicrobial classes) in *E. coli* from broilers halved, while the percentage of isolates that were susceptible to all antimicrobials doubled. Similar decreases were not observed in *E. coli* from pigs and their resistance levels, MDR and the proportion of completely susceptible isolates remained relatively stable.

Selective Isolation of Extended Spectrum Beta Lactamase (ESBL)/ AMP-C/ Carbapenamase producing *E. coli*

ESBL/ AMP-C producing *E. coli* are bacteria that are resistant to 3rd and 4th generation cephalosporins, antimicrobials that are of critical importance in the treatment of human *Salmonella* and *E. coli* infections. Carbapenamase producing bacteria are resistant to the carbapenem CIA class, which is exclusively licensed for use in human medicine. Additional specific monitoring aimed at detecting these bacteria in caecal (intestinal content) and retail meat samples has been ongoing since 2015. In 2016, Ireland recorded one of the highest levels of samples positive for ESBL/ Amp-C producing *E. coli* in the EU in broiler caeca, which was almost twice the EU average. However, the percentage of positive samples markedly decreased and stood at 16.3% in 2020, which is less than a fifth of the level recorded in 2016 (figure 20).

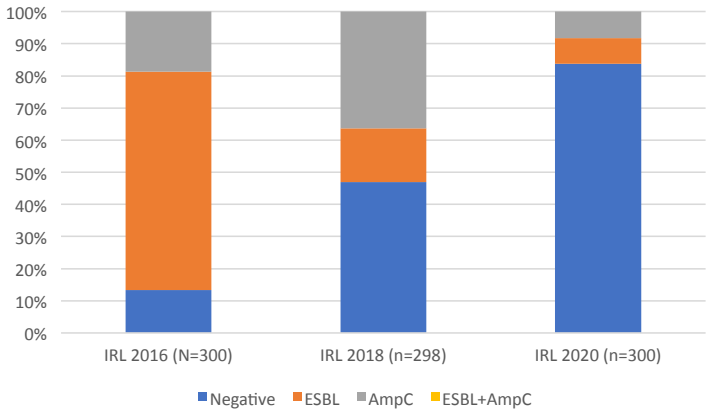


Figure 20: ESBL/ AmpC- producing *E. coli* in chicken caecal contents

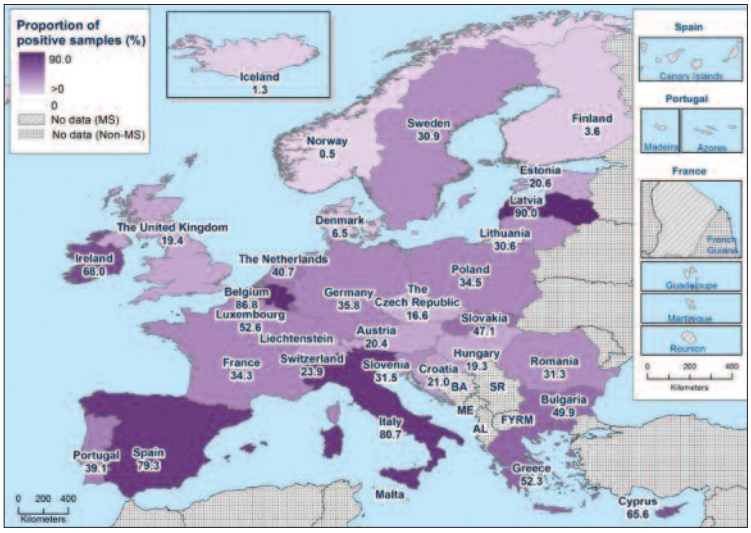


Figure 21: Prevalence of ESBL *E.coli* in broilers across Europe in 2016

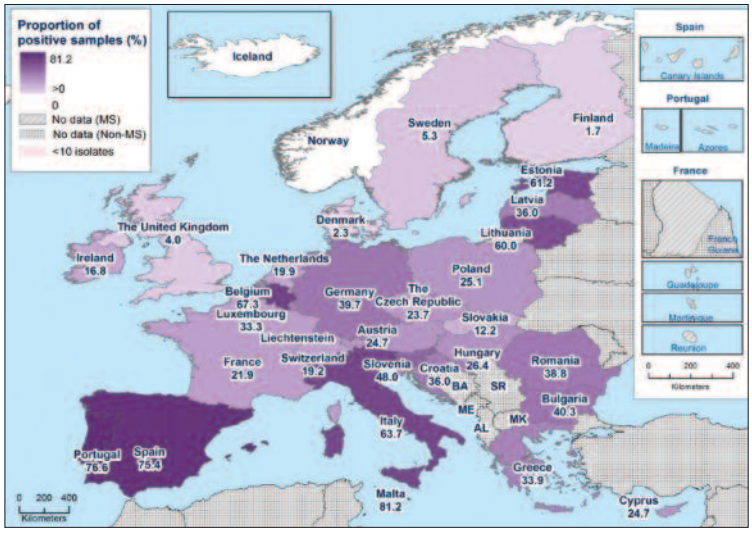


Figure 22: Prevalence of ESBL *E.coli* in broilers across Europe in 2018

Source EFSA

A similar decrease was observed in the percentage of retail chicken meat samples that were positive for ESBL/ AMP-C producing *E. coli*; the prevalence in 2020 (17%) was approximately a quarter of that seen in 2016.

In contrast to broilers, the prevalence of resistant *E. coli* in pig caecal contents increased from 30.3% in 2015 to 44.3% in 2019 and The levels observed in pork samples each year were significantly lower than those recorded in pig caecal samples and fewer than 1% of beef samples analysed yielded ESBL/ AMP-C producing *E. coli*.

No Carbapenamase producing *E. coli* have been identified in any surveillance samples.

Future Developments

On the 1st January 2021 new monitoring legislation, EU Decision 2020/1729, came into force and expanded the surveillance programme to include monitoring of resistance in *Salmonella* from pig caeca, the mandatory testing of *C. coli* from pigs and sampling of meat from non- EU countries at border control posts.

Surveillance of AMR in Veterinary Pathogens

Currently, disease- causing bacteria that are isolated from sick animals are tested in DAFM Regional Veterinary Laboratories and privately owned commercial laboratories.

The DAFM laboratories in conjunction with DAFM policy and AHI CellCheck are reviewing the laboratory aspects of culture and sensitivity testing to support appropriate prescribing for intramammary antibiotic tubes and mastitis antibiotic therapies and for surveillance purposes.

2.4 Overview of iNAP1 Achievements in Animal Health

The key achievements of iNAP1 2017-2020 in the animal health sector are presented in the context of the interventions and activities completed and ongoing in relation to the five strategic objectives. A Report of the iNAP Animal Health Implementation Committee has been published which outlines the progress achieved to date in delivering the actions contained in Ireland's first National Action Plan on antimicrobial resistance 2017-2020 (iNAP1) both in the animal health and environment sectors. Available at: gov.ie - iNAP Animal Health Implementation Committee (www.gov.ie)

Table 6: Overview table of some key achievements in the animal health sector under Strategic Objective 1

Strategic Objective 1: Improve awareness and knowledge of antimicrobial resistance **Key Achievements Animal Health Sector**
■ In 2019, DAFM collaborated with the Irish Farmers Journal (IFJ) on a One Health campaign aimed at farmers/farm advisors and other readers of the IFJ. ■ European Antibiotic Awareness Day (18th Nov) and World Antimicrobial Awareness Week (18th-24th Nov) were used as a platform to increase awareness of AMR by many INAP AHIC stakeholders. ■ Many awareness raising events held including in 2018 *'One Health 2018: A Joint Approach for Healthcare and Veterinary Professionals', 'Antimicrobial and Anthelmintic Resistance Conference "Awareness to Action"* in 2019 and a webinar titled *"Handle Antimicrobials with Care-One Health"* in 2020. ■ Members of the FSAI's Retail Forum have signed up to a statement of intent around the responsible use of antibiotics in food production systems. ■ Engagement with Agricultural colleges and educators of farm advisors resulted in AMR being included as a topic of relevance and importance for further education. ■ Animal Health Ireland and Teagasc used their field events and existing programmes to promote knowledge and awareness of AMR amongst vets and farmers. ■ Ireland's first baseline survey of farmer attitudes to AMR was carried out in 2018 by the IFA and APHA. ■ Veterinary Council of Ireland promoted and highlighted AMR events and information updates in newsletter, website, and social media. ■ Veterinary Ireland's Continuing Veterinary Education (CVE) events all featured topics on AMR and antimicrobial stewardship.

There was substantial work done by the AHIC to improve knowledge and awareness of AMR amongst farmers, vets, and all stakeholders in the agri-food sector. All committee members worked collaboratively both with committee colleagues but also with their respective stakeholders to build a solid foundation of knowledge and awareness of AMR across the agri-food sector.

The platform of European Antibiotic Awareness Day on November 18th and World Antimicrobial Awareness Week provided a backdrop against which many successful events were held over the past 3 years including in 2018 *'One Health 2018: A Joint Approach for Healthcare and Veterinary Professionals', 'Antimicrobial and Anthelmintic Resistance Conference "Awareness to Action"* in 2019 and a webinar titled *"Handle Antimicrobials with Care-One Health"* in 2020. These events served to place a spotlight on AMR at a national level and embodied two key objectives of iNAP in relation to improving knowledge and awareness of AMR, and also optimising the use of antibiotics in human and animal health.

Other iNAP projects delivered actions around awareness raising and further education of the veterinary profession both at postgraduate and undergraduate level. Engagement with Agricultural colleges and educators of farm advisors resulted in AMR being included as a topic of relevance and importance for further education. Animal Health Ireland and Teagasc made use of their field events and existing programmes to promote knowledge and awareness of AMR amongst vets and farmers.

In 2019, DAFM collaborated with the Irish Farmers Journal (IFJ) on a One Health campaign aimed at farmers/farm advisors and other readers of the IFJ. This initiative involved fortnightly articles both online and published in the journal, in tandem with a short video discussing each theme and highlighted key messages around the need for responsible use of antibiotics in animals in order to preserve their effectiveness in humans. Available at:
https://www.youtube.com/playlist?list=PLDJeTLwBCHdrGVLEmZM_ooSIj-PEODmIV

A nationwide survey of Irish Farmers conducted by the IFA and APHA in 2018 revealed a high level of awareness amongst farmers of AMR and its potential impact for both human and animal health. It was particularly encouraging that 83% of farmers surveyed were using vaccines to prevent disease, whilst 76% of farmers had a herd health plan in place to prevent disease, with almost half of the remaining respondents planning to have a herd health plan in the future.

Table 7: Overview table of some key achievements in the animal health sector under Strategic Objective 2

Strategic Objective 2: Enhance surveillance of antibiotic resistance and antibiotic use Key Achievements Animal Health Sector
■ The National Antimicrobial Usage Database for pigs (AMU pig) was launched by DAFM in November 2019. ■ Under the National AMR Surveillance Programme, annual monitoring and surveillance was carried out to determine the development and spread of resistance in the pig and poultry sectors in line with requirements of EU legislation - Commission Implementing Decision 2013/652. ■ The DAFM AMR surveillance programme also collated clinical isolates from other animal populations analysed by regional laboratories. ■ The results of the official testing carried out by the National Reference Veterinary Laboratory were collated and transmitted to EFSA annually, where they are included in the EU summary report on AMR in zoonotic and indicator bacteria from humans, animals, and food. ■ The 2020 All Island Disease Surveillance Report contains a summary of results on antimicrobial resistance in veterinary isolates, allowing stakeholders to access resistance trends. ■ NRL collaborated with colleagues in human health to publish Ireland's first 'One Health Report on Antimicrobial Use and Antimicrobial Resistance' Report (based primarily on 2016 surveillance data) in January 2019. ■ Since 2009, the Health Products Regulatory Authority (HPRA) has been collating data on antibiotic sales for the previous year provided to the HPRA by the marketing authorisation holders (MAHs) that market veterinary antibiotics and reporting this data to the EMA as part of the European Surveillance of Veterinary Antimicrobial Consumption (ESVAC) project. ■ UCD and AHI have collected, analysed and interpreted data on annual intramammary antimicrobial tube sales over the period 2003-2020. ■ Work began in Q4 2020 to gather the business requirements to support development of a National Veterinary Prescription System (NVPS) to allow for the collection of prescription level usage data electronically. ■ DAFM, along with representatives of UCD School of Veterinary Medicine and the Irish Equine Centre participated in the EU JAMRAI (joint action in antimicrobial resistance and healthcare-associated infections) project, aimed at establishing the scope of national surveillance systems for AMR in diseased animals.

Surveillance of AMR and antimicrobial sales trends at national and EU level is fundamental to benchmark Ireland's performance against other EU member states and measure progress. The National Antimicrobial Usage Database for pigs was launched by DAFM in November 2019 and continues to collect farm level data on the number of antimicrobials used on commercial Irish pig farms on a quarterly basis. AMU reports generated allow farmers to benchmark themselves against their peers and see how their AMU compares to the national average. This database serves as a tool both to measure AMU but also to drive behavioural change through benchmarking farmers against their peers and the national average.

As previously outlined under the National AMR Surveillance Programme, annual monitoring and surveillance is carried out to determine the development and spread of resistance in the pig and poultry sectors. The AMR

monitoring and surveillance is aimed at establishing AMR levels, identifying trends, as well as new and emerging resistance patterns and is reported to the EU annually for collation with similar data from other Member States.

DAFM, along with representatives of UCD School of Veterinary Medicine and the Irish Equine Centre participated in the EU JAMRAI (joint action in antimicrobial resistance and healthcare- associated infections) project, aimed at establishing the scope of national surveillance systems for AMR in diseased animals. This involved a country visit in 2019, during which data was gathered on Irish surveillance of AMR in pathogens of farm animals, companion animals and equines. Ireland was one of the 12 countries out of 27 surveyed to have a pre-existing surveillance network.

Following on from this project, the collaborators, including the NRL for AMR, are currently designing a European resistance surveillance network in veterinary medicine (EARS-VET) which would improve and try to harmonise surveillance across countries.

Continuous analysis of antimicrobial sales and usage data in tandem with AMR surveillance reports is key to inform policy interventions to mitigate against the spread of AMR. Work commenced during iNAP on the development of a National Secure Veterinary Prescribing System (NVPS). This electronic prescribing system will identify the sectors where antimicrobials are being used as well as the outliers in terms of high AMU.

Table 8: Overview table of some key achievements in the animal health sector under Strategic Objective 3

Strategic Objective 3: Reduce the spread of infection and disease **Key Achievements Animal Health Sector**
■ Animal Health Ireland has promoted and developed a number of disease eradication and control programmes including BVD eradication, Johnes' control, CellCheck and are developing options for a national IBR eradication programme all of which are playing a very significant role in improving the health status of the national herd. ■ Ireland's first National Farmed Animal Biosecurity Strategy (2021-2024) was launched during Animal Health Awareness Week 2020. ■ As part of the Rural Development Programme 2014-2020, co-funded by the Irish government and the EU, funding has been provided for a Targeted Advisory Service on Animal Health (TASAH), for a biosecurity assessment of commercial pig units. These biosecurity assessments, delivered by trained veterinary practitioners, have enabled farmers to engage with their veterinary practitioner to improve their biosecurity at farm level. ■ The Beef HealthCheck programme, developed by Animal Health Ireland, in conjunction with DAFM and Meat Industry Ireland, began providing feedback to beef and dairy farmers in relation to liver fluke and respiratory disease. ■ Work began on developing systems to allow the electronic capture of findings from ante- and post-mortem examinations (AM/PM) of animals sent to slaughter and feeding these results back to farmers and their PVPs to better inform animal health management on farm.

Reducing the need for antimicrobials through improved animal health and an increased focus on preventative measures is key to slowing the accelerating crisis of AMR. One of the key enabling principles of the National Farmed Animal Health Strategy 2017-2022 is "prevention is better than cure". The farmed animal private veterinary practice network is a significant repository of knowledge and expertise that can guide herd health planning and preventative veterinary medicine.

Animal Health Ireland (AHI), a public-private partnership, funded by government and industry, has promoted, and developed a number of disease eradication and control programmes including BVD eradication, Johnes' control, and CellCheck. AHI is also developing options for a national IBR eradication programme, all cattle and dairy programmes have and continue to play a very significant role in improving the health status of the national herd. CellCheck, an industry-led initiative to prevent and control bovine mastitis and improve milk quality has reduced national Somatic Cell Count (SCC) over the last 10 years. The average bulk tank Somatic Cell Count has fallen by 100,000 cells/ml in the past decade, with over two thirds of dairy farms in the country having an SCC of less than 200,000 cells/ml in 2020.

AHI CellCheck. Available at: https://animalhealthireland.ie/programmes/cellcheck/

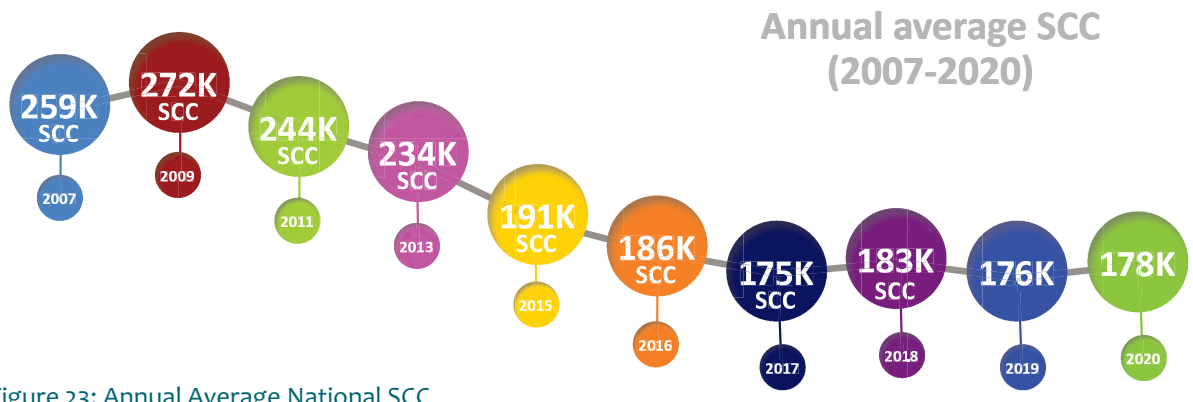


Figure 23: Annual Average National SCC

Source: Animal Health Ireland

CellCheck has promoted adoption of a selective dry cow therapy strategy in dairy herds which meet certain criteria. Milk recording is seen as a key management tool to support farmers in improving udder health, lowering bulk tank somatic cell count, increasing farm profitability and sustainability, and in tandem, driving down the use of antibiotics. CellCheck has supported and promoted further uptake of milk recording and of selective dry cow therapy (SDCT) via TASAH-funded Dry Cow Consults. Milk recording has increased significantly in the last year.

CASE STUDY:
Progress with a national BVD eradication programme

In common with many other countries, bovine viral diarrhoea virus (BVDV) was historically widespread in Ireland, with most herds having evidence of exposure. The virus uses a unique method to maintain itself in cattle, namely the creation of persistently infected (PI) calves, which are born following infection of pregnant cows during early pregnancy. These PI calves shed high levels of virus throughout their lifetimes and consequently the majority of animals in herds in which PI calves are born will undergo a period of infection. These include reduced fertility in older animals and weakening of the immune system of calves, leaving them more susceptible to diarrhoea and pneumonia, which routinely require treatment with antimicrobials.

To address this problem, the industry came together to in 2011 to develop and implement a compulsory national eradication programme which began in 2013, co-ordinated by Animal Health Ireland (www.animalhealthireland.ie), a public-private partnership between DAFM and stakeholders across the agri-food sector. The programme focusses on identification of PI calves immediately after birth through testing of tissue samples collected during routine management procedures from the entire national calf crop (in excess of 2 million) each year.

Considerable progress has been made since 2013, with the prevalence of infected herds, and of calves born PI, reducing by more than twenty-fold by the end of 2020. As a result, eradication is in sight, with the goal of obtaining official recognition of a BVD-free status within the European Union in the near future.

Already, the improved health of the national herd is estimated to have benefited farmers by more than €85M in 2020 alone, to have resulted in a significant reduction in the use of antimicrobials to treat sick calves and in addition to be contributing to mitigating greenhouse gas outputs from the sector.

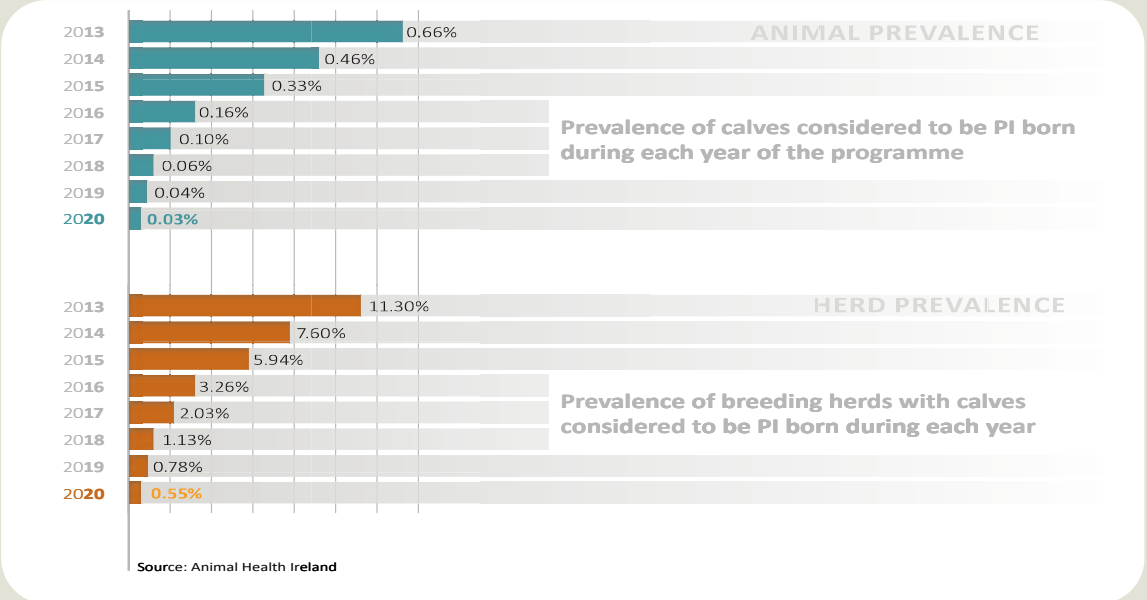


Figure 24: BVD Prevalence 2013-2020

Farm biosecurity is the core element of 'prevention' – serving to minimise risks and thus protecting the health of farmed animals. Reducing the risk of disease entering and spreading on-farm is key to protecting animal health. DAFMs first National Farmed Animal Biosecurity Strategy (2021-2024) which was launched during Animal Health Awareness Week 2020, will form an important component of a holistic approach to support the sustainable development of Ireland's agri-sector.

Pig HealthCheck is an AHI-led programme co-funded by pig producers and DAFM, with the aim of improving profitability and sustainability of the pig industry through improved animal health. Currently, funding is made available to all commercial pig farmers, through the Targeted Advisory Service for Animal Health (TASAH) mechanism under the co-funded Rural Development Programme to have a comprehensive and objective 'Biocheck.UGent' biosecurity review carried out on their farms by a trained private veterinary practitioner. These reviews provide each participating farmer with a report, quantifying the strength of their biosecurity practices and recommending key areas where improvement is required. Annual repetition of the biosecurity reviews will, over time, contribute to better pig health.

Commission Implementing Regulation (EU) 2019/627 requires that relevant ante mortem (AM) and post-mortem (PM) meat inspection findings of significance to public and animal health must be fed back to producers and private veterinary practitioners. Making this vital data available to farmers and their veterinary practitioners will help drive herd health management improvements, with consequential benefits for animal and public health outcomes. The first AM/PM system to be developed by the Department has been for pigs, with roll-out to other species expected to take place over the course of the next 3-4 years.

The *Beef HealthCheck* programme, developed by Animal Health Ireland, in conjunction with the Department and Meat Industry Ireland, has already been providing feedback to beef and dairy farmers in relation to liver fluke, liver abscesses and respiratory disease for a number of years, and has shown the value of such systems to farmers, the meat industry, veterinary practitioners and policy makers.

Table 9: Overview table of some key achievements in the animal health sector under Strategic Objective 4

Strategic Objective 4: Optimise the use of antibiotics in human and animal health
Key Achievements Animal Health Sector

- DAFM published a Policy Document on Highest Priority Critically Important Antimicrobials (HPCIAs) in 2018 which was revised in 2020 which sets out the conditions under which these last resort antimicrobials for human medicine are to be prescribed and used in animals.
- CellCheck oversaw the publication of a document on "Responsible Antibiotic use", particularly of HP-CIAs, in mastitis control.
- Veterinary Council of Ireland issued guidelines on the ethical use of antibiotics to all registrants.
- Veterinary Council of Ireland reviewed Code of Professional Conduct in relation to prudent use of antimicrobials
- Farming and Veterinary stakeholders of the INAP AHIC oversaw the publication of a number of guidance documents including A Code of Good Practice Regarding the Responsible Prescribing and Use of Antibiotics in Farm Animals as well as the following sector specific guidelines; Codes of Good Practice Regarding the Responsible Use of Antimicrobials on Pig/Dairy/Beef Suckler, Sheep and Poultry Farms.
- AHI and Teagasc held a series of workshops on Selective Dry Cow Therapy (SDCT) for Teagasc dairy discussion groups, dairy Processors and milk recording organisations.
- Teagasc developed a Pig Production Economic Model to allow farmers assess the cost and volume of antimicrobials being used on farms.
- Bord Bia commenced a review of their Quality Assurance Schemes, initially pig and poultry standards.
- Public Consultation and stakeholder engagement was carried out extensively by DAFM from 2019 in relation to transposing the new Veterinary Medicinal Regulations 2019/6 governing the sale and supply of antimicrobials in the animal health sector from Jan 2022.
- Supported by detailed research, UCD and CellCheck TWG have conducted a review of challenges to, and opportunities for, intramammary antimicrobial stewardship in the Irish dairy industry.

Under iNAP1 there was considerable collaboration between farming and veterinary stakeholders of the iNAP AHIC under the chairmanship of APHA to develop guidance on antimicrobial stewardship both at prescriber level and also for farmers. There was also a review of requirements of Quality Assurance schemes, commencing with pig and poultry schemes to emphasise the importance of optimising animal health to reduce overall use of antimicrobials.

DAFM published a Policy Document on the restricted use of Highest Priority Critically Important Antimicrobials (HPCIAs) in 2018 which sets out guidance on the conditions under which these highest priority antimicrobials for human medicine are to be prescribed and used. This document was revised in 2020 to reflect the updated recommendations of the European Medicine's Agency's Antimicrobial Advice Ad Hoc Expert Group (AMEG) on the categorisation of antimicrobials. Restricting the use of these particular antimicrobials in animals will help keep them effective for future use in human health.

The CellCheck programme has overseen the publication of a document on "Responsible Antibiotic use", particularly of HP-CIAs, in mastitis control. This document is a practical reference point for dairy farmers as they work with their veterinary practitioner to address mastitis control and antibiotic use on their farms.

CASE STUDY:

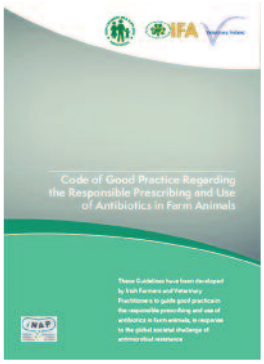
Dairy Farmer Successfully Moving Away from Using Antibiotics at Drying Off Towards a Selective Dry Cow Strategy

John O'Sullivan has been farming his dairy farm in Whitechurch, Co. Cork, for almost 50 years. John's dairy farm is a family business where he lives with his wife, and two sons, both of whom are now married with their own children. John and his two sons, together with a farm manager are managing the 500 cow Holstein Friesian herd.

It was at a discussion group meeting over 6 years ago that John considered the benefits of reducing his use of dry cow tubes in his herd. The saving in relation to the cost of dry cow tubes and withholding the milk from the tank were significant factors in his decision to move towards a selective dry cow therapy approach. John calves all year round, with 70% of the herd in the Spring and 30% in the autumn. His herd Somatic Cell Count was 150 ,000 cells/ml in 2020, and he was nominated by Dairygold in the 2021 National Dairy Council and Kerrygold Quality Milk Awards where he was overall runner up and category award winner for Business Innovation.

John is now using teat sealer only in 90% of his herd and has had no increase in mastitis cases since he and his farm team stopped using blanket dry cow therapy. His experience with selective dry cow therapy has been very positive, but his use of 6 weekly milk recording all year round has been essential to this. The use of the milk recording data and the focus on ensuring high hygiene standards on farm have ensured a continually low somatic cell count despite the size of the herd.

The O'Sullivan family recognise the importance of biosecurity and breed all their own replacements in order to minimise the introduction of disease into the herd. Vaccination is also a key component of the on-farm herd health plan in order to prevent disease and ensure minimal use of antibiotics. There is an increased focus on the use of antibiotics in the dairy sector, particularly for mastitis treatment and control. John's successful move to selective dry cow therapy will help ensure that the antibiotics that are found in dry cow tubes continue to be effective for both human and animal health – preserving their effectiveness for future generations. In changing his behaviour in relation to use of dry cow tubes, John and his family remain committed to producing high quality milk in a sustainable manner.



Under iNAP1 the Veterinary Council of Ireland have drawn up guidelines on the ethical use of antibiotics which will reinforce the veterinary practitioner's role as prescribers, and gatekeepers with regard to the supply and use of antimicrobials. The VCI guidance promotes the responsible and prudent use of antibiotics in the animal health sector, whilst optimising the use of antibiotics in animal health. The VCI also commenced a review and update of the Professional Code of Practice including professional standards and obligations with regard to the responsible prescribing and use of antimicrobials

Following on from extensive engagement and collaboration, farming and veterinary stakeholders involved in the iNAP Animal Health Sector Implementation Committee under the chairmanship of the Animal and Plant Health Association (APHA), have developed a number of guidance documents including *Codes of Good Practice Regarding the Responsible Prescribing and Use of Antibiotics in Farm Animals* as well as the following sector specific guidelines; *Codes of Good Practice Regarding the Responsible Use of Antimicrobials on Pig/Dairy/Beef/ Suckler/Poultry and Sheep Farms.* The practical strategies outlined in these documents highlight some of the important actions that farmers can take to reduce their overall use of antimicrobials, and to improve their herd health.

Optimal use of antibiotics will reduce the development and spread of AMR and maintain the efficacy of antimicrobials into the future. The AHIC acknowledges the importance of antimicrobial stewardship, and the actions completed and ongoing under this objective will serve as valuable tools into the future to protect antimicrobials.

Table 10: Overview table of some key achievements in the animal health sector under Strategic Objective 5

Strategic Objective 5: Promote research and sustainable investment in new medicines, diagnostic tools, vaccines, and other interventions
Key Achievements Animal Health Sector ■ DAFM completed a study to identify current areas of research in relation to AMR and identified knowledge gaps. ■ Teagasc and AHI carried out a study in Autumn/Spring 2020 on the use of selective dry cow therapy (SDCT) ■ UCD and AHI undertook a project on "Intramammary use over time and sociological work on attitudes to SDCT". ■ Safefood and Teagasc completed a behavioural science research project titled *Use of antimicrobials in animal health on the island of Ireland: knowledge, attitudes and behaviour.* ■ Results of a milk recording attitudinal study was shared with stakeholders, including Teagasc KT and a number of milk recording agencies, to inform their 2021 communication strategies to increase uptake. ■ Teagasc carried out the PATHSURVPIG project (2014-2018) which investigated respiratory disease on Irish pig farms, associated risk factors, and the relationship with performance, welfare and antimicrobial use. ■ Teagasc and UCD described the patterns of antimicrobial usage in pigs and poultry as part of the Antimicrobial Use and Resistance in Animal Production (AMURAP) research.

The actions in our 5th strategic objective acknowledge that our understanding of AMR and how best to effectively address it is constantly growing and evolving. The various research outputs provide an evidence base for policy decisions and interventions but behavioural change is key to addressing AMR.

Much has been done under iNAP1 and will continue into iNAP2 in the area of behavioural science and investigating the behavioural change interventions that are critical to achieving sustainable reductions in AMU. Change takes time and changing human behaviour is a very challenging task. Two separate studies are underway, one with Safefood and Teagasc titled *Use of antimicrobials in animal health on the island of Ireland: knowledge, attitudes and behaviour.* The second project which was commissioned by DAFM and is being led by the Economic and Social Research Institute (ESRI), focuses on the application of behavioural science to determine what factors are driving decision making in relation to antimicrobial use, and what policy level interventions would be appropriate to deliver favourable outcomes. Both projects will continue into the next iteration of iNAP. The results of both studies will complement each other.

The Safefood and Teagasc research has identified farm level interventions which will support behaviour change leading to more prudent use of antimicrobials. These interventions will then be piloted and evaluated as part of the follow-on AMU-FARM project due to begin in 2021. This research project has also surveyed farmer attitudes to selective dry cow therapy (SDCT), including an attitudinal survey to milk recording. The survey findings provided insights useful to industry to further promote the uptake of milk recording as a tool to increase the use of SDCT.

The PATHSURVPIG project (2014-2018) investigated respiratory disease on Irish pig farms, associated risk factors, and the relationship with performance, welfare and antimicrobial use. During this research infectious diseases of primary importance to the Irish pig industry were identified. The effects of these diseases on growing-finishing efficiency, disease treatment costs and measures to prevent disease occurrence were also identified during this research. Results suggested that farmers need to engage more with veterinary practitioners at farm level to improve pig health through improved nutritional management, internal biosecurity, improved herd health planning and appropriate vaccination programmes.

The Antimicrobial Use and Resistance in Animal Production (AMURAP) research project, (2016-2021) had key objectives with regard to better understanding the current use of antimicrobials in Irish pig farms, and the factors involved, with the goal of helping farmers reduce their use without incurring a negative economic impact. The AMURAP project also carried out research to determine the actual effect of specific antimicrobial use practices on the occurrence of resistance in zoonotic and commensal bacteria on the farms.

The second stage of the AMURAP project followed batches of pigs in high- and low-usage farms and preliminary results show associations between AMU and AMR. Particular attention will be paid to resistance against the highest priority critically important antimicrobials for human medicine. The project aims to provide a better understanding of how AMR evolves through the production period, how it is affected by AMU, and to identify patterns of use that present the highest risk for the development of resistance. Thus, farmers will have improved knowledge of the strategies available to minimise the risk of AMR while maintaining good health status in their herds.

Most actions under strategic objective five are in relation to research completed or ongoing. Investment in new medicines, diagnostic tools and vaccines continues at an international level.

Conclusion

This review highlights the considerable progress that has been made under Ireland's first National Action Plan to address the development and spread of antimicrobial resistance, specifically in the area of animal health. There were 54 projects or actions contained in iNAP1, of these 28 were successfully completed in the 3-year life of the plan, with the remaining actions in progress and continuing into iNAP2.

There was proactive engagement and leadership shown by all members of the AHIC committee, and a willingness to work in a collaborative way to deliver the many actions that were included in this first action plan. Individual farmers, with their veterinarians, have worked proactively to implement non-statutory disease control programmes and higher bio-security measures, aimed at reducing the total quantities of antibiotics being used in their animals. All stakeholders were agreed on the need for partnership between the agri-food sector and DAFM for industry-led animal health promotion.

However, many challenges remain, and sustained commitment is needed if we are to continue to make progress against what has been referred to as 'the silent pandemic', whilst at the same time ensuring the sustainability of the agri-food sector into the future. The significance of the statement that "healthy animals don't need antibiotics" cannot be over emphasised. The actions completed and in progress promote better animal health and also the reduced use of antimicrobials in food animals which impacts at a broader societal level to reduce AMR development and spread.

The AHIC and agri-food stakeholders support the principles of minimising the occurrence of disease on Irish farms through herd health plans, and disease eradication strategies built on the foundations of vaccination and farm biosecurity. The leadership shown in taking ownership and driving the many iNAP1 actions forward demonstrates the focus on achieving the highest international standards of animal health, improving productivity and profitability, and the economic, environmental, and social sustainability of Irish farms. Ensuring sustainability of the agri-food sector in relation to AMR also serves to protect public health and our shared environment.

2.5 Overview of iNAP Journey Environment Sector

Ireland's first National Action Plan on AMR has laid solid foundations for continued collaboration, cooperation, and action on AMR in Ireland. It is well recognised that collaboration across human, animal, and environmental sectors is instrumental if we are to tackle AMR from a truly One Health perspective. Under iNAP1, the environment sector has played a significant role in shaping and supporting relevant AMR activities and contributing to the One Health ethos at a national level.

Whilst considerable progress has been made during iNAP1, historically, the role of the natural environment in the emergence and spread of resistance has received relatively little attention in comparison to human and animal health sectors. However, the pivotal role which the environment plays in the development and transmission of antimicrobial resistance is increasingly being recognised and examined, both at a national and global level. The release of antimicrobial residues to the environment is a significant driver of the establishment of resistance 'in the wild'. In addition to the health risk to humans and farmed animals from the build-up of resistance, the environment in and of itself is a receptor – via ecosystems, fauna, and flora. – vulnerable to discharges of antimicrobials and resistant bacteria, as well as other resistance-driving chemicals such as biocides and heavy metals. There remains a growing need to enhance our understanding of the environmental dimension of AMR and generate supportive evidence in order to develop and implement effective risk management and preventative strategies to halt further spread.

The complexity of the issue means there are a critical number of knowledge gaps which must be answered. For example, the role of native Irish wildlife species in transference is not well understood. Moreover, the environmental fate and transport of different treatments such as antimicrobials, or their components and breakdown products thereof, or of shed biological loads and associated resistance genes, is not well understood. The complexity of the receiving environment, e.g., acid soils, alkaline soils, sandy or clay soils, coastal waters, fresh waters, or groundwater; are all expected to play a role in determining the environmental fate and transport of residues. Further challenge in understanding the role of the environment in establishment of antimicrobial resistance relates to detection - due to their low concentration it can be difficult to detect antimicrobial residues in the environment and, at present, it is difficult to determine the extent to which concentrations of antimicrobials reaching our environment are exerting substantial selective pressure on clinically relevant bacteria and those of importance to livestock and healthcare.

Established work undertaken under iNAP1 and activities to be pursued under iNAP2 will bolster our evidence, awareness, and action on AMR from the environmental standpoint and assist in addressing some of our critical knowledge gaps. Moreover, continued cooperation and collaboration across human health, animal health and environment sectors will provide the means to advance our national action on AMR from a truly One Health perspective.

Environmental Protection Agency (EPA)

The Environmental Protection Agency (EPA) is Ireland's statutory body for the balanced and sustainable protection and management of the environment, including by extension the health of our society and economy that depends on it. The EPA has a variety of roles that are important to AMR action planning. For example, regulation of emissions from large animal processing and food production industries such as intensive agriculture activities, slaughtering, rendering, dairy, and meat processing, fall within the competency of the EPA. All the waste-water treatment plants and large solid waste management processing facilities in the State are also regulated by the EPA. The EPA publishes a wide range of guidance on the safe operation of septic tanks, effluent treatments, and on groundwater protection - all of which are relevant sources and vectors for AMR in the environment. The regulation of drinking water supplies, as well as the monitoring of the quality of our groundwaters, coastal waters, lakes and rivers falls to the EPA. Moreover, the EPA manages an environmental research programme that delivers essential scientific support for environmental policy development, implementation and broader decision making.

Summary of Key Achievements in the Environment Sector from 2017 to date

An overview of some other key achievements in the environment sector from 2017 to date is presented in the table below.

Table 11: Overview table of some key achievements in the environment sector 2017 to date

Summary Key Achievements in Environment sector under iNAP1
■ Over the lifetime of iNAP1, the EPA provided funding of over €1.1million for a number of national and European research projects which aim to address Strategic Objective 2 in iNAP. Specifically: ■ AREST project (co-funded by HSE): Antimicrobial Resistance and the Environment -Sources, persistence, Transmission, and risk management. ■ PIER project: Public health Impact of Exposure to antibiotic Resistance in recreational waters. ■ WADA PhD Scholarship project: Analysis of antimicrobial resistance in private water drinking supplies. ■ SWAM PhD Scholarship project: Survival of mobile antibiotic resistance in water. ■ ANTIVERSA project: Biodiversity as an ecological barrier for the spread of clinically relevant antibiotic resistance in the environment.
■ Under the EU Water Framework Directive, a 'Watch List' mechanism has been implemented across all EU Member States to assess the occurrence and prevalence of a number of emerging pollutants of concern, including certain antimicrobials, in our surface waters. Sampling and analysis for the Watchlist substances has been complete by the EPA in four rivers since 2016.
■ A waste characterisation study was completed by the EPA in collaboration with HSE to analyse wastes collected as part of the 2018 Disposal of Unused Medicines Properly (DUMP) scheme (operated at 250 pharmacies in South-west of Ireland). The study suggests that there could be approximately 29,000 kgs of unused or out of date medicines arising annually. Findings from the characterisation study has feed into the drafting of the next iteration of the NHWMP (2021-2027).
■ A report detailing an assessment of the 5-year pilot National Farm Hazardous Waste collection scheme has been prepared by the EPA and circulated to the Antimicrobial Disposal Sub-Group which was established to examine the issue of waste management as a One Health issue.
■ The EPA provided sponsorship to the RTÉ series Eco-Eye and 10 Things to Know About to assist in improving awareness of environmental issues, including AMR, amongst the general public.In 2017, the 10 Things to Know About series featured EPA-funded research Dr Fiona Walsh (Maynooth University) in its Superbugs episode who discussed research undertaken as part of her of EPA- and Water JPI-funded project, StARE. In 2019, the Eco-Eye series featured EPA-funded researcher Dr Dearbhaile Morris (NUIG) in its 'Living Beach' episode who described research to be undertaken as part of EPA- and HSE-funded AREST project.

Protection of our aquatic environment is crucial for ensuring healthy aquatic ecosystems as well as healthy and sustainable water supplies. However, pollution of water bodies is an ever-increasing problem, and our waters represent a potential route for transmission of AMR to humans, animals, and the food chain. Under the European Union (EU) Water Framework Directive (WFD) a 'Watch List' mechanism has been implemented across all EU Member States to assess the occurrence and prevalence of a number of emerging pollutants of concern, including a range of antimicrobials, in our surface waters. Monitoring of the WFD Watchlist antimicrobials has been undertaken across four surface waters by the EPA since 2016.

During one round of sampling in 2019, exceedances of erythromycin were detected at two sites (Annalee and Liffey rivers). Levels of other antimicrobials were, in most cases, below the required limit of detection across remaining samples analysed. Annual monitoring of the WFD Watchlist antimicrobials will continue to be performed and additional specific sampling campaigns for substances of emerging concern, including antimicrobials, will be extended during iNAP2.

In striving to continually improve the management of Ireland's hazardous waste, including unused medicines such as antimicrobials, the EPA has a pivotal role in promoting and coordinating implementation of Ireland's National Hazardous Waste Management Plan (NHWMP) which set out a number of priorities to be pursued up to 2020.

As part of NHWMP 2014-2020 the EPA, in partnership with the Department of Environment, Climate and Communications (DECC), Teagasc, DAFM and others, run a successful joint Farm Hazardous Waste Collection Scheme to facilitate the collection, recovery and disposal of hazardous waste from farms, including end-of-life veterinary and animal healthcare products. Over the course of the scheme a total of 49 tonnes of waste veterinary medicines (plus 4 tonnes of syringes & needles) were collected nationally and subsequently safely disposed of. Injectable antibiotics accounted for approximately 30% of the weight of veterinary wastes collected; with a large portion of this being the glass containers.

A comprehensive report on the Scheme was prepared by the EPA and circulated to relevant stakeholders. Findings from the pilot scheme has fed into the drafting of the next iteration of the NHWMP (2021-2027) with the intention to establish a suitable nationwide collection scheme for farm hazardous wastes, including unused veterinary products. This work has also informed the development of relevant actions for iNAP2.

Perhaps one of the key areas in relation to developing our understanding of AMR in the environment is via research. The EPA operates a national environmental research funding programme (funded by the Government of Ireland and administered by EPA), and also participates in a number of European funding initiatives such as the Water Joint Programming Initiative and BiodivERsA network.

Over the course of iNAP1 significant investment has been made in research to advance and deepen our knowledge of the environmental dimension of AMR and the output of these ongoing research projects (AREST, PIER, WADA, SWAM and ANTIVERSA) will be critical to advancing our understanding of the role of the environment in AMR development and transmission. In particular, it is expected that the large-scale national projects AREST and PIER will provide key national level data and evidence.

The AREST project is a €650,000 award which is co-funded with the HSE, and is led by NUIG, NUIM, UCD, Teagasc and others. This project, which is due to complete in 2022, aims to generate national level data on the key sources, hot-spots, and drivers of AMR in the environment from various sectors, provide evidence of the extent of contamination of the environment and develop a risk ranking protocol to assess the relative contribution of various sectors in Ireland on sources and levels of AMR in the environment.

The PIER project is investigating whether people who regularly swim, surf or do other in-water activities in Irish rivers, lakes and coastal seas are more likely to pick up and carry AMR bacteria in their gut. The PIER project, which is valued at €550,000, is a 4-year funded research project led by NUI Galway and is due to complete in 2023.

Part 3: Approach and development of iNAP2

3.1 Approach to Development of iNAP2 One Health Actions

iNAP2 has a dedicated section which outlines the One Health actions which have been agreed by the multi-sectoral stakeholders for the iNAP2 cycle. These build on the collaborations and joint understanding which were deepened during the implementation of iNAP1. They are cognisant of the learning from the COVID-19 Pandemic, including from a wider societal context. The actions were presented and agreed at the meeting of the Interdepartmental Committee in May 2021.

3.2 Approach to Development of iNAP2 Human Health Actions

As part of the development process for iNAP2, three key principles guided the identification and agreement of actions with stakeholders. These are as follows:

- a patient centred approach, founded on integrated care, in line with Sláintecare.
- an approach focussed on people, patients, service users, staff, the public, stakeholders and participants who work with us in this process.
- an approach which ensures that there is learning from the COVID-19 Pandemic.

The development of iNAP2 is also cognisant of the reforms underway in the delivery of health and social care services. It is necessary to be cognisant of the changing models of health and social care and other contextual factors, such as changing demographics, as the actions in iNAP2 are rolled out.

Regard was had to the following key policies and strategies in developing iNAP2:

- Programme for Government: Out Shared Future.
- Sláintecare Report and Sláintecare Implementation Strategy and Action Plan 2021-2023.
- Learning from the COVID-19 and CPE Public Health Emergencies, aligning with the Resilience and Recovery 2020-2021: Plan for Living with COVID-19 (September 2020).
- COVID-19 Nursing Home Expert Panel Report (July 2020).
- Report of the European Commission / European Centre for Disease Prevention and Control One Health Country Monitoring Visit on AMR to Ireland (March 2020).
- WHO Global Patient Safety Action Plan 2021–2030: Towards eliminating avoidable harm in health care and HSE Patient Safety Strategy 2019 – 2024.

Format of the Human Health iNAP2 Actions - Mid-term Review in 2023

A mid-term review of the human health actions in iNAP2 is planned in Q1 2023.

Given the evolving COVID-19 situation, further developments in AMR and IPC, the potential for further changes in the way health and social care may be delivered, the mid-term review will build in flexibility to allow a further consideration of the human health iNAP2 actions, whether new actions may be needed and how best they may be scheduled and implemented over the remainder of the iNAP2 cycle. It is important to ensure any further learning across 2022 is captured to inform the remainder of the Plan.

The mid-term review of human health actions will provide the opportunity to ensure learning and reflections are incorporated as we emerge from COVID-19 Pandemic and inform the latter part of the iNAP2 Plan.

Consequently, human health Actions are classified into the following timeframes:

- ***2021 Specific Actions and Deliverables*** – these actions are already underway as the need for these actions was identified in 2020 when planning for 2021.
- ***2022 Specific Actions and Deliverables*** – these actions are planned to commence in 2022.
- ***2023-2025 Specific Actions and Deliverables*** – these actions are prioritised for the remainder of the plan as part of the mid-term review.
- ***Ongoing*** – these actions are ongoing throughout the iNAP2 cycle.

Guiding Principle 1: Patient-centred approach, founded on integrated care in line with Sláintecare

Since 2018, a patient-centred integrated approach has been used to support capacity building and new developments for AMR and IPC across acute and community health and social care services at both operational and policy levels. This approach has been successfully applied during the implementation of iNAP1 and to enable prioritisation of requirements identified by the Public Health Emergencies on CPE and COVID-19.

iNAP2 is building on this approach of designing and expanding joined up multi-disciplinary specialist IPC and AMS services working across and between acute and community services e.g. Community Response Teams. This is very much aligned with the Sláintecare reform model of delivering the Right Care, Right Place, Right Time. iNAP2 will support delivery of the Sláintecare Implementation Strategy and Action Plan 2021-2023 which acknowledges the forthcoming iNAP2 as a national roadmap and AMS and IPC as key enablers for the delivery of safe, high-quality care for patients and their families. Technology and innovation can help transform the delivery of health and social care and are important foundations to increase efficiency, advance knowledge, inform understanding, promote timely analysis, enhance training and education, improve prescribing practices, support staff in the delivery of AMS and IPC initiatives and to increase awareness for the public.

Guiding Principle 2: Developing iNAP2 with a focus on People

The second key approach in developing iNAP2 has been to ensure a key focus is on people, i.e. the people who make up our health and social care services – health and social care workers, patients and service users, their families and the public in general.

With regard to patients and service users, core actions under iNAP2 include enhancing patient and public involvement in AMR policy under Strategic Objective 5, and the patient and staff stories project under Strategic Objective 1.

Improving patient care through AMR and IPC does not happen without our health and social care workers. The widest possible healthcare team has been envisaged in iNAP2 and health and social care workers are encouraged to apply practices to promote any action that fall within their scope of practice to their day-to-day work. This applies regardless of setting and across both the public and private health and social care services.

Continuing to build and support the multi-disciplinary team required for IPC and AMS specialist services is again a core objective in iNAP2, as is finding innovative ways to promote AMR and IPC as a career option. Upskilling all health professionals and supporting them to maintain their competence in AMR and IPC is also a priority. iNAP2 has a number of workforce actions to continue to develop and build a sustainable workforce for AMR and IPC into the future.

Guiding Principle 3: Ensuring that learning from the COVID-19 Pandemic is incorporated

The profound impact that the COVID-19 Pandemic has had on Irish society and globally, especially for those who have lost loved ones and whose health has been impacted, requires that every opportunity for learning and improvement is attained. The importance of IPC measures in the context of the Pandemic cannot be overemphasised, so much so, that their significance, including hand hygiene, are now recognised at a societal level. This widespread societal understanding of IPC will be harnessed in the context of iNAP2.

Within the health service, the response to the COVID-19 Pandemic led to unprecedented interruption to normal healthcare activity, with both community and acute settings. As the system repivots and continues to increase provision of non-COVID-19 services, the importance of IPC will further increase due to the ongoing pressures of needing to continue to control COVID-19.

A further area of learning from the Pandemic evident in iNAP2 is the focus on an IPC strategy in the community sector including nursing homes and residential care. While all LTRC facilities were affected by the COVID-19 Pandemic, the most considerable impact seen has been in nursing homes. In August 2020, the COVID-19 Nursing Home Expert Panel published its Report and referring to IPC it recommended the *development of an IPC strategy in the community with particular focus on all nursing homes, public, private, or voluntary*. In September 2021, an integrated Community IPC Strategy was published. It set out a roadmap and priority actions to 2023 to establish community-based teams to ensure IPC and AMS expertise at Community Health Organisation (CHO) and Community Health Network (CHN) levels. Implementation of this Strategy will be closely aligned to the iNAP2 process.

The Pandemic response demanded innovative ways of care provision and the delivery of services to patients. This has been incorporated into iNAP2 but it is also important to ensure the learning informs implementation of iNAP2 as the Pandemic continues to evolve.

iNAP2 Development Methodology

The human health actions under iNAP2 were developed in consultation with a wide variety of stakeholders and informed by a range of reports and documents. These are outlined in the diagrams below.

Figure 25: Overview of the methodology used to develop and agree the human health actions for iNAP2

Figure 26: The inputs to the actions identified for iNAP2. The blue items represent stakeholder engagement and consultation and the green items represent documents and reports.

3.3 Approach to Development of iNAP2 Animal Health Actions

The proposed actions in iNAP2 aim to build on the foundations laid in iNAP1, while providing a dynamic plan for stakeholders to work from. In order to address the challenge of AMR in animal health, the focus of iNAP1 was to optimise animal health and ensure antimicrobials were used prudently and only when necessary. DAFM colleagues working in the plant health division were consulted to consider whether to include actions relating to plant health under iNAP2. However, unlike some countries worldwide, antibiotics are not used for disease control in plants/trees in Ireland.

Quarterly meetings of the AHIC throughout the lifetime of iNAP1 provided an effective mechanism to deliver on the overall aims of iNAP1, and so the AHIC was the platform used to develop iNAP2. This second action plan was also developed to align with objectives in other policy areas and national strategies:

- National Farmed Animal Health Strategy 2017-2022
- Plant Health and Biosecurity Strategy 2020-2025
- Ag Climatise A Roadmap towards Climate Neutrality
- National Farmed Animal Biosecurity Strategy 2021-2024
- Working together for Animal Welfare: Ireland's Animal Welfare Strategy 2021-2025
- Foodwise 2025
- Foodvision 2030

Methodology

The AHIC oversaw the development of iNAP2.There was extensive collaboration and consultation with members of the AHIC from September 2020 until December 2020 in relation to appropriate actions for inclusion in iNAP2. Several actions which began in iNAP1 particularly around raising awareness of AMR and improving animal health will be carried into iNAP2, while many new actions have also been identified. A literature review was carried out by DAFM in relation to strategic approaches being taken in other countries. The recommendations highlighted on foot of the One Health AMR country visit from the ECDC/DG Sante in 2019 were also considered and incorporated into the final list of agreed actions for the second national action plan.

The animal health and environment sector actions for inclusion in iNAP2 were agreed in January 2021 and an action plan was developed. This action plan is a living document which has the capacity to evolve over the lifetime of iNAP2 and outlines roles and responsibilities for all stakeholders including new members of the AHIC. There was also agreement on specific timelines throughout the five-year lifetime of the plan. This second iteration will also contain tangible measures of progress in terms of specific outputs in order to better assess the effectiveness of the actions completed and interventions to address AMR.

Ambitious targets outlined in the Farm to Fork Strategy as part of the European Green Deal seek a 50% reduction in the overall quantities of antimicrobials sold across the EU by 2030, taking 2018 as a reference year. The achievement of this goal will be supported by the implementation of the new Regulation (EU) 2019/6 on Veterinary Medicinal Products and (EU) 2019/4 on Medicated Feed from January 2022 which provide a wide range of measures to fight AMR and promote a more prudent and responsible use of antimicrobials in animals. The development of a National Secure Veterinary Prescription System (NVPS) to allow for the digital generation of a prescription to collect prescription level usage data electronically will satisfy requirements of (EU) 2019/6 which specifies a stepwise approach to the collecting and reporting of antibiotic usage data. The continued collection of sales data on antimicrobials by the HPRA will also be a requirement of the new Regulation.

In agreeing new actions, stakeholders made proposals that would address particular needs under each strategic objective. New additional actions which have been included in iNAP2 include those which seek to build capacity at a national level around antimicrobial susceptibility testing (AST) of bacterial isolates from clinical samples. Under iNAP2 Bord Bia will be launching a training module for farmers around raising awareness and knowledge of AMR, it's implications for public health and best practice principles underpinning the responsible use of antibiotics on farms. This module was developed by Bord Bia in collaboration with Teagasc and DAFM and it will be a requirement of Bord Bia's Quality Assurance Scheme that accredited farmers must complete the course.

The new Regulations place restrictions around the use of antibiotics prophylactically (to prevent disease in healthy animals) and metaphylactically (the treatment of a group of animals following the development of clinical signs of disease in some animals in the group to prevent the spread of disease) and this will pose challenges for intensive production sectors such as pigs. To address these issues under iNAP2, Teagasc will create a series of case studies in pig farms for the transition to not using prophylactic/metaphylactic AMs and Zinc Oxide.

In April 2021 members of the AHIC endorsed a statement of intent to cease the use of colistin in the animal health sector in Ireland. This action underlines the commitment and leadership shown within the agri- food sector to address societal concerns in relation to responsible use of antimicrobials in animals. The World Health Organisation has included colistin in a list of Highest Priority Critically Important Antimicrobials.

Under iNAP2 actions have been added relating to equines, companion animals and aquaculture; these sectors were not included under iNAP1. The new action plan for the animal health sector is highly ambitious and contains a total of 70 actions for the animal health sector so far, with a clear focus on measurable outcomes, in order to allow progress to be measured in a tangible way. Managing the public health threat of AMR requires a multifaceted One Health approach involving many different sectors, both nationally and internationally working together. A proactive, science and evidence-based approach will continue to inform effective integrated policy measures and provide assurance to society at large.

3.4 Approach to Development of iNAP2 Environment Actions

In striving to further promote awareness and knowledge of the issue of AMR both amongst relevant stakeholders and the general public, the EPA has committed under iNAP2 to raise AMR as an issue of concern in relevant national level consultations, policy developments and plans as well as continuing to identify opportunities for more general and widespread awareness via mainstream media.

During the period of iNAP2 the EPA has also committed to extending its sampling programme for antimicrobials through running specific campaigns testing for substances of emerging concern. This work will help to inform baseline conditions which was one of the frailties identified in the recently published EPA State of our Environment Report 2020 (refer AMR section on pages 374-375).

The EPA also has a role in articulating the National Hazardous Waste Management Plan (NHWMP) which, inter alia, assigns responsibilities to different bodies or Departments for actions. In relation to the safe management of used or waste antimicrobial treatments, both the Department of Health and the Department of Agriculture, Food and the Marine have an assigned action to arrange for a national collection scheme for used hazardous medicines and veterinary treatments. A revised NHWMP is expected to be published in 2021 and will inform iNAP2 follow-up actions.

Under iNAP2, research will remain as one of the key activities to further our knowledge of the environmental dimension of AMR. Under the EPA's new research framework, EPA Research 2030, which is a ten-year high-level framework for the EPA's research programming over the period 2021–2030, a thematic research assessment has been performed to provide an overview of the research areas linked to addressing knowledge and evidence gaps to support medium- and long-term environmental policy actions and objectives for the period 2021-2023. Understanding the increased environmental and human health risks posed by exposure to AMR in different environmental media and ecosystems has been identified as one of the research areas within this assessment. It is anticipated that this thematic assessment will be used as a resource to support and inform the preparation of the EPA Research Calls in the coming years, which will also support activities under iNAP2. Allied to this, the EPA has committed to funding a research gap and horizon scanning analysis in relation to 'AMR and the Environment' as part of the iNAP2 programme. It is expected that this analysis will inform future broader research needs at a national level.

3.5 iNAP Governance

The successful implementation of this iNAP2 plan is underpinned by clear governance, a strong collaborative response, as well as integrated surveillance, stewardship practices and commitment across all sectors at local, regional, and national levels. As the intersectoral co-ordination mechanism, the National Interdepartmental AMR Consultative Committee plays a key role in overseeing and informing the implementation of iNAP2. This Committee has a pivotal role in relation to delivering a One Health action plan that is effective and relevant to address the challenges across the three areas both at a sectoral level but also collaboratively at a One Health level. The Committee ensures that evidence-based objective advice is shared collaboratively to inform actions and policy decisions.

3.6 Governance within the Animal Health and Environment Sector

The Animal Health Implementation Committee (AHIC) was established to oversee the delivery of the animal health and environment sector actions under iNAP1 and provided an effective governance framework to deliver these actions. This committee ensures that there is clarity with regard to roles and responsibilities.

The AHIC will continue to be chaired by the Chief Veterinary Officer, with DAFM providing secretariat function. This committee will continue to oversee the delivery of actions specific to both sectors detailed in iNAP2. Acknowledging the recommendations of the One Health Country visit in 2019, the AHIC has included tangible measurements of progress both in terms of outputs and outcomes as part of iNAP2. The development of a dedicated action plan for the animal health and environment sector includes specific time frames for delivery of each action and quarterly progress reports are a requirement.

3.7 Monitoring, Surveillance & Governance within the Human Health sector

Monitoring, reporting and surveillance are the cornerstone for monitoring and identifying emerging trends in AMR and IPC, evaluating the impact of local, national and global strategies, as well as identifying areas for prioritisation and focus. iNAP2 introduces new processes for the collection, monitoring and reporting of health AMR and IPC indicators. This was identified in the report of the 2019 One Health County Monitoring Visit as a means of monitoring progress. It takes account of the new UN Sustainable Development Goal 3 indicator. Monitoring and reporting against indicators also enables assessment of return on investment and that value for money principles continue to be applied as new investments are made. An overview of the current human health indicators relevant to iNAP2 is provided in the table below. It is envisaged that further indicators development will be conducted during the iNAP2 cycle.

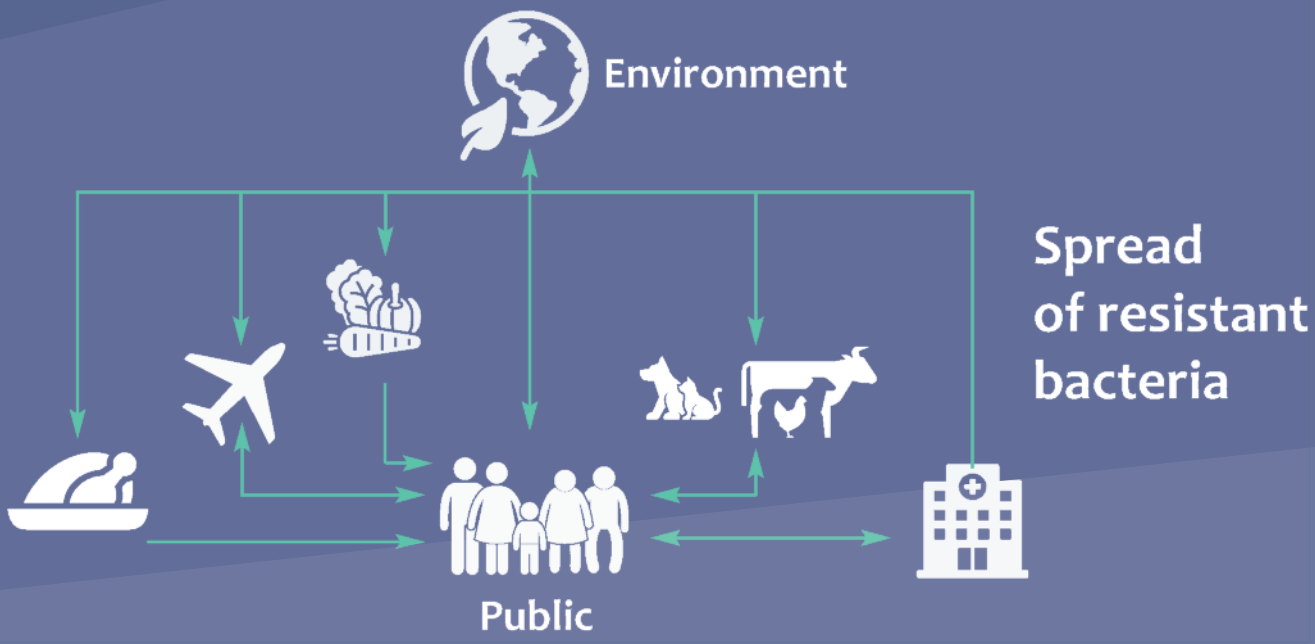
Key Performance Indicator	Definition	Frequency	Target	Source
Clostridioides difficile (C. difficile)	Rate of new cases of hospital associated *C. difficile* infection	Monthly	< 2/10,000 bed days used	HSE
Staphylococcus aureus (Staph. aureus)	Rate of new cases of hospital acquired Staph. aureus bloodstream infection	Monthly	<0.8/10,000 bed days used	HSE
Hospital Acquired COVID-19 Cases	Rate of new hospital acquired COVID-19 cases in hospital inpatients	Monthly	N/A	HSE
Carbapenem-producing *Enterobacteriales* (CPE)	No. of new cases of CPE	Quarterly	100%	HSE
Screening of patients with CPE	% of acute hospitals implementing the requirements for screening of patients with CPE guidelines	Quarterly	100%	HSE
National policy on restricted antimicrobial agents	% of acute hospitals implementing the national policy on restricted antimicrobial agents	Quarterly	100%	HSE
Consumption of antibiotics in community settings	Consumption of antibiotics in community settings (defined daily doses per 1,000 population) per day based on wholesaler to community pharmacy sales – not prescription level data	Quarterly	<22	HSE
C. difficile	Rate of new cases of *Clostridioides difficile* infection (CDI) in acute hospitals per 10,000 bed days used.	Annual	N/A	NHQRS
S. aureus	Rate of *Staphylococcus aureus (S. aureus)*, methicillin resistant *S. aureus* (MRSA) blood stream infections and methicillin-susceptible *S. aureus* (MSSA) blood stream infections in acute hospitals per 1,000 bed days used.	Annual	N/A	NHQRS
Carbapenemase Producing *Enterobacterales* (CPE)	are gram-negative bacteria that are carried in the bowel and are resistant to most, and sometimes all, available antibiotics. It has become increasing apparent in recent years that CPE may also persist for long periods in the hospital environment in particular in drains.	Annual	N/A	NHQRS
Antibiotic consumption in public acute hospitals	In-hospital antibiotic consumption rates are measured in Defined Daily Dose (DDD) per 100 bed days used (BDU).	Annual	N/A	NHQRS
Antibiotic consumption in the community	Community antibiotic consumption rates are measured in Defined Daily Dose (DDD) per 1,000 inhabitants per day from community consumption data.	Annual	N/A	NHQRS

Figure 27: Overview of current human health indicators relevant to iNAP2

One Health logo

One Health

Antimicrobial resistance can spread between animals, humans and the environment



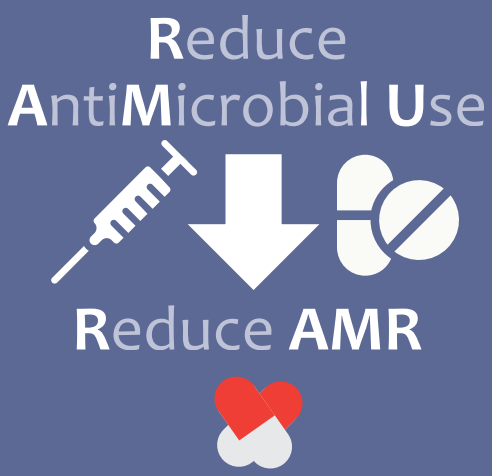
Part 4: Strategic Objectives and Actions under iNAP2

One Health Actions

No	Activity	Timeframe
OH-01	*One Health:* Continue to provide leadership for the One Health approach to AMR by hosting and providing secretariat to the **Interdepartmental AMR Consultative Committee**.	Ongoing
OH-02	*One Health:* Participate in the **One Health Network on AMR** hosted by the European Commission.	Ongoing
OH-03	*One Health:* Engage with **One Health country monitoring visits**, as provided by the European Commission & European Centre for Prevention and Disease Control.	2024
OH-04	*One Health:* Support and provide expertise to the **One Health country monitoring visits**, as provided by the European Commission & European Centre for Prevention and Disease Control.	Ongoing
OH-05	*One Health:* Strengthen co-operation with **Northern Ireland** on AMR policy.	Ongoing
OH-06	*One Health:* Collaborate with **UK and international stakeholders and organisations** to promote the One Health approach to AMR.	Ongoing
OH-07	*One Health:* Expand the **collaboration in communication activities** between different sectors to promote One Health communications on AMR.	Ongoing
OH-08	*One Health:* Coordinate on the use of the **European Antibiotic Awareness Day and the World Antimicrobial Awareness Week** platforms to communicate and promote One Health messages on prudent use of antibiotics and AMR across sectors.	Ongoing
OH-09	*One Health:* Establish a **single webpage for AMR policy**.	2021
OH-10	*One Health:* Support **traditional and social media** to provide public messaging on AMR and disease prevention.	Ongoing
OH-11	*One Health:* Promote **One Health approach in education** on AMR.	Ongoing
OH-12	*One Health:* Develop a **sustainable inter-sectoral process and governance** for the One Health Surveillance Report.	Ongoing
OH-13	*One Health:* Develop and publish the **One Health Surveillance Report** on an annual basis.	Ongoing
OH-14	*One Health:* **Share learning and best practice** in prescribing, AMS and AMR across the One Health sectors.	Ongoing
OH-15	*One Health:* Promote **research in the context of addressing AMR through a One Health approach** through research partners to fill research gaps.	Ongoing

Strategic Objective 1

Improve awareness and knowledge of AMR



5 WHO Moments for Hand Hygiene

AMR was noted as being a key issue of concern in the EPA's quadrennial State of Environment Report 2020

>40%

infections = antibiotic resistant bacteria. In some G20 countries.

Source: IACG. (2019). No time to wait: Securing the future from drug-resistant infections. Report to the Secretary-General of the United Nations.

Strategic Objective 1: Improve awareness and knowledge of antimicrobial resistance

No	Strategic Interventions/Actions	Responsibility	Timeframe
1-01	**Further develop and evolve communications activities to support AMR, AMS and IPC key messages, targeted to the audience.** This may include: ■ **Developing and implementing additional innovative approaches to engage the public with AMR, AMS and IPC issues** with a particular focus on people using the health and social care system and considering cultural norms, ■ Continued **roll out of the RESIST communications programme** and the ongoing public and professional information campaigns around AMR, AMS and IPC, ■ Working with relevant organisations to **increase awareness of inappropriate antibiotic use to students and younger audiences**, ■ Developing AMR, IPC and AMS awareness campaigns, targeting **community and residential healthcare services,** ■ Continuing and **expanding the current communications campaigns to raise awareness about prudent use of antibiotics** with key public and professional audiences, ■ Continuing to **use behaviour change approaches** and concepts to address antibiotic prescribing habits, ■ Promoting **year-round** public awareness campaigns, ■ Continuing to promote and participate in **European Antibiotic Awareness and World Antimicrobial Awareness Week**, ■ Promote **hand and respiratory hygiene** as a cornerstone of good IPC practice in society.	HSE, DOH	Ongoing
1-02	Continue to **carry out regular surveys to assess knowledge, belief and attitudes** of the general public (for example, Healthy Ireland Survey), as well as healthcare professionals, about antibiotics, antibiotic use and AMR and IPC. Also, seek to assess impact of awareness campaigns.	DOH	2023-2025
1-03	Develop a **patient and public policy engagement framework, to support iNAP2.**	DOH	2023
1-04	Undertake work to capture patients' and staff stories relating to their experience of AMR and IPC.	DOH collaboration with HSE	2021

No	Strategic Interventions/Actions	Responsibility	Timeframe
1-05	**Work with educational stakeholders to promote learning on AMR and IPC** for schools and educational institutions in order to promote and sustain good behaviours with respect to AMR and IPC.	DOH	2022
1-06	Promote best practice and **share new developments and key messages on AMR, IPC and AMS in newsletters for health and social care professionals,** in line with HSE AMRIC campaigns and iNAP2 national programmes and priorities.	IMC, NMBI, PSI, IDC, ICGP, RCSI, RCPI, IIOP.	2021
1-07	**Promote AMR and IPC as key areas for competence amongst health and social care professionals,** by recognition in professional practice standards and guidance, as appropriate.	IMC, NMBI, PSI, CORU, IDC.	2021
1-08	**Develop and promote HSE expert staff** as spoke-persons and advocates on AMR and IPC.	HSE	2022- 2025
1-09	Implement agreement with all Higher Education Institutions that they confirm that **all students on clinical placement have completed foundation course on AMR, IPC and AMS** before their first clinical placement.	HSE	2021
1-10	Encourage the participation of GPs, pharmacists, registered nurses, registered midwives and other healthcare staff in **continuous professional development and education on AMR, IPC and AMS** by promotion of resources and increased awareness of the importance of these areas for practice.	IMC, NMBI, PSI, IDC, ICGP, RCSI, RCPI, IIOP, HSE.	2022
1-11	Roll out the inclusion of key information on **AMR, IPC and AMS in all induction material for all incoming staff** and be built in to HSE supported continuing education and training.	HSE	2022
1-12	Develop and implement the **Core Competency Framework for healthcare staf**f for AMR and IPC.	HSE	2022
1-13	Create standards and requirements for **AMR educational modules in Nursing and Midwifery**.	NMBI	2022

No	Strategic Interventions/Actions	Responsibility	Timeframe
1-14	Ensure **education on AMR and IPC is included in pharmacy undergraduate and postgraduate core curriculum** training and examinations.	PSI	2022
1-15	Continue to work closely with health stakeholders, academics, professional **organisations, and researchers, so these organisations, their teams and individual practitioners become "ambassadors" for the key messages related to prudent antibiotic use**, to the general public and to their membership.	DOH, HSE	2022
1-16	Continue to support the **HSE Antimicrobial Stewardship Advisory Group**, ensuring expert input in relation to AMS.	HSE	2021
1-17	Continued support of a c**ollaborative approach to the dissemination of safety information from the EMA and HPRA.**	HPRA	Ongoing
1-18	Disseminate information and **promote participation of Irish stakeholders in the planned EU voluntary network on AMR in human health.**	DOH	2022
1-19	Continued development of DAFM /Veterinary Council **webpage, use of newsletters/webinars/podcasts/social media/meetings and events.**	Veterinary Council, DAFM, Bord Bia, AHI, FSAI, Teagasc	Ongoing
1-20	Carry out a **survey of pet owners waiting in companion animal veterinary practice waiting rooms** to gauge the level of awareness of AMR.	APHA, Veterinary Ireland	2022
1-21	Carry out a follow up survey of **farmer attitudes to AMR** to allow comparison with results from 2018 survey.	APHA, IFA	2021
1-22	Incorporate messages on AMU in relation to **mastitis** into revised content of Cell Check "Farm Guidelines for Mastitis Control" and promotion of these.	AHI	Ongoing
1-23	Use **AHI field events (e.g. Beef HealthCheck, Calf care, Pig HealthCheck)** and other communciations channels to promote awareness and management of AMR.	Teagasc	Ongoing

No	Strategic Interventions/Actions	Responsibility	Timeframe
1-24	Use **Teagasc field events** on different species (Farmer conferences, Open days) to promote awareness and management of AMR. Include AMU and AMR as part of the SignPost farm programme sustainability measures.	Teagasc	Ongoing
1-25	Include AMU and AMR as part of the SignPost farm programme **sustainability** measures.	Teagasc	Ongoing
1-26	Identify opportunities to highlight the areas of **antimicrobial stewardship** and AMR in the **curriculum** of undergraduate veterinary practitioner and veterinary nurses across the domains of knowledge, skills and professionalism.	UCD, DAFM	Ongoing
1-27	Incentivised completion of AMR related **CVE for veterinary practitioners.**	Veterinary Council	Ongoing
1-28	AMR related topic to be included in each annual Veterinary Ireland **Continuing Veterinary Education** event including VICAS conferences.	Veterinary Council	Ongoing
1-29	Promote awareness of responsible prescribing and use of antimicrobials by companion animal veterinary practitioners through newsletters/vet alert emails and the Veterinary Journal.	VICAS	Ongoing
1-30	Work with other stakeholders to increase awareness of the importance of the One Health agenda.	VICAS	Ongoing
1-31	Incorporate key messages on correct **disposal of intramammary antibiotics** in Cellcheck educational material.	AHI	2023
1-32	Promote **awareness** and explore opportunities to have AMR issues highlighted in national and regional newsprint, radio and television programmes such as the 10 Things to Know About series, and through press releases for published research.	EPA, DAFM	Ongoing
1-33	Inclusion of AMR as a concern in relevant national level consultations/ policy developments/plans.	EPA	Ongoing
1-34	Continued Engagement with **Irish meat retailers** to update them on iNAP2 initiatives from an animal health perspective.	MII	Ongoing
1-35	Use **FSAI and Bord Bia's** interactions with **retailers and processors** to further develop industry initiatives in relation to responsible use of antibiotics.	FSAI, Bord Bia, DAFM, IBEC's Food Drink Ireland (FDI) and Meat Industry Ireland (MII)	Ongoing

Strategic Objective 2

Enhance surveillance of antibiotic resistance & antibiotic use

The EPA and HSE funded AREST project found that multi-drug resistant microbes are widespread in Irish rivers, lakes and beaches.

48% MRSA

Reduction over 8 years

Source 2020 NHQRS Report (published by Department of Health in 2020)

50%

EU Farm to Fork Strategy aims for a 50% drop in sales of antimicrobials by 2030

ESBL E. coli in broilers

70%

2016-2020

Between 2009 and 2015, the percentage of preventable adverse events related to hospital-acquired associated infection decreased from 33% to 22% (INAES2).

FROM 33%

TO 22%

Strategic Objective 2: Enhance surveillance of antibiotic resistance and antibiotic use

No	Strategic Interventions/Actions	Responsibility	Timeframe
2-01	Establish a national system for continuous and enhanced **monitoring of HCAIs in intensive care units**.	HSE	2022
2-02	Establish a national system for continuous **monitoring of HCAIs in surgical site infections**.	HSE	2021
2-03	Establish a national system for monitoring of **common community-acquired infections**, to include UTI, in collaboration with GPs.	HSE, ICGP	2023
2-04	Scope and extend **provision of antibiotic prescribing data at prescriber and services levels** across settings to provide direct prescriber feedback, inform behavioural change and support extension of best practice projects, such as GP preferred antibiotics prescribing.	HSE, ICGP, PCRS	2022- 2025
2-05	Improve surveillance, collection, analysis, timely reporting, and feedback of **antimicrobial consumption data across key settings**, broadly built around the **WHO AWaRE classification**. For example, this may include but is not limited to General Practice, long-term residential care facilities and dental services.	HSE	2022
2-06	Develop and improve **annual national and European prevalence studies** of antimicrobial prescribing in acute hospital and long-term residential care facilities.	HSE, HPSC, DOH	Ongoing
2-07	Support participation in, and contribute to development, of the **WHO Global Antimicrobial Resistance Surveillance System (GLASS)**.	HSE	Ongoing
2-08	Develop sustainability and governance for continuation and further development of the **One Health Surveillance Reporting system** to include multi-disciplinary professional and clinical/administrative support.	DOH, HSE	2022
2-09	Develop and publish the **One Health Surveillance data report for 2017/2018/2019**.	DOH, HSE	2021

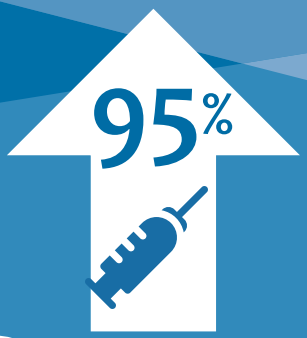
No	Strategic Interventions/Actions	Responsibility	Timeframe
2-10	Develop and report the **UN Sustainable Development Goal indicator (3.d.2)**, as it relates to human health.	DOH, HSE	2022
2-11	Develop and implement systems and processes to provide **more timely collation, frequency and reporting of key antimicrobial routine resistance data** from microbiology laboratories including both public and private laboratories built on the existing EARS-Net process.	DOH, HSE	2023-2025
2-12	Enhance **rapid laboratory diagnostic capacity** to support AMR and IPC stewardship, which may enhance patient flow.	HSE, RCPI	2022- 2025
2-13	Develop an **integrated and comprehensive microbiology human health reference laboratory service** that encompasses services for key antimicrobial resistance issues, including periodic structured national surveillance studies of antimicrobial resistance in key organisms.	DOH, HSE	2023-2025
2-14	Contribute to the development and implementation of **medical laboratory systems and eHealth systems** to ensure they support AMR and IPC surveillance.	DOH, HSE	2022-2025
2-15	Develop **a collaborative framework within which the HSE can work with private healthcare providers on** surveillance.	DOH, HSE	2023-2025
2-16	Carry out a review of the current **AMR surveillance programme** in animals and introduce any improvements that are necessary.	DAFM, AHI, ICMSA, ICOS, IFA, Veterinary Ireland, UCD, Teagasc	Ongoing
2-17	Address **quality and capability** in relation to antimicrobial culture and susceptibility testing and data management.	DAFM, AHI, ICBF	Ongoing
2-18	Develop national policy on methodology and management of **antimicrobial susceptibility testing** to support prudent prescribing and antimicrobial stewardship.	DAFM, AHI, ICBF	Ongoing
2-19	Develop **diagnostic and therapeutic protocols** for selected clinical presentations across species, with emphasis on those where AST is not possible in advance of treatment.	UCD, DAFM, AHI, Veterinary Ireland, Teagasc	Ongoing

No	Strategic Interventions/Actions	Responsibility	Timeframe
2-20	Construct a National Digital Veterinary Prescription System **(NVPS)** to align with requirements under new Veterinary Medicine Regulations 2019/6 (Article 104 (2)) which will measure the usage of antibiotics as well as all other prescription medicines.	DAFM	Ongoing
2-21	Develop and implement a system for the **collection of data** in relation to usage of intramammary tubes in the dairy sector.	AHI, DAFM, Teagasc, ICOS, ICMSA, Veterinary Ireland	Ongoing
2-22	Develop a scoping document investigating potential to increase **environmental surveillance** for AM residues from **point source risks** including hospitals, WWTPs, Septic Tanks, Knackeries, intensive agriculture, and biopharma discharges.	EPA, DHPLG, Irish Water, HSE, DAFM	2024
2-23	Undertake sufficiency review on environmental monitoring in **surface waters** for **AM residues** under WFD Watch list.	EPA, DHPLG, Irish Water	2024
2-24	Research output on **Antimicrobial Resistance and the Environment**- Sources, Persistence, Transmission and Risk Management.	EPA, Gov of Ireland funded and EPA Managed Research (NUIG lead on consortia)	Ongoing
2-25	Complete nationwide farm survey on prevalence of ESBL E. coli in soil	DAFM	2021

Strategic Objective 3

Reduce the spread of infection and disease

Healthy Animals Don't Need Antibiotics

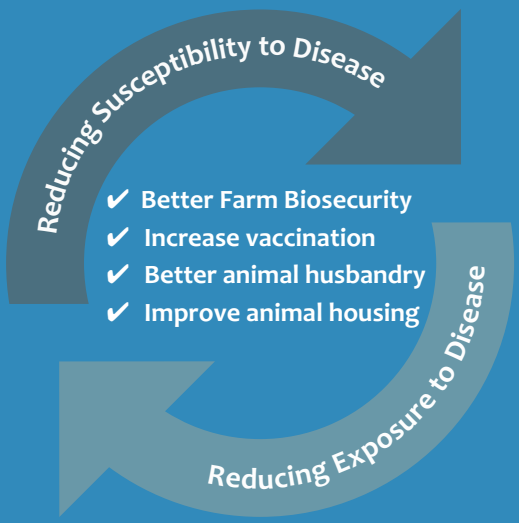


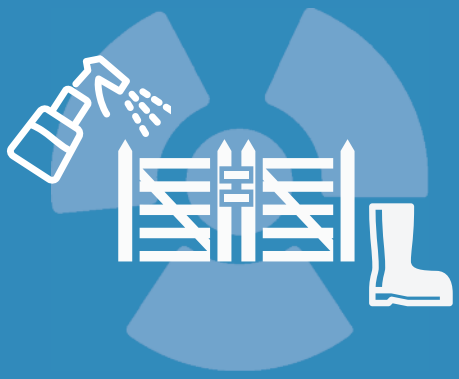
The Influenza vaccination uptake is in **excess of 95%** for residents of Long-Term Care Facilities.

Report of the findings of the Point Prevalance Survey of Antimicrobial Use in HSE Older Persons Residential Care Facilities (Oct-Dec 2020)

Flu vaccination in healthcare workers has steadily risen year on year.

2020 NHQRS Report
[Published by Dept of Health in 2020]





Good Farm Biosecurity reduces the risk of introducing disease or disease spread within farms

Strategic Objective 3: Reduce the spread of infection and disease

No	Strategic Interventions/Actions	Responsibility	Timeframe
3-01	Develop and implement the **HSE 2022-2025 AMRIC Action Plan**, cognisant of the learnings from COVID-19.	HSE	2022-2025
3-02	Implement the HSE **Community IPC Strategy** in line with the integrated approach to AMR and IPC and cognisant of the related recommendations in the Nursing Home Expert Panel Report on COVID-19 (2020).	HSE	2022
3-03	Promote best practice in IPC as **homecare** services develop, including guidance, education, and advice.	DOH, HSE, Private Providers	2022
3-04	**Enhance collaboration and promote community of practice** across all health and social care services.	HSE, HIQA, Private Providers	2021
3-05	**Promote best practice in governance models and arrangements** across AMR and IPC for all health and social care services.	HSE	2022-2025
3-06	**Enhance governance arrangements** across AMRIC for HSE-funded services.	HSE	2022-2025
3-07	Ensure IPC best practice requirements are embedded in **refurbishment projects** of older facilities and equipment, including IPC consideration of minimising transmission risk.	HSE, DOH	2022- 2025
3-08	Ensure IPC best practice requirements are embedded in **new major building projects**, including IPC consideration of minimising transmission risk.	HSE, DOH	2022- 2025
3-09	Ensure IPC best practice requirements are embedded in refurbishment projects under **minor capital**, including IPC consideration of minimising transmission risk.	HSE, DOH	2022- 2025
3-10	Include IPC considerations as part of the **prioritisation process** for investment in capital projects.	HSE, DOH	2022- 2025
3-11	Encourage participation in **professional networks related to AMR and IPC**, formally and informally, specialist and generalist for healthcare professionals.	HSE, HIQA, Private Providers	2022- 2025

No	Strategic Interventions/Actions	Responsibility	Timeframe
3-12	Review and evaluate current and potential other approaches to reduce infections associated with **Peripheral and Central Venous Catheter Related Infection**, including the development and implementation of guidance on prevention of infection.	HSE	2022
3-13	**Improve practice on incident reviews** of key healthcare associated infections and reporting in line with best practice in incident management.	HSE	2022- 2025
3-14	Continue the **monitoring programme** of IPC inspections in acute and community healthcare settings, designated centres for older persons, and persons with a disability.	HIQA	Ongoing
3-15	With regard to the relevant monitoring programmes, **inspection reports to include details of compliance plan responses** from providers outlining how they will come into compliance with required regulations or standards.	HIQA	2021
3-16	**Ensure residential care** staff have an increased understanding around implementation of IPC standards in their facilities.	Private Providers	Ongoing
3-17	Continue to promote **vaccination** as a means of preventing and limiting infection in line with the National Guidelines from the National Immunisation Advisory Committee.	DOH, HSE, Private Providers	Ongoing
3-18	Promote **general health and wellbeing measures**, through the Healthy Ireland framework, as a means of potentially preventing infection.	DOH, Private Providers	Ongoing
3-19	Co-ordinate **TASAH-funded biosecurity** assessments of pig and poultry farms through the BioCheck tool and generate benchmarking reports to herds/flocks, through a programme database or otherwise.	AHI, vets, farmers, Teagasc, Bord Bia	Ongoing
3-20	Complete **BVD eradication** programme.	AHI, Veterinary Ireland, IFA, ICMSA, UCD, Teagasc, DAFM, ICOS, ICSA, ICBF, IHFA	Ongoing

No	Strategic Interventions/Actions	Responsibility	Timeframe
3-21	Improved **animal welfare** on all commercial pig farms.	AHI, Teagasc, vets, farmers, Bord Bia	Ongoing
3-22	Initiate targeted communications to herds to promote IBR control, including vaccination where necessary. Develop options for a national **IBR eradication programme** for decision by an IBR IG.	AHI, DAFM, farm organisations, ICBF, IBR IG	Ongoing
3-23	Develop systems/databases to feedback **AM/PM** abattoir findings to cattle, pig and sheep farmers and their veterinary practitioners.	AHI, DAFM, Teagasc, MII, farmers, vets, ICBF	Ongoing
3-24	Promote registration in the **Irish Johne's Control** Programme, which includes elements designed to improve biosecurity and optimise calf health.	AHI, Teagasc, ICMSA, ICSA, IFA, VI, DAFM, IHFA, PCBCOI, ICBF, ICOS	Ongoing
3-25	Implement measures to improve the national **Somatic Cell Count** through the CellCheck programme, including promoting further uptake of milk recording and of **selective dry cow therapy (SDCT)** via TASAH-funded Dry Cow Consults. Develop and pilot a delivery mechanism of farm-specific mastitis investigations by appropriately trained local service provider teams.	AHI, DAFM, ICMSA, ICOS, IFA Teagasc, UCD, ICBF, Veterinary Ireland, Milk Recording Organisations	Ongoing
3-26	Undertake a review of the **National Salmonella Control Plan** and implement such changes as are agreed by the Implementation Group.	AHI, UCD, Teagasc, DAFM, Veterinary Ireland, MII, IFA, Bord Bia	Ongoing
3-27	Undertake a review of **calf housing** to generate recommendations of best practice.	AHI, UCD, Teagasc, DAFM	2021
3-28	Optimise feedback of **computerised meat inspection** findings and Precision Livestock Farming monitors on farm to improve pig health – PLFPigCarc.	Teagasc	2021

Strategic Objective 4

Optimise the Use of Antibiotics in Human and Animal Health

Higher usage of Green Antimicrobials compared to Red Antimicrobials in LTFCs.

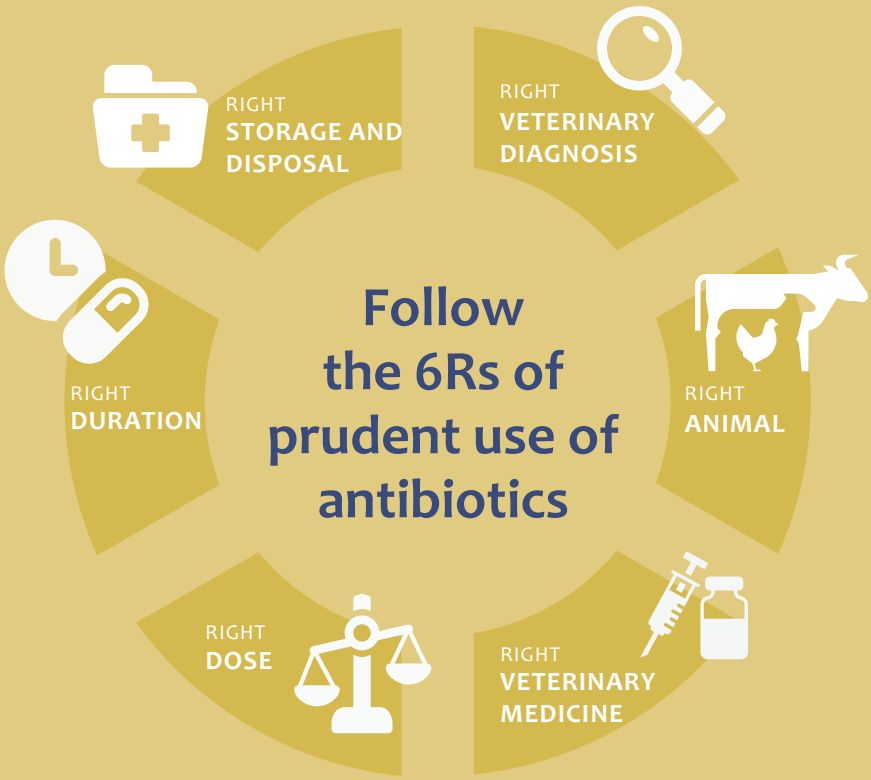
Report of the findings of the Point Prevalence Survey of Antimicrobial Use in HSE Older Persons Residential Care Facilities (Oct-Dec 2020) [Published 7th April 2021]

Antibiotic consumption in hospitals has risen over the past 10 years.

2020 NHQRS Report
[Published by Dept of Health in 2020]

Highest priority Critically Important Antimicrobials (HP-CIAs)

are medicines of **last resort** in human and animal health. They should not be used as first line treatments in animal health.



Follow the 6Rs of prudent use of antibiotics

Strategic Objective 4: Optimise the use of antibiotics in human and animal health

No	Strategic Interventions/Actions	Responsibility	Timeframe
4-01	Progress implementation of **electronic prescribing** throughout the healthcare systems, in order to support antimicrobial stewardship and audit.	HSE, DOH	2022- 2025
4-02	Develop and enhance **www.antibioticprescribing.ie** as a national platform to support prescribing for community services and acute hospitals. Update platform to enhance usability and promote best practice in antimicrobial prescribing.	HSE, DOH, ICGP	2022- 2025
4-03	Continue multi-agency participation in the **HSE Antimicrobial Guideline Review**.	HSE, HPRA	2022- 2025
4-04	Provide induction training on antimicrobial prescribing for all **new prescribers** and develop a process for assessment of completion.	HSE, ICGP	2022
4-05	Provide access to support for **individual prescribers to audit** their prescribing in community and acute hospital settings, which may include tools and education.	HSE	2022- 2025
4-06	**Conduct Pilot Project on Point of Care Testing** to support appropriate prescribing and use of antimicrobials based on the HIQA HTA (2019).	HSE	2023-2025
4-07	Develop mechanism which **enhances communication with AMRIC around potential and confirmed shortages of antimicrobial medicines**, including early alerts, and develop guidance in relation to the management of shortages for prescribers.	HSE, HPRA, Pharmaceutical sector	2022
4-08	Develop a mechanism for ensuring **supply of critical antimicrobials to patients at highest clinical need**.	HSE, HPRA, Pharmaceutical sector	2022
4-09	Highlight the **strategic vulnerability of antimicrobials** when production is restricted to few / one manufacturer, and subject to potential shocks on the global supply chain.	DOH, HSE	2022- 2025

No	Strategic Interventions/Actions	Responsibility	Timeframe
4-10	Inclusion of **medication safety and antimicrobial stewardship as a core part of a wider assessment methodology** which is under development against the *National Standards for Safer Better Healthcare* in contemplation of the Patient Safety (Notifications) Bill and Patient Safety (Licensing) Bill.	HIQA	Ongoing
4-11	Expand the **GP out of hours prescribing projects** and support AMS.	HSE, ICGP	Ongoing
4-12	Build **capacity in an integrated way, in line with agreed model**, to ensure AMRIC Multi-Disciplinary Teams across all settings. In line with overarching integrated AMRIC governance.	DOH, HSE	2022- 2025
4-13	Conduct **Mid Term Review of the Workforce Plan** in line with the strategic workforce objectives and policy approach in place at the time of the review.	DOH, HSE	2023
4-14	**Engage with the wider healthcare team** (for example, management, clinical pharmacy, laboratory, and cleaning facilities) to ensure IPC and AMR are an integral part of the delivery of all services.	All	Ongoing
4-15	Expand the **role and governance of the AMRIC Teams**, including the interface across acute and community services and with specialties such as Public Health, HPSC, Facilities Management, Hygiene Services and others for surveillance, prevention, and control of infectious disease.	HSE, DOH	2021
4-16	Develop models to support **recruitment and retention** of skilled IPC and AMS staff across the multi-disciplinary team and geographical distribution.	DOH, HSE	2022- 2025
4-17	Promote **IPC, AMS and AMR as specialist** areas to newly qualified healthcare professionals.	DOH, HSE	2022
4-18	Promote awareness of HPRA facility for **provision of advice on regulatory strategy to stakeholders.**	HPRA	Ongoing
4-19	Ensure systemic antimicrobials for human use to remain as **prescription-only products**.	HPRA	Ongoing
4-20	Update **HPRA Guidance on reclassification of medications** to include specific advice on reclassification of antimicrobials.	HPRA	2022

No	Strategic Interventions/Actions	Responsibility	Timeframe
4-21	Contribute to the development and implementation of **medical laboratory systems and eHealth systems** to ensure they support AMRIC stewardship.	DOH, HSE	2022- 2025
4-22	Meat Industry Ireland Members will engage with their farmer suppliers to promote the **prudent use guidelines** and highlight the increasing **customer/market focus** on this area.	MII, AHI, farmers	Ongoing
4-23	Publication of document on **"Responsible Antibiotic use"**, particularly of HP-CIAs, in **mastitis** control. Update CellCheck Guidelines in relation to recommendations on **SDCT** and prudent use of antimicrobials.	AHI	2021
4-24	Develop and champion adherence to a **code of good practice** regarding the prudent use of antimicrobials in **horses**.	UCD, DAFM, Equine Veterinary Ireland, DAFM	2021
4-25	Endorse and champion adherence to a **code of good practice** regarding the prudent use of antimicrobials in **aquaculture**.	Fish Veterinary practitioners, DAFM	2022
4-26	To support the development and distribution of national prescribing **guidelines for Companion Animal Veterinarians**.	VICAS, DAFM	2022
4-27	Revise the various **quality assurance schemes** to ensure that they include elements related to the prudent use of antibiotics in accordance with international best practice.	Bord Bia, Teagasc, DAFM, farmers, farm organisations	Ongoing
4-28	**Farmers** to complete module on **responsible use of antibiotics.**	Bord Bia, farmers, DAFM, Teagasc	Ongoing
4-29	Create a series of **case studies** in pig farms for the transition to not using **prophylactic/metaphylactic** AMs and ZnO.	Teagasc, UCD	2022
4-30	Draft and publish **Statutory Instruments** with regard to Regulation (EU) 2019/6 on Veterinary Medicines and Regulation (EU) 2019/4 on Medicated Feed.	DAFM	2022
4-31	Development and implementation of a **national collection scheme for antimicrobials**.	DAFM, DECC	Ongoing
4-32	Develop and endorse a Statement of Intent around the Voluntary **cessation in the use of colistin** in the Irish Agri-food sector.	DAFM, AHIC	2021

Strategic Objective 5

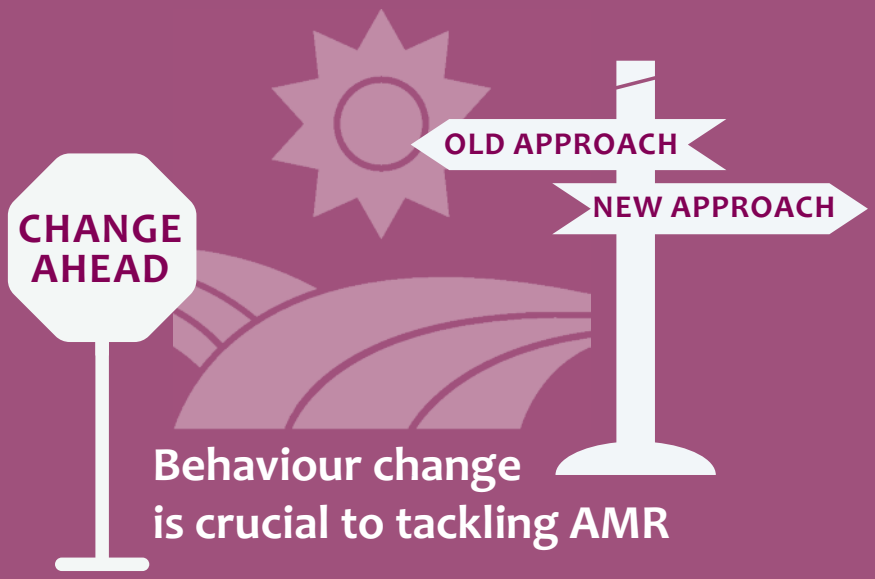
Promote research and sustainable investment in new medicines, diagnostic tools, vaccines and other interventions

1987

The year a new class of antibiotic last came onto the market

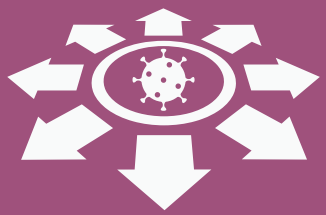
zero

new classes of antibiotics in clinical development to treat the world's most dangerous antimicrobial resistant bacteria



Behaviour change is crucial to tackling AMR

Since 2017, the EPA have committed almost €1.3 million to national and European research projects which explore the environmental dimension of antimicrobial resistance (AMR).



Since 2018, €24.4m to support AMRIC activities including 300 Healthcare professionals.

€24.4m

to support AMRIC activities

Strategic Objective 5: Promote research and sustainable investment in new medicines, diagnostic tools, vaccines and other interventions

No	Strategic Interventions/Actions	Responsibility	Timeframe
5-01	**Facilitate, where appropriate, research** in new medicines, diagnostic tools, vaccines, and other interventions; across acute, general practice, dental and community care settings.	HSE, DOH, RCSI, RCPI, ICGP, HRB, IDC	Ongoing
5-02	Develop a mechanism to **review the highest priority evidence gaps** on AMR and IPC aligned with the strategy, which will guide the exploration of opportunities and deliberations relating to co-funding.	DOH, HRB	2022
5-03	Explore opportunities, directly and in collaboration with other funders and stakeholders, to **advance research in AMR and infection control.**	DOH, HRB, HSE	Ongoing
5-04	Continue to strengthen, develop, and invest in **relevant co-funded research collaborations at EU and Global level** including the Joint Programming Initiatives on Antimicrobial Resistance (JPIAMR).	HRB	Ongoing
5-05	Review the **evidence base for behavioural change initiatives** to promote optimal antimicrobial prescribing and reduce antimicrobial consumption.	DOH, HSE	2022
5-06	Review **policy approaches to Patient and Public Involvement on AMR.**	DOH	2021
5-07	Develop a **tool to collect a core data set and collection / survey methodology for the collection of costs attributable to AMR at a point in time**, to initially consider public healthcare perspective.	HSE, HIQA	2022
5-08	**Undertake Health Technology Assessment(s) on AMR and IPC and/or HCAI-related topics as may be identified,** in line with outcome of the HIQA HTA prioritisation processes. In particular, consider developments in POCT technologies.	HIQA, DOH	2023-2025
5-09	Consider **innovative funding mechanisms** for new antimicrobial agents on a value, not volume, basis.	DOH	Ongoing

No	Strategic Interventions/Actions	Responsibility	Timeframe
5-10	**Assess the role of healthcare infrastructure** in potential environmental transmission of multi-drug resistant infection (for example, via infection reservoirs), including consideration of clinically and cost-effective management options.	DOH, HSE	2022
5-11	**Develop capacity and capability to support AMR and IPC workforce planning** in line with international best evidence, in particular the development and implementation of professional competency frameworks.	DOH, HSE	2022
5-12	**Promote a culture of continuous monitoring, audit methodologies and other mechanisms** to support AMR and IPC and inform continuous quality improvement.	HSE	2022
5-13	**Develop capacity and capability**, including supporting structures, to support **AMR, IPC and AMS clinical practice guidance development, update, review, and implementation in a timely way** informed by international and national evidence, best practice and learning from the public health emergencies.	DOH, HSE	2022
5-14	Submit the **Clinical Guideline on Infection Prevention and Control to the National Clinical Effectiveness Committee** for quality assurance and consideration for progression as a National Clinical Guideline.	HSE, DOH, NCEC	2022
5-15	Continue to support the response to the COVID-19 Public Health Emergency through evidence synthesis and **COVID-19 publications** which support the work of National Public Health Emergency Team (NPHET) COVID-19.	HIQA	2021-2022
5-16	Ensure **AMR and IPC indicators are captured and aligned to the Health Systems Performance Assessment Framework** as it continues to develop.	DOH, HSE	2022
5-17	Continue to develop **HPRA regulatory expertise** to support the assessment of new antimicrobial medicines, medical devices, vaccines, and other interventions.	HPRA	Ongoing
5-18	**Establish an annual Student Award** for research amongst the health and social care professionals student groups on AMR and IPC work.	DOH	2022
5-19	Establish a **thematic network** to direct future research.	DAFM, Teagasc	2022

No	Strategic Interventions/Actions	Responsibility	Timeframe
5-20	Undertake a research gap, and horizon scanning, analysis in relation to sources, fate & transport of **AM residues** in the **environment** with a view to informing new research calls.	EPA	2021
5-21	Make a presentation to **Science Foundation Ireland** with a view to promoting research in solutions for AMR and encouraging the development of **new** diagnostic tools, vaccines and other interventions.	DAFM, DOH, SFI	2022
5-22	Completion of **Worldcom** research project.	NUIG	2021-2022
5-23	Perform **economic analysis** with regard to selected interventions in different species.	Teagasc, AHI	Ongoing
5-24	Development and optimisation of an economic model for the Irish pig industry – **Piginvest**.	Teagasc	2022
5-25	Complete research on the use of antimicrobials in animal health on the island of Ireland: **knowledge, attitudes and behaviour.**	Safefood, Teagasc, Queens University Belfast, UCD	2021
5-26	Dissemination of research findings with regard to understanding **farmer motivation** to participate in **milk recording**.	AHI	2021
5-27	Implementation of behavioural change interventions tools in dairy and pigs -**Project AMU-Farm**.	Teagasc, UCD, AHI, QUB	2022
5-28	Develop **CellCheck Dashboards** on ICBF CellCheck with modules to enhance interrogation of SCC data, complementing existing CellCheck Reports.	AHI	Ongoing
5-29	Completion of **research on dietary manipulation** to reduce the need for antimicrobials in the pig sector - Project PigNutriStrats. This project also includes internal biosecurity.	UCD, MII, Teagasc, WIT, DAFM	Ongoing
5-30	**Quantifying antimicrobial use** on Irish dairy farms and validation of a self-report scale for dairy and pig farms - Project AMU-Farm.	Teagasc, UCD, QUB, AHI	Ongoing
5-31	Development of salivary and environmental **biomarkers** to manage AMU and AMR in pigs - Project BM-Farm.	Teagasc, UCD.	2022
5-32	Development of NGS technologies (MinION) portable device for on-farm pathogen **DNA sequencing** in BRD.	Teagasc, DAFM	Ongoing
5-33	Research on sustainable solutions to improve **gut health** and reduce losses using bioactives and early life nutrition.	Teagasc	Ongoing

"Antimicrobial resistance is a global threat – the clock is ticking, and we need to act now."

Stella Kyriakides,
EU Commissioner for Health and Food Safety (2019-2024)

Appendix 1: National Interdepartmental Antimicrobial Resistance Consultative Committee

The National Interdepartmental AMR Consultative Committee was launched in November 2014 on European Antibiotic Awareness Day. The Committee is a true One Health committee that brings together many of the key stakeholders in the human health, animal health and environmental sectors. The function of the Committee is as follows:

- Within the context of One Health to raise public and professional awareness in both the Health and Agricultural sectors of the human and animal health threat of AMR, and the repercussions for human health, the agricultural and food industry and the environment.
- Sharing best practice to provide guidance as to how best ensure that the matter of AMR is addressed holistically and in a coordinated way across both sectors at a national level, in a setting where the challenges faced by both sectors are understood by all.
- Provide guidance as how best to encourage, coordinate and support existing and planned work on the issue of AMR including research activities by various stakeholders across both sectors.
- Provide commentary and advice which will serve to inform future evidence based intersectoral policy decisions and actions in relation to AMR.
- Guide, support and monitor implementation of Ireland's National Action Plan on Antimicrobial Resistance 2021-2026 (iNAP2) and subsequent plans.

The Committee meets at least on a bi-annual basis but may meet more frequently as the need arises. The membership of the Committee is as follows:

	Membership
Co-Chairs	
Dr Tony Holohan	Chief Medical Officer, Department of Health.
Dr Martin Blake	Chief Veterinary Officer, Department of Agriculture, Food and the Marine.
Members	
Dr David Graham	CEO, Animal Health Ireland.
Ms Laura Burke	DG, Environmental Protection Agency.
Dr Pamela Byrne	CEO, Food Safety Authority of Ireland.
Dr Lorraine Nolan	CEO, Health Products Regulatory Authority.
Professor Martin Cormican	AMRIC, Health Service Executive.
Dr Kevin Kelleher	Asst National Director, Health & Wellbeing, Health Service Executive. (to November 2021)
Dr Niamh O'Sullivan	Chair, HSE/RCPI Clinical Advisory Group on HCAI.
Dr Karen Burns	Consultant Microbiologist, Health Protection Surveillance Centre.
Mr Pat McCormack	Irish Creamery Milk Suppliers Association.
Mr Tim Cullinane	Irish Farmers Association.
Dr Margaret O'Sullivan	Chair, National Zoonosis Committee.
Mr Joe Moffat	Veterinary Council of Ireland.
Mr Conor Geraghty	Veterinary Ireland.
Ms Brigid Doherty	Public Representative.
	Secretariat
Department of Agriculture, Food and the Marine	
Dr Paul Corkery	Head of Division (From 2020)
Mr Rob Doyle	Senior Superintending Veterinary Inspector (to 2020)
Ms Caroline Garvan	Superintending Veterinary Inspector
Ms Julie Bolton	Veterinary Inspector
Ms Zara Conlon	Veterinary Inspector
Department of Health	
Ms Marita Kinsella	Director, National Patient Safety Office.
Ms Rosarie Lynch	Head of Clinical Effectiveness and Antimicrobial Resistance Policy, National Patient Safety Office.
Ms Eithne Barron	Assistant Principal Officer, National Patient Safety Office. (to September 2020)
Dr Laura Dooley	Assistant Principal Officer, National Patient Safety Office. (from February 2021)
Ms Sarah Delaney	Higher Executive Officer, National Patient Safety Office.
Mr Austin Cullen	Administrative Officer, National Patient Safety Office. (from September 2021)

The Minutes of the Committee are published on the Department of Health and Department of Agriculture, Food and the Marine websites.

www.health.gov.ie **www.agriculture.gov.ie**

Appendix 2: Animal Health Implementation Committee

An Animal Health Implementation Committee (AHIC) was set up in January 2018, chaired by Ireland's Chief Veterinary Officer, and tasked with overseeing the completion of the Animal Health and Environment actions outlined in iNAP. This committee brought together various animal health and environment stakeholders to collaborate on achieving completion of the projects outlined in the Animal Health Implementation Plan which was developed jointly with the stakeholders. The Terms of Reference of the Committee are as follows:

- To provide a mechanism to guide and co-ordinate actions to address AMR in the animal health sector.
- To provide a forum for the sharing of information so that all stakeholders are kept up to date on actions being carried out across the sector.
- To provide a mechanism to identify any new or emerging issues, synergies, research gaps and opportunities, and to develop innovative solutions to address issues that arise.

The committee meets approximately three times per year and minutes of meetings are published at: https://www.gov.ie/en/publication/4256d-inap-animal-health-implementation-committee/

Membership of the committee is as follows:

	Membership
Chair Dr Martin Blake	 Chief Veterinary Officer, Department of Agriculture, Food and the Marine.
Members Dr David Graham Mr John Keogh Ms Alice McGlynn Dr Jonathan Derham Dr Aisling O'Connor Dr Lisa O'Connor Dr Lorraine Nolan Mr Mike Lynch Mr Ray Doyle Mr John Enright Mr Tomás Bourke Ms Deirdre Webb Mr Joe Ryan Ms Linda Gordon Dr Edgar Garcia Manzanilla Dr Simon More Ms Niamh Muldoon Mr Conor Geraghty	**Organisation** CEO, Animal Health Ireland. CEO, Animal and Plant Health Association (APHA). Accreditation and Policy Manager, Quality Assurance, Bord Bia. Head of Programme, Environmental Protection Agency (EPA). Scientific Officer, Environmental Protection Agency (EPA). Chief Specialist, Biological Safety, Food Safety Authority of Ireland (FSAI). Chief Executive, Health Products Regulatory Authority (HPRA). IT Projects Technical Leader, Irish Cattle Breeding Federation (ICBF). Livestock Services Executive, Irish Co-operative Organisation Society (ICOS). Secretary General, Irish Creamery Milk Suppliers Association (ICMSA). Executive Secretary Animal Health, Irish Farmers Association (IFA). Director, Irish Grain and Feed Association (IGFA). Director Meat Industry Ireland (MII). Chief Specialist in Food Science, Safefood. Head of Pig Development Department, Teagasc. Professor of Veterinary Epidemiology and Risk Analysis, UCD/CVERA. Registrar, Veterinary Council of Ireland (VCI). President, Veterinary Ireland (VI).
	Secretariat
Department of Agriculture, Food and the Marine Dr Paul Corkery Mr Rob Doyle Ms Caroline Garvan Ms Julie Bolton Ms Zara Conlon	 Head of Division (From 2020) Senior Superintending Veterinary Inspector (to 2020) Superintending Veterinary Inspector Veterinary Inspector Veterinary Inspector

Appendix 3: Key Stakeholders

Animal Health Ireland functions as a partnership between private sector organisations and businesses in the agri-food sector and the Department of Agriculture, Food and the Marine. AHI provides knowledge, education and coordination required to establish effective control programmes for non-regulated diseases of livestock.

The Animal and Plant Health Association is the representative body for manufacturers and sole distributors of animal health (veterinary medicines) and plant health (plant protection / agrochemical) products in Ireland.

Bord Bia is an Irish State Agency with the aim of promoting sales of Irish food and horticulture both abroad and in Ireland itself.

The Environmental Protection Agency is at the front line of environmental protection and policing. They ensure that Ireland's environment is protected, and they monitor changes in environmental trends to detect early warning signs of neglect or deterioration.

The Food Safety Authority of Ireland is a statutory, independent and science-based body, dedicated to protecting public health and consumer interests in the area of food safety and hygiene. They come under the aegis of the Minister for Health.

The Higher Education Authority leads the strategic development of the Irish higher education and research system with the objective of creating a coherent system of diverse institutions with distinct missions, which is responsive to social, cultural and economic development of Ireland and its people.

The Health Information and Quality Authority is an independent authority that exists to improve health and social care services for the people of Ireland.

Health Products Regulatory Authority's role is to protect and enhance public and animal health by regulating medicines, medical devices, and other health products. They are a state agency that put the health of people and animals at the core of that they do.

The Health Protection Surveillance Centre is Ireland's specialist agency for the surveillance of communicable disease. It works with service providers and sister organisations in Ireland and around the world to provide the best possible information for the control and prevention of infectious diseases.

The Health Research Board is a statutory agency under the aegis of the Department of Health. It is the lead agency in Ireland responsible for supporting and funding health research, information and evidence.

The Health Service Executive provides all of Ireland's public health services in hospitals and communities across the country.

Independent Patient Safety Council provides advice and guidance to the Minister for Health from a broad range of perspectives on the development of patient safety policy. Patient Safety aims to prevent and reduce risks, errors and harm that occur to patients and service users during the provision of health care.

The Irish Cattle Breeding Federation (ICBF) is a non-profit organisation charged with providing cattle breeding information services to the Irish dairy and beef industries. ICBF exists to benefit our farmers, our agri-food industry and our wider communities through genetic gain.

The Irish Co-operative Organisation Society serves and promotes commercial co-operative businesses and enterprise across multiple sections of the Irish economy.

The Irish College of General Practitioners is the professional body for general practice in Ireland. Its primary aim is to serve the patient and the general practitioner by encouraging and maintaining the highest standards of general medical practice. It is the representative organisation on education, training and standards in general practice.

The Irish Creamery Milk Suppliers Association represents all farmers, particularly dairy & livestock farmers. It aims to promote the interests of all engaged in agriculture at local, national & EU levels, and to advise on the protection and regulation of the agricultural industry in Ireland. It places special emphasis on preserving the family farm structure and defending the rights and incomes of farm families.

The Irish Farmers Association works to promote, foster and develop agriculture and defend the interests of Irish farmers and their families. It works across all sectors to accomplish its mission – to improve the incomes and conditions of all farm families.

The Irish Grain and Feed Association is the united voice of the compound feed manufacturers, feed material importers, grain intake and premix companies in Ireland.

The Marine Institute is the State agency responsible for marine research, technology development and innovation in Ireland. It provides scientific and technical advice to Government to help inform policy and to support the sustainable development of Ireland's marine resource.

Meat Industry Ireland provides a wide variety of services for its members including up-to-date information on all technical, legislative developments and policy changes that may affect the meat industry processing sectors.

The National Clinical Effectiveness Committee is a Committee established by the Minister for Health to provide a framework for quality assurance and endorsement of National Clinical Guidelines and audit in the health service.

The National Zoonoses Committee helps to advance the control of zoonotic diseases in Ireland through its support of regional zoonoses committees, its promotion of information-sharing and linkages between key stakeholders, and its identification and advice potential zoonotic risks.

The Private Hospitals Association co-ordinates the representation of private hospitals and offers a forum for exchange of information and best practice between members.

The Pharmaceutical Society of Ireland is an independent statutory body, established under the Pharmacy Act 2007 to protect the health, safety and wellbeing of patients and the public by regulating pharmacists and pharmacies in Ireland.

Safefood is the public body responsible for raising consumer awareness of issues relating to food safety and healthy eating across both the Republic of Ireland and Northern Ireland.

Science Foundation Ireland is the national foundation for investment in scientific and engineering research. It invests in academic researchers and teams who are most likely to generate new knowledge, leading edge technologies and competitive enterprises in the fields of science, technology, engineering and maths (STEM).

Teagasc is the Agriculture and Food Development Authority. It is the national body providing integrated research, advisory and training services to the agriculture and food industry and rural communities.

University College Dublin is a public research university in Dublin, Ireland, and a member institution of the National University of Ireland. With 33,284 students, it is Ireland's largest university, and amongst the most prestigious universities in the country. Six Colleges and their constituent Schools make up the academic structure of UCD. Through this structure, the University delivers excellence in teaching, scholarship and research.

The Veterinary Council of Ireland is the Statutory Body established under the Veterinary Practice Act 2005. Its principal function is to regulate and manage the practice of veterinary medicine and veterinary nursing in the State in the public interest.

Veterinary Ireland's role is to represent veterinary surgeons in Ireland and to facilitate the veterinary profession in its commitment to improving the health and welfare of animals under its care, to protecting public health and to serving the changing needs of its clients and the community through effective and innovative leadership.

Glossary

Antibacterials are substances that destroy bacteria or suppress bacterial growth or reproduction.

Antibiotic resistance vs Antimicrobial resistance: Antibiotic resistance refers specifically to the resistance developed by bacteria to antibiotics. Antimicrobial resistance is a broader term, encompassing resistance to drugs to treat infections caused by other microbes, such as mycobacteria (e.g. M. tuberculosis), parasites (e.g. malaria), viruses (e.g. HIV) and fungi (e.g. Candida spp. and Aspergillus spp.).

Antimicrobials are substances that destroy microorganisms or suppress microbial growth or reproduction. They are used to prevent and treat bacterial, viral, fungal and protozoal infections in humans and animals. They may be known respectively as antibacterials, antivirals, antifungals and antiprotozoals).

The terms 'antimicrobial' and 'antibiotic' are frequently used interchangeably. While antibiotics are produced naturally (from biological materials e.g. moulds or bacteria), antimicrobials may be produced from synthetic or biological material. The term 'antimicrobial' is technically more accurate to describe substances of non-biological origin that destroy microorganisms.

Antimicrobial Resistance (AMR) refers to a microorganism's ability to grow and reproduce or to survive exposure to an antimicrobial. AMR occurs when an antimicrobial that was previously effective is no longer effective to treat an infection or disease caused by a microorganism. AMR is exacerbated by human factors such as inappropriate use of antimicrobials in human and veterinary medicine, poor hygiene conditions and practices in healthcare settings or in the food chain facilitating the transmission of resistant microorganisms. Over time, this makes antimicrobials less effective and ultimately useless.

Antimicrobial Stewardship (AMS) is a systematic approach to optimising antimicrobial therapy. It includes not only limiting inappropriate use but also optimising antimicrobial selection, dosing, route and duration of therapy to maximise clinical cure while limiting unintended consequences, such as the emergence of antimicrobial resistance, adverse drug events and cost.

Bacteria are one of the major groups of microorganisms or microbes, some of which can infect and cause disease in humans and animals. Bacteria cultivated in a laboratory are referred to as isolates, those capable of causing disease as pathogens (pathogens that are transmissible between animals and humans are zoonotic), and those that are normally resident on or in humans/animals without causing disease as commensals or colonisers.

Benchmarking in the context of antimicrobials, refers to the process of measuring the level of antimicrobial prescribing by a veterinary practitioner, or usage by a farmer and comparing this to others in the sector. It is the process of comparison with peers.

COVID-19 is the illness caused by SARS – CoV-2 virus.

Critically Important Antimicrobials are antimicrobials of last resort for treatment of human and animal infection when the first line antimicrobials fail to work.

Empiric treatment is given without confirmation of the cause of the disease and based on clinical judgement. Sometimes urgency dictates empiric treatment (for example, when a significant infection by an unknown organism is treated with a broad spectrum antimicrobial while results of bacterial culture and other tests are awaited).

Enterobacteriales are a family of Gram-negative bacteria found in the bowel of humans and animals (e.g. *E. coli, Klebsiella pneumoniae, Salmonella* spp). Occasionally, they escape the bowel, causing infection elsewhere in the body.

Farm Biosecurity refers to farm management practices used to prevent both the introduction, and the spread of diseases within a farm.

Healthcare Associated Infection (HCAI) is an infection that is acquired after contact with healthcare services. The five most common HCAIs are: Surgical site infection; Pneumonia; Urinary tract infection; Bloodstream infection; Gastroenteritis.

Infection Prevention and Control (IPC) is a collection of practices, resources and specialist support that together help to prevent the spread of infection and minimise the impact of infection when it does occur. IPC practices, such as handwashing are used by everyone in daily life to prevent infection. In healthcare settings, IPC practices are of critical importance in protecting patients, healthcare workers and the functioning of healthcare services.

Metaphylaxis refers to the treatment of a group of animals after the diagnosis of infection and/or clinical disease in part of the group, with the aim of preventing the spread of infectious disease to animals in close contact, and at considerable risk, and which may already be (sub-clinically) infected or incubating the disease.

Microorganisms or microbes are microscopic living organisms, examples include bacteria, viruses, protozoa, and some fungi and parasites. They are widespread in nature and are vital to the sustainability of ecosystems. Many are essential to human and animal health. Some may cause illness.

One Health is a concept which promotes a "whole of society" approach which recognises that the health of people is connected to the health of animals and the environment. The goal of the 'One Health' concept is to encourage multidisciplinary collaborative efforts across different sectors such as health, agriculture and the environment to achieve the best health outcomes for people, animals and plants.

Prophylaxis in animal health refers to treatment of an animal or a group of animals, before clinical signs of infectious disease, in order to prevent the occurrence of disease or infection e.g. blanket dry cow therapy.

Surveillance means collecting, collating, analysing data and communicating information to those who need to know. It involves the generation and timely provision of information that can inform appropriate decision making and action.

Susceptibility testing is used to determine if a microorganism is susceptible or not to a selection of antimicrobial agents.

Zoonoses are infections that are transmissible between animals and people.

Abbreviations

AHI: Animal Health Ireland
AHIC: Animal Health Implementation Committee
AMEG: Antimicrobial Advice AdHoc Expert Group
AM: Antimicrobial
Amp-C: Ampicillin Resistance Gene Group C
AMR: Antimicrobial Resistance
AMRIC: Antimicrobial Resistance and Infection Control
AMS: Antimicrobial Stewardship
AMU: Antimicrobial Use
AMURAP: Antimicrobial Use and Resistance in Animal Protection
APHA: Animal and Plant Health Association
AR bacteria: Antibiotic Resistant bacteria
AREST: Antimicrobial Resistance and the Environment – Sources, Persistence, Transmission and Risk Management
AREST project: Antimicrobial Resistance and the Environment – Sources, Persistence, Transmission and Risk Management project
AST: Antimicrobial Susceptibility Testing
ATC/DDD calculation: Anatomic Therapeutic Chemical/ Defined Daily Dose
AWaRE: Access Watch Reserve
BDU: Bed Days Used
BRD: Bovine Respiratory Disease
BVD: Bovine Viral Diarrhoea
C. difficile: *Clostridium difficile*
CDI: *Clostridium difficile* Infection
CEO: Chief Executive Officer
CHN: Community Health Network
CHO: Community Healthcare Organisation (primary healthcare networks)
CMO: Chief Medical Officer
CORU: Regulator for Health and Social Care Professionals
CPE: Carbapenenase Producing *Enterobacteriales*
CRP: C-reactive Protein
CVE: Continuing Veterinary Education
CVO: Chief Veterinary Officer
CVRL: Central Veterinary Research Laboratory
DAERA: Department of Agriculture, Environment and Rural Affairs
DAFM: Department of Agriculture, Food & the Marine
DALYs: Disability-Adjusted Life Years
DCCAE: Department of Communications, Climate Action and Environment
DDD: Defined Daily Dose
DECC: Department of the Environment, Climate and Communications
DG: Director General
DHPLG: Department of Housing, Local Government and Heritage
DNA: Deoxyribonucleic acid
DOH: Department of Health

DUMP: Disposal of Unused Medicines Properly
EARSNet: European Antimicrobial Resistance Surveillance Network
EARS-Net Scheme: European Research Area Scheme
EARS-VET: European Resistance Surveillance network in veterinary medicine
ECDC: European Centre for Disease Control
E. coli: *Escherichia coli*
EFSA: European Food Safety Authority
EMA: European Medicines Agency
EPA: Environmental Protection Agency
ESBL: Extended Spectrum Beta Lactamase
ESRI: Economic and Social Research Institute
ESVAC: European Surveillance of Veterinary Antimicrobial Consumption
EU: European Union
EU-JAMRAI: European Union-Joint Action on Antimicrobial Resistance
EUnetHTA: European Network for Health Technology Assessment
FAO: Food and Agriculture Organisation
FDI: Food Drink Ireland
FSAI: Food Safety Authority of Ireland
GLASS: WHO Global Antimicrobial Resistance Surveillance System
GP: General Practitioner
HALT: Healthcare Associated Infections and Antibiotic use in Long-Term Care Facilities
HCAI: Healthcare Associated Infection
HEA: Higher Education Authority
HIQA: Health Information and Quality Authority
HIV: Human Immunodeficiency Virus
HPCIAs: Highest-Priority Critically Important Antimicrobials
HPRA: Health Products Regulatory Authority
HPSC: Health Protection Surveillance Centre
HRB: Health Research Board
HRB-CICER: Health Research Board-Collaboration in Ireland for Clinical Effectiveness Reviews
HSE: Health Service Executive
HSE-PCRS: HSE Primary Care Reimbursement Service
HSeLanD: The Irish Health service's eLearning and development platform
HTA: Health Technology Assessment
IBEC: Irish Business and Employers Confederation
IBR: Infectious Bovine Rhinotracheitis
IBR IG: Infectious Bovine Rhinotracheitis Implementation Group
ICBF: Irish Cattle Breeding Federation
ICGP: Irish College of General Practitioners
ICMSA: Irish Creamery and Milk Suppliers Association
ICOS: Irish Co-Operative Organisation Society
ICSA: Irish Cattle and Sheep Farmers Association

IDC: Irish Dental Council
IDIA: Irish Dairy Industries Association
IFA: Irish Farmer's Association
IFJ: Irish Farmer's Journal
IHFA: Irish Holstein Friesian Association
IIOP: Irish Institute of Pharmacy
IMC: Irish Medical Council
INAES-2: The second Irish National Adverse Event Study
IPC: Infection Prevention and Control
JPIAMR: Joint Programming Initiative on Antimicrobial Resistance
KPI: Key Performance Indicator
KT: Knowledge Transfer
LTCF: Long Term Care Facility
LTRC: Long Term Residential Care
MAHs: Marketing Authorisation Holders
MDR: Multi Drug Resistant
MII: Meat Industry Ireland
MMP: Medicines Management Programme
MRSA: Methicillin Resistant Staphylococcus aureus
MS: Member State
NAP: National Action Plan
NCEC: National Clinical Effectiveness Committee
NCPERLS: National Carbapenemase Producing Enterobacterales Reference Laboratory
NHQRS: National Healthcare Quality Reporting System
NHWMP: National Hazardous Waste Management Plan
NMBI: Nursing and Midwifery Board of Ireland
NPHET: National Public Health Emergency Team
NPSO: National Patient Safety Office
NRL: National Reference Laboratory
NUIG: National University of Ireland Galway
NUIM: National University of Ireland Maynooth
NVPS: National Secure Veterinary Prescription System
NVRL: National Virus Reference Laboratory
OECD: Organisation for Economic Co-operation and Development
OIE: World Organisation for Animal Health
PCBCOI: Pedigree Cattle Breeders Council of Ireland
PCRS: Primary Care Reimbursement Scheme
PCU: Population Correction Unit
PIER project: Public health Impact of Exposure to antibiotic Resistance in recreational waters project
POCT: Point Of Care Testing
PPS: Point Prevalence Survey
PSI: Pharmaceutical Society of Ireland

PVP: Private Veterinary Practitioner
RESIST: HSE Campaign to promote the judicious use of antimicrobials
RCPI: Royal College of Physicians of Ireland
RCSI: Royal College of Physicians of Ireland
RTIs: Respiratory Tract Infection
RVL: Regional Veterinary Laboratory
SAMHRAI: Northern Ireland's Strategic Antimicrobial Resistance & Healthcare Associated Infection committee
***S. aureus*/*Staph. aureus*:** *Staphylococcus aureus*
SCC: Somatic Cell Count
SDCT: Selective Dry Cow Therapy
SDGs: Sustainable Development Goals
SFI: Science Foundation Ireland
SPHeP-AMR: Strategic Public Health Planning for Antimicrobial Resistance
SWAM: Survival of mobile antibiotic resistance in water project
TASAH: Targeted Advisory Service on Animal Health
UCD: University College Dublin
UN: United Nations
UTI: Urinary Tract Infection
VCI: Veterinary Council of Ireland
VI: Veterinary Ireland
VICAS: Veterinary Ireland Companion Animal Society
VRE: Vancomycin-resistant *Enterococci*
WADA: Analysis of antimicrobial resistance in private water drinking supplies project
WFD: Water Framework Directive
WHO: World Health Organisation
WIT: Waterford Institute of Technology
WWTPS: Wastewater Treatment Plants
ZnO: Zinc Oxide

Bibliography

BiodivERsA network. Available at: https://www.biodiversa.org/

Bord Bia: Bord Bia's Quality Assurance Scheme. Available at: https://www.bordbia.ie/farmers-growers/get-involved/become-quality-assured/

Codex Alimentarius. C O D E X A L I M E N T A R I U S international food standards, guidelines and codes of practice contribute to the safety, quality and fairness of this international food trade. Available at: https://www.fao.org/fao-who-codexalimentarius/codex-texts/en/

Committee on the Future of Healthcare. Sláintecare Report. (2017). Available at: https://assets.gov.ie/22609/e68786c13e1b4d7daca89b495c506bb8.pdf

Connolly W, Rafter N, Conroy RM, Stuart C, Hickey A, Williams DJ. The Irish National Adverse Event Study-2 (INAES-2): longitudinal trends in adverse event rates in the Irish healthcare system. BMJ Quality & Safety. 2021;30(7):547-58. Available at: https://pubmed.ncbi.nlm.nih.gov/33436402/

Department of Agriculture, Food and the Marine. All-Island Animal Disease Surveillance 2019. Available at: http://www.animalhealthsurveillance.agriculture.gov.ie/media/animalhealthsurveillance/content/labreports/All-Island Disease Surv Report 2019_10112020.pdf

Department of Agriculture, Food and the Marine. Food Vision 2030. Available at: https://www.gov.ie/en/publication/c73a3-food-vision-2030-a-world-leader-in-sustainable-food-systems/#food-vision-2030

Department of Agriculture, Food and the Marine. Ireland's National Farmed Animal Health Strategy (2017-2022). Available at: https://wayback.archive-it.org/11501/20201125104156/https:/www.agriculture.gov.ie/animalhealthwelfare/nationalfarmedanimalhealthstrategy/

Department of Agriculture, Food and the Marine. National Farmed Animal Biosecurity Strategy (2021-2024). Available at: https://www.gov.ie/en/publication/d8cbf-animal-health-welfare-biosecurity/

Department of Agriculture, Food and the Marine. Policy on Highest Priority Critically Important Antimicrobials (2020). Available at: https://www.gov.ie/pdf/?file=https://assets.gov.ie/94006/71a8d1e0-bfe4-40a2-b15a-b7c7e45278f5.pdf#page=1

Department of Agriculture, Food and the Marine. Report of the iNAP Animal Health Implementation Committee (2017-2020). Available at: https://www.gov.ie/en/publication/4256d-inap-animal-health-implementation-committee/

Department of Agriculture, Food and the Marine. Rural Development Programme (RDP) (2014-2022). Available at: https://www.gov.ie/en/collection/6606a-rural-development-programme-rdp-2014-2020/#programme-strategy

Department of Agriculture, Food and the Marine. Statement of Strategy 2021 – 2024. Available at: https://www.gov.ie/en/publication/a9d51-statement-of-strategy-2021-2024/

Department of Health. COVID-19 Nursing Homes Expert Panel: Examination of Measures to 2021 Report to the Minister for Health. (2020). Available at: https://www.gov.ie/en/publication/3af5a-covid-19-nursing-homes-expert-panel-final-report/

Department of Health. Implementation of the recommendations of the COVID-19 Nursing Home Expert Panel: Progress Report - September 2021 (2021). Available at: https://www.gov.ie/en/publication/c7f5b-covid-19-nursing-homes-expert-panel-report-implementation-oversight-team/

Department of Health. NCEC National Clinical Guideline No. 2 on the Prevention and Control of Methicillin-Resistant Staphylococcus aureus (MRSA). (2013). Available at: https://www.gov.ie/en/collection/fd8c72-prevention-and-control-of-mrsa/

Department of Health. NCEC National Clinical Guideline No. 3 on Clostridium difficile. (2014). Available at: https://www.gov.ie/en/collection/37479c-clostridium-difficile/

Department of Health. NCEC Framework for Endorsement of National Clinical Guidelines (2015). Available at: https://www.gov.ie/pdf/?file=https://assets.gov.ie/11511/f498a946f1e147fd94429df362d07c2d.pdf#page=1

Department of Health. Sláintecare Action Plan 2019. (2019). Available at: https://www.gov.ie/en/publication/0d2d60-slaintecare-publications/#slaintecare-2019-action-plan

Department of Health. Sláintecare Implementation Strategy and Action Plan 2021-2023. (2021). Available at: https://www.gov.ie/en/publication/6996b-slaintecare-implementation-strategy-and-action-plan-2021-2023/

Department of Health. Sláintecare Report. (2017) Available at: https://www.gov.ie/en/publication/b14b24-about-slaintecare/

Department of Health. Statement of Strategy 2021-2023. Available at: https://www.gov.ie/en/organisation-information/0fd9c-department-of-health-statement-of-strategy-2021-2023/

Department of Health; Department of Agriculture, Environment and Rural Affairs; Food Standards Agency. Changing the Culture 2019 – 2024: One Health – Tackling Antimicrobial Resistance in Northern Ireland, A Five-Year Action Plan. (2019). Available at: https://www.health-ni.gov.uk/publications/five-year-action-plan-tackling-antimicrobial-resistance

Department of the Taoiseach. Programme for Government: Our Shared Future. (2020). Available at: https://www.gov.ie/en/publication/7e05d-programme-for-government-our-shared-future/

Environmental Protection Agency. Ireland's National Hazardous Waste Management Plan (NHWMP) 2014-2020. Available at: https://www.epa.ie/publications/monitoring--assessment/waste/hazardous-waste/NHWM_Plan.pdf

Environmental Protection Agency. Report on Farm Hazardous Waste Collections 2014-2017. (2019). Available at: https://www.epa.ie/publications/monitoring--assessment/waste/hazardous-waste/Farm-Hazardous-Waste-Collections-20132017_web.pdf

Environmental Protection Agency. EPA Research 2030: A Framework for EPA Research 2021-2030. (2021). Available at: https://www.epa.ie/publications/research/epa-research-2030/epa-research-2030-a-framework-for-epa-research-2021-2030.php

Environmental Protection Agency. State of our Environment Report 2020. Available at: https://www.epa.ie/our-services/monitoring--assessment/assessment/irelands-environment/state-of-environment-report-/#

European Centre for Disease Prevention and Control. Antimicrobial resistance in the EU/EEA (EARS-Net) Annual Epidemiological Report for 2019. (2020) https://www.ecdc.europa.eu/en/publications-data/surveillance-antimicrobial-resistance-europe-2019

European Centre for Disease Prevention and Control. Final Joint Report in respect of a One Health Country Visit to Ireland from 07 October 2019 to 11 October 2019 to discuss policies relating to Antimicrobial Resistance. (2020). Available at: https://www.ecdc.europa.eu/en/publications-data/country-visit-ireland-discuss-policies-relating-antimicrobial-resistance

European Centre for Disease Prevention and Control - Proposals for EU guidelines on the prudent use of antimicrobials in humans (2017). Available at: https://www.ecdc.europa.eu/en/publications-data/proposals-eu-guidelines-prudent-use-antimicrobials-humans

European Centre for Disease Prevention and Control. Summary Report on Antimicrobial Resistance in zoonotic and indicator bacteria from humans, animals and food in 2018/2019. (2021). Available at: https://efsa.onlinelibrary.wiley.com/doi/pdf/10.2903/j.efsa.2021.6490

European Commission. A European One Health Action Plan against Antimicrobial Resistance (AMR). (2017). Available at: https://ec.europa.eu/health/sites/default/files/antimicrobial_resistance/docs/amr_2017_action-plan.pdf

European Commission. EU Guidelines for the prudent use of antimicrobials in human health (2017/C 212/01). Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52017XC0701(01)&from=ET

European Commission. European Green Deal. (2019). Available at: https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

European Commission. Farm to Fork Strategy. (2020) Available at: https://ec.europa.eu/food/horizontal-topics/farm-fork-strategy_en

European Commission. Horizon Europe (2021-2027). Available at: https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe_en

European Commission. Pharmaceutical Strategy for Europe. (2020). Available at: https://ec.europa.eu/health/sites/default/files/human-use/docs/pharma-strategy_report_en.pdf

European Commission. Regulation(EU) 2019/6 of the European Parliament and of the Council on veterinary medicinal products. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R0006&from=EN

European Commission. Regulation (EU) 2019/4 of the European Parliament and of the council on the manufacture, placing on the market and use of medicated feed. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R0004&rid=9

European Commission. Commission Implementing Regulation (EU) 2019/627 laying down uniform practical arrangements for the performance of official controls on products of animal origin intended for human consumption. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R0627&from=EN

European Commission. Water Watchlist Antimicrobials. (2020) Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2020.257.01.0032.01.ENG&toc=OJ:L:2020:257:TOC

European Council. Official Journal of the European Union. Council conclusions on the next steps towards making the EU a best practice region in combatting antimicrobial resistance (2019/C 214/01). Available at:https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52019XG0625(01)&from=EN

European Environment Agency, European Environment Information and Observation Network, Central Data Repository - water quality data. Available at: http://cdr.eionet.europa.eu/ie/eea/

European Medicines Agency. ESVAC Sales of veterinary antimicrobial agents in 31 European countries in 2018. (2020). Available at: https://www.ema.europa.eu/en/documents/report/sales-veterinary-antimicrobial-agents-31-european-countries-2018-trends-2010-2018-tenth-esvac-report_en.pdf

Ghent University. Biocheck.UGent. Available at: https://biocheck.ugent.be/en

Government of Ireland. COVID-19 Resilience and Recovery 2021 - The Path Ahead. (2020) Available at: https://www.gov.ie/en/campaigns/resilience-recovery-2020-2021-plan-for-living-with-covid-19/?referrer=http://www.gov.ie/en/publication/resilience-and-recovery-plan-for-living-with-covid-19-your-questions-answered/

Government of Ireland. Ireland's National Action Plan on Antimicrobial Resistance 2017-2021. (2017). Available at: https://www.gov.ie/en/publication/ec1fdf-irelands-national-action-plan-on-antimicrobial-resistance-2017-2020/

Government of Ireland. Ireland One Health Report on Antimicrobial Use & Antimicrobial Resistance. (2019). Available at: https://www.gov.ie/en/publication/98f5bb-one-health-report-on-antimicrobial-use-antimicrobial-resistance/

Government of Ireland. National Development Plan 2021-2030. (2021). Available at https://www.gov.ie/en/publication/774e2-national-development-plan-2021-2030/

Government of Ireland. National Risk Assessment 2019: Overview of Strategic Risks. Available at: https://www.gov.ie/en/publication/ac294e-government-publishes-top-strategic-risks-facing-ireland/

Government of Ireland. National Risk Assessment 2020. Available at: https://www.gov.ie/en/press-release/5e685-national-risk-assessment-for-ireland-2020/

Government of Ireland. Resilience and Recovery 2020-2021: Plan for Living with COVID-19 (2020). Available at: https://www.gov.ie/en/publication/e5175-resilience-and-recovery-2020-2021-plan-for-living-with-covid-19/

Health Information and Quality Authority. Health Technology Assessment of C-reactive protein point-of-care testing to guide antibiotic prescribing for acute respiratory tract infections in primary care settings. (2019). Available at: https://www.hiqa.ie/reports-and-publications/health-technology-assessment/hta-c-reactive-protein-point-care-testing

Health Information and Quality Authority. Guidance on the assessment of Regulation 27 – Infection Control Designated Centres for Older People. (2021). Available at: https://www.hiqa.ie/reports-and-publications/guide/guide-and-framework-regulation-27-protection-against-infection-dcop

Health Information and Quality Authority. Guidance on the assessment of Regulation 27 – Protection against Infection Designated centres for persons (children and adults) with disabilities. (2021). Available at: https://www.hiqa.ie/reports-and-publications/guide/guide-and-framework-regulation-27-protection-against-infection-dcd

Health Information and Quality Authority. National Standards for infection prevention and control (IPC) in community services. (2018). Available at: https://www.hiqa.ie/reports-and-publications/standard/2017-national-standards-prevention-and-control-healthcare

Health Information and Quality Authority. National standards for the prevention and control of healthcare-associated infections in acute healthcare services. (2017). Available at: https://www.hiqa.ie/reports-and-publications/standard/2017-national-standards-prevention-and-control-healthcare

Health Products Regulatory Authority. Report on sales of veterinary antibiotics in Ireland during 2019. Available at: https://www.hpra.ie/docs/default-source/publications-forms/newsletters/report-on-sales-of-veterinary-antibiotics-in-ireland-during-2019.pdf?sfvrsn=11

Health Research Board. Strategy 2021–2025. Health research – making an impact. (2021). Available at: https://www.hrb.ie/strategy-2025/

Health Service Executive. HSE Community Health & Social Care Infection Prevention and Control and Antimicrobial Stewardship Strategy 2021-2023.

Health Service Executive. Infection Prevention & Control Link Practitioner Programme Framework Community Health & Social Care Settings 2021/2022. (2021). Available at: https://www.hse.ie/eng/about/who/healthwellbeing/our-priority-programmes/hcai/resources/general/ipc-link-practitioner-programme-framework.pdf

Health Service Executive. Interim Guidance on Infection Prevention and Control for the Health Service Executive 2021 V1.3. 11.01.2021. (2021). Available at: https://www.hpsc.ie/a-z/microbiologyantimicrobialresistance/infectioncontrolandhai/guidelines/Interim%20HSE%20Guidance%20on%20IPC.pdf

Health Service Executive. HSE National Service Plan 2021. (2021). Available at: https://www.hse.ie/eng/services/publications/serviceplans/national-service-plan-2021.pdf

Health Service Executive. HSE Patient Safety Strategy 2019-2024. (2019). Available at: https://www.hse.ie/eng/about/qavd/patient-safety/hse-patient-safety-strategy-2019-2024.pdf

Interagency Coordination Group on AMR. IACG Report to the Secretary General of the United Nations "No Time To Wait: Securing The Future From Drug Resistant Infections" April 2019. Available at: https://www.who.int/antimicrobial-resistance/interagency-coordination-group/IACG_final_summary_EN.pdf?ua=1

More, S.J. European perspectives on efforts to reduce antimicrobial usage in food animal production. (2020). Irish veterinary journal, 73(1), pp.1-12. Available at: https://irishvetjournal.biomedcentral.com/articles/10.1186/s13620-019-0154-4

Organisation for Economic Co-operation and Development (OECD). Health at a Glance 2019. (2019). Available at: https://www.oecd.org/els/health-systems/health-at-a-glance-19991312.htm

Organisation for Economic Co-operation and Development (OECD). Health at a Glance Europe 2020. (2020). Available at: https://www.oecd-ilibrary.org/social-issues-migration-health/health-at-a-glance-europe-2020_82129230-en?_ga=2.227475611.760003104.1634072792-1260042545.1607591998

Organisation for Economic Co-operation and Development (OECD). OECD strategic public health planning for antimicrobial resistance (SPHeP-AMR). Available at: https://www.oecd.org/health/stemming-the-superbug-tide-9789264307599-en.htm

Rafter N, Hickey A, Conroy RM, Condell S, O'Connor P, Vaughan D, et al. The Irish National Adverse Events Study (INAES): the frequency and nature of adverse events in Irish hospitals—a retrospective record review study. BMJ Quality & Safety. 2017;26(2):111-9. Available at: https://qualitysafety.bmj.com/content/26/2/111

United Nations. UN Sustainable Development Goals. Available at: https://sdgs.un.org/goals

Veterinary Council of Ireland. VCI guidelines on the ethical use of antibiotics. Available at: https://www.vci.ie/Publications/ETHICAL-USE-OF-ANTIBIOTICS-(1)

Water Joint Programming Initiative. Available at: http://www.waterjpi.eu/

World Health Organisation. 'Antimicrobials have added an estimated 20years to life expectancy'. (2012). Available at: https://www.euro.who.int/en/media-centre/sections/press-releases/2012/11/self-prescription-of-antibiotics-boosts-superbugs-epidemic-in-the-european-region

World Health Organisation. WHO Global Action Plan on Antimicrobial Resistance (2015). Available at: https://www.who.int/publications/i/item/9789241509763

World Health Organisation. Global Patient Safety Action Plan 2021–2030: Towards eliminating avoidable harm in health care. (2021). Available at: https://www.who.int/teams/integrated-health-services/patient-safety/policy/global-patient-safety-action-plan

World Organisation for Animal Health. OIE Strategy on AMR and the Prudent Use of Antimicrobials . (2016). Available at: Antimicrobial resistance - OIE - World Organisation for Animal Health

Rialtas na hÉireann
Government of Ireland

iNAP2
OBAIR LE CHÉILE CHUN ÁBHAIR FHRITHMHIOCRÓBACHA A CHOSAINT DON TODHCHAÍ
WORKING TOGETHER TO PROTECT ANTIMICROBIALS FOR THE FUTURE

"No single sector can solve this problem alone. Collective action is required to address the threat of antimicrobial resistance – across different economic sectors and country borders."

QU Dongyu
Director-General of FAO
(November 2020)