



A Global Consensus on tackling Antimicrobial Resistance through Education

What do children and adolescents need to
know to act as agents of change?

A global conversation facilitated by the Fleming Initiative, 2026



FLEMING
INITIATIVE

A partnership between

IMPERIAL


Imperial College Healthcare
NHS Trust

Antimicrobial Resistance (AMR) is a global threat, currently projected to cause over 8 million deaths globally per year by 2050 (1). AMR has consequences across the entirety of One Health¹ – in the same timeframe, cumulative losses due to AMR in livestock are predicted to be at least USD 953 billion (2). The 2024 target outlined by the UN aims for a 10% reduction in deaths associated with AMR by the year 2030, alongside a USD 100 million commitment (3).

At the Fleming Initiative, we believe that this global consensus document on what children and adolescents (aged 5-18 years) need to know about AMR to act as agents of change will support and strengthen the ongoing development of both community- and school-based educational initiatives. It aims to serve as a much needed and timely **resource for individual global regions when striving to embed AMR within school curricula and community-based interventions.**

AMR education should go beyond natural sciences and be woven into other subjects including the arts, personal health, history and human geography. This approach will **help enable children and adolescents to understand in a holistic manner both the mechanisms and magnitude of AMR** by making it relevant to their everyday lives, in turn inspiring and enabling them to become champions of antimicrobial stewardship, both now and in the future. Our hope is that these champions will **inspire and educate those around them**, fostering widespread collective behaviour change.

¹ *One Health is an integrated, unifying approach that recognizes the health of humans, domestic and wild animals, plants and the wider environment (including ecosystems) are closely linked and interdependent. (One Health High-Level Expert Panel definition)*

“

Education is a priority mentioned in the Global Action Plan on Antimicrobial Resistance, and this consensus document brings that priority to life. By equipping children and adolescents with competencies built on knowledge, skills and attitudes on infection prevention, appropriate use of antibiotics and AMR, we lay the foundation for behaviour change that protects health systems and saves lives. Embedding AMR education in schools is not optional – it is essential for achieving global targets and securing a future free from untreatable infections.

Dr Yvan Hutin, Director, Antimicrobial Resistance, World Health Organization (WHO)

”

“

Education is one of the most powerful tools we have to safeguard our shared future. By empowering young people with the knowledge and skills to understand the environmental dimensions of antimicrobial resistance, we are investing in a generation capable of championing responsible practices, protecting the environment, and strengthening the One Health response. UNEP is proud to support this global consensus, which places environmental stewardship at the heart of AMR education and equips learners everywhere to become agents of change.

Jacqueline Álvarez, Chief, Chemicals and Health Branch, United Nations Environment Programme (UNEP)

”

“

FAO welcomes this timely consensus document as a critical step in empowering children and adolescents to become the next generation of AMR champions across agrifood systems and beyond. Grounded in a One Health approach, it reinforces the power of education in fostering responsible antimicrobial use, strengthening prevention, and promoting sustainable practices that safeguard health, livelihoods and global food security.

Thanawat Tiensin, Chief Veterinarian, Food and Agriculture Organization of the United Nations (FAO)

”



“

Educating children about how animal health is deeply related to our own is critical. When they understand the interconnectedness, how AMR develops and spreads within their lives, and the future they will inherit, we are raising a generation that is compassionate, empathic, and responsible – champions of a healthier and sustainable tomorrow, where the effectiveness of antimicrobials is preserved for humans, animals and plants, all across the One Health spectrum.

Dr Javier Yugueros Marcos, Head of the Veterinary Products & Drug Resistance Department, World Organisation for Animal Health (WOAH)

”

Contents

Executive summary	2
Background	3
Approach	4
Scope	5
Who is this document written for?	
Principles of AMR education	7
A global consensus on what children and adolescents need to know about AMR to act as agents of change	9
Overarching themes	
Infection prevention and control	
Antimicrobial resistance	
A global vision, with a local approach	
Beyond an education in science	
Importance of behaviour change and communication	
Keeping up with innovation	
Linking AMR to other salient global issues	
Evaluating progress and real-world impact	
Key knowledge areas	14
The foundations of understanding: Infection prevention and control	
Knowledge of AMR and creating positive action	
Future work and next steps to create AMR agents of change	20
Contributing authors	22
Definition of One Health and references	26

Executive summary

This global consensus document, developed through a collaborative process led by the Fleming Initiative, **outlines a comprehensive educational knowledge framework to create present-day and future antimicrobial resistance (AMR) champions.**

Recognising the growing global threat of AMR, the document defines what children and adolescents need to know in order to act as agents of change.

Rooted in a One Health approach, the document emphasises the integration of AMR education across subjects – beyond science alone – **highlighting infection prevention, optimal antimicrobial use, behaviour change, innovation, and global equity and justice.**

It presents guiding principles, key knowledge areas tailored to age and context, and practical suggestions for local adaptation and impact measurement.

Designed for all those involved in AMR education, including educators, policymakers and community stakeholders, this consensus document aims to inform scalable, sustainable, culturally relevant initiatives that inspire long-term action to curb AMR worldwide.



Background

At the 79th United Nations General Assembly (UNGA) High-Level Meeting on Antimicrobial Resistance (AMR), held in New York on 26 September 2024, global leaders committed to a political declaration with clear targets and actions to tackle AMR (3).

In paragraph 51 of the declaration there is a commitment to “promote awareness of antimicrobial resistance and the appropriate use and disposal of antimicrobials, **through education and training**, social science approaches, communication and information campaigns, including through the media, behavioural change initiatives, the sharing of best practices and strengthening stewardship competencies and programmes across all relevant workforce sectors by **integrating antimicrobial resistance modules in primary, secondary and tertiary education and training curricula through systematic public, private, stakeholder and community engagement**, and in this regard acknowledge the importance of engaging patients and families as partners in promoting safe care, and working towards locally meaningful and sustainable solutions”.

This commitment provides additional momentum and validation for the improvement of ongoing initiatives to educate children and adolescents about AMR and antimicrobial stewardship, which itself must build upon an education in infection prevention and control, and waste and wastewater management. The Fleming Initiative is dedicated to the realisation of this commitment, (alongside others in the declaration) and recognise that **collaboration is more powerful than working in isolation when striving to create change**. We acknowledge that this commitment stretches across the full spectrum of education, training and engagement. This consensus document focuses on primary and secondary education.

Approach

Across three meetings in February, April and June 2025, the Fleming Initiative convened **over 70 experts in AMR, AMR education and AMR engagement from across the globe**. Each meeting provided the opportunity to showcase individual global AMR educational initiatives, promoting learning and sharing of practices. Education experts were also invited to provide broader learnings and an understanding of the barriers to adoption of AMR content into school curricula. Invitations to these three convening meetings were open – with key stakeholders being approached directly, encouragement for the invitation to be shared widely, and through an open invitation on Fleming Initiative social media channels. All meetings were online and repeated across time zones to maximise global participation. We ensured that **a range of organisations from across One Health** (incorporating agriculture, animal, human health and the environment) were invited to the meetings. All requests to join were reviewed by the Fleming Initiative team and any individuals working in AMR education were welcomed.

Meetings were chaired by the Fleming Initiative, and each had two sections. The first was a showcase of AMR focused educational initiatives from across the globe, including **representation from Nigeria, Sri Lanka, England, Pakistan and India**. The meetings also heard from **education experts from the UK, USA, Brazil and Australia**. The second section of each meeting involved open discussion regarding the key knowledge areas for AMR education, and how these might be relevant across the globe.

This consensus document on what children and adolescents should know about AMR to act as agents of change has been produced as one output of these convening meetings, **weaving in insights from the discussions and bringing together existing resources that were shared within the group**. The document reflects this broad conversation and has been refined through a process of collaborative discussion and three rounds of offline review with many of the participants.

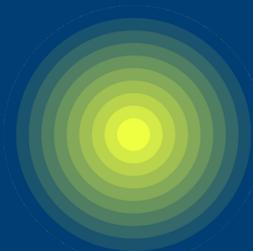
Scope

The scope of this document is to **outline what we believe children and adolescents aged 5-18 need to know to act as present-day agents of change and become the future champions of antimicrobial stewardship and infection prevention.** Our goal is to assist in the creation of a generation of antimicrobial stewards and advocates across the globe – reaching and educating them via the schooling system or community engagement work.

By focusing on AMR education, and integrating it into curricula, educators can reduce the impact AMR has on students' health and wellbeing. Current issues such as school access, performance and absenteeism may be exacerbated by AMR – making infections harder to treat, prolonging and increasing the severity of illnesses. **By integrating AMR education, schools can foster healthier learning environments, ensuring sustained access and improved educational outcomes.**

This document is the first step in **creating widespread, aligned global AMR educational initiatives**, and will be followed by future work on implementation and support for individual stakeholders.

We set out a **global vision for what children and adolescents need to know** to act as agents for change with respect to AMR, acknowledging that local adaptations are necessary to reflect cultural, resource and infrastructure differences.



Our Aim: For younger generations to have the knowledge required to co-create a future free of untreatable infections.

Scope

Who is this document written for?

A wide range of stakeholders play a critical role in AMR education and behaviour change – encompassing **AMR experts, those working in education, teachers, behavioural scientists, engagement specialists, primary care providers, community leaders, governance and regulatory authorities**, and the list goes on. **Students and their parents (or family unit)** are also key stakeholders and should not be forgotten.

This document is aimed at **any individual or organisation wishing to create an educational initiative for children and adolescents** (whether this is in a school or community setting).

It is also aimed to support those working in AMR education, research and policy to support the inclusion of AMR in educational curricula.

Included within the document are **guiding principles** for all educational initiatives, with suggestions for **key knowledge themes** that should be considered and incorporated where possible.



Principles of AMR education

Discussions over the three convening meetings led to the generation of a set of principles which future AMR educational initiatives should aspire to incorporate and adhere to, always reflecting local contexts. This will help ensure that AMR education is equitable, innovative, inclusive and constantly evolving alongside scientific discovery.

AMR education should strive to reach every child and adolescent, through programmes that are **equitable, inclusive** and independent of gender, race, socioeconomic position, geographical location or political situation.

A One Health approach should underpin all educational initiatives, emphasising that the **health of humans, domestic and wild animals, plants and the wider environment** are closely linked and interdependent.

Where feasible, AMR education should reach children and adolescents in their **native, preferred language or language of their region**.

Initiatives should be **scalable across global regions** where appropriate, incorporating both analogue and digital elements.

Social and cultural factors should be considered, especially when adapting initiatives across urban, rural and tribal areas.

AMR education should be **co-created, evidence-based, and be communicated** in simple and creative ways that are accessible and culturally appropriate.

Principles of AMR education

AMR education should move beyond facts, aiming to **instil a deep understanding and the development of life skills** that support the creation of champions of antimicrobial stewardship and infection prevention.

Students should be encouraged to take an **active role in educational activities**, moving away from passive learning.

Where possible, AMR education should be **incorporated into existing activities and curricula**, reducing additional burden on educational systems.

We advocate for **collaboration between initiatives across the globe**, reducing duplication and encouraging adaptation and sharing of work.

AMR education should be **framed in a positive manner** – emphasising that action and behaviour change can lead to positive outcomes and benefits.

Wherever possible, AMR education should be accompanied by the **provision of practical and infrastructure support** required to create sustained behaviour change.

AMR education should **demonstrate measurable impact** on real world outcomes.



A global consensus on what children and adolescents need to know about AMR to act as agents of change

This consensus document establishes **a global knowledge framework for AMR education which can be tailored and contextualised to each region or country** to meet its distinctive needs and priorities. It builds on existing local and regional work to develop local curricula and educational frameworks.

We outline **several key overarching themes** which educators across the globe should include in their educational material and initiatives. This is to ensure consistency in the information and messaging around AMR which children and adolescents receive. These will also help facilitate a consistent and holistic approach to AMR education, one in which children and adolescents are active collaborators in their learning. This will include moving beyond science lessons, incorporating a broader range of subjects including history, art, geography and personal, social and health education.

This consensus also **recommends that educational initiatives** aimed at children and adolescents **adopt a One Health approach** across all age ranges, ensuring that human health, animal health, plant health and impacts on the wider environment are all incorporated.

Our goal is that through comprehensive and holistic education on AMR for children and adolescents, **upcoming generations will champion antimicrobial stewardship and infection prevention**. It is also important that they are confident not only to change their own behaviour, but to encourage those around them to do the same. This consensus document focuses on ensuring that positive messages around behaviour change, policy and scientific innovation are included across the recommendations.

In addition to the key overarching themes, we have created **two tables with more detail on what children and adolescents should know** about both infection prevention and control (with a particular focus on preventing infections at home, school or in the community), and AMR. This is presented according to the global vision, but with suggestions for application to each local context.

Overarching themes



Theme 1: Infection prevention and control

Infection prevention and control (IPC) and AMR go hand in hand, and all educational content relating to AMR should ensure that IPC is incorporated into the programme. Within this document, **the term IPC refers to all infection prevention behaviours** both in the community and healthcare setting.

This should begin with an **education in health, disease and infections in humans, animals and plants**. Subsequent teachings should focus on what students can do in their home / community setting to prevent infection, before moving on to consider the wider determinants of infection and public health.

Teaching children and adolescents about IPC will **provide the foundations needed** to understand the development and transmission of AMR and help instil the core behavioural competencies required for antimicrobial stewardship. It also emphasises the importance of **preventing infections in the first place**, which helps preserve the effectiveness of antimicrobials by limiting the need for their use. Whilst global in scope, knowledge about IPC should be age and region specific – ensuring that content is relevant to the students and the communities they live in, thereby creating motivation to learn about a topic of real-world importance.

Knowledge regarding the prevention of infections should **develop over the course of an education**, encompassing wider prevention strategies such as access to safe water, hygiene and sanitation, vaccination, adequate waste and wastewater management, and IPC within specific contexts such as conflict, inadequate animal husbandry practices, or crop production. It is also important to ensure that knowledge on implementing such **prevention strategies within local communities** is integrated.

Theme 2: Antimicrobial resistance

Education relating to AMR should begin with the basics of **what microbes are (including bacteria, fungi, viruses and parasites)**, linking to IPC materials on the aetiology of infections. It is imperative to also highlight the importance of useful microbes.

It is important to educate children and adolescents on what antimicrobials are, and when and how to take antimicrobials (antibiotics, antifungals, antivirals and antiparasitic drugs), building the foundations of lifelong antimicrobial stewardship. As children get older, it is important for them to **understand the mechanism of the development of AMR**, in an age-appropriate manner, and the One Health implications of AMR (recognising the interconnectedness of humans, animals, plants and the environment). The **key role of environment in the development, transmission and spread of AMR** is important to be understood and well communicated as preventative environmental interventions are part of the solution to tackle AMR.

This should run alongside education regarding **antimicrobial stewardship behaviours** and how as individuals we can all contribute to the mitigation of AMR, through positive action and a focus on community stewardship.

Finally, the **concepts of innovation, new scientific discoveries, policies and behaviour change as mechanisms** for preventing the emergence and spread of AMR should be introduced to embolden children and adolescents with a range of options within which to become champions for antimicrobial stewardship.

Theme 3: A global vision, with a local approach

There are **cultural, resource and mechanistic differences in the manifestation of AMR across the globe**, and the requirements of antimicrobial stewardship differ in different local contexts. Whilst what children and adolescents should know and do about AMR should be broadly the same and adhere to overarching principles, iteration and adaptation for regional and local considerations will be necessary before scaling interventions across countries and regions.

It is also important to understand that **education structures vary greatly across (and often within) countries and regions**, and while this consensus document can act as a guide for the topics to include, these may require flexibility to implement AMR effectively in education systems worldwide. Context is crucial – local approaches to the education of children and adolescents require adaptation according to language, images used, teaching methods, amongst many more.

Equally important is the **support of families, communities, faith-based organisations and broader society**. Children and adolescents should not be expected to champion antimicrobial stewardship in isolation or face resistance from people in their immediate environment. A collective approach is essential to ensure that children and adolescents are supported as agents of change.

Theme 4: Beyond an education in science

Where AMR is currently present on formal school curricula it is typically limited to science content and often constrained by examination requirements. There is opportunity and scope to broaden education on AMR, **integrating it more holistically across such subjects as history, geography, art and personal, social and health education**. In itself, this may require openness by educators to training on different methods of engagement with children and adolescents. A One Health approach should be woven through the educational initiatives where appropriate – creating a holistic curriculum that encompasses human health, animal health, plant health and the environment. The opportunity to introduce themes related to equity and access in AMR should also be acknowledged and included across all sectors, along with the economic implications of AMR.

Theme 5: The importance of behaviour change and communication – making AMR relevant to every child and adolescent and inspiring long-term action

We cannot rely on scientific discovery and innovation alone to mitigate AMR – an important adjunct to these is widespread global citizen engagement and behaviour change in relation to our use of antimicrobials and infection prevention strategies. Teaching children and adolescents about AMR in **a way that feels real and relevant will help inspire them** to become the much-needed future champions of antimicrobial stewardship. This approach also helps build an antimicrobial stewardship culture within households, communities and through peer-to-peer encouragement.

It is important that children and adolescents are not just aware of AMR and its wide-ranging implications for human health, animal health, plant health and the environment, but **know there are positive actions they can take and how to take them**.

Knowledge alone does not change behaviour – educational initiatives should aim to move students from pre-contemplation, through contemplation into action, by making AMR feel relevant, and their role as champions of antimicrobial stewardship and infection prevention tangible and important. **We must also ensure the infrastructure required to enable such behaviour change is in place.**

Theme 6: Keeping up with innovation

Wider AMR related innovations and discovery need to be integrated into educational initiatives, ensuring the content is regularly updated and sustainable for generations to come. To achieve this, **those working to create AMR educational initiatives should be supported** to maintain regular communications with those in related fields (and vice versa), ensuring educational materials and initiatives are regularly updated to reflect ongoing scientific discovery and innovation, particularly when aimed at older children and adolescents. It is also important to ensure that innovations in educational approaches are regularly reviewed and incorporated as appropriate.

Theme 7: Linking AMR to other salient global issues

AMR is a topic which can be linked to other salient global issues, including conflict, climate change, biodiversity loss, rapid urbanisation and environmental preservation. The economic implications of AMR should also be a key consideration. **Linking AMR to these topics should be done in a multi-sectorial, systematic and integrated manner.** This approach has value in several respects – where these topics are already present in educational curricula, it allows AMR to be taught to children and adolescents without increasing the burden on existing and stretched resources. In addition, **it creates a broader series of touchpoints** where students can realise the real-world impact of AMR.

Theme 8: Evaluating progress and real-world impact

Within all initiatives and programmes, educators should strive to **ensure the growth of students' knowledge and skills over time.** An education in AMR should not be limited to one activity or lesson delivered at one point in time but **should develop in terms of depth as students age.** Progress – both in terms of factual knowledge and behavioural intent should be monitored, and consideration given to real world impact (such as changes in antimicrobial prescribing, and adherence to taking antimicrobials exactly as prescribed). Where possible, **impact should be measured objectively**, such as the ongoing incidence of infections following IPC education, or number of antimicrobial prescriptions issued, or reduced release of AMR into the environment. This should also include monitoring of non-responsible practices over time, such as unregulated over-the-counter sales, or the use of antimicrobials as growth promoters in animal production.

Key knowledge areas

In the two tables that follow, we present outlines of the **key knowledge areas for both IPC and AMR**, categorised according to the likely level of complexity within each topic. Given the need for each educational initiative to be appropriate to local and regional needs across the globe, we have not defined specific ages for each level, but instead shown progression of knowledge with increasing level of detail.

This categorisation allows individual educators to **create bespoke initiatives** that students can move through according to both their **age and baseline knowledge**.

These key knowledge areas aim to **provide a starting point** from which educators can subsequently focus upon skills, values and attitudes towards AMR and championing antimicrobial stewardship.

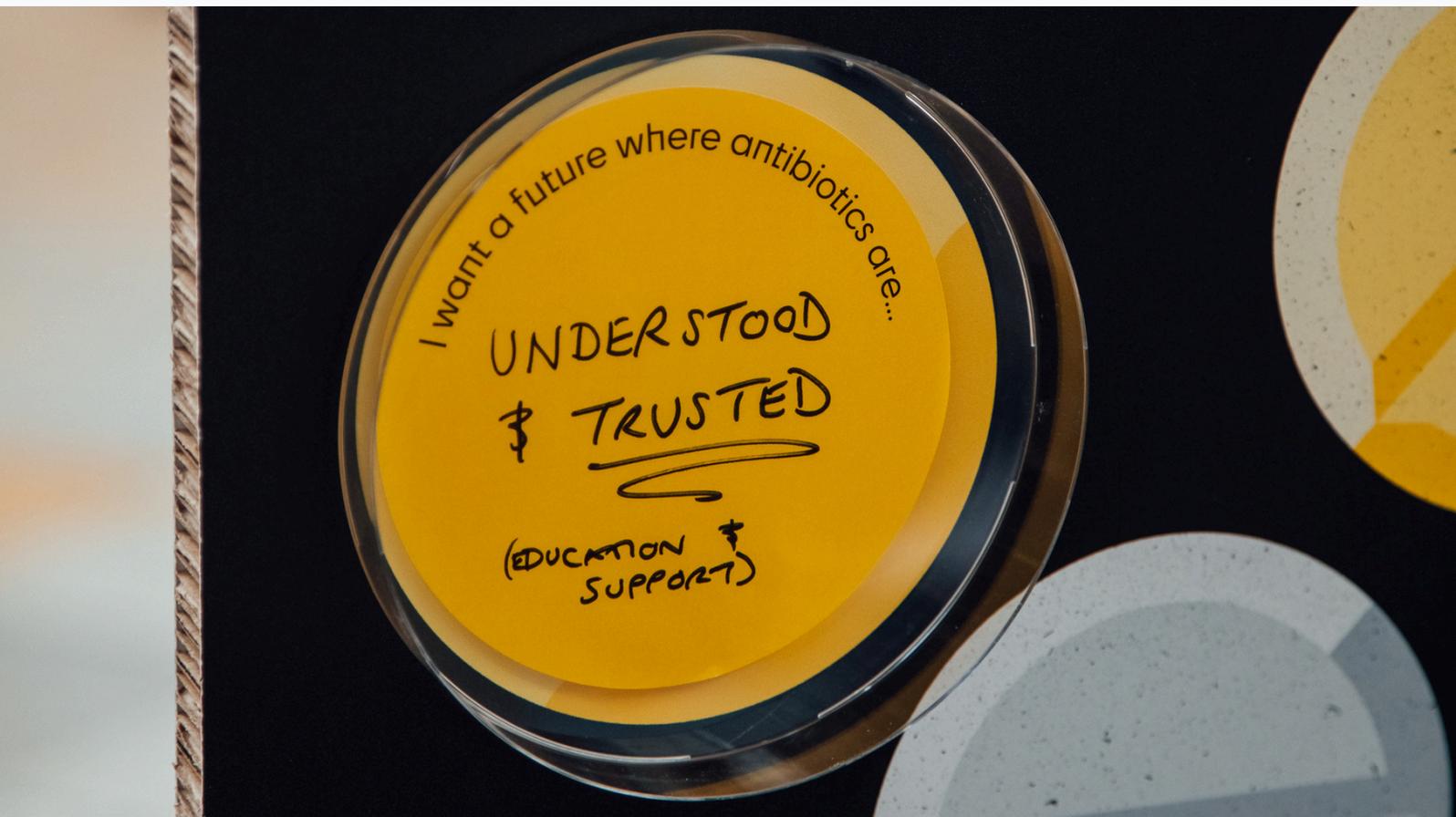


Table 1a

The foundations of understanding: Infection prevention and control - Global vision

Level	Key knowledge areas
Foundations	<ul style="list-style-type: none"> • What are infections, and what causes them? • Signs and symptoms of infections • Prevention of infections and hygiene <ul style="list-style-type: none"> ◦ Understanding the need for hand hygiene behaviours ◦ The importance of clean water, sanitation and hygiene ◦ Hygiene in different settings – home, agriculture, environment ◦ Vaccinations
Further understanding	<ul style="list-style-type: none"> • Prevention of infections and hygiene <ul style="list-style-type: none"> ◦ Understanding and enacting behaviours to minimise the spread of respiratory diseases and good respiratory hygiene ◦ Public and veterinary health measures including biosecurity and vaccinations ◦ Adequate wastewater and waste management across all sectors such as safe disposal of unused human and veterinary antimicrobials (e.g., take-bac schemes). ◦ Specific areas of personal hygiene, including oral and menstrual • Maintaining good health, including nutrition, exercise, sexual, dental and reproductive health
Deeper knowledge	<ul style="list-style-type: none"> • Different mechanisms of infection transmission, including air-borne, food and water borne, vector-borne and bi-directional zoonotic transmissions • Prevention of infections and hygiene <ul style="list-style-type: none"> ◦ Sexually transmitted infections and how to prevent ◦ Food and agriculture hygiene and best practices ◦ Hygiene for pets and domestic animals ◦ Wider determinants of infection prevention, including hydration, nutrition and social factors, with a focus on behaviour change • Infection prevention in a range of circumstances, e.g. conflict settings and the specific behavioural changes required

*continue to **local focus** on next page*

Table 1b

The foundations of understanding: Infection prevention and control - Local focus

Adaptation	Key knowledge areas
Content	<ul style="list-style-type: none"> • Adaptation of hand hygiene behaviours according to local resources, but in line with best practice for infection control • Adaptation of oral hygiene behaviours according to local resources, but in line with best practice for infection control • Types of infection and signs or symptoms adapted to regional context and disease prevalence • Preventative measures and behaviours adapted to regional context and disease prevalence • Vaccinations in humans and animals to reflect regional context or programmes
Delivery	<ul style="list-style-type: none"> • Flexibility to move between levels as required • Link to local or regional educational curricula and examination requirements where possible • Ensure accessibility for community organisations engaging with children and adolescents outside formal schooling • Ground in existing topics on curricula • Create real world relevance for students, suggested methods include: <ul style="list-style-type: none"> ◦ Problem solving activities using both clinical examples and activities related to daily living ◦ Problem solving activities using sustainable agriculture and farming examples ◦ Extra-curricular activities e.g. nature-based solutions ◦ Peer-to-peer learning activities ◦ Experiential learning ◦ Play-based learning
Measuring progress and real-world outcomes	<ul style="list-style-type: none"> • Consider the use of pre- and post- education assessment measures • Qualitative evaluations of behavioural intent, in both students and wider families / communities • Quantitative measures of real-world behaviour change e.g. changes in hygiene or rates of infection transmission • Map to existing assessments in examination curricula

Table 2a**Knowledge of AMR and creating positive action - Global vision**

Level	Key knowledge areas
Foundations	<ul style="list-style-type: none"> • What microbes are: <ul style="list-style-type: none"> ◦ Microbes as living organisms and their importance ◦ To include bacteria, fungi, viruses and parasites ◦ How some microbes can cause infections in humans, animals and plants • Beneficial role of microbes across One Health (encompassing animal health, human health, plant health, and the environment) • Concept of antimicrobials as treatments for infection • Appropriate indications for antimicrobial use
Further understanding	<ul style="list-style-type: none"> • The human and animal microbiomes • Treatment of infections <ul style="list-style-type: none"> ◦ Self-limiting infections – when and why treatments aren't indicated ◦ Use of antimicrobials (including antibiotics, antivirals, antifungals and antiparasitics), in humans, animals, plants • History of the discovery and development of penicillin by Alexander Fleming, Howard Florey, Ernst Chain, Dorothy Hodgkin and others • Fundamental role of antibiotics in modern medicine and food production • Development of AMR as <ul style="list-style-type: none"> ◦ An evolutionary response ◦ That the change is in the microbe (not drugs or people) • Antimicrobial Stewardship <ul style="list-style-type: none"> ◦ Access to antimicrobials – to only take following guidance from a health worker or veterinarian, and not to self-medicate or medicate animals without professional guidance ◦ Taking antimicrobials as indicated – to seek and follow instructions provided on the packaging, from health workers or veterinarians ◦ Appropriate disposal of antimicrobials

global vision continues on next page

Table 2a

Knowledge of AMR and creating positive action - Global vision

Level	Key knowledge areas
Deeper knowledge	<ul style="list-style-type: none"> • Development and monitoring of AMR <ul style="list-style-type: none"> ◦ Detailed understanding of the evolution of AMR in microbes ◦ Mechanisms of AMR development ◦ Prevalence of resistant microbes in the community – not only in those who are unwell • Importance of surveillance of resistant infections <ul style="list-style-type: none"> ◦ AMR and One Health ◦ Public health, animal health and plant health implications of resistant infections ◦ A One Health approach to antimicrobial stewardship ◦ Antimicrobial residues in agriculture and food production ◦ Presence of resistant microbes in the environment, and risk of resistance genes transferring between species ◦ Cross-contamination of diseases between animals, humans and the environment, with an emphasis on how preventive measures can have broader health and environmental benefits ◦ Global implications of AMR – economic, health and agriculture / food impacts • Strategies to prevent AMR <ul style="list-style-type: none"> ◦ Behavioural change required to mitigate the ongoing evolution of AMR ◦ Development of new antimicrobials ◦ Scientific Innovation to combat AMR, including the use of Artificial Intelligence, and new diagnostics ◦ Widespread public health initiatives including vaccination ◦ Effective waste and wastewater management • AMR as a broad global issue <ul style="list-style-type: none"> ◦ Link to climate change, biodiversity loss and pollution – the triple planetary crisis ◦ Introduction to the economics of sustainable investment in AMR – such as new medicines, vaccines, diagnostics, pollution prevention and control interventions ◦ Introduction to making impact through policy change, legislation and regulation – locally and globally ◦ Access to antibiotics and the potential presence of inequity ◦ The importance of transparency and data sharing across sectors ◦ Gender inequity in AMR and access to infection prevention resources

continue to local focus on next page

Table 2b

Knowledge of AMR and creating positive action - Local focus

Adaptation	Key knowledge areas
<p>Content</p>	<ul style="list-style-type: none"> • Relevant infections for the local community / region and associated resistance • patterns and development • Access to antibiotics and associated antimicrobial stewardship behaviours • Local context for the rates of antimicrobial use and resistance • Local context for the use of traditional and complementary medicines • Local context for agriculture / farming / environment • Local context for pet cohabitation and management of stray pet populations • Local context for waste and wastewater management
<p>Delivery</p>	<ul style="list-style-type: none"> • Flexibility to move between age groups as required • Link to local curricula and examination requirements as required • Ensure accessibility for community organisations engaging with children and adolescents outside formal schooling • Ground in existing topics on curricula • Consider connections with salient global issues, including global health security. • Promote positive language around AMR with a focus on solutions • Create real world relevance for students, suggested methods include: <ul style="list-style-type: none"> ◦ Problem solving activities using both clinical examples and activities related to daily living ◦ Problem solving activities using sustainable agriculture and farming, and environmental sustainability examples ◦ Extra-curricular activities e.g. nature-based solutions ◦ Peer-to-peer learning activities ◦ Experiential learning ◦ Play-based learning • Consider presenting information in multiple formats, including visual, audio, reading and kinaesthetic.
<p>Measuring progress and real-world outcomes</p>	<ul style="list-style-type: none"> • Consider the use of pre- and post- education assessment measures • Qualitative evaluations of behavioural intent, in both students and wider families / communities • Quantitative measures of real-world behaviour change e.g. change in antimicrobial use or disposal behaviours locally • Map to existing assessments in examination curricula

Future work and next steps to create AMR agents of change

This consensus document on what children and adolescents should know to act as AMR agents of change is the first step in creating and implementing coordinated educational initiatives across the globe. Future work will focus on how to support individuals and organisations to implement the inter-linked themes and principles outlined in this document.

Whilst many of the concerns surrounding AMR unite us across the globe, we remain mindful that significant cultural and country specific nuances exist that mean that the manifestation of antimicrobial stewardship and the associated determinants of behaviour may vary across regions. This consensus document provides a framework from which initiatives can be created and developed in a way which aligns our global thinking and ensures we are striving for the same level of antimicrobial stewardship worldwide. However, implementation strategies will vary across global regions and are beyond the scope of this document.

Following this convening process on education, the Fleming Initiative is committed to the maintenance of this global engagement, **creating an AMR Education Collaborative**, which will be open to all those working in AMR education.

The next steps for this collective will be to **co-develop a clear road map for implementation of this consensus document**, determining how best to involve stakeholders (including teachers, parents and policy makers), and how to streamline outcome measures and assessments across different initiatives.

Alongside this, a future aim is to **create resources to support teachers** when including AMR in what are often already content-heavy curricula. There is also scope to **co-develop a guide for parents that supports educational initiatives** aimed at children and adolescents, providing an opportunity to address AMR misconceptions across diverse audiences.

Future work and next steps to create AMR agents of change

This AMR Education Collaborative will also **advocate for the continued inclusion of AMR education into AMR National Action Plans** as well as education sector planning – helping to pave the way for ongoing resource allocation.

This document **connects to a living systematic review** created by the Fleming Initiative – designed to capture published and unpublished AMR initiatives globally. This resource will be open access, providing a repository of case studies that others can draw reference from when creating their own initiatives, alongside the principles outlined within this document.

We acknowledge the **upfront cost of teacher education, and the resources required to develop**, implement and monitor effective educational initiatives and programmes. As a result, we have created this guidance in the form of a set of principles and key knowledge areas, which can be accessed in a range of depths and detail, as individual resources and circumstances allow. To ensure the sustainability of school-based initiatives, teachers and learners should be actively engaged through the co-development, co-implementation, and co-evaluation of interventions. **Integrating AMR into education in the holistic manner** outlined in this document will require local and national support.



Contributing Authors

Professor Alison Holmes - Director, **Fleming Initiative**, Professor of Infectious Diseases, **Imperial College London**, David Price Evans Chair of Global Health and Infectious Diseases, **University of Liverpool**

Dr Kate Grailey - Behavioural Science Lead, **Fleming Initiative**

Dr Emily Scott Dearing - Public Engagement and Involvement Lead, **Fleming Initiative**

Dr Raheelah Ahmad - Professor of Health Systems, **City St George's, University of London**; Co-lead Informed Policy pillar, **Fleming Initiative, Imperial College London**

Ibrahim Adamu - Co-founder, **AMR Intersarsity Training Program, Nigeria**

Damilola Adesuyi - Programme Coordinator, AMR Mitigation & AMS, **One Health and Development Initiative, Nigeria**

Dr Altaf Ahmed - Head of Infection Prevention Control, **Pakistan Kidney and Liver Institute and Research Centre**

Dr Abdullah Al-Awal - Programs Operations & MEAL Coordinator, Public Health, **One Health and Development Initiative, Nigeria**

Silvinia Alessio - Education Officer, Coordinator Alforja Initiative, **ReAct Latin America**

Dr Hala Amer - Director, Prevention and Control of Infection Administration, **WHO EMRO**

Dr Afreenish Amir - Lead, **Resource Directives, Pakistan**

Julia Bishop - Director of Global Engagement, **AMR Policy Accelerator, Global Strategy Lab**

Dr Eimear Brannigan - National Clinical Lead, **Antimicrobial Resistance and Infection Control Division, Health Service Executive, Ireland AMRICC**

Sarah Brazier - Centre Manager, Wesfarmers Centre of Vaccines & Infectious Diseases, **The Kids Research Institute Australia**

Dr Enrique Castro-Sanchez - IPC Specialist, National Infection Prevention and Control Team, **UK Health Security Agency, London UK, Imperial College London, UK**

Sarah Chadwick - AMR and IPC Programme Manager, **NHS West Yorkshire Integrated Care Board**

Dr Mary Chambers - Head of Public and Community Engagement, **Oxford University Clinical Research Unit (OUCRU), Vietnam**

Dr Sujith J Chandy - Executive Director, **ICARS**

Egwu Kenneth Chukwuebuka - Co-founder, **AMR Intersarsity Training Program, Nigeria**

Dr Fiona Cooke – Microbiology Consultant and Sub Dean, **University of Cambridge, UK**

Pauline Coraci - Project Officer EBug France, **Public Health Department, Nice University Hospital, France**

Dr Peter Cotgreave - Chief Executive, **Microbiology Society**

Contributing Authors

Julie Couzinet - Program Assistant, UNESCO-IBEM
Martyn Cutts - Advanced Health Improvement Specialist – Health Protection, **Leeds City Council**

Ashata Dahal - Public Engagement Manager, **Oxford University Clinical Research Unit Nepal**

Zakariaya'u Dauda - Founder, **UDUYARS – Usmanu Danfodiyo University Young Antimicrobial Resistance Stewards**

Aitziber Echeverria - AMR Coordinator, **United Nations Environment Programme**

Dr Nathalie El Omeiri - Advisor, Antimicrobial Resistance Response, **Pan American Health Organization / World Health Organization**

Dr Emily Glynn - Clinical Fellow; Specialist Registrar, Clinical Microbiology, **Antimicrobial Resistance and Infection Control Division, Health Service Executive, Ireland**

Khushi Goel

Louise Gough - Chief Operating Officer, **The Trinity Challenge**

Dr Daniel Hale - Lead Behavioural Scientist, **Fleming Initiative, Imperial College London**

Nada Hanna - AMR Expert, **United Nations Environment Programme**

Dr Laure Hermet - Coordinator EBug France, **Public Health Department, UR2CA-RESPECT, Nice University Hospital, France**

Dr Xavier Hospital - Regional Advisor on Education for Health and Wellbeing, **UNESCO**

Dr Sweety Suman Jha - Research Scientist and Founder Member, **Foundation for Actions and Innovations Towards Health Promotion (FAITH), Kolkata, India**

Dr CarriAyne Jones-Parr - Lead for Biosecurity, AMR, and One Health and Head of UK Science and Technology Network in the Southeast US, **UK Foreign Commonwealth and Development Office, Atlanta, GA, USA**

Dr Somdata Karak - Co-Lead, **Superheroes against Superbugs**

Karina Khatic - Trustee, **International Veterinary Students Association**

Professor Rebecca King - Professor of Global Health and Community Engagement, **University of Leeds, UK**

Dr James Munyao Kingoo - Professor / Research officer, **Technical University of Kenya, Nairobi, Kenya**

Dr Tasha Koch - Co-founder, **Eh!Woza**

Dr Donna Lecky - Head of the Primary Care and Interventions Unit, **UK Health Security Agency**

Lucy Lehane - Independent Expert in Medical Diagnostics, **Lehane Consulting Ltd**

Dr Sonia Lewycka - Associate Professor, **Oxford University Clinical Research Unit (OUCRU), Vietnam**

Dr Direk Limmathurotsakul - Head of Microbiology, **Mahidol-Oxford Tropical Medicine Research Unit**

Dr Michael Lobritz - Global Head Infectious Diseases Therapeutic Area, **Roche Innovation Center**

Contributing Authors

Dr Pia Touboul Lundgren - Coordinator EBug France, Public Health Department, **UR2CA-RESPECT, Nice University Hospital, France**

Dr Sandeep B. Maharaj - Director, School of Pharmacy, **The University of the West Indies**

Dr Philip Mathew - Technical Officer (AMR), **WHO**

Mimi Melles-Brewer - Technical Officer – AMR Awareness and Campaigns, **WHO**

Dr Jess Mitchell - Chancellors Fellow, Global Agriculture and Food Systems, **Royal (Dick) School of Veterinary**

Studies, University of Edinburgh

Jenny Monsalve

Michael Joseph Mosha - Head of Operations - **Roll Back Antimicrobial Resistance Initiative**

Molly Moss - Global Health Policy Officer, **UN Foundation**

Dr Nathan Mugenyi - Lecturer, Department of Pharmacy, Faculty of Health Sciences, **Victoria University, Kampala, Uganda**

Gathai Mundia - Co-founder, **Zihi Institute**

Becky Murphy - Infection Prevention and Control Practitioner, **Kirklees Council, UK**

Venus Dadirai Mushininga - Public Health Consultant, **Freelance**

Mkhuzo Mwaya - Research Assistant Consultant, **ReAct Africa**

Dr Emile Ngabo - Director of Operations, **OAZIS Health**

Špela Oberstar - Projects Lead, **British Society for Antimicrobial Chemotherapy**

Stephen Ogweno - Founder & CEO, **Stowelink Foundation**

Dr Oluyinka Opoola - Curriculum Mapping Fellow, **The Global Academy of Agriculture and Food Systems, University of Edinburgh**

Edwin Panford-Quainoo - AMR Technical Lead, **Commonwealth Pharmacists Association**

Dr Jennifer Payne - Founder and CEO, **Curiosity Factory**; Research Scientist, **Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia**

Professor Stefan Swartling Peterson - Professor of Global Transformation for Health, **Karolinska Institute, Sweden**

Marie Philbin - Chief Pharmacist, Antimicrobial Resistance and Infection Control Division, **Health Service Executive, Ireland AMRICC**

Dr Maria Pránting - Scientific Coordinator, **ReAct – Europe**

Dr Arturo Quizhpe - Director, **ReAct Latin America**

Dr Eman Khairy Zajy Radwan - Acting Director of Healthcare Quality Department, **Ministry of Public Health, State of Qatar**

Dr Yogandree Ramsamy - Clinical Microbiologist, Antimicrobial Research Unit - **University of KwaZulu-Natal, JDJ Diagnostic Laboratories, South Africa**

Contributing Authors

Mourice Rawago - Visiting Lecturer, Centre for Pharmaceutical Medicine Research, **Institute of Pharmaceutical Sciences, King's College London**

Professor Michael J Reiss - Professor of Science Education, Institute of Education, **University College London**

Donna Roberts - Lead Infection Prevention and Control Nurse, **Kirklees and Wakefield Council, UK**

Jenny Sarna - Project Director, **NextGenScience, WestEd**

Yerkem Sembayeva - Communications Specialist, **FAO**

Dr Mohamed M. Sirdar - Global Program Specialist (AMR), **The International Society for Infectious Diseases (ISID)**

Dr Katie Summers - Technical SETA (CTR), **ARPA H**

Dr Maarten van Dongen - Director, **AMR Insights BV**

Erick Venant - Founder, **Roll Back Antimicrobial Resistance Initiative**

Dr Connie Walyaro - Global Public Health Specialist - Exec. Director; Exec. Committee, **WHO Working Group on Equity and AMR - Talk AB[M]R; International Society for Infectious Diseases ISID**

Daniel Warungi - Co-founder, **Zihi Institute**

Dr Javier Yugueros-Marcos - Head of the Antimicrobial Resistance and Veterinary Products Department, **World Organisation for Animal Health (WOAH)**

Report design created by **Pip Batey**, Freelance Generalist Designer, **UK** and **Mikayla Hu**, **Fleming Initiative**

Photo credits: **Eleanor Bentall**, **Brendan Foster**, **Imperial College London** and **Helena Dolby**



Definition of One Health and references

The above consensus document and AMR education framework has been created through expert discussions, input, and the synthesis of existing regional and local frameworks and AMR curricula from across the globe. Many of these resources are listed within the Fleming Initiatives AMR Education living review, which accompanies this consensus document.

We have utilised the Quadripartite One Health Definition as the basis for this consensus and the integration of a **One Health Approach**:

“One Health is an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems. It recognizes the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and inter-dependent. The approach mobilizes multiple sectors, disciplines and communities at varying levels of society to work together to foster well-being and tackle threats to health and ecosystems, while addressing the collective need for clean water, energy and air, safe and nutritious food, taking action on climate change, and contributing to sustainable development (4)”.

References:

1. Naghavi M, Vollset SE, Ikuta KS, Swetschinski LR, Gray AP, Wool EE, et al. Global burden of bacterial antimicrobial resistance 1990-2021: a systematic analysis with forecasts to 2050. *The Lancet*. 2024;404(10459):1199-226.
2. World Organisation for Animal Health. 2024 UN Political Declaration on AMR: Key takeaways for Veterinary Services. 2024.
3. United Nations. Political Declaration of the High Level meeting on Antimicrobial Resistance. 2024.
4. Adisasmito WB, Almuhairi S, Behravesch CB, Bilivogui P, Bukachi SA, Casas N, et al. One Health: A new definition for a sustainable and healthy future. *PLoS Pathog*. 2022;18(6):e1010537.