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STUDY GUIDE

COMMITTEE OEWG 4

Responsible Antimicrobial Use in Agrifood Systems

World Health Organization

Seventy-ninth World Health Assembly

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Draft updated global action plan on antimicrobial resistance 2026–2036[1]

I. Introduction

Growing threats of antimicrobial resistance

1. This second edition of the Global Action Plan on Antimicrobial Resistance (GAP-AMR) builds on a decade of implementation of the first GAP-AMR adopted by the World Health Assembly in 2015[2] and welcomed by the governing bodies of the other organizations that alongside WHO, form the Quadripartite Cooperation on One Health, namely the Food and Agriculture Organization of the United Nations (FAO), the United Nations Environment Programme (UNEP) and the World Organisation for Animal Health (WOAH), referred to as the "Quadripartite organizations". It draws on lessons learned, emerging evidence and an evolving global landscape, and is intended to guide countries in updating national action plans and support accelerated implementation of the 2024 United Nations General Assembly commitments through a robust One Health approach.[3]

2. AMR occurs when bacteria, viruses, fungi and parasites evolve and no longer respond to antimicrobial agents such as antibiotics, antivirals, antifungals and antiparasitics, making infections harder or impossible to treat and increasing the risks of disease spread, severe illness, disability and death. AMR also undermines the treatment of noncommunicable diseases and can make surgeries and routine medical procedures riskier. Growing resistance threatens to reverse decades of progress in human and veterinary medicine, agriculture, food production, and environmental sustainability and overall sustainable development.

3. Key drivers of AMR include inappropriate antimicrobial use in all sectors, weak infection prevention and control, and low vaccination coverage. Environmental discharges from pharmaceutical manufacturing, healthcare facilities, agriculture and food production, household and municipal and systems further contribute to the development of resistance. Spillover from agricultural activities and dense human settlements, international travel and trade in food products, live animals and wildlife migration facilitate cross-border transmission. Weak antimicrobial stewardship, substandard and falsified medicines and insufficient regulatory capacity, especially in low- and middle-income countries, exacerbate the problem.

[1] An earlier version of this draft updated global action plan was considered by the Executive Board at its 158th session in document EB158/18, Annex.

[2] Resolution WHA68.7.

[3] Tripartite and UNEP support OHHLEP's definition of "One Health" (accessed 13 October 2025).

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Definition 1

The Quadripartite brings together WHO, FAO, UNEP and the World Organisation for Animal Health (WOAH). Their One Health approach recognizes that the health of people, animals, plants and ecosystems is connected. This means reducing AMR requires cooperation across healthcare, farming, food production and environmental protection.

Definition 2

Antimicrobial resistance (AMR) develops when microorganisms change so that medicines used against them become less effective. Antibiotics treat bacterial infections, while other antimicrobials treat infections caused by fungi, viruses or parasites. Resistance develops in microorganisms—not in the people or animals receiving treatment.

Something to Think About 3

Antimicrobial residues and resistant microorganisms can reach rivers, soil and food through wastewater from farms and factories, manure spread on fields and poorly treated waste. Pollution can spread beyond the place where medicines were used. What standards should governments set for waste treatment and monitoring? How could small farms and lower-income communities meet those standards without losing essential income or food production?

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4. In 2021, bacterial AMR alone directly caused an estimated 1.14 million human deaths and was associated with 4.7 million deaths globally. Antibiotic use in the agrifood sector could increase by 29.5% from the 2019 levels, potentially reaching 142 481 tonnes by 2040. Without urgent action, AMR could reduce global life expectancy by 1.8 years within a decade and cause up to 39 million deaths by 2050, disproportionately affecting low- and middle-income countries.

5. The economic impacts are equally alarming. Without robust action, global treatment costs and productivity losses could reach US$ 412 billion and US$ 443 billion, respectively, by 2035. Cumulative global gross domestic product (GDP) losses in livestock production could reach US$ 575 billion by 2050, with nearly US$ 1 trillion in global welfare losses.

6. Conversely, investment in infection prevention and control, water, sanitation and hygiene, vaccination, and research and development for new antimicrobials, coupled with appropriate antimicrobial use and safe disposal, could avert over 110 million deaths and yield nearly US$ 1 trillion in economic gains between 2025 and 2050. A 30% reduction in antimicrobial use in livestock within five years could boost global GDP by US$ 120 billion, with additional benefits from addressing illegal trade in substandard and falsified products, stronger waste management and pollution control.

II. Strategic context of the global antimicrobial resistance response

Key progress since 2015

7. Since the launch of the 2015 GAP-AMR, political momentum has grown following the 2016 and 2024 United Nations General Assembly high-level meetings, successive G7 and G20 commitments and biennial ministerial conferences. Global governance structures have been established, including the Quadripartite Joint Secretariat on AMR, the Global Leaders Group on AMR, the AMR Multi-Stakeholder Partnership Platform and the Independent Panel on Evidence for Action against AMR. Over 170 countries have developed multisectoral AMR national action plans. Public awareness has been enhanced through the annual World Antimicrobial Resistance Awareness Week. The AMR Multi-Partner Trust Fund established in 2019 catalyses country efforts and progress monitoring through the Tracking AMR Country Self-Assessment Survey mechanism.

8. Strategic and operational guidance has been expanded by the Quadripartite organizations and partners, including through the publication of FAO's Action Plan on Antimicrobial Resistance 2021–2025 and the RENOFARM initiative; UNEP's landmark report *Bracing for Superbugs* (2023); WHO's strategic and operational priorities to address drug-resistant bacterial infections in the human health sector; and WOAH's 2016 Strategy on Antimicrobial Resistance and the Prudent Use of Antimicrobials.

9. Surveillance capacity has strengthened across sectors and new evidence from the Global Research on Antimicrobial Resistance (GRAM) has further strengthened understanding of AMR burden and trends. In 2025, 104 countries reported antimicrobial and use data to the WHO Global Antimicrobial Resistance and Use Surveillance System (GLASS), over 50 countries use the International FAO Antimicrobial Resistance Monitoring (InFARM) system, and 157 countries contributed to WOAH's global database on animal antimicrobial use (ANIMUSE). Between 2020 and 2022, antimicrobial use in animals decreased by 5% globally, while reporting coverage reached 71% of global animal biomass. Furthermore, 71% of countries reported no use of antimicrobials as growth promoters in animal production in 2022. However, environmental monitoring and surveillance of resistant microbes and antimicrobial residues remain limited. The

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Did You Know That... 4

As demand for meat, milk, eggs and farmed fish grows, producers may raise more animals or increase production in existing facilities. Where overcrowding, poor hygiene or limited veterinary care make disease more common, farmers may rely more heavily on antibiotics. The projected increase is not inevitable: vaccination, better housing, clean water and early diagnosis could help meet food demand without a comparable rise in antibiotic use.

Interesting Facts 6

Reducing unnecessary antimicrobial use could benefit the economy by slowing the development of resistance, helping medicines remain effective when they are needed. This could mean fewer infections that are difficult and expensive to treat, healthier animals, and fewer losses in agricultural production. It could also reduce the economic costs of resistant infections in humans. However, these benefits depend on farmers having access to effective disease-prevention measures, such as vaccination, better hygiene, improved animal housing and nutrition, and measures to prevent infections from spreading between animals. The projection is a global estimate, not a guaranteed outcome, and the costs and benefits could vary considerably among countries depending on farming practices and access to veterinary services, among other factors.

Did You Know That... 7

A national action plan may assign responsibilities to health, agriculture and environmental agencies, but adopting a plan is only the first step. Governments still need staff, laboratories, veterinary services and money to carry it out. For example, a plan might promise to test bacteria from livestock for resistance, yet produce little useful information if laboratories cannot afford equipment or trained technicians. Delegates should distinguish between a country's written commitments and what it can implement.

Interesting Facts 9

This figure refers to the percentage of countries reporting no antimicrobial use for growth promotion, not the percentage of livestock farms or animals worldwide where the practice had stopped. For example, a country with a relatively small livestock sector counts the same as one with millions of farm animals. Consequently, the figure does not tell us what proportion of the world's livestock was still receiving antimicrobials for growth promotion. It also does not explain whether countries stopped the practice through government regulations, voluntary changes by producers or other measures.

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Quadripartite organizations are developing the Global Integrated Surveillance System on AMR as a cross-sectoral data repository.

Significant gaps in the response

10. Despite the progress made, major gaps persist. Inadequate financing, weak accountability and limited integration of AMR into national and international development agendas continue to impede progress. Only 10% of countries reported dedicated domestic funding for their multisectoral AMR national action plans in 2024, significantly constraining implementation.

11. The environmental dimensions of AMR remain insufficiently addressed, with persistent evidence and policy gaps despite the recognition of the environment's critical role in resistance development, transmission and spread. Environmental interventions must be urgently integrated into the national AMR response and research promoted to better understand the significance.[4] Gaps also persist in plant production and protection, fungicide use, and antifungal resistance.

12. Socioeconomic and behavioural factors continue to risk driving AMR. These include cross-sectoral system fragilities exposed by the coronavirus disease (COVID-19) pandemic; inadequate infection prevention and control and water, sanitation and hygiene; low immunization coverage; humanitarian crises and population displacement; inadequate animal husbandry practices; and poor conditions for biosecurity.

13. The global pipeline for new antimicrobials and diagnostics remains stagnant owing to underinvestment and limited incentives for research and development, compounded by inequitable access to quality-assured products and weak antimicrobial stewardship across sectors.

14. Opportunities offered by technological advances, including artificial intelligence, genetic sequencing and digital tools, remain underutilized for surveillance, stewardship and evidence-based decision-making.

15. Countries require stronger capacity, financing and coordination to prioritize, cost, implement and monitor multisectoral AMR national action plans. Enhanced regional and global collaboration and technical assistance are essential for an effective One Health approach to AMR.

Strategic focus for the future

16. This GAP-AMR strategically focuses on accelerating actions to deliver on the 2024 United Nations General Assembly political declaration commitments through effective multisectoral governance, addressing environmental dimensions, and equitable access to antimicrobials, vaccines and diagnostic tools. It promotes a prevention-first approach, emphasizing infection prevention and control, water, sanitation and hygiene, biosecurity, adequate husbandry practices, vaccination, alternatives to antimicrobials and pollution prevention, alongside enhanced surveillance, antimicrobial stewardship, research and innovation, behavioural change and sustainable financing.

17. The plan provides adaptive guidance enabling countries to accelerate action through a whole-of-society and One Health approach, while responding to emerging threats based on national contexts and priorities. The GAP-AMR is complemented by separate operational guidance and a monitoring and evaluation framework.

[4] UNEP/EA.7/Res.11 – Resolution on environmental dimensions of antimicrobial resistance.

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Something to Think About **10**

When funding is limited, governments cannot implement every part of an AMR plan at once. Should they first pay for vaccines and veterinary visits that prevent disease, laboratories that identify resistant bacteria, farmer training, or safer treatment of wastewater and manure? How could they decide which investment would make the greatest difference?

Did You Know That... **10**

Developing a national action plan does not mean a country has the money to carry it out. Without dedicated funding, governments may be unable to train veterinarians, equip laboratories to detect resistant microorganisms, monitor antimicrobial use on farms or help farmers improve disease prevention.

Definition **12**

On farms, biosecurity means practical measures to keep disease-causing organisms from entering or spreading among animals—for example, cleaning equipment, controlling visitors, separating sick animals and safely managing animal waste. Better biosecurity can reduce infections and the need for antimicrobials.

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Development and consultation process

18. The Quadripartite organizations led an extensive consultative process beginning at the Fourth Global High-Level Ministerial Conference on Antimicrobial Resistance in November 2024, followed by a global online survey and an iterative drafting process. Open consultations were held with a broad range of stakeholders through the AMR Multi-Stakeholder Partnership Platform and with Member States through the respective Quadripartite mechanisms. The finalized text will be submitted for consideration by the Seventy-ninth World Health Assembly and by the governing bodies of the Quadripartite organizations in 2026 and 2027.

III. Goal and theory of change

Goal

19. The updated GAP-AMR aims to preserve the ability to treat human, animal and plant diseases by ensuring the equitable accessibility of safe and effective antimicrobials for current and future generations, while reducing the incidence of infections through a holistic and One Health approach and contribute to the 2030 Agenda for Sustainable Development.

Theory of change

20. The plan aims to: achieve a 10% reduction in bacterial AMR-associated human deaths; reduce global antimicrobial use in agrifood systems; and minimize environmental pollution of AMR microbes and antimicrobial residues by 2030 in line with the 2024 United Nations General Assembly AMR political declaration commitments.

21. The theory of change reflects the key outcomes relating to the effective and coordinated implementation of those critical interventions and the impact pathway from inputs to impact, taking into account national contexts.

IV. Strategic objectives

22. To achieve the plan's goal, six interconnected strategic objectives build on the 2015 GAP-AMR, providing a framework for countries, the Quadripartite organizations, implementation partners, civil society and the private sector to align and accelerate implementation of context-appropriate AMR national action plans.

Strategic objective 1: Strengthen awareness and promote appropriate social and behavioural change to reduce antimicrobial resistance risks across all sectors

23. **Behavioural change is essential for reducing AMR risks,** moving beyond awareness to action that drives lasting change. National AMR awareness and behavioural change strategies should be inclusive, evidence-based, context appropriate and locally tested, addressing socioeconomic and structural barriers with a focus on promoting appropriate use and reduce the need for antimicrobials across sectors. Stronger messaging is required to tackle the environmental drivers of AMR and promote waste and wastewater management and pollution prevention and control across all sectors. Digital tools and data-driven approaches could be leveraged to generate insights, design targeted and locally translated messages and strengthen the monitoring, evaluation and accountability.

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Definition **21**

A theory of change explains how a set of actions is expected to achieve a particular goal. It connects the resources needed (inputs), the actions taken (interventions), the changes those actions are expected to produce (outcomes), and the long-term results (impact). For example, a country might invest in veterinary training and vaccination programmes to help farmers prevent animal diseases. Healthier animals would need fewer antimicrobials, which could help slow the development of antimicrobial resistance. The theory of change also recognizes that countries have different resources, farming practices and veterinary services, so they may need different approaches to achieve the same goal.

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24. **All stakeholders[5] should be empowered** with the knowledge necessary to foster behavioural change for AMR prevention and control across sectors. Messaging should be developed with target groups, culturally relevant and delivered through appropriate platforms. It should address at-risk populations and build trust through consistent, evidence-based information. Inclusive and actionable communication should be tailored to community contexts to foster ownership of AMR responses while ensuring equity and reach.

25. **Education and training** at all levels should integrate competency-based, context-sensitive AMR content into school and university curricula and professional training. Pre- and in-service education for professionals[6] should address the multidimensional drivers of AMR and antimicrobial stewardship. These programmes should be complemented by participatory communication, peer-to-peer learning and digital campaigns. All training activities and campaigns should explicitly promote a One Health approach to reinforce multisectoral and sector-specific actions and cultivate long-term cultural and professional shifts that sustain effective prevention and antimicrobial stewardship practices.

26. **Systematic monitoring of awareness and behavioural changes** using routine, survey or behavioural and operational research data across sectors should be incorporated into AMR national action plans across sectors. Appropriate indicators capturing outcomes from the various behavioural change interventions and data disaggregated by relevant demographic factors should inform communication and awareness strategies and be used to drive accountability and continuous refinement for national, regional and global AMR policy processes.

Strategic objective 2: Strengthen surveillance systems and laboratory networks to inform effective, evidence-driven antimicrobial resistance policies and actions across all sectors

27. **AMR surveillance** across sectors should be established and/or strengthened, focused on bacterial resistance and expanded to include fungal, parasitic and viral resistance, where necessary, and antimicrobial residues. Trends in AMR and antimicrobial use should be consistently tracked and complemented by behavioural and socioeconomic data to enhance understanding of AMR drivers. Communities, academic institutions, civil society and the private sector should be meaningfully engaged in surveillance data sharing for accountability and effective use in policy-making.

28. **Quality-assured laboratory networks** at the national and/or regional levels, supported by reference laboratories and global diagnostic initiatives, should underpin AMR surveillance across sectors. Reliable supply chains for diagnostic tests, laboratory equipment and reagents; harmonization of and adherence to evidence-based standards for pathogen identification; antimicrobial susceptibility testing; and external quality assurance are critical to ensuring the capture of high-quality, consistent and comparable data within and across sectors and countries and to supporting policy development.

[5] Including policy-makers, parliamentarians, regulators, customs authorities, manufacturers, human and animal health professionals, farmers, agrifood workers, paraveterinarians, community animal health workers, aquatic animal health professionals, environmental professionals and water, sanitation and hygiene practitioners, civil society, media, industry and the public.

[6] Including human and animal healthcare professionals, agrifood and plant workers, and environmental and water, sanitation and hygiene professionals or practitioners.

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Definition **25**

Antimicrobial stewardship means ensuring that antimicrobial medicines are used only when needed and in the right way—for example, choosing the appropriate medicine, dose and treatment duration. In agriculture, this requires guidance from trained animal-health or plant-health professionals and reliable access to quality medicines when treatment is necessary.

Definition **27**

Antimicrobial residues are small amounts of a medicine that remain after it has been used or released. For example, residues may enter soil when manure is spread on fields or reach rivers through wastewater. Even at low concentrations, some residues can contribute to AMR by allowing resistant bacteria to survive and multiply while bacteria that are more vulnerable to the medicine are suppressed. Resistant bacteria may then spread through soil, water, animals and food. Residues are not the same as resistant microorganisms: one is a substance left behind, while the other is a living organism that can survive treatment. Monitoring both helps authorities understand how AMR-related risks may spread through the environment.

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29. **National AMR surveillance systems** should align with international standards to ensure systematic and consistent collection and analysis of quality-assured data that inform One Health policies, legislation and investments. Surveillance should cover humans, food-producing animals, food and the environment and, depending on country context and capacity, may also include informal production systems, companion animals and wildlife. Countries should routinely report national data to GLASS, InFARM and ANIMUSE. Environmental surveillance of antimicrobial resistance microbes and antimicrobial residues should be established and supported by regulations, standardized protocols and stewardship practices. Integrated surveillance based on common pathogens and commensal bacteria relevant to the national context with indicators spanning the One Health spectrum should be implemented, while the Global Integrated Surveillance System on AMR should serve as a repository for cross-sectoral data to support coordinated global action.

30. **National antimicrobial use surveillance systems** should systematically collect relevant harmonized data across sectors and at all levels of care. In human health, data should be disaggregated by indication, sex, age and other social determinants, applying the WHO Access, Watch, Reserve (AWaRe) classification of antibiotics. For agrifood and animal health, data should be stratified by species, production stage and system type, where possible, guided by FAO methodologies, Codex Alimentarius standards and WOAH's international standards, including the WOAH list of Antimicrobial Agents of Veterinary Importance and forthcoming WOAH equivalent of the AWaRe classification.

31. **AMR and antimicrobial use data** should be regularly analysed and published in national surveillance reports; shared within and across sectors and levels of care; and used to equitably strengthen infection prevention and control, immunization, diagnostic testing, treatment guidelines, antimicrobial stewardship, procurement, research and development, and environmental interventions. Data should also inform national action plan evaluations, risk assessments and early warning systems and detection and response to emerging AMR public health threats, including unusual, rare phenotypes and resistance genotypes that are difficult to identify in routine testing, with tailored support being provided to low- and middle-income countries in those cases. Environmental AMR data should be integrated into national monitoring to detect hotspots, guide pollution prevention and control and enhance preparedness and response to future emergencies through a coordinated One Health approach.

32. **Advances in digital technologies,** including artificial intelligence, next-generation sequencing and biosensors, could be leveraged to enhance AMR and antimicrobial use surveillance through alignment with national and international standards and digitization strategies to improve real-time data analysis, trend monitoring, hotspot detection and early identification of emerging threats and to enable data sharing across sectors and mutual accountability.

Strategic objective 3: Intensify infection prevention across all sectors to reduce the burden of infectious diseases and the need for antimicrobials

33. **Preventing infections** is central to minimizing the spread of resistant pathogens, thereby decreasing the need for antimicrobials, lowering morbidity and mortality and reducing the discharges into the environment. AMR national action plans should promote evidence-based, context-specific interventions across sectors. Focus should be on healthcare and veterinary facilities, good animal husbandry practices, biosecurity on farms, households, informal settlements, climate-vulnerable communities, and conflict and disaster-affected settings to prevent bi-directional spread of zoonotic diseases and AMR between humans and animals.

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Interesting Facts **29**

These systems answer different questions. WHO's GLASS collects information on resistance and antimicrobial use in human health; FAO's InFARM supports surveillance in animals and food; and WOAH's ANIMUSE collects data on antimicrobial use in animals. A country might discover, for example, that veterinary antimicrobial sales are falling while resistant bacteria remain common in food samples. Using different kinds of data together can reveal problems that one system alone would miss, although countries need trained laboratories and consistent reporting methods to make comparisons meaningful.

Something to Think About **31**

Monitoring every farm, river and food-processing plant would be costly. A country might begin near large livestock operations, slaughterhouses, pharmaceutical factories or places where wastewater enters rivers, then expand testing as capacity improves. Which locations should receive priority, and why? What equipment and training would laboratories need to test samples reliably? How should authorities respond if testing identifies an area with unusually high levels of resistance?

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34. **In human health,** the WHO infection prevention and control core components should be instituted in all healthcare settings, from primary to tertiary and including long-term care. Effective infection prevention requires universal access to safe water; sanitation and hygiene including hand and personal hygiene; quality oral healthcare; healthcare-acquired infections and sepsis prevention and management; reliable waste management in healthcare facilities and the community; and trained staff and sustained resources, including in fragile and resource-limited settings. National immunization programmes should be strengthened to meet vaccination targets to reduce the burden of preventable infections and antimicrobial use and, consequently, AMR. National policies should align with local context and relevant WHO infection prevention and control, water, sanitation and hygiene, and immunization guidance.

35. **In animal health, plant and agrifood systems,** preventing infections and AMR requires an integrated approach that considers animal welfare, health and production (including aquaculture), plant health, biodiversity, food safety, food security, sustainable management of land, soil, water and marine resources and safe manure and fertilizer practices. Priority actions should include strengthening prerequisites for sustainable agrifood systems, biosecurity, good husbandry practices, water management, stewardship, vaccination, and alternatives based on respective country contexts, guided by FAO's RENOFARM and the Farm 5Gs framework. Soil health maintenance, biodiversity conservation, improved nutrition and integrated pest management are also essential to reducing inappropriate antimicrobial use, particularly in crop production systems. Additionally, rapid detection and infection containment through quarantine, disinfection and appropriate treatment, and outbreak management supported by quality veterinary services, improved feed and nutrition and robust vaccination programmes, guidance from WOAH's List of Priority Diseases for which vaccines could help reduce antimicrobial use in animals and WOAH vaccine banks, should be considered.

36. **Environmental dimensions** should be explicitly integrated throughout the antimicrobial lifecycle, applying safeguards from production to safe disposal. Key priorities include: strengthening waste and wastewater management in pharmaceutical manufacturing, healthcare facilities and household/municipal systems; promoting green and sustainable chemicals, environmentally responsible manufacturing, sustainable procurement, transparency, eco-labelling; ensuring safe and cost-effective treatment and reuse of wastewater including for irrigation; and addressing intellectual property considerations. Reducing antimicrobial-resistant microbes and residues in waste and wastewater, along with resource recovery, should be prioritized to minimize environmental pollution impacts and support sustainable and cost-efficient practices.

Strategic objective 4: Ensure equitable access, appropriate use and safe disposal of antimicrobials, diagnostics and other health products across sectors

37. AMR national action plans should **promote equitable, affordable and sustainable access** to quality-assured antimicrobials, diagnostics and vaccines through systems strengthening across sectors. That should include reinforcing supply chains, forecasting and resilience measures towards universal health coverage and coverage in the agrifood systems, with particular attention to smallholder farmers, conflict-affected settings, community case management and stakeholder alignment to promote responsible antimicrobial use and safe disposal of unused antimicrobials. A comprehensive evidence-based approach should include formulary optimization, market intelligence, strategic sourcing, pooled procurement, expanded manufacturing, the promotion of knowledge sharing and the transfer of AMR-related technologies, respecting international and national rules in line therewith.

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Something to Think About **35**

Reducing dependence on antimicrobials means changing the conditions that make animals sick, not simply withholding treatment. Better ventilation can reduce respiratory infections, clean water and sanitation can limit disease transmission, and vaccination can prevent particular illnesses. Which changes would be affordable for small-scale livestock producers, and which might require grants, shared veterinary services or training? How could governments check that animal health and farmers' incomes are protected during the transition?

Definition **35**

Good animal husbandry means raising and caring for animals in ways that support their health and welfare. Examples include sufficient space, clean drinking water, appropriate feed, ventilation, regular observation and timely veterinary care. These measures can help prevent infections to reduce the need for medicines.

Definition **35**

Integrated pest management uses a combination of methods to protect crops, including monitoring pests, selecting resistant crop varieties, encouraging natural predators and using pesticides only when needed. It can help limit unnecessary use of antimicrobial products in plant production.

Something to Think About **36**

Reusing wastewater can conserve scarce water and help farmers irrigate crops, but poorly treated wastewater may carry antimicrobial residues and resistant microorganisms onto fields. Treatment systems, regular testing and safer irrigation practices can reduce risks, yet they may be expensive or difficult to maintain. What minimum safeguards should governments require? How could they support communities that depend on wastewater for irrigation but cannot afford advanced treatment facilities?

Something to Think About **37**

In some countries, farmers struggle to obtain affordable, quality-assured veterinary medicines or reach a veterinarian who can diagnose an animal's illness. Stricter sales rules may discourage unnecessary use but could also make essential treatment harder to obtain, especially in remote areas. How could governments expand veterinary services, improve access to reliable medicines and prevent the sale of poor-quality products while ensuring antimicrobials are used only when necessary? Should countries with limited veterinary services receive additional time and support to implement stricter rules?

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38. Equitable access should be complemented by **effective antimicrobial stewardship** promoting appropriate use and safe disposal across all sectors and levels of care, including primary care and informal settings. In human health, antimicrobial stewardship policies and up-to-date, evidence-based national treatment guidelines, including on clinical management, should be guided by local data and antimicrobial stewardship principles and by the AWaRe classification and antibiotic book, while national essential medicine lists should align with the WHO Model List of Essential Medicines. In the animal and plant health and agrifood sectors, responsible use should be guided by FAO Integrated Pest Management and International Plant Protection Convention guidance, Codex Alimentarius standards and FAO guidance on vaccine quality control and field implementation and WOAH international standards, guidance on veterinary vaccines and antimicrobial resistance for aquatic and terrestrial animals, and essential veterinary medicines lists for terrestrial and aquatic, food-producing and companion animals.[7] Evidence from antimicrobial use surveillance alongside behavioural insights could be used to inform prescribing and dispensing practices. Workforce capacity should be strengthened through education and training. Veterinary medicines and agricultural production practices should be integrated into national waste management systems to address overlooked waste streams.

39. **Expanding access to quality diagnostics and laboratory services,** coupled with diagnostic stewardship, is critical for ensuring appropriate prescribing and antimicrobial use, detecting resistant strains early, generating microbiology data for AMR surveillance and enabling timely outbreak response. Appropriate diagnosis should guide prescribing and provide evidence for research and development of new antimicrobials, vaccines and other interventions. Diagnostic services should be mainstreamed into broader national laboratory services to ensure adequate laboratory capacity and equitable access, and should be aligned with the WHO AMR Diagnostic Initiative, the FAO Assessment Tool for Laboratories and AMR Surveillance Systems, the WOAH Performance of Veterinary Services Pathway and relevant environmental laboratory guidance.

40. **National regulatory frameworks** should be reviewed and strengthened across sectors to cover the full antimicrobial life cycle from development and manufacturing to distribution, use and disposal, using the Quadripartite One Health legislative assessment tool for AMR. Policies should streamline product registration, harmonize regional approval pathways, phase out the use of antimicrobials for growth promotion starting with those categorized by WHO as medically important, and promote prudent and responsible prophylactic use consistent with Codex Alimentarius standards, FAO guidelines on integrated pest management and relevant WOAH international standards. Over-the-counter, unregulated online sales and substandard or falsified medical and veterinary medicinal products should be curtailed, while enabling the safe disposal of unused antimicrobials and waste. Coordination between human, veterinary and environmental regulatory authorities is crucial for accountability and sustainable stewardship.

41. **Safe disposal of unused antimicrobials** through strengthened waste prevention measures, take-back schemes of human and veterinary medicines and public awareness should be incorporated into national regulatory frameworks and antimicrobial stewardship policies.[8] Regulations (such as extended producer responsibility) should address the disposal of unused

[7] Namely Codex Alimentarius standards including Integrated Pest Management and International Plant Protection Convention guidance, WOAH Standards, Guidelines and Resolutions on veterinary vaccines and Antimicrobial Resistance and the use of antimicrobial agents, the forthcoming WOAH equivalent of the WHO AWaRe list, and essential veterinary medicines lists for food-producing and companion animals from Brooke, the World Veterinary Association (WVA), and the World Small Animal Veterinary Association (WSAVA).

[8] United Nations Environment Programme. Safe disposal of unused medicines — A One Health approach for national systems. Nairobi: United Nations Environment Programme; 2026 (accessed 13 May 2026).

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Definition **39**

Diagnostic stewardship means ensuring that appropriate laboratory tests are available and used effectively to identify infections, detect antimicrobial resistance and guide decisions about prescribing medicines. For example, testing can help veterinarians determine which antimicrobial is likely to work against a particular infection, avoiding unnecessary or ineffective treatment. Test results can also help researchers identify gaps in existing treatments and guide the development of new antimicrobials, vaccines and other ways to prevent or treat infections.

Effective diagnostic stewardship also requires countries to strengthen their laboratory services so that reliable testing is accessible beyond major cities and specialized facilities. This includes integrating AMR testing into national laboratory systems and using international guidance and assessment tools developed by WHO, FAO and WOAH to identify weaknesses and improve laboratory capacity, including laboratories that test soil, water and wastewater for antimicrobial residues and resistant microorganisms.

Something to Think About **40**

Some livestock producers use antimicrobials to promote faster growth or improve how efficiently animals convert feed into meat, rather than to treat illness. Phasing out this practice may require changes in housing, nutrition, hygiene and disease prevention that farmers—especially small-scale producers—cannot immediately afford. Continued use of medically important antimicrobials for growth promotion can contribute to resistance and undermine treatment of infections. What transition periods, financial support and practical alternatives would help countries meet the international commitment while protecting animal health, food security and livelihoods?

Interesting Facts **40**

Growth promotion refers to giving antimicrobials to food-producing animals to increase their rate of growth or improve how efficiently they convert feed into meat, rather than to treat an illness. Even healthy animals naturally carry bacteria, some of which may be resistant to antimicrobials. Regular use of antimicrobials for growth promotion can kill or suppress bacteria that are susceptible to these medicines, allowing resistant bacteria to survive and multiply. These bacteria can then spread to other animals, people and the environment, contributing to antimicrobial resistance even though the animals receiving the medicines were not sick.

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38. Equitable access should be complemented by **effective antimicrobial stewardship** promoting appropriate use and safe disposal across all sectors and levels of care, including primary care and informal settings. In human health, antimicrobial stewardship policies and up-to-date, evidence-based national treatment guidelines, including on clinical management, should be guided by local data and antimicrobial stewardship principles and by the AWaRe classification and antibiotic book, while national essential medicine lists should align with the WHO Model List of Essential Medicines. In the animal and plant health and agrifood sectors, responsible use should be guided by FAO Integrated Pest Management and International Plant Protection Convention guidance, Codex Alimentarius standards and FAO guidance on vaccine quality control and field implementation and WOAH international standards, guidance on veterinary vaccines and antimicrobial resistance for aquatic and terrestrial animals, and essential veterinary medicines lists for terrestrial and aquatic, food-producing and companion animals.[7] Evidence from antimicrobial use surveillance alongside behavioural insights could be used to inform prescribing and dispensing practices. Workforce capacity should be strengthened through education and training. Veterinary medicines and agricultural production practices should be integrated into national waste management systems to address overlooked waste streams.

39. **Expanding access to quality diagnostics and laboratory services,** coupled with diagnostic stewardship, is critical for ensuring appropriate prescribing and antimicrobial use, detecting resistant strains early, generating microbiology data for AMR surveillance and enabling timely outbreak response. Appropriate diagnosis should guide prescribing and provide evidence for research and development of new antimicrobials, vaccines and other interventions. Diagnostic services should be mainstreamed into broader national laboratory services to ensure adequate laboratory capacity and equitable access, and should be aligned with the WHO AMR Diagnostic Initiative, the FAO Assessment Tool for Laboratories and AMR Surveillance Systems, the WOAH Performance of Veterinary Services Pathway and relevant environmental laboratory guidance.

40. **National regulatory frameworks** should be reviewed and strengthened across sectors to cover the full antimicrobial life cycle from development and manufacturing to distribution, use and disposal, using the Quadripartite One Health legislative assessment tool for AMR. Policies should streamline product registration, harmonize regional approval pathways, phase out the use of antimicrobials for growth promotion starting with those categorized by WHO as medically important, and promote prudent and responsible prophylactic use consistent with Codex Alimentarius standards, FAO guidelines on integrated pest management and relevant WOAH international standards. Over-the-counter, unregulated online sales and substandard or falsified medical and veterinary medicinal products should be curtailed, while enabling the safe disposal of unused antimicrobials and waste. Coordination between human, veterinary and environmental regulatory authorities is crucial for accountability and sustainable stewardship.

41. **Safe disposal of unused antimicrobials** through strengthened waste prevention measures, take-back schemes of human and veterinary medicines and public awareness should be incorporated into national regulatory frameworks and antimicrobial stewardship policies.[8] Regulations (such as extended producer responsibility) should address the disposal of unused

[7] Namely Codex Alimentarius standards including Integrated Pest Management and International Plant Protection Convention guidance, WOAH Standards, Guidelines and Resolutions on veterinary vaccines and Antimicrobial Resistance and the use of antimicrobial agents, the forthcoming WOAH equivalent of the WHO AWaRe list, and essential veterinary medicines lists for food-producing and companion animals from Brooke, the World Veterinary Association (WVA), and the World Small Animal Veterinary Association (WSAVA).

[8] United Nations Environment Programme. Safe disposal of unused medicines — A One Health approach for national systems. Nairobi: United Nations Environment Programme; 2026 (accessed 13 May 2026).

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Something to Think About **41**

Unused veterinary medicines can be thrown into ordinary rubbish, poured down drains or left in places where they may enter soil and water. A take-back scheme lets farmers return unused or expired products to a pharmacy, veterinary clinic or another collection point for safer disposal. Should manufacturers and sellers help pay for such schemes? How could a government make collection practical for farmers who live far from towns or formal waste facilities?

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antimicrobials from healthcare facilities, agricultural production and household/municipal systems as a means of reducing pollution and minimizing environmental pathways for resistance and promoting sustainable antimicrobial use while safeguarding ecosystems.

Strategic objective 5: Accelerate antimicrobial resistance research and innovation across all sectors

42. **Multidisciplinary AMR research** should encompass basic science, clinical and epidemiological operational and implementation domains and address One Health and sector-specific priorities agendas. Consideration should be given to different contexts to ensure equity-driven, evidence-informed policies that have a measurable impact. Cross-sectoral research guided by the Quadripartite One Health Priority Research Agenda for AMR should address knowledge gaps regarding AMR drivers, vulnerabilities, behavioural change, governance and cost-effective and scalable interventions.

43. **Scale-up of research and development and innovation** is essential to reduce the need for antimicrobials and ensure equitable access to safe, effective, quality-assured human and animal health products, including vaccines, novel antimicrobials, alternatives to antimicrobials, non-traditional agents, point-of-care diagnostics, environmental solutions and innovations. It should also include, biosecurity, nutrition and animal welfare for disease prevention and control in animals, including the use of agroecological approaches, and minimize discharges into the environment. Research and development priorities in human and animal health should be guided by WHO bacterial and fungal priority pathogen and the WOAH priority diseases lists, research and development targets and target product profiles, and WHO, FAO and WOAH guidance on vaccines to reduce antimicrobial use in humans and animals. Partnerships and mechanisms, such as the SECURE initiative on expanding sustainable access to antibiotics, should support low- and middle-income countries. To determine the environment's significance and contribution to AMR and the impacts of AMR on the environment as well as to address AMR pollution, strengthen resilience and reduce AMR risks, environmental research and development should focus on: sustainable chemicals and procurement practices; waste and wastewater management; antimicrobial-resistant microbes and antimicrobial residue surveillance; and environmental drivers.

44. **Sustainable, context-appropriate financing models** should underpin AMR research and development and research and innovation investments across sectors. These models should be linked to access and stewardship provisions as well as to environmental sustainability and be supported by development partners and public–private partnerships. Financing should adopt a One Health, systems-based approach focusing on low- and middle-income countries, including blended finance, microfinance, incentive schemes and community-led solutions. Research and development may be incentivized through a mix of "push" mechanisms that lower the costs and risks of new antimicrobial or product development, and "pull" incentives that facilitate market entry, promote equitable access, and delink revenues from sales volumes, thereby encouraging innovation while safeguarding the appropriate use and disposal of antimicrobials. Global and regional mechanisms should complement national efforts to ensure coordinated and sustainable support for AMR-related research and development.

45. **Strengthening research capacity and innovation uptake** is essential to ensure that research outcomes extend beyond product development to inform policies and operational solutions. Development partners and public–private partnerships should assist national authorities in ensuring the rapid uptake of innovations, promote knowledge sharing and the transfer of AMR-related technologies, respecting international and national rules in line therewith.

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Interesting Facts **43**

Research, development and innovation are needed because reducing dependence on antimicrobials requires more than restricting their use. Farmers need effective ways to prevent infections and keep animals healthy without relying on routine antimicrobial treatment. Research can lead to new vaccines, faster and more affordable diagnostic tests, improved methods of preventing disease and new treatments when existing medicines no longer work because of resistance. However, these advances will have limited benefits if farmers, particularly in low-income countries, cannot afford them or lack access to veterinary services.

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