Integrated drug resistance action framework for HIV, hepatitis B and C and sexually transmitted infections, 2026–2030

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Cover photo: Health worker in Kinshasa. At the heart of this Framework, health workers deliver people-centred, high-quality care that helps prevent and respond to drug resistance. © WHO / Harandane Dicko

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Abbreviations

AMR	antimicrobial resistance
ART	antiretroviral therapy
COVID-19	coronavirus disease 2019
HBV	hepatitis B virus
HCV	hepatitis C virus
PrEP	pre-exposure prophylaxis
STIs	sexually transmitted infections

Executive summary

The emergence and spread of resistance to antimicrobial agents pose a threat to prevention and treatment for HIV, hepatitis B and C and sexually transmitted infections (STIs). Without timely, coordinated and sustained action, drug resistance could lead to rising rates of new infections and treatment failures, increase preventable morbidity and mortality and undermine progress toward global disease elimination goals.

The Integrated Drug Resistance Action Framework for HIV, Hepatitis B and C and Sexually Transmitted Infections, 2026–2030 (hereafter referred to as the Integrated Action Framework) provides a unifying framework to address this challenge. Rooted in the WHO Global Health Sector Strategies on, respectively, HIV, viral hepatitis and sexually transmitted infections for the period 2022–2030 and aligned with the Sustainable Development Goals, this integrated action framework contributes to the broader international response to antimicrobial resistance (AMR). It builds on the WHO Global Action Plan on Antimicrobial Resistance and promotes antimicrobial stewardship as a central pillar supporting the responsible use of antimicrobial agents to preserve their effectiveness for prevention and treatment. This Integrated Action Framework responds to the renewed political commitment following the 2024 United Nations General Assembly High-level Meeting on Antimicrobial Resistance and outlines strategic priorities and concrete actions to prevent and respond to drug resistance. It is informed by the best available evidence, inclusive consultation and multisectoral engagement.

The Integrated Action Framework aligns with WHO's 2023 people-centred approach to addressing AMR in the human health sector, which seeks to overcome the barriers individuals face when accessing services to prevent, diagnose and treat (drug-resistant) infections. By embedding this approach, the Integrated Action Framework places people, their needs and equitable access to high-quality health-care services at the centre of the AMR response across HIV, hepatitis B and C and STIs – ensuring that actions are responsive to real-world challenges in service delivery and health system capacity.

The Integrated Action Framework is a call to action – and a roadmap for global solidarity. It affirms that only through sustained, collective and coordinated efforts can life-saving prevention, diagnosis and treatment tools be safeguarded to ensure that the path to disease control remains within reach.

The case for action

AMR is a concern across HIV, hepatitis B and C and STIs, since it compromises the effectiveness of core prevention and treatment strategies. Although the mechanisms, scale and patterns of resistance vary by infection, growing evidence highlights vulnerabilities that require urgent and coordinated attention.

WHO-recommended dolutegravir-based therapy is highly effective in achieving and sustaining HIV viral load suppression, and long-acting cabotegravir is highly effective for HIV prevention. However, among individuals receiving dolutegravir-based antiretroviral therapy with unsuppressed viral load, HIV drug resistance to dolutegravir has been reported, ranging from 5% to 20% in programmatic settings in some low- and middle-income countries. In parallel, resistance mutations that confer cross-resistance to dolutegravir have been reported among people acquiring HIV and receiving long-acting cabotegravir pre-exposure prophylaxis.

The prevalence of hepatitis B virus drug resistance remains low at the population level, but historical exposure to lamivudine and other older antiviral agents has selected resistance-associated mutations that can reduce the effectiveness of entecavir among treatment-experienced individuals and may potentially affect susceptibility to tenofovir. Limited surveillance and sequencing capacity hinder the detection and understanding of resistance patterns, especially in underrepresented settings. Substitutions associated with drug resistance to hepatitis C virus have been detected in 79% of the people for whom WHO-recommended first-line direct-acting antiviral therapy fails and up to 96% of those with retreatment failure, highlighting the importance of monitoring treatment outcomes and drug resistance to hepatitis C virus.

Further, current limited evidence suggests that treatment efficacy is reduced for some hepatitis C virus subtypes endemic in low- and middle-income countries, likely caused by the presence of natural polymorphisms that are associated with resistance to the antiviral drugs. In addition, limited resistance data for hepatitis C virus genotypes 2, 4, 5, 6, 7 and 8 constrain the global understanding of treatment failure risks.

AMR is an important concern for the bacterial STIs, putting the current first-line regimens under pressure. Over the past decade, rates of AMR to these first-line regimens for *Neisseria gonorrhoeae* and *Mycoplasma genitalium* have substantially increased, with regional variation, while novel interventions such as doxycycline post-exposure prophylaxis require close monitoring of how they affect AMR in these and other infections, such as syphilis. Limited diagnostic and therapeutic antimicrobial stewardship and limited AMR surveillance coverage have been important drivers of these increases and necessitate an integrated action framework to prevent further rise and spread of drug-resistant STIs.

The emergence and spread of drug resistance across HIV, hepatitis B and C and STIs pose a challenge to sustaining public health gains in prevention and treatment. Although each of these presents distinct clinical and programmatic challenges, they share common drivers: overlapping modes of transmission, affected populations and structural barriers to care. They also share similar barriers and weaknesses – fragmented surveillance, limited stewardship of antimicrobial agents, underresourced laboratory systems and unequal access to timely diagnosis and effective treatment.

These converging threats require a coordinated response. Continuing to address drug resistance in isolated disease silos will only deepen inefficiency and delay progress. Unified action enables smarter resource allocation, promotes resilience in the face of supply chain disruptions and ensures that prevention and treatment gains are not reversed.

Antimicrobial stewardship efforts must be strengthened through coordinated actions to optimize antimicrobial use, prevent unnecessary exposure to antimicrobial agents and support enhanced surveillance, improved diagnostics, infection prevention and control and equitable access to effective diagnostics, prevention and treatment tools across diseases – ensuring that treatment benefits are sustained and resistance is contained.

The effectiveness of current and future prevention and treatment tools can be safeguarded through coordinated, cross-cutting efforts – enabling innovation to be sustained, new infections to be prevented and the burden of drug-resistant infections to be reduced while accelerating progress toward ending AIDS and the epidemics of hepatitis B, hepatitis C and STIs as public health threats.

A call for action

Vision: a world in which drug resistance does not undermine efforts to end AIDS and the epidemics of hepatitis B, hepatitis C and STIs as public health threats.

Goal: to prevent the emergence and spread of drug resistance and reduce its impact so that it does not compromise efforts to end AIDS and the epidemics of hepatitis B, hepatitis C and STIs as public health threats by 2030.

Scope
The Integrated Action Framework addresses drug resistance in HIV, hepatitis B virus, hepatitis C virus and priority bacterial STIs. Gonorrhoea and HIV are emphasized because of their global burden and treatment challenges, and *Mycoplasma genitalium* infection, hepatitis B and C and syphilis are highlighted for their emerging resistance risks, limited treatment alternatives and critical surveillance gaps.

Guiding principles and enablers
The Integrated Action Framework is guided by core public health principles, including equity, country ownership, community engagement and strategic investment. It promotes a public health approach with simplified and scalable interventions, supports multisectoral collaboration and emphasizes innovation, evidence-informed action, strong quality systems, workforce development and integrating disease-specific and cross-cutting approaches.

Strategic directions
The Integrated Action Framework is aligned with the five strategic directions of the Global Health Sector Strategies on, respectively, HIV, viral hepatitis and sexually transmitted infections for the period 2022–2030, which promote people-centred and evidence-informed services, optimizing systems and multisectoral partnerships, data-driven action, community leadership and innovation for impact.

The Integrated Action Framework is structured around five areas of work and their strategic objectives:

- **prevention and response:** implement high-impact, people-centred interventions to prevent infections and to prevent, detect and respond to drug resistance in HIV, hepatitis B and C and STIs;

- **monitoring and surveillance:** strengthen national surveillance systems to generate continuous, reliable and actionable data on drug resistance in HIV, hepatitis B and C and STIs and collect and analyse data from routine clinical care to assess the quality of service delivery for HIV, hepatitis B and C and STIs to inform interventions that help to prevent the emergence and spread of drug resistance;

- **research and innovation:** close critical knowledge gaps on the risk and drivers of drug resistance to current and emerging therapies, including service delivery factors that affect treatment outcomes, and drive relevant and innovative research aimed at developing and delivering interventions that prevent, minimize and manage drug resistance and improve treatment success for HIV, hepatitis B and C and STIs;

- l**aboratory capacity:** build, strengthen and expand robust, high-quality laboratory systems – including shared infrastructure and personnel when appropriate – to monitor the effectiveness of treatment outcomes and to conduct drug resistance surveillance for HIV, hepatitis B and C and STIs; and

- **governance and enabling mechanisms:** ensure that governance and enabling mechanisms – including country ownership, community engagement, advocacy and communication, coordinated action and sustainable funding – are in place to effectively support actions on drug resistance for HIV, hepatitis B and C and STIs.

A shared responsibility

This is a pivotal moment to unite around a shared agenda. An effective response to drug resistance requires the coordinated efforts of all stakeholders committed to ending AIDS and the epidemics of hepatitis B and C and STIs as public health threats. Sustained political commitment, empowered communities, scientific innovation, coordinated partnerships and long-term investment are essential. The success of the Integrated Action Framework relies on a common vision, clearly defined roles and joint action across countries, communities, researchers, implementing partners, donors, the private sector and WHO.

By working together in a coordinated and accountable manner, stakeholders can turn commitment into impact and ensure that drug resistance does not derail local and global efforts to eliminate disease.

A roadmap for implementation

An accompanying multisectoral roadmap for action defines tailored actions for stakeholders across the five work areas and their strategic objectives. It emphasizes the value of integrated approaches – across diseases and health systems – not only to improve coordination and efficiency but also to improve the use of resources. The roadmap supports both cross-cutting and disease-specific responses and encourages alignment with national health strategies, including national action plans on AMR.

Expected impact by 2030

The Integrated Action Framework is an important component of global efforts to end AIDS and the epidemics of hepatitis B, hepatitis C and STIs as public health threats and advancing the target from the Political Declaration of the 2024 United Nations General Assembly High-level Meeting on Antimicrobial Resistance of reducing the global number of people dying from AMR-related causes by 10%. Together with efforts to expand access to prevention, diagnosis and treatment, the Integrated Action Framework will help to preserve the effectiveness of current regimens by addressing drug resistance through coordinated, multisectoral action. Strengthening surveillance and laboratory systems will support the earlier detection of treatment failure and resistance, enabling more rapid, evidence-informed responses and informing appropriate treatment decisions. Integrated, people-centred service delivery across HIV, hepatitis B and C and STIs will improve access, equity and the quality of care – while optimizing limited resources through shared, interoperable laboratory and service delivery platforms. Sustained investment in research and innovation will be crucial to closing knowledge gaps and developing new tools to detect, prevent and manage resistance. These efforts will accelerate progress toward achieving elimination targets and enhance the resilience of health systems. The success of these efforts will depend on strong political commitment, community engagement and long-term financing to support durable, country-led responses.

Introduction

Antimicrobial resistance (AMR) is one of the most pressing global health challenges of our time. Within this broader crisis, drug resistance in HIV, hepatitis B and C and sexually transmitted infections (STIs) remains a significant challenge across all regions, threatening to erode decades of progress in controlling and eliminating diseases. Although major scientific and public health advances have expanded access to effective prevention tools, diagnostic tests and treatment regimens, the emergence of drug-resistant pathogens increases the risk of treatment failure, limits future preventive and therapeutic options and contributes to avoidable morbidity, mortality and new infections.

Drug resistance in HIV, hepatitis B and C and STIs is a major public health and development challenge. These share modes of transmission, disproportionately affect similar vulnerable populations and are influenced by common structural determinants of health such as poverty, stigma and limited access to timely and high-quality care. However, the clinical and public health challenges are also diverse between diseases and across settings. Addressing drug resistance effectively requires a dual approach: tailored, pathogen-specific strategies to reflect the distinct characteristics of each disease, alongside integrated responses that improve the use of shared platforms and resources across disease areas (such as surveillance systems, laboratories and supply chains). This helps to reduce inefficiency caused by parallel systems and, in turn, strengthens the overall resilience and sustainability of health systems.

This Integrated Drug Resistance Action Framework for HIV, Hepatitis B and C and Sexually Transmitted Infections, 2026–2030 (hereafter referred to as the Integrated Action Framework) provides a coordinated, multisectoral framework to prevent, monitor and respond to drug resistance. It builds on the WHO Global Health Sector Strategies on, respectively, HIV, viral hepatitis and sexually transmitted infections for the period 2022–2030 and aligns with the Sustainable Development Goals *(1, 2)*. The Integrated Action Framework responds to the growing need for harmonized action that transcends disease silos, strengthens health systems and safeguards the effectiveness of current and future prevention and treatment interventions.

The Integrated Action Framework is situated within the broader international response to AMR. It builds on the Global Action Plan on Antimicrobial Resistance *(3)* and responds to renewed political momentum following the 2024 United Nations General Assembly High-level Meeting on Antimicrobial Resistance *(4)*, which reaffirmed AMR as a critical global health and development threat, and is informed by WHO's forthcoming Global Action Plan on Antimicrobial Resistance 2026–2035. The Political Declaration of the High-level Meeting on Antimicrobial Resistance emphasized equity, solidarity and the need to leave no one behind, underscoring the importance of safeguarding access to effective, affordable and quality-assured antimicrobial agents, diagnostics and related health products *(4)*. By focusing on HIV, hepatitis B and C and STIs – disease areas specifically acknowledged in the Political Declaration as vulnerable to the consequences of AMR – the Integrated Action Framework contributes to global efforts by advancing coordinated action in domains that are essential to the AMR response. The Integrated Action Framework also promotes antimicrobial stewardship as a cornerstone of sustainable, people-centred responses.

> Antimicrobial stewardship is defined as a coherent set of actions that promote the appropriate use of antimicrobial agents *(5)*

Recognizing that addressing AMR requires a response focused on the needs and lived experiences of individuals and communities, WHO has advanced a people-centred approach that seeks to overcome the barriers people face in accessing prevention, diagnosis and treatment for drug-resistant diseases *(6)*. The Integrated Action Framework builds on this foundation to accelerate targeted action for HIV, hepatitis B and C and STIs – ensuring that responses are integrated, equity-focused and embedded within broader efforts to strengthen health systems.

The Integrated Action Framework outlines a framework that embeds drug resistance within comprehensive responses to HIV, hepatitis B and C and STIs. It defines five interlinked areas of work and sets out strategic objectives to guide collective action across countries, sectors and partners. By translating global priorities into context-specific actions, especially in resource-limited settings, the Integrated Action Framework contributes to ongoing efforts to end AIDS and the epidemics of hepatitis B, hepatitis C and STIs as public health threats – while helping to preserve the effectiveness of life-saving medicines.

Portrait of "Tee", a participant in the C-Free programme and staff member at Raks Thai, in Bangkok's Samrong neighborhood on 22 March 2024.

C-Free is the first community-based study in Thailand offering hepatitis and HIV testing and treatment for people who use drugs and their partners. Addressing AMR requires a response focused on the needs and lived experiences of individuals and communities.

Development of the Integrated Action Framework: a collaborative process

The Integrated Action Framework was developed through a broad and inclusive consultative process spanning two years (2023–2025) (Fig. 1). Numerous experts from multiple countries – with particular participation from focus countries and communities in which drug resistance poses the greatest threat – contributed to the Integrated Action Framework, representing a wide range of institutions, including health ministries, national public health agencies, academic and research institutions, civil society organizations, community members, multilateral agencies and donor partners and WHO. All external experts submitted to WHO a declaration of interest disclosing potential conflicts of interest that might affect, or might reasonably be perceived to affect, their objectivity and independence in relation to the subject matter of the Integrated Action Framework. WHO reviewed each of the declarations and concluded that none could give rise to a potential or reasonably perceived conflict of interest related to the subjects discussed at the meeting or covered by the guidance.

The development process included:

- disease-specific consultations (HIV, hepatitis B and C and STIs) to identify distinct challenges, priorities and opportunities for action within each disease area, ensuring that the Integrated Action Framework reflects the latest scientific and programmatic insights;
- expert meetings and bilateral consultations to explore technical issues in depth, align with ongoing global initiatives and build consensus around key strategies and actions;
- integration workshops to harmonize input across the three disease areas, fostering a cohesive, multisectoral roadmap for action that leverages synergy and avoids fragmentation;
- a global public consultation to ensure transparency, inclusiveness and responsiveness to diverse perspectives, strengthening the relevance, contextual insights and ownership of the Integrated Action Framework across regions; and
- final external review to validate the strategic direction, ensure technical accuracy and refine the Integrated Action Framework before it was finalized.

The Integrated Action Framework reflects a collaborative, multisectoral and evidence-informed effort to ensure a unified global response to preserve the effectiveness of prevention, diagnosis and treatment tools for HIV, hepatitis B and C and STIs – and to help keep the world on track to achieve the 2030 elimination goals.

Fig. 1. Milestones in developing the Integrated Action Framework

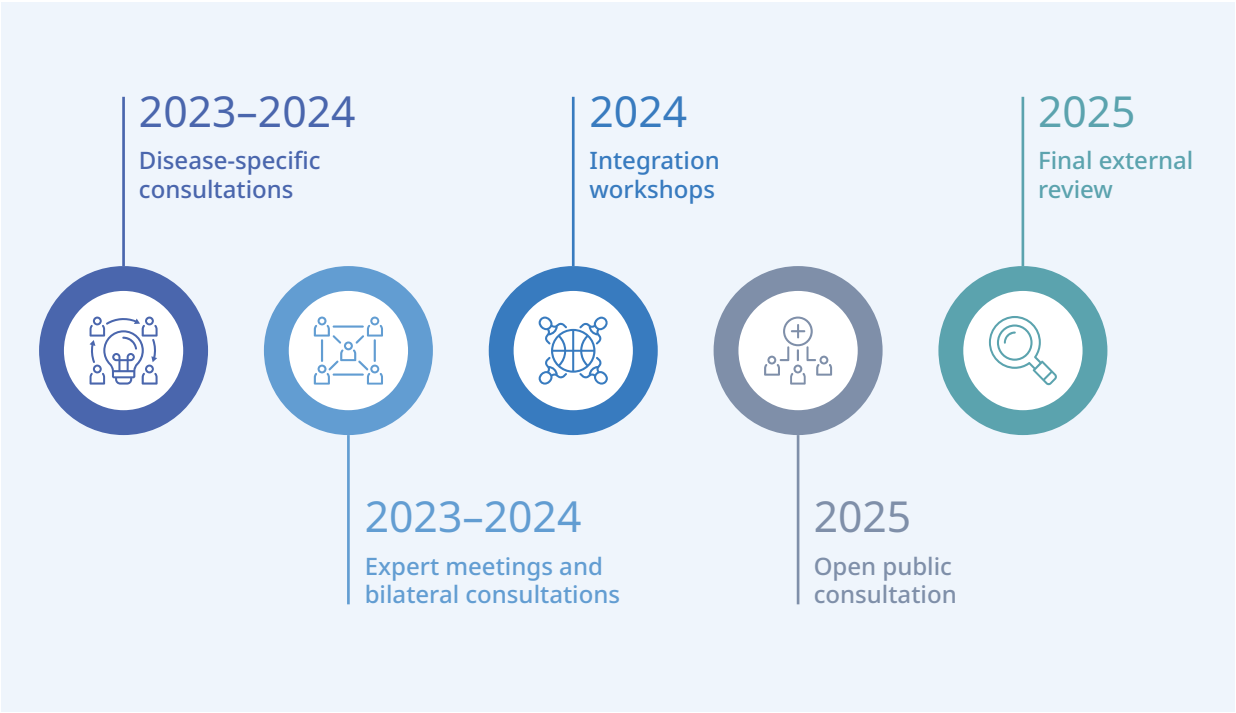


Fig. 1 illustrates the key milestones in the two-year development of the Integrated Action Framework, highlighting the sequence of consultations, integration, public engagement and expert review.

Epidemiological overview: the need for action

HIV, hepatitis B and C and STIs are united by shared transmission pathways, overlapping affected populations and often common social and structural determinants of health – including poverty, stigma, criminalization and barriers to care. Although gains have been made in reducing incidence and expanding access to comprehensive prevention, testing and treatment (Table 1), the emergence and spread of drug resistance threaten to jeopardize this progress – potentially increasing avoidable morbidity and mortality and placing local and global elimination targets at risk.

Table 1. Summary: global highlights and drug resistance challenges in HIV, hepatitis B and C and STIs

DISEASE	GLOBAL DISEASE SITUATION	DRUG RESISTANCE CHALLENGES
HIV	• An estimated 40.8 million people were living with HIV globally in 2024. • As of 2024, 87% of people living with HIV knew their HIV status; 89% of them were receiving antiretroviral therapy (ART); and 94% of those receiving ART had suppressed viral loads. • Between 2010 and 2024, the number of people acquiring HIV declined by 40% and the number of people dying from causes related to advanced HIV disease declined by 54%. • Children under 15 years accounted for 12% of AIDS-related deaths despite making up only 3.4% of people living with HIV. • WHO-recommended dolutegravir-based ART is used by 95% of adults on treatment in low- and middle-income countries, with strong suppression rates. • Pre-exposure prophylaxis (PrEP) coverage remains below 5% among key populations in many countries, despite WHO recommendations and proven effectiveness.	• Dolutegravir resistance has been observed in 5% to 20% of individuals with failure to suppress viral loads receiving dolutegravir-based ART in programmatic settings in some low- and middle-income countries. • As of 2023, surveys of dolutegravir resistance among individuals receiving ART had been completed in only 10 countries for adults and just six for children and adolescents. • Drug resistance to PrEP agents is emerging, especially when initiated during undiagnosed acute HIV infection.
Hepatitis B and C	• An estimated 254 million people are living with hepatitis B and 50 million with hepatitis C worldwide in 2022. • Access to curative direct-acting antiviral treatment for hepatitis C has increased nearly 10-fold since 2015, but only 36% are diagnosed and 20% treated. • Diagnosis and treatment coverage for hepatitis B remains critically low, with only 13% diagnosed and 3% treated. • Only 45% of newborns worldwide, and 17% in WHO African Region, receive the recommended hepatitis B birth-dose vaccine in 2024. • An estimated 1.3 million people died in 2022 from hepatitis B and hepatitis C related causes, while global prevalence continues to rise.	• Resistance to hepatitis B virus (HBV) antivirals (such as entecavir) has been observed among treatment-experienced individuals, especially those with previous lamivudine exposure. • HBV resistance data by genotype and geographical region are limited. • Resistance-associated substitutions to hepatitis C virus (HCV) direct-acting antivirals are found among about 79% of people with first-line treatment failure and among up to 96% of those with retreatment failure. • Sparse resistance data for HCV genotypes 2, 4, 5, 6, 7 and 8 – as well as endemic subtypes within genotypes 1 and 3 – hinder global understanding of treatment failure risks. Emerging evidence suggests that lower direct-acting antiviral efficacy in some subtypes is common in low- and middle-income countries, likely because of natural resistance-associated polymorphisms.
STIs	• In 2020, WHO estimates 374 million new curable STIs globally, including 82.4 million cases of *Neisseria gonorrhoeae*, with no signs of epidemic control. • There is an increasing trend in the number of syphilis cases with numbers rising from 7.1 to 8.0 million between 2020 and 2022; congenital syphilis rates have increased similarly over this period.	• Systematic reviews show increases in AMR rates in *Neisseria gonorrhoeae* and *Mycoplasma genitalium*, reducing effective treatment options to a limited number of drugs. • Data on AMR to STIs from many regions and populations are underrepresented. • Laboratory capacity for STIs diagnosis is constrained and access to standardized resistance testing is limited.

This section presents an overview of the evolving epidemiological and programmatic landscape across HIV, hepatitis B and C and STIs – highlighting areas of progress, persistent gaps and the challenge of drug resistance. It sets the stage for coordinated and sustained action to preserve treatment effectiveness and ensure that drug resistance does not derail the goal of eliminating these infections as public health threats.

HIV: drug resistance challenges in the era of dolutegravir-based treatment and expanded pre-exposure prophylaxis (PrEP) options

An estimated 40.8 million people were living with HIV globally by the end of 2024 *(7, 8)*. Without treatment, HIV infection progressively weakens the immune system and leads to advanced HIV disease – a condition marked by opportunistic infections, malignancies and high mortality. The global HIV response has made substantial progress. By the end of 2024, 87% of people living with HIV knew their HIV status, 89% of those diagnosed were receiving antiretroviral therapy (ART) and 94% of those receiving ART had suppressed viral loads *(8)*. Compared with 2010, by 2024 the number of people acquiring HIV had declined by 40% and the number of people dying from HIV-related causes had declined by 54% *(7, 8)*. Despite these gains, the pace of decline remains insufficient to meet the 2030 targets, which call for reducing both new HIV infections and AIDS-related deaths by 90% compared with 2010. In 2024 alone, 1.3 million people acquired HIV and 630 000 people died from HIV-related causes *(7–9)*, highlighting the substantial gap that must be eliminated to achieve these goals.

Children younger than 15 years continue to experience disproportionate HIV-related mortality, accounting for 12% of all AIDS-related deaths despite comprising only 3.4% of the people living with HIV *(7, 10)*. In 2024, an estimated 75 000 children died from AIDS-related causes *(7, 8)*. Key populations – gay men and other men who have sex with men, people who inject drugs, trans and gender-diverse people and sex workers and their partners – account for 55% of new HIV infections among adults aged 15–49 in 2022 *(11)* and yet face persistent barriers to care because of stigma, criminalization, discriminatory laws and policies and other social and structural determinants of health *(1)*. PrEP, although highly effective at preventing people from acquiring HIV, remains insufficiently used. As of 2023, 91% of reporting countries had adopted WHO PrEP recommendations, and yet coverage among key populations often remains less than 5% *(10)*. Other prevention methods, such as condom use, also remain low – often less than 50% among key populations in many countries *(10)* – highlighting persistent gaps in access to and uptake of comprehensive HIV prevention services and increasing the risk of STIs and hepatitis B and C.

HIV drug resistance can compromise the effectiveness of antiretroviral drugs for both prevention and treatment, contributing to increased HIV incidence, morbidity and mortality. To mitigate these risks, WHO recommends routine HIV drug resistance surveillance as an integral component of PrEP and ART programmes to guide timely public health policies and guidance *(12, 13)*. Relatively few people receiving PrEP acquire HIV or develop HIV drug resistance risk, but resistance risk is higher when PrEP is initiated and continued during undiagnosed HIV infection. In a 2024 review, 20% of 310 people diagnosed with HIV while receiving oral PrEP had any documented PrEP-associated drug resistance *(14)*. New PrEP options, such as the dapivirine vaginal ring and long-acting

injectable cabotegravir and lenacapavir, require ongoing targeted monitoring for potential resistance *(15, 16)*. Long-acting injectable cabotegravir is highly effective for HIV prevention, but rare cases of people acquiring HIV during use have been associated with integrase inhibitor resistance, including mutations predicting cross-resistance to dolutegravir – a key component of WHO-recommended ART *(17)*. These cases highlight the importance of accurate HIV testing and close monitoring throughout the course of long-acting injectable cabotegravir use to preserve treatment options. However, the risk of resistance should not deter the use of PrEP, given its proven effectiveness in preventing HIV infection. Similarly, lenacapavir-associated resistance may emerge in rare breakthrough infections, especially if PrEP is initiated during undiagnosed HIV infection or during the drug's pharmacokinetic tail. Current evidence shows no cross-resistance with WHO-recommended ART *(18)*, although this may change if lenacapavir-based treatment regimens are adopted, reinforcing the need for ongoing surveillance.

The widely used WHO-recommended dolutegravir-based ART regimens are highly effective in achieving suppressed viral loads *(16)*, as demonstrated in both clinical trials and programmatic settings *(19–24)*. Although resistance to dolutegravir remains relatively rare at the population level, early signals in specific contexts highlight the importance of timely surveillance and reporting to guide programmatic responses. Among individuals receiving dolutegravir-based ART with unsuppressed viral load, drug resistance to dolutegravir has been reported, ranging from 5% to 20% in programmatic settings in some low- and middle-income countries *(14, 25)*. A modelling study from South Africa projects a rapid increase in HIV drug resistance to dolutegravir associated with the failure of dolutegravir-based ART – rising from 18% in 2023 to 42% by 2035 if mitigation measures are not adopted *(26)*. Transmitted resistance to dolutegravir is also projected to rise, albeit more slowly, from 0.1% to 5% over the same period *(26).* These findings underscore the critical role of robust HIV drug resistance surveillance in guiding programmatic responses to maximize the continued effectiveness of dolutegravir-based ART.

By mid-2022, 108 of 123 reporting countries had adopted dolutegravir as the preferred first-line regimen *(27)*, and about 95% of adults receiving ART in low- and middle-income countries in which generics were accessible were receiving dolutegravir-based regimens *(28)*. Despite this near-universal adoption of dolutegravir-based ART, surveillance of HIV drug resistance among individuals receiving ART remains severely limited. As of July 2023, only 10 countries had conducted surveys of HIV drug resistance among adults receiving dolutegravir-based ART, with three additional surveys ongoing and 24 planned *(14)*. Only six countries had completed surveys for children and adolescents, one had a survey underway and 14 had plans to initiate surveillance *(14)*. These gaps underscore the need to expand WHO-recommended standardized surveillance across all regions to better understand the emergence and drivers of resistance to dolutegravir, especially in populations with limited existing data *(12, 29–31)*.

Monitoring programme quality indicators – such as ART pick-up, retention in care, viral load testing coverage, viral load suppression and timely regimen switching – is critical to preventing HIV drug resistance *(12)*. These indicators reflect the performance of ART clinics and programmes and provide actionable data to guide timely public health responses when gaps in service delivery are identified *(12, 32)*. However, many ART programmes in low- and middle-income countries face persistent challenges – in systematically monitoring these indicators, implementing evidence-informed actions to optimize performance when indicated and achieving globally recommended clinic and national targets – highlighting the need to strengthen data systems and ensure that findings are translated into timely, effective and community co-created and evidence-informed public health interventions *(14)*.

The growing threat of HIV drug resistance calls for a comprehensive stewardship approach that integrates diagnosis, prevention, treatment and surveillance as mutually reinforcing components of the HIV response. Key actions include optimizing the use of ART through appropriate selection of regimens, supporting adherence, ensuring retention in care, routinely monitoring viral load and timely switching if treatment fails in accordance with WHO recommendations. Strengthening the surveillance of drug resistance and routinely using programme quality indicators to generate actionable data are crucial for guiding responsive interventions and informing national treatment policies. Preventing people from acquiring HIV and reducing long-term reliance on ART requires expanding access to effective prevention tools – including PrEP, post-exposure prophylaxis, condoms, harm-reduction services and efforts to advance the elimination of vertical transmission of HIV. To minimize the risk of resistance, PrEP should be initiated after HIV infection has been ruled out through accurate diagnostics. Stewardship efforts must further include investing in health workforce training and community engagement to support adherence and treatment literacy and reduce stigma.

Hepatitis B and C: drug resistance amid expanded treatment access

In contrast to the global response to HIV, efforts to treat hepatitis B and C have gained momentum more recently, with countries beginning to scale up access to hepatitis B and C diagnosis and treatment. Hepatitis B and C are viral infections that primarily affect the liver and, if untreated, can lead to chronic liver disease, cirrhosis, hepatocellular carcinoma and death. Major strides have been made in prevention, diagnosis and treatment for hepatitis B and C. Effective hepatitis B vaccines and antiviral therapies, along with curative hepatitis C treatments, are becoming increasingly accessible and affordable *(33)*. Decentralized, integrated primary health care models have expanded service coverage, and countries such as Egypt are leading the way in public health approaches to eliminate hepatitis C – becoming, in October 2023, the first country to achieve WHO gold tier status on the path to eliminating hepatitis C through rapid testing and treatment scale-up *(33)*. The global 2020 target of reducing hepatitis B prevalence among children younger than five years to less than 1% was achieved, supported by increased infant vaccination and other prevention efforts *(1)*. Additional momentum for hepatitis B treatment has arrived through the 2024 WHO guidelines, which offer broader and more flexible treatment eligibility criteria and introduce a conditional recommendation for a dual therapy option using tenofovir disoproxil fumarate plus either lamivudine or emtricitabine *(34)*. In parallel, at the global level, the number of people receiving treatment for chronic hepatitis C increased nearly 10-fold between 2015 and 2020, contributing to reducing hepatitis C–related mortality *(1)*.

Despite this progress, the world is not on track to achieve the 2030 elimination goals *(1)*. In 2022, an estimated 1.3 million people die from hepatitis B– or C–related causes – equivalent to 3500 deaths per day – and the global prevalence of infection continues to rise *(33)*. An estimated 254 million people are living with hepatitis B[1] and 50 million with hepatitis C. However, only 13% of individuals with chronic hepatitis B are diagnosed and a mere 3% receive antiviral therapy *(10, 33)*. Although a single dose of hepatitis B vaccine can cost as little as US$ 0.55 *(37)*, global coverage of the critical birth dose remains low – only 45% of infants worldwide and just 17% in the WHO African Region, receive it in 2024 *(38)*. Correspondingly, global procurement volumes for hepatitis B vaccines declined by 12% between 2022 and 2023, and by 31% since 2019 *(39)*, reflecting persistent programmatic and demand challenges. For hepatitis C, 36% of people are diagnosed and only 20% have received curative treatment *(10, 33)*.

- **Hepatitis B drug resistance:** Treatment of chronic hepatitis B with a WHO-recommended nucleos(t)ide analogue – tenofovir or entecavir – is a cornerstone of global elimination efforts *(34)*. The population-level risk of hepatitis B virus (HBV) drug resistance remains low *(40)*; however, historical use of lamivudine (and other older agents) has led to the selection of resistance-associated substitutions, which may reduce the effectiveness of entecavir among treatment-experienced individuals *(40, 41)* and potentially influences tenofovir susceptibility if other mutations are also selected *(42, 43)*. As access to hepatitis B treatment expands, detecting and responding promptly to emerging resistance becomes increasingly important. Yet surveillance remains limited and critical data gaps persist – especially as HBV sequencing is not routinely undertaken and is inaccessible in many settings. Thus, there are considerable blind spots regarding resistance patterns across diverse HBV genotypes and among populations in low-resource and underrepresented settings *(40)*.

1 Although the Integrated Action Framework does not specifically address hepatitis D coinfection, about 4.5% of people with chronic hepatitis B globally are also infected with hepatitis D virus *(35)*. This translates to roughly 11 million people worldwide being infected with hepatitis D virus. Although this is a small percentage of the global population, hepatitis D virus infection significantly exacerbates the severity of liver disease related to hepatitis B virus (HBV). As new therapies for hepatitis D are developed, the monitoring will be required to determine the potential emergence of drug-resistant hepatitis D virus *(36)*.

- **Hepatitis C drug resistance:** For hepatitis C, WHO-recommended pangenotypic direct-acting antiviral agents are highly effective, achieving cure rates – defined as sustained suppression of viral loads 12 weeks after treatment – in over 90% of cases *(44–47)*. Factors contributing to failure to suppress viral loads include advanced liver disease, such as cirrhosis and the presence of resistance-associated substitutions – especially in some hepatitis C virus (HCV) genotypes prevalent in many low- and middle-income countries that naturally have polymorphisms, making them less susceptible to some of the direct-acting antiviral agents designed for the more commonly observed epidemic HCV subtypes – complicate the effectiveness of current direct-acting antiviral therapies *(45, 48)*. Although the vast majority of individuals with hepatitis C are expected to be cured with WHO-recommended pangenotypic direct-acting antiviral agents, a recent systematic review found resistance-associated substitutions among 79% of the people for whom first-line pangenotypic direct-acting antiviral therapy failed and among up to 96% of those for whom retreatment failed *(49)*. Resistance to hepatitis C treatment is primarily associated with mutations affecting inhibitors of the viral non-structural protein 5A, such as daclatasvir, velpatasvir and pibrentasvir, whereas resistance to sofosbuvir – an inhibitor of the non-structural protein 5B – remains uncommon *(49)*. However, available data are largely limited to epidemic subtypes of genotype 1 and genotype 3, with insufficient evidence on genotypes 2, 4, 5, 6, 7 and 8 – and few studies from the WHO African Region – despite its high genotype diversity *(49–51)*.

A comprehensive stewardship approach to hepatitis B and C drug resistance must be fully integrated into national hepatitis responses to preserve the long-term effectiveness of available therapies and minimize the risk of resistance. This includes scaling up access to preventive, diagnostic and curative tools. For example, for hepatitis B, dramatically increasing timely birth dose coverage followed by full vaccination is essential to prevent new infections and reduce future treatment needs. Prevention efforts must also focus on expanding harm-reduction services for people who inject drugs, advancing the elimination of vertical transmission, expanding vaccination for high-risk groups and improving infection prevention and control in health-care settings. For both hepatitis B and hepatitis C, expanding diagnosis and timely linkage to care and ensuring consistent, affordable access to WHO-recommended antiviral regimens with high genetic barriers to the selection of resistance are critical. Sustained investment in high-quality, person-centred hepatitis programmes – coupled with efforts to decentralize care, promote task-sharing and integrate services with broader health system priorities – will be vital to closing persistent access gaps. These efforts must also address stigma, discrimination, economic barriers, fragmented service delivery and inadequate language and culturally sensitive services for underserved populations, which undermine equitable access to prevention, diagnosis and treatment. Education and training for prescribers, communities and policy-makers are essential to support the appropriate use of antiviral medicines for hepatitis B and C, reinforce adherence, improve health literacy and ensure evidence-informed decision-making. As access to hepatitis B and C services expands, robust monitoring of treatment outcomes and surveillance of drug resistance must be given priority – including investment in laboratory capacity to monitor virological responses and detect drug resistance, expand access to sequencing technologies and ensure timely translation of results into evidence-informed public health responses.

STIs: escalating health burden and drug resistance challenges

STIs continue to impose a major global health burden given insufficient priority, with more than 1 million new curable infections occurring every day *(1, 52)*. In 2020, an estimated 374 million new cases of curable STIs occurred *(1)*. STIs contribute to substantial and often preventable reproductive tract sequalae, including tubal factor infertility, adverse pregnancy outcomes, ectopic pregnancy and increased HIV transmission risk *(52)*.

However, global progress remains off track, and most STIs remain undiagnosed and untreated because of persistent individual and health system barriers, including low political visibility, limited priority and funding for programmes, stigma, diagnostic and therapeutic challenges and service access and availability. *(10)*. Syndromic management remains widely used for STI care in low- and middle-income countries because of its simplicity and affordability. However, its reliance on symptoms rather than laboratory confirmation can result in missed asymptomatic cases and unnecessary and inappropriate antibiotic use, potentially contributing to AMR. Broader structural and financial barriers also continue to constrain access to STI care, especially in resource-limited settings *(1)*. Although notable achievements – such as eliminating the vertical transmission of syphilis in 18 countries by 2024 – offer a glimmer of hope *(53)*, none of the global 2020 STI control targets were met and global syphilis incidence has since increased, underscoring the need for renewed urgency *(1, 10)*. Meanwhile, AMR compounds these challenges and threatens treatment effectiveness.

- There were an estimated 82.4 million new cases of gonorrhoea in 2020 *(54)*. The continuing rise in drug resistance to *Neisseria gonorrhoeae* over the past decades poses a major threat to control efforts. Resistance has steadily evolved over the past 80 years. *N. gonorrhoeae* has now developed resistance to all major classes of antibiotics used for treatment – including penicillins, sulfonamides, tetracyclines, macrolides (including azithromycin), fluoroquinolones and cephalosporins *(55)*. An especially concerning development is the emergence of *N. gonorrhoeae* strains with resistance to ceftriaxone *(56–59)* – the current WHO-recommended first-line treatment *(60–62)* – and to multiple other antibiotic classes *(61, 63–69)*. Recent data show that nine countries now report reduced susceptibility to ceftriaxone in more than 5% of *N. gonorrhoeae* isolates – exceeding the WHO threshold at which an antibiotic should no longer be used as a first-line empirical treatment *(10)*. Despite these warning signs, global AMR surveillance data for *N. gonorrhoeae* are limited. WHO's Gonococcal Antimicrobial Surveillance Programme and regional initiatives such as Euro-GASP and the Gonococcal Isolate Surveillance Project of the United States Centers for Disease Control and Prevention have been critical for monitoring resistance trends. Within this framework, the Enhanced Gonococcal Antimicrobial Surveillance Programme strengthens laboratory capacity, standardizes sampling protocols linked to epidemiological data and generates additional genomic data, including susceptibility to novel drugs *(63, 70)*. Expanded surveillance – including supplementary protocols on treatment failure, standardized resistance definitions, extragenital sampling and whole-genome sequencing – is urgently needed to detect and respond to emerging resistance and to guide effective treatment policies *(71)*.

- *Mycoplasma genitalium* lacks a cell wall, which renders it intrinsically resistant to β-lactam antibiotics. Beyond this inherent resistance, acquired resistance to other antimicrobial agents is rising, undermining the effectiveness of commonly used treatments. A recent systematic review (2018–2021) estimated the global prevalence of macrolide resistance at 33%, fluoroquinolone resistance at 13% and dual-class resistance at 6% *(72)*. WHO recommends treating symptomatic *M. genitalium* infections, guided by resistance profiles when available, beginning with doxycycline to reduce bacterial load, followed by either azithromycin or moxifloxacin, depending on susceptibility *(73)*. However, in many settings, access to molecular testing remains severely

limited and empirical regimens need to rely on surveillance data or national prescribing practices (antibiotic consumption) for other infections as proxies for resistance *(73)*. Sustaining treatment effectiveness will require global investment in surveillance systems, broader access to diagnostics and resistance testing – including genomic resistance testing for *M. genitalium (74)* – and the development of alternative therapeutic strategies as part of a comprehensive approach to antibiotic stewardship.

- *Treponema pallidum* is the bacterium that causes syphilis, a preventable and curable STI, with an estimated 8 million new adult infections globally reported in 2022 *(75)*. Although 18 countries have successfully eliminated the vertical transmission of syphilis *(53)*, global congenital syphilis rates have escalated sharply and now exceed the 2025 target by more than 2.5-fold *(10)*. Benzathine penicillin G remains the WHO-recommended first-line treatment across all stages *(60, 76)*, especially during pregnancy *(60, 61)*. There have been no documented cases of *T. pallidum* resistance to penicillin despite decades of use. Challenges to penicillin use – including allergic reactions, limited supply and the need for intramuscular administration – are compounded by the scarcity of reliable alternatives *(76, 77)*. Macrolides, once considered a convenient alternative, have been compromised by widespread resistance. A global systematic review and meta-analysis estimated an overall prevalence of 58% (95% confidence interval 42–73%) for the 23S rRNA A2058G macrolide resistance mutation in *T. pallidum* strains tested across all studies reviewed from 2006 to 2021 *(78)*. This high prevalence has substantially limited the utility of azithromycin – and also affects erythromycin, which shares the same target and is still used in some countries. WHO now recommends azithromycin only in special circumstances when local susceptibility is likely *(76)*. When penicillin cannot be used or is unavailable, doxycycline is the preferred *(76)* alternative because of oral administration, lower cost and continued effectiveness. Notably, no treatment failures or resistance-associated mutations have been reported to date to doxycycline, and in vitro studies have failed to induce resistance *(79).* However, doxycycline is contraindicated in pregnancy, and other options such as ceftriaxone may be considered depending on the clinical context *(61).*

Doxycycline post-exposure prophylaxis has emerged as a promising strategy to prevent bacterial STIs – especially syphilis and chlamydia– among transgender individuals and gay men and other men who have sex with men. Although recent studies demonstrate its efficacy, growing use of doxycycline post-exposure prophylaxis raises concerns about the potential to drive AMR to tetracyclines in both target pathogens and in microorganisms that are not the intended target of the treatment but are still affected (such as gut microbiome and non-targeted pathogens) *(80, 81)*. Recognizing both its potential benefits and risks, WHO is currently developing guidelines on using doxycycline post-exposure prophylaxis and its implementation. Expanded AMR surveillance will be critical to ensure that doxycycline post-exposure prophylaxis contributes to STI prevention without undermining long-term treatment effectiveness.

To accelerate progress towards global STI targets, countries must expand access to high-quality, integrated, person-centred STI prevention, testing, treatment and partner services. This includes scaling up screening and testing for STIs, integrating STI services into HIV, reproductive health and primary care platforms and ensuring that service delivery is accessible, inclusive and stigma-free. Community-based and peer-led models – such as mobile clinics and digital outreach – can enhance reach and uptake, especially among key populations. Although ongoing efforts to reduce unmet needs for STI services are essential, the rising threat of AMR requires urgent action. Sustaining the effectiveness of STI prevention and treatment strategies requires a comprehensive approach to antimicrobial stewardship, including expanded AMR surveillance, improved access to resistance testing, continued investment in the research and development of novel diagnostics (such as point-of-care technologies) and treatment options and appropriate use of antibiotics based on up-to-date evidence and susceptibility data. This should include the use of WHO's AWaRe (access, watch, reserve) system to guide the access and use of antimicrobial drugs for STIs, support appropriate empirical treatment when needed, give priority to using antimicrobial drugs where suitable and reinforce appropriate prescribing practices *(60)*. Embedding antimicrobial stewardship principles into STI clinical care – through provider training, treatment guidelines and monitoring of antibiotic use – will be critical to preserving treatment effectiveness and safeguarding the long-term effectiveness of STI control efforts.

Rationale for a coordinated global response

Despite significant progress in prevention and treatment for HIV, hepatitis B and C and STIs, the growing threat of drug resistance risks undermining hard-won gains and risks slowing momentum toward global elimination targets. Current responses remain fragmented across disease programmes, with uneven surveillance, limited stewardship and persistent gaps in equitable access to effective diagnostics and therapies – especially in resource-limited settings. Nevertheless, many diagnostic tools, technologies and laboratory platforms lend themselves to use across infections, offering opportunities for integrated systems that improve efficiency and coverage. These infections share common transmission pathways, affect overlapping populations and are shaped by similar structural determinants of health. Given these shared characteristics, there is a clear opportunity – and need – for a more unified response. Further, the relative impact of drug resistance must be understood in context. For many countries, especially in low- and middle-income settings, the most urgent challenges remain scaling up prevention, diagnosis, linkage to care and access to treatment. Nevertheless, integrating drug resistance considerations within these broader priorities is fundamental to ensure that gains in access and new cures are not undermined as health systems expand coverage.

The Integrated Action Framework gives priority to drug resistance in HIV, hepatitis B and C and three curable STIs – *N. gonorrhoea, Mycoplasma genitalium* infections and syphilis. These diseases, highlighted in Box 1, have been selected because of accelerating resistance patterns, constrained therapeutic options and major gaps in surveillance, all of which pose significant obstacles to global disease elimination efforts.

The next step is to move beyond disease-specific progress toward a coherent global approach that connects efforts across HIV, hepatitis and STIs. By working together across disease programmes and sectors, and in alignment with national AMR action plans, collective action enables more efficient use of resources, fosters shared surveillance and laboratory systems and promotes integrated responses tailored to the realities of affected populations – maximizing impact while building more resilient health systems. The Integrated Action Framework responds to this urgent need by providing a coordinated, multisectoral roadmap for action to prevent the emergence and spread of drug resistance, ensure the continued effectiveness of prevention and treatment tools and accelerate progress toward ending AIDS and the epidemics of hepatitis B, hepatitis C and STIs as public health threats.

Sexual and reproductive health and rights in Nepal, April 2022.

A health worker delivers home-based counselling and care. The setting highlights the need for unified health systems that address overlapping vulnerabilities – a key theme in the rationale for a coordinated global response to drug resistance.

Box 1. Setting priorities for drug resistance within broader HIV, hepatitis and STI responses

Integrating drug resistance into broader HIV, hepatitis and STI responses requires balancing multiple priorities. The pathogens listed here are grouped into tiers to reflect differences in their relative impact and the current evidence base; all remain important for action.

Tier 1 – highest priority

- *Neisseria gonorrhoeae*: causes more than 80 million cases of gonorrhoea annually; resistance has emerged to all major antibiotic classes, including penicillins, tetracyclines, macrolides, fluoroquinolones and cephalosporins. Rising resistance to ceftriaxone, the current WHO-recommended first-line treatment, threatens the last reliably effective option.

- HIV: nearly 40 million people live with HIV globally; resistance undermines both ART and PrEP effectiveness. Emerging resistance to dolutegravir, the backbone of WHO-recommended first-line ART, risks compromising viral suppression outcomes, with PrEP-associated resistance requiring targeted surveillance to safeguard prevention benefits.

Tier 2 – priority

- *Mycoplasma genitalium*: rising acquired resistance, with one third of infections globally resistant to macrolides and more than 10% to fluoroquinolones. Few alternative treatments and limited access to molecular testing make resistance a growing challenge for management.

- HCV: 50 million people live with hepatitis C globally; pangenotypic direct-acting antiviral agents achieve cure in more than 90% of cases. Resistance is uncommon in first-line treatment but highly prevalent among treatment failures, with resistance-associated substitutions detected in most retreatment and relapse clusters. Data remain limited for many genotypes and regions, making surveillance essential.

- HBV: affecting more than 250 million people worldwide, hepatitis B treatment relies on nucleos(t)ide analogues with high genetic barriers, such as tenofovir. However, resistance to older low-barrier drugs such as lamivudine persists, and critical surveillance gaps leave blind spots on emerging resistance across genotypes and regions.

- *Treponema pallidum* (syphilis): causes about 8 million new infections annually; benzathine penicillin remains universally effective with no documented resistance. Nevertheless, persistent supply shortages and allergy concerns make alternatives necessary, and widespread macrolide resistance has compromised these options, leaving few reliable substitutes.

A call for collective action

To address the growing concerns around drug resistance and protect decades of progress in the HIV, hepatitis B and C and STI responses, the Integrated Action Framework defines a unified vision, a goal and strategic objectives to guide global and national efforts through 2030 (Fig. 2). Rooted in the principles of the WHO Global Health Sector Strategies on HIV, viral hepatitis and sexually transmitted infections 2022–2030 and aligned with the Sustainable Development Goals *(1, 2)*, the Integrated Action Framework outlines the actions needed to prevent, detect and respond to drug resistance across these disease areas. It calls for coordinated and immediate action to ensure that drug resistance does not derail elimination targets or undermine access to effective, quality-assured care. This section outlines the shared vision, overarching goal and scope of the Integrated Action Framework, followed by five strategic objectives, guiding principles and the expected impact of collective action by 2030.

Vision

A world in which drug resistance does not undermine efforts to end AIDS and the epidemics of hepatitis B, hepatitis C and STIs as public health threats.

Goal

To prevent the emergence and spread of drug resistance and reduce its impact so that it does not compromise efforts to end AIDS and the epidemics of hepatitis B, hepatitis C and STIs as public health threats by 2030.

Scope

The Integrated Action Framework outlines the key roles and actions of countries, global and national partners, communities, researchers, donors and WHO to address drug resistance in HIV, hepatitis B and C and STIs over the next five years. Structured around five strategic objectives, the Integrated Action Framework provides a coordinated roadmap for action to guide efforts in prevention, monitoring and surveillance, research and innovation, laboratory capacity and governance. It especially emphasizes supporting resource-limited settings, in which targeted and collaborative actions are essential to achieving global elimination targets and preserving the effectiveness of current and future prevention and treatment interventions.

The Integrated Action Framework addresses drug resistance in HIV, hepatitis B virus, hepatitis C virus and the three priority curable STI pathogens: *N. gonorrhoeae*, *M. genitalium* and *T. pallidum*. As outlined in Box 1, these pathogens are given priority because of their rising resistance trends, limited treatment alternatives or persistent surveillance gaps, which together pose critical challenges for global disease control.

The WHO Global Health Sector Strategies on HIV, viral hepatitis and sexually transmitted infections also recognize the public health importance of *Chlamydia trachomatis* and *Trichomonas vaginalis*. However, current evidence suggests that resistance is unlikely to emerge for *C. trachomatis* and remains of uncertain clinical relevance for *T. vaginalis*. Although chlamydia and trichomoniasis are not a primary focus of the Integrated Action Framework, their continued inclusion in prevention, diagnosis and treatment efforts remains essential to the broader STI response.

Fig. 2. Vision, goals and strategic objectives of the Integrated Action Framework

Vision

A world in which drug resistance does not undermine efforts to end AIDS and the epidemics of hepatitis B, hepatitis C and STIs as public health threats.

Goal

To prevent the emergence and spread of drug resistance and reduce its impact so that it does not compromise efforts to end AIDS and the epidemics of hepatitis B, hepatitis C and STIs as public health threats by 2030.

Strategic objectives

Monitoring and surveillance

Strengthen national surveillance systems to generate continuous, reliable and actionable data on drug resistance in HIV, hepatitis B and C and STIs

Collect and analyse data from routine patient care to assess the quality of service delivery for HIV, hepatitis B and C and STIs to inform interventions that help to prevent the emergence and spread of drug resistance

Laboratory capacity

Build, strengthen and expand robust, high-quality laboratory systems – including shared infrastructure and personnel where appropriate – to monitor the effectiveness of treatment outcomes and to conduct drug resistance surveillance for HIV, hepatitis B and C and STIs

Prevention and response

Implement high-impact, people-centred interventions to prevent infections and to prevent, detect and respond to drug resistance in HIV, hepatitis B and C and STIs

Research and innovation

Close critical knowledge gaps on the risk and drivers of drug resistance to current and emerging therapies, including service delivery factors that affect treatment outcomes

Drive relevant and innovative research aimed at developing and delivering interventions that prevent, minimize and manage drug resistance and improve treatment success for HIV, hepatitis B and C and STIs

Governance and enabling mechanisms

Ensure that governance and enabling mechanisms – including country ownership, community engagement, advocacy and communication, coordinated action and sustainable funding – are in place to effectively support actions on drug resistance for HIV, hepatitis B and C and STIs

Guiding principles and enablers

The Integrated Action Framework is underpinned by a set of guiding principles (Table 2) that reflect core public health values and lessons learned from national and global efforts to address HIV, hepatitis B and C and STIs.

Public health approach

A public health approach to drug resistance aims to maximize access to high-quality prevention, diagnostic and treatment services at the population level. It gives priority to simplified, standardized and scalable interventions that can be adapted across diverse settings, especially in resource-limited settings, while recognizing the challenges posed by limited resources and infrastructure.

People-centred approach

The Integrated Action Framework adopts WHO's people-centred approach to addressing AMR, which places individuals, their needs and their experiences at the centre of the response. This approach focuses on overcoming the health system and societal barriers people face when seeking prevention, diagnosis and treatment. It informs the design and delivery of Integrated Action Framework actions to ensure that services are accessible, acceptable, affordable and available to all, within a framework of high quality, stigma-free and people-centred care. By addressing AMR through a people-centred lens, the Integrated Action Framework supports more responsive and equitable health systems.

Strategic coordination and partnership

Effective responses to drug resistance requires strong coordination and collaboration among governments, communities, researchers, donors and development agencies, the private sector, WHO and other partners. Strategic partnerships and multisectoral alignment help to mobilize resources, harmonize efforts, avoid duplication and strengthen both national and global capacity. Coordinated action fosters greater efficiency, sustainability and shared accountability in implementing the Integrated Action Framework.

Country ownership and sustainability

The Integrated Action Framework has been developed with the engagement of focus countries, ensuring that national realities shape its priorities and actions. National governments are central to leading and sustaining responses to drug resistance. Country ownership enables context-specific implementation and ensures equitable and high-quality care that is responsive to the needs of affected populations. National leadership is critical for institutionalizing surveillance, investing in laboratory systems and scaling access to prevention tools, diagnostic testing and treatment. Mobilizing sustainable domestic resources is especially vital to sustain long-term efforts and ensure impact. Strong integration with existing national and regional regulatory systems will be critical to avoid duplication, ensure efficiency and accelerate access to quality-assured medicines and diagnostics.

Strategic investment and efficient use of resources

The Integrated Action Framework promotes targeted, efficient and sustainable investment in drug resistance responses, with a focus on interventions that deliver the greatest public health value. This requires long-term international, regional and national commitments to provide predictable technical and financial resources, enabling countries to sustain the availability of diagnostics, vaccines and appropriate treatments as well as capacity in prevention, monitoring and response. Resources should be allocated based on local priorities, equity considerations and opportunities to strengthen health systems, ensuring long-term impact across HIV, hepatitis B and C and STIs.

Equity and community engagement

The Integrated Action Framework gives priority to equitable access to health-care services and recognizes the critical role of affected communities, civil society and community-led organizations in raising awareness, advocating for high-quality and person-centred health services, supporting service delivery and contributing to prevention, monitoring and the response to drug resistance. It emphasizes that prevention, diagnosis and treatment must be accessible to all, especially those disproportionately affected, within a framework free from stigma and discrimination. Addressing stigma, discrimination and structural barriers is required to reach those most severely affected, empower communities and ensure that no one is left behind.

Innovation and evidence-informed action

The Integrated Action Framework encourages investment in research and innovation to improve tools and approaches for preventing, diagnosing and treating infections – and for preventing the emergence and spread of drug resistance. It underscores the value of transparent data sharing and multisectoral collaboration to generate and apply high-quality evidence. Harnessing data to inform adaptive strategies and guide the development of new drugs, diagnostics and delivery models is essential to stay ahead of evolving threats.

Table 2. Guiding principles and enablers of the Integrated Action Framework at a glance

PRINCIPLE	SUMMARY
Public health approach	Scalable, simplified and equitable access to essential services
People-centred approach	Address barriers to care and place people's needs at the centre of the response
Strategic coordination and partnerships	Collaborate across sectors and partners to align efforts and maximize impact
Country ownership and sustainability	Lead nationally and implement context-specific strategies
Strategic investment and efficient use of resources	Allocate resources to maximize public health impact and cost-effectiveness
Equity and community engagement	Reach underserved populations and empower affected communities
Innovation and evidence-informed action	Invest in research and use data to guide adaptive, effective responses
Standardization and quality assurance	Use harmonized methods and quality systems to generate reliable data
Integrated and disease-specific approaches	Promote cross-cutting action while tailoring disease-specific needs
Workforce development	Invest in training, mentorship and retention to build and sustain a skilled, motivated workforce

Standardization and quality assurance

Standardized approaches to drug resistance surveillance, laboratory testing and data sharing and analysis are essential for generating reliable, comparable and actionable data. Quality systems, including external quality assurance, must be embedded within routine monitoring to inform timely and appropriate programmatic responses.

Integrated and disease-specific approaches

The Integrated Action Framework promotes cross-cutting strategies that integrate responses to drug resistance in HIV, hepatitis B and C and STIs wherever appropriate – maximizing synergy, reducing fragmentation and strengthening health systems. These efforts are anchored in primary health care and broader integrated health systems, ensuring that responses contribute to stronger, more resilient services overall. This includes approaches such as co-locating diagnostic services, coordinating surveillance systems and linking with national AMR surveillance platforms established for other infections, pooling procurement of supplies and sharing laboratory equipment (such as sequencing platforms) and specialized personnel across programmes. In addition, the Integrated Action Framework recognizes the need for disease-specific interventions, technologies and delivery models tailored to the unique pathogen characteristics, epidemiology, populations and programmatic requirements of each disease area.

Human resource capacity-building and workforce development

Sustained responses to drug resistance require a skilled, adequately supported and equitably distributed workforce. Building and retaining human resource capacity across the clinical, laboratory, public health, research and community sectors is critical for implementing and scaling prevention, diagnosis, treatment, surveillance and research and innovation. This requires long-term investment in training, mentorship and career development, especially in low- and middle-income countries, and integrating workforce planning into national health strategies. By fostering expertise across generations and disciplines, countries can strengthen resilience, ensure the continuity of services and drive innovation to address evolving drug resistance challenges.

Health Workforce in Kisumu County – 26 April 2024.

Clinician Victoria at Railways Health Clinic exemplifies frontline workforce capacity. The setting reflects the importance of investing in training, support and equitable distribution to sustain responses to drug resistance.

Strategic directions of the Global Health Sector Strategies on HIV, viral hepatitis and sexually transmitted infections, 2022–2030

The Integrated Action Framework builds on the foundation of the five strategic directions of the Global Health Sector Strategies on HIV, viral hepatitis and sexually transmitted infections, 2022–2030. These directions provide an overarching guidance for coordinated action across diseases, guiding countries in strengthening their responses to drug resistance through comprehensive, people-centred and system-oriented approaches.

Strategic direction 1: Deliver high-quality, evidence-based, people-centred services

Expand access to a continuum of essential, high-quality services for HIV, hepatitis B and C and STIs tailored to the needs of diverse populations and settings. Ensure that service delivery is guided by evidence and innovation and that no one is left behind.

Strategic direction 2: Optimize systems, sectors and partnerships for impact

Promote synergy across health systems – including governance, financing, health workforce and supply chains – and engage multisectoral partnerships to address social and structural determinants of health.

Strategic direction 3: Generate and use data to drive decisions for action

Use high-quality, disaggregated data to monitor progress, guide programmatic and policy decisions and promote accountability, innovation and research.

Strategic direction 4: Engage empowered communities and civil society

Recognize and support the leadership of communities and civil society in advocacy, service delivery and policy-making. Ensure that responses are rights based, culturally appropriate and free from stigma and discrimination.

Strategic direction 5: Foster innovations for impact

Advance research and innovation agendas that enable the development and scale-up of new technologies, service delivery models and system solutions to overcome barriers and accelerate progress.

Integrated Action Framework strategic objectives

The Integrated Action Framework is organized around five areas of work: (1) prevention and response, (2) monitoring and surveillance, (3) research and innovation, (4) laboratory capacity and (5) governance and enabling mechanisms.

Strategic objective 1: Prevention and response

Implement high-impact, people-centred interventions to prevent infections and to prevent, detect and respond to drug resistance in HIV, hepatitis B and C and STIs.

Strategic objective 2: Monitoring and surveillance

Strengthen national surveillance systems to generate continuous, reliable and actionable data on drug resistance in HIV, hepatitis B and C and STIs and collect and analyse data from routine clinical care to assess the quality of service delivery for HIV, hepatitis B and C and STIs to inform interventions that help to prevent the emergence and spread of drug resistance.

Strategic objective 3: Research and innovation

Close critical knowledge gaps on the risk and drivers of drug resistance to current and emerging therapies, including service delivery factors that affect treatment outcomes, and drive relevant and innovative research aimed at developing and delivering interventions that prevent, minimize and manage drug resistance and improve treatment success for HIV, hepatitis B and C and STIs.

Strategic objective 4: Laboratory capacity

Build, strengthen and expand robust, high-quality laboratory systems – including shared infrastructure and personnel where appropriate – to monitor the effectiveness of treatment outcomes and to conduct drug resistance surveillance for HIV, hepatitis B and C and STIs.

Strategic objective 5: Governance and enabling mechanisms

Ensure that governance and enabling mechanisms – including country ownership, community engagement, advocacy and communication, coordinated action and sustainable funding – are in place to effectively support actions on drug resistance for HIV, hepatitis B and C and STIs.

Expected impact by 2030

Implementation of the Integrated Action Framework is an important component of global efforts to end AIDS and the epidemics of hepatitis B, hepatitis C and STIs as public health threats. Together with efforts to expand access to prevention, diagnosis and treatment, the Integrated Action Framework will help to preserve the effectiveness of currently recommended and future prevention and treatment regimens by directly addressing drug resistance through coordinated, multisectoral action – mitigating the emergence and impact of drug resistance and reducing incident cases and the need for more complex and costly alternatives.

Strengthened surveillance and integrated quality-focused laboratory systems will enable earlier detection of treatment failure and drug resistance, supporting more rapid and more effective public health responses. Integrated, people-centred service delivery for HIV, hepatitis B and C and STIs will expand access, improve equity and enhance service quality – while improving the use of limited resources through coordinated delivery and shared infrastructure.

Ongoing investment in research and innovation is required to close knowledge gaps, develop targeted interventions and advance new tools to prevent, detect and manage resistance. These efforts will accelerate progress toward elimination targets while enhancing the resilience of health systems and contributing to global health security. Importantly, these gains will depend on sustained political commitment, community engagement and long-term financing to ensure durable, country-led responses. When fully implemented at scale, the Integrated Action Framework is expected to yield long-term cost savings by reducing treatment failure, minimizing the need for more complex and costly treatment options and safeguarding existing investments in diagnostic tests, medicines and service delivery.

Theory of change

The Integrated Action Framework is underpinned by a theory of change (Fig. 3) that envisions a world in which drug resistance does not undermine efforts to end AIDS and the epidemics of hepatitis B, hepatitis C and STIs as public health threats. Achieving this vision requires coordinated action aligned with the five strategic directions of the Global Health Sector Strategies on HIV, viral hepatitis and sexually transmitted infections (2022–2030) and the four strategic priorities of WHO's strategic and operational response to AMR in the human health sector (2025–2035) and the updated second global action plan on antimicrobial resistance *(1, 82)*. These complementary frameworks guide countries in delivering people-centred services, strengthening systems and partnerships, generating and using data for action, engaging empowered communities and fostering innovation. The Integrated Action Framework translates these directions into a comprehensive roadmap for action that integrates disease-specific and shared interventions across prevention and response, monitoring and surveillance, research and innovation, laboratory capacity and governance and enabling mechanisms. These actions are supported by a set of enablers – including a public health approach, multisectoral collaboration, integrated and disease-specific strategies, community engagement, innovation and evidence-informed action, quality systems, country ownership and sustainability. Together, they aim to deliver key outcomes: the implementation of high-impact interventions; strengthened health, laboratory and surveillance systems; reliable drug resistance data; meaningful community engagement; and the generation of innovative solutions. By 2030, this coordinated effort will contribute to ending AIDS and the epidemics of viral hepatitis and STIs, reducing the burden of drug-resistant infections and advancing the target of the Political Declaration of the 2024 United Nations General Assembly High-level Meeting on Antimicrobial Resistance of reducing global AMR-related deaths by 10%.

Fig. 3. Theory of change of the Integrated Drug Resistance Action Framework for HIV, Hepatitis B and C and Sexually Transmitted Infections, 2026–2030

Vision: A world in which drug resistance does not undermine efforts to end AIDS and the epidemics of hepatitis B and C and STIs as public health threats

Strategic direction from GHSS 2022–2030[a]	AMR strategic priority[b]	Interventions: a comprehensive roadmap for action under the Integrated Action Framework	Desired outcomes of the Integrated Action Framework's strategic objectives	Impact
1. Deliver high-quality evidence-based people-centred services	1. Prevention 2. Access to diagnosis and treatment		**Prevention and response:** high-impact interventions are implemented to prevent and diagnose infection and to detect, prevent and respond to drug resistance in HIV, hepatitis B and C and STIs	**By 2030,** End AIDS and the epidemics of viral hepatitis and STIs Reduce the burden of drug-resistant HIV, viral hepatitis and STIs
2. Optimize systems, sectors and partnerships for impact	1. Prevention 2. Access to diagnosis and treatment 3. Strategic information, science and innovation		**Prevention and response:** health service delivery systems are enhanced to ensure consistent quality of care and integration of resistance data into routine service delivery **Laboratory capacity:** laboratory systems are strengthened to provide quality-assured treatment monitoring and drug resistance testing **Monitoring and surveillance:** drug resistance surveillance systems are institutionalized to detect, track and report resistance trends across HIV, hepatitis B and C and STIs	
3. Generate and use data to drive decisions for action	3. Strategic information, science and innovation		**Monitoring and surveillance:** reliable and actionable drug resistance data are obtained routinely through systematic surveillance and programmatic data analysis, enabling improved quality of care and informed public health interventions	
4. Engage empowered communities and civil society	4. Governance and financing		**Governance and enabling mechanisms:** • Communities and civil society are meaningfully engaged in advocacy, optimizing service delivery, programmatic monitoring and holding health programmes accountable to community needs and priorities • Structural barriers, stigma and discrimination are addressed to ensure equitable access and appropriate use of prevention, diagnostic and treatment tools • Governance and coordination mechanisms are established to lead and align national responses, incorporating i-GAP priorities into health policies and plans • Sustainable financing mechanisms are in place to support long-term implementation by mobilizing domestic and external resources	
5. Foster innovations for impact	3. Strategic information, science and innovation		**Research and innovation:** relevant and innovative research is catalysed to develop interventions with the greatest public health impact in minimizing drug resistance in HIV, viral hepatitis and STIs	

Guiding principles and enablers:

- Public health approach
- Multisectoral collaboration
- Integrated and disease-specific approaches
- Country ownership and sustainability
- Community engagement
- Innovation and evidence-informed action
- Strategic investment and efficiency
- Quality systems
- Workforce development

[a] Global Health Sector Strategies on, respectively, HIV, viral hepatitis and sexually transmitted infections for the period 2022–2030 *(1)*.

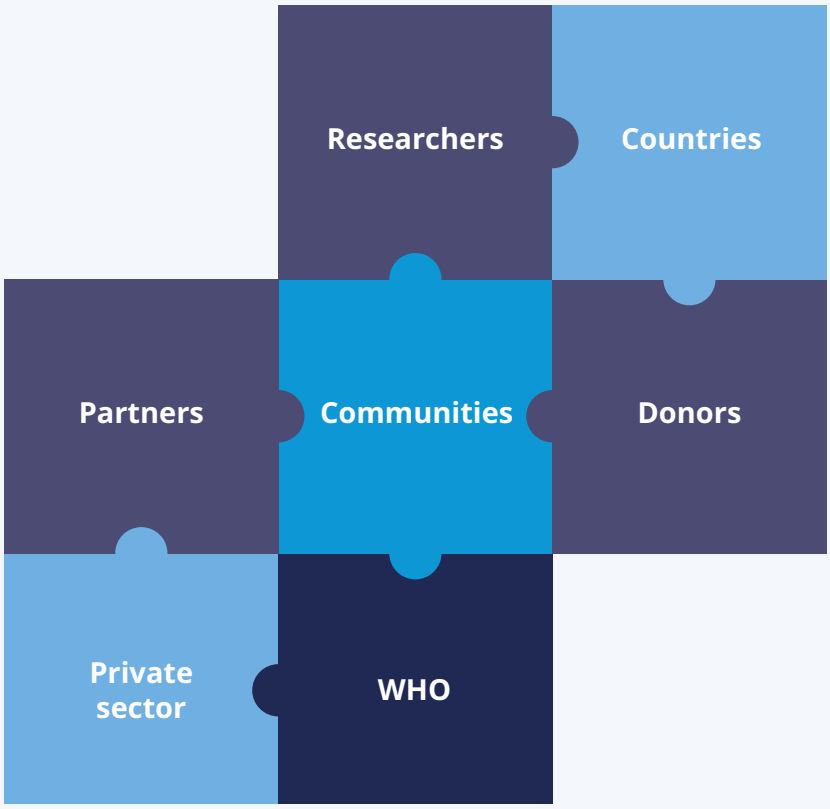
[b] WHO strategic and operational priorities to address drug-resistant bacterial infections in the human health sector, 2025–2035 *(82)*.

Addressing drug resistance: a shared responsibility

Preventing and responding to drug resistance in HIV, hepatitis B and C and STIs requires more than technical interventions – it requires sustained political commitment, community leadership and engagement, scientific innovation and long-term investment. Success hinges on clearly defined roles and collaboration across countries, communities, researchers, implementing partners, donors and development agencies, the private sector and WHO (Fig. 4). Ensuring that these roles are understood as part of a shared global commitment, paired with locally driven solutions and sustained through visible, incremental progress, will help to keep stakeholders engaged and accountable through 2030.

This section outlines the shared responsibilities of key stakeholders in putting the vision, goal and strategic objectives of the Integrated Action Framework into operation. These responsibilities are aligned with the multisectoral roadmap for action that follows and provide a foundation for integrated and accountable responses to drug resistance.

Fig. 4. Putting the Pieces Together: Multisectoral Collaboration on Drug Resistance



This illustration presents the key stakeholders as interconnected puzzle pieces—emphasising that addressing drug resistance in HIV, hepatitis B and C, and sexually transmitted infections requires all actors to work together. Countries, communities, researchers, partners, donors, the private sector, and WHO each play a distinct but interlocking role in operationalising the Integrated Action Framework and building a coordinated, accountable response.

Countries

National governments have a central leadership role in coordinating and implementing responses to drug resistance in collaboration with affected communities. This includes developing and executing national AMR action plans and guidelines, integrating drug resistance into broader health and AMR strategies and ensuring routine monitoring of treatment outcomes and drug resistance. Countries are also responsible for strengthening laboratory and surveillance systems, institutionalizing stewardship practices and ensuring access to high-quality care across disease areas. These efforts depend on the active engagement of public health services and health-care providers, including clinicians, pharmacists, microbiologists and other frontline professionals who play a vital role in prevention, early detection, antimicrobial stewardship, data management and coordinated responses. Educating and equipping health-care workers to identify and respond to resistance are essential to improve clinical outcomes and support national efforts. Sustained political commitment and increased national budgetary support are essential to institutionalize these efforts, especially in the context of competing public health priorities in resource-limited settings.

Global and national partners

Bilateral and multilateral agencies, technical partners and nongovernmental organizations play a critical role in supporting countries to build capacity, strengthen data systems and implement integrated and equitable service delivery models. They contribute to developing national laboratory and surveillance infrastructure, facilitating access to diagnostics, improving supply chains and strengthening workforce capacity. These partners also help to harmonize technical support, align resources and advocate for integrating drug resistance priorities into health sector plans.

Communities

Communities, including people with lived experience, are fundamental in advocating for equitable access to person-centred, quality-assured prevention, diagnosis and treatment services. They help to monitor programme performance through community-led accountability, raise awareness about drug resistance and promote health literacy. Community networks are also instrumental in reducing stigma and discrimination and other structural barriers, generating demand for prevention services (including post-exposure prophylaxis and PrEP for HIV, tenofovir prophylaxis for eligible pregnant women to prevent the vertical transmission of HBV and hepatitis B vaccination) and amplifying calls for stronger policies and increased resource allocation.

Researchers

Researchers in academic institutions, public health agencies and the private sector play a critical role in generating evidence and developing tools to prevent, interpret and address drug resistance in HIV, hepatitis B and C and STIs. They contribute to identifying research gaps, collaborate in setting priorities and implement national and global research agendas in coordination with WHO, national programmes and expert networks. Research efforts should address new and existing diagnostics, treatments and prevention tools – including vaccines and long-acting antiviral formulations – and assess resistance to current and emerging therapies. Mathematical and epidemiological modelling can help to estimate the burden of resistance, project the impact of interventions and guide evidence-informed strategies. Operational and implementation research is essential to improving service delivery, treatment adherence, behaviour change and access to care. Researchers also must support the timely dissemination and translation of findings into policies and scalable interventions, ensuring that evidence informs practice and contributes to reducing the burden of drug resistance.

Donors and development agencies

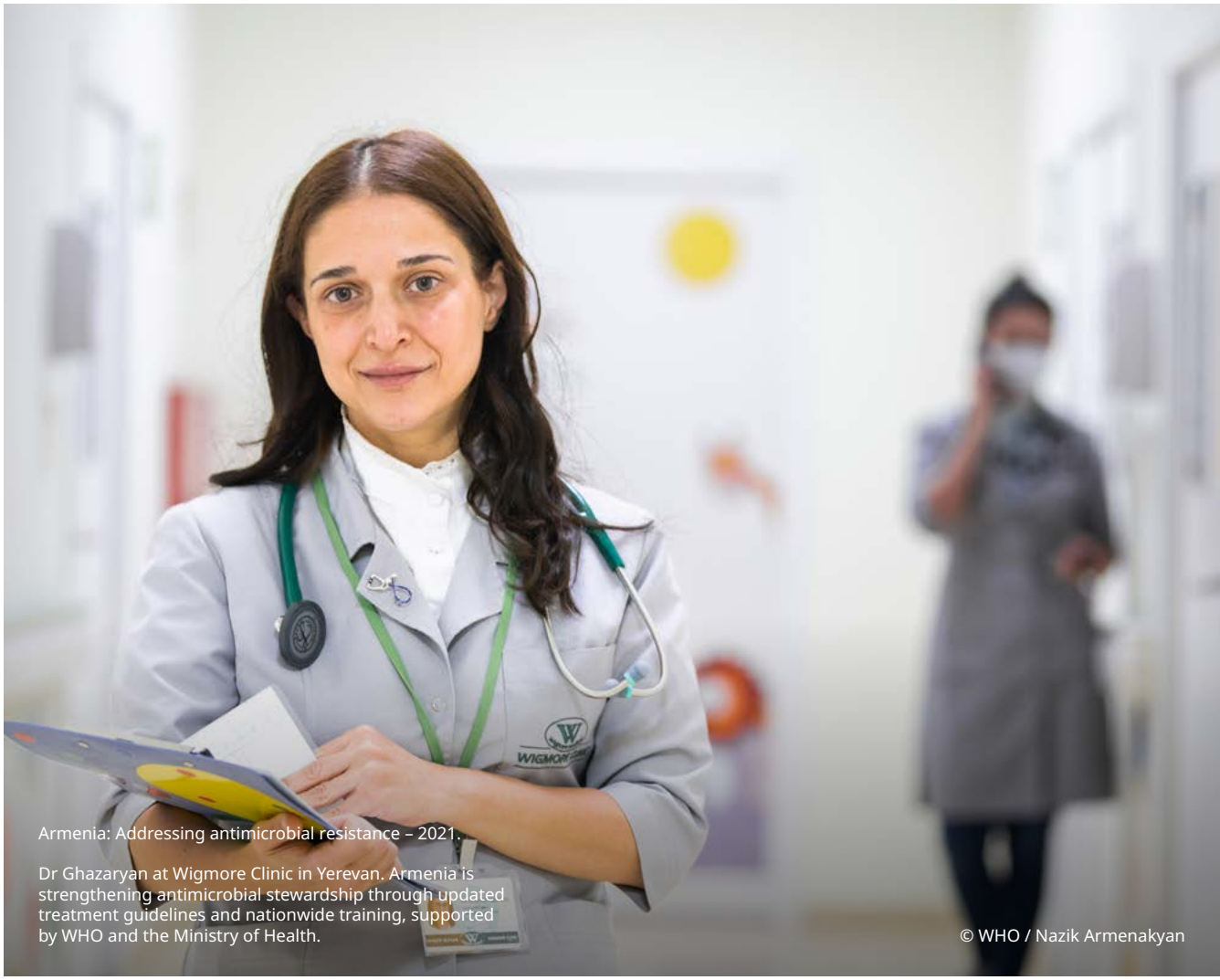
Donor and development agencies play a crucial role in facilitating national and global responses to drug resistance. Sustainable financing is crucial for effective long-term efforts to prevent and control drug resistance. Donors and development agencies are encouraged to invest in national and regional plans, facilitate co-financing and integration into broader health investments and support innovations in service delivery, prevention, diagnostics and medicines. Their financial support ensures that drug resistance efforts remain visible and high priority within global health agendas.

Private sector

Private health-care providers and clinics deliver prevention, testing and treatment services for HIV, hepatitis B and C and STIs and play a key role in ensuring that care aligns with national guidelines and reflects current drug resistance trends. They contribute to antimicrobial stewardship by promoting appropriate prescribing practices, participating in training led by health authorities and coordinating with public programmes to support continuity of care and treatment adherence. The pharmaceutical and diagnostics industries are responsible for developing and delivering effective, affordable and accessible products to support prevention, diagnosis and treatment. This includes investing in long-acting formulations for both prevention and treatment, simplified testing platforms and effective vaccines. The private sector also plays a role in monitoring drug resistance by conducting post-marketing surveillance, sharing relevant data and collaborating with public health authorities to detect and respond to emerging threats. In addition, the private sector is responsible for ensuring that product availability, marketing and distribution practices align with the principles of responsible antimicrobial stewardship. The private sector also plays a key role in technology transfer, supply chain strengthening and fostering public–private partnerships to scale access to innovations where they are needed most.

WHO

WHO provides global leadership by developing evidence-informed technical guidance and standards, convening partners and supporting countries with technical assistance. It coordinates global drug resistance surveillance initiatives and laboratory networks, facilitates alignment across health areas and ensures that strategic priorities are translated into action. WHO leads global agenda-setting, supports research priority-setting and promotes the integration of drug resistance prevention, monitoring and response into HIV, hepatitis B and C and STI strategies at the national, regional and global levels, while ensuring alignment with the broader One Health AMR response within WHO and across sectors.



Armenia: Addressing antimicrobial resistance – 2021.

Dr Ghazaryan at Wigmore Clinic in Yerevan. Armenia is strengthening antimicrobial stewardship through updated treatment guidelines and nationwide training, supported by WHO and the Ministry of Health.

Roadmap for action

This section presents a forward-looking implementation roadmap to guide strategies to prevent and respond to drug resistance in HIV, hepatitis B and C and STIs. Grounded in the strategic objectives of the Integrated Action Framework, the roadmap outlines actions for countries, global and national partners, communities, researchers, donors, private sector and development agencies and WHO. Each domain of the Integrated Action Framework roadmap supports the WHO core package of people-centred AMR interventions *(6)*, ensuring alignment with broader efforts to integrate AMR responses into national health strategies.

The roadmap is intended to serve as a flexible guide. Actions should be adapted to regional and national contexts and priorities set according to local epidemiology, resources and infrastructure in collaboration with relevant stakeholders.

It recognizes that activities may cut across disease areas or be disease specific, depending on the country context and priorities.

Importantly, the roadmap is underpinned by antimicrobial stewardship principles, including the appropriate use of medicines in alignment with WHO guidelines, strengthened diagnostic testing capacity, infection prevention and control, monitoring of treatment outcomes and surveillance of drug resistance. It also emphasizes the importance of education and training for prescribers, communities and policy-makers to promote informed decision-making and improve adherence to stewardship practices. By translating high-level goals into targeted, actor-specific responsibilities, the roadmap facilitates coordinated and sustained action, enabling integration into health systems and alignment with existing initiatives.

Prevention and response

Strategic objective

Implement high-impact, people-centred interventions to prevent infections and to prevent, detect and respond to drug resistance in HIV, hepatitis B and C and STIs

Preventing and responding to drug resistance requires coordinated, high-impact interventions across all levels of the health system and among a wide range of stakeholders. Table 3 sets out multisectoral actions to support the implementation of the prevention and response strategic objective.

These actions include cross-cutting interventions – including promoting responsible antimicrobial use, optimizing service delivery models to support adherence, strengthening health literacy and provider education and reducing stigma and discrimination – alongside disease-specific actions. These include expanding access to HIV post-exposure prophylaxis and PrEP and ensuring integrated antenatal care services to eliminate the vertical transmission of HIV, syphilis and hepatitis B. A cornerstone intervention is scaling up hepatitis B vaccination (timely birth dose, completion of the full series and catch-up for unvaccinated adolescents and at-risk groups), the only widely available vaccine-based strategy among the diseases addressed by the Integrated Action Framework. Together, these interventions reduce the incidence of diseases, thereby limiting the need for antimicrobial treatment and helping to curb the emergence and spread of drug resistance.

Timely and effective treatment of people with HIV, hepatitis B and C and STIs is also a critical priority. These interventions are designed to address the health system and societal barriers that individuals and communities face in accessing timely, acceptable, affordable and consistently available prevention, diagnosis and treatment services – especially for populations at greater risk or disproportionately affected – reflecting WHO's people-centred approach to AMR. For STIs, the WHO AWaRe system *(60)* provides practical guidance to support the use of appropriate empirical treatment,

when needed, to give priority to using antimicrobial drugs and reinforce stewardship efforts.

To ensure that responses are people-centred, equitable and sustainable, this roadmap promotes the integration of services into delivery platforms that are responsive to local context – anchored in primary health care and contributing to stronger integrated health systems – including community preferences, health system capacity and structural barriers to care. This includes tailoring delivery models to overcome barriers such as cost, distance, stigma, vaccine hesitancy or lack of trust in providers.

Key antimicrobial stewardship elements embedded in this roadmap include:

- optimizing treatment and supporting adherence to improve clinical outcomes and reduce the likelihood of AMR;
- ensuring the regular development, dissemination and use of up-to-date, evidence-informed treatment guidelines;
- education and training for prescribers, health-care workers and communities to promote informed prescribing and responsible use of antimicrobial agents;
- policies and practices that discourage the misuse of antimicrobial agents, including self-medication and inappropriate prescribing; and
- infection prevention and control measures such as vaccination, prophylaxis, eliminating vertical transmission and early diagnosis and treatment to prevent new infections and reduce transmission, thereby lowering the need for using antimicrobial agents and preserving drug effectiveness.

By fostering coordinated action across stakeholder groups and promoting integrated, people-centred approaches, the roadmap promotes the translation of antimicrobial stewardship principles into practice – supporting the scale-up of interventions that are contextually appropriate, responsive to people's needs and sustainable.

When implemented collectively, these actions will contribute to reducing the emergence and spread of drug resistance by improving prevention and treatment outcomes, thereby supporting progress toward ending AIDS and the epidemics of hepatitis B, hepatitis C and STIs as public health threats.

South Africa: HIV and STI prevention and treatment – May 2024.

Dr Jacobs and Mzwabantu during a consultation at Site B "Ubuntu" Clinic in Khayelitsha. The clinic's ART Club model supports adherence and access to treatment, illustrating people-centred interventions to prevent and respond to drug resistance.

Table 3. Actions for preventing and responding to drug resistance in HIV, hepatitis B and C and STIs

<table>
<tr><th>KEY ACTORS</th><th colspan="3">ACTIONS</th></tr>
<tr><td rowspan="11">Countries</td><td colspan="3">Develop and regularly review, update and implement national policies, guidelines and protocols for HIV, hepatitis B and C and STI prevention, testing, treatment, drug resistance testing and service delivery, ensuring alignment with WHO recommendations</td></tr>
<tr><td colspan="3">Strengthen supply chain systems to ensure uninterrupted availability of quality-assured drugs and diagnostic tests, reducing the risk of treatment interruptions, intermittent dosing and drug sharing that contribute to resistance, and link with national systems to prevent, detect and respond to substandard or counterfeit products</td></tr>
<tr><td colspan="3">Strengthen prevention and treatment services, increasingly delivered through primary health care and integrated health systems, to enhance the quality of care, overcome barriers to the availability, accessibility, affordability and acceptability of prevention, diagnosis, treatment and care services, support adherence to prophylaxis and treatment and reduce the risk of drug resistance in HIV, hepatitis B and C and STIs</td></tr>
<tr><td colspan="3">Implement and enforce policies that support antimicrobial stewardship to prevent and respond to drug resistance in HIV, hepatitis B and C and STIs by regulating antimicrobial drug use and promoting responsible prescribing practices</td></tr>
<tr><td colspan="3">Use findings of routine treatment outcome monitoring, drug resistance surveillance and quality-of-care indicators to identify and address programmatic gaps in service delivery</td></tr>
<tr><td colspan="3">Strengthen health literacy about drug resistance among health-care workers and communities to enhance AMR prevention and response efforts in HIV, hepatitis B and C and STIs, ensuring that materials are culturally appropriate and tailored to local literacy levels and information needs. Enhance education on laboratory test result interpretation, treatment goals, antimicrobial stewardship and drug resistance prevention</td></tr>
<tr><td colspan="3">Create enabling environments in health-care settings and communities to reduce stigma and discrimination and to ensure that services for prevention and treatment for HIV, hepatitis B and C and STIs are equitable, acceptable, people-centred and tailored to local needs</td></tr>
<tr><td colspan="3">Develop supply chain resilience plans, including buffer stocks, diversified suppliers, arrangements for delivery and rapid redistribution protocols during emergencies</td></tr>
<tr><td colspan="3">Establish safeguards to ensure continuity of care during pandemics, conflicts or natural disasters</td></tr>
<tr><td>HIV</td><td>Hepatitis B and C</td><td>STIs</td></tr>
<tr><td>• Provide equitable access to and support adherence for HIV PrEP and post-exposure prophylaxis to prevent new infections, reduce the long-term burden on treatment programmes and reduce the risk of drug-resistant HIV
• Expand ART access and strengthen adherence support to achieve and sustain viral suppression, reinforcing the “undetectable = untransmittable” concept as a core strategy to prevent HIV transmission and minimize the emergence of drug-resistant HIV through reduced viral load and treatment continuity
• Ensure universal access to antenatal testing, ART, delivery services and infant prophylaxis to prevent the vertical transmission of HIV</td><td>• Scale up and ensure equitable access to hepatitis B vaccination to prevent new infections (giving priority to the timely birth dose within 24 hours and completing the full schedule while also ensuring catch-up vaccination for adolescents and at-risk adults), thereby minimizing the long-term treatment burden and the risk of antiviral drug resistance
• Address hepatitis B vaccine hesitancy through targeted education and community engagement strategies
• Provide antenatal services, including tenofovir prophylaxis for eligible pregnant women, to prevent the vertical transmission of hepatitis B
• Expand access to timely and appropriate hepatitis B diagnosis and treatment in accordance with WHO recommendations as a key strategy to prevent disease progression, reduce transmission and minimize the emergence of drug-resistant HBV strains
• Expand access to timely hepatitis C diagnosis and curative treatment with direct-acting antiviral agents, thus reducing transmission and the risk of the emergence of drug-resistant HCV</td><td>• Scale up STI diagnostic testing and treatment by integrating services into expanding primary health care systems, ensuring timely detection and appropriate antibiotic use, thereby preventing drug-resistant infections
• Implement antenatal syphilis screening and timely treatment protocols to eliminate congenital syphilis
• Promote measures to prevent self-medication and inappropriate antibiotic use and strengthen regulatory enforcement to reduce the risk of AMR – thereby preserving the effectiveness of treatments for STIs and other infections. This includes using WHO’s AWaRe classification (60) to guide antibiotic selection and supporting stewardship efforts where empirical treatment is needed</td></tr>
</table>

KEY ACTORS	ACTIONS
Global and national partners	Support the strengthening of institutional and community capacity to enhance the quality of HIV, hepatitis B and C and STI programmes and services, including strengthened stewardship efforts, treatment adherence support, antimicrobial drug stock-out prevention and monitoring of treatment outcomes
	Support countries in strengthening forecasting, procurement and supply chain management systems to maintain consistent access to antimicrobial medicines and diagnostics, thereby preventing treatment interruptions that can drive AMR
	Support local initiatives to optimize the quality of care and prevent drug resistance and facilitate the scale-up of evidence-informed, sustainable interventions
	Support countries in strengthening the use of routine programmatic data for the purpose of optimizing care and treatment for HIV, hepatitis B and C and STIs to minimize the emergence and transmission of preventable drug resistance
	Participate in country-led dialogues to review, share and triangulate all available data sources to characterize drug resistance and support the development and implementation of evidence-informed policies, guidance and actions to prevent HIV, hepatitis B and C and STI drug resistance
Communities	Advocate for high-quality, stigma-free and accessible person-centred health service delivery to improve overall health and prevent the emergence of drug resistance in HIV, hepatitis B and C and STIs
	Engage in community-led monitoring and advocacy to ensure the use of treatment outcome monitoring, drug resistance surveillance findings and quality-of-care indicator results to identify opportunities to optimize service delivery
	Drive demand for comprehensive prevention, diagnosis, care and treatment and testing services for treatment outcome monitoring and drug resistance, thereby holding health programmes accountable to community needs
	Promote acceptance of hepatitis B vaccination, including birth dose, infant schedule and catch-up opportunities, by engaging trusted community voices, addressing local concerns and misinformation and advocating for its accessibility, availability and affordability
	Engage in education efforts about the responsible use of antimicrobial drugs and raise awareness about AMR
	Collaborate with researchers and health ministries to co-create people-centred interventions that enhance treatment adherence, optimize service delivery and improve the quality of care
	Engage in high-impact community-driven interventions to prevent and respond to drug resistance in HIV, hepatitis B and C and STIs, ensuring that local needs and priorities are addressed
Researchers	Generate and ensure the timely data sharing and dissemination of evidence on the most effective public health interventions for preventing and responding to drug resistance in HIV, hepatitis B and C and STIs to inform national and global decision-making
Donors and development agencies	Ensure adequate and sustainable funding to support national strategies for preventing and responding to drug resistance in HIV, hepatitis B and C and STIs
Private sector (private health-care providers and clinics)	Deliver HIV, hepatitis B and C and STI prevention, testing and treatment services in accordance with national guidelines, ensuring that prescribing and clinical management reflect current drug resistance trends and respect antimicrobial stewardship principles
	Participate in training and continuing education initiatives organized by health authorities to stay updated on evolving treatment recommendations, resistance patterns and stewardship principles
	Coordinate with public health programmes to strengthen continuity of care, especially for patients transitioning between public and private sectors, to prevent treatment interruptions and improve adherence
WHO	Regularly update and disseminate normative guidance on the use of drugs for prevention and treatment for HIV, hepatitis B and C and STIs, ensuring integration of emerging evidence on drug resistance and its consequences in a timely manner
	Strengthen global AMR stewardship efforts by coordinating recommended responses across WHO departments and engaging global AMR stakeholders to optimize strategies for drug resistance prevention in HIV, hepatitis B and C and STIs
	Support and monitor the implementation of public health recommendations by countries for preventing and responding to drug resistance in HIV, hepatitis B and C and STIs, ensuring alignment with global strategies and AMR priorities
	Advocate for adequate resources to support national AMR strategies to promote health, improve treatment outcomes and prevent and respond to drug resistance

Monitoring and surveillance

Strategic objectives

- **Strengthen national surveillance systems to generate continuous, reliable and actionable data on drug resistance in HIV, hepatitis B and C and STIs**
- **Collect and analyse data from routine patient care to assess the quality of service delivery for HIV, hepatitis B and C and STIs to inform interventions that help to prevent the emergence and spread of drug resistance.**

Robust monitoring of treatment outcomes and drug resistance surveillance systems are fundamental stewardship functions that support the early detection of resistance trends, identify suboptimal clinical practices and guide timely programmatic responses. Table 4 presents a set of multisectoral actions to strengthen the surveillance of drug resistance and monitor health-care service quality across HIV, hepatitis B and C and STIs.

These actions include cross-cutting actions, such as integrating drug resistance surveillance into national disease control strategies, using standardized methods (including both survey-based and routine data systems), encouraging interoperability and data sharing across programmes and stakeholders and ensuring that surveillance outcomes are calculated with appropriate population-level denominators, to enable meaningful public health decision-making.

The Integrated Action Framework also addresses disease-specific priorities, including adapting HIV drug resistance surveillance to new treatment and prevention modalities (such as long-acting PrEP), establishing drug resistance surveillance for hepatitis B and C and tracking suppressed and sustained viral response in hepatitis B and hepatitis C, respectively, while monitoring treatment failure and expanding the surveillance of AMR in STIs by identifying priority settings for implementation and integrating efforts into existing programmes and networks in alignment with WHO-recommended surveillance guidelines and protocols.

This set of actions incorporates the following core stewardship components:

- monitoring treatment outcomes to detect early signs of failure to inform corrective measures;
- surveying resistance patterns to guide the selection and adjustment of treatment regimens; and
- collecting and analysing data from routine clinical care and community-led monitoring to identify suboptimal prescribing and service-delivery practices and using these insights to drive continual quality improvement and targeted interventions to reduce the risk of resistance.

Monitoring the consumption and use of antimicrobial agents is an essential component of stewardship. Tracking prescribing practices and patient-level use can identify inappropriate or suboptimal treatment patterns. Integrating the consumption and use of antimicrobial agents into surveillance systems supports timely, evidence-informed interventions to optimize antimicrobial agent use and prevent AMR.

By generating timely, reliable and actionable data, these actions directly contribute to improving treatment outcomes, preventing and addressing the spread of drug-resistant infections and, therefore, supporting progress toward ending AIDS and the epidemics of hepatitis B and C and STIs as public health threats.

When designed and used in a people-centred way, monitoring and surveillance systems can help to ensure that clinical guidelines reflect local realities, that services are responsive to community needs and that policy decisions are based on the actual barriers and outcomes experienced by people across all levels of care.

Table 4. Actions for monitoring and surveillance of drug resistance in HIV, hepatitis B and C and STIs

<table>
<tr><th>KEY ACTORS</th><th>ACTIONS</th></tr>
<tr><td rowspan="10">Countries</td><td colspan="3">Ensure national coordination of drug resistance surveillance and monitoring for HIV, hepatitis B and C and STIs, aligning efforts with national AMR action plans and national AMR surveillance systems to enhance public health responses and guide programme adjustments</td></tr>
<tr><td colspan="3">Strengthen systems to monitor treatment outcomes and the quality of care for HIV, hepatitis B and C and STIs using WHO-recommended indicators and ensure that data are disaggregated by geography and population group to reflect the lived realities of service users and support responsive programme adjustments</td></tr>
<tr><td colspan="3">Establish and strengthen national mechanisms to systematically collect and analyse data from routine patient care, including community-led monitoring initiatives, to identify both service gaps and access barriers faced by patients, to inform people-centred improvements in care delivery and to evaluate programme performance and identify gaps in care delivery</td></tr>
<tr><td colspan="3">Develop and deploy interoperable digital surveillance platforms that support near real-time reporting from facilities and laboratories, with standardized data dictionaries and unique identifiers to enable linkage across programmes</td></tr>
<tr><td colspan="3">Facilitate the timely sharing and use of treatment outcome and quality-of-care data across relevant national programmes (including health-care providers) and with WHO and partners, including researchers and use these data to inform public health responses and strengthen service delivery</td></tr>
<tr><td colspan="3">Strengthen infrastructure for comprehensive drug resistance surveillance using WHO-recommended standardized approaches and expand the coverage and quality of drug resistance testing when clinically indicated and periodically report HIV, hepatitis B and C and STI drug resistance estimates to guide national and global policies</td></tr>
<tr><td colspan="3">Ensure the timely dissemination of HIV, hepatitis B and C and STI drug resistance findings from national surveillance systems to WHO and relevant stakeholders and use these data to support public health assessments, guide decision-making and develop evidence-informed guidelines</td></tr>
<tr><td colspan="3">Strengthen national antimicrobial use surveillance systems, including prescriber practices and patient-level use, to identify inappropriate or suboptimal prescribing and inform corrective action</td></tr>
<tr><td>HIV</td><td>Hepatitis B and C</td><td>STIs</td></tr>
<tr><td>• Continually adapt HIV drug resistance surveillance systems to respond to the introduction of new WHO-recommended drugs, drug delivery models and dosing strategies for HIV prevention and treatment, including long-acting PrEP
• Following WHO guidance, ensure timely adjustments in surveillance methods and data collection approaches as new interventions are implemented at the country level
• Strengthen systems for monitoring treatment outcomes and the HIV care cascade, supporting targeted improvements in service delivery</td><td>• Strengthen national treatment monitoring systems to identify and report gaps in hepatitis B and C care cascades, ensuring alignment with WHO recommendations
• Develop and implement national mechanisms to track sustained viral response rates among populations treated and re-treated for hepatitis C, including collecting systematic data on the proportion of individuals who do not achieve sustained viral response
• Establish systems to routinely monitor viral suppression among individuals receiving hepatitis B treatment, enabling the identification of treatment failure and suboptimal response patterns to inform clinical management and programmatic improvements</td><td>• Establish and strengthen systems to monitor STI treatment outcomes, including test-of-cure practices and retreatment rates, to identify patterns of treatment failure, inform programmatic adjustments and support timely response to emerging resistance
• Integrate surveillance of AMR in STIs into national disease surveillance programmes by identifying priority settings for implementation following WHO-recommended surveillance guidelines and protocols</td></tr>
<tr><td rowspan="5">Global and national partners</td><td colspan="3">Support countries in implementing HIV, hepatitis B and C and STI drug resistance surveillance and quality-of-care monitoring using WHO-recommended standardized approaches</td></tr>
<tr><td colspan="3">Support strengthening of institutional capacity to implement effective and sustainable drug resistance surveillance and monitoring for HIV, hepatitis B and C and STIs</td></tr>
<tr><td colspan="3">Support countries in developing and strengthening national antimicrobial use surveillance systems, aligned with WHO guidance, to inform antimicrobial stewardship programmes and optimize prescribing practices</td></tr>
<tr><td colspan="3">Advocate for sustainable funding and implementation of drug resistance surveillance and quality-of-care monitoring for HIV, hepatitis B and C and STIs as core components of national programmes – ensuring alignment with WHO guidance and leadership by health ministries</td></tr>
<tr><td colspan="3">Support the elimination of barriers to efficient data sharing on HIV, hepatitis B and C and STI drug resistance between national programmes, WHO and partners</td></tr>
</table>

KEY ACTORS	ACTIONS
Communities	Advocate for robust surveillance of drug resistance and monitoring of quality-of-care indicators for HIV, hepatitis B and C and STIs to inform and drive timely action
	Strengthen community-led monitoring of HIV, hepatitis B and C and STI prevention, treatment and care services. Systematically collect and report patient experiences, barriers of access to care and opportunities to improve service delivery. Advocate for including community-generated data in national and local programme reviews to drive responsive health system adjustments
Researchers	Collaborate with WHO to inform the design, refinement and evaluation of global surveillance methods – such as survey protocols, routine data systems and modelling approaches – to enhance the accuracy, efficiency and policy relevance of global and national drug resistance surveillance
	Generate and share evidence on patterns and determinants of antimicrobial agent use in HIV, hepatitis B and C and STIs to guide national surveillance of antimicrobial agent consumption and use and stewardship policies
	Contribute to national and global surveillance efforts by the timely sharing of relevant research data to complement data obtained through routine surveillance systems
Donors and development agencies	Ensure sustained funding for countries for the surveillance of drug resistance and quality-of-care monitoring for HIV, hepatitis B and C and STIs
Private sector (pharmaceutical companies and private health-care providers and clinics)	Conduct or support post-marketing surveillance of antimicrobial products used for prevention and treatment for HIV, hepatitis B and C and STIs, including through direct implementation or by funding independent entities to assess drug effectiveness and emerging resistance patterns
	Promote transparency by publicly reporting post-marketing surveillance findings that inform national and global drug resistance mitigation strategies
	Collaborate with public health programmes to support early detection and response to emerging resistance threats, including by participating in joint monitoring and surveillance initiatives, data-sharing platforms and public–private partnerships
WHO	Ensure that global surveillance and monitoring efforts for drug resistance in HIV, hepatitis B and C and STIs are strategically and programmatically integrated into the broader AMR response and national and regional and global surveillance systems, including the WHO Global Antimicrobial Resistance and Use Surveillance System
	Develop and periodically update guidance for the surveillance (including both survey-based and routine data systems and including the use of population-level denominators) of drug resistance and quality-of-care monitoring for HIV, hepatitis B and C and STIs, based on new evidence and lessons learned from implementation and research
	Provide technical assistance to countries implementing drug resistance surveillance and quality-of-care monitoring for HIV, hepatitis B and C and STIs. Ensure alignment with WHO-recommended standardized approaches and support countries in integrating surveillance findings into national programmatic decision-making
	Provide guidance on the surveillance of antimicrobial use and support its integration into national antimicrobial use surveillance systems to inform antimicrobial stewardship, treatment protocols and policy decisions
	Encourage the collection and use of data to accelerate scientific progress, strengthen global collaboration and enhance transparency and public trust
	Share, streamline and align global reporting requirements across HIV, hepatitis B and C and STI programmes to reduce the reporting burden and enhance the utility of collected data for national and global action
	In collaboration with countries and partners, regularly report global and regional drug resistance levels and trends for HIV, hepatitis B and C and STIs
	Strengthen and maintain national and global repositories of drug resistance surveillance data for HIV, hepatitis B and C and STIs. Ensure that these data systems facilitate timely analysis, reporting and integration into evidence-informed national and global health recommendations

Research and innovation

Strategic objective

Close critical knowledge gaps on the risk and drivers of drug resistance to current and emerging therapies, including service delivery factors that affect treatment outcomes, and drive relevant and innovative research aimed at developing and delivering interventions that prevent, minimize and manage drug resistance and improve treatment success for HIV, hepatitis B and C and STIs.

Research and innovation are foundational to sustaining gains in prevention, diagnosis and treatment for HIV, hepatitis B and C and STIs in the context of drug resistance. Table 5 provides a set of multisectoral actions to guide the implementation of the research and innovation area of work.

The roadmap outlines cross-cutting actions to strengthen research systems, foster ethical and equitable partnerships and ensure data generation and sharing to inform public health decision-making. It emphasizes developing and evaluating diagnostic, therapeutic and service delivery innovations, especially in low- and middle-income countries. This includes advancing research and development on new vaccines, alongside other prevention, diagnostic and treatment drugs and innovations, and ensuring that these products are evaluated for accessibility and use in diverse settings.

A central role of WHO is to identify research gaps, lead global research priority-setting and develop and disseminate agendas that guide international, regional and national action. This ensures that research efforts remain coherent, avoid duplication, and align with the Global AMR research agenda for human health *(83)* while accelerating the translation of evidence into policy and practice.

Stakeholder-specific responsibilities include identifying and giving priority to research questions that are most relevant to public health, mobilizing and sustaining investments in research and development and ensuring that research is responsive to community needs, aligned with national priorities and translated into policy and practice. It also highlights the need for robust research governance and the integration of research findings into global and national AMR action plans. When implemented collectively, these actions will advance the evidence base needed to anticipate, prevent and respond to drug resistance in HIV, hepatitis B and C and STIs.

Table 5. Actions for research and innovation related to drug resistance in HIV, hepatitis B and C and STIs

KEY ACTORS	ACTIONS
Countries	Identify locally relevant public health research priorities in collaboration with health-care providers, public health practitioners, researchers and communities to generate evidence that informs policies, improves programme performance, enhances treatment outcomes, supports behaviour change (including adherence and responsible prescribing), identifies determinants of drug resistance and minimizes drug resistance in HIV, hepatitis B and C and STIs
	Establish and maintain a publicly available national repository that collates all relevant HIV, hepatitis B and C and STI drug resistance research and surveillance data, supported by appropriate clinical metadata
	Facilitate regular multistakeholder reviews of available collated data, ensuring evidence-informed decision-making, dissemination of findings and integration of data into global reporting systems, including WHO
	Facilitate researcher access to routinely collected deidentified clinical data, surveillance data and cohort-based research collaborations to support studies on treatment outcome monitoring and drug resistance in HIV, hepatitis B and C and STIs while ensuring ethical use of data and alignment with public health priorities

KEY ACTORS	ACTIONS
Communities	Advocate for adequate and sustained investments in drug resistance research and innovation, ensuring that locally and globally relevant priorities for HIV, hepatitis B and C and STIs are addressed
	Engage in the advocacy and co-creation of ethical community-centred research to address knowledge gaps, including those related to behaviour change, and develop high-impact interventions that minimize drug resistance in HIV, hepatitis B and C and STIs. This includes representation on scientific committees and advisory boards to ensure that community-informed priorities are integrated into research planning, implementation and decision-making
Researchers	Actively participate in identifying research gaps and setting priorities for research needs through interdisciplinary approaches to tackle drug resistance in HIV, hepatitis B and C and STIs, collaborating with WHO, national programmes and expert networks to shape national and global research agendas
	Implement the national and global research agendas on drug resistance in HIV, hepatitis B and C and STIs, including basic science, development of drugs and diagnostics, clinical studies, implementation research and epidemiology
	Develop, evaluate and promote innovative prevention and diagnostic tools, treatment and behaviour-change interventions to minimize drug resistance, ensuring that innovations are applicable to public health settings in low- and middle-income countries
	Contribute to developing and maintaining national and global drug resistance data repositories by sharing research findings in a timely manner
	Support the identification of priority mutations and resistance patterns for molecular surveillance and clinical management, especially for new drugs and evolving treatment strategies. Develop simple-to-use automated interpretation tools to support public health decision-making
	Ensure ethical research practices and community co-creation in all stages of drug resistance research to foster trust and to ensure that research priorities reflect community needs
	Contribute to workforce development by mentoring early-career researchers and supporting training initiatives that build long-term capacity in epidemiology, virology, implementation science and public health relevant to drug resistance
Donors and development agencies	Give priority to sustained funding for implementing the national and global research agendas on drug resistance for HIV, hepatitis B and C and STIs
	Ensure adequate and sustained investment in research and development for innovative prevention approaches, diagnostic and resistance tests and treatment options for HIV, hepatitis B and C and STIs
	Support long-term human capital development through investments in training programmes, mentorship networks and capacity-building initiatives to prepare the next generation of researchers and technical experts to address drug resistance and broader global health challenges
Private sector (pharmaceutical and other companies)	Invest in research on and development of innovative prevention, diagnostic and treatment products – including long-acting formulations for prevention and treatment strategies, simplified testing platforms and vaccines – and make them accessible in low- and middle-income settings
	Foster public–private partnerships and support technology transfer and supply chain strengthening to accelerate the availability and uptake of innovative prevention, diagnostic and treatment products where they are needed most
WHO	Identify research gaps in drug resistance for HIV, hepatitis B and C and STIs in collaboration with research institutions, expert networks and communities to ensure that research efforts address the most pressing public health needs
	Convene a WHO-led research priority-setting process based on identified gaps to develop and publish research agendas for drug resistance in HIV, hepatitis B and C and STIs, ensuring alignment with the WHO global AMR research agenda for human health and timely dissemination to partners
	Foster strategic collaborations among researchers to advance the drug resistance research agenda for HIV, hepatitis B and C and STIs, ensuring that partnerships align with identified gaps and priority research agendas
	Facilitate the translation of research findings into actionable policies and scalable high-impact programmatic interventions, including through WHO normative guidance and support for countries. This includes working across WHO departments to promote the inclusion of priority products in the prequalification programme, the WHO Model List of Essential Medicines (84) and the WHO Model List of Essential Diagnostics (85), to accelerate access to tools that address drug resistance in HIV, hepatitis B and C and STIs

Laboratory capacity

Strategic objective

Build, strengthen and expand robust, high-quality laboratory systems – including shared infrastructure and personnel when appropriate – to monitor the effectiveness of treatment outcomes and to conduct drug resistance surveillance for HIV, hepatitis B and C and STIs

Effective laboratory systems are crucial to monitoring treatment success and detecting emerging drug resistance in HIV, hepatitis B and C and STIs. Table 6 presents a set of multisectoral actions to put the laboratory capacity strategic objective into operation.

These actions include cross-cutting priorities such as integrating drug resistance testing into broader national laboratory strategies, expanding access to quality-assured testing (including viral load and resistance testing), leveraging new technologies as appropriate, promoting development and access to point-of-care technologies and using shared platforms, bioinformatics and external quality assurance systems to ensure sustainability and efficiency. Special consideration should be given to leveraging laboratory capacity built for other diseases (such as coronavirus disease 2019 (COVID-19)) to monitor treatment outcomes, including drug resistance. Strengthening laboratory data systems for routine reporting, effective data sharing, timely analysis and alignment with public health priorities is also emphasized.

WHO designated HIV drug resistance genotyping laboratory - Hazardous Pathogen Laboratory, National Institute of Health, Department of Medical Sciences. MOPH, Thailand.

Table 6. Actions for strengthening laboratory capacity to address drug resistance in HIV, hepatitis B and C and STIs

<table>
<tr><th>KEY ACTORS</th><th>ACTIONS</th></tr>
<tr><td rowspan="8">Countries</td><td colspan="3">Integrate drug resistance testing for HIV, hepatitis B and C and STIs into broader national AMR and laboratory strategies and plans</td></tr>
<tr><td colspan="3">Support the development, coordination and expansion of shared platforms for procurement of supplies, testing (including integrated diagnostics and core genomics), training, bioinformatics and quality assurance systems to strengthen laboratory capacity for monitoring treatment outcomes and drug resistance in HIV, hepatitis B and C and STIs</td></tr>
<tr><td colspan="3">Leverage laboratory capacity built for other diseases (such as COVID-19) to enable monitoring treatment outcomes and drug resistance in HIV, hepatitis B and C and STIs</td></tr>
<tr><td colspan="3">Develop and implement stepwise workforce capacity-building plans for laboratory personnel, including training in diagnostics, sequencing, bioinformatics and quality management, to ensure sustainable national capacity</td></tr>
<tr><td colspan="3">Facilitate the establishment, integration and strengthening of data-management and data-sharing systems on drug resistance patterns to inform treatment guidelines and public health strategies for HIV, hepatitis B and C and STIs</td></tr>
<tr><td>HIV</td><td>Hepatitis B and C</td><td>STIs</td></tr>
<tr><td colspan="2">Build, strengthen and expand country laboratory capacity and quality assurance management systems for HIV, HBV and HCV viral load testing to monitor treatment outcomes, ensuring expanded coverage (including point-of-care testing), high-quality testing and prompt reporting of results for clinical management</td><td rowspan="2">• Strengthen national laboratory capacity for STI diagnosis by improving specimen management, integrating point-of-care testing (when available), nucleic acid amplification techniques and culture-based methods and supporting laboratory networks in performing testing with systems to minimize turnaround time
• Build and strengthen national laboratory capacity for STI drug resistance surveillance and patient management. Strengthen the infrastructure, external quality assurance and supply chain systems to support quality STI drug resistance testing
• Enrol national laboratories in regional and global STI drug resistance testing laboratory networks</td></tr>
<tr><td>• Implement and strengthen laboratory services for HIV drug resistance testing following WHO guidance
• Support a national laboratory in achieving and maintaining membership in the WHO HIVResNet Laboratory Network</td><td>• Implement and strengthen laboratory services for HBV and HCV drug resistance testing following WHO recommendations
• Support a national laboratory in achieving and maintaining membership in the WHO HepResNet Laboratory Network</td></tr>
<tr><td rowspan="6">Global and national partners</td><td colspan="3">Support the integration of treatment-outcome monitoring and drug resistance testing for HIV, hepatitis B and C and STIs into broader laboratory capacity-building efforts</td></tr>
<tr><td colspan="3">Support the integration of laboratory services through shared platforms, systems and data management to enhance capacity for monitoring treatment outcomes and drug resistance in HIV, hepatitis B and C and STIs</td></tr>
<tr><td colspan="3">Support countries in building and sustaining national capacity for quality-assured drug resistance testing for HIV, HBV, HCV and STIs through standardized methods, external quality assurance and integration into regional and global laboratory networks</td></tr>
<tr><td>HIV</td><td>Hepatitis B and C</td><td>STIs</td></tr>
<tr><td colspan="2">• Support countries in building national capacity and expanding access to quality-assured viral load testing to enhance treatment monitoring for HIV and hepatitis B and C
• Support HIV, HBV and HCV drug resistance testing following WHO-recommended protocols for quality-assured testing in countries lacking resources or capacity</td><td>• Support the expansion of laboratory capacity for STI drug resistance testing following WHO-recommended protocols for quality-assured testing
• Facilitate training, external quality assurance and standardized reporting to enhance the efficiency and accuracy of STI drug resistance testing</td></tr>
<tr><td>Communities</td><td colspan="3">Advocate for strengthening laboratory capacity to monitor treatment outcomes and drug resistance in HIV, hepatitis B and C and STIs</td></tr>
</table>

KEY ACTORS	ACTIONS		
Researchers	Develop and validate new laboratory methods for treatment outcome monitoring and drug resistance detection in HIV, hepatitis B and C and STIs		
	Conduct implementation research to evaluate and optimize laboratory workflows, quality assurance processes and integrated diagnostics in real-world settings for HIV, hepatitis B and C and STIs		
	Contribute to capacity-building efforts by providing training and mentorship in laboratory techniques, culture-based methods when relevant, genomic sequencing and bioinformatics for HIV, hepatitis B and C and STIs		
Donors and development agencies	Mobilize sustained financial support to develop and expand high-quality national and regional laboratory capacity for monitoring treatment and drug resistance outcomes in HIV, hepatitis B and C and STIs		
	Provide adequate resources to support laboratories in performing drug resistance testing in alignment with international quality standards for surveillance		
WHO	Identify opportunities to incrementally integrate drug resistance testing for HIV, hepatitis B and C and STIs into broader national AMR action plans and laboratory networks – leveraging shared laboratory platforms, streamlined management, external quality assurance and training to enhance efficiency, coordination and coordination and resource optimization		
	Develop, update and support the implementation of global guidance (including laboratory operational frameworks, quality assurance requirements, data-sharing mechanisms and minimal criteria for external proficiency testing schemes) to strengthen laboratory capacity for phased, stepwise monitoring of treatment outcomes and drug resistance testing for HIV, hepatitis B and C and STIs		
	Promote the development of and access to rapid affordable near-point-of care and point-of-care technologies to monitor treatment outcomes and drug resistance		
	Provide technical assistance to countries to progressively establish and scale up quality-assured laboratory systems for monitoring treatment outcomes and to conduct drug resistance testing of HIV, hepatitis B and C and STIs		
	Establish minimal criteria for external quality assurance proficiency testing schemes to ensure quality-assured drug resistance results		
	HIV	**Hepatitis B and C**	**STIs**
	Support the expansion and strengthening of the WHO HIVResNet Laboratory Network to meet current demands for HIV drug resistance testing	• Establish, expand and operationalize the WHO HepResNet Laboratory Network for HBV and HCV drug resistance testing, ensuring alignment with WHO-recommended protocols, external quality assurance and integration with existing networks • In collaboration with experts, develop a standardized and updated bioinformatic resource for genotyping and for identifying and interpreting resistance mutations	Establish, expand and strengthen STI laboratory networks to meet STI drug resistance testing demands

Disease-specific actions reflect the distinct testing needs across diseases. For HIV and hepatitis B and C, the roadmap gives priority to expanding viral load testing to support the monitoring of hepatitis C cure rates and viral suppression among individuals receiving therapy for HIV, hepatitis B or both. It also emphasizes strengthening laboratory capacity for resistance testing. To support these efforts, countries are encouraged to participate in global laboratory networks – such as the WHO HIVResNet, which is fully operational and supports HIV drug resistance testing and the WHO HepResNet, which is being established to support hepatitis B and C resistance testing – ensuring alignment with WHO protocols, external quality assurance and standardized data interpretation tools. For STIs, key actions include scaling up diagnostic capacity, integrating testing into relevant service platforms, expanding surveillance of AMR in STIs and establishing dedicated regional or global laboratory networks.

WHO, donors and partners are called to support countries through technical assistance, standard-setting and investment in laboratory infrastructure. Together, these actions aim to ensure timely, reliable and quality-assured laboratory data for programmatic action, ultimately improving treatment outcomes and limiting the spread of drug resistance.

Governance and enabling mechanisms

Strategic objective

Ensure that governance and enabling mechanisms – including country ownership, community engagement, advocacy and communication, coordinated action and sustainable funding – are in place to effectively support actions on drug resistance for HIV, hepatitis B and C and STIs.

Effective action on drug resistance will not be achieved without strong governance and supportive systems that create the political, social and financial conditions for sustained implementation. The governance and enabling mechanisms area of work addresses these essential foundations, ensuring that countries and partners can coordinate efforts, advocate for support, mobilize resources and take ownership of national priorities for preventing and responding to drug resistance. To reflect the breadth of this domain, the set of actions is divided into three interrelated subareas:

- advocacy and communication;
- sustainable funding; and
- coordination, integration, alignment and country ownership.

This roadmap sets out the steps for coherent and sustained action through multisectoral collaboration, political leadership and resource mobilization. Although the actions vary by stakeholder group and subarea, all are grounded in the principle of country-led, inclusive and integrated responses to drug-resistant HIV, hepatitis B and C and STIs and are designed to align with national AMR responses and action plans to avoid silos and duplication.

Advocacy and communication

Table 7 outlines the actions needed to build political will, enhance public understanding and ensure consistent messaging about the risks and impact of drug resistance. These actions emphasize the importance of health literacy, the role of communities as advocates, educators and solution co-creators and the need for transparent, clear and effective communication to inform prevention and treatment decisions. The actions presented support governments, WHO, partners and communities in amplifying advocacy efforts and mobilizing sustainable support for action on drug resistance.

Sustainable funding

This section outlines actions to mobilize, allocate and sustain the financial resources necessary to implement national and global strategies on drug resistance. Table 8 highlights the importance of integrating drug resistance priorities into national budgets, broader health system financing and universal health coverage strategies and global financing mechanisms, promoting co-financing and supporting countries in building solid investment cases and mobilizing domestic financial resources. It provides direction to countries, donors and partners to ensure long-term financial sustainability for drug resistance surveillance, prevention and treatment interventions.

Coordination, integration, alignment and country ownership

The third subarea focuses on ensuring that countries lead coordinated, multistakeholder responses that are aligned with national priorities and global strategies. The actions (Table 9) call for establishing national coordination mechanisms, integrating drug resistance into health sector plans and developing national action plans. They also promote cross-sectoral collaboration and institutionalized community engagement to ensure shared accountability and long-term commitment to addressing drug resistance.

Table 7. Actions related to advocacy and communication for responding to drug resistance in HIV, hepatitis B and C and STIs

KEY ACTORS	ACTIONS
Countries	Strengthen decision-makers' awareness of the public health and programmatic impact of drug resistance in HIV, hepatitis B and C and STIs on achieving national and global targets, treatment outcomes and programme sustainability
	Engage relevant partners to implement country-level communication strategies that improve understanding and awareness of the risk and consequences of drug resistance in HIV, hepatitis B and C and STIs
	Strengthen health literacy and education on drug resistance in HIV, hepatitis B and C and STIs among health-care workers, policy-makers and communities to improve antimicrobial stewardship, ensuring that materials are culturally appropriate, tailored to literacy levels and responsive to local information needs
	Identify, support and equip national and local champions – including health-care professionals, policy-makers and community leaders – to advocate for drug resistance prevention and response, ensuring sustained political commitment and community engagement
	Promote transparent and rapid communication about national drug resistance trends and risks, ensuring that information is appropriately tailored for policy-makers, health-care workers and the general public
Global and national partners	Advocate for a central role of drug resistance surveillance, prevention and response within national HIV, hepatitis B and C and STI programmes and action plans, promoting integration when feasible
	Support countries in integrating drug resistance messaging into national programme communications, technical guidance and training materials to ensure clarity and alignment with global recommendations
	Strengthen global and national advocacy for affordable access to drug resistance tests across HIV, hepatitis B and C and STIs
Communities	Advocate for enabling policies and sustainable domestic and international resources to support drug resistance prevention, monitoring and response efforts
	Lead community-driven awareness and peer-led education efforts on drug resistance in HIV, hepatitis B and C and STIs that reflect the diverse realities of people seeking care and ensure that messages are accessible, culturally relevant and empower individuals to make informed decisions about prevention and treatment
	Mobilize community leaders and networks to serve as champions for drug resistance prevention and response, amplifying advocacy efforts at the local, national and global levels
Researchers	Disseminate research findings in a timely manner in plain language on drug resistance in HIV, hepatitis B and C and STIs, ensuring accessibility for policy-makers, programme managers and affected communities to inform prevention and response efforts
WHO	Develop and disseminate global advocacy guidance and messaging to support countries, global partners and communities in communicating the risks and impact of drug resistance in HIV, hepatitis B and C and STIs
	Provide technical support to countries and global partners to implement effective communication strategies that promote awareness, health literacy and behavioural change to prevent and respond to drug resistance in HIV, hepatitis B and C and STIs
	Promote transparent and rapid communication about national drug resistance trends and risks, ensuring that information is appropriately tailored for policy-makers, health-care workers and the general public
	Engage with global stakeholders, including multilateral organizations, funders and civil society, to amplify advocacy efforts and mobilize sustainable resources for drug resistance prevention and response
	Leverage global advocacy platforms such as World AMR Awareness Week to improve awareness and understanding of AMR, highlight the specific challenges of drug resistance in HIV, hepatitis B and C and STIs and promote best practices among the public, policy-makers and One Health stakeholders

Table 8. Actions for sustainable funding for responding to drug resistance in HIV, hepatitis B and C and STIs

KEY ACTORS	ACTIONS
Countries	Identify and allocate national resources to fund drug resistance prevention, surveillance and response activities as core components of HIV, hepatitis B and C and STI programmes, ensuring that these are reflected in national budgets and financing frameworks and integrated into broader health system financing and universal health coverage strategies – while aligning with equity-focused approaches that address underserved and at-risk populations
	Strengthen financial accountability and transparency in drug resistance programmes through efficient resource allocation, expenditure tracking and reporting on financial commitments
	Engage with multilateral and bilateral donors to secure sustained funding for actions to address drug resistance in HIV, hepatitis B and C and STIs
	Safeguard the continuity of essential functions during financial instability by giving priority to critical prevention, diagnosis, treatment, care and surveillance activities
Global and national partners	Mobilize sustainable financing at the global, national and local levels under the umbrella of the broader AMR response to support strategies for drug resistance prevention, monitoring and response in HIV, hepatitis B and C and STIs
	Advocate for and support the inclusion of drug resistance activities in national health budgets and major global funding mechanisms while enabling funding integration across HIV, hepatitis B and C and STI programmes
	Mobilize sustained funding for research, development and innovation in drug resistance diagnostics, prevention, surveillance and response for HIV, HIV, hepatitis B and C and STIs, ensuring investment in new drugs, vaccines and treatment strategies
	Support countries in developing investment cases to justify domestic and international funding for drug resistance programmes, ensuring integration into national strategic plans and funding proposals
	Promote innovative funding mechanisms, including catalytic and domestic financing, pooled procurement and investment in the health-care workforce, to enhance financial sustainability for implementing drug resistance action plans
Donors and development agencies	Ensure sustained and predictable funding for drug resistance prevention, surveillance and response in HIV, hepatitis B and C and STIs, aligning investment with national, regional and global strategies
	Create and promote flexible funding mechanisms to facilitate the integration of drug resistance activities across HIV, hepatitis B and C and STIs and broader efforts within AMR and health system strengthening
	Support countries in securing domestic co-financing commitments and external resources to ensure sustainable funding for national drug resistance prevention, monitoring and response efforts in HIV, hepatitis B and C and STIs
	Foster multisectoral partnerships and innovative financing mechanisms (such as catalytic funds, pooled procurement and private sector engagement) to diversify and expand sustainable funding sources for drug resistance programmes
	Support contingency financing arrangements that can be rapidly deployed to sustain prevention and treatment services, quality care, surveillance, monitoring and response efforts, thereby safeguarding continuity of services and system resilience during pandemics, conflicts, natural disasters or financial crises
WHO	Convene global and national partners and multilateral and bilateral donors to align funding priorities and mobilize sustainable financial resources for preventing, monitoring and responding to drug resistance in HIV, hepatitis B and C and STIs
	Develop and disseminate guidance on sustainable financing models for preventing, monitoring and responding to drug resistance in HIV, hepatitis B and C and STIs, ensuring integration into universal health coverage, national health budgets and global financing mechanisms
	Promote the integration of drug resistance financing into broader efforts in health system strengthening, ensuring sustainable resource allocation beyond disease-specific funding streams
	Provide guidance on protecting essential programme functions during funding instability, with clear priority-setting strategies to maintain the continuity of services

Table 9. Actions for strengthening coordination, integration and country ownership in responding to drug resistance in HIV, hepatitis B and C and STIs

KEY ACTORS	ACTIONS
Countries	Establish and strengthen national coordination mechanisms to oversee prevention, monitoring and response for drug resistance in HIV, hepatitis B and C and STIs, ensuring multisectoral collaboration and alignment with the national and subnational multisectoral AMR governance and coordination mechanism
	Integrate prevention, monitoring and response for drug resistance in HIV, hepatitis B and C and STIs into national action plans on AMR, national health policies, strategic plans and universal health coverage frameworks, ensuring sustainability within broader health systems
	Develop, implement and monitor multi-year national action plans on AMR that explicitly address drug resistance in HIV, hepatitis B and C and STIs, ensuring that they are country-driven and evidence-informed, include milestones and a funding plan and are aligned with the priorities of the Integrated Action Framework
	Strengthen national leadership and accountability in drug resistance governance by securing financial, technical and human resources, institutionalizing inclusive community engagement and ensuring policy implementation
	Strengthen regulatory and pharmacovigilance systems, in accordance with WHO guidance, to monitor the quality of medicines and diagnostics and safeguard uninterrupted access to quality-assured products
	Collaborate with research institutions, partners, affected communities and national programmes across HIV, hepatitis B and C, STIs and other relevant health priorities to ensure cross-sectoral synergy, people-centred planning and integration of diverse community needs and perspectives into policy development and implementation
Global and national partners	Support countries in strengthening national coordination mechanisms for responding to drug resistance in HIV, hepatitis B and C and STI, fostering cross-sectoral collaboration, multistakeholder partnerships and integration with broader efforts in AMR and health system strengthening
	Support countries in developing and implementing multi-year, evidence-informed national action plans for drug resistance in HIV, hepatitis B and C and STI, ensuring alignment with the Integrated Action Framework
Communities	Engage in national and regional coordination mechanisms to ensure that the co-creation of national action plans for drug resistance in HIV, hepatitis B and C and STIs reflects community perspectives, experiences and priorities
Private sector (pharmaceutical companies and private health-care providers and clinics)	Adhere to national regulatory frameworks that govern the ethical promotion and responsible use of HIV, hepatitis B and C and STI medicines
WHO	Assist countries in developing and implementing AMR national action plans that includes actions to prevent, monitor and respond to drug resistance in HIV, hepatitis B and C and STIs
	Facilitate multistakeholder dialogue among communities, researchers, national programmes, policy-makers, donors and global partners to strengthen coordination, integration and country ownership in preventing and responding to drug resistance
	Convene countries, partners and manufacturers to advocate for reducing the cost of and increasing the availability and accessibility of essential diagnostic tests, drugs and vaccines
	Monitor implementation of the Integrated Action Framework, maintain a global repository of drug resistance data and ensure regular dissemination of progress through global reports
	Support the alignment of national drug resistance efforts with the Integrated Action Framework and national AMR action plans, ensuring policy coherence and integration across HIV, hepatitis B and C and STIs
	Identify and strengthen governance structures, such as technical working groups and global coordination mechanisms, to support the prevention of, monitoring of and response to drug resistance across HIV, hepatitis B and C and STIs

Implementation considerations

To support countries in translating the Integrated Action Framework into measurable progress, WHO promotes a structured, stepwise approach for the sustainable implementation of national responses to drug resistance in HIV, hepatitis B and C and STIs. This approach – adapted from the WHO implementation handbook for national action plans on AMR *(86)* – comprises six interrelated steps (Fig. 5) that can guide the development and operationalization of context-specific action plans aligned with the Integrated Action Framework. These steps can help countries in giving priority to high-impact interventions, optimizing available resources and institutionalizing sustainable, multisectoral responses.

Strengthen governance

Countries are encouraged to establish or reinforce functional multisectoral coordination mechanisms that explicitly integrate drug resistance priorities across HIV, hepatitis B and C and STIs. These mechanisms should operate with clearly defined terms of reference, designated budgets and accountability frameworks that reflect the shared responsibilities outlined in the Integrated Action Framework. Alignment with broader AMR and health sector governance structures enhances coherence, efficiency and sustainability.

Set priorities for activities

Drawing from the Integrated Action Framework roadmap for implementation, countries should set priorities according to their context and available resources to identify feasible, high-impact actions. The priorities should reflect national epidemiological trends, health system capacity and programmatic gaps. This step ensures that implementation efforts are focused and respond to urgent needs. The process should involve key stakeholders to ensure that selected actions are technically sound, contextually relevant and aligned with both public health and community needs.

Cost the operational plan

Selected priority actions should be incorporated into a detailed, costed operational plan that specifies activities, responsible actors, implementation timelines and resource needs. Costing should build on existing programme budgets when possible and support the integration of drug resistance actions into national disease strategies, universal health coverage frameworks or broader national action plans on AMR.

Mobilize resources

To ensure sustainability, countries should map available and potential funding sources, advocate for domestic investment and align donor and partner contributions with national priorities. Incorporating interventions of the Integrated Action Framework into national budgets and leveraging financing mechanisms can help to bridge resource gaps and promote long-term ownership (Box 2).

Implement priority activities

Implementation should be phased, locally adapted and led by national disease programmes in collaboration with key stakeholders. Countries are encouraged to embed drug resistance activities into existing service delivery platforms and surveillance systems to maximize impact, strengthen health system resilience and avoid duplication. Strengthening surveillance systems and laboratory capacity is critical to detect, monitor and respond to drug resistance. Integration across surveillance platforms, laboratory networks and information management systems is essential to maximize efficiency, reduce costs and ensure timely, high-quality data that can inform action at the local, national and global levels.

Monitor and evaluate

Monitoring and evaluation mechanisms should be established or adapted to track the implementation of the Integrated Action Framework. Countries are encouraged to use disaggregated indicators aligned with national and global targets, including those related to prevention, quality of care and treatment outcomes. Periodic progress reviews will support adaptive implementation, facilitate accountability and foster shared learning at the national, regional and global levels.

This implementation pathway reinforces the Integrated Action Framework's core principles of country ownership, strategic coordination, people-centred care and efficient resource use. By following this approach, countries can translate the vision and strategic objectives of the Integrated Action Framework into effective, sustainable action – contributing to achieving elimination goals and preserving the effectiveness of existing and future tools to combat drug resistance.

Fig. 5. Six steps for sustainable implementation of national action plans on AMR *(86)*

Box 2. Building resilience amid evolving funding landscapes

Longstanding global health initiatives addressing HIV, hepatitis B and C and STIs have benefitted from substantial international investments. However, recent shifts in political and economic priorities – including changes to major donor funding – have raised concerns about the sustainability of progress, especially in areas such as service delivery, surveillance and research.

Recent analyses also warn of increased drug resistance risks following disruptions to large-scale donor-funded programmes *(87)*, underscoring the urgency of building system resilience and sustaining prevention, monitoring and response efforts.

These developments underscore the importance of strengthening the resilience of national and global responses to drug resistance. The Integrated Action Framework calls for diversified financing strategies, robust domestic resource mobilization and the integration of drug resistance efforts into broader health systems and universal health coverage agendas. WHO also recommends practical approaches to help countries maintain the continuity of essential services under constrained resources. These include structured priority-setting frameworks, such as tiered service categorization, rapid evidence-informed assessments and tailored strategies to protect services for vulnerable populations *(88)*.

In parallel, adopting cost-effective delivery models – such as virtual interventions – can support programme continuity, optimize resource use and serve as a mitigation strategy to reduce costs *(89)*. The Integrated Action Framework further emphasizes safeguarding continuity of epidemiological monitoring by integrating drug resistance surveillance into broader health information systems.

By reinforcing national ownership, enhancing efficiency and strengthening commitment to AMR stewardship and financial stability, countries and partners can better withstand external shocks and maintain momentum toward elimination goals.

Conclusions and next steps

The Integrated Action Framework provides a comprehensive and unified roadmap to safeguard the effectiveness of antimicrobial prevention and treatment tools that are vital to achieving global health goals. By bringing together targeted and cross-cutting strategies, stakeholder commitments and an operational roadmap for coordinated action, the Integrated Action Framework responds to the risk posed by drug resistance across HIV, hepatitis B and C and STIs.

Grounded in the principles of equity, country ownership, multisectoral collaboration and people-centred care, the Integrated Action Framework transforms global commitments into context-adaptable actions that strengthen health systems, promote resilience and give priority to the needs of affected populations. It bridges vertical disease programmes and fosters synergy across surveillance, antimicrobial stewardship, innovation and service delivery.

To ensure that the Integrated Action Framework translates into meaningful progress, countries and partners must focus on implementation. This includes developing or updating national action plans, giving priority to high-impact interventions based on local epidemiology and systems capacity, planning for and securing sustainable financing and embedding HIV, viral hepatitis and STI drug resistance responses within broader health, AMR and universal health coverage strategies. Critical enablers – such as political commitment, empowered communities and strong accountability mechanisms – must be nurtured and sustained. Progress will be tracked through regular monitoring and reporting, aligned with the Global Health Sector Strategies on HIV, viral hepatitis and sexually transmitted infections (2022–2030), to support accountability and inform course correction as needed.

WHO will support these efforts through technical assistance, coordination, normative guidance development and strategic partnerships – ensuring alignment with the Global Health Sector Strategies on HIV, viral hepatitis and sexually transmitted infections (2022–2030), the Global Action Plan on Antimicrobial Resistance and the Sustainable Development Goals. Regular monitoring and reporting will track implementation and impact, and the lessons learned will inform adaptive strategies, innovation and continual improvement.

The Integrated Action Framework is both a call to action and a tool for progress. Acting now – together and at scale – can prevent avoidable illness and death, sustain the effectiveness of current and future life-saving prevention and treatment tools and ensure that drug resistance does not derail the path toward ending AIDS and the epidemics of hepatitis B, hepatitis C and STIs as public health threats by 2030.

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Annex. List of contributors to the consultation process for the Integrated Drug Resistance Action Framework for HIV, Hepatitis B and C and Sexually Transmitted Infections, 2026–2030

The development of the Integrated Drug Resistance Action Framework for HIV, Hepatitis B and C, and Sexually Transmitted Infections (2026–2030) was shaped by a series of consultation meetings and collaborative engagements. These brought together a diverse group of stakeholders, including representatives from governments, global health organizations, public health institutions, academia, the private sector and civil society.

Key consultations included:

- HIV and hepatitis stakeholder meetings held in Geneva, Switzerland (10–13 July 2023);
- a WHO HIVResNet meeting in Cape Town, South Africa (23 September 2023);
- an STIs stakeholder consultation in Geneva, Switzerland (9–10 May 2024);
- a series of integration workshops conducted between 8 October and 3 December 2024; and
- an online public consultation held from 31 July to 28 August 2025.

These engagements provided essential technical input and contextual insights, ensuring that the Integrated Action Framework reflects a wide range of expertise and perspectives.

Table A1 lists all contributors who participated in these consultations.

Table A1. Individual contributors by affiliation and country

NAME	REPORTED AFFILIATION	COUNTRY	CONSULTATIONS
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Mahamadou Balkissa	Ministry of Health	Niger	Hepatitis meeting
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Catriona Bradshaw	Monash University	Australia	STIs meeting
Daniel Bradshaw	UK Health Security Agency	United Kingdom	Hepatitis meeting
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Mohamed Chakroun	University of Monastir	Tunisia	HIV, hepatitis and STIs meetings
Fatim Cham-Jallow	Global Fund to Fight AIDS, Tuberculosis and Malaria	Switzerland	HIV and hepatitis meetings

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Lubinda Chingumbe	Not reported	Zambia	Public consultation
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STIs meeting	WHO		HIV, hepatitis and STIs meetings
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Hiwot Haile-Selassie	WHO		HIV and hepatitis meetings
Rachel Halford	World Hepatitis Alliance	Switzerland	Hepatitis meeting
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Ganiyu Jamiu	Ministry of Health	Nigeria	Hepatitis meeting

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Jan Derek Junio	Antimicrobial Resistance Surveillance Reference Laboratory	Philippines	STIs meeting
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Tadashi Kikuchi	National Institute of Infectious Diseases	Japan	HIVResNet meeting
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Vinie Kouamou	University of Zimbabwe	Zimbabwe	HIVResNet meeting
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Anna Kramvis	University of the Witwatersrand	South Africa	Hepatitis meeting
Nagalingeswaran Kumarasamy	VHS Infectious Diseases Medical Centre, CART Clinical Research Site, Voluntary Health Services	India	HIV, hepatitis and HIVResNet meeting
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Tom Loosli	University Hospital Zurich	Switzerland	HIV, hepatitis, STIs and HIVResNet meetings
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Frank John Lule	WHO		Public consultation
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Anna Machiha	Ministry of Health	Zimbabwe	STIs meeting
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Eleanor Namusoke Magongo	Ministry of Health	Uganda	HIV, hepatitis and STIs meetings
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Haruna Mohamed Mahmoud	Ministry of Health	United Republic of Tanzania	Public consultation
Ioannis Mameletzis	WHO		HIV meeting
Ariyaratne Manathunge	Not reported	Sri Lanka	Public consultation
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Jolynne Mokaya	Sanger Institute	United Kingdom	Hepatitis meeting
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Paul Sandstrom	Public Health Agency of Canada	Canada	HIV and hepatitis meetings
Lon Sayheng	National Center for HIV/AIDS, Dermatology and STD	Cambodia	STIs meeting
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Janke Schinkel	Amsterdam University Medical Center	Netherlands (Kingdom of the)	Public consultation
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William Shafer	Emory University	United States of America	Public consultation
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Mark Siedner	Africa Health Research Institute	South Africa	HIVResNet meeting
Nishi Prabdial Singh	National Institute for Communicable Diseases	South Africa	Hepatitis meeting
Vindi Singh	Global Fund to Fight AIDS, Tuberculosis and Malaria	Switzerland	HIV, hepatitis and HIVResNet meetings
Alexandra Smith	World Hepatitis Alliance	Switzerland	Public consultation
Olusegun O. Soge	University of Washington	United States of America	STIs meeting
Traore Sory	Ministry of Health	Mali	Public consultation
Subasree Srinivasan	Global Antibiotic Research and Development Partnership	Switzerland	STIs meeting
Deogratius Ssemwanga	MRC/UVRI & LSHTM Uganda Research Unit	Uganda	HIVResNet meeting
Maja Stanojevic	University of Belgrade	Serbia	Public consultation
Kim Steegen	National Health Laboratory Service	South Africa	HIV, hepatitis, STIs and HIVResNet meetings

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Gang Sun	Not reported	Not reported	Public consultation
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