

Foreword

World Antimicrobial Awareness Week 2025 — Act Now: Protect Our Present, Secure Our Future

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Antimicrobial resistance (AMR) threatens to reverse a century of medical progress, representing a silent pandemic in the 21st century driven by the relentless evolution of bacteria against antimicrobials and the looming prospect of a post-antibiotic era. This existential threat directly challenges human health, environmental integrity, food security, and economic stability worldwide (1). To address this crisis, the One Health Quadripartite Joint Plan of Action (2022–2026) was launched to combat health threats across humans, animals, plants, and the environment. The plan focuses on strengthening health system capacities, addressing emerging and re-emerging zoonotic epidemics, endemic zoonotic diseases, neglected tropical and vector-borne diseases, food safety risks, antimicrobial resistance, and environmental health. The Quadripartite organizations — the Food and Agriculture Organization of the United Nations (FAO), the United Nations Environment Programme (UNEP), the World Health Organization (WHO), and the World Organisation for Animal Health (WOAH, founded as OIE) — have announced “Act Now: Protect Our Present, Secure Our Future” as the theme for World Antimicrobial Awareness Week (WAAW) 2025 (2).

BACKGROUND

As *Science* magazine highlighted in its 125th-anniversary issue, overcoming antibiotic resistance remains one of the most pressing scientific challenges of our time (3). China has mounted a comprehensive national response to address this challenge. Building on the success of the National Action Plan to Contain Bacterial Resistance (2016–2020) and guided by the Biosecurity Law, China escalated its policy framework through the “National Action Plan to Contain Antimicrobial Resistance (2022–2025)” (4). Jointly issued by 13 ministries, this pivotal document marks a strategic expansion from “bacterial” to “microbial” resistance, representing a concerted national effort to strengthen governance across all sectors affected by AMR. Through implementing this expanded plan and generating evidence spanning the One Health spectrum — from clinical settings to environmental reservoirs — China demonstrates its commitment to combating this pervasive global threat.

China has launched several major AMR research initiatives under the National Research and Development Programme during the 14th Five-year Plan period. These include research on the evolution and transmission mechanisms of multidrug resistance (MDR) in the human-animal-environment system (2024YFE0106300 and UK Research and Innovation MR/Y015223/1), multidrug-resistant foodborne pathogen tracing and resistance gene transmission warning (2022YFC2303900), and livestock pathogen drug resistance generation and transmission mechanisms (2022YFD1800400). Selection for AMR occurs across One Health microbiomes; however, the relative contribution of selection in each compartment to the emergence of AMR in human pathogens, and the transmission dynamics between ecosystem compartments, remain poorly understood. One promising approach involves developing and applying machine learning methods to investigate the relationship between resistance gene carriage and MDR phenotypes in microbiomes and pangenomes.

This issue integrates five Chinese studies to present a comprehensive view of the AMR crisis across its critical domains (Figure 1). The clinical domain reveals narrowing therapeutic options for pathogens such as *Nocardia*, highlighting neglected reservoirs of resistance. Environmental pathways — exemplified by the Yellow River — silently disseminate key resistance genes (e.g., *bla*_{CTX-M}) from agricultural sources to waterways. The food chain functions as an amplifier, where species like *Enterococcus faecium* pose escalating public health risks. Community reservoirs, illuminated through surveillance of asymptomatic food workers, demonstrate rising MDR *Salmonella* and tetracycline resistance in parallel with socioeconomic development. Finally, global trade networks serve as powerful

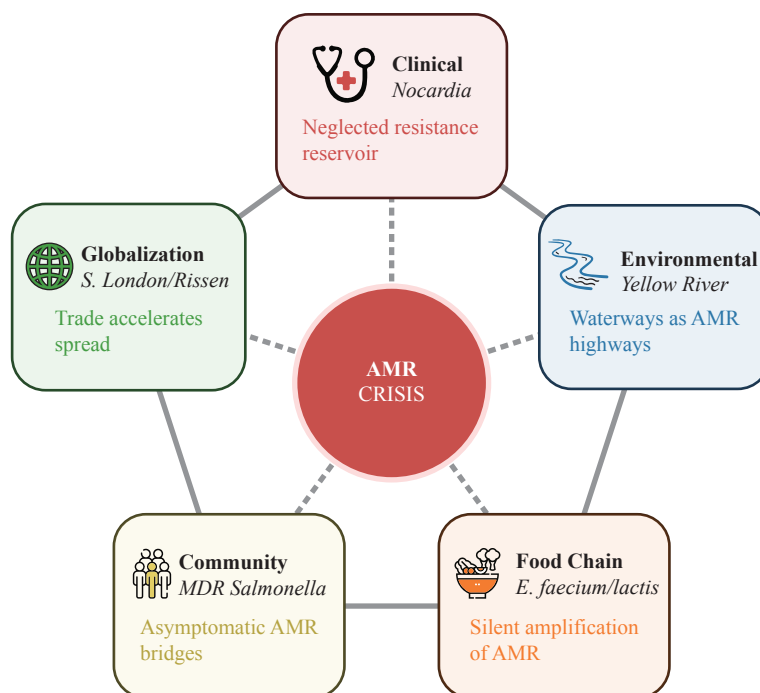


FIGURE 1. The AMR crisis intensifies across interconnected systems. Each frontline simultaneously generates and amplifies resistance, establishing a self-reinforcing cycle that necessitates coordinated, multisectoral intervention across all five domains.

Abbreviation: AMR=antimicrobial resistance; MDR=multidrug resistance.

accelerators, disseminating pathogens such as *Salmonella* London worldwide on plasmids carrying multiple antimicrobial resistance genes.

Evidence synthesized from clinical, environmental, food chain, community, and global surveillance within China's policy framework converges on an inescapable conclusion: AMR represents a metastasizing emergency that compounds in severity across interconnected biological and social systems. This body of evidence establishes a scientific imperative for the decisive action championed by the WAAW 2025 theme, "Act Now: Protect Our Present, Secure Our Future." These findings align with China's strategic commitments under its National Action Plan, demanding an urgent transition from awareness-building to accountable, coordinated multisectoral intervention.

THE EXPANDING AMR CHALLENGE: EVIDENCE FROM FRONTLINES

Clinical Frontline: Neglected Reservoirs of Resistance

Analysis of *Nocardia* clinical isolates collected between 2014 and 2024 demonstrates that this environmental commensal has emerged as a significant AMR reservoir. Although linezolid and amikacin maintain therapeutic efficacy, the pathogen exhibits adaptive capacity by developing resistance to first-line trimethoprim-sulfamethoxazole while harboring established resistance to multiple additional antimicrobial agents. *Nocardia* species now function as repositories of diverse resistance mechanisms, continuously accumulating and diversifying resistance determinants. These findings emphasize the critical need for ongoing antimicrobial susceptibility surveillance and enhanced stewardship programs to prevent the amplification and transmission of resistance across interconnected biological systems.

Environmental Frontline: Waterways as AMR Transmission Highways

Surveillance of the Yellow River system (2023–2024) reveals aquatic environments functioning as natural reservoirs and transmission pathways for AMR. Clinically significant *bla*_{CTX-M} genes demonstrated widespread

presence with markedly higher abundance during dry seasons. Genomic analysis identified *Escherichia coli* ST6802 carrying *bla*_{CTX-M-14} as the dominant strain, coexisting with numerous resistance genes and virulence factors. Phylogenetic evidence confirmed that these aquatic isolates shared close genetic relationships with strains from pig manure treatment systems, tracing the flow of animal-origin resistance into river ecosystems. These findings illuminate the silent journey of resistance genes through water networks and emphasize the need to monitor these natural pathways while intervening at contamination sources.

Food Chain Frontline: Silent AMR Amplifiers in Microbial Ecosystems

Comprehensive analysis of *Enterococcus faecium* and *E. lactis* isolates from China's food chain (2015–2024) demonstrates how microbial ecosystems serve as reservoirs that accumulate and diversify antimicrobial resistance traits. Following recent taxonomic reclassification, *E. faecium* demonstrates significantly elevated multidrug resistance rates and harbors more extensive resistance genetic elements compared to *E. lactis*, despite both species maintaining comparable virulence gene profiles. This divergence in resistance capacity alongside conserved pathogenic potential reveals a critical evolutionary pathway through which AMR propagates within food production systems. These observations underscore the necessity for sustained surveillance programs and targeted intervention strategies that incorporate both ecological dynamics and genetic adaptability to effectively limit AMR transmission through the food chain.

Community Frontline: The Asymptomatic AMR Bridge of Human Populations

Twelve-year surveillance conducted in Yulin (2013–2024) demonstrates that asymptomatic food workers serve as persistent reservoirs for AMR within community settings. This transmission pathway, though clinically silent, exhibits a pronounced evolutionary trajectory: multidrug-resistant *Salmonella* carriage increased to 41.9%, while tigecycline resistance emerged and escalated from undetectable levels to 24.4%. Notably, resistance patterns correlate strongly with regional socioeconomic development, as expanding healthcare infrastructure and economic growth inadvertently establish selective pressures that favor resistant strains. These findings reveal the complex relationship between human development and microbial adaptation, demonstrating that community environments function as dynamic sites for resistance evolution requiring integrated surveillance and intervention approaches.

Globalization Frontline: Trade Networks as Evolutionary Accelerators for AMR

Genomic investigation of *Salmonella* London and Rissen isolates collected in Shanghai (2020–2024) demonstrates how international trade networks function as evolutionary conduits that accelerate antimicrobial resistance dissemination across continents. While *S. London* displays historical segregation into geographically distinct clades reflecting limited intercontinental transmission, *S. Rissen* exhibits extensive contemporary gene flow, with Thailand identified as a primary source population. This global connectivity enables the widespread distribution of high-risk plasmids harboring up to 15 resistance genes, with Chinese isolates demonstrating the highest resistance burden among analyzed populations. These observations reveal the profound influence of modern commerce on pathogen evolution and underscore the urgent need for integrated global surveillance systems that span human health, animal agriculture, and international food trade to effectively prevent the emergence and spread of pan-drug-resistant pathogens.

CHINA'S COMPREHENSIVE AMR GOVERNANCE STRATEGY FOR A POST-ANTIBIOTIC ERA

Compelling evidence from multisectoral frontline studies aligns with China's National Action Plan to Contain Antimicrobial Resistance (2022–2025) within the One Health governance framework (Figure 2). This strategic alignment demonstrates how empirical findings from clinical, environmental, food chain, community, and global surveillance inform policy development and implementation.

China is strengthening antimicrobial efficacy through a comprehensive system of coordinated interventions. Prevention-centered approaches address infections at their source through healthcare controls, environmental sanitation, and vaccine expansion. Public education initiatives build health literacy across urban-rural populations



FIGURE 2. China's National Action Plan (2022–2025) exemplifies the translation of World Antimicrobial Awareness Week (WAAW) 2025's “Act Now” imperative into accountable, measurable interventions characterized by specific targets and sustained investment.

and schools. Antimicrobial stewardship is being implemented comprehensively across medical and agricultural sectors, effectively safeguarding last-resort antibiotics. Surveillance systems have evolved from passive data collection into proactive early-warning networks that seamlessly integrate human health, animal health, and environmental monitoring. Sustained investment in scientific innovation spans novel antimicrobials, diagnostics, and molecular epidemiology studies. International cooperation facilitates knowledge exchange and technical assistance globally. This multidimensional strategy, backed by inter-ministerial coordination and evaluation mechanisms, exemplifies translating the “Act Now” imperative into accountable, cross-sectoral interventions that safeguard health security and ensure a healthier future.

ACT NOW, SECURE OUR FUTURE TOGETHER

The World AMR Awareness Week 2025 theme, “Act Now: Protect Our Present, Secure Our Future,” functions as both an urgent warning and a global call to action. Building on the momentum generated by the 2024 United Nations General Assembly High-Level Meeting on AMR, this imperative urges all stakeholders — including governments, civil society organizations, healthcare providers, veterinarians, agricultural producers, environmental advocates, and the public — to transform political commitments into tangible, accountable, life-saving interventions.

China has demonstrated its commitment through the implementation of the National Action Plan, establishing comprehensive surveillance systems and promoting the One Health approach across all sectors. These concrete measures represent significant progress in containing AMR within a complex, interconnected system. We call upon all nations to strengthen their AMR containment efforts through coordinated global action, including the sharing of best practices, alignment of policies, and fostering of multilateral cooperation. Together, we can preserve antimicrobial efficacy and create a healthier, more sustainable world for generations to come.

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