

Introductory Note: Special Issue-13

AI vs. Superbugs: The Next Frontier in AMR



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Antimicrobial resistance (AMR) has emerged as one of the most pressing global health challenges of the 21st century, threatening the effective prevention and treatment of infectious diseases. The growing burden of drug resistance is driven by factors including inappropriate and excessive antimicrobial use, inadequate infection prevention and control, environmental dissemination of resistance determinants, and the horizontal transfer of antimicrobial resistance genes. The emergence of multidrug-resistant pathogens has increasingly limited therapeutic options, underscoring the need for effective surveillance, rapid diagnostics, antimicrobial stewardship, and innovative therapeutic strategies. Addressing this complex challenge requires coordinated action across human, animal, agricultural, food, and environmental health within a One Health framework.

In response to this escalating threat, World AMR Awareness Week is observed annually from 18–24 November to promote responsible antimicrobial use, strengthened surveillance and diagnostics, infection prevention and control, research and innovation, and coordinated One Health action. Reflecting this global priority, the 2026 WHO theme, “One Health, One Action: Prevent AMR Now,” emphasizes the shared responsibility of different sectors in preventing and containing antimicrobial resistance.

Against this background, Artificial Intelligence (AI)

offers promising opportunities to strengthen AMR research, surveillance, diagnosis, and therapeutic development. By analysing complex microbiological, genomic, clinical, epidemiological, and environmental datasets, AI and machine-learning approaches can support rapid pathogen identification, prediction of antimicrobial susceptibility, detection of resistance-associated genes and mutations, and monitoring of emerging resistance patterns. Computational approaches can further facilitate antimicrobial discovery through virtual screening, molecular modelling, drug repurposing, and the identification and optimisation of novel antimicrobial compounds and peptides.

The potential of AI extends beyond individual clinical applications to support a more predictive and integrated approach to AMR. AI-enabled systems may assist antimicrobial stewardship through treatment selection, dose optimisation, and monitoring of therapeutic outcomes, while integrating data from human, animal, agricultural, food, and environmental sources could improve the identification of resistance transmission pathways and emerging threats. Such applications may help shift AMR management from predominantly reactive responses towards earlier detection, prediction, and prevention.

Realising this potential will require high-quality and representative datasets, rigorous validation, transparency, data privacy, appropriate regulatory frameworks, and close collaboration among microbiologists, clinicians, computational scientists, bioinformaticians, and public-

health professionals. The responsible integration of AI with microbiology and One Health surveillance therefore represents a promising avenue for developing more precise, timely, and evidence-based strategies to prevent, detect, and contain antimicrobial resistance.

Recognizing the emerging role of AI in addressing these challenges, the Department of Microbiology, Valliammal College for Women, Chennai, is pleased to organize the International Online Conference on “AI vs. Superbugs: The Next Frontier in AMR.” The conference brings together faculty members, researchers, research scholars, students, healthcare professionals, and experts from microbiology and allied disciplines to present recent findings, examine emerging technologies, and explore innovative approaches to antimicrobial resistance. Through expert sessions and research presentations, the conference seeks to foster interdisciplinary dialogue and examine how responsible applications of AI can complement microbiological research and contribute to more effective strategies for the prevention, detection, and management of drug-resistant infections.

The scientific programme features expert sessions and research presentations addressing emerging developments in AI-enabled microbiology and AMR research. The sessions encompass advances in computational microbiology, antimicrobial discovery, resistance surveillance, antimicrobial stewardship, infection prevention and control, and the application of data-driven approaches in clinical and public health. Together, these presentations will provide perspectives

on emerging technologies and their integration with established microbiological practices.

Distinguished experts and resource persons will share their research findings, professional experiences, and perspectives on current developments in AMR research. The conference provides a forum for scientific interaction and discussion, bringing together diverse perspectives on contemporary challenges, emerging technologies, and innovative approaches in the field.

We extend our sincere appreciation to the organizing committee, invited speakers, authors, reviewers, faculty members, research scholars, students, and all participants for their valuable contributions to this scientific gathering. Their collective efforts have enriched the conference and strengthened the exchange of ideas across disciplines. We warmly welcome all contributors and hope that the discussions and research presented during the conference will stimulate further inquiry, encourage meaningful scientific collaboration, and contribute to the advancement of innovative approaches for preventing and addressing antimicrobial resistance.

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