



Sameeksha* – Antimicrobial Resistance (AMR)

* *Sameeksha* is a Hindi word, meaning review. This compilation of publications and resources (along with a brief summary) aims to review and share information according to the strategic priorities of India's National Action Plan on AMR, to facilitate containment of antimicrobial resistance in India. Kindly note, inclusion of publications and resources in this review/compilation does not imply an endorsement by WHO.

Key highlights of volume 1

- WHO's Global Antimicrobial Resistance and Use Surveillance System (GLASS) Report, 2021
- ICMRs design & development of customizable web API for interoperability of AMR data
- Isolation of multidrug resistant *Salmonella* spp. from the Yamuna in Delhi
- Challenges and opportunities for regulation of OTC sales of antibiotics for human use in India
- Cost effectiveness of typhoid vaccination in India
- India ranks tenth on the 2021 AMR preparedness index developed by GCOA and IDSA

Strategic priority 1: Awareness and understanding

Global Antimicrobial Resistance and Use Surveillance System (GLASS) Report: 2021

- The fourth GLASS report summarizes the 2019 data reported to WHO in 2020 and includes AMR data on 3,106,602 laboratory-confirmed infections reported by 24,803 surveillance sites in 70 countries.

WHO | GLASS report | 9 June 2021 | [Online link](#)

Knowledge, attitude, and practice survey on antimicrobial use and resistance among Indian clinicians: a multicentric, cross-sectional study

- Multicentric cross-sectional observational study across five tertiary care teaching medical colleges on knowledge, attitudes and practices among 506 Indian physicians related to antimicrobial use and AMR.
- Despite satisfactory background knowledge regarding the rational use of antimicrobials and AMR patterns, discrepancies in the physicians' prescribing attitudes were observed strengthening the case for instituting regular CME programs, development of institutional antibiotic policies, induction of infectious disease consultants, hospital infection control nurses, and pharmacists in implementing ASPs.

Perspectives in Clinical Research | Original Article | 31 May 2021 | [Online link](#)

JIACRA III – Antimicrobial consumption and resistance in bacteria from humans and animals

- Third joint inter-agency report on integrated analysis of antimicrobial agent consumption and occurrence of antimicrobial resistance in bacteria from humans and food-producing animals in the EU/EEA, 2016–2018.

ECDC | Surveillance report | 30 June 2021 | [Online link](#)

Antimicrobial resistance and stewardship e-Learning Repository

- Searchable database with peer and non-peer reviewed AMR and antimicrobial stewardship educational resources from differing health economies across the globe.
- Classified according to location, source, topic, target audience, duration, access, language, WHO region, accreditation/certification, etc.

BSAC and JAC-AMR | Repository | [Online link](#)

Strategic priority 2: Laboratories and surveillance

Design & development of customizable web API for interoperability of antimicrobial resistance data

- iDIA (data import app) proposes a platform-independent, web-based, and login-protected tool to facilitate interoperability of AMR data by automatically importing data from LIS and HIS into ICMRs antimicrobial resistance research and surveillance network.
- The user-friendly, open-source web-based framework can automatically import medical data from CSV files into generic data management and analysis systems.

Scientific reports | Article | 27 May 2021 | [Online link](#)

Surveillance strategies using routine microbiology for antimicrobial resistance in low and middle-income countries

- Authors aimed to review strategies for AMR surveillance using routine microbiology results in low and middle income countries (LMICs) and to highlight areas that need support to generate high-quality AMR data.
- Significant challenges remain in transition to a case-based approach in settings where resources, expertise and experience are limited.
- Guidelines, trainings and local capacity development as well as tertiary hospitals, research institutions and pharmaceutical companies with microbiology testing and involved in AMR data collection could play a role in leading and supporting the transition to case-based AMR surveillance.

Clinical Microbiology and Infection | Narrative Review | 7 June 2021 | [Online link](#)

Population-level faecal metagenomic profiling as a tool to predict antimicrobial resistance in *Enterobacterales* isolates causing invasive infections: An exploratory study across Cambodia, Kenya, and the UK

- A novel approach to population-level prediction of AMR in clinical isolates from 403 species of Enterobacterales, in 81 genera and 8 families, using metagenomic profiling of pooled DNA extracts from human faecal samples was developed and tested.
- Intermittent metagenomics of pooled samples could represent an effective approach for AMR surveillance to predict population-level AMR in clinical isolates, complementary to ongoing development of laboratory infrastructures processing individual samples.

EClinicalMedicine | Research Paper | June 2021 | [Online link](#)

Predicting antimicrobial resistance using partial genome alignments

- Global chromosomal alignments for *Klebsiella pneumoniae*, *Mycobacterium tuberculosis* and *Salmonella enterica* were generated and systematically searched for small conserved regions of the genome that enable the prediction of AMR phenotypes.

- Random forest-based machine learning classifiers were built for predicting susceptible and resistant phenotypes, and the subalignments were able to predict multiple AMR phenotypes with at least 70% accuracy, even though most did not encode an AMR-related function.

Antimicrobial Chemotherapy | Research Article | 15 June 2021 | [Online link](#)

Strategic priority 3: Infection prevention and control

Isolation of multidrug resistant *Salmonella* spp. from the river Yamuna in Delhi region of India

- Water samples from different locations of river Yamuna flowing through three states of Delhi NCR were collected and processed as per standard guidelines for isolation of *Salmonella* spp.
- All *Salmonella* isolates were positive for *invA* gene, and multidrug resistant (MDR) for at least five drugs with multiple antibiotic resistance index (MARI) above 0.2 indicating their origin from high source of contamination.
- Presence of MDR *Salmonella* spp. in the Yamuna is a serious public health concern emphasizing the need for containment of MDR *Salmonella* spp. to prevent its spread to susceptible human and animal population.

IJCMAS | Original Research Article | 10 February 2021 | [Online link](#)

Antimicrobials and food-related stresses as selective factors for antibiotic resistance along the farm to fork continuum

- Reviews the use of non-antibiotic stressors, such as antimicrobials, food-processing treatments, or even novel approaches to ensure food safety, as potential drivers for resistance to clinically relevant antibiotics.
- It is important to address cross-resistance or co-resistance events as a food safety issue, along with study of these effects during the experimental stage of evaluation of novel control strategies.

Antibiotics | Review | 4 June 2021 | [Online link](#)

Role played by the environment in the emergence and spread of antimicrobial resistance (AMR) through the food chain

- Food-producing sectors are linked with human, animal and environmental sources of AMR bacteria and antimicrobial-resistance determinants/genes (ARGs) – in a cyclical manner which are introduced to animal and plant-based food production environments, mostly through faecal waste of humans and animals.
- Reducing the occurrence of faecal microbial contamination of fertilisers, water, feed and production environment and minimising persistence/recycling of ARB within animal production facilities is a priority for all sectors.

EFSA Journal | Scientific Opinion | 17 June 2021 | [Online link](#)

Strategic priority 4: Optimise use of antimicrobials

Over-the-counter sales of antibiotics for human use in India: The challenges and opportunities for regulation

- Assesses the regulatory framework relating to OTC sales of antibiotics for human use in India.
- Advocates for an approach to regulation that incorporates a broader concept of regulation that encompasses binding as well as non-binding regulatory instruments and initiatives aimed at influencing stakeholder behaviour and makes the case for enhanced stakeholder participation in regulatory design.

Medical Law International | Article | 17 June 2021 | [Online link](#)

Measuring antimicrobial use needs global harmonization

- Monitoring antimicrobial use (AMU) in humans and animals is an essential strategic objective of global and national action plans on antimicrobial resistance as AMU, especially in food animals, contributes to the development and dissemination of AMR bacteria and genes.
- To ensure reliable AMU comparisons among different data sets including humans and animals, a tripartite WHO/OIE/FAO collaboration is needed to develop and implement a globally acceptable AMU metric system.

Global Challenges | Perspective | 10 June 2021 | [Online link](#)

The association between antibiotic use and survival in renal cell carcinoma patients treated with immunotherapy: a multi-center study

- Patients who received antibiotics during 3 months before or 3 months after start of immunotherapy had shorter overall survival.
- The findings support cautious use of antibiotics based on meticulous risk-benefit assessments in patients who are either receiving or are expected to receive immunotherapy.

Current Problems in Cancer | Article | 5 June 2021 | [Online link](#)

Development of a multifaceted antimicrobial stewardship curriculum for undergraduate medical education: the antibiotic stewardship, safety, utilization, resistance, and evaluation (ASSURE) elective

- The authors describe a novel antimicrobial stewardship curriculum for medical students that increased confidence in antibiotic prescribing and knowledge of antimicrobial stewardship principles
- This course could serve as an example to guide the development of similar curricula at other institutions.

Open Forum Infectious Diseases | Brief report | 8 May 2021 | [Online link](#)

Strategies to improve antimicrobial utilization with a special focus on developing countries

- Reducing AMR should be a high priority across countries given its clinical and economic impact and needs multiple coordinated activities across sectors driven by Governments and others.
- Coordinated approach including all key stakeholder groups is needed to minimize misinformation and maximize the impact of future interventions to reduce AMR rates.

Life | Review | 4 June 2021 | [Online link](#)

Strategic priority 5: Research and innovations

Cost effectiveness of typhoid vaccination in India

- Cost-effectiveness of introducing typhoid conjugate vaccine (TCV) was assessed for urban and rural India. In urban areas, TCV introduction would prevent 17% to 36% typhoid cases and deaths, and ICER (incremental cost per quality adjusted life years gained) was ₹ 151,346, ₹ 61,710 and ₹ 45,188 for 3 scenarios, which were cost saving. In rural areas, TCV is estimated to reduce the typhoid cases and deaths by 19% to 36%, with ICER ranging from ₹ 2340 to ₹ 3574 thousand inclusive of indirect costs, among the 3 vaccination scenarios.
- Introduction of TCV is a cost saving strategy in urban India, but not in rural India due to low prevalence.

Vaccine | Article | 10 June 2021 | [Online link](#)

Influenza vaccination and antimicrobial resistance: strategic recommendations

- Scientific evidence shows that influenza vaccination reduces antibiotic use, which may go on to reduce AMR, but despite greater awareness in recent years about this intervention, it is often not implemented at a policy level.
- This report is aimed at government officials, policy makers, public health organizations, academic researchers and health care professionals working in the field of vaccination and AMR.
- Strategic recommendations include:
 - 1) Gather high-quality data to, among others, produce a cost-benefit analysis to raise awareness regarding vaccination and AMR among policy makers,
 - 2) Increase influenza vaccination coverage rates among healthcare professionals, risk groups and the general public,
 - 3) Raise global awareness and understanding of influenza vaccination to reduce antibiotic use and include this topic in all AMR national action plans, and
 - 4) Build on the experiences of the COVID-19 pandemic to strengthen the importance of vaccination against viral respiratory pathogens.

Nivel | Report | 9 June 2021 | [Online link](#)

rMAP: the rapid microbial analysis pipeline for ESKAPE bacterial group whole-genome sequence data

- Authors developed the Rapid Microbial Analysis Pipeline (rMAP), capable of profiling the resistomes of ESKAPE pathogens (*Enterococcus faecium*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Acinetobacter baumannii*, *Pseudomonas aeruginosa* and *Enterobacter* species) using whole-genome sequencing data generated from sequencing platforms.
- rMAP is recommended as a tool for continuous monitoring and surveillance, suitable for assessing AMR gene trends especially in low resource settings

Microbial Genomics | Research Article | 10 June 2021 | [Online link](#)

Strategic priority 6: Collaborations

2021 AMR preparedness index

- Framework for accountability and evaluation, identifying best practices, to drive policy change and stimulate action and collaboration to address AMR by ranking 11 countries – Brazil, Canada, France, Germany, Italy, India, China, Japan, South Korea, the United Kingdom, and the United States – on country-level progress on 7 interconnected categories that contribute to the AMR challenge – national strategy for AMR; awareness & prevention; innovation; access; appropriate & responsible use; AMR & the environment; and collaborations.
- Key conclusions
 - COVID-19 pandemic demonstrated importance of responding proactively to a public health crisis;
 - AMR crisis will become a full-blown humanitarian catastrophe, threatening the miracle of human longevity if countries fail to take needed action;
 - National governments must step up to address existing threats; and with concerted action, progress can be made.
- India and China are tied with a score of 37 at tenth and ninth rank, respectively. Despite isolated improvements, Chinese research investment, vaccine utilization, and surveillance efforts are insufficient, while usage rates and the environment for innovation remain concerns. India has been unable to effectively manage and tackle the AMR threat, with poor healthcare and sanitation infrastructure and rampant antimicrobial misuse and overuse.

GCOA and IDSA | Index of national level commitments to address AMR | June 2021 | [Online link](#)

Innovative policy approaches for mitigating antimicrobial resistance: polycentric systems and the governance of antimicrobial usage

- Authors review and apply polycentric governance concepts to AMU and AMR at the local, regional, national, and transnational levels and discuss the critical issues pertaining to AMR and AMU, including learning, experimenting, communication, mutual trust, leakage, inconsistent regulatory initiatives, and free riding.
- The findings could be used to inform decision-making processes by public health experts, researchers, and policymakers to mitigate the public health risks of AMR.

Public Health Review | Article | 4 June 2021 | [Online link](#)