AMRSense: A People-Centric, AI-Enabled Scorecard for Antimicrobial Resistance Stewardship and Surveillance in Karnataka, India

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Background

Antimicrobial resistance (AMR) poses a growing threat to the resilience of health systems, particularly in LMICs. However, most empirical evidence on AMR in LMICs is derived from hospital-based surveillance networks, offering limited insight into transmission dynamics and antimicrobial use in the community.

Critical gap. The absence of systematic, community-level AMR data constraints effective policymaking and weakens the impact of antimicrobial stewardship and surveillance programmes.

Our Solution: *AMRSense*, a socio-technological scorecard and a multi-sectoral partnership that generates granular, locality-specific evidence on AMR trends, promotes AMR-preventive behaviours, and enables data-driven policy action.

Unique Partnership: Govt. of Karnataka, Academic lead, Implementation lead, Apex Medical Research Organization, & India's largest online pharmacy.

Objectives

To,

- **Improve data quality and longitudinal fidelity** while reducing the drudgery of community-level data collection through the use of Artificial Intelligence (AI) and Ayushman Bharat Health Account (ABHA) IDs.
- **Sense and triangulate local AMR trends** by integrating data on community awareness and behaviours, microbiology laboratory results, antibiotic sales, and hospital surveillance.
- **Translate evidence into actionable policy insights** using advanced modeling, interactive visualizations, and decision-support dashboards tailored for multiple stakeholders
- **Catalyze empowered community health networks** by introducing social recognition badges that reward community health workers for championing AMR evidence generation, rational antibiotic use, and infection prevention and control behaviours in community settings.

Methodology – Pillar 1: Community-Level Data

- Co-development of a **Delphi validated, gamified, culturally adapted data collection tools** that integrate ABHA ID, computer vision and AI to capture illness episodes, care-seeking, and antibiotic use in low-literacy populations, generating community-level AMR signals.
- Innovative use of AI and social badges to improve data quality and reduce drudgery.
- Scalable via integration with ABHA (National Health ID).


***AMRSense* Ecosystem**
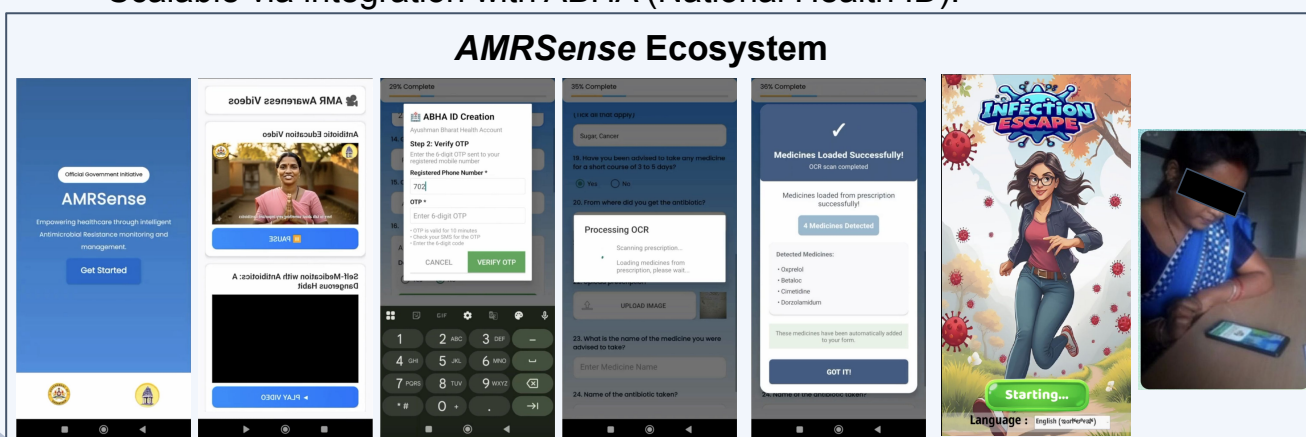
Methodology – Pillars 2 & 3: Awareness and Antibiotic Consumption

- **World Antimicrobial Awareness Week, 2024** - Co-development, and pilot testing of *InfectionEscape* serious game in collaboration with CHRI-PATH and Greater Bengaluru Municipal Corporation.
- **World Antimicrobial Awareness Week, 2025**
  - Co-development, and pilot testing of expert-validated, AI-generated videos to reinforce knowledge, attitudes, and practices for ASHA training in collaboration with CHRI-PATH and Greater Bengaluru Municipal Corporation.
  - AMR Reel Challenge inviting young changemakers (age group 18-28) across India to use their creativity for raising awareness through short, powerful reels.
- Ongoing development of a KAP survey and design of a pre-post intervention trial in collaboration with ICMR and CHRI-PATH.
- Unique partnership with Tata 1mg provides near-real-time, pincode-level aggregated resistance trends, prescription patterns and sales analytics for antibiotics.

## Methodology – Pillar 4: Microbiology & a Novel Scorecard

- *AMROrbit* - a novel scorecard designed to work with hospital and surveillance data was implemented.
- **Antimicrobial Susceptibility Testing** (AMST) data from Tata 1mg diagnostics are integrated into the AMROrbit scorecard, linking prescribing patterns to resistance through dynamic trajectories and quadrant-based benchmarking.
- Cluster robust estimation to incorporate bespoke level of granularity (e.g. ward, department, hospital, city, district, state, country) for local stewardship.

AMROrbit Tool

manuscript under review

AMROrbit Research Preprint
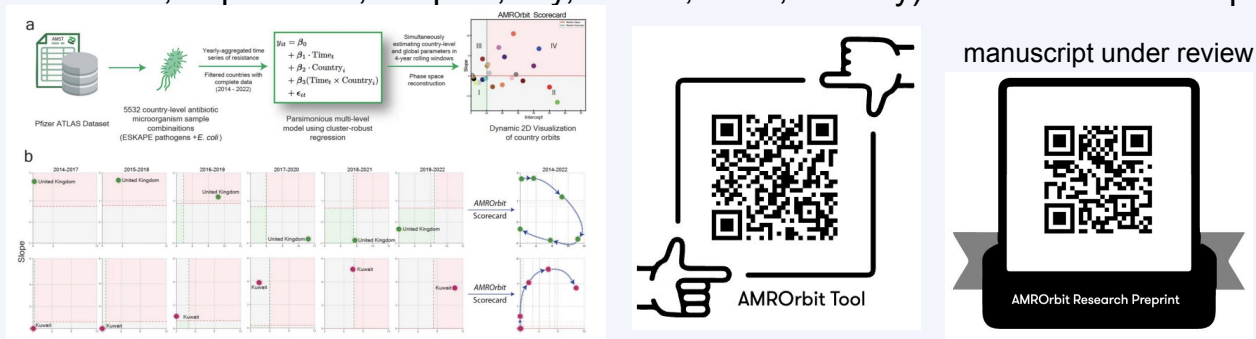
Major Findings

National Trends and Associations
- Community level trends of resistance are largely concordant with hospital based trends published by ICMR.
- Trends and inflection points in Carbapenem resistance are more pronounced, strengthening the validity of the approach.
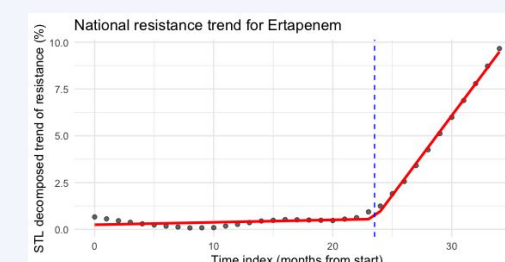
Monthly aggregated time-series were decomposed to obtain linear trends, seasonality followed by a changepoint analysis showing clear inflection point in increase in Ertapenem resistance in early 2025.

Global Trends and Scorecards
Pilot analyses spanning more than 80 countries show that over 60% of antibiotic–pathogen combinations display upward resistance trajectories in the AMROrbit Scorecard analysis.

Conclusion & Policy Recommendations

- *AMRSense* demonstrates that community-level AMR surveillance is both feasible and policy-relevant when enabled by multi-sectoral partnerships, co-design principles and expert-in-the-loop AI tools.
- The concordance between community-derived signals and hospital-based trends, alongside early detection of resistance inflection points, underscores the value of integrating non-traditional data sources into national and state action plans.
- Intuitive visualizations such as *AMROrbit* scorecards enable evidence based antimicrobial stewardship in tertiary care hospitals as well as microbiology labs.

Policy actions recommended:

- Institutionalize community-level AMR surveillance as a formal complement to hospital networks within national and state action plans for containment of AMR.
- Leverage digital public infrastructure (e.g. ABHA IDs) to improve continuity, attribution, and longitudinal monitoring of antimicrobial use and resistance.
- Integrate consumption, microbiology, and behavioural data streams to enable early warning systems and geographically targeted stewardship interventions.
- Embed AI-driven analytics, scorecards, and dashboards into routine decision-making for state and national health authorities to support timely, evidence-based responses.

Scalability, Recognition & Contact

Design for Scale

- Grassroot innovation and social recognition mechanisms to sustain motivation and performance of community health workers.
- Seamless linkage with ABHA for national roll-out and cross-state comparability.
- Fail-fast, co-design principles, human centric and expert-in-the-loop use of AI to reduce data collection burden.
- Accelerated insights through value partnerships (government, academia, industry, health research to enable lab research to community action.
- Globally transferable, multi-layered approach for strengthening AMR surveillance and stewardship. Extensible to include One Health layers.

Recognition: Joint Second Prize Winner in *The Trinity Challenge*, 2024; Vivli Innovation Award, 2024; Used as a case study in the World Economic Forum's AMR report; Featured on the Principal Scientific Advisor's (Govt. of India) Website

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