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SCIENTIFIC

STRATEGIC ROUNDTABLE MEETING

Strengthening **ANTIMICROBIAL RESISTANCE (AMR)**

Surveillance Through
CROSS-SECTORAL COLLABORATION

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Executive Summary

This white paper documents the second edition of the Voice of Healthcare (VOH) Strategic Roundtable on Strengthening Antimicrobial Resistance (AMR) Surveillance, convened in New Delhi and supported by Thermo Fisher Scientific. The meeting brought together clinicians, microbiologists, veterinary and fisheries scientists, environmental and genomics researchers, national standards bodies, digital-health specialists, policymakers and industry representatives to take stock of where India's AMR surveillance currently stands and to map out what a genuinely functional multisectoral system would look like in practice.

The picture that emerged is one of real but incomplete progress. India has built credible surveillance infrastructure in the human-health sector, principally through the ICMR and NCDC hospital networks, and comparable systems are maturing in the animal and fisheries sectors under ICAR's INFAAR network. What remains stubbornly unresolved is the question of convergence. Data generated across the human, animal, food and environmental domains still do not speak to one another in any meaningful sense. The methods differ, the reporting formats differ, the breakpoints and ontologies differ, and the result is that information which should be complementary ends up siloed and largely unactionable.

Participants were not brought together to revisit a challenge that is already well recognised and extensively documented, but rather to identify the most actionable points of intervention. The discussion converged around three immediate priorities: addressing fragmented data systems through standardised reporting templates and a shared, federated national repository, designed from the outset to align with the Ayushman Bharat Digital Mission (ABDM) rather than sit apart from it; strengthening consistency in laboratory quality through harmonised SOPs and context-appropriate accreditation frameworks across sectors; and initiating a focused, pathogen-specific multisectoral pilot supported by an integrated laboratory network, under the stewardship of an empowered coordinating authority with the mandate to make reporting stick.

In parallel, participants emphasised the need to transition from categorical disk-diffusion reporting toward quantitative MIC-based surveillance to enable more meaningful resistance monitoring, where case volume, funding and technical capacity justify it. Considerable attention was also drawn to the often-overlooked impact of antibiotic contamination in driving environmental antimicrobial resistance, alongside the importance of developing sustainable financing mechanisms to retain trained personnel beyond the lifecycle of grant funding. A recurring observation, in the Chair's words, was that surveillance in India has become reasonably good at generating data and considerably less good at converting that data into a treatment guideline, a stewardship intervention, or a regulatory decision, a gap the roundtable resolved should be treated as a recommendation in its own right, not an implicit hope.

This edition also strengthens its treatment of diagnostic stewardship across the total testing pathway, molecular and genomic diagnostics, artificial intelligence and laboratory informatics, operational mechanisms for private-sector integration, and a phased implementation roadmap anchored to measurable performance indicators and workforce development.

The national policy architecture is solid and the commitment at the highest levels of government is genuine. The gap is in implementation, in converting frameworks into functioning systems, and surveillance outputs into decisions that clinicians and policymakers can actually use.

Annual surveillance	31	Diagnostic stewardship
ICMR AMRSN publishes hospital-based antimicrobial resistance surveillance reports.	Participating in ICAR's All India Network Programme on AMR, as reported in April 2025.	Priority: strengthen appropriate testing and the use of laboratory results in prescribing.

1. Introduction

Antimicrobials are not simply one category of drugs among many. They underpin the entire architecture of modern medicine: without effective antibiotics, routine surgery carries infectious risk, cancer chemotherapy becomes untenable, organ transplantation is unsafe, and infections that were once trivially treatable become potentially fatal. Antimicrobial resistance (AMR) is the progressive erosion of that architecture. The WHO defines it as the reduction in susceptibility of microorganisms to antimicrobials; in practice, it means that drugs stop working, and the pipeline for genuinely new ones is thin.

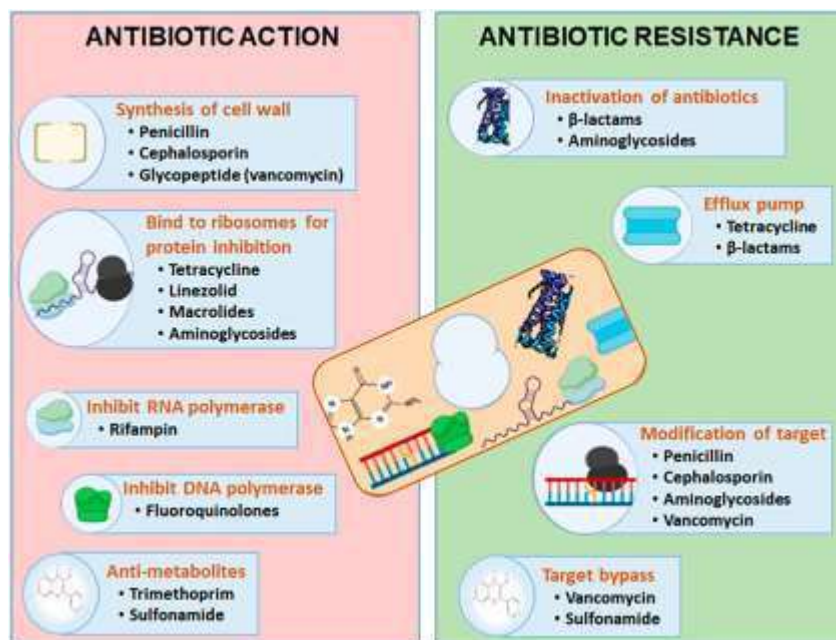


Figure 1. How common antibiotic classes act on the bacterial cell (left) and the corresponding resistance mechanisms that can defeat them (right): inactivation, efflux, target modification and target bypass. 1, One Network–One Nation–One Health India's Strategic Blueprint for Resilient, Cross-Sectoral Health Systems. Aerobiology. 2026

For India, the challenge is compounded. The infectious disease burden is high, antibiotic use is heavy and frequently unsupervised, and diagnostic capacity, particularly outside tertiary urban centres, is uneven. The result is a situation where empirical prescribing of broad-spectrum agents is the norm rather than the exception, which selects for resistance and makes the surveillance data we do have harder to interpret.

This white paper documents the second edition of the VOH Strategic Roundtable on AMR Surveillance. The first edition established why diagnostics and surveillance are the foundation of any effective AMR response. This second edition asked the harder question: how, specifically, can surveillance be operationalised across sectors in a way that produces data that are comparable, timely and actually used? The discussions covered the current state of surveillance systems, interoperability and governance, laboratory quality assurance, the emerging technology landscape and, persistently, the question of financing.

The One Health framing ran through the entire conversation. Resistant bacteria and resistance genes do not respect the boundaries between human medicine, veterinary practice, food systems and the environment. Anything that changes selection pressure in one sector, heavy antibiotic use in poultry farming, for instance, or inadequate effluent treatment at a hospital, has potential consequences in others. But participants were equally clear that One Health cannot be invoked as a reason to merge everything prematurely. Each sector's surveillance needs to be robust in its own right before cross-sector inference becomes meaningful rather than misleading.

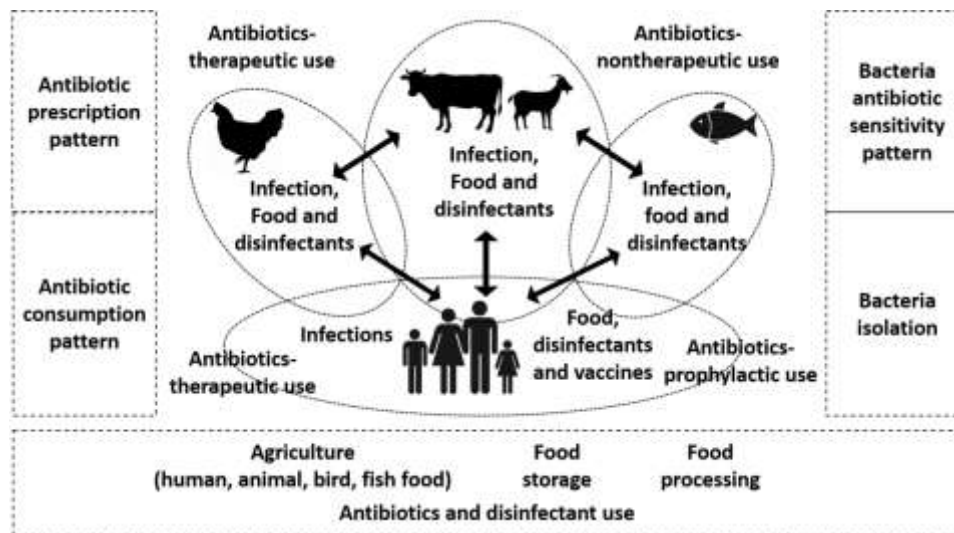


Figure 2. A harmonized One Health surveillance framework linking antibiotic use, infection, food and disinfectant practices, and antibiotic sensitivity/isolation patterns across human, livestock, poultry and fish populations. Source: Kakkar M, et al. Harmonized One Health Trans-Species and Community Surveillance for Tackling Antibacterial Resistance in India: Protocol for a Mixed Methods Study. *JMIR Res Protoc* 2020;9(10):e23241. <https://www.researchprotocols.org/2020/10/e23241/>

2. Background and Context: India's AMR Surveillance Landscape Today

India's surveillance ecosystem has evolved considerably over the past fifteen years, moving from largely reactive, facility-level monitoring toward something that at least aspires to be an integrated national biosurveillance posture. The principal pillars discussed at the roundtable were:

- **ICMR AMR Surveillance Network:** a hospital-based network that publishes annual antimicrobial resistance surveillance reports. Strengthening representation across levels of care remains important for generating evidence applicable to different clinical settings
- **NCDC AMR Network:** anchored in medical colleges, supported by a robust external quality assessment programme and regular training, with annual reports.
- **The India AMR Innovation (IAIH)** envisioned as the Innovation Arm of NAP 2.0, anchored at C-CAMP, Bangalore, also works towards innovations in the area of surveillance.
- **ICAR INFAAR Network:** the Indian Network for Fisheries and Animals Antimicrobial Resistance, covering more than 31 centres across livestock, poultry, dairy and aquaculture, with multi-year data on key indicator organisms.
- **Environmental and wastewater surveillance:** emerging programmes including the repurposing of INSACOG for AMR sewage surveillance across approximately seven institutes in around 24 states, and an ICMR environmental surveillance project funded under the National One Health Mission. The Department of Biotechnology (DBT) has separately established a nationwide network for longitudinal sewage surveillance of AMR, modelled on the INSACOG framework, intended to enable systematic monitoring of resistance trends over time and to support evidence-based public health interventions across the country. Participants noted that this network should be brought within the same federated data architecture proposed in Recommendation 1, rather than developing as a further parallel stream.
- **National One Health Mission:** coordinated through the Office of the Principal Scientific Adviser and engaging more than sixteen ministries and departments, with a dedicated pillar for federated, interoperable data systems.

These pillars represent genuine progress. The central limitation is that they remain largely siloed, with limited interoperability and inconsistent translation of data into action. That tension between what exists and what the data could do if properly connected was the recurring theme of the day.

India's One Health Timeline (2004–2023)



Figure 3. India's One Health timeline, 2004 to 2023, from the foundational launch of IDSP through policy and surveillance expansion to the announcement of the National One Health Mission (NOHM-2024).

3. Overview of the Roundtable Discussion

The roundtable ran as a four-hour moderated deliberation, chaired by Dr. Sweta Raghavan. Following introductions, discussions moved through sequential sessions, each opened by a keynote contribution and followed by open comment. Sessions addressed the current status, strengths and gaps of AMR surveillance; mechanisms for coordination, governance and science-to-policy translation; laboratory standardisation and quality assurance; future opportunities and emerging technologies; and the formulation of prioritised recommendations with sustainable financing in mind.

Anchoring contributions came from the ICMR perspective on national surveillance; from the Office of the Principal Scientific Adviser on the national policy and One Health framing; from an international industry specialist on the distinction between clinical management and epidemiological surveillance; and from a researcher working on the translation of surveillance data into antibiotic-contamination monitoring.

What participants returned to, in different formulations across the day, was a single unifying point: surveillance data are only as useful as what gets done with them. A surveillance system that generates data that never feed back into clinical guidelines, treatment protocols or policy decisions is, in practice, a documentation exercise. Bridging the gap between what the science produces and what ministers and clinicians can act upon is the real work that remains.

4. Expert Views and Major Findings

4.1 Current Status of AMR Surveillance in India

Robust tertiary-care surveillance exists, but it does not represent the whole country.

The ICMR and NCDC networks have done something historically significant: they have closed a longstanding evidence gap at the tertiary-care level. The country now has a credible picture of resistance in tertiary hospitals. Evidence generation was described by several participants as the single most important historical bottleneck; without it, policy is essentially guesswork.

Participants highlighted an important limitation in interpreting tertiary-care surveillance data. Tertiary centres predominantly manage referred and clinically complex cases and therefore tend to report substantially higher antimicrobial resistance rates. If treatment guidelines were based exclusively on such data, the resulting implication would be the widespread initiation of last-line therapies across patient populations.

Surveillance findings from tertiary-care hospitals should be interpreted in the context of their patient populations and referral patterns. Greater representation of secondary and district-level facilities would help establish how resistance patterns vary across levels of care and support prescribing guidelines appropriate to each setting. Comparisons should specify the organism, antimicrobial, specimen type, patient population and surveillance period.

A number of more specific observations were made:

- Many district hospitals still lack qualified microbiologists or adequately equipped microbiology laboratories. This is not a peripheral concern; it is the central reason national surveillance data are skewed.
- The private sector manages an estimated 72% of Rural and 79% of urban clinical workload in India, but its participation in surveillance is largely voluntary. Several participants argued it should be mandatory, with appropriate data-governance and confidentiality protections.
- Operationalising mandatory private-sector reporting, reviewers noted, will need concrete mechanisms rather than a general mandate: phased onboarding that brings large private laboratory chains in first through standard API-based reporting interfaces, before extending to standalone laboratories; accreditation-linked incentives, such as preferential empanelment under government health-insurance schemes for EQAS-compliant laboratories; a data-governance framework that anonymises patient-identifiable information before aggregation; and a single, published reporting specification so that private networks are not asked to build bespoke integrations for every state or scheme they participate in.
- Multiple reporting portals coexist, WHONET, ICMR platforms and others, without a shared data language. The analogy offered was that of electrical plugs: what is needed is not more sockets, but a common connector.
- Responsible reporting matters. Environmental and genomic surveillance, in particular, can surface findings with significant commercial or reputational implications for agriculture, aquaculture or medical tourism, and reporting without adequate attention to data quality and clinical context can cause disproportionate harm.

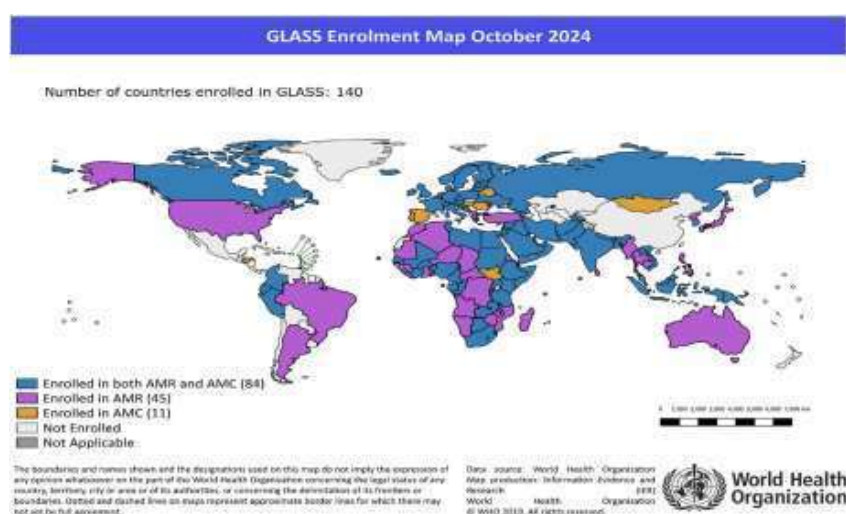


Figure 4. Countries enrolled in WHO's Global Antimicrobial Resistance and Use Surveillance System (GLASS) as of October 2024, split by enrolment in AMR surveillance, antimicrobial consumption (AMC) reporting, or both. Source: World Health Organization.

4.2 One Health Integration and the Transmission Question

Sectoral systems need to be strengthened individually before cross-sector inference becomes reliable.

There was broad agreement that AMR must be approached through a One Health lens connecting human, animal, food and environmental health. The ICMR–ICAR collaboration and the maturing INFAAR network were pointed to as positive developments. At the same time, participants were cautious about the tendency to attribute clinical resistance to the veterinary sector before the evidence for transmission has been adequately established.

In studies examining the overlap of antibiotic resistance genes across clinical, hospital-environment and livestock isolates in two Indian cities, significant overlap was found between human and hospital-environment samples, unsurprising, since hospital effluents carry patient excreta and discharged antimicrobials. The overlap between human and animal isolates was more limited, with the notable exception of fluoroquinolones, where heavy human consumption makes interpretation difficult.

Several methodological cautions followed:

- A meaningful One Health study requires co-located sampling from livestock, their owners, and the shared environment within the same geography, rather than comparing clinical isolates from one city against veterinary isolates from another. Whole-genome sequencing is needed to establish clonal origin and genuine transmission links.
- The directionality of transmission between sectors remains poorly characterised, a genuine and important research gap, not a technicality.
- Environmental surveillance should be treated as a distinct stream. The environment harbours a vast and varied resistome, and environmental breakpoints differ from clinical ones; mixing the two creates interpretive problems. Its value lies specifically in functioning as an early-warning system that complements clinical data not as a substitute for clinical microbiological surveillance, and its breakpoints and interpretive frameworks should be defined separately from clinical breakpoints from the outset.
- Antimicrobial consumption and resistance are directly linked. An NCDC analysis of government hospitals documented heavy prescribing of broad-spectrum Watch-group agents, which exerts the strongest selection pressure. Infection prevention, antimicrobial stewardship and surveillance are not separate programmes; they are parts of the same feedback loop.

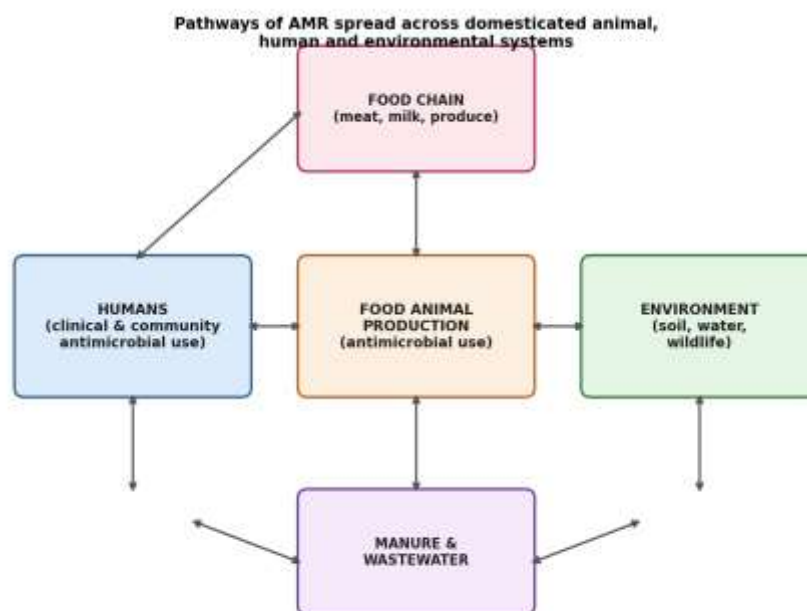


Figure 5. Pathways of AMR spread across domesticated animal, human and environmental systems — antimicrobial use in food animal production, humans and the environment interact via the food chain, manure, wastewater, direct contact and runoff. Redrawn for this paper from the interaction map in: Graham DW, Bergeron G, Bourassa MW, et al. Complexities in Understanding Antimicrobial Resistance Across Domesticated Animal, Human, and Environmental Systems. *Ann N Y Acad Sci* 2019;1441(1):17–30. <https://doi.org/10.1111/nyas.14036>

Supplementing this, a 2025 systematic review by Pham and Wozniak formalised these interactions into a causal loop model, showing how antibiotic use in humans and animals and antibiotic concentrations in the environment reinforce AMR evolution through feedback loops with infections and treatment failures in turn driving further prescribing.

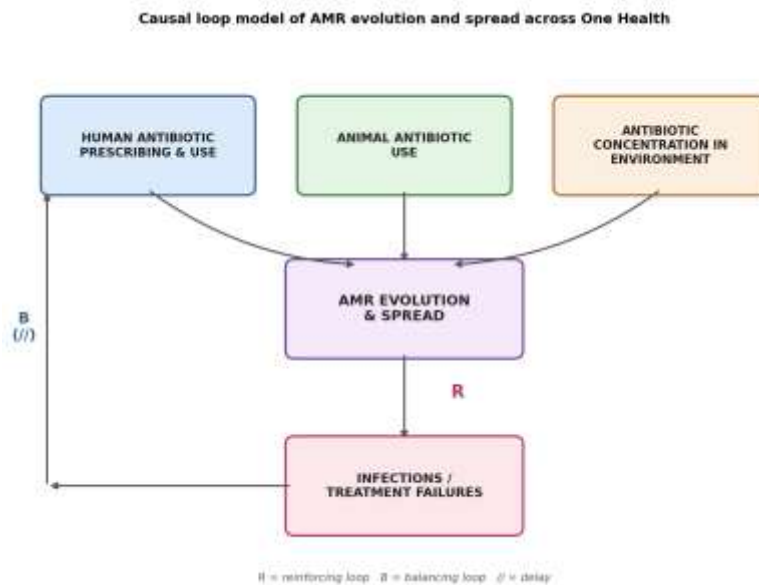


Figure 5a. A causal loop model of AMR evolution and spread across One Health, showing reinforcing (R) and balancing (B) feedback loops between antibiotic use, AMR evolution, and infections. Redrawn for this paper from: Pham Y, Wozniak TM. *Systems Thinking to Understand the Complexity of Antimicrobial Resistance Across One Health: A Systematic Review of Current Approaches*. *One Health* 2025;20:101081. <https://doi.org/10.1016/j.onehlt.2025.101081>

4.3 Data Interoperability, Standards and Governance

Participants emphasised that a federated, interoperable data architecture is likely to be more effective than a single centralised database for advancing integrated AMR surveillance.

The governance challenge is fundamentally structural. AMR is inherently multisectoral, yet the sectors involved operate under different ministries, with varying degrees of overlap and coordination. Some mandates intersect, while others leave critical gaps. Pollution control boards, for example, are essential to any comprehensive environmental surveillance strategy but function outside the health ministry ecosystem.

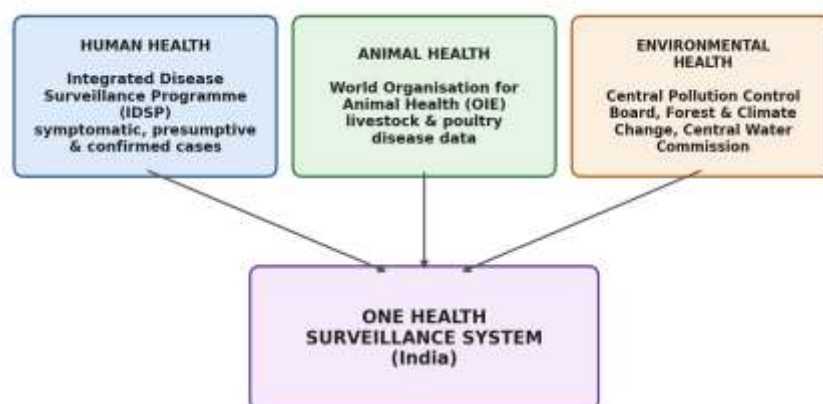
As a result, implementation remains highly uneven across geographies. A state may demonstrate strong engagement from the animal husbandry sector while showing limited participation from pollution control authorities, making the generation of integrated environmental datasets difficult in practice.

In response, the National One Health Mission is working toward an interoperable, federated data framework. However, foundational challenges remain substantial: identifying what datasets currently exist across sectors, establishing common indicators and standards, and clearly defining institutional responsibilities for data collection, stewardship and quality assurance.

On specific governance and standardisation questions, the following themes recurred:

- **Data standards:** clinical informatics has established frameworks like SNOMED and LOINC (the latter including AST and MIC concepts), but harmonised data definitions for AMR and microbiology across sectors are still absent. Without them, interoperability is a word rather than a reality.
- **Federated rather than centralised:** a single national repository is neither technically nor politically sustainable; sectoral data ownership is a real consideration. A federated model can address concerns about sharing, anonymity and accountability, provided each sector builds a strong enough local data ecosystem to contribute meaningfully to it.
- **The NTEP model:** the National Tuberculosis Elimination Programme's reporting portal, with mandatory reporting from both public and private facilities, a common dashboard, and Ministry of Health-led inter-ministerial coordination, was repeatedly cited as the most apposite Indian template for what AMR surveillance should aspire to.

- **Using existing infrastructure:** rather than creating bespoke surveillance sites from scratch, participants saw merit in drawing on routine, already-digitised laboratory data, with AI tools used to structure unstructured laboratory notes as an initial step toward richer data capture.
- **Administrative speed:** the pace of regulatory and inter-departmental approvals was raised as a tangible barrier, one environmental surveillance project had waited over two years for permissions. Faster inter-departmental processing is itself a surveillance priority.



Post-COVID-19 boost to cross-domain One Health surveillance coordination

Figure 6. India's existing One Health surveillance architecture the Integrated Disease Surveillance Programme (IDSP) for human health, OIE-reported livestock and poultry data for animal health, and CPCB/Forest & Climate Change/Central Water Commission data for environmental health, feeding a combined One Health surveillance system. Redrawn for this paper from: Raut J, Joshi A, Mudey A, Mehendale AM. The Past, Present, and Future of One Health in India: A Narrative Review. *Cureus* 2023;15(9):e44992. <https://doi.org/10.7759/cureus.44992>

4.4 Laboratory Standardisation and Quality Assurance

For surveillance purposes, quantitative MIC measurement matters more than categorical breakpoint classification.

Standardised methods and quality assurance underpin comparable surveillance:

Antimicrobial susceptibility surveillance requires validated methods, consistent interpretation and documented quality control. Disk diffusion produces inhibition-zone measurements that can be interpreted using the relevant breakpoints, while MIC methods measure the concentrations needed to inhibit growth. These measurements provide different forms of information and should be retained with the testing method and interpretive-standard version.

Method selection should reflect the organism–antimicrobial combination, surveillance objective and laboratory capacity. MIC testing can add useful resolution where justified, while standardised disk diffusion remains part of the surveillance framework. Any investment in additional testing capacity should follow the site-specific assessment and vendor-neutral procurement approach described in Recommendation 4.

On quality assurance more broadly, a layered approach was endorsed:

- **Internal quality control:** daily checks on media quality, inoculum preparation and the performance of reference strains of known susceptibility on both automated and manual systems.
- **External quality assessment:** participation in recognised EQAS programmes for bacterial AMR through bodies such as the Indian Association of Medical Microbiologists and CMC Vellore, and for mycology through PGI Chandigarh, supplemented by inter-laboratory comparisons and split-sample testing.

- **Proportionate accreditation:** ISO 15189 applies to medical laboratories; ISO/IEC 17025 to other testing environments. Full accreditation of the most peripheral facilities is not a realistic near-term target, but prescribing one or two standardised methods for those settings is.
- **National breakpoints and reference strains:** guideline-version drift, laboratories still using CLSI 2015 when the current edition would reclassify the same isolate, is an underappreciated source of error. Accessible national breakpoints and affordable indigenous reference strains (through MTCC/IMTECH, VTCC and equivalent collections) would reduce both the inconsistency and the cost burden on peripheral laboratories.
- **Workforce:** placing qualified microbiologists at district hospitals and ensuring minimum culture and AST capability at those facilities was described as essential, not optional. As surveillance moves toward genomics, the skill mix required in laboratories will also need to shift.

4.5 Antibiotic Contamination and Environmental Surveillance

Monitoring antibiotic contamination in the environment is as important as monitoring resistance genes.

One of the more striking contributions at the roundtable concerned the role of antibiotic contamination in driving environmental resistance, a dimension of the AMR problem that receives considerably less attention than it deserves. The core point is straightforward: resistance evolves under antibiotic exposure, and the environment is saturated with antibiotics. Most of the orally consumed antibiotic, >70% for tetracyclines and up to 70% for fluoroquinolones are excreted as parent compound or active metabolite and reach sewage. Agents such as amoxicillin, tetracycline, erythromycin and streptomycin reach substantial concentrations in wastewater from both community and hospital sources.

Surveillance data shared at the meeting illustrated the consequences.

During the COVID-19 period (2020–2022), heavy azithromycin use across India was followed by a subsequent rise in macrolide (erythromycin) resistance genes, alongside detectable erythromycin contamination in environmental samples across six states. This is a plausible causal sequence, though it is correlational; establishing it definitively requires the kind of co-located, longitudinal, genome-resolved studies that remain rare.

The implication for surveillance design is that programmes should be measuring antibiotic concentrations alongside resistance genes, not one or the other. INSACOG has been repurposed for this function, now sampling airports, hospitals, community wastewater and livestock sources for both bacteria and fungi across approximately 24 states. But gaps remain: few medical colleges operate effluent treatment plants, those that exist lack standards for antimicrobial removal, and historical participation in sewage AMR work has been limited.

The Department of Biotechnology's new nationwide sewage surveillance network, modelled explicitly on the INSACOG framework, is a direct response to this gap. Because it is designed for longitudinal monitoring rather than one-off sampling, it should make it possible to track resistance-gene and antibiotic-concentration trends over time at a consistent set of sites, which is precisely the kind of data the roundtable identified as rare. Its value will depend on how tightly it is integrated with the ICMR-NHM environmental programme and the wider federated data architecture, rather than run as a separate reporting line.

The path forward outlined during the roundtable centred on structured, objective-driven environmental surveillance studies. Key examples included a Karnataka state initiative examining the interconnectedness of clinical, environmental and veterinary domains, alongside a Pan-India ICMR–NHM environmental surveillance project spanning approximately 60 centres and employing metagenomics and qPCR methodologies.

Importantly, these initiatives are not intended to generate additional data for its own sake. Rather, they are designed to determine whether, and in what ways, environmental surveillance signals can meaningfully complement clinical antibiograms and strengthen antimicrobial resistance monitoring, addressing a system challenge that is increasingly defined not by data scarcity, but by the ability to translate existing evidence into actionable insights.

4.6 Future Opportunities and Emerging Technologies

Point-of-care diagnostics and culture-independent methods can extend surveillance beyond the urban tertiary core.

Participants were broadly optimistic about the technology horizon, but clear-eyed about what will actually shift the dial at scale. Point-of-care diagnostics were identified as the single highest-leverage technology priority, in particular, C-reactive protein testing in primary care settings as a means of triaging viral from bacterial illness. If a clinician in a primary health centre can establish with confidence that a patient does not have a bacterial infection, the pressure to prescribe an antibiotic is

relieved. Several participants judged that CRP point-of-care testing, deployed at community level, could offer the greatest single lever against community-level antibiotic overuse currently available.

Beyond CRP, a range of further opportunities were discussed:

- **Rapid, culture-independent diagnostics:** CRISPR-based platforms; and syndromic multiplex PCR panels that include resistance-gene detection alongside pathogen identification.
- **Sequencing:** targeted next-generation sequencing and nanopore approaches can now return results within roughly 24 hours and are increasingly practical for surveillance applications; whole-genome sequencing remains the reference standard for source attribution and cross-sector spillover analysis. The development of locally relevant bioinformatics pipelines, particularly for fungal AMR, where existing databases are thin, is an important enabling step.
- **Antibiotic potentiators:** given how little genuinely new antibiotic classes are in the pipeline, approaches that restore the activity of existing agents through potentiation, extending beyond the established beta-lactamase inhibitor combinations to aminoglycosides and macrolides, were raised as both scientifically interesting and practically important.
- **Indigenisation:** cost-effective, locally manufactured surveillance reagents, consumables and platforms are essential if surveillance is to be sustainable and scalable. A reliance on expensive imported materials limits both the number of laboratories that can participate and the continuity of programmes when external funding lapses.
- **Behavioural and systems approaches:** the outpatient and home-care prescribing segment remains almost entirely outside formal surveillance. AI-driven clinical decision support, mining of electronic health records and e-prescriptions, and consumption-versus-resistance monitoring all offer routes into this currently invisible domain.
- **Drug disposal:** take-back schemes at retail pharmacy level and photocatalytic or other treatment of pharmaceutical effluent were raised as practical interventions to reduce environmental antibiotic loading, requiring inter-ministerial cooperation between the Department of Pharmaceuticals and pollution-control authorities.

Multiplex PCR and syndromic molecular panels, rapid resistance-gene detection, whole-genome sequencing, nanopore sequencing, metagenomics and other culture-independent approaches are already reshaping how outbreaks are detected and investigated internationally, and the roundtable's own consensus is that India's surveillance strategy should build toward these methods rather than treat them as optional extras.

4.7 Diagnostic Stewardship Across the Total Testing Pathway

This section was added following expert review, which identified diagnostic stewardship as a foundation of surveillance quality that the original discussion of laboratory standardisation had not fully captured. Diagnostic stewardship is the deliberate management of the entire testing pathway, not only the analytical step, so that the right test is performed on the right patient, on the right specimen, at the right time, and reported in a way the clinician can actually act on. Because every surveillance number ultimately traces back to a specimen someone decided to collect, weaknesses at the pre-analytical and post-analytical ends of the pathway propagate directly into the resistance rates the country reports.

The pathway is usefully thought of in three phases, each with its own quality determinants:

- **Pre-analytical:** appropriate test selection and clinician ordering practices; correct specimen type, volume and collection technique; blood-culture stewardship specifically, including the number and volume of sets drawn before antibiotic initiation, since under-collection is a major driver of false-negative cultures; defined transport conditions and timeframes; and explicit, enforced specimen-rejection criteria for contaminated, mislabelled or inappropriately transported samples.
- **Analytical:** covered in Section 4.4 above, this is the phase conventional laboratory standardisation efforts have focused on, but it is only the middle third of the pathway.
- **Post-analytical:** selective and cascade antimicrobial susceptibility reporting, in which broader-spectrum or reserve agents are reported only when first-line options fail, so that reporting itself nudges prescribing toward narrower-spectrum choices; structured interpretive comments attached to resistant or unusual results; and reliable, timely laboratory-to-clinician communication, particularly for critical or panic values.

Reflex and selective testing strategies, deciding in advance which confirmatory or additional tests a given result should automatically trigger, sit across the analytical and post-analytical phases and were highlighted as a practical way to raise diagnostic yield without proportionately raising laboratory workload. Embedding clinician education on all three phases,

rather than treating stewardship as a laboratory-only concern, was seen as essential: many of the pre-analytical failure points originate at the bedside, not the bench.

Quality indicators from this pathway, blood-culture contamination rates, specimen rejection rates, and turnaround time from collection to actionable report, belong alongside the EQAS and accreditation metrics.

4.8 Artificial Intelligence and Laboratory Informatics

Experts noted that artificial intelligence was mentioned only briefly in the original discussion, chiefly as a tool for structuring unstructured laboratory notes, when its plausible role in surveillance is considerably broader. This section consolidates that broader picture, added following expert review, without implying that any of these applications were piloted or committed to at the roundtable itself; they are set out here as the near-term technology agenda the paper's recommendations point toward.

On the analytics side, the applications most frequently discussed in the wider field include AI-assisted generation of local and regional antibiograms, predictive resistance modelling that flags likely emerging resistance before it is widely reported, automated surveillance dashboards that update as new isolate data arrives, outbreak-prediction and early-warning systems, embedded clinical decision support at the point of prescribing, and machine learning-based forecasting of resistance trends to inform procurement and treatment-guideline cycles.

None of this is achievable without the underlying laboratory informatics and interoperability layer. That means functioning laboratory information systems (LIS) at every contributing facility; adoption of recognised interoperability standards, HL7 and FHIR for messaging, LOINC for test identifiers, and SNOMED CT for clinical terminology; continued and expanded WHONET integration, since it is already the de facto data format many Indian laboratories use; and automated reporting pipelines that push results into the federated architecture proposed in Recommendation 1 without requiring manual re-entry. This informatics layer is treated in this white paper as infrastructure on the same footing as laboratory equipment, not as a downstream digital-health enhancement to be added later.

5. Key Challenges Identified

The discussion surfaced a set of interlocking challenges. They are not independent; many interact with and reinforce one another, which is why piecemeal solutions have had limited impact.

Challenge Area	Description
Fragmented, Non-Interoperable Data	Surveillance data generated across human, animal, food and environmental sectors do not interoperate. Multiple reporting portals coexist, data definitions are not harmonised, and information rarely reaches shared, actionable formats.
Uneven Laboratory Capacity	Wide heterogeneity in diagnostic capacity across the healthcare system. Many district and peripheral facilities lack qualified microbiologists or adequately equipped laboratories, which means tertiary-care data over-represent resistance and are not nationally representative.
Method and Reporting Variability	Inconsistent AST methods (disk diffusion versus MIC/BMD), guideline-version drift in breakpoints, and variable reporting formats undermine comparability and the confidence one can place in results.
Limited Private and District Sector Reporting	The private sector handles the majority of India's clinical workload; lower-tier public facilities participate in surveillance only partially and largely on a voluntary basis.
Underdeveloped Environmental and One Health Surveillance	Environmental and antibiotic-contamination monitoring remain nascent. Effluent treatment plants are scarce and lack antimicrobial standards. Co-located, genome-resolved One Health studies that can establish transmission directionality are very limited.
Diagnostic Stewardship and Total-Testing-Pathway Gaps	Pre-analytical weaknesses (inconsistent specimen collection, inadequate blood-culture volumes, unclear rejection criteria) and post-analytical weaknesses (limited cascade or selective reporting, weak laboratory-clinician communication) undermine surveillance quality upstream and downstream of the analytical test itself.
Governance and Coordination Gaps	No single coordinating body with real authority exists; multiple ministries and inter-departmental tensions, slow approval processes, and weak feedback loops impede translation of data into policy and clinical guidance.
Funding and Workforce Sustainability	Short-term, fragmented funding leads to the loss of trained manpower and non-reproducible datasets. Sustained financing and staffing continuity, including bioinformatics and genomics skills, are lacking across sectors.

6. Strategic Recommendations

What follows is a set of recommendations that emerged from sustained, expert deliberation among people who work in this system and understand its constraints. The framing throughout was practical: what can actually be done, by whom, and in what sequence. For each recommendation, the roundtable's own sense of who should own it, over what horizon, and how progress should be judged is set out alongside the substance, deliberately, so that this white paper reads as a set of commitments rather than a wish-list.

Recommendation 1: Resolve Fragmented Data With a Standardised, Federated Architecture Aligned to ABDM

- Adopt standardised data templates and harmonised data definitions across all sectors, drawing where possible on established frameworks such as LOINC and SNOMED.
- Build a federated, interoperable architecture under the National One Health Mission rather than a single centralised repository, preserving sectoral data ownership while enabling cross-sector analysis.
- Design this architecture from the outset with a defined pathway into the Ayushman Bharat Digital Mission (ABDM). Several participants were direct on this point: India already has a national digital health backbone under construction, and an AMR data system built in parallel to it, rather than in reference to it, risks becoming one more silo layered on top of the ones the roundtable is trying to dismantle. AMR and antimicrobial-use data should be positioned to eventually sit alongside the clinical and prescription records ABDM is assembling, with the consent, privacy and health-ID standards ABDM already sets.
- Require each sector to build a strong local data ecosystem as the foundation for federation, with appropriate data-governance, confidentiality and anonymity safeguards.
- Bring newly established, adjacent networks, including the Department of Biotechnology's nationwide sewage surveillance network, into this same architecture from their inception, rather than allowing another well-intentioned but separately reporting system to take root.
- Constitute a national AMR data ontology taskforce, with representation from human, veterinary, agricultural and environmental sectors, tasked with harmonising terminology, indicator definitions and reporting fields ahead of federation so that "federated" does not default to each sector federating its own inconsistent definitions.

Lead / responsible agencies: National One Health Mission (Office of the PSA) in coordination with the National Health Authority (ABDM), ICMR, NCDC, ICAR and DBT

Indicative timeline: Common data templates and definitions notified within 6–9 months; ABDM interoperability standard and integration roadmap agreed within 18–24 months

Success metrics: Number of sectors reporting on the common template; a signed interoperability framework or MoU with the National Health Authority; proportion of participating facilities whose systems are ABDM-compatible

Recommendation 2: Harmonise Methods and Quality Across All Sectors

- Prescribe standardised SOPs and mandate external quality assessment participation for all laboratories contributing to surveillance, scaled proportionately to their sector and setting.
- Pursue accreditation pragmatically: ISO 15189 for medical laboratories and ISO/IEC 17025 for others, starting with one or two prescribed methods at the most peripheral facilities and building from there.
- Advance consensus test-method standards, including for genotypic testing, through BIS and the joint ISO working group as a complement to phenotypic AST. National breakpoints continue to be set and disseminated by ICMR and NCDC, not BIS, consistent with BIS's clarification that breakpoint-setting sits outside its standards-development mandate.
- Reduce dependence on costly imported reference strains by developing and subsidising indigenous reference strains through national culture collections.

Lead / responsible agencies: ICMR, NCDC and NABL for SOPs, EQAS enrolment, accreditation and national breakpoints; national culture collections (MTCC/IMTECH, VTCC) for indigenous reference strains; Bureau of Indian Standards (BIS), confined to developing consensus test-method standards and representing India in relevant ISO technical committees, with IAMM, CMC Vellore and PGI Chandigarh for EQAS delivery

Indicative timeline: National SOPs and mandatory EQAS notified within 12 months; phased accreditation roadmap over 3 years; indigenous reference-strain panels available within 18 months

Success metrics: Proportion of surveillance-contributing laboratories enrolled in EQAS; number of laboratories achieving ISO 15189 / 17025 accreditation year-on-year; reduction in guideline-version drift detected in inter-laboratory audits

Recommendation 3 :Establish a Shared National AMR Database and Dashboard Under an Empowered Coordinating Authority

- Create an accessible national AMR database and common dashboard spanning human, animal, food and environmental data, modelled on the mandatory-reporting, single-dashboard architecture of the National Tuberculosis Elimination Programme.
- This ambition, participants were clear, will not survive contact with India's ministerial map unless it sits under a coordinating authority with actual teeth, not a committee that meets and recommends, but a body empowered to mandate reporting formats, arbitrate between line ministries, hold sectors to reporting timelines, and be answerable if the dashboard does not fill up. Whether this takes the shape of a dedicated AMR Coordination Cell under the National One Health Mission, or an expanded mandate for an existing body, was left open, but the roundtable was unambiguous that the authority needs budgetary standing and a cross-ministerial mandate, besides a convening role.
- Make reporting mandatory for both public and private facilities, with appropriate safeguards, and ensure consistent, periodic, quality-assured publication.
- Phase private-sector integration deliberately: large private laboratory chains onboarded first through standard API-based reporting, followed by standalone laboratories; tie participation to concrete incentives such as preferential empanelment under government health-insurance schemes for EQAS-compliant laboratories and accreditation-linked benefits, rather than relying on the mandate alone.
- Return surveillance outputs to clinicians and policymakers in usable forms: local and regional antibiograms, and hyperlocal decision-support tools.

Lead / responsible agencies: Ministry of Health & Family Welfare (nodal), with the empowered coordinating authority housed under the National One Health Mission / Office of the PSA, and formal representation from ICAR, MoEFCC and BIS

Indicative timeline: Coordinating authority notified and staffed within 12 months; dashboard minimum viable version live within 18–24 months; full mandatory reporting across sectors within 36 months

Success metrics: Coordinating authority formally constituted (yes/no) with a published mandate; number and proportion of eligible facilities reporting into the national dashboard; data completeness and timeliness rates tracked quarterly

Recommendation 4: Strengthen Quantitative Susceptibility Testing Capacity Alongside Standardised Disk Diffusion

- Treat AMR surveillance as the quantitative tracking of MIC trends, a distinct exercise from clinical breakpoint categorisation. Where a facility has the case volume, funding and technical capacity to justify it, support migration from disk diffusion toward MIC/BMD-based methods but require a documented cost-benefit case at each site before committing to platform investment, rather than treating migration as a default target for all networks.
- Retain and continue to standardise disk diffusion, performed to CLSI or EUCAST protocols, as a valid, internationally accepted, and lower-cost method for the large majority of laboratories, particularly at secondary and district level, so that any transition adds capability rather than disqualifying data from facilities not yet resourced for it.
- Where MIC/BMD adoption is pursued, select methods and platforms through open, vendor-neutral technical specifications and competitive procurement, evaluated against accuracy, cost per isolate, maintenance burden, and applicability across human, veterinary, agricultural and environmental settings — rather than specifying a particular technology or supplier in advance.
- Strengthen inter-laboratory proficiency testing and links to international reference laboratories, independent of which susceptibility-testing method or vendor a given site uses.

Lead / responsible agencies: ICMR and NCDC surveillance networks lead site-level adoption decisions and inter-laboratory proficiency testing; BIS's role is confined to publishing the vendor-neutral technical specification for MIC/BMD methods and platforms, with diagnostics industry partners consulted at that standard-setting stage only, not as platform selectors

Indicative timeline: Vendor-neutral technical specification and cost-benefit framework published within 12 months; site-level adoption decisions made against that framework on an ongoing basis

Success metrics: Proportion of surveillance isolates tested by MIC/BMD versus disk diffusion; number of sites with a documented cost-benefit case on file; proportion of MIC/BMD procurement run through open, vendor-neutral specifications

Recommendation 5, Strengthen Environmental Surveillance and Antibiotic-Contamination Monitoring

- Treat environmental AMR surveillance explicitly as an early-warning system, not a substitute for clinical surveillance, with breakpoints and interpretive frameworks defined separately from clinical breakpoints from the outset.
- Conduct environmental surveillance as a distinct, complementary stream and measure antibiotic contamination concentrations alongside resistance genes.
- Expand effluent treatment plant coverage and establish antimicrobial discharge standards for hospitals and pharmaceutical manufacturing facilities.
- Scale structured, objective-led environmental studies using metagenomics and qPCR calibrated against clinical antibiograms to define the public-health meaning of environmental signals.
- Integrate the Department of Biotechnology's new nationwide sewage surveillance network, modelled on INSACOG, with the existing ICMR-NHM environmental programme from the outset, using shared sampling sites, shared methodologies and a single reporting line into the national dashboard, so that India ends up with one longitudinal environmental AMR data stream rather than two running in parallel.

Lead / responsible agencies: Ministry of Environment, Forest and Climate Change / CPCB and State Pollution Control Boards, with ICMR–National One Health Mission and the Department of Biotechnology for the linked scientific programme

Indicative timeline: Antimicrobial discharge standards for hospitals and pharma manufacturing notified within 18 months; effluent treatment plant coverage expansion phased over 3–5 years; DBT-ICMR sampling-site harmonisation completed within 12 months

Success metrics: Number of discharge standards notified; number of medical colleges/hospitals with functioning, standards-compliant effluent treatment; trend data on antibiotic and resistance-gene concentrations at sentinel sites, reported through a single consolidated stream

Recommendation 6: Operationalise One Health Through a Linked Laboratory Network

- Associate veterinary, fisheries, food-safety and environmental laboratories with established NCDC and ICMR network laboratories to share SOPs, training, quality systems and trained personnel.
- Design true One Health studies with co-located sampling and whole-genome approaches to establish genuine transmission links and their directionality.
- Define common objectives, common indicator pathogens and common testing panels across sectors as the basis for integrated AMR and antimicrobial-use surveillance.

Lead / responsible agencies: ICMR, NCDC and ICAR jointly, with FSSAI for food-safety linkages and state animal husbandry departments

Indicative timeline: Indicator pathogens and common panels agreed within 12 months; first co-located One Health studies initiated within 18–24 months

Success metrics: Number of laboratories formally linked into the network; number of co-located, genome-resolved transmission studies completed; number of common indicator pathogens under active multisectoral tracking

Recommendation 7: Expand Surveillance Beyond Tertiary Care

- Extend surveillance to secondary, district, community and rural settings so that data are representative and treatment guidelines are not calibrated on atypically resistant tertiary populations.
- Post microbiologists at district hospitals and ensure minimum culture and AST capability, with quality-assured media, discs and equipment procured through controlled government channels.
- Ensure that surveillance coverage is both spatial (geographic representation) and longitudinal (change over time).

Lead / responsible agencies: ICMR and NCDC networks, State Health Departments, Ministry of Health & Family Welfare for posting and procurement policy

Indicative timeline: District-level microbiologist posting policy within 12 months; secondary/district-site onboarding to surveillance network phased over 3 years

Success metrics: Number of secondary and district facilities onboarded to surveillance networks; proportion of sanctioned microbiologist posts filled at district level; representativeness of resistance-rate data across levels of care

Recommendation 8: Invest in Emerging, Indigenised and Point-of-Care Technologies

- Prioritise affordable point-of-care diagnostics, including CRP testing in primary care, to reduce empirical prescribing and extend surveillance reach beyond the urban tertiary bias.
- Advance rapid culture-independent assays, syndromic panels, targeted and whole-genome sequencing, and locally relevant bioinformatics pipelines, including for neglected areas such as fungal AMR.
- Support antibiotic potentiators and drug-repurposing programmes, and use surveillance data to directly inform diagnostic and therapeutic development pipelines.

Lead / responsible agencies: Ministry of Health & Family Welfare and Department of Biotechnology, with diagnostics and pharmaceutical industry partners

Indicative timeline: CRP point-of-care pilots in primary care within 12–18 months; indigenised diagnostic and bioinformatics pipeline investments reviewed annually

Success metrics: Number of primary health centres equipped with point-of-care diagnostics; number of indigenised products validated and procured; measurable reduction in empirical broad-spectrum prescribing at pilot sites

Recommendation 9: Secure Sustainable, Blended Financing and Workforce Continuity

- Provide continuous, multi-year funding, including follow-on grants that scale proven studies, to preserve trained manpower and ensure reproducible datasets.
- Adopt blended-finance models combining government funding, foundations, civil society and industry, recognising the inherent unreliability of CSR funding cycles; use government as a first buyer to de-risk indigenous innovation.
- Add AMR and One Health as explicit priority research areas in funding calls across relevant ministries, with specific incentives for multisectoral project design.
- Establish ring-fenced funding lines for AMR surveillance within NAP-AMR 2.0, protected from reallocation across budget cycles, and create permanent career-track positions not grant-funded contractual roles for microbiologists, bioinformaticians and surveillance data scientists, to directly address the attrition problem this recommendation otherwise only names.

Lead / responsible agencies: Ministry of Health & Family Welfare and Office of the PSA, with Department of Biotechnology and philanthropic/CSR partners

Indicative timeline: Multi-year (3–5 year) funding windows introduced for AMR programmes within the next budget cycle; blended-finance framework established within 18 months

Success metrics: Number of multi-year funding commitments secured; staff retention rate in trained AMR surveillance roles across a funding cycle; number of ministries including AMR as a named priority area in funding calls

Recommendation 10: Translate Surveillance Into Policy and Public Health Action

Surveillance should not end with data collection; it must drive measurable public health action. This was, in many ways, the sharpest note the second edition struck relative to the first: India is closing the evidence gap, but a dataset that sits in a dashboard without a downstream consequence is not, on its own, a public health intervention. Participants asked that this translation step be named explicitly as a recommendation, rather than left as an implicit hope attached to every other one.

- Develop predefined pathways through which surveillance findings trigger updates to treatment guidelines, antimicrobial stewardship programmes, infection prevention measures and regulatory interventions, agreed in advance, so that a resistance signal has a known route to a decision rather than requiring an ad hoc committee each time.
- Establish mechanisms for the routine dissemination of state and district antibiograms to clinicians, hospitals and policymakers, on a fixed and predictable schedule rather than on request.

- Create periodic national and state AMR situation reports highlighting emerging threats, trends and recommended actions, written for a clinical and policy audience rather than a purely technical one.
- Evaluate the impact of surveillance on prescribing practices, patient outcomes and resistance trends through regular monitoring and review, so that the system can show, not merely assert, that surveillance is changing what happens at the bedside and in policy.

Lead / responsible agencies: ICMR and NCDC (guideline and antibiogram dissemination), Ministry of Health & Family Welfare (regulatory and stewardship pathways), State Health Departments (state-level reports and antibiogram distribution), professional bodies such as IAMM for clinical uptake

Indicative timeline: Trigger pathways from surveillance signal to guideline/stewardship/regulatory action defined and published within 12 months; first national AMR situation report within 18 months and annually thereafter; state and district antibiograms disseminated on a defined recurring schedule from year one; first outcome-evaluation study completed within 24–30 months

Success metrics: Number of guideline or stewardship-protocol updates directly attributable to surveillance findings; frequency and reach of antibiogram dissemination; publication of the national and state AMR situation reports on schedule; documented change in prescribing practice, patient outcomes or resistance trends at evaluation sites

Recommendation 11: Institutionalise Diagnostic Stewardship Across the Total Testing Pathway

- Issue national diagnostic stewardship guidance covering appropriate test selection, specimen collection and rejection criteria, and blood-culture stewardship, developed jointly by ICMR, NCDC and professional bodies and endorsed by the Ministry of Health & Family Welfare.
- Embed selective and cascade antimicrobial susceptibility reporting, together with structured interpretive comments, as a standard feature of laboratory information systems rather than a matter of individual laboratory practice.
- Build structured laboratory-clinician feedback loops, including routine review of blood-culture contamination and specimen-rejection data at the facility level, into existing quality-assurance and accreditation processes.

Lead / responsible agencies: ICMR and NCDC, with the Indian Association of Medical Microbiologists (IAMM) and other professional bodies for guidance development, and NABL for embedding requirements into accreditation standards, drawing on BIS-developed test-method standards where applicable

Indicative timeline: National diagnostic stewardship guidance published within 12–18 months; incorporated into accreditation and EQAS standards within 24 months

Success metrics: Reduction in blood-culture contamination rates and specimen rejection rates at participating facilities; proportion of laboratories implementing cascade or selective reporting; turnaround time from specimen collection to actionable report

Recommendation 12: Build Molecular, Genomic and AI-Enabled Surveillance Infrastructure

- Expand multiplex PCR, syndromic panel and whole-genome sequencing capacity at reference and regional laboratories, prioritising sites already positioned as referral nodes within the ICMR and NCDC networks.
- Adopt common laboratory informatics and interoperability standards nationally, HL7 and FHIR for messaging, LOINC for test identifiers and SNOMED CT for terminology, with continued WHONET integration, so that molecular and genomic results flow automatically into the federated architecture proposed in Recommendation 1.
- Pilot AI-assisted antibiogram generation and predictive resistance modelling on the national dashboard proposed in Recommendation 3, validated against subsequent real-world surveillance data before wider rollout.
- Build locally relevant bioinformatics pipelines, with particular attention to fungal AMR and to genomic surveillance in under-resourced sectors, rather than relying solely on pipelines built for other countries' pathogen profiles.

Lead / responsible agencies: Department of Biotechnology and ICMR jointly, with C-DAC and NIC for informatics standards, and diagnostics and genomics industry partners

Indicative timeline: Informatics interoperability standard published within 18 months; reference-laboratory sequencing capacity expansion phased over 3 years; AI-assisted dashboard pilots within 24–30 months

Success metrics: Number of reference laboratories with functioning whole-genome sequencing capability; number of laboratories on an interoperable LIS meeting the published standard; predictive resistance models validated against at least one subsequent surveillance cycle before deployment

Recommendation 13: Adopt a Phased Implementation Roadmap With Workforce Development and Measurable KPIs

- Publish a five-year implementation roadmap covering Recommendations 1–12, with a named accountable owner and three phases: year one, years two to three, and years four to five.
- In year one, establish baseline measures, publish the roadmap and constitute and staff the coordinating authority. In years two to three, launch the dashboard within 18–24 months, implement phased private-sector onboarding and achieve the mandatory reporting milestone specified in Recommendation 3 within 36 months. In years four to five, consolidate coverage, interoperability, workforce capacity and sustainable financing. Set numerical performance targets against the year-one baseline, with MIC-related targets limited to sites where adoption is justified under Recommendation 4.
- Establish structured training programmes and competency assessment in clinical microbiology, bioinformatics, genomics and laboratory data science, aimed at both new entrants and the existing workforce, so that infrastructure investment is matched by the people able to run it.
- Track a defined set of key performance indicators nationally and by state, including culture contamination rates, turnaround times, external quality assessment performance, reporting completeness, proportion of MIC/BMD utilisation, and surveillance coverage across levels of care, published alongside the national dashboard proposed in Recommendation 3.

Lead / responsible agencies: Ministry of Health & Family Welfare and Office of the PSA as roadmap owners, with ICMR and NCDC for training delivery and academic institutions for curriculum development

Indicative timeline: Roadmap published within 12 months; first structured training cohorts completed within 18 months; KPI dashboard live alongside the Recommendation 3 dashboard, with baseline data captured in year one

Success metrics: Roadmap milestones met on schedule; number of personnel trained and certified annually; KPI dashboard populated with baseline and year-on-year trend data across all listed indicators

7. Consensus Priorities and the Proposed Multisectoral Pilot

When participants were asked to identify the priorities achievable within roughly twenty-four months, three came forward with clear consensus:

- **Resolve fragmented data:** agree a standardised template and harmonise data across sectors, with a clear line of sight to ABDM, so that information becomes comparable and actionable.
- **Assure quality:** implement uniform SOPs and methods and ensure appropriate quality assurance and accreditation across laboratories in their respective domains.
- **Build a shared national database** with common objectives and common indicators, accessible across the human, animal and environmental sectors, under the stewardship of a coordinating authority with the standing to enforce it.

A Focused Multisectoral Pilot

To give these priorities a concrete form, participants proposed a focused pilot built around a small number of common indicator pathogens monitored across sectors simultaneously, rather than attempting to harmonise the entire AMR spectrum at once. The pilot would rest on a linked laboratory network, associating veterinary, fisheries, food-safety and environmental laboratories with established NCDC and ICMR network sites. This would allow SOPs and training to be shared, manpower to be built, and genuine One Health tracking to occur, for instance, following a non-typhoidal *Salmonella* signal from a clinical laboratory into associated animal and environmental settings in the same geography.

For the pilot to generate credible data, participants identified several design requirements: consensus on what to test, how to test it and which antimicrobials to include; representative sampling from premier institutes through district-level facilities in every sector; spatial and longitudinal coverage; uniform diagnostic modalities throughout; and, where feasible, integration of electronic health record and e-prescription data to capture outpatient prescribing.

The roundtable initiated a practical exercise to map under-represented pathogens, populations and geographies in current surveillance. The findings are to be consolidated by the organisers as a concrete input to pilot design.

8. Stakeholder Roles and Shared Accountability

Surveillance at this scale and complexity will not succeed if every stakeholder is waiting for someone else to move first. The table below sets out the roles that participants agreed need to be owned, not just acknowledged.

Stakeholder	Role
Office of the PSA / National One Health Mission	Provide overall coordination across ministries; develop the federated, interoperable data architecture; anchor the innovation agenda through the India AMR Innovation Hub; house or oversee the proposed coordinating authority.
Ministry of Health & Family Welfare	Act as nodal coordinator for inter-ministerial alignment; issue directives on minimum laboratory capability, mandatory EQAS participation and quality-assured procurement; steward ABDM alignment of AMR data.
National Health Authority (ABDM)	Define the technical and consent-management standards needed for AMR and antimicrobial-use data to interoperate with ABDM-linked health records.
ICMR & NCDC	Sustain and expand clinical surveillance networks; publish quality-assured, consistently formatted data; set and disseminate national breakpoints and treatment-guideline updates; provide training across the system, including diagnostic stewardship guidance.
Department of Biotechnology (DBT)	Lead the new nationwide longitudinal sewage AMR surveillance network modelled on INSACOG; support genomic surveillance, bioinformatics pipeline development and workforce capacity-building in genomics.
ICAR / Animal Husbandry / Fisheries	Strengthen and standardise animal and aquaculture surveillance through INFAAR, with sector-specific panels and agreed indicator pathogens.
Ministry of Environment / CPCB / State Pollution Boards	Lead environmental surveillance and effluent regulation, including establishing antimicrobial discharge standards for hospitals and pharmaceutical manufacturers.
Bureau of Indian Standards (BIS)	Develop consensus standards and methods, including for genotypic testing, and represent India in the relevant ISO technical committees.
State Governments	Translate national priorities into ground-level action, strengthening laboratories, generating hyperlocal antibiograms, and coordinating across departments.
Industry & Diagnostics Partners	Support laboratory strengthening, standardised methods and panels, surveillance platforms, training and indigenised point-of-care innovation.
Academia & Research Institutions	Generate evidence, run structured One Health and environmental studies, and build genomics, bioinformatics and laboratory data-science capacity.
Voice of Healthcare (VOH)	Act as a convening platform enabling dialogue, knowledge sharing and cross-stakeholder alignment.

9. Key Findings and Conclusion

A Strong but Siloed Surveillance Backbone

India has built credible AMR surveillance in the human-health sector and is developing comparable systems in the animal and fisheries sectors. The defining limitation is not the quality of what exists within each sector, but the absence of meaningful connection between sectors, limited interoperability, inconsistent reporting formats, and few mechanisms for feeding surveillance findings back into local clinical or policy decision-making.

Standardisation Is the Precondition for Convergence

Comparable surveillance data require harmonised, validated testing methods, consistent quality assurance and shared data definitions. Standardised disk diffusion remains a valid surveillance method. MIC-based testing should provide additional capability where surveillance needs, laboratory capacity and a documented site-specific cost-benefit assessment justify its adoption.

Environmental and Antibiotic-Contamination Monitoring Are Pivotal but Underdeveloped

Environmental surveillance, including the systematic monitoring of antibiotic contamination as a resistance driver, is a distinct, complementary stream that remains nascent. It requires structured, objective-led investment, clear effluent standards, and careful separation from clinical surveillance in both method and interpretation.

One Health Is Recognised but Not Yet Operational

The One Health framework is embedded in national policy. Practical implementation requires strengthening of inter-sectoral coordination in the absence of genome-resolved studies capable of establishing transmission routes and directionality, and the governance gap that comes from a mandate spanning more than sixteen ministries without a coordinating mechanism with teeth.

Translation, Governance and Sustainability Are the Binding Constraints

A coordinating mechanism with real authority, a common national dashboard linked into ABDM, Ministry of Health-led inter-ministerial alignment, faster regulatory approvals, sustained blended financing, continuity of trained manpower, and, as the roundtable insisted this time round, defined pathways from surveillance finding to policy or clinical action, are not peripheral concerns. They are the practical determinants of whether sound policy produces measurable change.

Diagnostic Stewardship, Digital Infrastructure and Workforce Are Equally Binding Constraints

Expert review of this edition added a further constraint of the same order: a surveillance system can be well governed and well-funded and still under-perform if the specimens feeding it are poorly collected, if its data cannot move between laboratory information systems, or if there are not enough trained people to run it. Diagnostic stewardship across the total testing pathway, molecular, genomic and AI-enabled infrastructure built on common interoperability standards, and a workforce development plan tied to measurable indicators are treated in this edition as core implementation requirements, set out in Recommendations 11 to 13, not as optional refinements.

Conclusion

Antimicrobial resistance is a defining challenge for India's health system and for the future of public health globally. The message from the second-edition roundtable was pointed: India's policy architecture is solid and the political commitment at the highest levels is real. The gap is in implementation. Converting frameworks into functioning systems, connecting fragmented surveillance streams, giving that architecture a coordinating authority with genuine standing, and getting surveillance outputs into the hands of the clinicians and policymakers who can act on them, that is the work that remains.

The recommended next step, a focused, pathogen-based multisectoral pilot supported by a linked laboratory network, standardised methods and a shared, ABDM-aligned dashboard, run under an empowered coordinating body and married to a clear translation-to-action pathway, is not a grand design. It is a tractable starting point that could generate the kind of evidence needed to build the larger system. India has the scientific capacity, the institutional infrastructure and the policy frameworks needed to make this work. What is now required is the coordination, the sustained investment and the institutional will to follow through.

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