

Pakistan's AMR Crisis: Can Diagnostic Laboratories Close the Gap?

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Antimicrobial resistance (AMR) is one of the most silently catastrophic threats to Pakistan's health system. It causes no epidemic alarm but the unremarkable death of a febrile child whose typhoid no longer responds to ceftriaxone or of a septic surgical patient for whom every reasonable antibiotic has failed. The 2024 Global Research on Antimicrobial Resistance analysis in The Lancet estimated that around 1.14 million deaths were directly caused by bacterial AMR in 2021 and projected almost 39 million cumulative deaths between 2025 and 2050, with the greatest burden falling on low- and middle-income countries like ours [1]. The same urgency led the World Health Organization to update its Bacterial Priority Pathogens List in 2024 [2], highlighting the carbapenem-resistant Gram-negatives that are increasingly populating our wards. This is not a prediction of a problem for Pakistan in the far future, but a story of the present.

Pakistan stands at the epicenter of one of the world's most important AMR stories [3]. The extensively drug resistant (XDR) *Salmonella Typhi* first reported from Sindh in 2016 has now developed resistance to the first line agents, fluoroquinolones and third generation cephalosporins and has left azithromycin and carbapenems as the last reliable options. In 2025, a systematic review estimated that about a quarter of typhoidal isolates in the country are currently XDR, and travel associated cases have been exported to the United States, the United Kingdom and Canada, turning a local sanitation failure into a global health security issue [4]. These strains are underpinned by a familiar architecture of risk: unregulated over-the-counter sales of antibiotics, empirical prescribing without culture, fragile water and sanitation infrastructure.

Crucially, the question remains: do our diagnostic laboratories possess the capacity to confront this surging tide? Too often they are not. Many facilities still rely on disc diffusion testing using non-standardized media, interpreted with out of date breakpoints, such as failing to apply current strict carbapenem or polymyxin cutoffs, and without the internal quality control or reference strains that make a susceptibility report credible. Adherence to existing

CLSI (or where adopted, EUCAST) standards is patchy and antibiograms where they exist at all, are seldom compiled, validated or fed back to clinicians. An unreliable culture result is worse than no result: it breeds false confidence and encourages the very misuse that generates resistance [5]. Pathologists and microbiologists are not bystanders in this crisis; they are the front line. The levers through which resistance is detected, contained, and reversed are reliable identification and antimicrobial susceptibility testing, cumulative antibiogram reporting, and active participation in antimicrobial stewardship committees. The strength of surveillance, through Pakistan's participation in the WHO Global Antimicrobial Resistance and Use Surveillance System (GLASS) and the National AMR Action Plan [6], hinges on laboratory data of good quality.

The blueprint for mitigation is clear and actionable:

For Laboratories: Standardize susceptibility testing uniformly to current CLSI or EUCAST criteria, mandate regular participation in external quality assessment (EQA) schemes, and commit to publishing annualized institutional antibiograms.

For Clinicians: Cultivate a culture of diagnostic stewardship by ordering specimens before initiating empiric coverage, viewing the laboratory as an active diagnostic partner rather than an afterthought.

For Institutions: Adequately resource infection prevention and control (IPC) and diagnostic stewardship teams, recognizing them as core patient-safety functions rather than optional administrative extras.

For Policymakers: Strictly enforce legislation restricting over-the-counter antimicrobial sales without valid prescriptions and sustain national surveillance architectures with concrete, long-term financial investment.

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