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Letter to the Editor

Wrong diagnosis — Wrong antimicrobials: Rise in antimicrobial resistance in developing countries

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ABSTRACT

Antimicrobial resistance (AMR) is a growing global health crisis, disproportionately affecting developing countries. A key driver is the chain of wrong diagnosis leading to inappropriate antimicrobial use. Misclassification of infections—such as viral illnesses mistaken for bacterial infections—and failure to identify infection sources needing drainage or debridement result in unnecessary or ineffective antimicrobial therapy. This accelerates AMR, compels reliance on high-end antimicrobials, and fosters emergence of extensively drug-resistant pathogens. Compounding factors include sample contamination, absence of diagnostic-laboratory feedback loops, and empirical therapy without microbiological confirmation. Together, these perpetuate a vicious cycle of diagnostic error and AMR escalation. Strengthening diagnostic accuracy through point-of-care testing, molecular diagnostics, source control measures, and integration of diagnostic stewardship into antimicrobial stewardship programs is critical. Policy reforms, clinician education, and adoption of digital health innovations can support these efforts, breaking the cycle and preserving antimicrobial efficacy in resource-limited settings.

Introduction

Antimicrobial resistance (AMR) has emerged as one of the most formidable global public health challenges, with developing countries disproportionately affected due to infrastructural, educational, and systemic limitations. Central to this crisis is the sequence of errors beginning with diagnostic inaccuracies that lead to the misuse of antimicrobials, which in turn accelerates the selection and spread of resistant pathogens. The cycle is vicious: a wrong diagnosis prompts the use of unnecessary or inappropriate antibiotics, often broad-spectrum agents, which fail to target the causative pathogen and at the same time exert selective pressure on microbial populations. In such settings, the impact of these errors is compounded by the lack of laboratory support, inadequate feedback loops between laboratories and clinicians, and logistical issues like sample contamination.

The vicious wrong cycle – one wrong begets another

One of the primary drivers of antimicrobial misuse in developing countries is the misclassification of infectious syndromes. Commonly, viral illnesses such as upper respiratory tract infections, dengue, or chikungunya are incorrectly diagnosed as bacterial infections, resulting in the prescription of antibiotics that offer no benefit. Studies in sub-Saharan Africa and South Asia have highlighted that more than 70 % of febrile illnesses in children are treated with antibiotics even when malaria and bacterial infections have been ruled out [1,2]. This empirical overuse is exacerbated by a reliance on syndromic diagnosis where detailed clinical examination and targeted investigations are either unavailable or underutilized. For instance, a child with fever and cough may be labeled as having pneumonia without radiographic confirmation, leading to antibiotic administration, even though viral etiologies predominate. Similarly, typhoid fever is often diagnosed on clinical grounds alone in febrile patients, with limited laboratory confirmation, and treated with antibiotics that may not be warranted [2].

Compounding the issue of misclassification is the failure to recognize infections that require essential source control measures in addition to antimicrobial therapy. Abscesses, empyemas, necrotic tissue, and infected prosthetic material mandate physical removal or drainage for effective cure. In many settings, due to either diagnostic oversight or lack of surgical or interventional radiology facilities, such infections are managed solely with antimicrobials. This constitutes both a diagnostic and therapeutic failure. The persistence of infection despite antibiotics creates an environment conducive to resistance, as suboptimal concentrations of the drug reach the nidus of infection, enabling selection of resistant organisms [3,4].

Empirical antimicrobial therapy, though at times life-saving, is frequently instituted without microbiological confirmation in many resource-limited hospitals. In South Asia, for example, broad-spectrum cephalosporins are often administered for sepsis syndromes prior to obtaining blood cultures, or without obtaining cultures at all, and rarely adjusted once results are available [5]. The consequence is both the promotion of resistance and delays in appropriate therapy for those with resistant infections. Outbreaks of multidrug-resistant and extensively drug-resistant organisms, such as *Klebsiella pneumoniae* and *Acinetobacter baumannii*, have been documented in neonatal intensive care units where prophylactic or empirical antibiotic use was widespread and diagnostic confirmation minimal. Mortality rates in these settings have been alarmingly high, underscoring the clinical impact of these errors [6]. Similarly, case reports from surgical wards have illustrated how intra-abdominal abscesses treated only with antibiotics, without drainage, result in prolonged hospital stays, complications, and infections with resistant flora such as *Bacteroides fragilis* and extended-spectrum beta-lactamase (ESBL)-producing *Escherichia coli* [7].

Modern diagnostic tools, including point-of-care tests like C-reactive protein (CRP) and procalcitonin, as well as molecular diagnostics like

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multiplex polymerase chain reaction (PCR) panels, offer a means of mitigating such errors. Studies from Vietnam and Kenya have demonstrated that CRP-guided antibiotic prescribing can reduce unnecessary antibiotic use by as much as 50 % without compromising patient outcomes [8,9]. Similarly, molecular panels can rapidly identify causative pathogens and resistance markers, facilitating early de-escalation or targeted therapy. However, the uptake of such technologies remains limited in many parts of the developing world due to cost, logistical challenges, and the need for laboratory infrastructure. Moreover, the success of diagnostic interventions depends not just on availability but also on integration into antimicrobial stewardship and infection prevention frameworks. Programs that combine diagnostic stewardship with prescriber education and feedback loops have shown substantial reductions in broad-spectrum antibiotic use and resistance rates [10].

Health system limitations in low-resource settings often mean that even basic diagnostic tools are unavailable at the point of care. Surveys across LMICs indicate that only about a quarter of primary health centers possess functional microscopy or culture facilities [11]. As a result, prescribers often feel compelled to provide antibiotics empirically as a precaution, driven by both clinical uncertainty and patient expectations. Cultural and financial pressures—wherein clinicians fear losing patients or income if they do not prescribe medications—further fuel this practice. Efforts to address AMR must therefore include system-level changes that ensure diagnostic support is universally accessible.

Policy interventions provide one avenue to align diagnosis and prescribing practices. For instance, India's National Action Plan on AMR has mandated hospital laboratory accreditation and promoted the rational use of antimicrobials through prescription audits. The Philippines has pioneered insurance models where antibiotic reimbursement is tied to diagnostic confirmation, resulting in measurable reductions in antibiotic sales [12]. Such policies, however, require robust governance, monitoring, and support for implementation at local levels.

Another key factor contributing to diagnostic and treatment errors is the gap in medical education and ongoing professional development. Many clinicians, particularly junior doctors and those in rural settings, report low confidence in distinguishing bacterial from non-bacterial infections. In such environments, antibiotic use is often the default response to diagnostic uncertainty [13]. Addressing this requires embedding diagnostic reasoning and antimicrobial stewardship principles in undergraduate and postgraduate curricula, alongside provision of clinical decision support tools. Artificial intelligence (AI) and digital health platforms hold promise in this regard. Early trials in Nigeria using AI-based tools to guide antibiotic prescribing have demonstrated improvements in appropriateness, though scalability and integration into existing health systems remain challenges [14].

The vicious cycle of diagnostic error leading to antimicrobial misuse, resistance emergence, and further diagnostic challenges is perpetuated by several factors. A wrong diagnosis, whether due to misclassification, failure to identify the source, or reliance on contaminated specimens, leads to inappropriate antimicrobial therapy. The resulting selection pressure fosters AMR, necessitating the use of high-end antibiotics like carbapenems or colistin. As resistance escalates, clinicians are left without effective options, and in the absence of sophisticated diagnostic capabilities to identify complex resistant pathogens, the likelihood of further diagnostic error rises. Laboratory errors, including sample contamination during collection or processing, and the lack of clinician-laboratory communication, exacerbate the issue by leading to misinterpretation of colonizers or contaminants as pathogens. The inappropriate treatment of these findings reinforces the cycle of antimicrobial misuse.

Breaking this cycle requires recognition that source control is as vital as antimicrobial therapy. Without drainage of pus, removal of infected prosthetic devices, or debridement of necrotic tissue, antibiotics alone are insufficient and promote resistance. Programs must therefore emphasize procedural as well as pharmacological stewardship. Effective infection management mandates the integration of diagnostics, timely source control, and appropriate antimicrobials, supported by policies, education, and technology.

Conclusion

The rise of AMR in developing countries, driven by the sequence of wrong diagnoses leading to wrong antimicrobials, demands a comprehensive response. Investments in diagnostic infrastructure, implementation of diagnostic stewardship within antimicrobial stewardship and infection prevention programs, policy mechanisms that tie prescribing to microbiological confirmation, and improvements in clinical training are critical. The deployment of AI tools and other digital innovations offers further avenues to support clinicians. Most importantly, interventions must address both the pharmacological and procedural dimensions of infection management. Only through coordinated, multisectoral action can we hope to preserve the effectiveness of existing antimicrobials and safeguard global health.

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Consent

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CRediT authorship contribution statement

Prasan Kumar Panda: Conceptualization, Data curation, Formal analysis, Methodology, Validation, Writing – original draft, Writing – review & editing.

Competing interests

We declare that we have no conflicts of interest.

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Availability of data and material

Everything is provided in the manuscript.

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