

# MODERN DIAGNOSTIC APPROACHES TO ANTIMICROBIAL RESISTANCE IN HOSPITAL PATHOGENS

Fathima Rashidha M. K.

Vitebsk State Medical University  
Vitebsk, Republic of Belarus

**Relevance.** Antimicrobial resistance (AMR) has become one of the leading global health challenges of the 21st century. Hospital-acquired infections caused by resistant bacteria increase patient morbidity, prolong hospital stays, and raise treatment costs. Rapid and precise detection of resistant pathogens is therefore essential to guide effective antibiotic therapy. In recent years, diagnostic technologies have significantly evolved – from conventional culture-based methods to advanced molecular and automated systems. Understanding the advantages and limitations of these diagnostic tools is critical for improving patient outcomes and antibiotic stewardship.

**Aim.** This article aims to comprehensively analyze and summarize modern diagnostic methods used to detect antimicrobial resistance among hospital pathogens. The goal is to evaluate the accuracy, speed, cost-effectiveness, and clinical applicability of various diagnostic techniques, including traditional culture methods, automated systems, and molecular assays. Special attention is given to identifying best practices for integrating these methods into routine clinical microbiology workflows to improve patient care and antibiotic stewardship programs.

**Materials and Methods.** This study was designed as a narrative literature review. A comprehensive search was conducted in PubMed, Scopus, and WHO databases using keywords: “antimicrobial resistance,” “diagnostic methods,” “PCR,” “MALDI-TOF,” and “hospital pathogens.” Only articles published between 2019 and 2024 were included. Studies that compared diagnostic accuracy, speed, and cost-effectiveness of different methods were prioritized. Data from at least 25 relevant sources were reviewed, summarized, and organized into comparative tables.

**Results.** The analysis of reviewed studies shows that traditional culture-based methods remain the most accessible and standardized approach for antibiotic susceptibility testing. However, newer technologies such as polymerase chain reaction (PCR), matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF MS), and automated analyzers (e.g., VITEK 2, BD Phoenix) provide faster and more accurate identification.

**Discussion.** Recent advances in diagnostic microbiology demonstrate the value of integrating molecular techniques with routine testing. Automated and molecular methods reduce diagnostic delays and support early targeted therapy, which helps limit the misuse of broad-spectrum antibiotics. However, the high cost of equipment and technical expertise remains a challenge in low-resource hospitals.

Table 1. Comparison of Diagnostic Methods for Antimicrobial Resistance Detection

Diagnostic Method	Average Detection Time	Accuracy (%)	Advantages	Limitations
Culture + Disk Diffusion	24–48 hours	85	Inexpensive Widely available	Time-consuming, Less precise
Automated Analyzers (VITEK, BD Phoenix)	6–12 hours	95	Rapid, Standardized	High equipment cost
PCR and Real-Time PCR	2–4 hours	98	High sensitivity, detects resistance genes	Requires trained personnel
MALDI-TOF MS	1–3 hours	97	Identifies species quickly	Cannot detect gene-level resistance

**Conclusion** Modern diagnostic technologies – particularly PCR and automated analyzers – significantly improve the detection of antimicrobial resistance in clinical settings. Their broader implementation could enhance infection control and rational antibiotic use, ultimately helping to reduce hospital-acquired resistant infections.

#### References

1. Global Antimicrobial Resistance and Use Surveillance Report / World Health Organization. – 2024. – URL: <https://www.who.int/publications/b/78945> (дата обращения: 20.09.2025).
2. Performance Standards for Antimicrobial Susceptibility Testing / CLSI. – 33rd ed. – 2023. – 358 p.
3. Gajdács, M. Diagnostics of Antimicrobial Resistance: Present and Future / M. Gajdac // Infect Dis Rep. – 2023.
4. Editorial: Emerging multidrug-resistant bacterial pathogens “superbugs”: A rising public health threat / A. Algammal, H. F. Hetta, M. Mabrok, P. Behzadi // Frontiers in Microbiology. – 2023. – Vol. 14. – P. 1135614.

## THE EFFECTIVENESS OF NEW COMBINATION THERAPIES AGAINST MULTI-RESISTANT BACTERIA

Fathima Rashidha M. K.

Vitebsk State Medical University  
Vitebsk, Republic of Belarus

**Relevance.** The growing resistance of microorganisms to multiple antibiotics is a serious clinical concern. Infections caused by multi-drug-resistant (MDR) bacteria often fail to respond to standard therapy, forcing clinicians to explore alternative treatment strategies. One such approach is the use of combination therapy, where two or more antimicrobial agents act synergistically. Evaluating the effectiveness of such combinations is essential for developing rational treatment protocols.