



# THE RELEVANCE OF EARLY DETECTION OF ANTIBIOTIC RESISTANT PATHOGENS IN WAR-RELATED INJURIES

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### INTRODUCTION

Combat wounds in conflict zones are highly susceptible to infections by antibiotic-resistant pathogens due to limited medical resources, inadequate infrastructure, and disrupted healthcare systems [1, 3, 4, 8]. This leads to increased mortality and morbidity among affected populations. Early detection of resistant organisms is crucial to prevent their spread and to ensure timely, targeted treatment. However, challenges such as lack of rapid diagnostic tools and insufficient infection control measures hinder effective management [2, 5, 9]. However, the lack of innovations in Point-of-Care (POC) testing, evacuation staging, and antibiotic supply chain management hinders effective management of Antimicrobial Resistance (AMR) [6, 7, 8], leading to increased mortality and morbidity and placing additional burdens on already overwhelmed healthcare systems [5, 6].

### BEST PRACTICES, INNOVATIONS & LESSONS LEARNED

The following best practices are derived from data collected in conflict zones, a comprehensive literature review, and personal experiences. Regions considered include the Middle East and Ukraine.

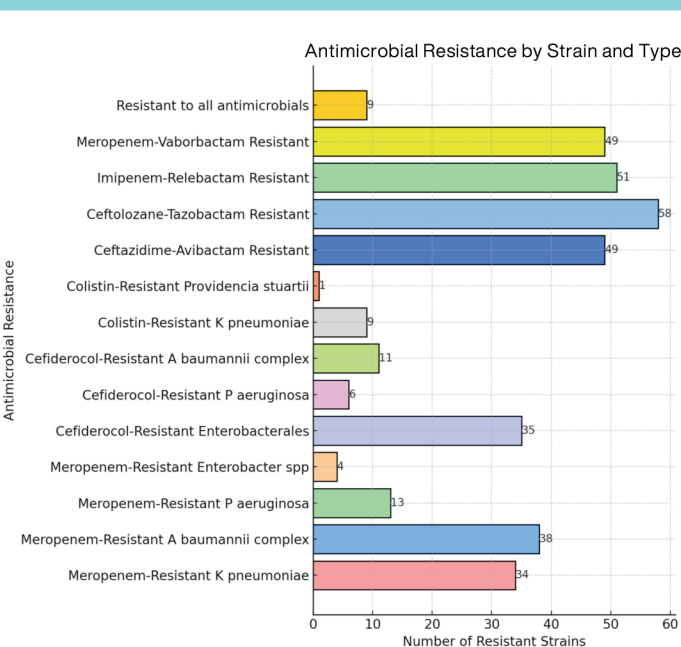
#### Improved Protocols:

Refining protocols to detect antibiotic resistance early, using mobile POC testing and real-time diagnostics, has significantly reduced infection rates [6, 7, 8]. Rapid diagnostic tools facilitate timely identification of resistant organisms, enabling appropriate antimicrobial therapy.

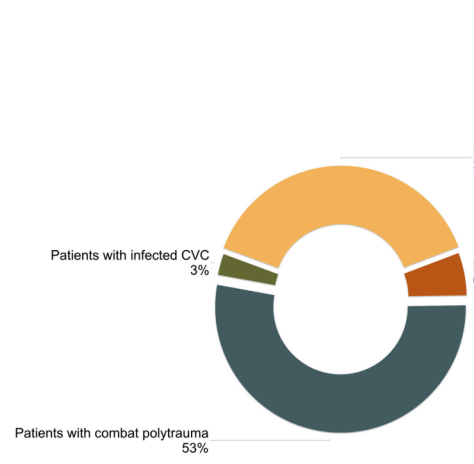
In the context of AMR, **stratification** means categorising patients by their risk of harbouring or transmitting resistant pathogens. This involves assessing prior antibiotic use, healthcare exposure, and local prevalence of resistant organisms. Stratification identifies patients needing special infection control measures or tailored antibiotic therapies. Implementing AMR-guided triage during evacuation and admissions enables efficient use of limited antibiotics and rapid identification of resistant strains [6, 8]. This helps medical teams optimise patient flow, allocate resources efficiently, implement targeted infection prevention strategies, and reduce the spread of AMR within healthcare facilities and the community.

**Effective management of the supply chain** for antibiotics, diagnostic tests, and laboratory reagents is crucial in conflict settings. By ensuring the availability and proper distribution of narrow-spectrum antibiotics, overuse can be minimized, leading to improved patient outcomes [7, 8]. Additionally, maintaining a reliable supply of diagnostic tests and lab reagents enables timely and accurate identification of resistant pathogens, which is essential for appropriate treatment decisions. Antibiotic stewardship programmes in conflict zones, supported by a robust supply chain that includes essential diagnostics, help preserve antibiotic efficacy and prevent the emergence of resistance

#### Breakdown of Antimicrobial Resistance by Strain and Type



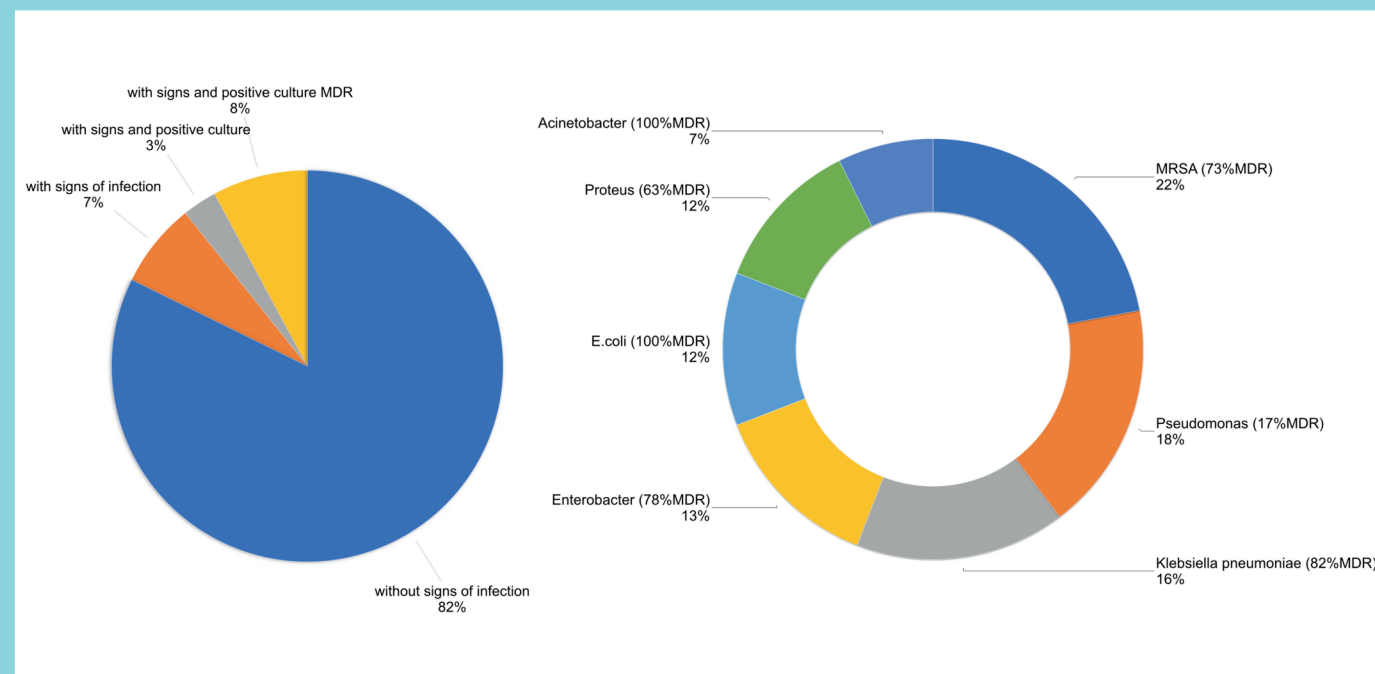
Proportion of Patients with Pathogens



**Left:** Highly multidrug-resistant Gram-negative bacterial infections in war victims in Ukraine, 2022. Phenotypical characterisation was performed on 156 isolates retrieved from 141 patients, which included 133 adults with war injuries and eight newborn babies with ventilator-associated pneumonia. [12]

**Right:** Multidrug-resistance (MDR) breakdown. Cohort study using routinely collected data from 457 consecutive Syrian civilians that received surgical treatment for acute conflict-related injuries during 2014–2016 at a Jordanian hospital supported by Médecins Sans Frontières. [1]

#### Breakdown of Multidrug-Resistant (MDR) Bacterial Infections in Syrian Civilians with Conflict-Related Injuries



### CONCLUSIONS & POLICY RECOMMENDATIONS

- Increase investment in research and development of rapid diagnostics and AMR detection tools, particularly in conflict settings. This will enable quicker response times in treating infections.
- Encourage the use of narrow-spectrum antibiotics to prevent further resistance development. Policies should promote stewardship programs in conflict healthcare settings.
- Invest in infrastructure for infection control in hospitals and during evacuations, focusing on better sanitation, sterile environments, and stratified care.
- Strengthen protocols for early diagnosis and patient stratification during medical evacuations, ensuring patients receive appropriate, timely care without contributing to AMR.
- Encourage international collaboration to share data on resistant pathogens and best practices in combat medicine, ensuring global preparedness.

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