

## Antimicrobial resistance in the ongoing Gaza war: a silent threat

Conflicts and wars, such as those in Iraq and Syria, contribute substantially to the development and spread of antimicrobial resistance.<sup>1</sup> In the Gaza Strip (or Gaza), such resistance is rising, with a 300% increase in resistance to specific antibiotics seen in isolates from injured patients after the Great March of Return demonstrations, compared with non-injured patients.<sup>2</sup> War-related contributing factors to antimicrobial resistance include restricted resources, high casualties, suboptimal infection prevention control, and environmental pollution from infrastructure destruction and heavy metals release from explosives.<sup>2,3</sup> Before the start of the war on Oct 7, 2023, inadequate wastewater management in Gaza led to bacterial contamination in 34% of hospitals' water and surface samples with high resistance to antibiotics, particularly to carbapenems and cephalosporins.<sup>4</sup> Access to essential antibiotics, primarily through donations, has been a continuous challenge due to the blockade of Gaza, resulting in availability as low as 45%.<sup>5</sup> An already restricted national surveillance system for antimicrobial resistance adds to these challenges.

From May, 2018, to December, 2022, at Al-Awda Hospital's reconstructive surgical project in Gaza (supported by Médecins Sans Frontières), approximately 70% of positive cultures—predominantly from patients with osteomyelitis—were multidrug resistant. In 2022, around 65% of *Staphylococcus aureus* isolates were resistant to methicillin, and around 35% of *Pseudomonas aeruginosa* isolates showed resistance to ceftazidime and imipenem. Resistance mechanisms included 30% extended-spectrum beta-lactamases in Gram-negative isolates, with almost 25% of resistant Enterobacteriaceae being resistant to carbapenem

(unpublished monitoring data from the Médecins Sans Frontières project in Gaza).

The current conflict in Gaza poses multiple challenges related to antimicrobial resistance. Gaza faces a constant influx of injured people with heavily contaminated wounds, mass casualties with restricted resources to manage the deceased, overcrowded hospitals with wounded patients lying on floors, and an absence of transmission-based precautions, exacerbating hospital-acquired infection transmission and community spread. Functioning hospitals have converged into sanctuaries for internally displaced people (IDPs), with Al-Shifa Hospital hosting around 50 000 IDPs, Al-Quds Hospital 2000, and Al-Ahli Arab Hospital 3000 during the bombing on Oct 17, 2023, with a total of around 117 000 IDPs.<sup>6</sup>

This overcrowding, coupled with the breakdown of the water and sewage system due to bombings and the 1.5 million people being displaced into unhygienic cramped areas, has led to a surge in infection rates. As of Nov 1, 2023, the overwhelmed health system had treated 20 000 wounds with just 2500 beds initially available, and with only a third of hospitals functioning following fuel shortages. Consequently, heavily contaminated wounds with substantial devitalised tissue are not being operated on as frequently as needed to prevent infection. A severe shortage of medical professionals puts further strain on already exhausted staff who prioritise limb-saving and life-saving procedures over infection and antimicrobial resistance prevention. Moreover, critical shortages in basic medical equipment and essential antibiotics, along with chaos, destruction, and dysfunctional microbiological laboratories, make implementing antimicrobial stewardship an unattainable luxury.

This war poses a substantial setback to the Gaza Ministry of Health's implementation of a national action plan to combat antimicrobial

resistance, and disrupts achievement of the WHO-recommended core interventions for a people-centered approach in preventing such resistance. Immediate actions are needed to address the unfolding public health and antimicrobial resistance catastrophe in Gaza. These actions include ensuring clean and sufficient water, essential medical supplies, improvements to hospitals, and a humanitarian corridor for transferring wounded patients out of Gaza. Emergency preparedness should incorporate antimicrobial resistance prevention packages for rapid deployment and implementation during large-scale emergencies such as wars. Without prompt action, this war threatens to redefine antimicrobial resistance epidemiology in Gaza and beyond.

We declare no competing interests.

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