Le Infezioni in Medicina, n. 2, 247-249, 2026
doi: 10.53854/liim-3402-15

Fragility of Immunisation and Water Systems in Gaza: Infectious Disease Risks in a Conflict-Affected Setting

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Article received 27 February 2026 and accepted 20 April 2026

Dear Editor,
The Israeli military intervention in the Gaza Strip following the terrorist attack of 7 October 2023 has caused an ongoing humanitarian crisis and created a convergence of epidemiological risks rarely observed except in cases of large-scale system collapse [1]. The disruption of immunisation services, water and sanitation infrastructure, and access to essential healthcare has enabled the re-emergence of infectious threats that had been largely controlled for decades. Recent developments involving poliovirus, meningitis, and waterborne hepatitis illustrate the systemic consequences of infrastructure degradation in a high-density population [1, 2].

Poliovirus
In July 2024, circulating vaccine-derived poliovirus type 2 (cVDPV2) was detected in wastewater samples from central and southern Gaza. In August 2024, a confirmed case of acute flaccid paralysis (AFP) in an unvaccinated infant marked the first locally reported paralytic polio case in approximately 25 years [3]. Environmental surveillance through early 2025 continued to identify viral circulation [4, 5].
The report provoked considerable alarm both regionally and globally, prompting the World Health Organization (WHO) to launch an emergency vaccination campaign aimed at reaching all children under 10 years of age. During the first phase of the campaign, approximately 640,000 children were vaccinated in September 2024, followed by an additional 630,000 in February 2025, covering more than 90% of the target population despite severe access constraints [3].
Nevertheless, due to the protracted state of war and its aftermath, thousands of children remain vulnerable and unprotected. As of September 2025, the WHO reported a total of 50 AFP cases - a figure likely to rise in the absence of sustained health and political interventions [4].
This outbreak reflects structural vulnerability rather than an isolated failure. Prior to the escalation of conflict, routine immunisation coverage in Gaza exceeded 95% [3-5]. Displacement, supply chain disruption, damage to healthcare facilities, and insecurity created immunity gaps sufficient to allow cVDPV2 transmission. Poliovirus epidemiology demonstrates that even small declines in coverage can permit viral circulation in settings with compromised sanitation [5]. Wastewater surveillance proved critical for early detection, highlighting the importance of maintaining laboratory-linked monitoring systems during crises.

Meningitis
Humanitarian monitoring reports from mid-2025 documented a marked rise in suspected meningitis cases, particularly among children living in overcrowded shelters [6]. However, these diagno-

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ses were often empirical and based solely on symptomatology due to a severe shortage of lumbar puncture kits; consequently, treatments were also empirical.
During the same period, the Ministry of Health in Gaza reported 337 meningitis cases, of which 259 were viral. A WHO report indicated that, since May 2025, 1,143 suspected meningitis cases had occurred in the Gaza Strip, of which 74% were probably viral and 26% probably bacterial, corresponding to an incidence of 15.7 per 100,000 persons per year for bacterial forms and 42.5 per 100,000 persons per year for viral forms [7].
Given that the total number of recorded cases from 2003 to 2022 in the West Bank and Gaza was 1,682, these data are alarming. Moreover, they are likely underestimated due to underreporting associated with the ongoing conflict [8].
Laboratory confirmation remains constrained by shortages of reagents, electricity, and diagnostic capacity. Under stable health system conditions, prompt lumbar puncture, microbiological confirmation, and parenteral antibiotics reduce mortality from bacterial meningitis to approximately 10–15% [7]. Under collapse conditions, delayed diagnosis and treatment substantially increase mortality and neurological sequelae. Malnutrition and weakened immunisation further amplify risk among displaced children.

Hepatitis HEV
Although studies conducted before the war did not identify significant clusters of hepatitis E virus (HEV) [9], and large-scale outbreaks have not yet been formally documented in Gaza, the determinants associated with HEV transmission - unsafe water sources, destruction of sewage systems, and mass displacement - are clearly present [10].
Parallel increases in hepatitis A (HAV) cases confirm widespread faecal-oral transmission pathways. HEV infection is typically self-limiting but carries a markedly elevated case fatality rate among pregnant women in genotype 1 outbreaks [10]. In the absence of robust viral hepatitis surveillance systems, cases may remain under-recognised until severe maternal outcomes emerge. These hypothetical developments should not be interpreted as independent outbreaks but as indicators of system-level breakdown.
In September 2024, the United Nations Relief and Works Agency for Palestine Refugees reported that, since October 2023, nearly 40,000 cases of HAV had been documented within its facilities. In addition, between 800 and 1,000 new cases of acute jaundice syndrome were being reported weekly [10]. Under such extreme circumstances, identifying HEV infections is extremely challenging. While jaundice allows for clinical recognition, confirming viral hepatitis and determining its aetiology require laboratory testing that is often unavailable. Consequently, most diagnoses remain empirical.
A WHO report from 14 September 2025 supports the hypothesis that some cases of acute hepatitis may be attributable to HEV by documenting 114 cases of Guillain–Barré syndrome - a neurological disorder now recognised as a possible immune-mediated complication of HEV infection. However, epidemiological evidences are not definitive.
The conflict crisis simultaneously weakens three protective layers fundamental to infectious disease control: routine immunisation, safe water and sanitation (WASH), and functional access to healthcare. When all three protections erode in a densely populated territory, the resurgence of controlled pathogens becomes probable rather than exceptional [11].
Policy priorities should include safeguarding routine immunisation during conflict, integrating emergency WASH restoration into outbreak response planning, and reinforcing syndromic and laboratory surveillance through mobile or externally supported diagnostic networks when local capacity is compromised.
Taken together, the detection of vaccine-derived poliovirus, the increase in suspected meningitis cases, and the risk of waterborne hepatitis represent not coincidental outbreaks but a recognisable systems failure phenotype [3-4]. The simultaneous erosion of three interdependent protective layers - routine immunisation, safe water and sanitation, and access to clinical care - creates conditions in which the resurgence of controlled pathogens becomes epidemiologically predictable [1, 2].
In densely populated, conflict-affected settings, even short-term disruption of these layers may reverse decades of progress. In an interconnected region characterised by population mobility, failure to stabilise core public health functions in conflict settings may have transboundary implications, undermining broader eradication and regional control efforts [1-3].

Funding
This research received no grant from any funding agency.

Conflicts of interest
None.

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