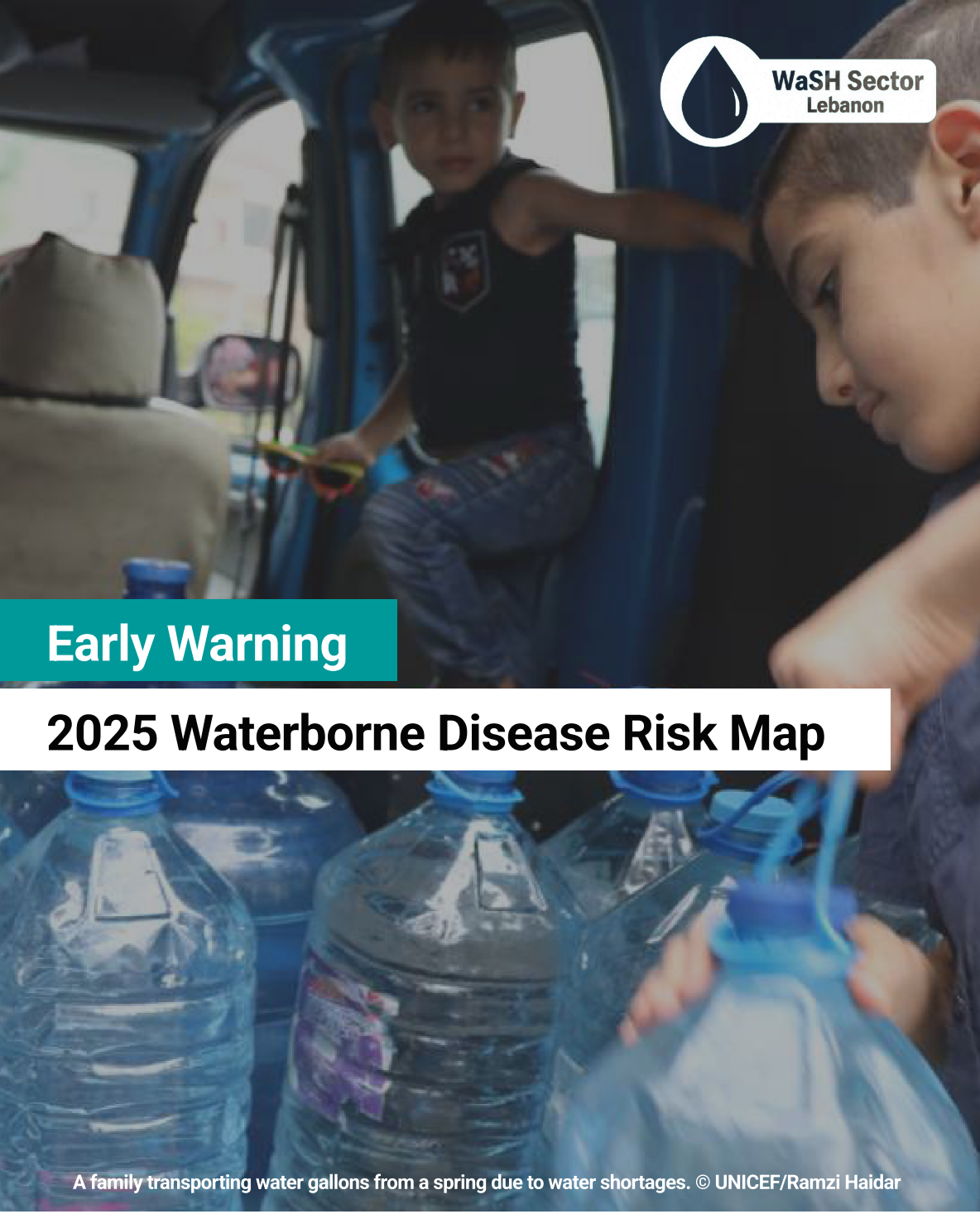
WaSH Sector
Lebanon

Early Warning

2025 Waterborne Disease Risk Map



A family transporting water gallons from a spring due to water shortages. © UNICEF/Ramzi Haidar

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Overview

Lebanon continues to face threats from waterborne diseases (WBD) such as cholera, hepatitis A, and rotavirus due to poor water, sanitation, and hygiene (WaSH) conditions and severe drought.

To strengthen preparedenss, the Cholera Map was initially developed in September 2022 to support preparedness for an expected cholera outbreak. The tool demonstrated a strong correlation between reported cases and areas identified as high-risk, showcasing the potential of predictive mapping for early warning and anticipatory action.

The 2025 update reflects changes in socio-environmental context, including prolonged drought, population displacement, and damaged water infrastructure, and applies updated indicators to better predict emerging WBD risks.

Background: Predictive Success

- **2022 Cholera Risk Map:** Developed in early September 2022, the map highlighted areas at high risk aleriting cholera potential introduction and spread in Lebanon.

- **2022 Cholera Outbreak:** The first cases were confirmed on October 6, 2022, in villages across North Lebanon and Akkar governorates precisely in areas previously identified as high-risk by the 2022 Cholera Risk Map demonstrating the tool's predictive accuracy.

Key Terms

- Waterborne Diseases (WBD): Illnesses transmitted through contaminated water, including cholera, hepatitis A, rotavirus, etc..
- Acute Watery Diarrhoea (AWD): Sudden onset diarrhoea, sometimes causing dehydration, used for syndromic surveillance.
- Cholera: A severe form of AWD caused by Vibrio cholerae, confirmed by lab tests.

Note: The 2022 model focused on cholera; the 2025 update covers all WBD, capturing broader climate and population stress.

Rationale for 2025 Update

Lebanon's 2025 drought created unprecedented stress on water resources: reservoirs and groundwater levels reached critically low levels, public water systems were failing, and communities increasingly relied on unsafe water sources. These pressures, combined with ongoing population displacement (including new arrivals) and infrastructure damage due to hostilities, heightened WBD vulnerability across multiple cadastres.

For the 2025 analysis, the WBD Risk was enhanced by integrating the Drought Vulnerability Index (DVI 2025). The DVI was combined with existing population, surveillance, water access, and environmental factors to capture the added pressures that drought imposes on both water quantity and quality. More information on how the DVI was developed, as well as the map, can be found **here.**

By considering both the likelihood of occurrence (short-term disease trends, water quality, etc.) and potential consequences (population exposure, service disruption, demographic vulnerability), the 2025 WBD Risk Map serves as a forward-looking early warning tool. It identifies not only current high-risk areas but also locations likely to become high-risk in the coming months due to reduced access to safe water, higher contaminant concentrations, and increased reliance on unsafe sources. This approach enables anticipatory alerts for emerging threats such as cholera and hepatitis A linked to climate stress.

Why Drought Matters for 2025?

- Reduced access to safe water forces communities to rely on unsafe sources, such as wells, rivers, or trucked water.
- Lower water flow increases the concentration of pathogens in rivers and reservoirs.
- Overloaded sanitation systems can contaminate drinking water with untreated sewage.
- The 2025 DVI identifies areas where drought-driven scarcity overlaps with high population density and weak infrastructure, creating WBD hotspots.

2025 WBD Risk Model Indicators

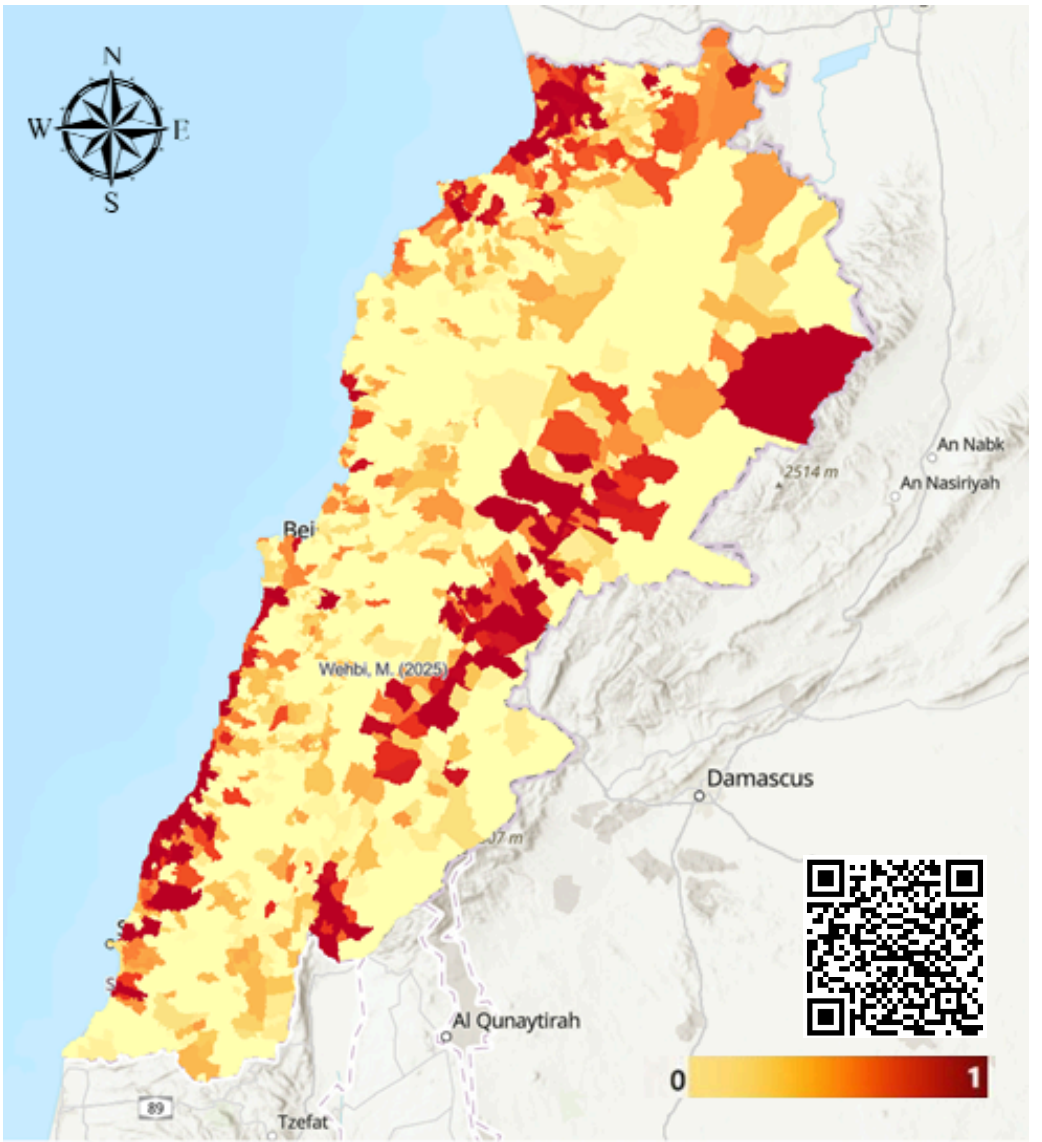
To reflect changes in context and improve predictive accuracy, the 2025 risk model incorporates both updated and newly applied indicators:

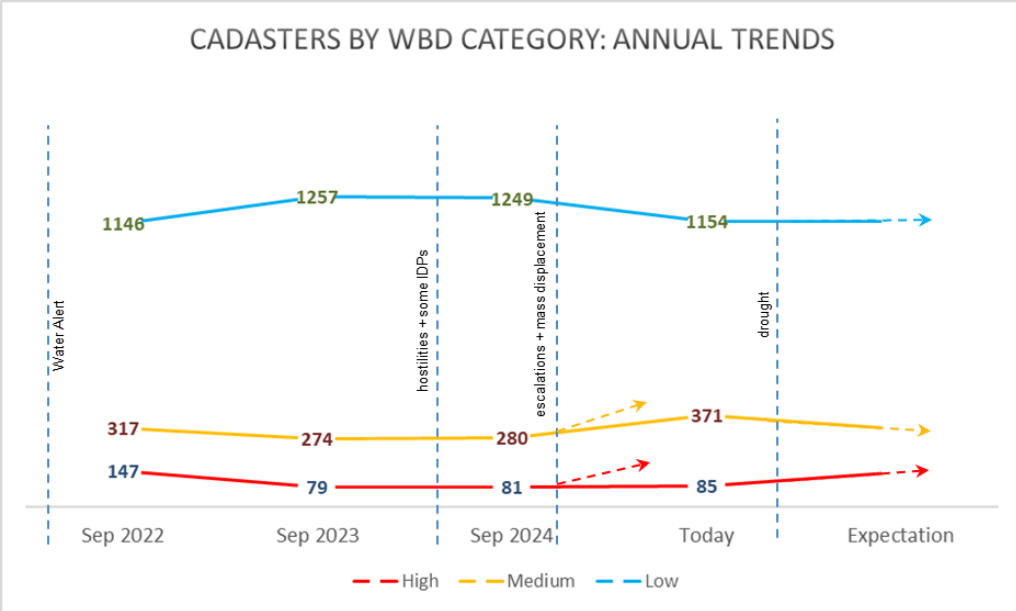
- **Population density and vulnerability:** includes the number of people in each area, taking into account collective shelters for displaced Syrians, informal settlements, and the proportion of high-risk groups such as children under five, the elderly, and other vulnerable populations.
- **Proximity to contamination sources:** permanent/seasonal rivers and known polluted sites.
- **Access to functional water infrastructure:** factoring real-time data on hostilities-related damage and drought impacts (2024–2025).
- **Recent WBD occurrence:** combines MoPH ESU-reported cases (past and current year, weighted for the last six months) with self-reported symptoms collected from informal settlements over the same period. This integrated measure captures both official surveillance data and community-level trends, providing a more complete picture of current disease patterns.
- **Non-conforming water samples:** percentage of water tests failing LIBNOR standards, emphasizing recent results.
- **Drought Vulnerability Index (DVI 2025):** composite hazard driver including precipitation anomalies, hydrogeological resilience, groundwater quality, land use/cover, and population pressure.
- **Sanitation and wastewater services:** includes access to sanitation infrastructure, the functionality of wastewater treatment plants (based on 2024 data), and desludging service coverage and frequency in informal settlements. This combined indicator reflects both system performance and service delivery to vulnerable populations.

These indicators were processed and normalized in the GIS to generate the WBD risk score for each cadastre, enabling early identification of high-risk areas for WBD diseases such as cholera.

2025 WBD Risk Map

After a thorough analysis of the data above, the 2025 WBD risk map has been developed. This map serves as a visual representation of the areas at highest risk for water-borne diseases, providing stakeholders with a clear understanding of the areas that require immediate attention and action. While the 2025 WBD Risk Map identifies 85 highly vulnerable cadastres, this does not imply that other areas are free from risk; ongoing surveillance and preventive measures remain essential across the country.





The above graph represent Trend Analysis of Cadastres by Risk Level from 2022 to 2025

- Risk was increased in October 2024 due to mass IDP movement related to hostilities.
- Drought conditions are expected to compound risk in high and medium-risk cadastres.

Strategic Priorities for Anticipatory Action

1. Institutionalize WBD Early Warning
   - Integrate WBD risk mapping into WaSH and Health sectors planning.
   - Use syndromic surveillance for AWD to flag hotspots early

- Focus on Water Safety During Drought
  - Scale up safe water provision (chlorination, emergency trucking).
  - Strengthen wastewater treatment and desludging in drought-stressed areas.

- Target High-Risk Populations
  - Vaccination campaigns (e.g., oral cholera, Hepatitis A in hotspot cadastres).
  - Hygiene promotion in informal settlements, schools, and collective centres.

- Resource Mobilization & Advocacy
  - Push for climate-WaSH integrated funding.
  - Mobilize rapid response financing for drought-exposed cadastres.

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Advocacy for International Support and Preparedness

Building on the 2025 Drought Advocacy Note, which outlines critical activities and funding requirements access here, Lebanon can enhance anticipatory action for waterborne diseases. Pre-positioning hygiene kits, chlorination supplies, and other essential WaSH materials in high-risk cadastres identified by the 2025 WBD Risk Map ensures rapid response capacInves

Investing in these measures is highly cost-effective: for every $1 spent on WaSH preparedness, up to $4 can be saved in downstream outbreak response. All cross-sector impacts converge on health, and without timely international support, a major outbreak is a matter of when, not if.

Without urgent investment, Lebanon risks another preventable outbreak. The WBD Risk Map and DVI Vulenrabiltiy Map provide the evidence to act now

Conclusion

The 2022 cholera outbreak validated Lebanon's predictive risk mapping and demonstrated how quickly waterborne diseases can spread when access to safe water is compromised. With the 2025 WBD Risk Map now incorporating drought vulnerability, Lebanon has an unprecedented opportunity to shift from a reactive to a proactive approach. Early warning must drive early action to prevent cholera and other WBD from becoming recurring emergencies in an already fragile context.

The map provides action-oriented insight by guiding early warning, prioritizing interventions, and informing resource allocation. It also serves as a compelling advocacy and fundraising tool to mobilize investments in safe water, sanitation, hygiene, and vaccination campaigns, ensuring interventions reach Lebanon’s most vulnerable populations before outbreaks occur.

By integrating climate stress, population pressure, and infrastructure vulnerabilities, Lebanon can strengthen anticipatory action and reduce recurring WBD emergencies, safeguarding public health and improving resilience in the face of ongoing drought and displacement challenges.

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