**TERMS OF REFERENCE FOR A SOLICITED WRC PROJECT**

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| **THEMATIC AREA** | **WATER QUALITY AND HEALTH** |
| **TITLE** | **Predicting and Preventing Epidemic Threats at the Human-Water-Environment Interface: An Interdisciplinary Approach to Solidify Preparedness against Cholera, Enteric Fever and Plague** |

## 1 BACKGROUND

Two-thirds of global Cholera cases and most of the cholera related deaths that have occurred in 2025 so far have been on the African continent. At the Africa Emergency High-Level Meeting on the 4th of June 2025. The WHO Director-General Dr. Tedros Adhanom Ghebreyesus warned of a "worsening cholera crisis across the continent, driven by climate change, conflict and systemic failures in water, sanitation and health systems". Heads of State and Government endorsed a unified Call to Action to eliminate cholera in Africa by 2030.

South Africa is surrounded by countries that are currently in the grips of major cholera outbreaks and the possibility of a cholera outbreak as occurred in Hammanskraal is no longer inevitable. Increased risk is further compounded by climate change. Rising global temperatures promote the proliferation *of Vibrio cholerae* in aquatic ecosystems and increase the frequency of extreme weather events such as floods, which can contaminate water sources. Similarly, warming conditions and altered rainfall patterns in combination with poor waste management supports larger and more active rodent populations and flea vectors, elevating the potential for a re-mergence of *Yersinia pestis* (plague) transmission. Climate-driven migration and overcrowding in informal settlements and the occurrence of asymptomatic carriers of disease may exacerbate these challenges, creating high-risk conditions for epidemic emergence. Although, endemic to South Africa, Typhoid fever (causative agent-*Salmonella enterica* serovar Typhi) remains a notifiable condition in South Africa with outbreak potential especially in areas with a breakdown in WASH infrastructure. However, investigation of recent cluster outbreaks did not identify a source of infection.

This growing threat of infectious diseases with epidemic potential requires novel, interdisciplinary approaches for early detection and prevention. There is need to leverage a combination of ecological monitoring, assessing WASH infrastructure, advanced microbiological methods (whole genome sequencing) and socio-economic dynamics to understand the drivers for disease emergence, predict when multiple drivers come together, and to forecast and mitigate potential epidemic threats at the human-animal-environment

interface (one-health approach). The findings of this work will be of direct relevance to informing not only South African but global epidemic preparedness, particularly in low- and middle-income countries, and will contribute to national and international efforts to mitigate future outbreaks.

## 2 OBJECTIVES

The main objectives of this study are as follows:

- Identify what infrastructural, social and ecological factors predict cholera, enteric fever and plague.
- Develop open source/access early-warning prediction models integrating climatic, microbiological, socio-behavioural, and infrastructure data which can better forecast epidemic risk.
- Test and compare the effectiveness of current prevention strategies.
- Co-design with key stakeholders' non-pharmaceutical interventions that are effective across different pathogens and socio-economic contexts and have the possibility of being scaled up.
- Build capacity of key stakeholders involved in epidemic response.

## 3 SCOPE OF WORK

The scope of work will require a multi-disciplinary team and inter-disciplinary processes to ensure real integration of methods and knowledge from various disciplines to achieve the objectives of the study. As some of the short term and medium outcomes include improved outbreak detection and prevention readiness, it is imperative that pilot sites are selected and that local and national health related bodies are approached to facilitate adoption of tools, models and frameworks. Data integration, modelling, field research and behavioural studies will be key activities involved in this work and must be budgeted for adequately.

## 4 DELIVERABLES

Deliverables must align with the objectives of the study and should include but not be limited to the following:

- Open access early warning predictive models
- Report on the effectiveness of current epidemic prevention strategies (including addressing barriers because of a lack of trust, cultural narratives and governance structures).
- Policy recommendations to improve sanitation, waste management, and public health interventions, particularly in high-risk urban and peri-urban areas.
- Report on multi and interdisciplinary capacity building for key stakeholders involved in epidemic response.

- A final draft report
- Print ready final report (20% of the total budget)

**Time Frame: 01 September 2025 – 31 August 2029**

**Total Funds Available**
**Budget:** R 4 million
**Year 1:** R 800 000.
**Duration:** 4 years