Open-Pandemic-Risk: Alert, Enrich, Evaluate, Recommend, Open Platform for National Public Health experts with AI agents and explainble models.

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Abstract

This project is an attempt to build a pandemic risk monitoring platform for public health experts in policy or fieldwork with four stages: Alert, connecting verified health professional signals, Enrich, a scalable multiturn agent with search gathering external context, Evaluate, a risk assessment model (doubleml) to score risk and confidence of the alert and enriched data, and Recommend, a grounded AI agent recommending actionable response steps to public-health teams for faster response from raw signals to actions recommendations based on explainable models policy makers are familar with. The project ended up scaffolded and is deployable with the pipeline runnable, however, model experiments were not rigorously run nor verified. It serves as an entrypoint to continue transparent open development of explainable, live, grounded, and actionable alerting and response of pandemic risk where speed and transparency matter.

1. Introduction

Pandemic Risk Monitoring is an important step for modern public health ministries, experts, and field workers to mitigate viral spread. Speed and decisive intervention is critical as spreads can become exponential and prevention is the most resource efficient approach to mitigation and resolution. However, there are a couple of bottlenecks such as the clarity/ reliability of information gathered and humans in the loop to evaluate risk and decide on action is not scalable as edge cases could have exponential takeoffs if not addressed and contained. A multitude of platforms have been built such as BlueDot powerful but closed, SORMAS for field work, Promed using manual expert curation, HealthMap as an aggregator

Our main contributions are:

1. *Developing a deployable and open platform for pandemic risk monitoring*
2. *Scaffolding an end to end pipeline aligned with policy makers and modern technology to aggregate natural language data regarding the alert signal in a scalable manner. Alert to Response where speed and validity is crucial.*

2. Related Work

Platforms such as HealthMap, Bluedot, Go.Data, and Sormas have taken different approaches to address these issues. Bluedot being strong but not open, which is crucial for both explainability / future prevention, mitigation and policy/ intervention improvement. While others such as Sormas and Promed have more specific vectors such as fieldwork and data syncing and expert curation, but aren't scalable or aren't unifying for alert to response. HealthMap has powerful aggregation but weak reasoning.

3. Methods

We address these gaps by using open and modern technology using the scalability of AI in natural language processing and reasoning to enrich and verify alerts, causal models aligned with policy experts such that risk assessment is explainable for key decision makers in the alert loop to make tradeoff decisions, and finally another AI layer to draw from past decisions and risk to recommend response action. This addresses the issues of human scalability of manual curation, memory, and speed of verification such that they are no longer bottlenecks while maintaining industry experts in an open and explainable loop.

We used WHO api specifically of the IHR core capacity + emergency preparedness identifiers, can this country detect/respond now, event outbreak codes related to disesases (H5N1, Yellow fever, etc...) , core infectious burden families as features and regressed them on target_72h alert data which is a quick validated signaling threshold.

4. Results

We did not have time to measure the statistical significance nor performance of the risk assessment model nor the performance of the AI models on enrichment and decision making and especially validate them with domain experts. Currently the platform is deployable but needs further tuning and development around the risk model and also the two AI models and further data source enrichments.

5. Discussion and Limitations

Limitations

We did not yet address using ProMed, wastewater, news, and flight data. It would be interesting to connect CDC wastewater data to eliminate testing bias and have better leading indicators, and then enrichment around news and flight data to track/ prevent the pandemic spread in a scalable geographical and temporal dimensions.

Future Work

Naturally, it'd be interesting to better define our risk assessment model and it's training sets to have more robust experimentation with data. Also connecting the datasources as mentioned with wastewater data, flight data, news, and potentially field work data if necessary would provide robust improvements to our alerting and predicting system. Additionally, both of our AI models would benefit from fine tuning: the research agent in enrichment and data collection to make it robustly collect enough reliable data from the WHO, healthmap api, upstream datasources, or generic web before funneling them to risk assessment and also the recommendation AI model to perhaps use generative recommendation systems to be able formally align with past decision recommendations and tune itself to response related data validated by experts.

6. Conclusion

We built an open source Alert-Enrich-Evaluate-Respond deployable platform. Which is transparent, explainable, and scalable, helping public health experts on the field or national ministries to decide on action where speed and decisiveness matters.

Code and Data

Include links if applicable. If your project doesn't involve code (e.g., policy analysis) or if there are info-hazard considerations, note that here.

- ***Code repository**: https://github.com/yao-creative/Open-Pandemic-Risk*

- ***Data/Datasets:*** *https://www.who.int/data/gho/info/gho-odata-api WHO data*

Author Contributions (optional)

Solo Project by Yao

References

1. Target_T72H & The 2026 Pandemic Agreement

The "Target_T72H" (72-hour notification) is codified under the ***Article 12 Pathogen Access and Benefit-Sharing (PABS)*** *system of the new treaty.*

- ***World Health Organization.*** *Implementation of the WHO Pandemic Agreement: Pathogen Access and Benefit-Sharing System and Annex Modalities. Geneva: World Health Organization; 2025. [Report No.: BLT.25.294146].*
- ***World Health Assembly.*** *Proposed amendments to the International Health Regulations (2005): Final report of the Working Group on Amendments to the International Health Regulations. Geneva: World Health Organization; 2024.*

2. HealthMap (Global Digital Surveillance)

HealthMap is the pioneer of "Event-Based Surveillance" (EBS) using unofficial internet sources to find signals before official reports.

- ***Brownstein JS, Freifeld CC, Reis BY, Mandl KD.*** *Surveillance Sans Frontières: Internet-Based Emerging Infectious Disease Intelligence and the HealthMap Project. PLoS Medicine. 2008;5(7):e151. doi:10.1371/journal.pmed.0050151.*
- ***Chan EH, Brewer TF, Madoff LC, et al.*** *Global capacity for emerging infectious disease detection. Proceedings of the National Academy of Sciences (PNAS). 2010;107(50):21714-21719.*

4. SORMAS (Surveillance Outbreak Response Management & Analysis System)

SORMAS is the open-source standard for bi-directional communication between labs and clinics, specifically in West Africa and Europe.

- ***Silenou BC, Tom-Aba D, Adeoye O, et al.*** *Use of Surveillance Outbreak Response Management and Analysis System for human monkeypox outbreak, Nigeria, 2017–2019. Emerging Infectious Diseases. 2020;26(2):345-349. doi:10.3201/eid2602.191139.*

- ***Fähnrich C, Denecke K, Adeoye OO, et al.*** *Surveillance and Outbreak Response Management System (SORMAS) to support the control of the Ebola virus disease outbreak in West Africa. Eurosurveillance. 2015;20(12):21071.*

5. ProMED (Program for Monitoring Emerging Diseases)

The "Global Alarm" system that famously broke the news of SARS (2003) and COVID-19 (2019).

- ***Woodall J, Calisher CH.*** *ProMED-mail: background and purpose. Emerging Infectious Diseases. 2001;7(3 Suppl):563.*
- ***Madoff LC.*** *ProMED-mail: An Early Warning System for Emerging Diseases. Journal of Public Health Management and Practice. 2004;10(3):224-226.*

6. WHO Global Health Observatory (GHO) API

- ***World Health Organization.*** *World Health Statistics Indicators: Metadata and API Documentation. Global Health Observatory. Geneva: World Health Organization; 2026. Available from: https://www.who.int/data/gho/info/gho-odata-api.*

LLM Usage Statement

I used LLMS to verify and search up the citations in this report and retrieve and summarize data sources of the other projects and of the importance and impact which domain experts such as health ministries and field workers would care about of features developed. The assembling of domain importance, future work, and outline of the project was written by me.