

VITAALERT HEALTH GRID

Scientific & Operational Brief

Platform logic, operating model, and potential impact. Phase 1 prototype.

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VitaAlert Health Grid is a prototype AI-assisted operational intelligence and field-coordination system for epidemic response in low-resource environments in sub-Saharan Africa. This brief outlines the platform's clinical and operational logic: what it does, how it is intended to work alongside community health workers, field hospitals, and ministries of health on the ground, and the impact it could have for communities facing outbreak threats. It is written for clinical and research readers. We are candid about what is implemented in the prototype today and what remains to be empirically validated.

01 EPIDEMIOLOGICAL PREMISE

Once an outbreak is under way, the factor that most determines its trajectory is not laboratory capacity — which is improving rapidly with mobile RDT — but how quickly information becomes coordinated action: whether responders can predict where transmission is heading, direct scarce resources to those points, and coordinate across the community–district–ministry–border chain faster than the pathogen moves. The bottleneck VitaAlert targets is that response loop. The evidence below shows why response speed is decisive.

Detection lag. Median lag from index case to outbreak alert in low-resource Filovirus, Mpox-clade-I, and cholera contexts is consistently estimated at 14–21 days (synthesis of WHO IDSR data, post-event reviews, and peer-reviewed retrospective analyses). Days lost before the response even begins are the hardest to recover.

Containment math. For pathogens with R_0 in the 1.5–2.5 range (Zaire ebolavirus, Marburg, Mpox clade I), each day of delay compounds case load. Standard transmission models suggest sub-72h detection-and-response is necessary to maintain R -effective < 1 under realistic intervention capacity in rural African districts.

Information flow. Existing tools are paper-based, web-only, or hospital-centric. None turn field reports into a forecast of where the outbreak is heading or coordinate the response across borders, and none are AI-augmented, offline-first, and built around the community-health-worker as the primary signal source. VitaAlert is built around that primary signal source.

Spillover acceleration. Zoonotic spillover events have more than doubled since 2000, driven by climate, land-use change, and human-wildlife interface expansion. The question is no longer whether outbreaks continue — it is whether prediction, coordination, and resource movement can outrun transmission.

02 ARCHITECTURE AND DATA FLOW

Field layer. Android-first, offline-resilient reporting app. CHW captures: structured symptoms, exposure history (funeral, household, healthcare contact, animal contact, travel), GPS, optional photo and voice note. Multilingual (English, French, Swahili at launch). Designed for low-literacy and intermittent-connectivity contexts.

Intelligence layer. Risk scoring runs on-device for offline triage, then re-scores in the cloud as additional context becomes available. Score components are exposed (explainable AI): every alert displays the signals and their weights that produced it. We do not use black-box models for clinical or operational triage in the prototype, and we commit to maintaining that posture through pilot.

Operations layer. Web dashboard for district supervisors, MoH, and WHO/Africa CDC operators. Live geospatial outbreak view, contact-transmission graph, resource-stress modeling (PPE, isolation beds, clinic capacity), cross-border activity tracking, and timeline replay for retrospective analysis.

Coordination layer. Workflows aligned to International Health Regulations (IHR 2005). Auto-generation of cross-border notification packets to WHO AFRO + Africa CDC + neighbouring MoHs when transmission events cross borders. Full audit trail for after-action review and IHR reporting.

03 METHODOLOGY — PROTOTYPE VS. VALIDATED

Honesty about state-of-readiness is central to how we approach advisor recruitment.

What the prototype contains today. A full, working operator dashboard and an interactive, simulated 14-day Zaire ebolavirus scenario in the DRC–Uganda Albertine corridor (eight fictional districts modelled on the real recurrence zone). The demo walks the intended workflow end to end — risk-tiered case triage with plain-language explanations, a contact-transmission graph with super-spreader flagging, geospatial overlays, and cross-border movement alerts. It runs on synthetic data: the risk scores, the super-spreader concentration index, and the border events are illustrative outputs authored into the scenario, not yet produced by live scoring or inference engines. The underlying risk-scoring rules, contact-graph construction, and cross-border inference are in development (TRL 3–4); the validation plan below describes how they will be built and tested.

What is not yet empirically validated. Predictive accuracy of the risk-scoring model against historical outbreak datasets; super-spreader detection sensitivity and specificity; false-positive rate in low-prevalence (non-outbreak) settings; usability of the field app across CHW literacy levels and device profiles. None of these are claimed as validated in current materials.

Pilot-phase validation plan. Retrospective validation against published Filovirus and Mpox outbreak datasets (West African 2014–16, North Kivu 2018–20, Mpox clade I 2024). Prospective validation against a partnered district surveillance system across a 6–12 month observation window. Pre-registered analysis plan.

Independent algorithm audit. We intend to commission an independent academic audit of the risk-scoring model — both quantitative (calibration, sensitivity/specificity across pathogens) and qualitative (review of feature weights and explainability output) — as a precondition of any first operational deployment.

Adversarial / failure-mode testing. Specific attention to: false-positive cascades in seasonal arbovirus contexts, under-reporting in conflict-affected districts, and supervision-gap signal degradation. We invite advisor input on the right test design.

04 DATA GOVERNANCE, IP, ETHICS

Data sovereignty. Reports collected within a country remain that country's MoH property. VitaAlert provides infrastructure; the data is theirs. This is not negotiable.

Co-authorship and publication. Pilot-phase epidemiological analysis is by default co-authored with the relevant MoH epidemiologists and partner academic groups. Advisors with substantive scientific contribution are co-authors, not acknowledgments.

Algorithmic transparency. All risk-scoring weights are inspectable; no proprietary black-box clinical triage. Model cards will accompany any version deployed operationally.

Personal data minimization. Patient identifiers are pseudonymized at field capture. Raw identifiers remain on-device under MoH control. PII handling is calibrated to be defensible under both GDPR analogues and emerging African Union data-protection frameworks.

IRB / ethics pathway. Pilot deployments require host-country ethics approval. We anticipate IRB partnerships with one US academic medical center and one African public-health institution as part of the pilot funding application.

IP posture. Field-layer Android app is intended to become open-source under a permissive license once the pilot stabilizes. Operations/coordination-layer infrastructure remains the proprietary component that funds continued development.

05 MODUS OPERANDI — HOW VITAALERT WORKS ON THE GROUND

VitaAlert is built around four operating tiers, each calibrated to the existing health-system layer it integrates with. The platform is designed to amplify existing actors — community health workers, clinic operators, district supervisors, regional coordinators — not replace them. The same case, the same person, the same outbreak appears in each tier at the appropriate resolution and with the appropriate decision authority.

Community level · the community health worker. The CHW conducts routine household visits, attends community gatherings, and is often the first health-system contact for a symptomatic patient. When a case meets suspect criteria — hemorrhagic symptoms, atypical fever pattern, recent funeral or animal contact — she submits a structured report on her Android phone. No internet connectivity is required. The AI risk score is calculated on-device and returned to her within seconds, so she knows on the spot whether to refer, isolate at home, or place under watch. Voice notes and photos supplement structured fields in low-literacy contexts. Reports sync to the cloud the moment connectivity returns. Multilingual at launch: English, French, Swahili.

Field hospital / clinic level. Clinic operators receive flagged cases with the AI's reasoning attached — they see why the case scored high, not just that it did. When a high-risk case is admitted, the IPC posture for the facility upgrades automatically, PPE stock is checked against the projected case load, and the isolation-bed register is updated. The patient register links to contact-graph nodes: each patient is simultaneously a clinical case and a position in a transmission network. Integration with DHIS2 (the standard African health-information system) and the IDSR (Integrated Disease Surveillance & Response) framework is intended for the pilot phase, so VitaAlert reinforces existing systems rather than competing with them.

District / Ministry of Health level. District supervisors and MoH operators see a live dashboard: active cases, risk overlays, cluster detection, resource stress. AI operational recommendations are generated with a human approval gate — the system proposes, the operator decides. Cross-district coordination workflows trigger when transmission events span administrative boundaries. The same decisions that normally take days of phone calls and emails are surfaced to the right decision-maker in minutes, with the evidence pre-assembled. Full audit trail for after-action review and IHR (2005) reporting.

Regional / cross-border / international level. Automatic IHR (2005) notification packets fire when transmission crosses an international border. Bilateral coordination workflows open between neighbouring MoHs. WHO AFRO and Africa CDC can be granted view-only access to aggregates without compromising MoH data sovereignty. A pathway to integrate with continental surveillance systems (the Africa CDC Event-Based Surveillance network, the WHO EIOS platform) is envisioned for Phase 2. The architecture treats the international layer as an integration partner, not as a substitute for national authority.

06 POTENTIAL COMMUNITY IMPACT

If deployed with the operating model above, VitaAlert has the potential to shift outcomes across five dimensions — clinical, social, infrastructural, diplomatic, and institutional.

Clinical · faster response, fewer deaths. Compressing the lag between an outbreak spreading and a coordinated response reaching it fundamentally changes case-load trajectories. For pathogens with high case-fatality and short generation intervals (Ebola, Marburg, Mpox clade I), every day between spread and response compounds — mortality is exponentially sensitive to time-to-response in the early outbreak phase.

Social · less community disruption. Shorter outbreaks translate to less stigma against affected communities, shorter school and market closure, less disruption to women's economic activity, less family separation, and less stress on traditional burial and grieving practices. The social cost of an outbreak falls even when the medical cost is similar — and the social cost is often what damages community trust in the health system long after the outbreak ends.

Infrastructural · CHW network strengthening that persists. Phones, training, recognition pathways, and the basic dignity of being heard by the institution persist long after any single outbreak. VitaAlert does not replace the community health worker — it amplifies her authority by giving her a tool that ministries and partner organizations take seriously. The CHW network is the asset; VitaAlert helps build it.

Diplomatic · cross-border coordination becomes predictable. Automatic IHR notifications and bilateral workflows remove the political ambiguity that often slows neighbour-to-neighbour outbreak response, particularly in trade corridors and refugee-route zones where coordination is most needed and most fraught. Predictability lowers the political cost of asking for help.

Institutional · audit, accountability, and sovereignty preserved. Decision logs, contact graphs, and resource burn are exportable. After-action reviews become rigorous rather than reconstructive. Donors and ministries alike can trace decisions to outcomes. Crucially, reports collected within a country remain that country's MoH property — VitaAlert is infrastructure, not data extraction.

07 AREAS OF ACTIVE DEVELOPMENT AND REFINEMENT

Active development priorities for the next twelve months, shaped by ongoing operational and clinical input:

- **Validation against retrospective outbreak datasets** — West African 2014–16, North Kivu 2018–20, Mpox clade I 2024 — are leading candidates.
- **Cross-border detection ethics** — operational guardrails for mobility inference in trader, migrant, and refugee populations.
- **Supervision-gap signals** in conflict-affected districts, and operational adaptation where standard CHW chains are disrupted.
- **Disease coverage** — extension beyond the five Phase-1 pathogens (Ebola, Marburg, cholera, Mpox, Lassa) toward dengue, yellow fever, and meningitis.
- **Pilot geography** — the DRC–Uganda Albertine corridor leads, with the Sahel, Lake Chad Basin, and East African Rift under evaluation.