Overcoming Barriers:

The Essential Role of Community Health Workers in Humanitarian Responses

Examining the vital role of structured Community Health Worker programs in overcoming barriers and enhancing health system resilience during humanitarian crisis

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Contents:

List of Abbreviations

CBPR	Community-Based Participatory Research
CHW	Community Health Worker
CHWs	Community Health Workers
COVID-19	Coronavirus Disease 2019
CQI	Continuous Quality Improvement
EMT	Emergency Medical Team
ERV	Ebola Response Volunteers
ETC	Ebola Treatment Center
ETU	Ebola Treatment Unit
FBR	Fear-Based Response
EVD	Ebola Virus Disease
iCCM	Integrated Community Case Management
INGO	International Non-Governmental Organization
IOM	International Organization for Migration
KB	Kafu Bullum
LK	Lokomasama
MEQ	Monitoring Evaluation and Quality
MIRA	Multi Cluster/Sample Initial Rapid Assessment
MMT	Mobile Medical Teams
NGO	Non-Governmental Organization
PDSA	Plan-Do-Study-Act
PHEP	Public Health Emergency Preparedness
PIH	Partners in Health
PL	Port Loko
PSS	Psychosocial Support
QI	Quality Improvement
RQA	Rapid Qualitative Assessment
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
Tievac	Outfits worn in the hot zone of Ebola treatment facilities
UN	United Nations
UNHCR	United Nations High Commissioner for Refugees
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
WHO EMT	World Health Organization Emergency Medical Team
WHO	World Health Organization

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Executive Summary

Humanitarian crises, whether driven by disease outbreaks, climate-related disasters, or political instability, expose and exacerbate the vulnerabilities of health systems. In these complex settings, community-based strategies have emerged as essential to sustaining access to care. This thesis investigates how structured Community Health Worker programs contribute to the health system resilience in these fragile settings.

The central research question guiding this work is: *How can structured CHW programs be effectively designed and implemented to enhance health system resilience during humanitarian crises?* The aim of the thesis is to identify effective strategies, structures, and enabling factors that support the successful integration of CHWs in disaster and emergency response settings.

This dissertation comprises three interlinked studies that examine CHW programs in diverse humanitarian settings:

- **The first study** investigates the experiences of CHWs during the Ebola epidemic in Sierra Leone using rapid qualitative assessments to identify fear-based responses within the population. It highlights the vital function CHWs played in ensuring continuity of care, identifying community-level health priorities, and managing community fears in a rapidly evolving crisis.
- **The second study** focuses on the application of continuous quality improvement (CQI) methods, including Plan-Do-Study-Act (PDSA) cycles into CHW programming in a response setting. It demonstrates how structured supervision, regular feedback, and iterative adaptation can enhance CHW performance and health service delivery in unstable environments.
- **The third study** presents case studies from Sierra Leone and the Bahamas that explore how CHWs helped sustain healthcare access during three different crises: the Ebola epidemic, in the aftermath of Hurricane Dorian, and during the global COVID-19 pandemic. These cases illustrate how embedded community actors adapt rapidly to disrupted systems, sustain trust, and serve as bridges between formal health systems, humanitarian response systems, and underserved populations.

In Sierra Leone, CHWs provided essential mental health support and referrals, ensuring continuity of care despite widespread healthcare disruptions. In the Bahamas, CHWs from the Haitian immigrant community bridged cultural barriers, fostering trust and facilitating access to essential health services for marginalized populations. These examples illustrate the vital role CHWs play in disaster response by rapidly mobilizing, adapting to evolving conditions, and maintaining community engagement.

A key contribution of this research is the identification of structural elements that enhance the effectiveness of CHW programs in humanitarian settings. Together, these form the foundation for a scalable model for CHW programs in crisis settings:

- **Community Involvement:** CHW recruitment through community leadership structures fosters trust, legitimacy, and local ownership.
- **Supervision and Communication**: Strong oversight, frequent in-person visits, and clear communication channels ensure accountability and enhance program impact.
- **Data Collection and Quality Improvement**: CHWs contribute to real-time health surveillance, enabling early outbreak detection and responsive healthcare strategies.
- **Government Collaboration**: Effective CHW programs align with national health priorities, ensuring sustainability and integration within existing healthcare frameworks.
- **Mental Health Support**: Supporting the psychological well-being of CHWs themselves and the communities they serve enhances retention, effectiveness, and the overall sustainability and impact of these programs.
- **Supply Chain Adaptability**: CHWs ensure continued access to essential medical supplies, especially when traditional distribution channels are disrupted.

This thesis advocates for a paradigm shift in how health systems are designed and supported during humanitarian crises. Rather than relying solely on centralized, top-down interventions, this thesis advocates for the systemic integration of CHWs as a core component of emergency health responses. The findings provide a compelling case for the strategic expansion of CHW programs as a cornerstone of resilient health systems, particularly in the face of intensifying global challenges such as climate-related disasters, epidemics, political instability, and future as-yet-unknown public health emergencies.

Samenvatting

Humanitaire crisissen — veroorzaakt door epidemieen, klimaatgerelateerde rampen of politieke instabiliteit — leggen de kwetsbaarheid van gezondheidssystemen bloot en versterken deze. In dergelijke complexe situaties blijken gemeenschapsgerichte strategieën essentieel om de toegang tot zorg te waarborgen. Dit proefschrift onderzoekt hoe gestructureerde programma's met *Community Health Workers (CHWs)*bijdragen aan de veerkracht van gezondheidssystemen in fragiele en ontwrichte omgevingen.

De centrale onderzoeksvraag luidt: **Hoe kunnen gestructureerde CHW-programma'seffectief worden opgezet en geïmplementeerd om de veerkracht van gezondheidssystemen tijdens humanitaire crisissen te versterken?** Het doel van dit proefschrift is om effectieve strategieën, programmatische structuren en randvoorwaarden te identificeren die de succesvolle integratie van CHWs in noodhulp en rampenrespons ondersteunen.

Het proefschrift omvat drie onderling verbonden studies naar CHW-programma's in diverse humanitaire contexten:

- **De eerste studie** onderzoekt de ervaringen van CHWs tijdens de ebola-epidemie in Sierra Leone, waarbij kwalitatieve methodes werden gebruikt om het gedrag van de bevolking, dikwijls gebaseerd op angst en onwetendheid, in kaart te brengen. De studie toont aan hoe CHWs een cruciale rol spelen voor de continuïteit van de zorg, het identificeren van gezondheidsprioriteiten op gemeenschapsniveau en het omgaan met angst in een snel veranderende crisissituatie.
- **De tweede studie** richt zich op de toepassing van *Continuous Quality Improvement (CQI)*-methodieken, waaronder *Plan-Do-Study-Act (PDSA)*-cycli, in CHW-programma's tijdens een noodhulpinterventie. De resultaten tonen aan dat gestructureerd toezicht, regelmatige feedback en iteratieve aanpassingen de prestaties van CHWs en het verzekeren van gezondheidsdiensten in instabiele omgevingen kunnen verbeteren.
- **De derde studie** presenteert casestudy's uit Sierra Leone en de Bahama's, die illustreren hoe CHWs de toegang tot gezondheidszorg wisten te waarborgen tijdens drie verschillende crisissen: de ebola-uitbraak, de nasleep van orkaan Dorian en de COVID-19-pandemie. Deze casussen laten zien hoe lokaal verankerde gezondheidswerkers zich snel kunnen aanpassen aan ontwrichte systemen, vertrouwen in stand houden en fungeren als brug tussen formele

gezondheidsdiensten, humanitaire hulpstructuren en gemarginaliseerde bevolkingsgroepen.

In Sierra Leone boden CHWs essentiële psychosociale steun en doorverwijzingen, waardoor de continuïteit van zorg werd gehandhaafd ondanks het instorten van het formele gezondheidssysteem. In de Bahama's slaagden CHWs uit de Haïtiaanse immigrantengemeenschap erin om culturele barrières te overbruggen, vertrouwen op te bouwen en de toegang tot gezondheidszorg voor kwetsbare groepen te verbeteren. Gezamenlijk onderlijnen deze voorbeelden de essentiële rol van CHWs bij rampenrespons: zij mobiliseren snel, passen zich aan veranderende omstandigheden aan en behouden betrokkenheid binnen de gemeenschap.

Een belangrijke bijdrage van dit onderzoek is de identificatie van structurele elementen die de effectiviteit van CHW-programma's in humanitaire contexten versterken. Deze vormen samen het fundament voor een schaalbaar model voor CHW-programma's tijdens crisissen:

- **Gemeenschapsbetrokkenheid:** Werving van CHWs via leiderschapsstructuren binnen de gemeenschap bevordert vertrouwen, legitimiteit en lokaal eigenaarschap.
- **Toezicht en communicatie:** Sterk toezicht, frequente persoonlijke contacten en heldere communicatiekanalen bevorderen verantwoording en vergroten het impact van het programma.
- **Dataverzameling en kwaliteitsverbetering:** CHWs dragen bij aan *realtime* gezondheidsbewaking, waardoor uitbraken vroegtijdig kunnen worden opgespoord en responsstrategieën tijdig kunnen worden aangepast.
- **Samenwerking met de overheid:** Effectieve CHW-programma's sluiten aan bij nationale gezondheidsprioriteiten, wat duurzaamheid en integratie in het bestaande zorgsysteem bevordert.
- **Psychosociale ondersteuning:** Ondersteuning van het welzijn van zowel CHWs zelf als de getroffen gemeenschappen verbetert retentie, effectiviteit en de algehele duurzaamheid van de programma's.
- **Aanpasbare toeleveringsketens:** CHWs waarborgen de voortdurende toegang tot essentiëel medisch material , vooral wanneer traditionele distributiekanalen verstoord zijn.

Dit proefschrift pleit voor een paradigmaverschuiving in de wijze waarop gezondheidssystemen worden ontworpen en ondersteund tijdens humanitaire crisissen. In plaats van uitsluitend te vertrouwen op gecentraliseerde, top-down interventies, bepleit

het de systematische integratie van CHWs als een kernonderdeel van noodhulp in de gezondheidszorg. De bevindingen bieden een overtuigend pleidooi voor de strategische uitbreiding van CHW-programma's als fundament van veerkrachtige gezondheidssystemen, met het oog op toenemende mondiale uitdagingen zoals klimaatgerelateerde rampen, epidemieën, politieke instabiliteit en toekomstige gezondheidscrisissen.

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Introduction

Community Health Workers

Disaster response and humanitarian crises present significant challenges to healthcare systems worldwide, often exposing existing vulnerabilities and inadequacies (BBC News, 2019). These events, whether caused by natural disasters, armed conflicts, or pandemics, can lead to a sudden influx of patients, an overwhelming demand for medical services, and the collapse of the existing healthcare delivery capacity (Institute of Medicine & National Research Council, 2009; Allen & Lacson, 2015; Callaway et al., 2012; Fredricks et al., 2015; Miller et al., 2020a; Rosales et al., 2015; Siekmans et al., 2017). As healthcare facilities become strained, the continuity and quality of care is jeopardized, and essential services may be disrupted or entirely halted (Allen & Lacson, 2015; Callaway et al., 2012; Dara et al., 2005; Fredricks et al., 2015; Means et al., 2020; Miller et al., 2020a; O'Neill et al., 2016; Rosales et al., 2015; Rwabukwisi et al., 2017; Siekmans et al., 2017). The rapid deterioration of public health infrastructure during crises necessitates a reevaluation of existing healthcare delivery models, emphasizing the need for resilience and adaptability (Arab-Zozani & Ghoddoosi-Nejad, 2020; Dara et al., 2005; Kellerborg et al., 2020; Rosales et al., 2015). Additionally, the psychological and physical toll on healthcare workers can further complicate response efforts, highlighting the importance of support systems for those on the front lines (Betancourt et al., 2016; Bitanihirwe et al., 2016; Hoh, 2020; Kahn et al., 2009; Kuday et al., 2023; Salvi et al., 2021a; Steimer, 2002). Ultimately, effective disaster response requires a coordinated approach that not only addresses immediate health needs but also strengthens the overall resilience of healthcare systems for future challenges (Fredricks et al., 2015; Institute of Medicine & National Research Council, 2009; Miller et al., 2020b; Rosales et al., 2015; Siekmans et al., 2017). As the global community continues to face an increasing frequency of humanitarian crises, the imperative for resilient and flexible health systems has never been more critical.

In the face of these increasing global health challenges, Community Health Workers (CHWs) emerge as a proven and pivotal element in strengthening health systems. Structured community health worker programs first emerged in the 1960s primarily in Central America (Green, 2010; Lehmann & Sanders, 2007; Miller et al., 2020a; Perry et al., 2014). Since then, CHW programs have expanded significantly across a wide range of global contexts. The WHO estimates there are currently more than 5 million CHWs around

the world, 2.3 million of those in India alone (World Health Organization [WHO], n.d.). In addition to being implemented in countries by international nongovernmental organizations (INGOs) or national nongovernment organizations (NGOs) many national community health worker programs exist as well, structured and managed by Governments (Miller et al., 2020a).

The definition of CHWs encompasses a diverse category of health workers, primarily individuals who are not trained health professionals, operating in community settings affiliated with a geographically fixed health facility (Perry et al., 2014). Traditionally recognized as respected local leaders, they are lay people who have some healthcare training to help them deliver services within homes. CHWs offer a broad spectrum of essential services that vary by country and government priorities. The services offered by CHWs include health education, vitamin distribution, promotion of prenatal care, advocacy for health facility deliveries, endorsement of water, sanitation, and hygiene (WASH) practices, education on and provision of contraceptives, surveillance, active case finding, referral to clinical services, and mental health and psychosocial support (MHPSS)(Assoumou et al., 2024; Bani, 2008; Bhutta et al., 2005; Israel et al., 1998; Lehmann & Sanders, 2007; Miller et al., 2020a; Mistry et al., 2009; Perry et al., 2014). Their adaptability, characterized by flexible work schedules and dispersion across a geographic location, enables them to respond effectively to the dynamic needs of their communities, particularly in times of crisis (Gilmore et al., 2016; Kruk et al., 2015; Miller et al., 2020b; Perry et al., 2014; Siekmans et al., 2017; Taubenberger & Morens, 2006).

CHWs play a crucial role in enhancing health system resilience by effectively operating at the micro or local level (Ager et al., 2015; Living Goods, 2023; O'Mara-Eves et al., 2015; "Placing Enterprise and Business Thinking," 2008). Despite exhibiting several key components of resiliency, CHWs are chronically underutilized in humanitarian settings. Below are factors that contribute to resilient health systems that are entrenched in CHW program design (Emami et al., 2024):

1. **Awareness**: CHWs maintain up-to-date information on all available resources, including human, physical, and informational assets.
2. **Diversity**: Their roles encompass a variety of fixed locations, including both clinics and communities, supported by flexible and adaptable structures.
3. **Self-regulation**: They possess the ability to isolate and contain health threats through vigilant surveillance and redundant capacities.
4. **Integration**: CHWs connect diverse populations and health system actors to collaboratively develop solutions and initiate actions. Their practice of openly

sharing information and facilitating clear, multidirectional communication exemplifies an integrated health system.

5. **Adaptability**: This quality is especially vital during periods of stress on the health system, such as disasters or epidemics. A truly resilient health system must demonstrate effectiveness at the micro level while also exhibiting adaptability and resilience at both meso- and macro levels.

The Role of Community Health Workers in Disaster Settings

In the Global Humanitarian Overview 2025 (UNOCHA) Community Health Worker programs, or community-based health care delivery, are not mentioned once. This lack of recognition or dedicated funding, including under both the Health and Protection clusters, reinforces the fact that CHW programs are routinely excluded from mainstream humanitarian health financing and planning, despite their proven ability to increase access equity, health outcomes, and resilience (Barbelet, 2018; Fredricks et al., 2017; Miller et al., 2020a; Perry et al., 2014; Roepstorff, 2020; Siekmans et al., 2017; UNOCHA, 2024). This omission underscores the need for a more integrated approach that includes CHW programs as a vital component of humanitarian responses. This exclusion can be attributed to several factors:

- **Short-Term Focus**: Humanitarian funding often prioritizes immediate, short-term needs over what can be seen as longer-term community-based interventions. Viewing CHW programs as a longer-term intervention overlooks the numerous proven benefits they bring to crisis settings (Adolph et al., 2021; Ager et al., 2013; Barbelet, 2018).
- **Lack of Integration**: CHW programs are often viewed as development initiatives rather than integral parts of an emergency response. This in turn prevents donors from supporting these efforts in humanitarian settings (Gilmore et al., 2016; kok et al., 2015b; Miller et al., 2020a).
- **Gendered Discrimination and Hierarchies:** CHWs, who are predominantly women, often face systemic discrimination within hierarchical health systems that privilege the roles of doctors and nurses. These gendered power dynamics lead to undervaluing CHWs' contributions, limiting their inclusion in humanitarian planning and decision-making processes (Kok et al., 2015a; Kok et al., 2015c; Lehmann & Sanders, 2007; Mistry et al., 2009).
- **Insufficient Data**: Limited data on the impact of CHW programs in emergency settings can lead to their exclusion from funding appeals and response planning (Gilmore et al., 2016; Miller et al., 2020a; Wilkinson et al., 2017).

The existing literature offers evidence that informs this thesis's examination of strategies, structures, and enabling factors that facilitate the effective integration of CHWs in disaster and emergency response contexts. CHWs have been shown to function effectively during civil disruptions and disasters, especially when services do not rely on drug supplies or when CHWs are clearly guided in their new roles (Kozuki et al., 2018; Miller et al., 2020a). In several settings, including the Central African Republic, South Sudan, and Burundi, CHW programs continued operations even when formal health services collapsed. Their integration in Integrated Community Case Management (iCCM) models has also helped maintain care during displacement and instability (Edmond et al., 2018; Feierman et al., 2010).

Evidence from the Ebola outbreaks in Liberia, Sierra Leone, and Guinea further highlights CHWs' resilience and rapid mobilization. They resumed services faster than formal health systems and pivoted quickly to support surveillance, education, and referrals—requiring little infrastructure and minimal retraining (Bell et al., 2016; Delamou et al., 2017; Kallon et al., 2023; Miller et al., 2018; Ngo et al., 2021; Perry et al., 2016; Richards et al., 2019; Shultz et al., 2015; WHO, 2015). In Sierra Leone, community members perceived CHWs as their most reliable allies during the crisis (Siekmans et al., 2017). Notably, All of these examples involved CHW programs that had been established before the disaster or crisis, and were then adapted to support the humanitarian response.

The resilience of CHW programs stems from several key attributes: decentralized structures (Ager et al., 2013; Walsh & Johnson, 2018), trained and trusted personnel (Kruk et al., 2015; Kutalek et al., 2015), and the ability to self-regulate, adapt, and maintain clear communication in dynamic environments (Burkle et al., 1996; Callaway, 2012; Ramsbottom et al., 2019; Vasovic et al., 2020). The low infrastructure demands of CHW programs make them uniquely suited to operate amid health system disruptions, whether caused by environmental disasters, epidemics, or conflict, thereby positioning CHWs as a cornerstone of resilient community health systems. When communities are equipped, empowered, and supported through well-designed CHW models, they can help sustain health systems during even the most severe humanitarian shocks.

Nonetheless, reluctance to fully integrate CHWs into humanitarian response persists, often due to the absence of clear frameworks for structuring and scaling such programs. Addressing this gap through the development of standardized guidance would be a critical step forward. This is particularly relevant at the intersection of humanitarian and development work, where the demonstrated success of CHWs can be leveraged more broadly (Perry et al., 2016).

Resilient Health Systems Structures in Disaster Settings

Resilient health systems depend on well-defined structures that enable them to withstand shocks and adapt during disasters (Ager et al., 2015; Arab-Zozani & Ghoddoosi-Nejad, 2020; Bennett et al., 2011; Rwabukwisi et al., 2017; Shultz, 2014). These structures encompass various components, including:

1. **Human resources**: recruitment, training, and retention of skilled healthcare personnel, ensures that communities have access to qualified providers during emergencies.
2. **Supervision frameworks**: essential for maintaining quality control and providing ongoing support to healthcare workers, facilitating effective communication and problem-solving in real time.
3. **Compensation structures:** ensure that health workers are remunerated for their efforts, which can enhance motivation and retention, particularly in high-stress environments.
4. **Logistics and supply chain management**: coordinated resource allocation helps ensure that essential medical supplies and equipment are readily available when needed.

When Community Health Worker (CHW) programs are embedded and properly supported, they can enhance service continuity and strengthen health system responsiveness during crises (Durlak & DuPre, 2008; Kok et al., 2016; Miller et al., 2020a; Perry et al., 2014; Siekmans et al., 2017). However, this evidence does not translate into systemic inclusion of CHW programs as a core component of humanitarian response frameworks (UNOCHA, 2024).

The selection and training of supervisors is one of the most critical yet overlooked enablers of CHW effectiveness. In humanitarian contexts, supervision is often underfunded or deprioritized. However, well-trained supervisors are essential to ensuring the quality, continuity, and effectiveness of CHW efforts (Burkle et al., 1996; Gilmore et al., 2016; Harris et al., 2004; Horwood et al., 2017; Kok et al., 2015c; Miller et al., 2020a; Rwabukwisi et al., 2017; Sabo et al., 2017). Effective supervision supports CHW morale, maintains quality standards, and strengthens accountability within decentralized systems.

Research demonstrates that CHWs can maintain service delivery during armed conflict, displacement, and public health emergencies (Miller et al., 2020a; Kozuki et al., 2018). Their embeddedness within communities allows them to continue working even when facilities are closed or inaccessible. Many core CHW functions, such as clinic referrals or hygiene promotion, require little to no infrastructure and can be sustained with minimal resources (Bricknell et al., 2016; Gulzar et al., 2012; Perry et al., 2014; Reicher & Stott,

2020). In cases of displacement, CHWs frequently relocate with their communities, enabling uninterrupted care (Campbell & Stanley, 1959; Health Data Collaborative, n.d.; Pellecchia et al., 2015; Rosales et al., 2015).

Pre-existing training further equips CHWs to pivot quickly to emergency protocols. Their longstanding presence and trust within communities position them as reliable sources of health information and guidance during crises (Farmer, 2014; Kutalek et al., 2015; Perry et al., 2016; Qiu & Chu, 2021). Their ability to function without extensive external infrastructure or clinical facilities makes them critical frontline actors (Adam & Donelson, 2020; Bennett et al., 2011; Diallo & Thuillier, 2005; Espinola et al., 2016; Israel et al., 2020; Latkin et al., 2021; Pappas et al., 2009; Shultz et al., 2016; United Nations Office for the Coordination of Humanitarian Affairs, 2018).

All of these factors underscore the argument that CHW programming should be systemically integrated into humanitarian responses. This aligns with the growing global momentum behind the concept of 'localization', which is widely acknowledged as essential for building more effective and resilient responses (Barbelet, 2018; Roepstorff, 2020; van Brabant & Patel, 2018). As recent funding cuts push the sector to re-evaluate its structures and priorities, localization is increasingly viewed not just as a cost-saving measure, but as a necessary shift to strengthen both humanitarian and health systems. Meaningful localization dismantles entrenched donor–recipient hierarchies, enabling local actors to shape response efforts in line with contextual knowledge and community needs (Dany, 2021; Toukan, 2025). CHW programs are uniquely designed to do so. When local leadership is supported in setting priorities and evaluating impact, humanitarian action becomes more legitimate, trusted, and sustainable. Similarly, frontline responders, such as CHWs, are often the first to act, the most trusted by communities and the best positioned to ensure long-term resilience (Barbelet, 2018). Together, these findings reinforce the central claim of this thesis, that CHW programs, when locally designed and led, exemplify how health and humanitarian systems can respond more equitably and effectively in times of crisis.

One of the more persistent barriers to the full integration of CHWs into health systems is discrimination, as mentioned above, but pervasive enough that it warrants more attention. CHWs are predominantly women and often operate within hierarchical health systems that prioritize the authority of formally trained professionals, such as doctors and nurses (Lehmann & Sanders, 2007; Kok et al., 2016). This dynamic can marginalize CHWs' contributions and reinforce gendered power imbalances that limit their voice and influence in decision-making processes (Kok et al., 2015a; Kok et al., 2015c). Despite their critical role as trusted links between communities and health services, CHWs frequently face inadequate compensation, unequal access to leadership opportunities, limited

professional recognition, and the undervaluation of their work (Miller et al., 2020a). Addressing these structural barriers is essential to fully leverage CHWs' potential and to promote more equitable and resilient health systems (Gilmore et al., 2016).

While CHW programs contribute to health system resilience, they are not without limitations. CHWs often face role overload, particularly during crises when expectations expand rapidly and support structures are strained (Gilmore et al., 2016; Kok et al., 2015b). In politically unstable or resource-constrained environments, sustaining CHW programs can be especially challenging due to interrupted funding, security concerns, and weak institutional backing (Fredricks et al., 2017; Arab-Zozani & Ghoddoosi-Nejad, 2020). Integration into formal health systems remains uneven, and poor supervision, inadequate compensation, and lack of career pathways can undermine both performance and retention (Horwood et al., 2017; Kok et al., 2016). Acknowledging these challenges highlights the importance of designing CHW programs with structural support, flexibility, and long-term sustainability in mind, especially if they are to function reliably during complex emergencies.

The 2014 Ebola Outbreak in Sierra Leone exacerbated systemic health system weaknesses. An integrated CHW program was proposed to mitigate these gaps and facilitate the wider response (Cancedda et al., 2016).
Gaps exposed:
1. Breakdown in community engagement and trust
2. Collapse of basic health services
3. Severe staffing and infrastructure gaps
4. Gaps in disease surveillance and mobilization

This thesis presents case studies, including one focused on Sierra Leone, that demonstrate how CHW programs can be adapted and scaled during crises to address gaps and increase response effectiveness. These programs require minimal infrastructure and are capable of sustaining service delivery through flexible and community-driven models (Kok, 2015a; Rissel, 1994; Salvi et al., 2021b). When properly structured, CHW programs can respond to emerging needs, reinforce system resilience, and ensure continuity of care. By integrating disaster-resilient features, they enhance not only survival and recovery but also the long-term stability of health systems (Hagan et al., 2015; Keusch & Institute of Medicine, 2009; Kneebone & Schlegel, 2021).

In the first paper, we examine the role of Rapid Qualitative Assessments in structuring community-based health programming during a humanitarian response (Bates et al., 2007; Johnson & Vindrola-Padros, 2017; Leaderman & Polychronopoulos, 2019; Nagata et al.,

2021; Ray et al., 2020; Springgate et al., 2009). In the second paper we discuss how the use of Continuous Quality Improvement and Plan-Do-Study-Act cycles, when integrated into the design of the community-based interventions, allows them to remain adaptable and resilient in the humanitarian settings (Christoff, 2018; Harris, 2017; Langley, 1999; Provost, 2011). In the third paper, we discuss two case studies where these tools were utilized to support the health system and overall humanitarian response, in Sierra Leone and the Bahamas (Campbell, 1975; Cancedda et al., 2016; Nagata et al., 2021; World Health Organization, 2021).

Collectively, these findings demonstrate how community-based CHW programs when locally led, resiliently structured, and backed by effective systems, can serve as a vital complement to clinical services in disaster and humanitarian settings.

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3
Community Health System program structure and design for humanitarian settings

Building on the conceptual framework and contextual background established in the previous section, this section introduces the design of the Community Health Worker (CHW) program implemented during the 2014 Ebola epidemic in Sierra Leone. The program's structure not only reflects core themes of health system resilience and community trust discussed earlier, but also serves as a foundation for the empirical analyses presented in the three published papers that follow. By detailing the program's components here, this chapter bridges the theoretical underpinnings of the thesis with the practical implementation strategies that were later evaluated in diverse humanitarian contexts. It also offers a potential model for future humanitarian responses seeking to integrate CHWs effectively. The program framework presented here also served as the foundational model for the CHW interventions deployed in the Bahamas during Hurricane Dorian and the COVID-19 pandemic. As these interventions adapted the same core principles to their respective contexts, they are not described in full detail here but are analyzed within the published case studies.

Sierra Leone Ebola Epidemic 2014
In December of 2014 Sierra Leone was in crisis. The Ebola epidemic had been running rampant for months and by that point, 9,446 people had been confirmed infected, and 2,758 people had died (Miller et al., 2018; Siekmans et al., 2017). It was recognized within Sierra Leone, as well as globally, that immediate emergency intervention was needed to slow the rate of spread and save lives. The virus needed to be stopped in West Africa and not be allowed to spread to other countries and continents (Johnson & Vindrola-Padros, 2017; Miller et al., 2018; Nally et al., 2021). National Healthcare providers were hesitant to treat patients due to fear of infection and death, and family members were reluctant to seek help for any illness displaying the symptoms of Ebola (Miller et al., 2018; Richards et al., 2019; Siekmans et al., 2017; Steimer, 2022).

At the request of the government of Sierra Leone, Partners in Health proposed a large Community Health Worker (CHW) network be established in 3 Chiefdoms in the Port Loko

district, one of the regions with rapidly increasing Ebola infection rates. An Ebola Treatment facility was also established, providing a fully parallel health system as the existing national health system had largely collapsed during the outbreak (Miller et al., 2018; Nally et al., 2021; Richards et al., 2019; Siekmans et al., 2017).

Although Partners in Health's proposal aligned with national interests, it would be developed in an atmosphere of widespread distrust toward health care workers (Richards et al., 2019; Shultz et al., 2016). Prior to the Ebola epidemic, Sierra Leone had established a national network of CHWs, though the system had not yet been fully staffed. Nevertheless, there was a broad awareness of the CHW model and recognition of the vital role CHWs could play in contributing to a resilient health system (Siekmans et al., 2017). So the proposal aligned with national interests. During this perilous period, CHWs emerged as trusted figures, providing guidance and delivering critical education on Ebola prevention.

Program Implementation

Rapid Qualitative Assessment (RQA)
To inform the design of the CHW program, a Rapid Qualitative Assessment was conducted utilizing key informant interviews (KIIs) and focus group discussions (FGDs) (Nally et al., 2021). Participants included community leaders, health workers, and affected families, selected through a snowball sampling method. This approach facilitated the identification of diverse perspectives and experiences related to the Ebola response, as well as local barriers and enablers for CHW engagement. A total of 25 KIIs and 10 FGDs were conducted. All participants consented to participate, and no prior relationships existed between interviewers and participants, ensuring unbiased data collection.

Financing and Governance in Humanitarian CHW Programs
In humanitarian settings, financing and governance are intertwined. A well-governed program must not only define roles and responsibilities but also ensure that staff and CHWs are adequately resourced and compensated. Financial mechanisms, such as timely and adequate salary disbursement and support for logistics, are not merely operational details but key governance levers that influence motivation and accountability. For this reason, the program's financial and governance structures are presented together here as mutually reinforcing components.

Design of the CHW Program	
The program design was based on insights gained from the RQA and included the following components (Nally et al., 2021):	
Selection of CHWs	Criteria for selecting CHWs were established to ensure that individuals were trusted, respected, and lived in the communities they would be working in (Adam & Donelson, 2020; Health Data Collaborative, n.d).
Training	A holistic training curriculum was developed that covered essential topics such as Ebola awareness, health education, and safety protocols. Training sessions were interactive and included practical components to enhance learning, including role-playing scenarios to prepare CHWs for real-life situations.
Supervision	Regular supervision meetings were scheduled to provide support, address challenges, and ensure compliance with program protocols (Durlak & DuPre, 2008; Mistry et al., 2009). These meetings also served as a venue for CHWs to share their experiences and insights.
Plan-Do-Study-Act (PDSA) Cycles	Continuous improvement was driven and facilitated using PDSA cycles, allowing for real-time adjustments to the program based on feedback and observations from multiple stakeholders (Nally et al., 2025, Provost, 2011, Siekmans et al., 2017).
Linkages to Health System	Clear referral and communication pathways were established to connect CHWs with local health facilities, ensuring that community members could access urgently needed care without barriers.
Motivation and Retention	Strategies to motivate and retain CHWs included a salary, ongoing training opportunities, and community support, fostering a sense of ownership and commitment to the program (Durlak & DuPre, 2008; Miller et al., 2015).

Staffing of the Program	Based on gaps identified in the RQA (Nally et al., 2021), 3 cadres of CHWs were needed, the CHWs are referred to as Ebola Response Volunteers in all program documents.
Field Based Ebola Response Volunteers	
504 Field Based ERVs who worked 6 days per week. There were 37 Supervisors, each who managed 10 to 16 staff, who provided direct supervision and support and were instrumental in the flow of communication between the ERVs and the Program leadership at national and district levels. Each ERV was responsible for a catchment	

	population of approximately 100-150 people, and they laid eyes on each of them once every 2 weeks.
Active Case Finding	If they find a person in the community who is sick they call the national hotline and stay with the family until the Surveillance team arrives. If the person is then determined to be a suspect case, the ERV continues to stay with the family until the ambulance arrives.
Health Message Delivery	The ERVs delivered evidenced-based information about the Ebola virus and the response door to door in the communities where they worked.
Social Mobilization	As the response evolved and there were public health measures or announcements that needed to occur, the ERV network was utilized to distribute those messages. For example, when the local schools were about to re-open, the ERVs carried messages to the communities related to the public health measures that had been put in place to ensure that the students would be safe returning to school.
Facility Based Ebola Response Volunteers	
14 Facility Based ERVs, all of whom were Ebola survivors. 12 who worked at Maforki as the Care Givers, and 4 who were assisting with triage at the Petit Fou Junction CHC in Lokomasama. There were 3 Supervisors for these ERVs, each managing 3 to 10 staff.	
Communication Links	Their primary role was connecting patients in the facilities to their families in the village, and linking them to services that might support them. For example the Survivor program, the national HIV program, or the Psycho-Social support ERVs. They passed messages from patients to their families and maintained those vital connections in an environment where families could not access the patients.
Direct Support	They entered the Hot Zone at the ETU and provided direct psycho-social support to the patients.
Psycho-Social Ebola Response Volunteers	
144 Psycho-Social ERVs. They were managed by 9 Supervisors, each responsible for 13-17 PSS ERVs.	
Psycho-Social Support	Provide Psycho-Social support in impacted communities. They were assigned, much like case workers, to support a family

	member or family until that support was no longer required. Some triggers for being assigned a PSS ERV include living in a quarantined home, having a suspect Ebola patient removed from your home, being a survivor of Ebola and returning to your community, and losing a family member
Direct Case Management	We also assign PSS ERVs in any case we identified needing extra Psycho-social support, for example there was an older man home alone and sick and it appeared no one in the community was caring for him. So we sent a PSS ERV to understand the situation and assist in resolving the problem and supporting the sick individual.

Program Management

Active management and clear lines of communication were key to the success of this implementation (Nally et al., 2021; Nally et al., 2024; Siekmans et al., 2017). All of the staff were Sierra Leonian, except for the Training Manager and the Program Manager who were staff of Partners in Health and from the United States.

1. There were three Program Managers at the headquarter level who managed each cadre of ERVs.
2. The program was spread across 3 Chiefdoms, and there was one Chiefdom Level Coordinator who oversaw all the activities in that Chiefdom and liaised with the Paramount Chief.
3. There was one staff member who provided Logistical and Financial Support, and one Driver.
4. There were 3 staff members responsible for tracking the data for the program.
5. There was a Training Manager responsible for all of the training materials and for leading the trainings, and one Training Coordinator for additional support.
6. There was a Program Officer who supported the overall Program Manager

Program Manager	Provided overall management of the program at national level: implementation, structure, budgeting, staffing, strategy
	Responsible for external communication with all government and non-government partners
	Ensured implementation strategy was well understood and implemented

	Directly supervised the Program Officer, Training Manager, Logistics/Finance Coordinator, MERL Staff, and drivers
Program Officer	Directly supervised the Project Coordinators and Chiefdom Coordinators
	Ensured all staff had the supplies, training and tools needed to implement the program
	Reported to the Program manager
Project Coordinators (Field based, Facility based, Psycho-Social)	Met with all ERV supervisors weekly to collect data, facilitate communication, and address any emerging problems.
	Ensure supervisors / CHWs had all they needed (data collect tools, report tools, home base care kit) etc
	Ensured supervisor / CHWs received their salaries on time
	Responsible for continuous trainings for ERVs and ERV Supervisors
Chiefdom Coordinators	Collect daily report and weekly data reports from CHWs and their direct supervisors
	Monitored the Chiefdom level communities being served and reported any emerging problems immediately to the Program Manager
	Mentored CHW Supervisors in the field to ensure quality programming
Supervisors: (Field based, Facility based, Psycho-Social)	Provided supportive supervision to ERVs on a daily basis
	Ensured ERVs were doing their jobs and had the tools they needed
	Liaised with community stake-holders to ensure CHWs safety
	Mentored CHWs in the field to ensure quality programming

Selection: The ERVs were selected from the three Chiefdoms, in cooperation with the Paramount Chief's and the leaders in each community.	
Criteria for ERV	Literacy
	Leaders in their communities
	Trusted and respected by their communities
Training: All ERVs were provided with a 2-day broad ERV training	
Training Topics	What is a Community Health Worker?

	Ebola evidenced-based information: including origin, transmission, prevention, and treatment
	Communication Skills
	Details on completing program documentation
	The importance of personal safety and self-care
Psycho-Social Support ERVs Specialty Training	Psychological First Aid
	Community Health Education principles
	Community dynamics and traditions
	Psychological First Aid
Facility Based ERVs Specialty Training	Roles and responsibilities
	Ebola Treatment Facility overview: Green Zone, Red Zone, patient admittance and discharge
	Practice with the Tievac Red Zone outfits: donning and doffing safely
Compensation	Each ERV signed a contract and they were provided with a Nokia telephone and service, pens and papers to conduct their work, and were paid $100 USD per month. Half covered any travel expenses and half was provided as their salary. All of the staff was also compensated with a salary that complied with local labor laws. The staff was paid in cash once per month. The compensation was delivered in the Chiefdom capitals and ERVs were required to travel there to receive their salaries.

Structure of the CHW Program: The program was structured to delineate clear lines of communication and continuous feedback loops.

CHW/ERV Management Structure
PIH Ebola Response 2015
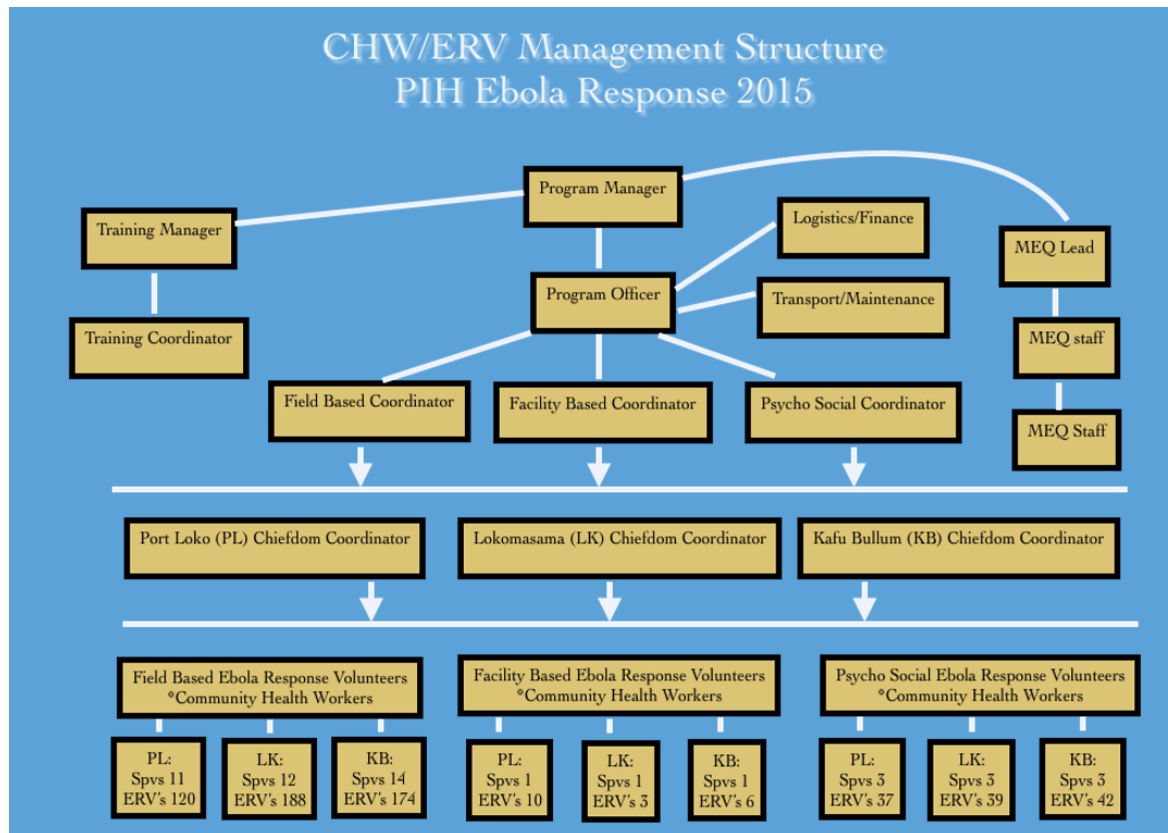
Continuous Qualitative Improvement

To ensure the program's effectiveness, continuous qualitative improvement was integrated into the overall design. (Nally et al., 2024) This involved several key components including:

- Regular Meetings: Scheduled meetings for CHWs, their supervisors, and project staff to discuss progress, challenges, and solutions, creating a culture of open communication. It should be noted that the technology of the Nokia phones provided to each CHW allowed only for texting and calling.
- Clear Communication Pathways: Establishing and clearly communicating effective feedback channels to facilitate information sharing and problem-solving, ensuring that information shared by the community was promptly addressed. The addition of modern technology (e.g., Signal, WhatsApp, cloud data collection) would strengthen and facilitate communication in future program designs if incorporated.

Program Monitoring and Data Collection

Monitoring was a critical component of the program, with every CHW assigned specific catchment areas. (Nally et al., 2021; Nally et al., 2024)	
Data collection methods included	Bi-weekly Community Visits: CHWs conducted bi-weekly visits to every community member to assess health needs and provide support, ensuring that health education was being effectively communicated.
Data Collection Tools	Each CHW was equipped with mobile phones and data collection sheets containing standardized questions to ensure consistency and reliability in data gathering. Supervisors would accompany them occasionally as they conducted their work to ensure compliance and comprehension by the community and the CHW.
Data Entry and Management	During the 4-month duration of this program, 436,295 people were screened by the CHWs for symptoms associated with the Ebola virus. As it was not feasible for our data entry team to record each screening, we utilized a random number generator in Excel to determine which records would be entered. Consequently, the recorded data represents a subset of the total data gathered. While acknowledging that the full data set would have provided more conclusive findings, recording them was not feasible in this setting.

Safety Considerations

Safety was prioritized throughout the program, with comprehensive safety training provided to all CHWs. This training included protocols for personal safety, infection prevention, and emergency response measures. All designed to address the unique risks associated with working in an Ebola-affected environment (Nally et al., 2021; Nally et al., 2024; Nally et al., 2025).

4
Methods

Research Design and Orientation

This dissertation is grounded in methodology informed by implementation science, systems thinking, and process research. Although each of the three papers employs distinct methods appropriate to its inquiry, they share a unified commitment to understanding how structured Community Health Worker (CHW) programs and other community-based interventions can strengthen health systems and responses in humanitarian settings.

Implementation science provides a systematic lens for examining how health interventions are adopted, adapted, and sustained in real-world conditions. It is suited to humanitarian contexts, where urgent needs, logistical complexity, and shifting governance arrangements necessitate flexible yet rigorous approaches to health service delivery (Kok et al., 2015b; Perry et al., 2014).

Systems thinking complements this orientation by recognizing the dynamic interconnections between actors, structures, and processes, allowing for a holistic analysis of the role CHWs play in enhancing health system resilience (Adam & Donelson, 2020; Lehmann & Sanders, 2007).

Process research further enriches this design by foregrounding change over time. This dissertation adopts a process view that values longitudinal observation, embedded learning, and the tracking of systemic adaptation during crisis events (Campbell, 1975; Langley 1999; Provost, 2011). The research is therefore best classified as analytical, with the aim of informing future performance rather than simply describing current states (Cancedda et al., 2016; Demming, 1993).

Studies Setting Overview and Positionality of Researcher

Data were collected from two distinct humanitarian settings: Sierra Leone and The Bahamas. These countries were selected because they represent contrasting crisis types, an infectious disease epidemic, a climate-related disaster, and an opportunity to pivot a humanitarian program from a climate-related disaster to supporting a global pandemic

response. Both countries, and the three disasters, offered opportunities to observe CHW program development in real time. Importantly, they were also the settings where I was actively working during the periods of crisis. My professional role enabled embedded access and firsthand observation of critical health system challenges. In both contexts, I identified gaps in community-level service delivery that could, based on my experience, be addressed through the structured integration of CHW programs. These observations informed the design and implementation of the studies included in this thesis.

Logic of Inquiry

The logic of inquiry follows the principles of analytical studies and their operationalization (Deming, 1993, Provost, 2011). Analytical studies emphasize prediction and system learning over estimation. They are designed to support action on the underlying causal system, acknowledging that the conditions under which results are used will differ from those under which data were gathered. Methods such as temporal bracketing and visual mapping were used to track program evolution and identify mechanisms of change over time (Langley, 1999).

Iterative Process and Team Roles

All three studies employed an iterative design that allowed findings from one phase to inform the next. This was particularly important in the RQA and CQI phases, where rapid data collection fed into ongoing program refinement. The research team consisted of both expatriate and national staff, with local actors engaged as co-researchers and analysts where appropriate.

- **Grounding and Co-analysis**: Each study included mechanisms for validating and reframing findings with community members and stakeholders. In Sierra Leone, themes from RQA interviews were reviewed with local chiefs and government officials. In The Bahamas, community feedback shaped the adaptation of CHW tasks and messaging.
- **Team Contributions**: Data collection and analysis were conducted collaboratively. The primary researcher supported methodological consistency, while local staff ensured contextual relevance and cultural grounding. This dual perspective was essential to the integrity and credibility of the findings.

Ethical Approval

Ethical approval for all research activities was obtained through relevant institutional and national ethics review boards. Informed consent was obtained from all participants. Program stakeholders, including Ministries of Health, implementing NGOs, and CHWs themselves, were engaged in the design, review, and, where appropriate, co-analysis of the research.

Methods by Paper

Paper 1: Rapid Qualitative Assessments of Community Needs

This study employed a Rapid Qualitative Assessment (RQA) methodology to understand community health needs, roots of fear-based responses, and perceptions of the health system during the early phases of humanitarian crises. The RQA method is adaptable to a variety of emergency response settings and can serve as a practical tool for mapping humanitarian efforts and identifying critical gaps in service delivery.

Study Setting:
This Rapid Qualitative Assessment was conducted in January 2015 during the escalation of the 2014–2016 Ebola outbreak in Sierra Leone, a period marked by high community fear, overwhelmed health facilities, and urgent needs for localized behavioral insights. Port Loko District, in Sierra Leone's Southern Province, was selected due to its high infection and transmission rates at the time (Cancedda et al., 2016). This district was also an operational priority area for government and NGO Ebola response activities.

Demographics	
Estimated national population	~6.1 million. Approximately 41% under age 15; high rural population (~60%)
Estimated population in the Port Loko District	~615,000
Literacy rate	~43%; significantly lower among women
Poverty rate	~70% lived below the national poverty line
Health system access	Major disparities in service availability and infrastructure
Time Period	January 2015, coinciding with the launch of national Ebola campaigns focused on behavior change, community mobilization, and clinical referrals.

Location	Data collection took place in the Port Loko District, Southern Province, Sierra Leone. Specifically, within three rural and peri-urban chiefdoms; Port Loko, Kaffu Bullum, and Lokomasama. Interviews occurred in community meeting areas, local clinics, and village centers across the selected Ebola-affected areas.

Contextual Information:

The setting was characterized by subsistence agriculture, limited access to formal health services, high levels of poverty, and community governance led by traditional leaders (paramount chiefs, chiefs, and elders). Health infrastructure was minimal, with severe shortages of trained medical personnel, supplies, and transport existing pre-event. Trust in the health system was low, and rumors and misinformation were widespread, particularly around Ebola transmission and treatment.

Justification:

The district's high burden of Ebola made it an urgent site for intervention. It also offered practical advantages, including established partnerships with the District Health Management Team (DHMT), community leaders, and local NGOs like Wellbody Alliance. PIH was invited by the Sierra Leonean government to support the local Ebola response, enabling access and trust required for rapid data collection.

Limitations:

The study was conducted under significant constraints, including security restrictions, poor transportation infrastructure, and rapidly evolving outbreak conditions. Language diversity and the urgency of the crisis also limited the breadth of interviews in more remote areas. As such, findings may not fully represent all geographic regions or marginalized populations within Sierra Leone.

Participant Selection and Sampling Strategy	
Sampling Procedure	The team used a combination of purposive and snowball sampling to identify participants with firsthand knowledge of Ebola response efforts. This included individuals involved in decision-making, health service delivery, and those affected at the community level.
Sample Size Determination	The assessment included approximately 35 participants across key informant interviews and small focus groups (3–7 participants). The data collection phase ended once thematic

	saturation was reached, when no new insights were emerging, and core themes consistently reappeared across groups.
Study Population	The assessment began with interviews of District Medical Officers, national/international responders, and Paramount Chiefs. Additional participants were recruited based on referrals from these initial informants.
Inclusion Criteria	Individuals with direct experience of the outbreak, either through professional roles (e.g., response leaders, local health officials) or lived experience (community members, chiefs).
Exclusion Criteria	Individuals not residing in or engaged with affected areas during the initial outbreak escalation

Data Collection	
Design	RQA using participatory and observational methods, including stakeholder mapping and in-person interviews with a 3-person research team (1 expatriate and 2 local mobilizers with prior response experience).
Duration	Four consecutive days of field interviews.
Interview Guide	Four open-ended guiding questions: • What's currently happening? • What are the gaps? • What filled those gaps pre-event? • Why isn't it working now?
Process	Interviews were conducted with the full team present.
	Notes were taken by hand and reviewed in daily debriefs.
	Emerging findings were validated in real time by participants (member-checking).
	Snowball sampling and stakeholder mapping ensured relevance and depth.
Analysis	Inductive coding and thematic synthesis based on grounded theory principles: • Daily review of findings enabled rapid theme identification. • Community feedback helped validate interpretations. • The iterative process ensured cultural grounding and practical application to program design.

The rapid nature of this approach allowed for findings to be synthesized within days, facilitating real-time program adjustments. Although applied here in support of CHW

programming, this method can be used more broadly in humanitarian settings to assess needs, map response efforts, and guide decisions where time and context constraints limit traditional data collection approaches.

Paper 2: Continuous Quality Improvement and PDSA Cycles

This study applied a Continuous Quality Improvement (CQI) approach using Plan-Do-Study-Act (PDSA) cycles to strengthen community health worker (CHW) programming during the 2015 Ebola crisis in Sierra Leone. It demonstrates how continuous feedback mechanisms enabled real-time program adjustments in a highly dynamic, resource-constrained humanitarian setting.

Study Setting
This implementation study took place in January to June 2015, during the height of the Ebola outbreak in Sierra Leone, when case incidence was high, community fear was widespread, and health infrastructure was overwhelmed. The intervention was implemented by Partners In Health (PIH), in collaboration with the Government of Sierra Leone and local stakeholders.

Location:
The study was conducted in three chiefdoms of Port Loko District: Lokomasama, Kaffu Bullum, and Port Loko. These areas were selected for their high Ebola burden, operational relevance to the CHW program, and existing government and NGO partnerships that facilitated coordinated response activities.

Time Period:
January–June 2015. This period coincided with critical response phases of the Ebola epidemic, including heightened quarantine enforcement, misinformation, and fear-based behaviors, which affected CHW operations and community trust.

Justification:
The chiefdoms selected had operational CHW programming underway, significant Ebola transmission, and multilevel governance structures that allowed for continuous communication across field and district levels. The setting was conducive to testing CQI methods in real time, as PIH was already embedded in the district and had trusted relationships with local health actors.

Participant Selection and Sampling Strategy	
Sampling Procedure	Participants were selected through a combination of total program inclusion and purposive sampling. The full CHW program cohort, comprising CHWs, supervisors, chiefdom-level coordinators, and PIH field staff, was included as the core study population. In addition, purposive sampling was used to identify relevant leadership and stakeholder perspectives. This included District Health Management Team (DHMT) officials, chiefdom-level authorities, clinic staff, and national and international response partners. Snowball sampling was applied to identify further key informants across community leadership and governmental structures, ensuring multi-level representation and contextual relevance
Sample Size Determination	The sample was determined by the size of the deployed CHW cohort and the inclusion of decision-makers and field managers involved in weekly CQI meetings. The intervention involved more than 683 individuals, including: • 616 CHWs • 49 CHW Supervisors • 3 Chiefdom Coordinators • 14 Sierra Leonean PIH field staff • 1 expatriate CQI technical advisor • Government and INGO officials engaged in response coordination
Inclusion Criteria	CHWs active in the Ebola response, supervisors, district and chiefdom health leadership, PIH field staff, national response partners, and community elders.
Exclusion Criteria	Individuals not directly engaged in the implementation, coordination, or oversight of the CHW response during the January–June 2015 period.

Contextual Information:

The intervention occurred in rural and peri-urban areas marked by:

- o Subsistence farming economies and widespread poverty
- o Limited health system infrastructure and personnel
- o Distrust in formal health services due to the high mortality in Ebola Treatment Units (ETUs)
- o Active community governance led by Paramount Chiefs and elders

Limitations:

Limitations included restricted movement due to quarantines, limited communication technology, and rapidly shifting public health guidance.

Data Collection	
Design	Continuous Quality Improvement (CQI) approach was implemented using PDSA cycles and embedded feedback loops. Emphasis was placed on iterative, field-led adaptations.
Interview Guide	Three guiding questions structured all feedback channels: 1. What is working? 2. What isn't working? 3. How can we do better?
Data Collection	Data were collected through direct field observation, verbal reports, structured debriefs, and weekly meetings
Data Analysis	The Socratic method was used to probe community-level behavioral drivers and emerging needs.
	CHWs and supervisors documented community concerns, logistical issues, and implementation challenges, which were escalated via structured channels.
CQI Infrastructure: Weekly coordination meetings occurred at multiple levels	These forums enabled rapid synthesis of qualitative insights and the testing of small-scale interventions via PDSA cycles: • **Field-Level:** CHWs, supervisors, Chiefdom and village level leaders • **District-Level:** PIH staff, District Health Management Team • **National-Level:** PIH leadership, Ministry of Health, and INGOs

Analysis

- Real-time qualitative feedback was reviewed weekly to identify program gaps, emerging risks, and behavioral responses.
- CQI teams applied PDSA cycles to test adaptations (e.g., revised referral protocols, changes in community mobilization techniques) and used outcome monitoring to determine their utility.
- Visual mapping was used to trace communication and decision-making flows, identify systemic breakdowns, and prioritize adaptive responses.

Conclusion

This study illustrates the value of CQI methods for real-time learning and adaptation in complex emergencies. By embedding bi-directional feedback loops at all operational levels, the intervention was able to maintain CHW engagement, respond to shifting community needs, and adapt programming amid an evolving public health crisis. These findings suggest CQI holds significant potential for improving responsiveness and sustainability in humanitarian health programming.

Paper 3: Comparative Case Studies of CHW Integration in Crises

This study presents three case studies of CHW integration across different humanitarian emergencies: the 2014–2015 Ebola outbreak in Sierra Leone, and the dual crises of Hurricane Dorian and the COVID-19 pandemic in The Bahamas. These case studies examine how CHW programs were deployed, adapted, and sustained to support community-based health service delivery during acute and protracted crises.

Study Settings: This multi-country case study draws from two primary locations	
Sierra Leone	Port Loko District during the Ebola outbreak (2014–2015)
The Bahamas	Abaco and surrounding islands in the aftermath of Hurricane Dorian (2019-2020)
	Continuation into the COVID-19 pandemic response (2020-2022)
Time Periods	**Sierra Leone**: January – June 2015 (peak and post-peak Ebola response)
	The Bahamas: • Hurricane Dorian: September 2019 – early 2020 • COVID-19 response: March 2020 – June 2022

Justification for Case Selection

These cases were selected due to their variation in crisis type (epidemic, natural disaster, and pandemic) and their application of CHWs within localized response models. Each setting provided distinct operational insights into CHW adaptability, integration into existing health systems, and their role in fostering community trust. Although I was actively engaged in implementation during these responses, I maintained a critical research lens throughout, systematically documenting processes, challenges, and adaptations to inform broader learning across humanitarian health settings.

Bahamas Demographics 2019	
Estimated national population	~400,000, ~18.5% under age 15
Literacy rate	~95% adult literacy
GDP Per Capita	High-income country, with significant economic disparities across islands.
Health system access	About 80 primary clinics and 4 private labs operational across major islands; smaller Family Islands served by localized clinics. Healthcare spending around 8% of GDP; uneven infrastructure and expensive out-of-pocket payments remain issues. Two-thirds of the population resides on New Providence and Grand Bahama; the rest are dispersed across smaller islands, often with limited infrastructure.

Contextual Information

- In all settings, CHWs were deployed as part of broader emergency medical responses coordinated by national health authorities and I/NGO partners.
- In Sierra Leone, PIH worked with local stakeholders to integrate CHWs into community-based surveillance, contact tracing, and health education efforts.
- In The Bahamas, Americares partnered with the Ministry of Health to recruit and train CHWs for door-to-door outreach, risk communication, and service continuity among displaced and underserved populations. When the COVID-19 pandemic began, Project HOPE collaborated with the Ministry of Health to pivot the existing CHW program, addressing fear-based public responses and disseminating accurate, evidence-based health information about COVID-19.
- Both contexts featured health systems weakened by crisis, and a need for trusted intermediaries to bridge community gaps in care.

Limitations

- Data availability varied across sites, with more structured monitoring systems in place in Sierra Leone.
- CHW activity reporting in The Bahamas was largely qualitative or observational, limiting comparative quantitative analyses.
- Findings may not generalize to regions with different governance or health infrastructure capacities.

Participant Selection and Sampling Strategy	
Sampling Procedure	Participants were included through total program participation (CHWs, supervisors, support staff), purposive selection of government and NGO partners, and snowball sampling to reach key informants across ministries and communities.
Study Population	**Sierra Leone**: 683 program participants, including CHWs, chiefdom coordinators, and field staff.
	The Bahamas: 8 CHWs deployed during Hurricane Dorian, who continued through the COVID-19 response; local health officials, NGO staff, and community members.
Inclusion Criteria	Individuals involved in CHW programming or affected by the crisis during the study period.
Exclusion Criteria	Individuals not residing in affected areas or lacking direct involvement in response activities.

Community Engagement

- Community members played an active role in CHW selection, messaging adaptation, and program feedback.
- Local leadership was involved in shaping outreach strategies and fostering acceptance of CHWs in both contexts.

Data Collection	
Design	Embedded, multi-method case study design using qualitative, semi-quantitative, and programmatic data
Sierra Leone	Pre-program Rapid Qualitative Assessment
	CHW household visit logs: referrals, health messaging, and symptom surveillance
	Continuous, real-time feedback loops using field observations, structured staff debriefs, community engagement reports, and weekly coordination meetings, all aligned with Plan-Do-Study-Act (PDSA) cycles
The Bahamas: Hurricane Dorian	Community needs assessment using snowball sampling
	Daily CHW field logs: education sessions, patient tracking, and rumor monitoring
The Bahamas:	CHW records of vaccination outreach, household follow-ups, and community engagement

COVID-19 Response	Program documentation and staff debriefs

Analysis

- **Sierra Leone**:
    - Analysis of ETU data revealed a 32% increase in in confirmed Ebola cases in the study Chiefdoms, suggesting the CHW program improved trust and strengthened surveillance.
- **The Bahamas**:
    - Thematic analysis of CHW logs, feedback loops, and program reports.
    - Comparative insights between acute disaster (Dorian) and longer-term crisis (COVID-19) responses.

Key Features of the Case Study Approach

- CHWs were rapidly recruited from the communities they served, enhancing trust and local knowledge.
- Clear supervision and coordination structures were implemented, enabling feedback and responsiveness.
- Programs emphasized iterative adaptation based on real-time community feedback and CHW insights.
- In The Bahamas, CHWs continued their work informally beyond the formal project period, demonstrating sustained community trust.

Across all three cases, CHW integration contributed to improved surveillance, increased service access, and enhanced health system responsiveness. These case studies illustrate the operational feasibility and strategic value of embedding CHWs within humanitarian response models, including Mobile Medical Teams (MMTs) and Emergency Medical Teams (EMTs). They further highlight the adaptability of CHWs in maintaining continuity of care across both acute and protracted crises. In doing so, the cases offer concrete, actionable insights for the structural design of future humanitarian health programming.

Researcher Role and Methodological Considerations

As a practitioner-researcher actively involved in the design and implementation of these programs, my positionality shaped both access and framing. This embedded perspective offered unique insights into operational dynamics and community relationships, but also

introduced potential for normative assumptions. To ensure analytical rigor, I applied triangulation across data sources, conducted peer debriefings with local collaborators and external reviewers, and maintained transparency throughout the research process. These measures were deliberately integrated to mitigate bias and strengthen the trustworthiness of the findings. Rather than a limitation, my dual role aligns with emerging standards in global health research that recognize embedded positionality as a strength, when paired with reflexive and systematic methodology (Berger, R., 2015; England, K.V., 1994; Finlay, L., 2002; Greene, J.C., 2014). This reflexive stance allowed for deeper contextual interpretation while maintaining analytic clarity, bridging the gap between academic inquiry and programmatic utility.

5
Results

This section presents findings from the Sierra Leone CHW program implemented during the 2014–2015 Ebola epidemic. The data provide insight into the reach, activity, and influence of CHWs on case detection, referral, and system trust during a time of extreme health system disruption. These findings are framed through an implementation science and systems thinking lens and should be interpreted in light of the methodological and contextual realities of data collection in humanitarian settings.

Challenges in Collecting CHW Data During Crisis

Tracking reliable data during humanitarian emergencies presents substantial challenges. Crises like the Ebola epidemic place extraordinary pressure on health systems, diverting attention and resources toward immediate response rather than systematic documentation. Financial constraints, workforce shortages, and competing priorities often mean that data systems are fragmented or deprioritized. In Sierra Leone, as in many fragile contexts, there was a historical absence of infrastructure to support real-time community-level data collection. Evidence-based best practices for monitoring community-based programming during such emergencies remain limited, and unfortunately CHW programs are frequently implemented without robust systems for tracking their contributions (Cancedda et al., 2016; Miller et al., 2020b; Perry et al., 2014; Ramsbottom et al., 2018; Wilkinson et al., 2017).

CHW Data Collection Methods and Sampling Strategy

Insights from the earlier Rapid Qualitative Assessment (RQA) informed the CHW data strategy by identifying behavioral drivers, fear-based responses, and community concerns that required ongoing monitoring. Although not all such information was captured through structured forms, it influenced supervisory priorities and shaped how field teams interpreted trends across chiefdoms. Despite the rapidly evolving crisis and system limitations, a structured community-level data collection process was implemented. Each CHW monitored the health status of 100 to 150 individuals in their designated catchment area. Using printed data sheets, CHWs recorded whether any individuals exhibited Ebola-related symptoms, whether weekly health messaging had been shared, and whether they were referred to a health facility. Supervisors collected these paper forms weekly and submitted them to Coordinators, who then passed them to the Data Entry Team.
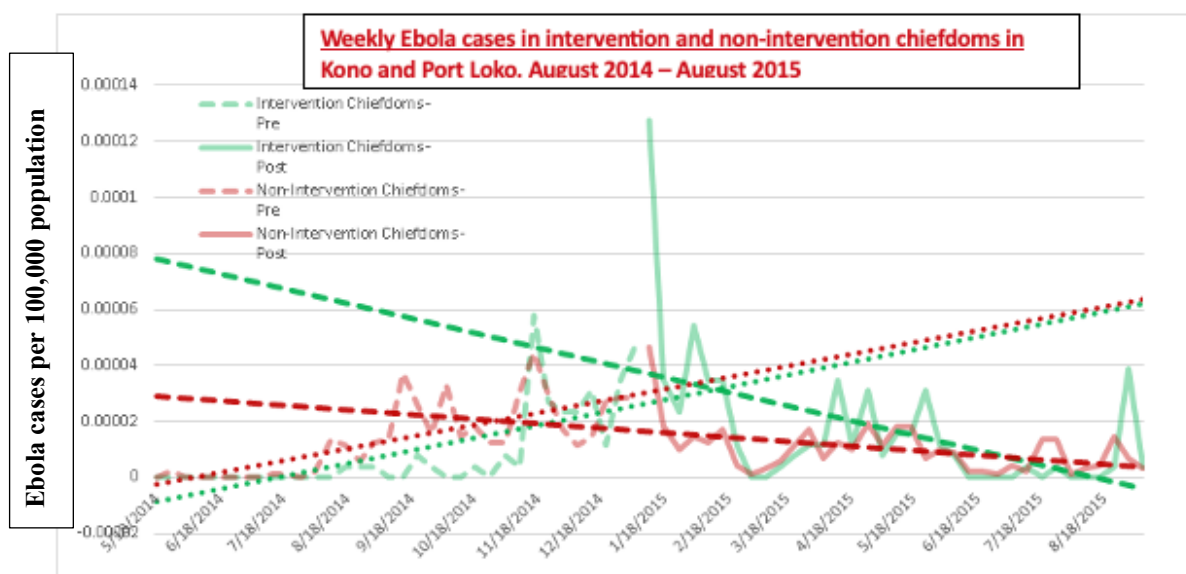
CHW reporting and the intervention formally began in January 2015 and continued through May 2015. Data captured trends from both the early transitional phase and the more structured implementation period.

Given resource constraints, only three data entry staff were available, despite CHWs engaging with more than 17,000 individuals per week. It was therefore not feasible to digitize all reports. To ensure feasibility while preserving analytic value, an Excel-based randomizer was used daily to select a representative sample of data sheets for entry. This sampling approach was pragmatic and aligned with the program's real-time decision-making needs.

Limitations of CHW Data Sample and Statistical Power

This sampling method, while practical, introduces limitations. Not all data were entered, which may result in underestimation of total CHW activity and limits the precision of any subgroup analyses. Furthermore, the lack of longitudinal identifiers precluded individual tracking over time. Despite these limitations, the findings presented below reflect systematically collected, field-verified data that offer strong insights into program-level trends and impacts. To mitigate these limitations, triangulation across sources and peer debriefings with local stakeholders were used to validate trends.

#1 Data for statistical differences in communities with intervention vs those without:

Weekly Ebola cases in intervention and non-intervention chiefdoms in Kono and Port Loko. August 2014 – August 2015

The chart above presents a visual comparison between the intervention and non-intervention groups over time. Before the introduction of the CHW program, both groups

exhibited parallel trends, with the two dotted lines showing similar upward slopes. This indicates minimal to no difference between the groups. Following the intervention, the slopes diverge significantly, suggesting a marked difference between the two cohorts. This pattern supports our claim that the intervention heightened case detection in the communities where it was implemented, as evidenced by the differing slopes post-intervention.

The line graph is intended to provide a visualization of trends, while the primary statistical evidence is presented through ANCOVA analyses. There are limitations to using linear trends and while there would be additional value in a formal time series model, due to limitations in available data points across consistent time intervals, it is not possible to conduct a robust time series analysis.

#2 Suspect Cases

VassarStats Printable Report
One-Way ANCOVA for 2 Independent Samples
Mon Mar 05 2018 23:39:18 GMT+0000 (Greenwich Standard T

Dependent Variable		
Sample		
A	B	Total
n		
20	3	23
Observed Means		
32.15	51	34.6087
Adjusted Means		
31.2308	57.128	34.6087

Aggregate Correlation within Samples: CV vs DV	
r = 0.77	r^2 = 0.6

ANCOVA SUMMARY

Source	SS	df	MS	F	P
adjusted means	1732.51	1	1732.51	3.92	0.061642
adjusted error	8840.38	20	442.02		
adjusted total	10572.89	21			

Test for homogeneity of regressions:

Source	SS	df	MS	F	P
between regressions	611.89	1	611.89	1.41	0.249690
remainder	8228.49	19	433.08		
adjusted error	8840.38	20			

This table outlines the summary results for suspected cases including statistical analyses conducted via ANCOVA. The findings reveal a p-value of 0.062 for the difference in post-intervention suspected cases between the chiefdoms where the CHW program was operating and chiefdoms in the same district with no CHW intervention, indicating a significant difference when controlling for pre-intervention case numbers. Thus, there is evidence that chiefdoms with CHWs saw significantly higher numbers of suspect cases when controlling for the level of pre-intervention cases. The analysis of homogeneity of regression lines for suspected cases resulted in a p-value of 0.250, suggesting no significant evidence of differing relationships between pre- and post-intervention case numbers based on group classification. Overall, these results imply that, after controlling for pre-intervention suspected case numbers, districts with CHWs had a higher incidence of suspected cases compared to similar districts without CHWs.

#3 Confirmed Cases

```
VassarStats Printable Report
One-Way ANCOVA for 2 Independent Samples
Mon Mar 05 2018 20:40:59 GMT+0000 (Greenwich Standard Time)
```

Dependent Variable		
Sample		
A	B	Total
n		
20	3	23
Observed Means		
20.7	51	24.6522
Adjusted Means		
20.0034	55.6441	24.6522

Aggregate Correlation within Samples: CV vs DV	
r = 0.53	r² = 0.28

ANCOVA SUMMARY

Source	SS	df	MS	F	P
adjusted means	3270.42	1	3270.42	4.64	0.043610
adjusted error	14101.78	20	705.09		
adjusted total	17372.2	21			

Test for homogeneity of regressions:

Source	SS	df	MS	F	P
between regressions	1754.93	1	1754.93	2.7	0.116795
remainder	12346.85	19	649.83		
adjusted error	14101.78	20			

This table presents the summary results for confirmed cases using the same statistical framework as for suspect cases. A statistically significant difference was observed in the number of post-intervention confirmed cases between intervention and non-intervention chiefdoms (p = 0.044), with chiefdoms supported by CHWs recording a higher average number of confirmed cases following the intervention. This finding suggests that CHW engagement contributed to improved case detection and reporting at the community level. An analysis of the homogeneity of regression lines yielded a p-value of 0.117, indicating no statistically significant difference in the relationship between pre- and post-intervention case counts across the two groups. However, this value approaches conventional significance thresholds and may indicate a meaningful trend. One plausible interpretation is that, as the overall epidemic declined across Sierra Leone, areas with more robust detection mechanisms, namely, those with CHW support, initially recorded more cases and subsequently experienced sharper declines. This pattern is consistent with the role of CHWs in expanding system reach and responsiveness as the epidemic evolved.

#4 Analysis of Confirmed EVD Cases in Sierra Leone by Chiefdoms

Chiefdom	Population	Pre-Jan. 15 case rate per 100k	Post-Jan. 15 case rate per 100k	% Post/Pre
Bombali Sebora	27,589	2012	98	
Buya Romende	34,285	446	3	
Gbonkolenken	59,926	102	3	
Kholifa	59,722	216	5	
Kissi Teng	39,539	132	0	
Konike Sanda	53,825	137	2	
Koya	78,226	180	12	
Marampa	44,402	381	52	
Masimera	40,389	161	10	
Neini	49,364	205	10	
Nongowa	67,518	551	4	
Paki Masabong	20,955	200	81	
Tane	27,862	208	0	
Upper Bambara	36,921	176	0	
Non-Intervention Total	*640,523*	*318*	*15*	*4.7%*
Kaffu Bullom	85,633	203	95	
Lokomasam	88,967	120	34	
Maforki	83,671	159	24	
Intervention Total	*258,271*	*160*	*59*	*36.7%*

Table four presents a comparative analysis of confirmed EVD (Ebola Virus Disease) cases in a subset of Sierra Leone chiefdoms characterized by populations ranging from 20,000 to 100,000 and exhibiting more than 100 confirmed cases per 100,000 individuals. The goal in using this subset is to compare chiefdoms of roughly similar size and caseload as the key intervention chiefdoms. The analysis focuses on the confirmed caseloads before and after January 15. Notably, the results indicate a significant difference in confirmed case rates between chiefdoms where the CHW program was implemented and those where it was not. Chiefdoms with CHW interventions demonstrated a higher rate of confirmed cases. This finding supports the hypothesis that CHWs may have effectively engendered trust in the humanitarian health system and encouraged local populations to seek care at Ebola Treatment Units (ETUs), resulting in increased reporting of confirmed cases.

Interpretation and Implementation Insights

The data presented in this chapter provide compelling evidence of the effectiveness of CHW integration during the Ebola response in Sierra Leone. Intervention chiefdoms experienced a 36.7% increase in confirmed Ebola case rates post-January 15, compared to only a 4.7% increase in non-intervention chiefdoms, a net difference of 32%. This differential supports the conclusion that the CHW program improved community-level surveillance, case reporting, and access to care.

From an implementation science perspective, this outcome illustrates how community-based interventions can be rapidly adopted and embedded within emergency response systems to generate real-time impact. The program's adaptability, reliance on local actors, and iterative feedback loops reflect core principles of effective implementation under crisis conditions. Simultaneously, viewed through a systems thinking lens, the intervention helped strengthen fragile system linkages, particularly between households and formal health services, by leveraging CHWs as trusted intermediaries.

Despite limitations in data completeness, the observed trends underscore how strategically structured CHW programs can extend system functionality and responsiveness during complex health emergencies. These findings contribute to a growing body of evidence supporting CHW integration in crisis settings and lay the foundation for the comparative cases that follow, which explore CHW adaptability in both natural disaster and pandemic responses. The thematic and systems-oriented lens applied here aims to inform future implementation across similarly fragile contexts.

The data collection strategy was grounded in operational constraints but designed through an implementation lens, balancing rigor with responsiveness. My role as a practitioner-researcher supported close collaboration with field teams to ensure validity and feasibility while mitigating bias through systematic sampling and regular debriefing with supervisory staff.

6

Strengthening Health Systems While Responding to a Health Crisis: Lessons Learned by a Nongovernmental Organization During the Ebola Virus Disease Epidemic in Sierra Leone

Corrado Cancedda,Sheila M. Davis,Kerry L. Dierberg, Jonathan Lascher, Mohammed Bailor Barrie et al., **Cora Nally**, et al., Joia S. Mukherjee, and Paul E. Farmer

Contextualizing the Health System Response to the 2014–2016 Ebola Crisis in Sierra Leone

The following published article offers a detailed account of the broader health system response implemented by Partners In Health (PIH) in collaboration with the Ministry of Health and Sanitation and the Wellbody Alliance. While I was a contributing author on this paper, I was not a primary author; as such, it is not included in the core set of thesis papers. Nonetheless, it plays an important contextual role.

This article documents how the NGO-led response aimed not only to address the acute public health emergency caused by the Ebola outbreak, but also to simultaneously strengthen the underlying public health infrastructure in some of Sierra Leone's most affected districts. Its relevance to this thesis lies in its illustration of the broader system-level strategy within which the CHW program examined in this research was embedded. By situating community-based programming within a coordinated national and subnational framework, the work described in this article reinforces a central argument of the thesis: that CHWs are most effective when integrated into a broader, well-resourced, and strategically aligned health system response.

This framing sets the stage for the first paper in the thesis, which explores how Rapid Qualitative Assessments (RQAs) were used during the same Ebola response to understand and address fear-based behaviors in the affected population. That work, grounded in

community engagement and iterative learning, demonstrates how CHWs were mobilized within this larger system to respond rapidly and effectively at the community level.

Strengthening Health Systems While Responding to a Health Crisis: Lessons Learned by a Nongovernmental Organization During the Ebola Virus Disease Epidemic in Sierra Leone

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An epidemic of Ebola virus disease (EVD) beginning in 2013 has claimed an estimated 11 310 lives in West Africa. As the EVD epidemic subsides, it is important for all who participated in the emergency Ebola response to reflect on strengths and weaknesses of the response. Such reflections should take into account perspectives not usually included in peer-reviewed publications and after-action reports, including those from the public sector, nongovernmental organizations (NGOs), survivors of Ebola, and Ebola-affected households and communities. In this article, we first describe how the international NGO Partners In Health (PIH) partnered with the Government of Sierra Leone and Wellbody Alliance (a local NGO) to respond to the EVD epidemic in 4 of the country's most Ebola-affected districts. We then describe how, in the aftermath of the epidemic, PIH is partnering with the public sector to strengthen the health system and resume delivery of regular health services. PIH's experience in Sierra Leone is one of multiple partnerships with different stakeholders. It is also one of rapid deployment of expatriate clinicians and logistics personnel in health facilities largely deprived of health professionals, medical supplies, and physical infrastructure required to deliver health services effectively and safely. Lessons learned by PIH and its partners in Sierra Leone can contribute to the ongoing discussion within the international community on how to ensure emergency preparedness and build resilient health systems in settings without either.

Keywords. Ebola; Sierra Leone; emergency response; health system strengthening.

The epidemic of Ebola virus disease (EVD) in West Africa, responsible for over 28 616 infections and 11 310 deaths through May 2016, has caused great suffering across a region already burdened by extreme poverty, recent histories of civil conflict, and weak health systems [1]. Sierra Leone, Liberia, and Guinea are among the countries with the world's lowest levels of public investment in health. Therefore, it was not surprising that their underresourced and understaffed hospitals and health centers were the fault lines along which the EVD epidemic exploded. Nor is it surprising that caregivers—both clinicians who lacked the personal protective equipment necessary to halt transmission and those who, by necessity, nursed sick family members at home—were infected at disproportionate rates. More than 500 health professionals have died from EVD since this epidemic began.

Multilateral organizations such as the United Nations and the World Health Organization, bilateral and philanthropic donors, and international nongovernmental organizations (NGOs) were initially slow to respond to the EVD epidemic. Eventually, exponentially increasing rates of new infections in West Africa and a handful of cases exported from West Africa to the United States and Europe in late 2014 spurred sizable, if belated, commitments of financial and human resources from the international community. While rates of new infections began to fall steeply as the EVD epidemic entered its second full year [2], case-fatality rates remained widely divergent across settings, and small clusters of cases continued to emerge across the region through the end of 2015 and into 2016. As the EVD

epidemic subsides, Sierra Leone, Guinea, and Liberia face the daunting challenge of building health systems resilient enough to protect their populations from other health crises (whether current, future, acute, or chronic). They face this challenge bereft of health professionals.

While much has been written from policy and public health perspectives about the response to the EVD epidemic, less has been written from the perspective of those called to implement these policies and provide clinical care to patients. As implementing partners in the emergency Ebola response, international NGOs delivered a wide range of health services, which included identifying new infections in Ebola-affected communities, providing clinical care to the critically ill in Ebola treatment units (ETUs), advocating for and employing survivors of Ebola to help with the response, and reopening district hospitals and health centers shuttered at the height of the epidemic.

Partners In Health (PIH), an international NGO with more than 30 years of experience working with the public sector to deliver health services to poor and marginalized patients in 10 countries around the world [3], began working in Sierra Leone in October 2014 at the invitations of the national government and Wellbody Alliance, a local NGO that has delivered community-based health services in the eastern part of the country since 2006. In this article, we outline the strategic choices made, the guiding principles implemented, the activities pursued, and the lessons learned during PIH's participation in the emergency Ebola response. We also describe PIH's simultaneous efforts to strengthen the health system in 4 of Sierra Leone's most Ebola-affected districts (Port Loko, Kono, Kambia, and Western Area Urban; Figure 1). During the same time frame, PIH launched a response to help contain the EVD epidemic in Liberia, which will be described in a future article [4].

THE STATE OF SIERRA LEONE'S HEALTH SYSTEM AND OF THE EVD EPIDEMIC AT THE TIME OF PIH'S ENGAGEMENT

Sierra Leone's health system was unprepared to tackle the formidable challenge posed by the EVD epidemic. One careful study in 2010 compared the capacity of Sierra Leone's hospitals to perform essential surgery with that of US Civil War field hospitals, concluding that the latter were "equivalent and in many ways superior" [5, p 1743]. Another recent study assessed the capacity of district hospitals across the country to adopt universal precautions and to implement best practices for infection prevention and control, concluding that "items such as gloves, eye protection, and aprons were routinely in limited supply" and that "Government facilities were unacceptably deficient in protective supplies" [6, p 1196]. In the district of Port Loko, the main public hospital was found to be without electricity, running water, or a regular supply of oxygen [7]. Not surprisingly, by autumn 2014 the same hospital would be among the hardest-hit by nosocomial transmission of Ebola to health professionals in Sierra Leone.

In late October 2014, Sierra Leone was reporting over 500 new EVD cases per week (with more than 100 cases each week in the district of Port Loko alone—the highest Ebola incidence ever documented in a rural area) [8]. The British government warned that this figure would exceed 1000 by early December without a dramatically accelerated response from the international community [9]. Virtually no beds were available for patients with EVD at any of the health facilities in Port Loko [10], with the exception of an isolation ward in the district's main public hospital, which was filled to more than twice its capacity and dangerous for both patients and health professionals [11]. Although the Government of Sierra Leone was converting an abandoned vocational school into a 108-bed ETU, no international NGO was yet present in Port Loko to help provide clinical care to patients with EVD.

An assessment conducted that month (October 2014) by the Centers for Disease Control and Prevention revealed that most health professionals in Port Loko had received no formal training on infection prevention and control, that stocks of personal protective equipment were insufficient in quantity and did not meet internationally recognized quality standards, and that the number of health professionals was inadequate across all levels of the health system [12]. Furthermore, 23 health professionals had been infected with Ebola in the district between May and October 2014 [13]. As a result, basic health services, limited in scope and reach before the EVD epidemic, had collapsed: by mid-October, rates of deliveries in health facilities and malaria cases diagnosed and treated had fallen by 49.1% and 60.5%, respectively, in Port Loko when compared to rates in October 2013 (Figure 2) [14].

PIH'S GUIDING PRINCIPLES FOR THE EMERGENCY EBOLA RESPONSE

To guide its emergency Ebola response in Sierra Leone, PIH adopted the same principles that had been developed and refined over 3 decades of working to strengthen the health systems of low-income countries while responding to humanitarian and health crises (from earthquakes and floods to epidemics of cholera and multidrug-resistant tuberculosis).

PIH's main strategic goal is to be of service to national governments and support the public sector in areas (both geographic and programmatic) where the need is the greatest. In Sierra Leone, the National Ebola Response Center, the governance body responsible for leading the emergency Ebola response, attempted to coordinate the contributions of each donor and implementing partner from the international community. This was a daunting task, given the large number of partners involved, each with unique expertise and priorities, and the dynamic nature of the epidemic. PIH sought to support the National Ebola Response Center and the Ministry of Health and Sanitation (MoHS) by being a flexible partner and by tailoring its activities to address evolving local needs. This meant following the recommendations of the National Ebola Response Center and of the
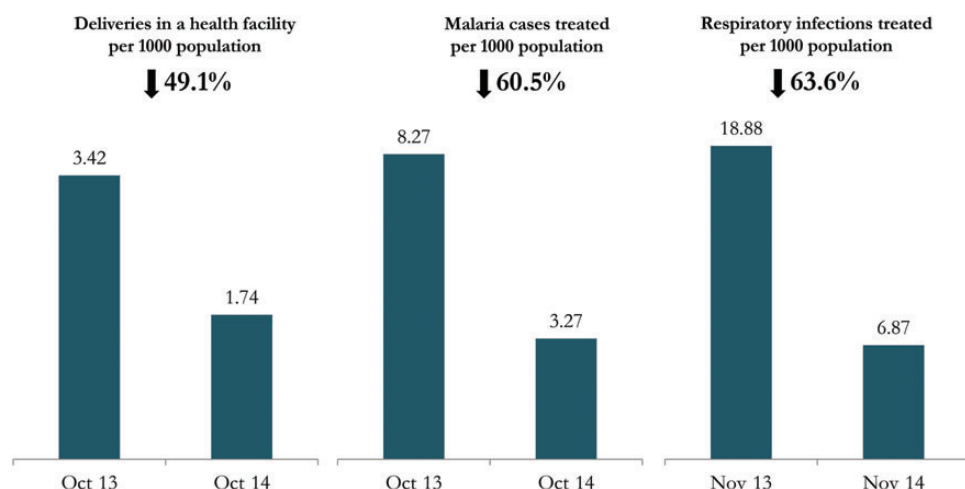
Figure 1. Health facilities supported by Partners In Health in Sierra Leone, 2014–2015. The capacity at each unit is as follows: Maforki Ebola treatment unit (ETU), 108 beds; District Hospital holding units, 60 beds; 12 community care centers (CCCs), 195 beds; and PCMH holding unit, 11 beds.

MoHS when selecting the districts and, within those districts, the health facilities to support. This also meant, at times, either conducting entirely new activities (such as initiating an Ebola survivor program) or opting out of activities (such as delivering community-based health services in 2 of 4 PIH-supported districts) in which PIH had significant expertise but were already underway or promised by other implementing partners.

To demonstrate commitment to building capacity within the public sector, PIH has traditionally pursued a 3-pronged approach: (1) reinforcing ongoing government efforts with additional health professionals (both local and expatriate) and medical supplies, (2) improving and/or developing new policies and procedures for health service delivery, and (3) refurbishing the infrastructure of existing government-run health facilities [15]. In Sierra Leone, this meant that PIH would not build and operate a new purpose-built ETU independently (which would have taken up to 8 weeks) but would instead devote substantial human and financial resources to working in and

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Deliveries in a health facility per 1000 population
↓ 49.1%

Malaria cases treated per 1000 population
↓ 60.5%

Respiratory infections treated per 1000 population
↓ 63.6%

Figure 2. Disruption of essential maternal and child health services in Port Loko District.

improving health facilities already operated by the MoHS. As a result, PIH was able to scale up delivery of health services for patients with EVD and support to Sierra Leonean clinicians rapidly, in part by leveraging existing resources available to and partnerships established by the MoHS.

In the countries where it operates, PIH seeks to find the balance between the quality, scale, and safety of its activities. Therefore, in Sierra Leone, PIH decided to support 17 health facilities across 4 districts (Figure 1) and, within those facilities, sought to both improve the quality of clinical care provided to patients with EVD and ensure the safety of the clinicians providing such care. The response of the international community to previous EVD outbreaks in rural Africa had been characterized by placing more emphasis on halting transmission relative to improving outcomes for those already infected, a choice that was partly responsible for the abysmal case-fatality rates reported in the literature [16, 17]. However, policies that pit prevention against care deter sick individuals from going to health facilities, undermine trust, and hinder efforts to refer, isolate, rapidly diagnose, and effectively treat patients with viral hemorrhagic fevers [16, 18–20]. In Sierra Leone, PIH and other international NGOs sought to move away from a prevention-only focus (which prioritized isolation of patients with EVD over provision of clinical care) to an integrated approach, whereby the prevention of new infections and the improvement of patient outcomes would be equally prioritized and explicitly recognized as mutually interdependent objectives [21].

Last, effective delivery of health services requires a continuous and integrated chain of activities that links together hospitals, health centers, and communities. To achieve continuity and integration, PIH works to strengthen the public sector across all levels of the health system. In Sierra Leone, PIH believed that the emergency Ebola response should be no exception (Figure 3). For example, supporting an ETU would not suffice to contain the

EVD epidemic if communities in the surrounding areas were not effectively mobilized to recognize the symptoms of EVD and refer potentially infected individuals as early as possible to that facility [18]. Conversely, social mobilization and educational outreach efforts in those communities alone would not convince individuals with symptoms of EVD to seek admission in an ETU unable to provide high-quality and dignified clinical care, nor would transmission in the community be halted only by ubiquitous billboards discouraging either the consumption of bush meat (since all documented EVD cases in 2014 and 2015 spread from human to human) or prohibiting any contact with individuals with symptoms of EVD (since, in the absence of an ambulance service to transport them to a nearby ETU, this would mean leaving loved ones and neighbors to die) [22]. Such disruptions in the health service delivery chain had in fact facilitated the early spread of Ebola in West Africa and complicated efforts to build the trust required for effective disease surveillance and accurate reporting, to say nothing of early diagnosis and prompt initiation of effective clinical care [20, 23, 24].
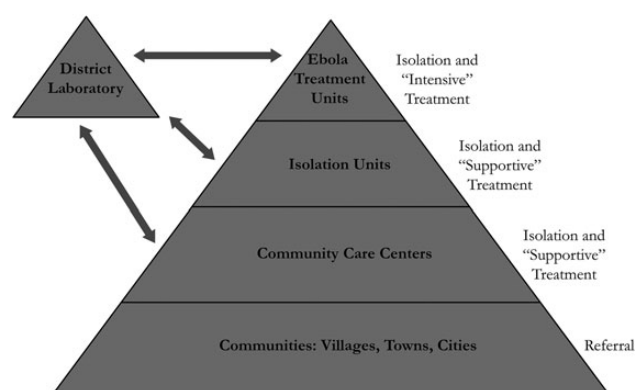
Figure 3. Levels of health service delivery in the emergency Ebola response.

IMPLEMENTING THE EMERGENCY EBOLA RESPONSE

By February 2015, PIH was working across 4 districts and supporting 17 health facilities that were providing clinical care to patients with EVD (totaling 374 beds; Figure 1). Those health facilities included a 108-bed ETU in Port Loko (the ultimate destination for all patients with EVD diagnosed in that district, where the most intensive clinical care was provided; Figure 4); 4 holding units (isolation wards at regular health facilities for patients with symptoms of EVD), including one within Princess Christian Maternity Hospital in Freetown (Sierra Leone's main maternity hospital); and 12 community care centers (smaller decentralized health facilities where individuals with symptoms of EVD were first isolated and stabilized prior to referral to an ETU). PIH also provided logistical support to 2 biocontainment laboratories with diagnostic capability operated by Erasmus University and funded by the Dutch government.

Between October 2014 and June 2015, approximately 1900 patients were admitted to the 17 PIH-supported health facilities, and 366 of those patients received a diagnosis of EVD. Based on a preliminary analysis, the overall case-fatality rate for patients with a diagnosis of EVD in the Port Loko ETU was 49%, which contrasts with anecdotal reports of rates exceeding 80% in the

Figure 4. *A*, Clinicians from the Ministry of Health and Sanitation and from Partners In Health Providing Clinical Care to Patients at the Ebola Treatment Unit in Port Loko. *B*, Ebola survivors employed by Partners In Health ride through Freetown, Sierra Leone, to recruit other survivors to work for the emergency Ebola response. Photos are by Rebecca E. Rollins.

same facility prior to PIH's engagement. Among the 274 pregnant women who were admitted to the holding unit at Princess Christian Maternity Hospital in Freetown, 28 received a diagnosis of EVD. Nine of them (and their fetuses) died, while 19 were stabilized and referred to one of the ETUs in Freetown. Mortality for patients with a diagnosis of EVD in the Port Loko ETU varied month to month and, as in other cohorts [8, 25–28], was higher in infants (71% among those aged <12 months) and patients aged >45 years (74%) than in adolescents and young adults.

There were obvious risks associated with providing clinical care to large numbers of patients with EVD in health facilities not designed specifically for this purpose. From the beginning, the MoHS and PIH worked together to both improve the quality of clinical care provided to patients with EVD and to reduce the risk of transmission among health professionals. Clinical protocols were refined through an iterative process, and PIH sought to standardize them across all the 17 health facilities supported. Clinicians in the Port Loko ETU and within Princess Christian Maternity Hospital's holding unit implemented aggressive intravenous fluid resuscitation, closer monitoring of inputs and outputs, management of electrolyte disturbances (measured by point-of-care i-Stat devices [Abbott Laboratories, Abbott Park, Illinois]), and enhanced nutritional support during and after patients' admission. To improve the safety profile of the health facilities, the MoHS and PIH worked together to strengthen water and sanitation systems, train local health professionals in infection prevention and control, and bolster supply chains for personal protective equipment. One expatriate clinician working for PIH became infected (and fully recovered following medical evacuation to the United States), while 3 health professionals employed by the MoHS who had worked alongside PIH clinicians became infected (1 died and 2 recovered after being treated at an ETU operated by the British military).

PIH also sought to strengthen the emergency Ebola response at the community level. By June 2015, approximately 800 community health workers employed by PIH and Wellbody Alliance had conducted over 1.1 million home visits in Ebola-affected communities to identify individuals with symptoms of EVD, referred 357 of those individuals to PIH-supported health facilities, monitored hundreds of family members of patients with EVD who were under quarantine at home, and delivered educational messages on Ebola to nearly 900 000 Sierra Leoneans. These community health workers were trained to couple education about Ebola with psychosocial support and empathetic counseling of Ebola-affected households and individuals. Especially in Kono, many of these community health workers had previous experience delivering health services to poor and underserved patients with human immunodeficiency virus (HIV) infection and other chronic diseases through Wellbody Alliance. As a result, they were able to leverage local

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knowledge, trust, and bonds of solidarity to educate entire villages on the importance of identifying individuals with symptoms of EVD and seeking early diagnosis and referral to health facilities.

Survivors of Ebola remain vulnerable to both clinical and social sequelae, often experiencing lingering physical ailments, severe stigmatization, and economic marginalization [29]. As a result, PIH launched an Ebola survivor program that grew to include >900 survivors in the Port Loko, Kono, and Western Area Urban districts between October 2014 and May 2015. The program enrolls survivors in vocational and literacy training, pays school fees to help children who either survived Ebola or were orphaned by it, and directly employs survivors to lead social mobilization and community outreach efforts in Ebola-affected communities.

PIH partnered with the MoHS, GOAL Global, International Medical Corps, Christian Blind Mission, and the World Health Organization to operate a clinic for survivors of Ebola within the Baptist Eye Hospital in Port Loko. Between March and August 2015, >650 survivors were evaluated at this facility. Additionally, PIH partnered with the MoHS, GOAL, Médecins Sans Frontières, Médecins du Monde, Welthungerhilfe, Sightsavers, the University of Toronto, the Emory Eye Center, and the World Health Organization to launch a national initiative to screen and treat survivors for long-term ocular complications of EVD. As in previous outbreaks [30–32], many survivors present with arthralgias and myalgias, vision impairment, hearing loss, persistent fatigue, and other lingering physical ailments [33, 34]. More than 2700 survivors were screened for ocular complications of EVD through December 2015; approximately 1 in 5 received a diagnosis of uveitis (a condition that, when left untreated, can lead to blindness) and treated with topical or systemic corticosteroids. While providing clinical care to survivors, PIH and other partners were also generating knowledge on how

to diagnose and treat the clinical sequelae of EVD and training clinicians across the country in the management of those sequelae (Sierra Leone had only 2 ophthalmologists until 2015, one of whom practiced in the Port Loko clinic; Figure 5).

PIH considered the development and utilization of novel vaccines, diagnostic assays, and therapeutic tools to be an essential priority for the emergency Ebola response. PIH leveraged the resources and expertise available through its affiliation with Harvard Medical School and partnered with Public Health England and other stakeholders to conduct field validation studies of 2 novel rapid diagnostic tests for EVD: a point-of-care finger stick lateral flow immunoassay (ReEBOV Antigen Rapid Test Kit; Corgenix, Broomfield, CO) and an automated, 2-target, sample-to-answer reverse transcription–polymerase chain reaction (RT-PCR) assay (Xpert Ebola Assay; Cepheid, Sunnyvale, California). Both assays were shown to be highly sensitive and specific in comparison with the laboratory-based RT-PCR tests used for routine diagnosis of EVD [35, 36]. The Xpert assay is now being considered for scale-up across West Africa as part of ongoing surveillance efforts; both assays are being considered as key components of diagnostic algorithms to be implemented during the response to future EVD epidemics. The participation of Sierra Leonean laboratory technicians and health professionals in these studies ensured that local staff were trained in the diagnosis of EVD and provided an assessment of the feasibility of integrating point-of-care assays into future testing strategies in local health facilities.

HEALTH SYSTEM STRENGTHENING IN THE MIDST OF THE EPIDEMIC

Throughout much of 2014, government-run health facilities where regular health services had been routinely delivered were emptied of clinicians (who had died from EVD, were recruited to serve in an ETU, or refused to work in highly unsafe
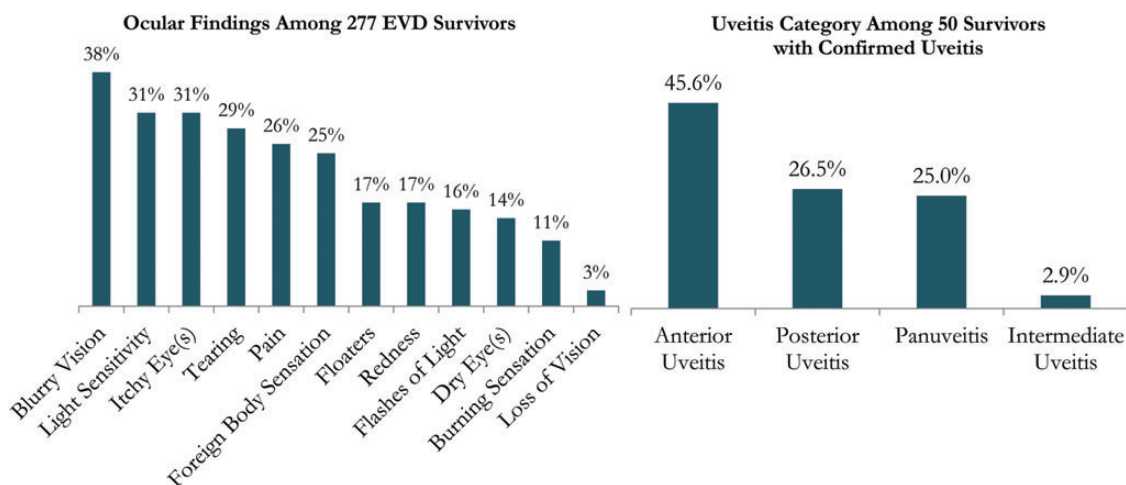
Figure 5. High prevalence of ocular symptoms and uveitis among survivors of Ebola at Partners In Health–supported clinic in Lunsar, Port Loko District. Abbreviation: EVD, Ebola virus disease.

environments) and patients (who had lost faith in the public sector) [37, 38]. Rates of premature mortality—already among the world's highest, especially among women and children—increased dramatically as hospitals and health centers were closed, vaccination coverage plummeted, and supply chains for essential medications were interrupted [39]. Furthermore, attempting to contain the spread of Ebola only by building new ETUs and community care centers was not enough to halt transmission: the vast majority (90.3%) of health professionals infected with Ebola virus in Port Loko before PIH's arrival, for example, were exposed at hospitals and health centers not specifically devoted to the treatment of EVD [40].

From the beginning of the emergency Ebola response, the MoHS emphasized that only long-term partnerships with donors and international NGOs would allow Sierra Leone to recover from the EVD epidemic. PIH therefore agreed to remain in country beyond the duration of the response, to help the MoHS and partners such as Wellbody Alliance resume the delivery of regular health services and strengthen the health system. In 2014 and 2015, PIH clinicians and logistics personnel worked alongside local health professionals to operate district hospitals and health centers, restart vaccination and antenatal care programs, respond to outbreaks of measles resulting from plummeting immunization coverage [41], and strengthen infection prevention and control policies and procedures. The health center operated by Wellbody Alliance and supported by PIH clinicians in Kono was one of the few health facilities in Sierra Leone that continued to treat patients with HIV infection and tuberculosis during the epidemic.

In April 2015, the MoHS outlined its long-term strategy to strengthen Sierra Leone's health system. The following goals are at the core of the strategy, which have informed PIH's strategic objectives for the next 5 years in Sierra Leone: (1) ensuring the safety of health professionals and patients, (2) resuming and improving the quality of basic health services, (3) capacity building and career development for health professionals, (4) robust and routine disease surveillance and community mobilization (Table 1). Over the coming years, PIH will leverage its long-standing partnerships with Harvard Medical School and Brigham and Women's Hospital to support and strengthen the public sector and to ensure that, as in Rwanda, health service delivery across all levels of care (hospital, health center, and community) is linked to training and to the generation of new knowledge [42].

CHALLENGES AND LESSONS LEARNED

PIH faced significant challenges throughout the implementation of the emergency Ebola response and learned valuable lessons in the process of addressing them. While some resulted from factors inherent to PIH's structure, others can only be understood within the broader context of the international

Table 1. Alignment Between Ministry of Health Goals and Partners in Health's (PIH's) Strategic Objectives and Activities for Long-Term Health System Strengthening

Health System Strengthening Goal	PIH's Strategic Objectives and Activities for Next 5 Years
Ensuring the safety of patients and health workers	Developing infrastructure and protocols and providing training in non-Ebola public sector health facilities to improve infection control for EVD and other infectious diseases (ie, Lassa fever, measles, and cholera)
Resuming basic health services	Improving staffing, equipment, and infrastructure at district hospitals and health centers; resuming basic health services for maternal and child care, malnutrition, HIV infection, and tuberculosis; launching and sustaining programs to care for EVD survivors; and expanding or improving health services for other medical conditions (essential surgery, noncommunicable diseases, mental health, and cancer)
Career development and capacity building for health workers	Continuing professional development of local health workers through training, mentoring, and supervision; creating partnerships with local and international academic institutions to strengthen graduate and postgraduate health professional education
Ongoing disease surveillance and community mobilization	Creating a network of community health workers focused on integrated management of childhood and adult illnesses (and able to screen for EVD), maternal and child care, malnutrition, HIV infection, and tuberculosis; expanding the network of community health workers to include other illnesses (noncommunicable diseases and mental health)

Abbreviations: EVD, Ebola virus disease; HIV, human immunodeficiency virus.

community's current frameworks for emergency preparedness and for long-term development (Figure 6).

First, it is essential to build capacity for health governance and management within the public sector of low-income countries. In Sierra Leone, the MoHS was initially overwhelmed by

1. The capacity of local governments and ministries of health to articulate their strategies and coordinate the contributions of donors and implementing partners must be built before a health crisis occurs.

2. As the acuity and severity of health crises increases globally, implementing partners must be ready to intervene with greater flexibility, at a faster pace, and at a greater scale.

3. Improving the quality of clinical care is a strategic, epidemiologic, and moral imperative.

4. Knowledge generation must be integrated with health service delivery, and training and must go hand in hand with implementation, not lag behind.

5. Donors must facilitate rapid and effective implementation by minimizing restrictions on ways in which funds can be spent.

6. Donors and implementing partners should eliminate any dichotomy between the response to an acute health crisis and the effort to strengthen a chronically weak health system and should ensure continuity between both.

Figure 6. Lessons learned during the emergency Ebola response by partners in health.

the scale and complexity of the EVD epidemic. The establishment of the National Ebola Response Center was critical to the scale-up and eventual success of the emergency Ebola response because it improved coordination between donors and implementing partners and was able to mobilize what scant financial and human resources were available in the country. Representatives from Sierra Leone's MoHS served on the Center's leadership committee, an arrangement that has facilitated the transition from the emergency Ebola response to a long-term health system strengthening strategy. To support this transition, PIH has seconded staff within the MoHS to assist local policymakers with administrative duties and operational challenges. However, to prevent future health crises from having such a devastating impact in West Africa, it will be important to build capacity within the region's health sectors for emergency preparedness well before their onset. Some international NGOs (such as the Clinton Health Access Initiative and the Africa Governance Initiative) are now tackling the important priority of health governance and management both regionally and globally, but more remains to be done.

Second, increasing the speed by which the international community responds to another health crisis in the future is key. Like many other international NGOs, PIH began working in West Africa well into the course of the EVD epidemic and could have mobilized earlier than in autumn 2014. This delay was due in part to the limited number of experienced clinicians and logistics personnel available within the organization for immediate deployment. PIH is now considering the establishment of emergency teams that can be deployed in the event of similar health crises. The World Health Organization and other international NGOs are weighing similar solutions [43]. Additionally, for international NGOs like PIH to expand their reach, it will be necessary to recruit from a pool of less experienced expatriates willing to be trained and deployed for a limited period. Short-term clinicians and logistics personnel can add significant value but require considerable mentoring and supervision, as well as sufficient logistical and mental health support, to perform effectively in settings of privation and risk. The establishment of standardized procedures and processes to rapidly recruit, evaluate, train, deploy, and support short-term health professionals is critical and will require ongoing adjustments by PIH and other implementing partners [44].

Many clinicians at academic medical centers and other institutions with global health programs in the United States who wished to volunteer with PIH and other international NGOs in West Africa faced substantial administrative and legal barriers to doing so. Some who were deployed by PIH in Sierra Leone were obligated to return prematurely to the United States to attend on the inpatient service of their employing academic medical centers at a time when their expertise was sorely needed in Sierra Leone. Others had to quit their jobs to volunteer in Sierra Leone because their employers denied them unpaid leave.

Academic medical centers and other employing institutions should devise standardized policies regarding the deployment of their clinicians and the coverage of domestic professional duties during humanitarian and health crises.

Third, raising the quality of clinical care provided to patients remains imperative for both halting transmission and saving lives. Initially, the EVD epidemic was difficult to contain partly because patients avoided going to health facilities that were unable to provide high quality and dignified clinical care, while clinicians understandably feared for their own safety [45]. In Sierra Leone, the establishment of an ETU operated by the British military and capable of providing intensive supportive care more likely increased the retention of health professionals [46]. Access to high-quality clinical care for viral hemorrhagic fevers and other infectious diseases must be ensured not only for local clinicians, but also for the general population in the event of future epidemics.

The case-fatality rate for patients with EVD treated at the PIH-supported ETU in Port Loko remained too high, at 49%. While the case-fatality rate across the region was higher, at 64%, among admitted patients and exceeded 90% among those who remained at home [8], 2 ETUs near Freetown reported case-fatality rates of 31% and 37% in large cohorts following the implementation of more-intensive clinical protocols similar to those implemented by PIH [47, 48]. In PIH-supported health facilities, clinicians from Sierra Leone, the United States, and Cuba (in the Port Loko ETU) routinely provided intravenous fluid resuscitation, treatment of electrolyte disturbances, and even intra-osseous fluid resuscitation for infants and small children with hypovolemic shock caused by EVD [49, 50].

However, despite PIH's best efforts and the heroic dedication of all clinicians involved, the conditions within PIH-supported health facilities remained far below the standards of an average community hospital in the United States, much less those of an intensive care unit. Conversely, the case-fatality rate for those evacuated to medical centers in Europe or North America, where patients with EVD had access to high-quality supportive and critical care, remained <20% (0% among American clinicians, some of whom were shown to lose up to 10 L of fluid per day at rates that could never be replenished by oral rehydration alone) [51]. Debates regarding the reasons underlying such divergent outcomes will continue [16, 17, 52–54]. Yet it is clear that when patients have access to modern medicine, even without taking into account experimental drugs (such as specific antivirals, monoclonal antibodies, or small interfering RNA molecules), EVD is a treatable disease; the vast majority of patients infected with Ebola in West Africa did not—and still do not—have such access [55, 56].

PIH clinicians sought to challenge the notions that most pregnant women with EVD would die even with treatment—based on a case series of 15 women who received little supportive care during the 1995 EVD outbreak in Kikwit [57]—and

that caring for them posed too great a risk for health professionals. The final outcomes for all 28 pregnant women who received a diagnosis of EVD at Princess Christian Maternity Hospital are not known because those who were stabilized were referred to other ETUs. However, the opening of a holding unit at Sierra Leone's only tertiary-level health facility for women with complications of child birth meant that not only those 28 women, but hundreds of febrile women who had to be isolated and treated in the PIH-supported holding unit until they tested negative for EVD were able to deliver in a health facility when they might otherwise not have received any clinical care. Other international NGOs, including Médecins Sans Frontières, sought to demonstrate that EVD in pregnancy is treatable [58, 59]; more work remains to understand and address the factors responsible for high rates of fetal death.

Fourth, given the importance of timely data collection, surveillance, and quality improvement in the face of a dynamic epidemic, PIH sought to monitor and evaluate its activities from the outset of its engagement in Sierra Leone. As with many other responding organizations, the amount of financial and human resources devoted by PIH to monitoring, evaluation, and research was initially inadequate, leading to delays in PIH's ability to document what was being done and to lack of reliable data capturing the first 2 months of implementation. Despite these challenges, PIH was able to generate important knowledge regarding clinical care of patients with EVD and survivors [34] and to evaluate 2 point-of-care diagnostic assays that may significantly improve ongoing surveillance and preparedness for future EVD epidemics [35, 36]. Notably, these validation studies were possible to conduct under challenging field conditions because they were linked to ongoing efforts to support local clinicians, improve the quality of clinical care available to patients with EVD, and strengthen the health system. Even within the context of an epidemic, research should be integrated with health service delivery and training whenever possible [60].

Although promising results have recently been published, the international community could have done more to generate knowledge from the EVD epidemic as well [61]. For example, many studies to evaluate the effectiveness of experimental drugs or vaccinations began too late. A disconnect between implementing and research organizations, data-sharing challenges, and a lack of funding for phase 1 efficacy and safety studies prior to the epidemic are among the reasons for such delay [62]. The World Health Organization is now working on a much-needed framework to expedite research and development for diseases of poverty in anticipation of (and, if necessary, during) future health crises. Independent research organizations, companies, and funders should engage in similar efforts.

Fifth, more flexible funding mechanisms would likely have enhanced a more robust response to the EVD epidemic. The amount of funding eventually devoted to the emergency Ebola response was substantial, and it was critical to halting transmission. However, by being too prescriptive regarding how funds should be spent, donors can unintentionally limit options for implementation and stifle innovation. For example, some donors' refusal to finance medical evacuations or the construction of permanent infrastructure, forced international NGOs like PIH to raise funds independently to fill gaps, especially for long-term projects. Furthermore, national and local health authorities across West Africa were often bypassed by donors in favor of international NGOs with limited experience in the region; by one conservative estimate, only 11.5% of resources appropriated for the emergency Ebola response were channeled through the governments of the 3 most affected countries [63]. This fraction was only 5% in Sierra Leone [64]. Limited management capacity and corruption are often presented, sometimes without much supporting evidence or without meaningful effort to address them, as justifications for neglecting the public sector across Africa. Yet it is perhaps too easy to conflate weak health systems with a propensity for graft; increased transparency on the part of donors and NGOs will also be essential to ensuring that shared goals translate into lasting results [65].

In future health crises, donors should consider prioritizing outcomes over inputs or processes, allowing national health authorities and implementing partners to spend funds as dictated by local needs and evolving circumstances rather than by contracts fixed at the outset of a dynamic health crisis. The establishment of standing emergency funds by the US Office of Foreign Disaster Assistance and the United Kingdom Department for International Development is an encouraging start, but more will be required to address the chronic emergencies that exist wherever outbreaks might evolve into epidemics after spreading through dilapidated health systems.

Sixth, the responsibility of the international community to West Africa will be fulfilled only when the health systems of Liberia, Sierra Leone, and Guinea are resilient enough to quickly identify and contain future epidemics of EVD and other infectious pathologies (from Lassa fever to cholera and measles) and, most importantly, to consistently deliver comprehensive and high-quality health services to their populations. Some international NGOs and donors have opted to remain in Sierra Leone beyond the duration of the emergency Ebola response and to work with the MoHS to strengthen the health system. However, despite this joint commitment, there have been large gaps in funding such a transition: implementing partners have often been unable to quickly redirect unspent or unused resources that were earmarked for Ebola toward resuming and expanding the delivery of regular health services (including meeting the needs of Ebola survivors and families heavily affected by the epidemic). For instance, PIH's ongoing effort to strengthen the health system is supported only through independently raised funds that are separate from those received for the emergency

Ebola response. Some private philanthropies (such as the Open Society Foundations and the Paul Allen Foundation) have begun to recognize and address this gap, yet greater donor flexibility is desperately needed to ensure the kind of continuity between intensive short- and long-term efforts that might render health crises less deadly or prevent them altogether. Finally, as in the global response to the AIDS pandemic, those most affected by a disease have much to teach, and their expertise is critical to efforts to build stronger health systems and a means of stopping this epidemic and preventing the next one. Ebola survivors have been at heart of PIH's response, and many today serve as community health workers at the forefront of efforts to heal the wounds caused by Ebola's march across West Africa and the long years of conflict and neglect that preceded it.

CONCLUSION

While the international response to the EVD epidemic saved many lives, major challenges have hindered the translation of these investments into long-term protection for the populations most affected; these issues must be addressed before the next unexpected health emergency arises here or elsewhere where poverty and a heavy burden of disease converge. The historic neglect of the region's health systems, delays in the engagement of donors and international NGOs, and the endorsement by responders of false dichotomies (between, for example, prevention and care, or between an emergency response and long-term health system strengthening) were among the main challenges encountered. We hope that the lessons learned by PIH and its partners in Sierra Leone to date will contribute to the ongoing dialogue on how best to improve the way the international community currently mobilizes against health crises and invests in health systems capable of detecting and preventing the spread of diseases like Ebola and offering quality care to those who do fall ill.

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Germs, Guns, and Fear in Disaster Response: A Rapid Qualitative Assessment to Understand Fear-Based Responses in the Population at Large: Lessons from Sierra Leone 2014-2015

Cora P. Nally MPH, Patrick Van de Voorde MD, PhD, FERC, Marleen Temmerman MD, PhD, and Mary Adam MD

This paper presents findings from a Rapid Qualitative Assessment (RQA) conducted during the 2014–2015 Ebola outbreak in Sierra Leone. The assessment was designed to identify behavioral and systemic gaps in the ongoing response effort and to inform the development of a structured Community Health Worker (CHW) program. The RQA provided valuable insights, including that fear and fear-based responses (FBRs) were causing community members to adopt behaviors that unintentionally accelerated disease transmission. These fear-based responses included avoiding health facilities, hiding symptomatic individuals, and mistrusting response actors. The research highlighted that relying solely on secondary data or externally driven assumptions in crisis settings can be detrimental to response efforts and undermine the effectiveness of the humanitarian response.

This paper provides empirical grounding for the thesis's core argument, that resilient, community-based health interventions must be informed by direct engagement with affected populations. The RQA shaped the early design of the CHW intervention by highlighting the value of context-specific, participatory information-gathering during emergencies. This paper plays a foundational role in illustrating how CHWs can serve not only as healthcare providers but also as trusted conduits for real-time information and community-led action in crisis contexts.

Concepts in Disaster Medicine

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Germs, Guns, and Fear in Disaster Response: A Rapid Qualitative Assessment to Understand Fear-Based Responses in the Population at Large: Lessons From Sierra Leone 2014-2015

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Abstract

We set out to assess the feasibility of community-focused randomized qualitative assessment at the start of an emergency to identify the root causes of fear-based responses driving the pandemic. We used key informant interviews, focus group discussions, reviewing of government and non-government organization documents, combined with direct field observation. Data were recorded and analyzed for key-themes: (1) lack of evidence-based information about Ebola; (2) lack of support to quarantined families; (3) culturally imbedded practices of caring for ill family members; (4) strong feeling that the government would not help them, and the communities needed to help themselves: (5) distrust of nongovernmental organizations and Ebola treatment centers that the communities viewed as opportunistic. On-the-ground real-time engagement with stakeholders provided deep insight into fear-based-responses during the Ebola epidemic, formed a coherent understanding of how they drove the epidemic, presenting an alternative to the standard disaster-response United Nations-strategy, producing community-driven solutions with local ownership.

Fear has an evolutionary purpose for humans. Steimer defines fear as "a motivational state aroused by specific stimuli that give rise to defensive behavior or escape.[1]" Response to fear can trigger life-saving actions; however, it can also trigger life-endangering behavior such as avoidance and the spreading of misinformation. The fear-based responses (FBR) and their contribution to the Ebola crisis in West-Africa 2014-2016 are well documented by Shultz et al.[2] Our current study discusses a rapid qualitative assessment (RQA) model that relied heavily upon community participation to identify the causes of the FBR that were driving the spread of the Ebola virus in Sierra Leone. The efficacy of an in depth RQA is previously proven; however, this model focuses on inclusion of all stakeholders, not isolated groups within the impacted communities.[3] This community-based information provided an informed and data-driven basis for implementing an effective and rapid response.[2] Such models continue to demonstrate their relevance even now with FBRs driving behavior related to the coronavirus disease 2019 (COVID-19) global pandemic.

"Fear-related behaviors (FRBs) are individual or collective behaviors and actions initiated in response to fear reactions that are triggered by a perceived threat or actual exposure to a potentially traumatizing event. Importantly, FRBs modulate the future risk of harm.[2]" When a disaster occurs as the result of 1 event, such as a tsunami or hurricane, then FBR protect human life and serve an evolutionary and biological purpose. Programs that arrive and deploy quickly, providing outside resources and expertise, are welcomed by the communities impacted and are able to deliver life-saving care and interventions in directly impactful ways. Individual choices and fear are still driving decision-making in these types of disasters. However, when the threats are viral and go global, like with Ebola and coronavirus viruses, individual decision-making and fear drive human choices at a regional and a global scale in ways that often promote the spread of disease and destruction. Addressing fear-based responses of health-care workers and the population at large must be an essential strategy in these types of disaster responses because they hamper the ability of implementing partners to achieve any measure of success.[2] The real impact of FBRs is wide ranging, and impacts mental health for essential workers, the ability for governments and agencies to effectively respond and contain threats, and restricts economic growth by prolonging epidemics and pandemics.[2] Very few models exist to rapidly assess the determinants of FBRs and combat them within epidemic or disaster settings, which was imperative in this

response as FBRs were the number 1 drivers of the epidemic as stated by Johnson and Vindrola-Padros.[3]

Methods

Setting

The Ebola epidemic had been running rampant since July 2014 when the first case was diagnosed in the Pujehun District near the Liberia border. By December 2014, a total of 9446 people were confirmed to be infected and 2758 people had died.[4] As the crisis continued, additional global actors mobilized to respond. Among the global actors was Partners in Health (PIH), an International Non-Governmental Organization (INGO) whose mission is "to provide a preferential option for the poor in health care.[4]" PIH partnered with a local Sierra Leonian non-governmental organization (NGO), The Wellbody Alliance, to tap into that organization's experience and knowledge of the local context, as well as being able to leverage their presence in a region that was developing community health volunteers before Ebola. PIH was determined to establish a Community Health Workers (CHW) program, as they believe that "paid, trained and coordinated community health workers are vital to health education, case detection, and linking people to care.[4]" PIH had already been responding to the crisis with medical interventions through a partnership with the Sierra Leonian government to staff and run the government Ebola Treatment Unit (ETU) in Port Loko. This partnership with the government provided an entry into expanding their response to include community-based components. PIH chose to focus on survivor services and the creation of a robust CHW program to support the medical response.

Study Design/Model for RQA

A 3-person, community-centered team was deployed by PIH. It included 1 expatriate with a master's degree in public health and 15 plus y of experience working in development as well as extensive experience working in Sierra Leone with community-based programs. It also included 2 local staff members who were community mobilizers and had been involved in the epidemic response from the beginning. We elected to conduct a participatory RQA of stakeholders in the Ebola response before designing the intervention requested by PIH. This RQA would focus on the 3 Chiefdoms with the highest case numbers and involve extensive community participation. We started with identified community and response leaders and used a snowball network approach to access a range and scope of perspectives. Every group or person we spoke with advised us of others who could also provide in depth information regarding the community views on the response, the gaps, and the drivers of fear. We also gathered observational and qualitative data from the government officials, Ebola Treatment Facilities, and the British Military.

The following 4 open-ended questions framed the assessment: (1) What's currently happening? (2) What are the gaps? (3) What filled those gaps pre-event? (4) Why isn't it working now?

During the phase 1 interviews, the 3 team members took handwritten notes. All the interviews were conducted with all 3 team members present, so the notes could be validated against others' perceptions during the analysis. The information shared by participants was reframed and repeated back to them for clarification and validation of summary findings on the spot. At the end of each day, the team analyzed the interviews through peer debriefing and
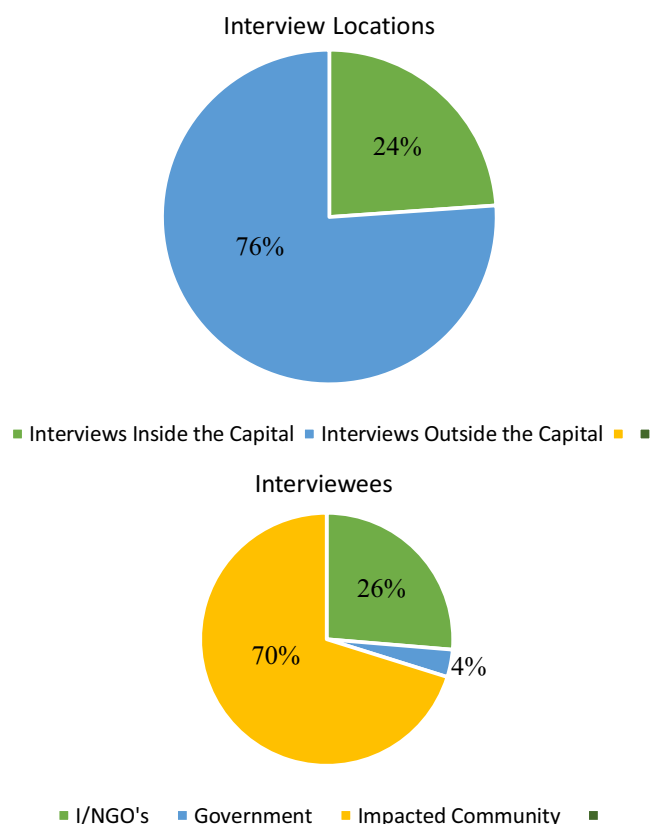
Figure 1. Breakdown by percentage of interviews done in the district capital versus outside the capital. As well as who in the communities were interviewed.

visual mapping. They identified key themes, which were used to frame the enquiries of the following day. The assessment was conducted over 4 d. It began with identified community leaders and evolved to include Ebola response coordination partners, both government and NGO leadership, community leaders, both elected and socially selected. It also included pre-event community organizations such as men's and women's groups in each village, the Paramount Chiefs for each administrate Chiefdom in the district, religious leaders, education leaders, and government officials. A total of 76% of those interviewed were outside the capitol, 24% lived or worked in the capitol. Seventy percent of those interviewed were community members directly impacted by the epidemic, 26% were INGOs working on the Ebola response, and 4% were Sierra Leonian government employees. The interviews were halted after 4 d, once the team began to hear repetition in the responses and the key themes reached saturation. See also Figure 1.

Data Analysis and Verification

The team used an integrated approach to analyzing the data gathered. Every evening at the end of the interviews, the notes were re-read and discussed and classified into thematic categories. We all had knowledge of the fear-based behaviors that saturated media coverage, and our thematic framing focused on rooting out the causes of those FBRs, as highlighted in the article by Cancedda et al.[4] The results of our integrated analysis were then shared with the community groups and leaders previously interviewed, and their feedback and contributions were actively sought for phase 2 and will be described in the Methods section. Overall, this process involved asking for community participation

at 2 phases in the design process, ensuring that the information gathered was contextually and culturally validated to the Ebola epidemic in process. The use of a snowball method to select participants, the integrated data analysis, and the final validation leant confidence in our findings and the resulting program design that was built.

Results

The RQA focused on all stakeholders, those in the community and those that were part of the response. Recurring themes emerged during the course of the RQA and were tracked against known fear-based responses driving the spread of the virus, as highlighted by Richards et al.[5] Once a saturation of these thematic concepts was reached, the team moved on to phase 2: analysis and verification. This was done by revisiting approximately 25% of the interviewees to confirm our findings. Our findings allowed us to clearly draw a line between the fears in the community and the resulting behavior. We could see that a lack of evidence-based information on the virus as well as the treatment and care provided in the ETUs was preventing the population from seeking assistance. We also learned that this lack of knowledge was exacerbating the continuation of harmful behavior and practices that spread the virus further. For more details on the themes identified and the correlating data collected, please see Figure 2.

Gaps Identified

During the RQA of the existing response, the following gaps were identified in the response system that could be addressed using Community Based Participatory Research (CBPR) in the form of a comprehensive Community Health Worker program. Our findings correlated with a similar assessment done in Liberia by The Ministry of Health the World Health Organization offices in that country.[6]

Maintaining quarantine integrity:

> Families were being quarantined to their home compounds with no access to food, water, communication, or information about their ill family members in the ETUs. This was causing countless people to violate their quarantine, further spreading Ebola and exacerbating the epidemic.

Active case finding need:

> When people were falling ill, family members were keeping them at home to care for them because they did not trust the ETUs or the government. Part of this distrust was caused by a lack of communication from the ETU to the family after patients were admitted. Another factor was a generational distrust of the government, communities were accustomed to taking care of themselves independently and not relying on the government. The involvement of the military, both British and Sierra Leonian, contributed to this distrust as well.

Evidence-based community education about Ebola, what happens in the ETU, and survivors:

> This information coming from a trusted source to the community would increase compliance with necessary epidemic restrictions, limiting the spread of disease and decreasing the mortality if people could be treated earlier as confirmed by Kellerborg et al.[7]

Provide communication link between villages/families and the ETUs:

> Patients were removed from the communities by the government ambulances and then seemed to disappear, with family members never hearing which ETU they were taken to or how they were fairing.

A multifaceted intervention to implement guidelines around best practices in community health work to improve trust in a health system was needed. As the existing health system had collapsed, it was important that the intervention be built within an existing social structure that was culturally appropriate. The assessment phase had concentrated its focus on the communities impacted, building the system in a way that leaned into existing community infrastructure would rely on the relationships already begun. The RQA provided a clear picture of the FBRs contributing to the continuing spread of Ebola. For more information on the FBRs and the resulting program components developed to address them, please see Figure 3.

Conclusions/Discussion

Based on the themes of the interviews, identification of gaps in the existing response structure, and identification of the root causes of the FBRs, the following key components for a community-based program were identified. The information gathered in the RQA would go on to inform the structure of the program, the topics and length of the training necessary, and the methods for integration into the existing response structure in a way that would close gaps and strengthen the overall response. We would use community-based participatory research similar to that of Harris et al., the relationships with the stakeholders developed during the RQA, and establish a comprehensive CHW program.[10] It would consist of a 1 group pretest-posttest design and continual feedback loops allowing for continual adaptation and maximum efficacy due to the ever-evolving nature of the epidemic and response. This program will be highlighted further in a future study expanding on the structure and implementation of the CHW program of Ebola response volunteers.

Historically, our crisis and disaster response models are predicated on older military models of warfare, as highlighted by Dara et al.[11] The focus in these cases is on body retrieval from battlefields and rapid medical assessments and care. Most current medical responses follow a similar model, focusing heavily on rapid clinical assessment, care for the sick or injured, and management of the dead. The UN has a model of coordination that is activated during most disaster responses. It dictates that coordinating committees be constituted, and that they include representatives from the local government as well as I/NGO partners.[12] This has proven effective previously because it provides a consistent pattern to response that can be duplicated quickly worldwide. In our case study, we demonstrate that community participation at the inception of this coordination should exist well beyond tokenism to address underlying fear-based behaviors that are causing the disaster. This idea is supported in other literature but those primarily focus on RQAs with specific stakeholders only. There should be further study and examination of methods that involve all stakeholders at the start of any disaster or epidemic response. Schultz and other researchers also recommend a "a rapid assessment of outbreak-associated psychological stressors, for both civilians and health care

Theme 1	**A lack of evidence-based information about Ebola in the general population**
Interview comments	• Many declared Ebola was not real and not the cause of the deaths. • There was widespread messaging sharing false causes of Ebola, such as 'foreigners have brought it to Sierra Leone as a way to control us' or 'witches are infecting people who do not believe in God'. • An often-repeated quote was "The ETUs are only places people go to die". • Traditional medicine was seen as a better option for care than the ETUs.
Theme 2	**A lack of support to families in quarantine**
Interview comments	• Families quarantined in their homes had no access to water or electricity and could not work on their family farms or secure food for their families.
	• Most homes in this agrarian-based society consisted of a 1- or 2-room house, built of mud and sticks, and surrounded by a pounded dirt yard where the family activities and living were mainly focused. • The quarantine area included the yards but did not extend to communal water or food sources in order to decrease the risk of infection spreading.
Theme 3	**A desire to continue with historical practices of caring for ill family members in the home or accompanying them to the hospital if the illness was severe enough**
Interview comments	• People were not calling for ambulances to transport sick family members because the ambulances would not share where the patients were going. • Once a patient was admitted to an ETU, no one kept the family up to date on their status. • Families could not visit patients in the ETUs, due to the risk of infection, but the fact families were denied this access only raised their suspicions that the ETUs were not providing care. • There was a historical distrust of hospitals as 'places to die' that had been altered to also include ETUs. • All of these fears led people to hide sick family members in their homes, further infecting the family and spreading the Ebola virus.
Theme 4	**A desire by the Paramount Chiefs and other community leaders to organize communities in some way to combat Ebola, but the only model they were familiar with was a punitive one where threats and social pressure were used to gain compliance**
Interview comments	• The Paramount Chiefs were organizing door-to-door campaigns in their Chiefdoms to provide information about Ebola and the ETUs. • These were often coupled with complete lockdowns, requiring everyone except the teams designated by the Paramount Chiefs to remain in their homes or yards all day. • Often during these campaigns, intimidation and threats were used to get people to comply with restrictions and observe the requirements for calling an ambulance and reporting neighbors who appeared to be sick. • Paramount Chiefs were asking the government to provide more information and tools to them so they could sensitize their communities and mobilize them more effectively, but the government had not provided such assistance yet.
Theme 5	**A strong feeling that the government would not help them, and the communities needed to somehow organize to help themselves**
Interview comments	• The Paramount Chiefs reported getting no replies to their requests for information (related to above). • There is evidence that the government did delay their response to the Ebola outbreak and that this delay cost lives.[5] • There is historical precedence for the districts and Chiefdoms relying on their own resources and ingenuity to solve problems in their communities.
Theme 6	**A distrust of the ETUs, which were seen only as a place people go to die**
Interview comments	• This mirrored the historical distrust of hospitals, and the general view that you just went there to die. • This was a primary reason that families wanted to be able to accompany their sick relatives, to ensure that nothing nefarious was done to them in the hospitals or treatment centers.
Theme 7	**A distrust of 'outsiders' (NGO workers) who were viewed as coming to make money off of the epidemic and not to help the people**
Interview comments	• This dated back to the extreme violence that plagued the country from 1991-2002 during the Guerilla War.[5] • This fear was being exacerbated by I/NGOs unfamiliar with communities driving in with big SUVs and chastising the residents for their behavior, before driving away again abruptly.

Figure 2. Themes.

FBR 1	Escaping from quarantined homes or leaving areas with high concentration of the virus
	Families in quarantine were fleeing their homes, further spreading Ebola. During the recent violent civil war, much of the violence was perpetrated by soldiers and 'governments,' and this fear of the government was still very much a factor in people's memories. Families were also being quarantined to their home compounds with no access to food, water, communication, or information about their ill family members in the ETUs.
Program component to counter this FBR: *Maintaining quarantine i employed ntegrity:* Support was needed to ensure that quarantined families had access to fresh water and food. They also needed to be connected to their community in some way, instead of isolated and stigmatized. It was imperative that a communication system between the ETUs and the quarantined families be developed so they would know the health status of their family members in the ETU.	
FBR 2	Not calling for the ambulance if a family member began to display symptoms of Ebola
	The government was demanding that people call for an ambulance if a family member developed symptoms. Then the ambulance would come and remove the family member to a place unknown and no one could visit them. There was also no communication from the ETUs as to the status of the patient, or even at which ETU they were being treated. Traditionally, family members are cared for at home and if they are admitted to a hospital, the patient's family still cares for them, bringing food daily and bathing the patient, among other normal caregiving activities. People were 'hiding' sick family members in their home and caring for them as they always had, this led to further spread of Ebola. Entire families were wiped out due to this fear-based practice, also highlighted in Ngo et al[8].
Program component to counter this FBR: *Active case finding:* Active case finding was necessary to identify people displaying symptoms before they could infect others in their family. These active case finders could also reassure suspect Ebola patients and their families that they would receive care in the ETUs and the quarantined family would be supportive. They could provide evidence-based information to the families about the steps that must be taken in order to isolate the suspect patient and care for the family. Developing a direct communication line between the ETUs and the families was also imperative. No one can imagine the pain of surrendering a family member who may very well die to the care of strangers in an ambulance, and then never knowing where they are being cared for or what has happened to them.	
FBR 3	Denial of the disease and questioning its provenance
	People continued to practice risky behaviors and relied upon traditional preventions such as magic spells and herbal medications.
Program component to counter this FBR: *Evidenced-based community education:* Evidence-based community education about Ebola and what happens in the ETU was crucial. This information had to come from a trusted source in the community in order to increase compliance with necessary epidemic restrictions, limiting the spread of disease and decreasing the mortality if people could be treated earlier, as affirmed by Pellechia et al.[9]	

Figure 3. Fear-based responses.

workers,"[2] specifically in the context of this Ebola epidemic in West Africa, but that same recommendation can be easily applied to all types of emergency responses.

During the assessment phase of the United Nations model there is a Multi Cluster/Sample Initial Rapid Assessment (MIRA) process outlined. This step does include information gathering at the community level, but only allows for a "good enough" approach.[12] Emphasis is placed on the fact that community level information should be gleaned from secondary data review and external direct observation in the first phase of a response. This has proven useful in more static response, such as hurricanes or tsunamis. We propose that this is inadequate and does not allow the responders to understand the full context of the crisis, and, therefore, how to adequality address it. This is particularly true when the crisis is exacerbated by human behavior and fear-based responses. Our findings correlated with a similar assessment done in Liberia by The Ministry of Health the WHO offices in that country.[6]

We propose that community level information be gathered at the same time as government and I/NGO organizations are arriving and coordinating. We provided an example of a model that is rapid and easily implemented but has enormous impact on the depth and breadth of the response, by gaining a deeper understanding of the social anthropological drivers of behavior. Then this information can be combined with the medical response to develop a relief pathway for the impacted communities. An interdisciplinary model that pauses, for just a moment, to explore the boundaries of those intrinsic systems, will be stronger and more quickly able to respond to the unfolding crisis.

Fear-based responses had an impact on the current global pandemic, potentially accelerating the spread of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which causes COVID-19. Early in the pandemic, studies examined the impact fear had on how people absorbed and interpreted information related to the virus. Salvi et al, showed that people who were afraid were more likely to believe and share false information about the

virus.[13] This further reinforces the paper's argument that gathering information on the causes of FBRs needs to be integrated into the response as well. An early, and targeted focus on the root causes of FBRs might support slowing the spread of disease, potentially saving lives and money.

More research in the field of community-based interventions during an emergency response is desperately needed. This model has only been tested in this Ebola epidemic, and further testing in additional settings would be beneficial to demonstrate its importance and impact. Public health emergency preparedness (PHEP) focuses on the institutional and medical capacity, which is extremely important. We believe that the community capabilities and insights are equally important and should be considered at all phases of the response. This collaboration will lead to better distribution of resources and improved outcomes for all stakeholders, affirmed by Ramsbottom et al.[14] Biological crises versus natural disasters do offer different contexts, but the same model could easily apply. We strongly concur with the declaration of Horwood et al. "Now is the time to consider how to bring social science into the center of future pandemic surveillance, response, community preparedness, and health system strengthening."[15]

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Using Continuous Quality Improvement in Community-based Programming During Disasters: Lessons Learned from the 2015 Ebola Crisis in Sierra Leone

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This paper examines the application of a Continuous Quality Improvement (CQI) approach within a community-based health program during the 2015 Ebola crisis in Sierra Leone. The paper describes how CQI, in this instance the iterative collection and analysis of field-level qualitative data, was used to inform real-time decision-making in a dynamic emergency setting. By integrating both clinical and community response components from the outset, the intervention enabled collaborative problem-solving and responsiveness to changing field conditions.

Framed within principles of systems theory and organizational learning, the CQI process provided a mechanism for identifying and addressing gaps in strategy execution, communication flows, and coordination structures. In doing so, it operationalized the concept of a "learning health system," in which reflection, feedback, and adaptation are not peripheral but central to program performance, particularly in complex humanitarian settings. This aligns with implementation science frameworks such as the Consolidated Framework for Implementation Research (CFIR) and the Dynamic Sustainability Framework, which emphasize ongoing adaptation, feedback loops, and contextual responsiveness as key to sustainable program effectiveness.

The CQI approach fostered a reflective, adaptive response model that allowed the team to make timely course corrections based on evidence emerging from within the intervention itself. This paper is central to the thesis's argument that resilient, community-based health systems in disaster settings must incorporate flexible, learning-oriented structures. The use of CQI demonstrates how structured reflection and iterative feedback can strengthen

CHW-led interventions, improve epidemic response outcomes, and enhance responsiveness to population needs. This article offers practical evidence that resilience is not only built into system design but also cultivated through continuous, real-time learning during implementation.

Using Continuous Quality Improvement in Community-based Programming During Disasters: Lessons Learned from the 2015 Ebola Crisis in Sierra Leone

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Abstract

This paper describes the CQI (Continuous Quality Improvement) process of collecting and analyzing field level qualitative data in an ongoing cycle. This data can be used to guide decision-making for effective emergency response. When medical and community components are integrated from the earliest stages of the disaster, it allows for true collaboration and supports the CQI process to be responsive to evolving data. Our CQI process identified and addressed gaps in communication and coordination, problems with strategy implementation and, on a conceptual level, gaps in the disaster response model. The 2015 Ebola crisis in Sierra Leone provided a case study demonstrating improved effectiveness when a CQI approach is implemented in the Humanitarian Setting, equally in terms of reducing disease spread, and in meeting the broader needs of the population served.

Continuous quality improvement (CQI) has been in common use as a business model since the 1920s.[7] It is now an emerging strategy in the field of Humanitarian Response, enlarging the toolkit of first responders in disaster management and response. CQI is particularly well-suited to community-based programing in disasters because community engagement at scale is essential for implementing evidenced-based solutions. We use our experience in Sierra Leone and the Ebola crisis as a demonstration of the value and impact of CQI. As we will demonstrate in this case study, CQI utilizes real time feedback loops to provide data for decision making at the front line, not just at command central. CQI facilitates incorporating local actors as well as an understanding of local perceptions of how disease processes work. In so doing, it addresses relevant cultural practices and supports an informed messaging strategy.

The 2014 Ebola epidemic in Sierra Leone began with a rapid spreading of the virus as a result of multiple interacting factors.[1] These included the slow recognition of the dangers Ebola posed, the lack of information at the household level, and an overall weak health system. These factors compounded to delay information from reaching people in positions of power and hampered the coordination of a large-scale response to stop the disease.[1] As the epidemic unfolded, the behavior of Sierra Leoneans was increasingly motivated by fear due to the lack of consistent messaging from all levels of government. This, in turn, caused the national government to become increasingly restrictive, halting border crossings as well as local travel. These restrictions had an unintended effect of spiraling fear of the disease, without driving any effective messaging on prevention. Because many of the early deaths from Ebola were Health Care Providers, fear was pervasive and included health care workers. Community Health Clinics were abandoned out of fear for the virus.[1] By October of 2014, approximately 5 months after the first Ebola cases were identified, Sierra Leone experienced a simultaneous collapse of the health system and local and national governance structures because of fear. The government created significant delays in declaring a national emergency, according to several documented sources.[16]

The Sierra Leone population was no longer sure who to trust or where to turn. This generated fear-based responses on the population level. One example was to disregard circulating information which had the logo of the ministry of health, even if it was being produced by disaster response organizations.[3] Myths about the "strange disease" abounded. Prevention measures such as restrictions on washing and touching dead family members conflicted with existing cultural practices and were, thus, not trusted. In Port Loko, an urban center in the West of Sierra Leone, there was a widespread lack of confidence in the emergency health care systems that had been set up by the local government, which included foreign, military, and international non-

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governmental organizations (INGOs) who had arrived to assist.[1] Despite their best efforts, by early 2015, the district was coping with increasing infection rates and death.

As demonstrated by our case study, outlined below, disasters are often dynamic in nature, even if they result from a single event. They require programming that is "responsive" to the ever-evolving situation.[2] Continuous Quality Improvement (CQI) allows models to be flexible and adaptive, with a Plan-Do-Study-Act (PDSA) loop applied to each of its interventions.[3] Real-time field level data drive such dynamic feedback loops. Often models of disaster response assume the underlying state of things to be static and approach things in a linear way, both in terms of planning and subsequent implementation.[4] Such programs might plan and do but fail to further study the effectiveness of their interventions and act upon the new reality. "Unresponsive" implementation strategies increase problems instead of resolving them.[5]

Emergency response actors often arrive with a pre-existing agenda aligned with their own experiences or institutional directives, as stated by Vasovic.[6] Importantly, they expect a central coordinating agency to work hand in hand with national and local governance systems. These central coordinating agencies heavily rely on local data input, which is usually only available at the national level. Many, therefore, struggle without community level data due to lack of details. Feedback loops allow for the appreciation of community and household level data. A good example of the application of feedback loops in public health was presented in 1994 by Rissel.[8] They specifically discussed the role of "Community Empowerment" as a process that centers on a sense of community and results, by means of feedback loops, in community members obtaining control over their own resources, and eventually gaining autonomy in the emergency response process. They also identified the critical importance of access to evidenced-based medical information in the case of an infectious disease-induced disaster. There are many examples of emergency response actors developing information messages with limited indigenous contributions, distrusting local cultural-driven communication networks (e.g., word of mouth, vernacular radio programs, or community meetings), and with "unadapted" timeframes.[9] Messages with insufficient cultural sensitivity may be technically correct but misunderstood, rendering no benefit at the household level where disease is being transmitted and decisions related to behaviors are being determined. This problem of communication further contributes to a general lack of trust encountered in the communities.

In developing this paper, we also undertook a structured rapid review of the current literature using the following keywords: CQI, quasi experimental study design, plan do study act cycles, emergency response, rapid response, community based programs, and emergency response evaluation/qualitative/monitoring tools. There is significant research published about gathering qualitative data during an emergency response, but very little written about how to analyze and effectively improve programming based on that data. We discovered very few articles in peer reviewed journals that addressed completing the PDSA cycles and incorporating CQI into program design in the emergency response setting. There was a case study published by UNHCR in Skopje that came closest to highlighting our findings and conclusions, but clearly more research needs to be done in varied emergency response settings.[13]

Methodology and Approach to Data Collection

Based on our success with CQI in the humanitarian context, we felt compelled to share how we had utilized this tool, which is mostly associated with business models and health care systems. In this paper, we describe a dynamic CQI model using continuous real-time data feedback loops. Feedback was sought from all stakeholders. The usual disaster response approach is to include feedback at a national level and/or local aggregate level. CQI described here differs. Engagement of the front-line local community was required to gain a true field perspective. We needed to ask why in order to understand the context. This meant the responding team from PIH had to ask the specific detail of why certain behaviors were being chosen or avoided by the local population. Specifically, each member of the response team, which included 10 Sierra Leoneans and 1 consultant from Partners in Health, collecting data was charged with seeking answers to 3 questions continuously in their interactions with community members, government officials, other responders, and health care providers. The questions were: What is working? What isn't working? How can we do better? These questions were asked and answered using the Socratic Method; then, qualitative data were noted and shared during planned weekly meetings with direct supervisors. Qualitative data were received by the 11 office staff mentioned above and written into a shared report providing critically comprehensive feedback to decision makers at local parish, district, and national levels. This resulted in continuous adjustments to programming at all levels of implementation. The listening and learning posture of CQI engenders trust and thus improved compliance to containment messages. It also resulted in improved coordination between different arms/actors of the external response team as well as population level outcomes.[5]

Case study: Feedback Loops as Part of a CQI in the 2015 Sierra Leone Disaster Response

Partners in Health, in cooperation with the Sierra Leone government, developed a responsive community health worker (CHW) network in the face of a collapsed health system in order to support the emergency medical response and to extend the emergency health system into the impacted communities. The government of Sierra Leone adopted a Community Health Worker framework well before the Ebola epidemic and was, therefore, familiar with the benefits of community-based interventions. The geographic areas covered by this program included Lokosama, Port Loko, and Kaffu Bullum. All Chiefdoms within the District of Port Loko in Sierra Leone. The population was roughly 260, 000. A 4-arm program model was developed after an initial rapid qualitative assessment identified gaps in the disaster response.[10] The gaps identified are listed in Table 1. Rapid feedback loops were incorporated into field program design to address the gaps in the disaster response. Examples of gaps identified via feedback loops and how they were addressed can be seen in Table 2. These feedback loops included weekly meetings with direct reports and direct supervisors, facilitating the movement of this feedback rapidly to the decision makers for the response.

The CQI program integrated information from many different sources (program staff, other NGO, government partners, the British military, community leaders, and community members) on a regular basis. Feedback loops were utilized at all program levels, according to plan-do-study-act cycles and informed by real time field data (Nally et al 2021). Clear lines of communication were delineated in each level of the program management structure (who reports to whom and where should information flow to

Table 1. Identified gaps

Maintaining quarantine integrity:
Families were being quarantined to their home compounds for 28 days when 1 member tested positive for Ebola. They had limited to no access to food, water, communication, or information about their ill family members in the Ebola Treatment Units (ETU's). This was causing countless people to violate their quarantine and further spread Ebola.

Active case finding need:
When people were falling ill, family members were keeping them at home to care for them because they didn't trust the ETU's or the government. Reasons for this distrust were, among others, a lack of communication from the ETU to the family of admitted patients and the military involvement. Moreover, most (often remote) communities were accustomed to taking care of themselves independently and not relying on the government. Evidence-based community education was needed (about Ebola, what happens in the ETU, and Survivors): "The availability and dissemination of information coming from a trusted source to the community would increase compliance with necessary epidemic restrictions and by doing so limit the spread of disease."[7]

Improved communication between villages/families and the ETU's:
We identified a lot of distrust and fear in local communities and families as patients were transported away by (government) ambulances and then seemed to "disappear," with families never hearing where they were taken to or how they were faring.

and from) so that meaningful data for decision making does not get lost. At each level, leaders are identified and have the important responsibility to continuously gather and share the information needed (Figure 1). Too often data are gathered via feedback loops but largely remain ignored.[12] The key to feedback loops is their cyclic nature (plan-do-study-act) where data lead to identification of potential gaps and adjusted decision making to improve program delivery.

Figure 1 lays out the feedback loops occurring at each level of the management structure during the Ebola Response in Sierra Leone. We can see that weekly the gathering of information and feeding it both "up and down" the management structure is integral to the design of the program. This model can be adapted and used in many settings by emergency response programs. These models require leaders at each level to accept responsibility for gathering and sharing information continuously. Through this constant cycling of information, the program activities can be adjusted immediately to accommodate the evolving disaster or close gaps in implementation.

The Feedback Loops and PDSA Cycle in Practice

The key to this process is utilizing the information gathered to inform decision making for the program. There are countless instances where information is gathered in this way and then ignored due to various biases.[12] By incorporating the feedback, you can build trust in the program and implementors, respond more effectively to the changing nature of a disaster, and ensure the resources are used to the greatest impact. Below are some examples from this program highlighting information the feedback loops provided that was acted upon to improve program delivery and impact. In most cases, other organizations or people had begun the PDSA cycle, but not completed it, thus stalling or slowing the response and impeding its adaptability to the evolving context. After these highlighted cycles were implemented, the feedback loops continued to validate or highlight gaps in the implementation

and disaster response, and this meant that each of the 4 arms of programming could be adjusted.

Discussion

In the above case study, we demonstrate how a structured plan-do-study-act approach can rapidly highlight issues related to implementation of emergency response programs. Once information was fed back to emergency responders, they acted to rectify these gaps in coordination and implementation.[10] Together with the Sierra Leonian government, they developed and integrated community-based responses as part of broader CQI feedback loops.[14]

Feedback loops creating data for decision making are a part of CQI, but where and how this information is gained is often ignored or its importance is diminished at the national coordination and implementation level.[15] Many disaster response models do not build in community-based feedback loops. Medical data on case findings is gathered and pushed out, but community level implementation data received from community actors who are doing the case finding is not considered relevant to the implementation and impact. Therefore, it is not analyzed or used to inform programmatic decisions. Household level decision makers need data they can trust. Too often in disaster response, education is viewed as a tertiary program and not integral to reducing FBR's and integrating the community. It can be easier, in some cases, to rely on fear as a motivator for compliance. Two examples of this are highlighted in our case study. These challenges were remedied once frontline information was fed back to the decision makers at the national coordination level and at the household level.[1]

UNHCR published an interesting case study highlighting the importance of feedback loops in building trust in emergency response and disaster settings. They propose a similar structure to ours and highlight their own success in completing the PDSA cycles. However, there were very few other field-tested examples, and none that focused on the importance of closing these PDSA cycles completely and having them run continuously during the implementation period. The importance of feedback loops has been highlighted anecdotally most recently during the Global Coronavirus Pandemic. Many governments and responding bodies have struggled with messaging and securing compliance to restrictions by the wider population.[1] This has necessitated the use of feedback loops, the CQI process, and PDSA cycles, whether formally or not,[10] thus bringing their importance to the forefront of our current global public health climate.

The tendency of disaster responders to arrive with a prepackaged or preconceived idea of how the response should proceed ignores the impact and importance of indigenous systems and belief to the detriment of the health and lives at stake.[5] CQI is not often thought of as the method for responding to evolving disasters but as the science of QI and the ability to use real time data for decision making, hallmarks of both good disaster response and QI processes. For this program, community members were directly involved in the PDSA cycles.[5] CQI uses many small feedback loops to test both process and outcome measures.

While in practice feedback loops and quick responsive program adaptations do increase trust and impact in disaster response, it becomes challenging to effectively measure impact over time. Traditional models of assessment are difficult when parts of a program or implementation plan are constantly evolving. You
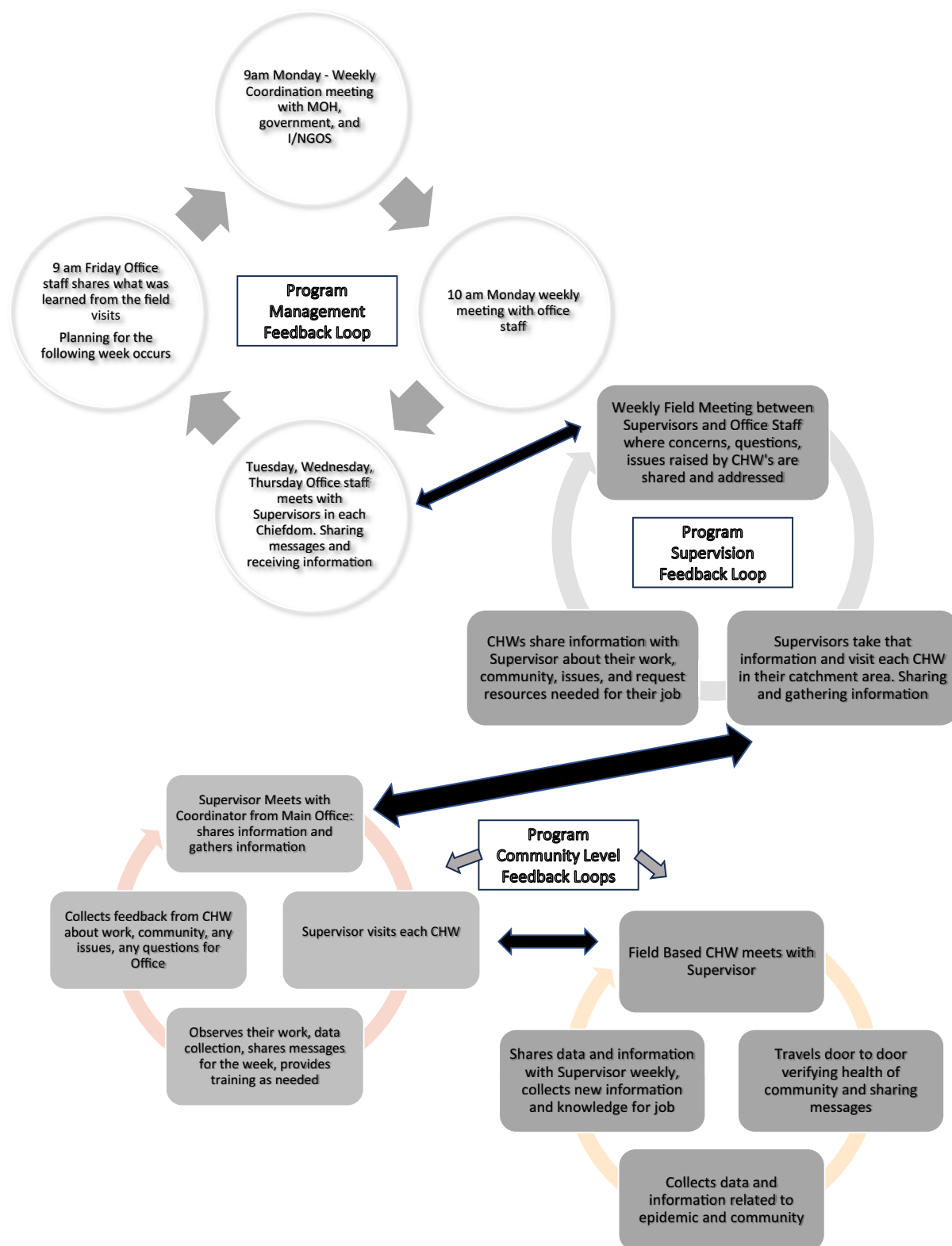
Figure 1. Feedback Loops for the Port Loko Ebola Response.

can have a data point to start with and a clear idea of where you hope to end up, but many models of quantitative and qualitative research require periodic measurements of the same data point, which becomes difficult if the program evolves and that data point

is no longer relevant to creating the outcome hoped for at the start of the process.

The case study of Ebola in 2015 provides an excellent example of an evolving epidemic that requires the ways real time data feedback

Table 2. Feedback loops and PDSA cycle in practice

Feedback loops identify gaps in your response model where data and reality collide	
Problem	With more and more people falling ill in a country with limited medical infrastructure, remote communities, and weak referral pathways there was a need for a consolidated way to alert the government and response actors to a new potentially infected person.
Plan	The **government of Sierra Leone** set up a national hotline to call an ambulance to your home if a member of your family displayed any Ebola symptoms.
Do	There was an initial surge of calls to the hotline, which then sharply dropped off even though the death numbers were still climbing (Walsh et al 2018).[24]
Stop	This is the point where the feedback system was sending information, but it was not being regarded or considered. The call rates were initially high but then began to drop off, even as case numbers, discovered due to death, kept climbing. (Walsh et al 2018)[24] Community engagement was critical to understand and address the breakdown in this system.
Study: via assessment for the planned ERV program	Upon examination by **Partners in Health** it was realized that families were not calling ambulances because there was no way for them to learn which ETU was admitting their family members. The families wanted to know the location and status of their sick family members.
Act	One Ebola Response Volunteer (ERV) working for Partners in Health, who was based in Port Loko where the 3 ETU's were, was tasked to visit each ETU daily and collect the names and villages of the people admitted. This information was then passed to the ERV's in those communities who would in turn visit the family's home and directly inform them where their loved one was being cared for. With the programs placement of ERV's inside the ETU's as well, families were able to call and speak with their loved ones directly. This increased trust in the ambulance process, as indicated by the districts where Partners in Health ERV's were working had an almost double rate of suspect patients referred to ETUs.[10]
Feedback loops allow you to pick up on weak implementation of good strategies	
Problem	The government and British Military were placing families in 28 days of quarantine when 1 member tested positive for Ebola. However, the families were fleeing into the bush instead of staying in their homes during the quarantine. As a result, the disease was continuing to spread and soldiers were being deployed to guard quarantined homes with guns.[1]
Plan	The **government of Sierra Leone** needed to develop a plan to maintain quarantine integrity to slow the spread of Ebola. They directed soldiers to guard families under quarantine under threat of being shot if they violated that quarantine.
Do	The soldiers were deployed to guard the homes of families under quarantine; however, the families were escaping the soldiers and running to hide in the bush or with other families in the communities (Walsh et al 2018).[24]
Stop	This caused the government to clamp down even harder on quarantined families and threaten to shoot people who ran away. This step only increased fear of the government and emergency responders. It may have slowed the spread of disease, but it did not contribute to trust in the response health system, which was critical, in order to ensure people reported to the ETU's when they had symptoms instead of hiding with their families in their homes. The responders did not look further into the root of the reason the families were fleeing from their quarantine.
Study- by PIH ERV's via community survey	Upon study by **Partners in Health** it was determined there were several factors causing people to flee from quarantine. Fear of the soldiers, fear of the ETU's, lack of access to food or water in quarantine (households were confined to their interior and a small yard only, which in this agrarian system meant they could not visit the community water source or access their fields where food was growing), and lack of access to power to charge their phones and other electronic devices (many individual households did not have power, and charging locations were operated as small shops in the villages where people would go and pay a small fee to charge their devices daily).
Act	One **Partners in Health** ERV was assigned to each family in quarantine. They were tasked with coordinating care for the family with INGO's providing food, community members who could fetch water, and community leaders to meet the other needs of the quarantined family. Thus making it possible for the families to remain in quarantine while still having their basic needs met.
Cycle continued	The ERV's continued to survey the community to identify any gaps in this system. Continuous monitoring led to the discovery that people were selling things to the quarantined families at higher prices due to their limited access to other options. PIH engaged the Chiefs in the communities to address this and ensure that the quarantined families were not taken advantage of. And the cycle continued.
Feedback loops help identify gaps in coordination of response by multiple actors	
Problem	There was limited access to Infection Prevention and Control supplies in the smaller communities in Sierra Leone, as well as socioeconomic barriers for families living on less than $1 per day to purchasing their own IPC supplies to mitigate infection if a family member became infected with Ebola.
Plan	An INGO had imported hundreds of self-care kits for families that were in quarantine. These included: a bucket, gloves, bleach, instructions for infection prevention, and instructions for caring for and isolating someone suspected to be infected with Ebola while waiting for the ambulance or assessment teams to arrive.
Do	The kits were procured and shipped to Port Loko, which was a major Ebola hot spot for the country at this point.
Stop	The supplies were delivered to Port Loko and safe storage was secured for them in a locked house. The INGO did not have any staff on the ground in Port Loko so the supplies remained secure in their storage location and were not distributed.

(Continued)

Table 2. (*Continued*)

Feedback loops help identify gaps in coordination of response by multiple actors	
Study	A **Partners in Health** ERV noticed there was a locked house in their community that no one seemed to live in. They asked the community leaders about the house and were informed it was being used as storage by the UN. The ERV passed this information to their Supervisor, who shared it at the weekly coordination meeting with the office staff, who then in turn shared it with the Program Manager. At a coordination meeting, the Program Manager approached the UN rep to inquire about this house and learn what was being stored there. The UN rep explained that there were self-care kits in the house that were intended for families who were being quarantined. However, there was a shortage of staff currently to monitor the inventory or distribute these supplies.
Act	**Partners in Health** did have the staff, as well as a network of ERV's in place to coordinate distribution and ensure the kits were going directly to families who needed them. We trained the 680 ERV's on the contents of the self-care kits, their uses, and how to obtain one for an identified quarantined household. An agreement regarding inventory management and distribution was reached with IOM and this program donated 500 self-care kits to families in quarantine over the course of the Epidemic.
Cycle continued	Feedback came from one of the Paramount Chiefs that one of our ERV's was selling these buckets to quarantined families. We investigated and found the accusation to be true so we terminated that ERV.

loops allow implementation adjustments to programming to reflect and impact the situation as it evolves. In this paper, we demonstrated how simple feedback loops produced data guiding our response adaptation to help "keep up" with the ever-evolving epidemic and community needs. Further field testing is necessary to understand how traditional measures of success can still be applied to disaster implementation.

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Bridging the Gap: Community Health Workers as a Vital Link in Humanitarian Medical Responses

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This paper presents three case studies, the Ebola epidemic in Sierra Leone, post-Hurricane Dorian in The Bahamas, and the COVID-19 pandemic, that illustrate the critical role Community Health Workers (CHWs) can play in humanitarian medical responses. Through integration with Mobile Medical Teams (MMTs), CHWs in all three settings contributed to improved health outcomes, more effective communication, and increased trust between crisis-affected communities and external response actors. In Sierra Leone, the intervention led to a 32% greater increase in referrals to formal health services in intervention areas, demonstrating the measurable impact of CHW-led community engagement. In all case studies, CHWs served as trusted intermediaries for follow-up care, health messaging, and navigating local dynamics, often under conditions of stress, mistrust, or limited infrastructure.

This paper directly supports the thesis's central argument, that CHWs are not only viable but necessary contributors to resilient, people-centered humanitarian health systems. It also reinforces earlier chapters by offering real-world, cross-contextual evidence of how CHW programs can be adapted to diverse emergencies, from outbreaks to climate-driven disasters to global pandemics, all while maintaining cultural credibility and logistical flexibility. By concluding with policy recommendations, the article strengthens the thesis's broader call for the integration of CHWs into emergency planning frameworks and global humanitarian health policy.

* The 32% increase referenced in this paper refers to the difference in confirmed case rate growth between intervention and non-intervention chiefdoms (Results section). Intervention areas saw a 36.7% post-January 15 increase, compared to a 4.7% increase of confirmed EVD infections in non-intervention areas. A net difference of 32%. This supports

the conclusion that the CHW intervention described in this paper improved case reporting and access to care.

Bridging the gap: community health workers as a vital link in humanitarian medical responses

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Community Health Workers (CHWs) have proven essential in improving health outcomes and building community trust and their role in humanitarian emergency medical responses warrants further study. We illustrate this point with two case studies, the integration of community health workers into Mobile Medical Teams [MMTs] in both The Bahamas and Sierra Leone. CHWs in these examples came to the forefront of addressing community mistrust for external medical teams, health communication efforts and patient follow-up care. In Sierra Leone, this program resulted in a 32% rise in referrals to established health services. By exploring these contexts, the paper provides a new framework for enhancing humanitarian responses through CHWs, outlining the strategic, logistical, and cultural benefits of such an approach. This research suggests that integrating CHWs with MMT's can bolster health outcomes, especially in communities affected by political instability, natural disasters, and resource limitations. The paper ends by providing policy implications and recommendations for further research on the use of CHWs during a range of emergency contexts.

KEYWORDS

Community Health Worker (CHW), Mobile Medical Team (MMT), Sierra Leone Ebola database, Hurricane Dorian 2019, community based programs, humanitarian response

Introduction

Humanitarian emergencies often require rapid, large-scale medical responses, frequently provided by international organizations such as Mobile Medical Teams (MMT) or the WHO Emergency Medical Teams (EMTs). However, despite their critical role in saving lives, MMT/EMTs can face challenges in gaining the trust of local populations (1, 2). These external teams are deployed to affected areas to provide triage of patients and immediate medical care, while local healthcare systems are stressed or fractured. External teams can help to support local rebuilding of local healthcare systems during and after the immediate crisis. These external clinical teams often face numerous challenges in delivering effective healthcare services. Some of these challenges include: lack of language proficiency and other communication barriers, limited resources and supplies, fractured supply chains, lack of familiarity with culture, high workload and stress, broken or destroyed infrastructure, as well as fear and inadequate support from the surrounding community (2, 3).

Community Health Workers (CHWs) are recognized for their ability to serve as bridges between healthcare systems and local communities, particularly in under-resourced areas (4, 5). Although there is some research on the role of CHWs in

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humanitarian medical responses, it is contextually limited. Consequently, despite their success in non-emergency settings, the potential of CHWs in these situations remains underutilized and insufficiently explored. This paper explores the integration of CHWs into MMT/EMT responses, demonstrating how this collaboration can improve patient trust and communication, resulting in improved outcomes.

Community Health Workers (CHWs) play a vital role in humanitarian settings, serving as a bridge between healthcare systems and affected populations. They are critical for engagement during crisis scenarios, drawing upon local knowledge and trust to implement health interventions and promote disease prevention (4). For example, during the West African Ebola epidemic, CHWs were instrumental in mobilizing communities, disseminating health information, and addressing cultural beliefs that influenced health behaviors (2). Additionally, CHWs contribute to the rebuilding of health systems post-conflict, as evidenced by their impact in Sierra Leone, where they helped restore health services and foster community resilience (3). However, the effectiveness of CHWs is often contingent upon the integration of health diplomacy and support from larger humanitarian frameworks, which can enhance their operational capacity during emergencies (1). Strengthening CHW programs is essential for improving health outcomes in humanitarian crises, as they not only provide immediate care but also empower communities to participate in their health governance.

Globally efforts have been made in the past decades to standardize these external medical teams to ensure they are delivering medical care ethically to the impacted communities. The WHO has a global emergency medical team program that sets standards for mobile medical teams and allows organizations and countries to be verified as World Health Organization Emergency Medical Team (WHO EMT) providers. Once verified, these groups affirm their commitment to provide services in a standardized, coordinated effort to support communities impacted by disasters (1).

When a clinical medical team, MMT/EMT, is dropped into a response setting the government has invited them to come and deliver health care directly to the impacted population. While effective in delivering care, the model faces limitations in building trust with local populations and ensuring continuity of care post-discharge (3). They can also face difficulty coordinating within the local health system and with impacted communities (22). MMT/EMTs are typically composed of foreign medical professionals, which can inadvertently distance them from the communities they serve. In fragile settings, this gap can severely impact the acceptance of medical interventions, especially in the context of widespread misinformation or pre-existing distrust of international organizations (1, 14, 21). In such cases, the local knowledge and cultural competence of CHWs offer a potential solution to bridge this gap.

Context in which the innovation occurs

Disruption to systems emerge as a consistent factor in humanitarian response, whether triggered by infectious agents like Ebola or Coronavirus Disease, natural calamities such as earthquakes or hurricanes, or human conflicts. Such disruptions invariably lead to the breakdown of essential systems, resulting in scarcities of basic necessities like food and clean water, heightened healthcare demands due to the loss of routine medical services like midwifery, and the collapse of infrastructure. Consequently, medical services, supply chains, and infrastructure often suffer, leaving families bereft of loved ones and devoid of shelter and possessions. Amidst this turmoil, trust becomes a scarce commodity, with individuals grappling with uncertainty regarding whom to rely on.

In crisis situations, Community Health Workers (CHWs) and Mobile Medical Teams (MMT/EMT) hold complementary roles that are critical for effective health response and recovery. CHWs, traditionally embedded within local communities, serve as important pathways for health information and services, addressing immediate health needs while fostering community engagement and trust (4, 5, 14). During the Ebola epidemic in West Africa, for example, CHWs played a key role in educating communities about disease prevention and mobilizing local resources to combat the outbreak (2). MMTs and EMTs provide specialized medical care and logistical support, often deploying rapidly to areas affected by disasters to stabilize health systems and manage acute medical needs (7). The integration of these teams with CHWs enhances the overall effectiveness of humanitarian responses, as CHWs can facilitate the delivery of emergency care while ensuring that interventions are culturally sensitive and contextually appropriate (1, 16). Lessons learned from past crises, such as in Sierra Leone, highlight the importance of collaboration between CHWs and medical teams to support and rebuild health systems in these settings (3, 19). A coordinated approach that leverages the strengths of both CHWs and MMT/EMT teams is essential for improving health outcomes in humanitarian crises.

We propose that an option for mitigating this outsider status is to utilize community-based health workers and programming to support the clinics set up by the MMT/EMT's. Having a local voice in the medical team provides this vital link. This increases the public's trust in the care being offered (6), which in turn improves outcomes for patients and communities. A community health worker program set up in cooperation with these MMT/EMT's supports community members as they gain a complete understanding of the medical team's processes and clinic services (7, 8). These trusted community members serve as ambassadors in their communities where they explain and answer questions about the mobile medical team, it's services, as well as treatments being offered and the medicine being distributed.

Engaging the community in such a central way in these responses empowers them to actively participate in the response efforts and to share responsibility for their success. Community involvement can include many factors: information-giving, consultation, joint decision-making, acting together, and supporting independent community interests (20). The components of traditional Community Health programs naturally incorporate these elements and provide communities with their own voice in the design and implementation of response activities.

Establishing trust in such circumstances presents formidable obstacles. However, standardizing Community Health Worker programs to complement MMT/EMTs or other clinical

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humanitarian responses bolsters trust in emergency healthcare systems. This, in turn, holds the potential to enhance outcomes for affected communities by fostering greater confidence in the healthcare services provided during times of crisis.

Detail to understand key programmatic elements

We examined two Community Health Worker (CHW) programs that supported clinical interventions during very different humanitarian responses. One case of a CHW program supporting clinical interventions was the natural disaster in the Bahamas post Hurricane Dorian in 2019 where mobile clinics were established using the EMT model. The other was an infectious epidemic in Sierra Leone, where at the height of the Ebola Epidemic in 2015 a standing clinic was established in cooperation with the Sierra Leonian government and staffed primarily by foreign clinicians. In these diverse contexts, the humanitarian response was enhanced by structurally aligning with CHW programs. These case studies demonstrate how CHW programs can rapidly build the efficiency and effectiveness of the humanitarian response, bridging the gap between external providers and the local context.

Community health workers in the Bahamas post Hurricane Dorian

After Hurricane Dorian struck the Bahamas in September 2019, the island of Abaco was left utterly devastated. Less than 20% of the buildings remained standing, and most were severely damaged or destroyed (8). One of the few buildings still standing was the largest health facility in Marsh Harbor, a key city serving a population of ~17,200. This facility acted as a central hub for smaller health centers on surrounding cays and islands. However, every health facility in Abaco was either damaged or destroyed, wiping out the physical infrastructure along with critical medical equipment and supplies (9, 10).

Given the damage to the health system infrastructure, mobile medical teams were deployed in the immediate aftermath to meet the needs of the remaining and returning residents. Even before the hurricane, there were significant gaps in healthcare services on the island: women were required to travel to Nassau to give birth, as Abaco had no capacity for surgical procedures and only two X-ray machines, both of which were damaged in the storm (23). Americares' lead staff on the ground, drawing on prior experiences from humanitarian responses in Sierra Leone, proposed a structure that had been successful there. This included the training and deployment of CHW's to improve community engagement. Based on direct observation of the benefits of CHWs during the Ebola outbreak response, a proposal was made to replicate and adapt this model for the Bahamas' unique context (7, 14, 21).

At the request of the Bahamian Ministry of Health, Americares provided two mobile medical teams to serve Abaco and the surrounding islands. One team, consisting of a doctor, two nurses, and a logistician, was based in Hope Town, one of the smaller cays off the coast of Abaco. The local clinic had been relocated to a private home due to damage to the original building. The

second team, with a doctor, four nurses, a pharmacist, and a logistician, operated on the main island of Abaco, rotating through five communities to provide essential medical services while the local infrastructure was rebuilt.

A quantitative assessment of the affected communities was conducted, utilizing various needs assessment methods, including snowball sampling. This assessment informed the design and implementation of the CHW program. Six CHWs were selected, one for each of the five communities on Abaco and one for Hope Town. Following a three-day training session, these CHWs began their work under the supervision of a designated supervisor, who provided weekly in-person support and additional training as needed.

The CHWs had several primary roles. They informed their communities of the mobile medical team's weekly schedule and provided public health education, which evolved based on the community's needs. Early on, they focused on informing residents about the medical services available. Later, they shifted to hygiene education, emphasizing handwashing in areas with limited access to clean water, and educating about the importance of the tetanus vaccine, particularly as residents undertook reconstruction work (14, 21).

CHWs also acted as surveillance officers, alerting the mobile medical teams about specific needs in advance, such as shortages of the tetanus vaccine. They served as vital communication links between remote communities and the mobile teams, especially during a time when there was no ambulance service on Abaco (10). In one case, a CHW alerted the mobile medical unit to a mother in preterm labor. A nurse practitioner was dispatched to assess the situation and accompany the mother to the nearest functioning clinic in Marsh Harbor, where foreign doctors were also supporting the humanitarian response.

The value of the CHWs became even more evident as COVID-19 began to spread. They shared evidence-based information about the virus with their communities, helping to reduce fear and panic. Even after Americares had to demobilize its response team due to the pandemic and global travel restrictions, the CHWs continued to support their communities without pay. When asked why they persisted, many said they had always wanted to help and that the training they received from Americares had empowered them to continue, despite no longer being employed.

Community health workers in Sierra Leone at the height of the Ebola epidemic

In December 2014, Sierra Leone was in the midst of a severe crisis due to the ongoing Ebola epidemic. By that time, 9,446 people were confirmed infected, and 2,758 had died. Immediate emergency intervention was crucial to curbing the spread of the virus and saving lives (7). Alongside its efforts to establish an Ebola treatment facility in partnership with the Sierra Leonean government, Partners in Health also recognized the need to create a CHW program.

At that point, the fatality rate for hospitalized Ebola patients was 60%. Ebola test results took three days, during which

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individuals were placed in "suspect" patient wards with others, drastically increasing the chance of contracting the virus if they were not already infected (7, 11, 17). The capacity of contact tracers was limited, with each able to track down only four contacts per patient, which was inadequate for the large family and community networks typical in the country. In some cases, the military was called in to enforce quarantines, with soldiers ordered to shoot those who violated the rules, intensifying public fear of both the disease and the treatment units (12, 17). Many healthcare workers had become infected, and the public was often too frightened to seek medical care.

In response, Partners in Health, together with the government, launched a CHW program to address these challenges (8, 11). A Rapid Quality Assessment (RQA) helped identify gaps in the humanitarian response, and the program was designed to fill those gaps (8, 13). The CHWs, chosen from within their communities, received training and were tasked with building trust in the health system, providing transparency about Ebola treatment, and facilitating communication between patients, their families, and healthcare providers (8). Supervisors supported CHWs through weekly meetings, ensuring strong communication and the ability to adapt as the crisis evolved.

A semi-quantitative analysis revealed that across the three chiefdoms served by the CHW program, there was a 32% increase in the number of referrals to Ebola treatment facilities (14, 15). Importantly, this did not lead to a proportional increase in confirmed Ebola cases, suggesting that the program's success lay in boosting community trust and engagement with the healthcare system. This resulted in greater participation in surveillance and early detection efforts without unnecessarily burdening the health infrastructure (8). This data was gathered by the CHW's as they went door to door each week in their communities, speaking with every person in their catchment area. They spoke with more than 17,000 people per week, and a lack of financial and human resources prevented a more detailed tracking of data. This unfortunately limits our abilities to parse this data further.

Results and recommendations

In both the Bahamas and Sierra Leone, the integration of CHWs into MMT/EMTs produced measurable improvements:

1. Increased trust: CHWs provided cultural competence and established trust with local communities, facilitating better communication and patient follow-up (13–15).
2. Higher referral rates: The presence of CHWs led to a 32% increase in the number of patients referred to healthcare facilities, as seen in Sierra Leone (7, 14).
3. Improved continuity of care: CHWs helped to ensure that patients, especially those with chronic conditions, received the necessary follow-up care MMT/EMT visit (7, 14).

The positive outcomes suggest that CHWs can be critical assets in addressing some of the key challenges faced by MMT/EMTs, particularly in gaining community trust and improving long-term health outcomes.

The following recommendations are proposed [see Nally et al. for more details (14, 21)]:

- Adopt a formal framework: Humanitarian organizations should develop standardized guidelines for integrating CHWs into MMT/EMT operations, ensuring that this collaboration is prioritized in future responses.
- Capacity building: Investment in CHW training for emergency settings should be a key component of preparedness strategies, particularly in areas vulnerable to recurring crises.
- Local partnerships: Strengthening partnerships with local NGOs and health authorities to recruit and train CHWs can improve the sustainability of humanitarian health interventions.

Acknowledgment of any conceptual or methodological constraints

These case studies highlight the potential for a systematic approach to integrating CHWs into international humanitarian health responses. The success in the Bahamas and Sierra Leone suggests that CHWs can enhance not only the effectiveness of EMTs but also their acceptability within local communities. More research in the field of Community-Based Interventions During an Emergency Response is desperately needed. Ramsbottom et al. states that "Public health emergency preparedness (PHEP) all too often focuses only on institutional capabilities, including their technical expertise and political influence, while overlooking community capabilities. However, the success of institutional emergency preparedness plans depends upon communities and institutions working together to ensure successful anticipation, response and recovery" (18). Biological crises vs. natural disasters do offer different contexts, but the same model could easily apply. "Now is the time to consider how to bring social science into the center of future pandemic surveillance, response, community preparedness, and health system strengthening" (2).

This integration is particularly relevant in low-resource settings, where political instability, climate change, and distrust in external organizations complicate health interventions. There are also external challenges to implementing and scaling CHW programs globally, such as financial constraints, political instability, and resistance within the existing health system. By leveraging CHW programs demonstrated strengths, humanitarian responses can be more culturally competent, sustainable, and effective. This provides a promising approach to addressing the trust and access barriers often encountered in humanitarian settings. Future research should explore the scalability of this model across different regions and types of emergencies, such as urban conflict zones or protracted crises. With further investigation, CHWs could become a cornerstone of more effective, culturally sensitive humanitarian health interventions.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

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Author contributions

CN: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Validation, Visualization, Writing – original draft, Writing – review & editing. MT: Supervision, Writing – review & editing. PV: Conceptualization, Formal analysis, Supervision, Writing – review & editing. AK: Methodology, Project administration, Writing – review & editing. MM: Methodology, Project administration, Writing – review & editing. MA: Conceptualization, Data curation, Formal analysis, Supervision, Validation, Writing – original draft, Writing – review & editing.

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Discussion and Lessons Learned

Summary of Major Findings

This thesis demonstrates that structured Community Health Worker (CHW) programs are not only beneficial but essential for enhancing health system resilience during crises. CHWs, as respected members of their communities, establish vital connections to health facilities. Unlike many health professionals who may be assigned to unfamiliar areas, CHWs are deeply embedded within their own communities, providing a critical foundation for health system resilience. By acting as the eyes and ears of the community, they can directly communicate local needs and hold health facilities accountable for providing necessary services. These programs create greater resilience in difficult times such as environmental disasters and epidemics (Gulzar et al., 2012; Miller et al., 2020; Perry et al., 2014; Siekmans et al., 2017).

Health systems with integrated CHW programs have been shown to be more resilient than traditional health systems during humanitarian disasters (Gulzar et al., 2012; Kok, 2015; Kok et al., 2015b; Miller et al., 2020; Perry et al., 2014; Siekmans et al., 2017). This thesis offers a practical framework for designing and scaling CHW programs during disasters, an element still largely absent from mainstream disaster response programming (UNOCHA, 2024). During the Sierra Leone Ebola epidemic, for instance, CHWs continued delivering essential services when clinical staff fled. They adapted their practices by conducting outdoor visits, implementing infection prevention protocols, and effectively communicating critical health information. Similarly, following Hurricane Dorian in the Bahamas, CHWs rapidly mobilized to assess community needs and coordinate emergency response efforts before formal systems could be reestablished. These examples demonstrate that contrary to common perceptions, well-designed and properly implemented CHW programs enhance healthcare access, promote preventive measures, and facilitate effective community-based interventions in resource-limited settings. By positioning CHWs at the forefront of disaster response, this thesis highlights their value and advocates for their systematic integration into health system planning and implementation, thereby enhancing overall health outcomes for vulnerable populations.

The following examples from Sierra Leone and The Bahamas further illustrate how CHWs contributed to resilience in concrete, practical ways. In Sierra Leone when most tertiary

care ceased during the Ebola epidemic one of the CHWs supervisors, who was a midwife by training, took it upon herself to track all the pregnant women in her catchment area, approximately 2,000 people. She would visit them regularly and while she couldn't provide primary care, she was able to offer knowledge and refer patients as needed to the hospital in the capital city. After Hurricane Dorian in the Bahamas, the large Haitian community in Abaco was identified by the MOH as a community at risk. Like many immigrant communities globally they faced discrimination and isolation and felt disenfranchised by any government supported systems as they were in the country without documentation. Americares was able to hire CHWs from those communities and provide them training with the support of clinicians from the Bahamian health system. This collaboration bridged a cultural gap that began to build a foundation of trust and understanding and led to more Haitian residents seeking care in the health system. These examples illustrate the critical ways that CHW programs contribute to the resilience of health systems after disease and disaster disrupted them. They demonstrate that integrating community-based health strategies into disaster responses is both feasible and necessary, and that doing so ensures response efforts remain grounded in the needs and realities of the affected communities.

This thesis highlights the organization of CHW programs in humanitarian settings, where CHWs emerge as key figures in understanding and addressing the complex health needs of vulnerable populations. These programs are often locally driven and tailored to the unique needs of affected communities, bringing vital health services to areas with limited formal resources. Integrating CHWs into localized health strategies enhances responsiveness, builds trust, and strengthens the overall resilience of the health system. Localization is not just a mechanism for efficiency, it is a path toward equity. By elevating the role of CHWs and local actors, localization dismantles entrenched donor-recipient hierarchies and reorients humanitarian response toward more just, contextually appropriate, and sustainable models of care (Dany, 2021; Toukan, 2025). As demonstrated throughout this thesis, well-designed and adequately supported CHW programs, grounded in community agency and contextual knowledge, play a pivotal role in expanding healthcare access, promoting preventive health measures, and facilitating inclusive, community-led interventions (Emami et al., 2024).

Findings in Context with Existing Literature

There are common themes that connect all CHW programs and contribute to their strength and resiliency in humanitarian settings. Below are some of the structural pillars intrinsic to

CHW programs that facilitate their integration into humanitarian response programming and were highlighted in our research.

Community Involvement

Communities should play a crucial role in selecting and hiring CHWs. For the programs highlighted in this thesis, potential CHWs were identified through community leaders, including men's and women's groups, district leaders, and traditional authorities such as paramount chiefs. Literature emphasizes the importance of selecting CHWs from the communities where they will work. This approach remains critical during times of crisis. This approach ensures that CHWs are familiar with the cultural, social, and economic contexts of the people they will be working with. Community members evaluate potential candidates based on their knowledge, trustworthiness, and ability to communicate effectively with local populations. Continued support from the community not only provides CHWs with encouragement and recognition, but also establishes a feedback loop that can highlight both exemplary performance and areas for improvement. Most importantly, when CHWs are selected by the community itself, a foundation of trust is established early, strengthening the acceptance of the CHWs messaging and role. (Kok, 2015a; Kok et al., 2015b; Kozuki et al., 2018; Kruk et al., 2015; Siekmans et al., 2017)

This emphasis on community empowerment and localization of CHW recruitment was evident across the case studies in this thesis. Both Sierra Leone and the Bahamas have nationalized health systems, which means that clinicians are assigned to their clinics or hospitals by the Ministry of Health (MOH). Often, they are working far from their own home and in communities where they are strangers, at least at first. This contrasts the CHWs who were hired from the communities where they work.

In Sierra Leone, following the Ebola outbreak, recruitment began with formal permission from the MOH and local Paramount Chiefs. Community engagement followed, with leadership teams, including men, women, youth, and religious leaders, tasked with identifying potential CHWs. These candidates were expected to be literate and recognized as informal leaders. From the submitted names, interviews were conducted to select those who would participate in training.

The Bahamas had a similar health system, but geographically and population wise the island Abaco was much smaller. In this context, post-Hurricane Dorian, we hung up flyers advertising the CHW positions and asking interested community members to call. When they called, a phone interview was conducted to determine their eligibility. There were several factors considered in this context, including level of education and previous community involvement. This community involvement built immediate trust in these new

health system actors and provided an initial structure amid a collapsed local health system. Leaning into localization principles and working through existing community structures strengthened the emerging health response system during both the disaster and the ensuing public health crisis.

Supervision and Communication

Supervision has been shown in the literature to link directly to the success of CHW programs. Gilmore et al. (2016) specifically cites supervision being closely linked to increased performance by CHWs, as well as contributing to credibility and community standing. A focus on active and participatory supervision is well documented as being a key to success in community-based programming (Horwood et al., 2017; Kok, 2015a; Kok et al., 2015b; Lehmann & Sanders, 2007). Conversely, a lack of clear communication channels has been shown to negatively impact the quality of humanitarian programming (Kok, 2015a; Siekmans et al., 2017).

Supportive supervision was integral to the structured CHW program in this thesis. In Sierra Leone, the effectiveness of the supervisory and communication framework was evident in the high levels of accountability and the program's ability to act on data (Nally et al., 2021; Nally et al., 2024; Nally et al., 2025). Our program allocated 10-15 CHWs per supervisor, ensuring in-person supervisory visits every two weeks. We provided cell phones to all supervisors and CHWs, establishing clear communication channels. Rather than reporting to central offices or chiefdom coordinators, CHWs communicated directly with their supervisors, creating a streamlined flow of information that enabled rapid issue resolution and timely updates.

In The Bahamas, a similar model was adopted following Hurricane Dorian. Each CHW had clearly designated communication channels and received weekly in-person supervisory visits. This structure not only reinforced program quality but also fostered continuous learning and responsiveness.

Together, these case studies reinforce the evidence in the literature: structured supervision and clear communication pathways are essential to CHW program success—particularly in dynamic and resource-constrained humanitarian settings.

Data Collection and Quality Improvement

Effective data collection is essential for any CHW program's success. This includes tracking key indicators and gathering community insights to inform responsive programming in the changing humanitarian landscape. Such data collection enables real-time program adaptation, crucial in continuously evolving situations. Equipped with

mobile phones, CHWs facilitated ongoing reporting and data collection, enabling continuous improvement and instant communication. Robust data collection also facilitates surveillance and early disease outbreak detection (Kok, 2015a; Kok et al., 2015b; Kozuki et al., 2018; Perry et al., 2014). By systematically gathering health data, CHWs identified patterns signaling disease emergence, allowing timely interventions. Our programs implemented plan-do-study-act cycles where issues were quickly identified, referred to appropriate authorities or subject matter experts, and resolved system-wide (Christoff, 2018; Provost, 2011).

The Case Studies in this thesis illustrate how robust data systems function effectively in complex humanitarian settings. In Sierra Leone each Field Based CHW was assigned a catchment area of approximately 240 people. They were required to visit each person in their catchment area every 2 weeks to conduct a visual assessment and ask health-related questions. If they identified a community member reporting or displaying symptoms of Ebola, they contacted their supervisors immediately to assist with an assessment and determine whether an ambulance should be called to transfer that person to an Ebola Treatment Unit (ETU). The Field Based CHWs tracked the number of people they spoke with, their health question replies, and the number of people referred to an ETU.

The Facility Based CHWs tracked who was admitted to the ETUs as a suspect or confirmed patient, and what their outcomes were. Finally, the Psychosocial CHWs tracked the Survivors of Ebola when they returned to their community and their readjustment, as well as the families in quarantine. All data was compiled weekly and used to determine work plans for the following week, demonstrating the role of timely, localized data in operational planning.

In the Bahamas the CHWs visited their community members weekly, going door to door to share health messages and assess family needs. These needs were reported through their Supervisor to the Program Manager who relayed them to the relevant clinic in that catchment area, creating a closed feedback loop. This information flow was vital to ensuring a learning health system that adapted to emerging needs in real time.

Maintaining the level of communication necessary for continuous quality improvement (CQI) in the humanitarian setting posed challenges. In Sierra Leone, early in the Ebola response, CHWs were unsure of the communication hierarchy. The Coordinator, overseeing 482 Field-Based CHWs and 37 Supervisors, received over 100 direct calls per day during the first week. The CHWs were bypassing their Supervisors and the Chiefdom Coordinators by communicating this way, and they were completely overwhelming that capacity of the Coordinator. This was resolved by reinforcing reporting lines during

supervisory meetings and sending a text reminder to all 680 staff, which significantly reduced call volume by the second week. This example underscores the importance of clearly defined communication pathways in maintaining effective supervision and information flow.

A primary factor in the success of the CQI system was building trust that feedback would be acknowledged and addressed appropriately. In one instance, a CHW was discovered selling home-care kits intended for families in quarantine. In many communities, informal justice mechanisms dominate, and both whistleblowers and those accused may face harsh extrajudicial retaliation. Nevertheless, someone reported the misconduct, trusting that the program's systems would respond fairly. The incident was escalated through community and program leadership, and after a collaborative review that included the Paramount Chief, the CHW was dismissed and restitution made. The peaceful and rapid resolution of this situation, despite the heightened tensions of the crisis, illustrates the power of embedded CQI mechanisms to uphold integrity and community trust.

Limitations and Challenges of this Study

Our research recognizes there are limitations and challenges in implementing structured CHW programs during humanitarian crisis. While the findings affirm the potential of CHWs to enhance resilience and service delivery, the ability to scale and sustain these programs depends on broader systemic factors, in particularly the role of governments. Governments hold the jurisdictional authority to shape their health systems, defining priorities and establishing the necessary policy frameworks to respond effectively to crises. This interplay between pre-existing systems and emergency health infrastructure was clearly observed in both case studies: in Sierra Leone, where international support complemented a fragile health system, and in The Bahamas, where the Ministry of Health demonstrated effective leadership in coordinating responses to natural disasters and public health emergencies. As the following sections will explore, maximizing the impact of CHW programs requires attention to several interrelated components: meaningful engagement with patients, families, and communities; provision of mental health support to CHWs themselves; and reliable supply chain systems. Together, these areas illustrate the importance of a collaborative, locally grounded, and resilient approach to health system strengthening. Particularly timely in the face of increasingly complex global health challenges.

Government Jurisdiction
The international health community recognizes that national governments maintain

jurisdiction over their health systems (Miller et al., 2020), including determining priorities and establishing policy and organizational structures. In Sierra Leone there was a national structure to their Health System as well as their response system, which was supported by the British Military (Cancedda et al., 2016). Engagement with the government required attendance at meetings led by the response partners as well as the MOH, nationally and regionally. In the Bahamas the MOH coordinated the response to Hurricane Dorian as well as COVID-19 and collaborated well with NGO's and INGO's who came to support those efforts. This collaboration was key to the integration of the response programming into the existing health structure and was used to facilitate ethical, community-focused, closing and transitioning to the health system of all programs when the response period had ended.

However, such collaboration was not without challenges. In Sierra Leone, for example, initial implementation of the CHW program encountered resistance from the District Health Officer (DHO), despite prior approvals from the national government and local communities. The objection stemmed from the recent adoption of a national CHW policy. Although it had not yet been implemented, the DHO felt that a parallel CHW program outside national guidelines could undermine future efforts. The impasse was resolved through a simple but strategic adjustment: renaming the CHWs as "Ebola Response Volunteers." With this change, the DHO granted approval, allowing implementation to proceed.

This example illustrates that while working within government structures can be complex, respectful engagement, problem-solving, and adaptability are essential. Identifying the root of bureaucratic hesitation and offering constructive, locally acceptable alternatives can unlock stalled processes and build long-term trust.

Enhanced Engagement of Patients and Families
The COVID-19 pandemic highlighted universal weaknesses in health systems and emphasized the need for enhanced engagement of patients, families, and communities as active partners in healthcare (Isasi et al., 2021). No longer could these groups be viewed as passive participants in health care, they needed to be engaged as active partners. The consequences of any nation's health infrastructure succumbing to pandemic stressors reverberate globally. In the context of a global crises such as COVID-19, the notion that "health system resilience is (thus) a global public good and needs a collective response from the global community " gained prominence, as emphasized by Kruk et al. (2015, p.1). This assertion is particularly relevant for infectious diseases, which can impact globally and compel a collective global response. The research is clear that CHWs advocate for patients and communities, ensuring their voices are heard in healthcare decisions and

promote self-advocacy which improves health outcomes (Bitanihirwe, 2016; Emami et al., 2024; Gilmore et al., 2016; Horwood et al., 2017; Kok et al., 2015b)

During the responses to Ebola and COVID-19 the best positioned health care workers to strengthen this link with patients and families were CHWs (Nally et al., 2021). The case study in Sierra Leone showed how they were able to engage the community by maintaining connection with patients in the ETU's. They also provided direct support to families in quarantine by organizing their communities to fill gaps that could not be filled by the government or international response, for example the daily collection of water for these families unable to leave their compounds. By creating consistent, trusted lines of communication, CHWs helped to ease the fear-based responses that had previously taken hold in communities. Responses rooted in mortal fear, long-standing disconnection from formal health systems, and a lack of locally grounded community health engagement.

The COVID-19 pandemic in the Bahamas demonstrated the strength of engaging direct community support in particular when the CHWs explained the evidence-based details of the virus and how it was transmitted. This in turn increased compliance with mask and distancing mandates in their communities.

These examples underscore the importance of engaging families and communities in the design and implementation of humanitarian interventions. A localized lens that is rooted in real-time feedback and community-identified barriers, enables more adaptive, relevant, and resilient programming that better meets the needs of those most affected.

Mental Health Support
CHWs and their supervisors often operate in environments marked by chronic stress, insecurity, and trauma. Without adequate support systems, these pressures can severely affect their mental health and compromise both individual wellbeing and program effectiveness. While CHWs are often positioned as providers of psychosocial support, their own experiences as survivors of the same crises are frequently overlooked.

Research underscores the necessity of addressing CHW mental health, not only as an ethical imperative, but also as a practical strategy for sustaining high-quality, community-based health interventions in humanitarian settings (Chaturvedi et al., 2025; Fredricks et al., 2017; Hoh, 2020; Perry et al., 2014; Siekmans et al., 2017). The mental wellbeing of frontline health workers is foundational to program resilience, trusted engagement, and appropriate care delivery.

This thesis demonstrates the value of mental health interventions for community members, but equal attention must be paid to supporting CHWs and other frontline responders. In the Case Studies featured here, mental health services for CHWs were integral to the program design, through debriefing sessions, peer support, and trauma-informed supervision, mental health support from front-line healthcare workers should be considered a core component of humanitarian health programming, not an optional addition.

The literature confirms that mental health support is critical to effective programmatic implementation (Bitanihirwe, 2016; Hoh, 2020). Regular supervision and peer support groups can create a space for CHWs to share experiences and challenges, thereby reducing feelings of isolation. Providing training focused on mental health awareness and coping strategies can empower CHWs to manage their own psychological well-being. Creating a supportive organizational culture that prioritizes the mental health of CHWs can lead to better outcomes for both workers and the communities they serve.
In Sierra Leone the mental health of CHWs was supported through multiple program elements. All CHWs received training in mental health best practices, including communication skills, stigma reduction, and the reintegration of Ebola survivors into community life. The CHWs themselves were provided weekly in-person visits by supervisors which included Wellness Checks for the CHWs and their families. This direct support allowed individualized support to be developed, whether for grief, stress, or family-related challenges.

One example of this occurred when a CHW in Sierra Leone passed away from a heart condition. Their death left their wife and children bereaved, and without the financial support the position brought. After a discussion with the CHWs Supervisor and the Paramount Chief in the district, the program offered the CHW position to the brother of the deceased staff. We also determined that we would pay the brother now doing the work, and we would pay the widow of the CHW for the remainder of their contract. This community-endorsed response illustrates how programs can address both mental health and economic stability in culturally responsive ways.

In the Bahamas CHWs received instruction on Psychological First Aid as part of their training. Ongoing psycho-social support was facilitated weekly via WhatsApp check-ins between supervisors and CHWs, as well as weekly in person visits. These engagements included discussions of weekly "highs and lows" and enabled the tailoring of support mechanisms for individual CHWs and their communities.

These examples highlight the importance of providing structured mental health support to all program participants, communities and staff alike. The support should be culturally grounded and tailored to address the specific psychological impacts of the crisis context.

Supply Chain Management

In humanitarian settings, developing strategies for stable supply chains is imperative for uninterrupted work. This may include establishing parallel systems and maintaining slight overstocks of essential items, along with decentralized storage. While common practice establishes central warehouses where CHWs replenish supplies at fixed times, decentralizing this system would strengthen health system resilience (Burkle et al., 1996; Kruk et al., 2015; Kuday et al., 2023; Lehmann & Sanders, 2007). Some methods include allowing supervisors to store stock in their homes or establishing supervisor-managed warehouses closer to communities, ensuring feasible access during disruptions.

In Sierra Leone, a CHW reported a locked home in their community that appeared to be full of buckets with International Organization for Migration (IOM) stickers. This was reported through the communication chain to the Program Director who reached out to IOM to inquire about the home. We learned that IOM had purchased these cleaning supplies for quarantine families, but they had no way to distribute them. In coordination with IOM, we implemented a system within our program where CHWs could request the supplies for a family in quarantine, and they would be delivered by our Logistics Coordinator directly to the families.

In the Bahamas after Hurricane Dorian, it was difficult for the impacted communities to travel between islands in order to collect their prescription from the pharmacy serving the many tiny islands surrounding Abaco. The CHW working on one of these small islands, Man of War Cay, reported this issue to their supervisor. We devised a method whereby the local doctor would call the prescription into the pharmacy on the main island, and one of our supervisors would pick them up weekly and deliver them to the ferry service for the various small islands. The CHWs in turn would meet the ferries and distribute the prescriptions. In this way the CHW program filled a gap in the supply chain exacerbated by the hurricane.

These examples illustrate the vital role that CHWs can play in maintaining functional supply chains in disrupted environments. By decentralizing storage and integrating community feedback into logistics systems, CHW programs can increase flexibility and responsiveness, which are key components of resilient humanitarian response. Embedding supply chain responsiveness into CHW program design, as demonstrated in

our Case Studies, strengthens not only service continuity but also trust and relevance at the community level.

Limitations and Challenges of CHW Programs

While Community Health Worker (CHW) programs have demonstrated success in improving health outcomes, their implementation is not without significant limitations and challenges. A primary issue lies in the persistent undervaluation of CHWs within health systems. Despite their deep community knowledge and critical bridging role, CHWs are often excluded from decision-making processes and viewed as peripheral rather than integral to healthcare delivery. This marginalization is particularly evident in hierarchical systems where professional cadres such as doctors and nurses are prioritized, resulting in limited recognition, poor remuneration, and constrained career progression for CHWs (Kane et al., 2016; Kok et al., 2015a; Kok et al., 2015c; Krok-Schoen et al., 2016; Lehmann & Sanders, 2007; Mistry et al., 2009).

Another major challenge is the organizational and operational strain placed on CHW programs. High workload, insufficient training, weak supervision, and lack of logistical support all undermine CHW effectiveness. Evidence from low- and middle-income countries highlights that CHWs are frequently tasked with too many responsibilities— ranging from health promotion to surveillance—without corresponding increases in resources or support (Astale et al., 2023; Gilmore et al., 2016; Kok et al., 2015b). Many operate in remote, underserved areas with limited infrastructure, leading to reduced productivity, risk of burnout, and attrition (Arab-Zozani & Ghoddoosi-Nejad, 2020; Fredricks et al., 2017). Programmatic inconsistencies—such as unclear role definitions, inadequate integration with formal systems, and lack of career progression—further challenge program stability and sustainability (Asweto et al., 2016; Horwood et al., 2017; Kok et al., 2016; Scott et al., 2018).

These limitations were evident in the case studies presented in this thesis. For example, in the Bahamas, integrating CHWs into formal clinical settings was complicated by language and cultural barriers, fear-based behavior among community members, and resistance from clinic staff. Overcoming these barriers required individualized engagement and sustained advocacy, which was effective but not easily scalable. Such examples underscore the need for institutional-level shifts that recognize CHWs as core health actors, rather than temporary or auxiliary workers.

The literature and this thesis consistently identify the following barriers and limitations to CHW effectiveness and sustainability in humanitarian and health system settings:

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- **Workload and task burden**: CHWs commonly report being overburdened with multiple and sometimes competing responsibilities, which negatively impacts performance and well-being (Astale et al., 2023; Gilmore et al., 2016; Kok et al., 2015b).
- **Inconsistent training and supervision**: Variability in the quality and frequency of training, along with insufficient ongoing supervision, hinders program quality and CHW confidence (Horwood et al., 2017; Kok et al., 2016; Scott et al., 2018).
- **Poor clinical integration**: CHWs often struggle to coordinate with clinical teams due to role ambiguity and institutional resistance (Kok et al., 2015a; Kok et al., 2015c; Schriger et al., 2024).
- **Job insecurity and funding gaps**: Many CHWs work under temporary contracts or programs reliant on short-term funding, creating instability and high turnover (Arab-Zozani & Ghoddoosi-Nejad, 2020; Fredricks et al., 2017; Hand et al., 2021; Krok-Schoen et al., 2016).
- **Limited empowerment and recognition**: Structural and relational barriers within health systems can limit CHW autonomy, suppressing their ability to act as true agents of community empowerment (Kane et al., 2016; Kok et al., 2015a; Lehmann & Sanders, 2007; Mistry et al., 2009).

Addressing these entrenched systemic and operational challenges is essential to strengthening CHW program effectiveness and ensuring their sustainability, particularly in crisis-prone or resource-constrained settings. The following section discusses structural and programmatic approaches to mitigate these barriers and realize the full potential of CHW programs in future humanitarian responses.

Reflection on What Could Be Done to Optimize Support for CHWs

While this thesis provides evidence that demonstrates the value of CHW programs in humanitarian and disaster contexts, optimization of their support structures is urgently needed. Numerous studies emphasize that well-supported CHWs are more effective, resilient, and sustainable. Optimizing CHW support requires not only financial investment but also institutional recognition, protection, and alignment within broader health system goals. Literature reviewed suggests that CHWs thrive when systemic enablers are present, particularly those that affirm their legitimacy, enhance their working conditions, and strengthen coordination mechanisms (Kok et al., 2015b; Miller et al., 2020a; Scott et al., 2018).

CHWs are often under-compensated, under-supervised, and insufficiently integrated within the health system. Addressing these barriers requires both concrete reforms and a

broader paradigm shift that repositions CHWs as core health actors rather than supplemental or temporary labor. Strengthening support must occur across domains: training, compensation, coordination, protection, and career development. Critically, optimizing CHW programs also involves co-design with local stakeholders and CHWs themselves to ensure contextual appropriateness, cultural alignment, and long-term sustainability (Kane et al., 2016; Astale et al., 2023; Gopalakrishnan & Raghunandan, 2018).

Across the three case studies in this research, several optimization strategies were successfully implemented. These included ongoing training, fair remuneration, structured supervision, and provision of psychosocial and peer support for front-line health workers. However, other key elements of optimization were limited by structural constraints within the humanitarian response system and the lack of sustained funding post-disaster, even for scaled-down versions of the program. These gaps underscore how systemic barriers, rather than programmatic intent, often inhibit the full realization of CHW potential. Recommended Strategies to Optimize CHW Support:

- **Standardized and continuous training**: Ensure initial training is context-specific, participatory, and regularly updated through refresher courses and peer-learning structures (Kok et al., 2015c; Scott et al., 2018).
- **Fair remuneration and job security**: Compensate CHWs in line with national standards for public health workers and provide secure contracts with benefits where feasible (Krok-Schoen et al., 2016; WHO, 2021).
- **Supervisory structures**: Embed structured and supportive supervision within CHW programs, including mentorship models and feedback loops (Horwood et al., 2017; Astale et al., 2023).
- **Recognition and professional pathways**: Integrate CHWs into national health systems with formal recognition, opportunities for advancement, and eligibility for certification or formal roles (Miller et al., 2020a; Gopalakrishnan & Raghunandan, 2018).
- **Psychosocial and peer support**: Establish mental health services, debriefing spaces, and peer-to-peer networks, particularly in post-crisis settings (Schriger et al., 2024; Hoh, 2020).
- **Infrastructure and logistics support**: Provide adequate supplies, mobile tools, and transportation options to facilitate outreach and maintain safety and efficiency in remote contexts (Scott et al., 2018; Astale et al., 2023).

- **Co-creation and localization**: Involve CHWs in program design and monitoring and align programs with local governance and customary leadership systems to build ownership and sustainability (Perry et al., 2016; Barbelet, 2018).

Ultimately, supporting CHWs is not merely a technical task but a political commitment. It requires sustained investment and structural inclusion, particularly in fragile contexts where their contributions are both essential and overlooked. Optimized support enables CHWs to act not only as service providers but as agents of resilience, equity, and trust in humanitarian response systems.

Researcher Positionality

As both a researcher and a practitioner with over two decades of experience in humanitarian health programming, my dual role inevitably shaped the framing, interpretation, and priorities of this study. My professional background provided deep contextual understanding and facilitated access to field sites, partners, and decision-making spaces that might otherwise be inaccessible to academic researchers. This positionality enabled nuanced insights into the dynamics of CHW implementation during crises. However, it may also have introduced certain biases, particularly in the advocacy of CHWs as agents of resilience and in the interpretation of programmatic success. While every effort was made to apply rigorous analytical and methodological standards rooted in Implementation Science, Systems Thinking, and process and analytical research, including triangulation, peer debriefing, and transparent data interpretation, I acknowledge that my commitments to equity and localization in humanitarian practice likely influenced the research's normative framing. This reflexive approach aligns with a growing call in global health and implementation science to recognize the positionality of embedded researchers and to situate knowledge production within its social and institutional contexts (Adam & Donelson, 2020; Kok et al., 2016; Vindrola-Padros et al., 2020). As such, this research is best understood as analytical, with the aim of informing future performance rather than simply describing present conditions.

Reflection on Research Aims and Theoretical Contributions

This thesis set out to examine how Community Health Worker (CHW) programs can be designed, implemented, and evaluated to strengthen health system resilience in humanitarian and disaster settings. The three empirical papers responded to this aim by exploring (1) the use of rapid qualitative assessments to inform program design in acute emergencies, (2) the integration of Continuous Quality Improvement (CQI) methods to

support adaptive implementation, and (3) the role of CHWs in sustaining community trust, improving service access, and supporting psychosocial recovery.

Collectively, the findings demonstrate that CHWs can serve as a bridge between communities and formal health systems, not only delivering services, but also facilitating real-time data collection, community feedback, adaptive learning, and trust-building. This supports the thesis's central argument that resilient health systems require not only strong structures but also embedded learning mechanisms that engage communities as active partners in health governance.

This thesis contributes to the implementation science literature by demonstrating how commonly referenced frameworks (such as CFIR and the Dynamic Sustainability Framework) can be operationalized in chaotic, low-resource humanitarian environments. It also contributes to systems thinking by illustrating how CHW programs function as adaptive, decentralized systems nested within broader humanitarian response architectures. By combining empirical fieldwork with an embedded, participatory approach to learning and governance, the thesis positions CHW-led models as both evidence-based and context-responsive tools for future humanitarian health interventions.

Research Gaps and Future Directions

This thesis establishes a practical framework for the rapid implementation and scaling of Community Health Worker (CHW) programs to meet humanitarian needs. CHWs have demonstrated considerable potential for improving health system resilience during humanitarian emergencies, however, further research is needed to optimize their effectiveness. Key areas for further investigation include:

1. **Development of an evidence-based comprehensive guide for implementing CHW programs during humanitarian responses**: While this thesis provides a foundational structure for designing and scaling CHW programs during crises, a globally applicable, evidence-based implementation guide is needed. Future research should explore diverse models of recruitment, training, supervision, and integration, particularly in fragile and fast-changing environments. Comparative analysis of training methodologies would also contribute significantly to the global humanitarian health toolkit.

2. **Efficient methods of data gathering**: Although data collection in humanitarian settings can be challenging and is often perceived as burdensome, it is essential for informing effective decision-making. In complex disaster settings, programmatic

choices must be grounded in timely, relevant data to ensure responses are efficient, adaptive, and ultimately lifesaving. Research into tools and technologies that reduce data collection burdens while preserving data quality will be essential to operational effectiveness.

3. **Sustainable Funding Mechanisms for CHW programs in disaster settings**: Long-term financing remains one of the most critical and persistent barriers to implementing and scaling CHW programs in humanitarian settings. Strategic investment is needed to ensure fair compensation and provision of essential components outlined in this thesis, such as adequate compensation, training, supervision, and mental health services. Further research should examine how donor frameworks, domestic resource mobilization, and public-private partnerships can collectively support the development and sustainability of durable CHW systems in crisis settings.

4. **Address systemic barriers within health systems that limit CHW effectiveness**: Drawing on optimization frameworks and implementation science, future research should explore how to embed CHW programs more deeply and equitably within national health strategies.

Addressing these research gaps is critical to more effectively leveraging CHWs to improve health outcomes and reinforce both community and system resilience in humanitarian contexts. Future work must continue to build the evidence base for what works, why it works, and how it can be replicated ethically and efficiently across diverse settings.

Conclusions

This thesis underscores the critical role of CHWs in enhancing health system resilience during humanitarian crises and offers guidance for establishing and scaling CHW programs in such settings. The findings affirm that well-structured CHW programs are essential for delivering culturally relevant care, driving localization, and bridging gaps between communities and formal healthcare systems. CHWs must be recognized as integral actors in humanitarian programming.

As trusted community members, CHWs are uniquely positioned to address local health needs, foster trust, and improve health outcomes. Their embeddedness enables them to serve not only as service providers but also as connectors, advocates, and first responders.

The implications of this research extend beyond immediate findings. A paradigm shift is needed, one that fully integrates CHWs into health systems as core contributors to

resilience, particularly during times of stress. This thesis provides actionable recommendations for incorporating CHWs into humanitarian responses, including strategies for rapid assessment, adaptive implementation, and sustainable integration.

As we navigate increasingly complex global health challenges, CHWs represent a critical strategy for both emergency response and long-term system resilience. Policymakers, practitioners, and researchers must collaborate to implement these findings, ensuring CHWs are adequately supported, equipped, and empowered to lead health improvements from within their own communities. By centering CHWs in humanitarian health efforts, we can build systems that are not only more responsive and resilient, but also more equitable and just.

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Strengthening Health System Resilience through Community Health Worker Programs in Humanitarian Crises

Structured Community Health Worker (CHW) programs are essential to resilient health systems during crises like natural disasters and epidemics. CHWs are trusted members of their communities and serve as important links between local populations and health facilities. They live and work in the same areas as the people they serve so they understand local needs and can effectively communicate those needs to health providers, as well as communicating key health information to their community from the health systems. Their local knowledge and established trust within communities enable them to combat misinformation and facilitate health education effectively. This unique connection thus supports appropriate and targeted action during emergencies.

Research has shown that health systems with integrated CHW programs tend to be more resilient than traditional health systems when faced with humanitarian disasters. However, there is minimal research on how to best organize such programs for maximum effectiveness during health crises. This thesis describes the Ebola outbreak in Sierra Leone as a valuable example of how CHWs can be effectively utilized in such situations. By placing CHWs at the forefront of the response, this dissertation highlights their importance and calls for their systematic inclusion in health planning to improve outcomes for vulnerable populations.

Importantly, effective CHW programs must be thoughtfully designed, with strong communication channels, active supervision, and robust data collection methods. In our text we therefore give examples of building an effective and impactful CHW program in a humanitarian context, including applications for Rapid Qualitative Assessments (RQA), Quality Improvement (QI), and plan-do-study-act cycles (PDSA). CHWs can indeed quickly adapt to changing circumstances, such as during the Ebola outbreak when they modified their home visit practices to ensure safety while continuing to provide care.

In summary, this thesis highlights the essential role of CHWs in enhancing health system resilience, particularly during emergencies. It calls for further attention to how health systems incorporate CHWs into their frameworks and emphasizes the need for further research to strengthen these programs. By investing in and supporting CHWs, we can improve health outcomes and build stronger, more resilient communities, ultimately leading to a healthier and more equitable world.

Versterking van de veerkracht van gezondheidssystemen door *Community Health Worker*-programma's in humanitaire crises

Gestructureerde 'Gezondheidwerkers vanuit de Gemeenschap' (GwG) programma's zijn essentieel voor de veerkracht van gezondheidssystemen tijdens crises zoals natuurrampen en epidemieën. GWG's zijn vertrouwde leden van hun gemeenschappen en dienen als belangrijke schakels tussen de lokale bevolking en gezondheidsfaciliteiten. Ze wonen en werken in dezelfde gebieden als de mensen die ze van dienst zijn, zodat ze de lokale behoeften begrijpen en deze effectief kunnen overbrengen aan zorgverleners en omgekeerd ook belangrijke gezondheidsinformatie vanuit die zorgverleners kunnen doorgeven aan hun gemeenschap. Dankzij hun lokale kennis en gevestigde vertrouwen binnen gemeenschappen kunnen ze verkeerde informatie bestrijden en effectief gezondheidsvoorlichting geven. Deze unieke verbinding zorgt dus voor passende en gerichte actie tijdens noodsituaties.

Onderzoek heeft aangetoond dat systemen waar GWG-programma's bestaan veerkrachtiger zijn dan traditionele gezondheidssystemen wanneer deze geconfronteerd worden met humanitaire rampen. Er is echter minimaal onderzoek gedaan naar hoe deze programma's het beste georganiseerd kunnen worden voor maximale effectiviteit tijdens gezondheidscrises. Dit proefschrift beschrijft de Ebola-uitbraak in Sierra Leone als een waardevol voorbeeld van hoe GWG's effectief kunnen worden ingezet. Door GWG's in de voorhoede van de respons te plaatsen, benadrukt deze dissertatie hun belang en roept het op tot een systematische opname van GWG in de planning van de gezondheidszorg om aldus de uitkomst voor kwetsbare bevolkingsgroepen te verbeteren.

We benadrukken verder dat effectieve GWG-programma's doordacht moeten worden georganiseerd, met sterke communicatiekanalen, actief toezicht en robuuste methoden voor gegevensverzameling. In de tekst geven we daarom voorbeelden bij het opbouwen van een effectief en impactvol GWG-programma in een humanitaire context, waaronder toepassingen voor Rapid Qualitative Assessments (RQA), kwaliteitsverbetering (QI) en plan-do-study-act cycli (PDSA). GWG's kunnen zich immers snel kunnen aanpassen aan veranderende omstandigheden, zoals tijdens de Ebola-uitbraak, toen ze hun werkwijzen voor huisbezoeken aanpasten om de veiligheid te garanderen en toch zorg te blijven verlenen.

Samenvattend benadrukt dit proefschrift de essentiële rol van GWGs in het verbeteren van de veerkracht van gezondheidssystemen, met name tijdens noodsituaties. Het vraagt om meer aandacht voor de manier waarop gezondheidssystemen GWG's opnemen in hun kaders en benadrukt de noodzaak voor verder onderzoek om deze programma's te versterken. Door te investeren in GWG's en ze te ondersteunen, kunnen we gezondheidsresultaten verbeteren en sterkere, veerkrachtigere gemeenschappen opbouwen, wat uiteindelijk leidt tot een gezondere en rechtvaardigere wereld.

Appendices

Global Presentation of Research

Nally C. Ebola Outbreak: Population based fear. International Conference on Emergency Medicine (ICEM), Amsterdam, The Netherlands. In person. June 16, 2023

Adam MB, Donelson AJ, **Nally C**, Okutoyi L, Shelton, B. Trust is the Treatment: QI's Opportunity to Address the Health Systems Most Desperate Dilemma. Institute for Healthcare Improvement Forum, Orlando Florida, Dec 14, 2022

Adam MB, Donelson AJ, **Nally C,** Okutoyi L, Shelton, B. Re-imaging Design: How Human Centered Design unlocks potential in view of the Human Capital Index. 6th Global symposium on Health Systems Research, (virtual) November 18, 2020.

Nally C. Community Based Response During an Epidemic Disaster. 2019 Aga Khan University Hospital, Nairobi, Kenya. In person. In person. June 27, 2019

Acknowledgments

Weekly Report: Community Health Worker Program May 2, 2015

Written and compiled by **Cora Nally**, with information gathered from all 680 members of the Community Health Worker Ebola program, and the wider Ebola Response coordination system.

What follows is an example of the weekly reports provided to the response leaders, government representatives, British Military response coordination, and the Paramount Chiefs in the districts where this program operated.

Weekly Report for April 26 – May 2, 2015
Community Health Worker Program
Port Loko, Sierra Leone
Compiled by: Cora Nally, CHW Program Manager

Work update: 1) We completed a full assessment of our work in the Field. The assessment included a review of field data we receive weekly, independent reports from other NGO's regarding our activities, in person discussions with our Chiefdom Coordinators, discussions with community leaders, and a random sampling of interviews in communities where our workers are performing active case finding and social mobilization. Based on the survey we can confirm our staff is working on the ground performing Social Mobilization activities. 2) We completed the UNICEF assessment of 306 schools and presented a report at the District Task Force meeting.

Field Based ERV's: health message delivery and screening					
Chiefdom	# of households visited	# of females screened	# of males screened	# of children under 5	Total people screened	# of sick people found
Kafu Bullum	3,438	13,145	12,929	3,804	26,074	11
Lokomasama	3,553	14,114	13,551	5,259	27,665	0
Maforki	2,218	8,775	8,646	3,107	17,643	0
TOTAL	**9,209**	**36,034**	**35,126**	**12,170**	**71,382**	**11**

Psycho-Social ERV's			
Chiefdom	New Suspect Case Families Supported	New Bereaved Families Supported	New Quarantined Homes Supported
Kafu Bullum	1	26	0
Lokomasama	3	4	0
Maforki	2	8	0
TOTAL	**6**	**38**	**0**

Psycho-Social ERV's Demographics *started tracking week 8				
Chiefdom	Females Supported	Males Supported	Total People Supported	People reporting improvement after PSS vistit
Kafu Bullum	238	190	425	342
Lokomasama	143	133	276	200
Maforki	91	61	142	125
TOTAL	**472**	**384**	**843**	**667**

Staff update: 1) Adama Nyelenkeh was promoted from PSS Coordinator to Program Officer for the CHW Program. We are very confident she will continue to lead with wisdom, knowledge, and compassion. 2) Cora Nally, the Program Manager, is departing Sierra Leone on Wednesday as her contracted time has ended. She would like all the CHW staff to know how much she enjoyed her time in Port Loko, how proud she is of the amazing job done every day by the staff in the office and the ERV's in the community, and how much she will miss everyone.

Trainings this week: 1) The Field Based Supervisors participated in a TOT focusing on identifying why people in the community are dying but no one is reporting being sick. The Supervisors should return next week to the field visit with some in site. 2) The PSS workers continued to sensitize this week using 'Effective EVD Messages" provided by the WHO. They also delivered messages about going back to school and focusing on the safety of children while at school. **Total Trained: (19 males, 21 females)**

Looking ahead We plan to use our employees at the Chiefdom level to assist with a survey of all PHU's in the District. This activity will be led by CDC and WHO with support from the DHMT. We are going to ask our Supervisors to determine whether there were Health Committees existing in the villages before Ebola. If we determine they were there before, we will work to reactivate them in order to stimulate the Social Mobilization at the community level.

Psycho-Social ERV's Outreach Efforts			
Chiefdom	# of Households Visited	# of females reached	# of males reached	Total People Reached
Kafu Bullum	271	576	487	1,063
Lokomasama	465	832	751	1,583
Maforki	347	388	351	759
TOTAL	**1,083**	**1,796**	**1,589**	**3,405**

Program Overview and Demographics

The CHW program in Port Loko was started January 12, 2015. We have hired and trained 677 community based Ebola Response Volunteers (ERV's) who work under three designations; Field Based ERV's, Facility Based ERV's, and Psycho-Social ERV's. All 677 are currently working in three Chiefdoms; Kafu Bullum, Lokomasama, and Maforki. 178 of them are women, 499 are men. Of the 48 Supervisors, 25 are women and 23 are men. 27 of our CHW's are Survivors.

- Field Based ERV's are 'active case finders' and deliver health messages in the villages.

- Facility Based ERV's provide a communication link between patients in facilities and their families in the villages, they also provide pscyho-social support to patients and connect them with other health services when they are discharged.

- Psycho-Social Support ERV's are assigned specific cases to follow and support; bereaved families, quarantine homes, and families where a suspect case has been removed. PSS workers have started providing health outreach to communities; for them moment they are focusing on hand washing. Week after next the focus will switch to condom use.

- There is a team of 11 managing and supporting these ERV's and the overall CHW Program in Port Loko.

TOTAL TO DATE						
Field Based ERV's: health message delivery and screening						
Chiefdom	# of households visited	# of females screened	# of males screened	# of children under 5	Total people screened	# of sick people found
Kafu Bullum	22,708	76,452	74,575	24,246	167,715	118
Lokomasama	22,794	79,759	72,221	33,100	174,879	22
Maforki	11,131	42,080	40,743	16,611	93,701	54
TOTAL	**56,633**	**198,291**	**187,539**	**73,957**	**436,295**	**194**

TOTAL TO DATE			
Psycho-Social ERV's			
Chiefdom	Suspect Case Families Supported	Bereaved Families Supported	Quarantined Homes Supported
Kafu Bullum	39	138	21
Lokomasama	17	37	4
Maforki	35	70	4
TOTAL	**91**	**245**	**29**

CORA P. NALLY, MPH

QUALIFICATIONS

Health Systems Strengthening | Program Development/Management | Emergency Response

Capacity Building | Maternal & Child Health | Health Care Delivery
Curriculum Development | Training Delivery
Project Strategy | Research Management & Facilitation

EDUCATION

PhD Candidate, *Defending in June of 2025*, Ghent University, Belgium
    Dissertation title: The Role of Community Health Workers in Disaster and Humanitarian Settings
    Supervisors: Prof. Dr. Patrick Van de Voorde, Prof. Dr. Marleen Temmerman, Dr. Mary Adam
Masters, Public Health, AT Stills University, USA
BS, Psychology: Washington State University, USA

RESEARCH INTERESTS

Community Health Workers (CHWs)	Health Systems Resilience
Disaster and Humanitarian Response	Continuous Quality Improvement
Rapid Qualitative Assessment	PDSA Cycles

ACADEMIC PUBLICATIONS

1. Lead Author: Nally, C. P., Van de Voorde, P., Temmerman, M., Koroma, A., Mitchell, M., & Adam, M. B. (2025). Bridging the gap: Community health workers as a vital link in humanitarian medical responses. *Frontiers in Disaster Emergency Medicine, 3*, Article 1529772. https://doi.org/10.3389/femer.2025.1529772
2. Lead Author: Nally, C. P., Temmerman, M., Van de Voorde, P., Koroma, A., & Adam, M. B. (2024). Using continuous quality improvement in community-based programming during disasters: Lessons learned from the 2015 Ebola crisis in Sierra Leone. *Disaster Medicine and Public Health Preparedness, 18*, e316. https://doi.org/10.1017/dmp.2024.270
3. Lead Author: Nally, C. P., Van de Voorde, P., Temmerman, M., & Adam, M. (2021). Germs, guns, and fear in disaster response: A rapid qualitative assessment to understand fear-based responses in the population at large: Lessons from Sierra Leone 2014–2015. *Disaster Medicine and Public Health Preparedness.* https://doi.org/10.1017/dmp.2021.358
4. Contributing Author: Cancedda, C., Davis, S. M., Dierberg, K. L., Lascher, J., Kelly, J. D., Barrie, M. B., Nally, C. P., et al., & Farmer, P. E. (2016). Strengthening health systems while responding to a health crisis: Lessons learned by a nongovernmental organization during the Ebola virus disease epidemic in Sierra Leone. *The Journal of Infectious Diseases, 214*(Suppl 3), S153–S163. https://doi.org/10.1093/infdis/jiw345

RELEVANT EXPERIENCE

Americares
Director, International Humanitarian Response
Headquarters, USA
2022 to 2025

Lead Americares international humanitarian team in responding to sudden onset emergencies and disaster globally
- Supported the organization wide response to sudden onset disasters and emergencies, 25-30 globally annually, with budgets ranging from $20k to $3 million USD
- Built capacity in 6 country offices to respond locally to emergencies and disasters
- Strengthened the humanitarian programs team through collaboration and coordination across the department, organization, and globally

Project HOPE
Country Director
Nassau and Abaco, The Bahamas
2020 to 2022

Lead the Project HOPE response to Hurricane Dorian in the Bahamas, pivoting to Covid-19 Response and Health Systems Strengthening
- Developed, Hired, and Trained a CHW work force for Abaco and the surrounding Cays: focused on WASH Education, Covid-19 Mitigation and Information, NCD community support, and RNMCH
- Managed, coordinated, and lead the Project HOPE Bahamas program, including further health System Strengthening
- Served as a deployable Team Lead for Emergency Responses, including serving as Team Lead for the Haiti earthquake in 2021
- Innovated a proven NCD program model by using CHW's as the implementors to further demonstrate their value in strong health systems

Americares
Country Lead
Nassau and Abaco, The Bahamas
2019 to 2020

Lead the Americares response to Hurricane Dorian in the Bahamas, pivoted to Covid-19 Response as the Pandemic spreads
- Managed, coordinated, and lead the Americares medical team as they provide primary care, including mental health and psychosocial support services, to people impacted by Hurricane Dorian.
- Piloted the first Community Health Volunteer (CHV) program in the country in cooperation with the Ministry of Health. After a successful pilot, we have scaled that program to Greater Abaco.
- The CHV program began to strengthen the health system after the devastation of Hurricane Dorian, it then pivoted to Pandemic support, providing evidence-based information to the communities in Abaco. Program also focused on hurricane preparedness with the community.

Partners in Health Ebola Response
Community Health Worker Program Manager
Port Loko, Sierra Leone
2015

Built an Ebola Response work force of 680 trained Health Workers that provided a health systems for 250,000 people
- Hired and trained 680 Community Health Workers (CHWs) for the Ebola response. Training included transmission, prevention, treatment, signs and symptoms, as well as effective CHW communication and work skills.
- Built three cadres of CHWs through training and field capacity-building:
  - Field Based CHWs who specialized in active case finding and social mobilization.
  - Facility Based CHWs who focused on providing communication feedback to the community and extra care to patient's receiving treatment in a low resource health system.

Cora P. Nally MPH
tcnally@gmail.com

        o   Psycho-Social CHWs who were deployed as case managers to any person or household needing extra support in the district.

- Managed, hired, and trained 11 program staff to supervise and implement the program.
- Coordinated with partners on the ground for Ebola Response, including sharing resources and combining training efforts.
- Managed a budget of $4 million annually in a country with rampant pilfering; expected 6% loss and our program lost 0%.
- Created a comprehensive plan for Post-Ebola health systems strengthening. Including comprehensive management structures, training plans for three years, and reporting and funding structures.

Global Public Health Consultant
2007 to 2025

- Lead international humanitarian responses for 25–30 emergencies annually, managing budgets up to $3M and strengthening country office response capacity.
- Managed global health programs, including the Hurricane Dorian response and CHW workforce development initiatives.
- Established and scaled CHW programs in crisis settings like Sierra Leone and the Bahamas, introducing innovative emergency healthcare models.
- Designed national strategies for maternal health, NCD care, and pandemic response with Ministries of Health and NGOs.
- Contributed to strategic planning for global humanitarian response, localization frameworks, and climate resilience, including a 5-year Gaza plan.
- Published on CHWs in disaster settings, fear-based behaviors, and quality improvement in peer-reviewed humanitarian journals.
- Partnered with organizations like CARE, Save the Children, and PIH to deliver large-scale, sustainable health programs.
- Developed and delivered emergency health training and curricula for global audiences, from Sierra Leone to Russia.
- Managed multi-million-dollar humanitarian operations in complex emergencies including Ebola, Haiti, Libya, and Gaza.
- Led programs across Africa, the Caribbean, Eastern Europe, and Asia, bringing cross-cultural expertise in diverse geopolitical contexts.

LANGUAGES
English 4/4 – Native Speaker
French 2/2
Japanese 1/1

PUBLIC SERVICE
Peer Review Roles Frontiers in Disaster and Emergency Medicine, Disaster Medicine and Public Health Preparedness, BMC Health Services Research, The Lancet Public Health
Peace Corps, Community Development Volunteer in Benin
Seattle Childbirth Association, Seattle, Washington: *Board Member*
Midwives on Missions of Service, Freetown, Sierra Leone: *Volunteer*
American International School of Freetown, Freetown, Sierra Leone: *Board Member*
Anglo American School, Moscow, Russia: *Board Member*
MPC Social Services, Moscow, Russia: H*ealth Education and Community Partnerships*

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