Disaster Medicine and Public Health Preparedness

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Concepts in Disaster Medicine

Cite this article: Nally C, Temmerman M, Van de Voorde P, Koroma A and Adam M (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, 1–6
https://doi.org/10.1017/dmp.2024.270

Received: 14 February 2022
Revised: 10 April 2024
Accepted: 06 September 2024

Keywords:
emergency responders; Ebola; community health workers; continuous quality improvement; feedback loops

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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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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-

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

https://doi.org/10.1017/dmp.2024.270 Published online by Cambridge University Press

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

https://doi.org/10.1017/dmp.2024.270 Published online by Cambridge University Press

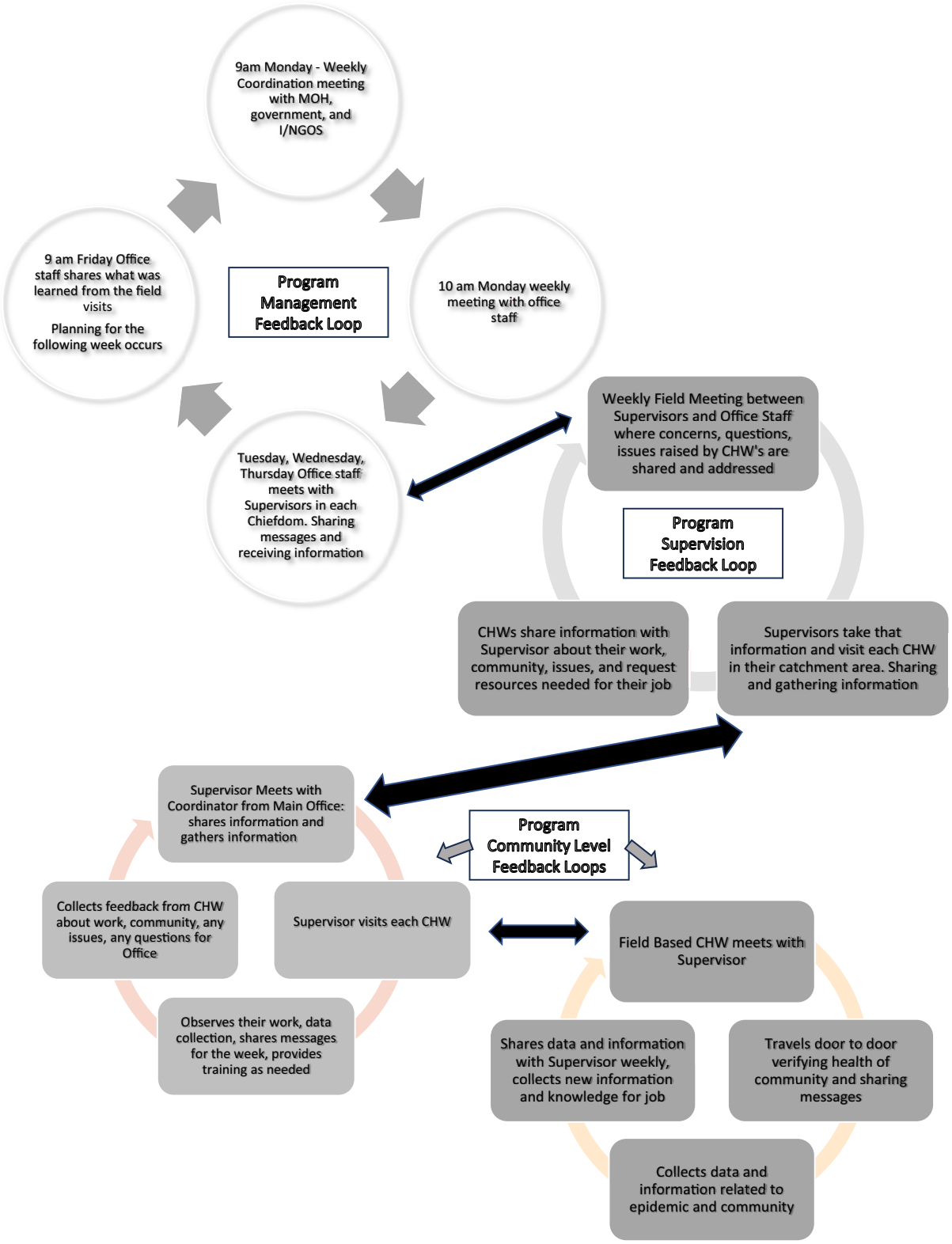

Figure 1. Feedback Loops for the Port Loko Ebola Response.

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

https://doi.org/10.1017/dmp.2024.270 Published online by Cambridge University Press

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*)

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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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