

**SORT IT SUPPLEMENT: POST-EBOLA RECOVERY IN WEST AFRICA****Ebola and community health worker services in Kenema District, Sierra Leone: please mind the gap!**M. A. Vandi,<sup>1</sup> J. van Griensven,<sup>2</sup> A. K. Chan,<sup>3,4</sup> B. Kargbo,<sup>5</sup> J. N. Kandeh,<sup>5</sup> K. S. Alpha,<sup>1</sup> A. A. Sheriff,<sup>1</sup> K. S. B. Momoh,<sup>1</sup> A. Gamanga,<sup>6</sup> R. Najjemba,<sup>7</sup> S. Mishra<sup>3,8</sup><http://dx.doi.org/10.5588/pha.16.0082>**Setting:** All community health workers (CHWs) in rural Kenema District, Sierra Leone.**Objective:** CHW programmes provide basic health services to fill gaps in human health resources. We compared trends in the reporting and management of childhood malaria, diarrhoea and pneumonia by CHWs before, during and after the Ebola outbreak (2014–2016).**Design:** Retrospective cross-sectional study using programme data.**Results:** CHW reporting increased from 59% pre-outbreak to 95% during the outbreak ( $P < 0.001$ ), and was sustained at 98% post-outbreak. CHWs stopped using rapid diagnostic tests for malaria mid-outbreak, and their use had not resumed post-outbreak. The average monthly number of presumptive treatments for malaria increased from 2931 pre-outbreak to 5013 during and 5331 post-outbreak ( $P < 0.001$ ). The average number of monthly treatments for diarrhoea and pneumonia decreased from respectively 1063 and 511 pre-outbreak to 547 and 352 during the outbreak ( $P = 0.01$  and  $P = 0.04$ ). Post-outbreak pneumonia treatments increased (mean 1126 compared to pre-outbreak,  $P = 0.003$ ), and treatments for diarrhoea returned to pre-outbreak levels ( $P = 0.2$ ).**Conclusion:** The CHW programme demonstrated vulnerability, but also resilience, during and in the early period after the Ebola outbreak. Investment in CHWs is required to strengthen the health care system, as they can cover pre-existing gaps in facility-based health care and those created by outbreaks.

As the minimum human resources for health to provide essential maternal and child health services, the World Health Organization (WHO) recommends 23 physicians, nurses and midwives per 10000 population.<sup>1</sup> As of 2010, Sierra Leone had two skilled providers per 10000 population.<sup>2</sup> Community health workers (CHWs) have emerged as a critical cadre to fill the human resource gap and deliver health services directly to communities, including services that could prevent most childhood illnesses and deaths in sub-Saharan Africa.<sup>3</sup> In Sierra Leone, 156/1000 children die before the age of 5 years, and many of these preventable deaths are related to malaria, diarrhoea and pneumonia.<sup>4</sup> The CHW programme in Sierra Leone started in Kenema District in 2009, delivering syndromic management for uncomplicated malaria, diarrhoea and pneumonia in children.<sup>5</sup>

The Ebola virus disease (EVD) outbreak in Sierra Leone started in May 2014, and infected over 11000 people, including 350 health care workers (HCWs), 221 of whom died.<sup>6</sup> The outbreak took hold in Kenema on 24 June 2014, infecting at least 503 people, and leading to the deaths of 51 of the 840 HCWs in the district.<sup>6</sup> In addition to depleting the health care workforce, the outbreak crippled service delivery and uptake at health care facilities in Sierra Leone,<sup>7</sup> leading to an even greater need for health service delivery at the community level.<sup>8</sup>

The outbreak may also have affected the provision and reporting of CHW services. Diversion of CHW activities to support outbreak management was part of the national response, and included social mobilisation, contact tracing and community-based surveillance for EVD.<sup>6</sup> However, this also meant that greater attention was paid to CHWs, whose previous experience with establishing community relationships was exploited for the outbreak response. There were reports of fear among CHWs of going out to communities affected by EVD, and rejection by communities of any HCW, including CHWs.<sup>6</sup> Nevertheless, as CHWs were engaged in social mobilisation, this may have mitigated such fears on both sides. In July 2014, many districts, including Kenema, instituted a 'no touch' policy for community-based health care to interrupt transmission of EVD, and in the context of deficits in personal protective equipment and infection prevention and control training. The policy recommended that CHWs refrain from conducting finger-prick blood tests for rapid malaria diagnostics and basic physical examinations.<sup>9</sup> Taken together, CHW reporting and services may have declined or continued after the outbreak began.

Understanding how large outbreaks and their management might influence the reporting and delivery of community-based health care is critical to the design of resilient health systems in the face of future outbreaks, particularly in settings with pre-existing gaps in facility-based care. To date, there are no published data on how the EVD outbreak may have affected CHW services in West Africa. We sought to compare trends in the following monitoring and service delivery components of the CHW programme in Kenema District, Sierra Leone, before, during and after the EVD outbreak: 1) the proportion of expected CHW reports per month submitted to the Ministry of Health and Sanitation (MoHS); and 2) the volume of CHW services measured

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as the monthly number of malaria rapid diagnostic tests (RDTs) and treatments for malaria, diarrhoea and pneumonia in children aged <5 years.

## METHODS

### Study design

We conducted a retrospective cross-sectional study using aggregate CHW programme data.

### Study setting

In Sierra Leone (population 7.1 million),<sup>10</sup> health care services are provided at three levels: primary or peripheral, secondary and tertiary. Rural communities access care through peripheral health units (PHUs), and each unit covers one catchment area.<sup>2</sup> Kenema District is divided into 16 chiefdoms, and has a population of 609 873.<sup>10</sup> The EVD outbreak in Kenema started on 24 June 2014 and ended on 9 February 2015.<sup>6</sup> Outbreak size varied across chiefdoms, and seven chiefdoms had zero cases.

The Appendix details the CHW programme. Each CHW is registered with a supervising PHU, and covers the catchment area of that PHU. CHWs are volunteers whose clinical duties include symptom-directed screening for malaria, including performing RDTs for malaria; eliciting a history from care givers; performing basic examinations, such as recording respiratory count; and providing non-injectable treatment for malaria, diarrhoea and pneumonia.

### Study population and period

The study population included all CHWs registered in Kenema PHUs during three study periods, as defined by the dates of the national EVD outbreak: before (1 June 2013–30 April 2014), during (1 June 2014 to 30 April 2015) and after the outbreak (1 November 2015 to 30 April 2016). We excluded the month of May 2014 to prevent potential spill-over effects from the pre-outbreak period into the outbreak period. We excluded the period from 1 May to 1 November 2015, when small transmission clusters remained active in other districts and the national outbreak was not yet declared over.<sup>6</sup>

### Data collection

We extracted data from the electronic MoHS CHW Programme Data System, which is generated from summary sheets submitted by PHU supervisors. CHWs record their daily activities in registers, and their reports are collated by the PHU supervisor who generates a monthly summary of all CHW activities attached to that PHU. We extracted data on chiefdoms with and without EVD cases from the MoHS Surveillance Report.<sup>11</sup> We collected the following data per PHU, per month and year: chiefdom, type of health facility, number of registered CHWs (i.e., expected number of CHW reports), number of CHWs who submitted their reports, total number of RDTs performed, and total number of cases treated (malaria, diarrhoea, pneumonia).

### Data analysis

We imported the electronic data into EpiData version 2.2.2.182 (EpiData Association, Odense, Denmark) to

develop the study database and for analysis. We examined outcome trends over time using Student's *t*-test for continuous variables and the  $\chi^2$  test for proportions, to compare each pair of time periods: pre- vs. during EVD, and pre- vs. post-EVD. To address potential seasonal variations in CHW activity and in childhood illnesses, we included the same calendar months for each comparison. Pre- vs. post-outbreak comparisons were thus restricted to the months inclusive of November to April in each time period. If a PHU had not submitted a report, we used the most recent month for which data were available to impute the number of expected CHW reports, and imputed zero for all outcome variables for that month. If a PHU had submitted a report, but outcome variables such as number of malaria treatments were missing, we imputed zero for that month.

### Ethics approval

The Sierra Leone National Ethics and Scientific Review Committee, the Sierra Leone Ministry of Health and Sanitation, Freetown, Sierra Leone, and the Ethics Advisory Group of the International Union Against Tuberculosis and Lung Disease, Paris, France, provided ethics and institutional approval. Participant consent was not required, as aggregate programme data were used.

## RESULTS

### Routine reporting of community health worker activity

Of the 123 PHUs in Kenema District, 106 with registered CHWs were included in the study. Sixty-two PHUs provided summary reports for all 28 months of the study period; 15% of the expected 2968 reports were missing from 44 PHUs (Figure 1). Missing reports were restricted to the pre-outbreak period.

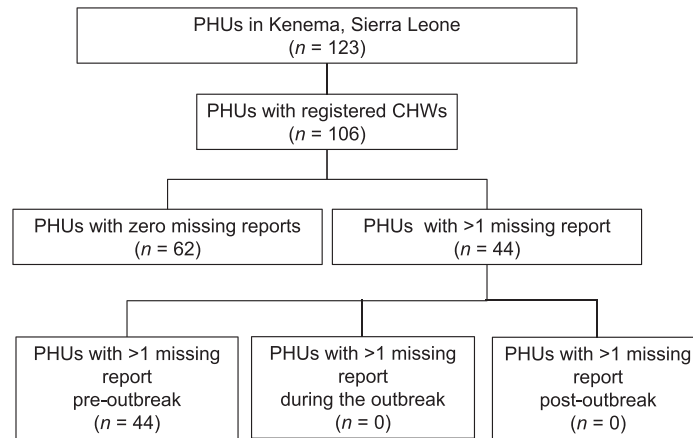
The total number of registered CHWs per month, and thus the number of expected CHW reports, varied between 947 and 1093 (Figure 2), and was lowest in the pre-outbreak period ( $P < 0.05$ , Table 1). The proportion of registered CHWs who reported any activity increased from 59% pre-outbreak to 95% during the outbreak ( $P < 0.001$ ), and was sustained at 98% post-outbreak (Figure 2). Trends in increased reporting during and after the outbreak were similar across chiefdoms with and without EVD cases (data not shown).

### Community health worker services to diagnose and treat malaria

CHWs did not perform RDTs until October 2013, and monthly RDT use varied between 0 and 3931 before the outbreak (Figure 3). During the outbreak, monthly RDT use declined from a maximum of 2810 in July to 0 by October 2014. Post-outbreak, a total of 150 RDTs were performed and the mean monthly number of tests was 25 compared to 1785 pre-outbreak ( $P = 0.02$ , Table 2). In contrast, the number of children treated by CHWs for malaria increased during the outbreak, and remained significantly higher post-outbreak than at baseline ( $P < 0.001$ ; Table 2, Figure 3). The trend in

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**FIGURE 1** Complete and missing PHU reports on CHW services in Kenema District, Sierra Leone. PHU = peripheral health unit; CHW = community health worker.

increased malaria treatment over time was similar across chiefdoms with and without EVD cases (Table 2).

### Community health worker services to treat diarrhoea and pneumonia

The monthly number of children treated by CHWs for diarrhoea or pneumonia decreased significantly from a mean of respectively 1063 and 511 pre-outbreak to 547 and 253 during the outbreak (Figure 4, Table 2). Monthly treatments for pneumonia were already decreasing before the outbreak began (Figure 4). After the outbreak, pneumonia treatment numbers increased to levels significantly higher than the pre-outbreak period, while diarrhoea treatments returned to pre-outbreak levels (Figure 4, Table 2).

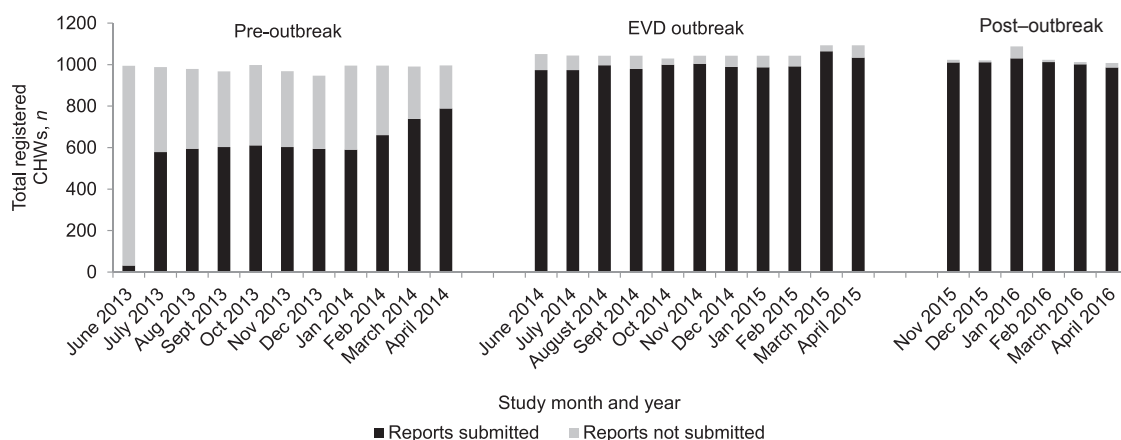
Trends in pneumonia treatment were similar across chiefdoms with and without EVD cases (Table 2). In contrast, only chiefdoms with cases experienced a decline in diarrhoea treatments during the outbreak. Diarrhoea treatment in chiefdoms without cases remained stable before, during and after the outbreak (Table 2).

## DISCUSSION

Reporting of CHW services to the MoHS improved during the EVD outbreak, with levels sustained thereafter. While childhood

malaria treatment increased during the outbreak as RDTs were discontinued, treatment of diarrhoea and pneumonia decreased over the same time period. CHW treatments for all three conditions increased in the 6 months after the outbreak was declared over, at levels higher than before the outbreak for malaria and pneumonia.

Routine and complete reporting in programmes is critical for monitoring services. Missing reports in the pre-outbreak period were likely driven by inadequate and irregular supervision and frequent stock-outs of reporting tools. Changes to the role and supervision of CHWs during the outbreak may have led to improved reporting. As CHWs already played a major role in alerting health-related events to their supervising PHUs,<sup>5</sup> many were asked to also conduct community EVD surveillance via a performance-based remuneration system (for reporting), and were provided with direct supervision. The improvements to CHW supervision continued into the post-EVD recovery period in the district and country, even with remuneration returning to pre-outbreak stipends (equivalent of US\$2/month) for transport refund. After the outbreak, community surveillance transitioned into the MoHS Integrated Disease Surveillance and Response (IDSR) programme, which is focused on heightened reporting of all symptoms that may be due to communicable diseases. CHW and PHU



**FIGURE 2** Expected numbers of CHW reports per month in Kenema District, Sierra Leone, between June 2013 and April 2016. CHW = community health worker; EVD = Ebola virus disease.

**TABLE 1** Activity reports submitted by CHWs before, during and after the EVD outbreak in Kenema, Sierra Leone

	Number of CHW activity reports/month, mean $\pm$ SD					
	Before vs. during EVD outbreak			Before vs. after EVD outbreak		
	Before*	During†	<i>P</i> value‡	Before§	After¶	<i>P</i> value‡
Expected	983 $\pm$ 16	1052 $\pm$ 21	<0.001	982 $\pm$ 20	1029 $\pm$ 30	0.009
Submitted	581 $\pm$ 195	999 $\pm$ 27	<0.001	662 $\pm$ 84	1008 $\pm$ 14	<0.001

\*1 June 2013–30 April 2014 (11 months) for the pre- vs. during EVD outbreak comparison.

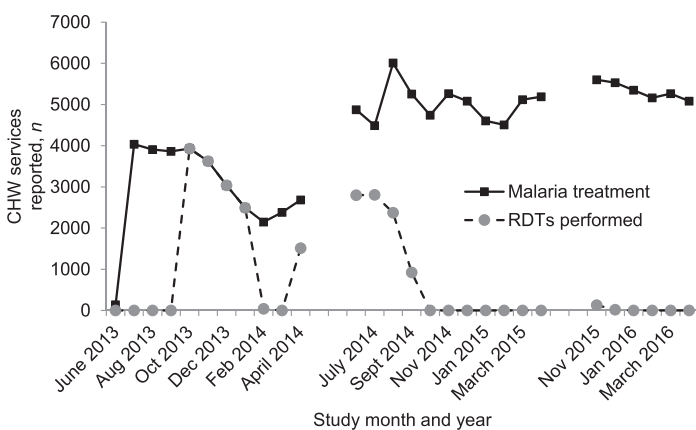
†1 June 2014–30 April 2015 (11 months).

‡*t*-test. For the pre vs. post-outbreak comparison, pre-outbreak data were restricted to 1 November 2013–30 April 2014.

§1 November 2013–30 April 2014 (6 months), for the pre- vs. post-EVD outbreak comparison.

¶1 November 2015–30 April 2016 (6 months).

CHW = community health worker; EVD = Ebola virus disease; SD = standard deviation.

**FIGURE 3** Monthly number of malaria diagnostics and treatments provided by CHWs for children aged <5 years in Kenema District, Sierra Leone, 2013–2016. CHW = community health worker; RDT = rapid diagnostic test (for malaria).

reports contribute to the IDSR. Performance-based financing followed by enhanced supervision and the downstream effects of heightened surveillance systems may thus have contributed to the improved reporting during and after the outbreak.

The shift from RDT-based to presumptive treatment for malaria may have contributed to the observed increase in malaria treatments during and after the outbreak. RDT should be re-introduced and CHWs re-trained on RDT procedures in the post-EVD period if the potential development of antimalarial resistance is to be limited. In addition, CHWs responsible for event-based EVD surveillance may have been actively screening for cases of fever in the community. Temperature screening at checkpoints and non-health facilities was common during the outbreak, and may have led to increased detection of fever.

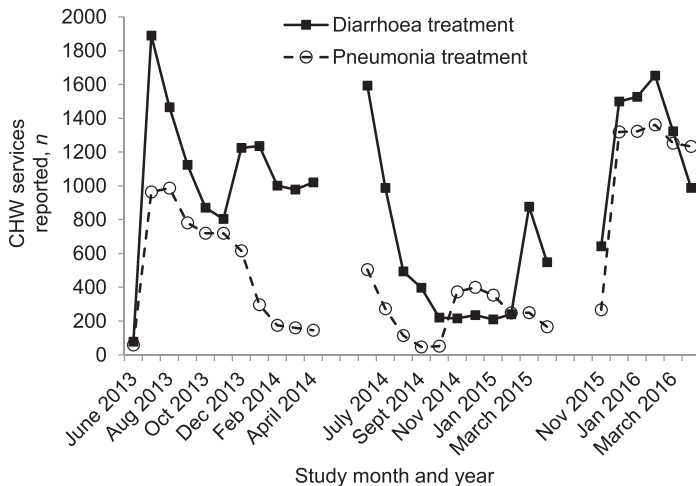
In contrast, the effects of the outbreak on CHW treatment for diarrhoea and pneumonia mirror the negative effects on other services reported across community and facility-based care in Sierra Leone.<sup>7</sup> Although they are associated with EVD, gastrointestinal or respiratory symptoms may be less likely than fever to garner the attention of CHWs engaged in EVD surveillance. Supply-chain interruptions may also have affected services as national stores diverted supplies to EVD facilities. Chiefdoms with-

**TABLE 2** CHW services for childhood illness before, during and after the EVD outbreak in Kenema District, Sierra Leone

CHW service	Number of children per month who received CHW services, mean $\pm$ SD					
	Pre-outbreak (11 months: 1 June 2013–30 April 2014)	During outbreak (11 months: 1 June 2014–30 April 2015)	<i>P</i> value*	Pre-outbreak (6 months: 1 November 2013–30 April 2014)	Post-outbreak (6 months: 1 November 2015–30 April 2016)	<i>P</i> value*
Malaria RDT	1331 $\pm$ 1638	809 $\pm$ 1225	0.4	1785 $\pm$ 1534	25 $\pm$ 53	0.02
Malaria treatment						
District level	2931 $\pm$ 1162	5013 $\pm$ 442	<0.001	2728 $\pm$ 532	5331 $\pm$ 203	<0.001
Chiefdoms						
With EVD cases	2015 $\pm$ 760	3571 $\pm$ 337	<0.001	1935 $\pm$ 374	3757 $\pm$ 161	<0.001
With no EVD cases	916 $\pm$ 414	1441 $\pm$ 139	<0.001	793 $\pm$ 171	1574 $\pm$ 63	<0.001
Diarrhoea treatment						
District level	1063 $\pm$ 446	547 $\pm$ 441	0.01	1044 $\pm$ 163	1272 $\pm$ 385	0.2
Chiefdoms						
With EVD	751 $\pm$ 289	396 $\pm$ 327	0.01	754 $\pm$ 102	925 $\pm$ 265	0.2
With no EVD cases	754 $\pm$ 102	925 $\pm$ 265	0.2	290 $\pm$ 82	347 $\pm$ 120	0.4
Pneumonia treatment						
District level	511 $\pm$ 350	253 $\pm$ 148	0.04	352 $\pm$ 253	1126 $\pm$ 424	0.003
Chiefdoms						
With EVD	359 $\pm$ 237	186 $\pm$ 109	0.04	260 $\pm$ 192	845 $\pm$ 318	0.003
With no EVD cases	152 $\pm$ 115	67 $\pm$ 42	0.03	93 $\pm$ 61	281 $\pm$ 108	0.004

\**t*-test. For the pre vs. post-outbreak comparison, pre-outbreak data were restricted to 1 November 2013–30 April 2014.

CHW = community health worker; EVD = Ebola virus disease; SD = standard deviation; RDT = rapid diagnostic tests (for malaria).



**FIGURE 4** Monthly number of treatment provided by CHWs for diarrhoea and pneumonia in children aged <5 years, Kenema District, Sierra Leone, 2013–2016. CHW = community health worker.

out cases did not experience a reduction in diarrhoea treatments, suggesting that some community and CHW effects may only occur where there is active transmission. Further investigation into the steps required for adequate CHW service delivery and referrals to EVD surveillance and non-EVD health facilities are needed to clarify the possible pathways that led to service disruption for treating diarrhoea and pneumonia, but increased treatment for malaria.

Sustained increases in CHW services post-outbreak may be partly due to the IDSR programme's active engagement of care givers to seek out CHWs if their children were ill. CHWs now play a larger role in integrated surveillance and receive better supervision. Post-outbreak increases in service uptake may be a natural 'catch-up' that occurs in a system when delivery is temporarily interrupted.<sup>12</sup> While the post-outbreak findings are encouraging, they represent an early post-EVD recovery period, and the long-term durability of the downstream effects of the outbreak and response will require further study.

Strengths of our study include the use of data from all submitted and expected reports from all trained, registered and active CHWs across 16 chiefdoms in a district with a large EVD outbreak and which led the early MoHS response.<sup>13</sup> Kenema was the first district to implement the national CHW programme; it has the largest number of CHWs in the country and the longest history of service upon which to draw historical comparisons with the outbreak and post-outbreak periods.<sup>5</sup> The conduct and reporting of the study also adhered to STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines and sound ethics principles.<sup>14,15</sup>

Limitations include the use of aggregate data sourced from an electronic database (MS Excel; Microsoft, Redmond, WA, USA) managed by the MoHS. As we did not have access to the original hard copies of the CHW summary reports stored at the PHUs, we could not check the electronic data against the source. Second, our measure of CHW services was based on CHW self-report, and was not cross-checked against medication and RDT supply at PHUs. Third, the considerable amount of missing pre-outbreak data may have biased our finding of low levels of service provision during this period if activities took place but reports were not submitted by PHUs. Finally, as our interpretation is limited to the

scope of CHW reports, we do not know if increases or decreases in CHW treatments were offset by decreases or increases at health facilities, and how they directly relate to the additional roles assigned to CHWs during the outbreak.

Calls for health system strengthening remain the dominant narrative surrounding outbreak and emergency preparedness.<sup>16,17</sup> Our findings have important implications for the inclusion of CHWs in health systems strengthening. First, the unintended consequences of a large outbreak and response on a health system may be largely negative,<sup>7,8</sup> but they can also be positive. The positive effects may be drawn from the CHWs, whose experience and relationships with communities can be exploited not only to support outbreak management, but also to continue (and with adequate resources) to scale up community-based, non-EVD health services.<sup>18</sup> Second, outbreak management guidelines should explicitly include non-EVD-related aspects of the affected health systems and the role of the CHWs.<sup>19–21</sup> Finally, sustained investment in CHW programmes through adequate remuneration, substantive capacity building and effective supervision structures—starting early in the post-recovery period—could create a solid foundation for CHWs to support emerging or sudden gaps in health care and improve the resilience of the health systems.

In conclusion, the EVD outbreak and response had contrasting effects on the reporting and delivery of services for childhood malaria, diarrhoea, and pneumonia within a large CHW programme in rural Sierra Leone. Health systems strengthening should include sustained investments in CHWs; otherwise it will be a missed opportunity to address pre-existing gaps and those created by outbreaks.

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## APPENDIX

### *Details of the Sierra Leone Community Health Worker programme*

The community health worker (CHW) programme was designed in 2009 to address gaps in health care service delivery in rural communities by decentralising the screening, diagnosis and treatment of high-burden diseases with high fatality in children.<sup>1</sup> After community mapping of households, CHWs were recruited and trained to provide services at a ratio of 100 households per CHW. The number of CHWs per peripheral health unit (PHU) depends on how the population is distributed across the villages within the catchment area of the PHU. The programme started by focusing on uncomplicated malaria, with referral to health facilities for suspected complicated malaria. The CHWs' role gradually broadened to include other community health interventions, including childhood diarrhoea and pneumonia, by 2012. By 1 June 2013, additional CHW responsibilities included maternal and other child health issues. As of 1 June 2013, there were approximately 1000 trained CHWs in Kenema District, and 108 peer supervisors. CHWs are adult volunteers who command respect in their communities; the majority (79%) are literate in English.<sup>2</sup>

The nationally standardised 10-day CHW training course covers specific clinical duties, including the screening, detection (including rapid diagnostic tests [RDTs] for malaria), and non-injectable treatment of malaria (artemisinin-based combination therapy).<sup>1</sup> For the screening and detection of diarrhoea, CHWs are trained to elicit a history from care givers, while for the screening and detection of pneumonia, CHWs are trained to elicit a history and record the respiratory count. They are also trained to provide non-injectable treatment for diarrhoea and pneumonia with zinc and oral rehydration solution (ORS), and septrim syrup, respectively.<sup>1</sup>

CHWs act as the first contact point for health problems in the community. Medication and reporting forms are stocked in supervising PHUs in their catchment area. Small quantities of medications at a time are allocated to the CHWs and recorded. These medications are accounted for by individual CHWs during monthly PHU meetings in a form of stock-taking against the number of reported interventions. The main duty of the PHU staff during the monthly meetings is to ensure adherence to treatment protocols, identification of capacity gaps and coordination of other health interventions in the catchment area. There is no specified work schedule for CHWs. Nevertheless, they are expected to be available every day in the early hours of the morning and evenings, as the majority of the residents are farmers who spend most of the time in their farms and return late to the villages. CHWs may go directly to a patient's home, or patients may be brought to the CHW's home for assessment and treatment.

CHWs do not routinely visit every home to screen for malaria, diarrhoea and pneumonia. Rather, they are alerted to potential cases by the community, after which time the CHW screens for causes of illness.

### *Documented changes to delivery of care during the Ebola virus disease outbreak in Kenema*

The Ebola virus disease (EVD) outbreak in Kenema started on 24 June 2014 and ended on 9 February 2015.<sup>3</sup> Some chiefdoms were more severely affected than others, with six of the 16 chiefdoms having no cases. During the outbreak, a 'no touch' policy was in effect in Kenema from July 2014 onwards. The policy meant that in the absence of appropriate and adequate infection prevention control measures, equipment and training, all invasive procedures were cancelled at health facilities and pharmacies.<sup>4</sup> This included the cessation of RDTs for malaria diagnosis and the provision of injectable medications. The policy was enforced with active monitoring, and removal of injectables, needles and syringes, and even examination couches from private pharmacies and private clinics, to ensure adherence to the 'no touch' policy. In PHUs, all invasive procedures were stopped; however, no equipment was removed. In secondary and tertiary hospitals, invasive procedures continued with strict infection prevention and control measures and adequate stock of personal protective equipment, and ongoing training and supervision by the District Health Management Team (DHMT), the World Health Organization, the US Centers for Disease Control and Prevention and partner non-governmental organisations.

The 'no touch' policy affected the CHW malaria programme because the baseline policy was RDT confirmation before treatment. During the outbreak, CHW use of RDT was thus suspended such that malaria treatment was syndromic. There were no official protocol changes to the screening, diagnosis and treatment of diarrhoea and pneumonia. However, CHWs were instructed to abstain from examining children as they may have done pre-outbreak. After the last Ebola case in February 2015, plans were underway to retrain CHWs to return to the original pre-outbreak policy. The training had not started as of August 2016.

In addition to the 'no touch' policy, there were documented additions to CHW activities during the outbreak. These included contact tracing and monitoring of quarantine homes, community social mobilisation, neighbourhood watch (to enforce the ban on travelling between villages, chiefdoms and districts for persons who had not resided in that community for at least the previous 2 weeks) and working as burial team members.

During the outbreak in Kenema, there were few reports of CHW deaths due to EVD, but this has not been officially quantified. None were known to have resigned from their duties offi-

cially, or to have migrated to another community or district. However, as they are volunteers, CHWs are not required to officially report resignation or migration.

During the height of the outbreak in Kenema, supplies to the district were primarily focused on the EVD response. The district's requests for ORS and medications, and the supplies, were prioritised for the Ebola treatment and isolation units and holding centres, and may not have been delivered to the PHUs where CHWs normally obtain their supplies. Antibiotics were therefore not available to CHWs in Kenema. ORS and zinc were available intermittently. Data entry by the DHMT was not affected during the outbreak, as personnel and staffing remained stable. There was also no provision of screening, diagnosis or treatment of malaria, diarrhoea or pneumonia in the quarantine homes. In-

stead, symptomatic persons in quarantine homes were taken to Ebola facilities for testing. These persons would not be treated by CHWs.

### References

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**Contexte :** Tous les travailleurs de santé communautaires (CHW) du district rural de Kenema, Sierra Leone.

**Objectif :** Les programmes de CHW offrent des services de santé de base pour combler les lacunes en matière de ressources humaines en santé. Nous avons comparé les tendances du signalement et de prise en charge du paludisme, de la diarrhée et de la pneumonie de l'enfant par les CHW avant, pendant et après l'épidémie d'Ebola (2014–2016).

**Schéma :** Étude rétrospective transversale sur les données du programme.

**Résultats :** Les rapports des CHW ont augmenté de 59% avant l'épidémie à 95% pendant la flambée ( $P < 0,001$ ), et se sont maintenus à 98% après la flambée. Les CHW ont arrêté d'utiliser les tests de diagnostic rapide pour le paludisme au milieu de l'épidémie et leur utilisation n'a pas repris après la flambée. Le nombre moyen

mensuel de traitements présomptifs du paludisme a augmenté de 2931 avant la flambée à 5013 pendant et 5331 après la flambée ( $P < 0,001$ ). Le nombre moyen mensuel de traitements pour diarrhée et pneumonie a diminué de 1063 et 511 avant la flambée à 547 et 352, respectivement, pendant la flambée ( $P = 0,01$  et  $P = 0,04$ ). Après la flambée, les traitements de pneumonie ont augmenté (moyenne 1126 comparée à avant la flambée,  $P = 0,003$ ), tout comme les traitements pour diarrhée, qui sont remontés aux niveaux précédant la flambée ( $P = 0,2$ ).

**Conclusion :** Le programme des CHW a démontré sa vulnérabilité, mais également sa résilience, pendant la flambée et dans la brève période qui a suivi l'épidémie d'Ebola. Le renforcement du système de santé devrait investir dans les CHW car ils peuvent combler les lacunes pré-existantes des soins de santé basés dans les structures et celles créées par les épidémies.

**Marco de referencia:** Todos los agentes de salud comunitarios (CHW) en la zona rural del distrito de Kenema, en Sierra Leona.

**Objetivo:** Los programas de CHWs prestan servicios básicos que compensan las deficiencias de recursos humanos del sistema de salud. En el estudio se comparó la evolución de las notificaciones y el tratamiento del paludismo, la diarrea y la neumonía en los niños por parte de los CHW, antes del brote epidémico de fiebre hemorrágica del Ébola; durante y después del mismo (2014–2016).

**Método:** Fue este un estudio transversal retrospectivo a partir de los datos del programa.

**Resultado:** La notificación por parte de los CHW aumentó de 59% antes del brote a 95% durante el mismo ( $P < 0,001$ ) y permaneció estable en 98% después de la epidemia. Los CHW interrumpieron la utilización de las pruebas diagnósticas rápidas del paludismo en la mitad del período epidémico y no reanudaron su aplicación al finalizar el brote. El número promedio de tratamientos de

presunción por paludismo aumentó de 2931 antes del brote a 5013 durante el mismo y 5331 después de la epidemia ( $P < 0,001$ ). El promedio de tratamientos mensuales por diarrea y neumonía disminuyó respectivamente de 1063 y 511 antes del brote a 547 y 352 durante el mismo ( $P = 0,01$  y  $P = 0,04$ ). Después de la epidemia del Ébola los tratamientos por neumonía aumentaron (promedio 1126;  $P = 0,003$ ) con respecto al período anterior al brote y los tratamientos por diarrea recuperaron las cifras anteriores a la epidemia ( $P = 0,2$ ).

**Conclusión:** Se puso de manifiesto la vulnerabilidad del programa de CHW a la epidemia del Ébola, pero se demostró también su capacidad de recuperación durante el brote y el período inicial después de la epidemia. El fortalecimiento de los sistemas de salud debe comportar una inversión en los CHW, que pueden cubrir las lagunas preexistentes de la atención institucional de la salud y las deficiencias que aparecen como resultado de las epidemias.