RESEARCH ARTICLE

Post-Ebola Community Health Worker programme performance in Kenema District, Sierra Leone: A long way to go! [version 1; peer review: 1 approved, 1 approved with reservations]

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Abstract

Background: The devastating 2014-2015 Ebola outbreak in Sierra Leone could erode the gains of the health system including the Community Health Worker (CHW) programme. We conducted a study to ascertain if the positive trend in reporting cases of malaria, pneumonia and diarrhoea treated by CHWs in the post-Ebola period has been sustained 18 months post-Ebola.

Methods: We conducted a retrospective cross-sectional study using aggregated CHW programme data (2013-2017) from all Primary Health Units in Kenema district. Data was extracted from the District Health Information System and analysed using STATA. Data in the pre- (June 2013-April 2014), during- (June 2014-April 2015) and post-Ebola recovery (June 2016-April 2017) periods was compared and analysed for reporting completeness; Rapid Diagnostic Tests (RDTs) performed and cases of malaria, diarrhoea and pneumonia treated per month. Differences across periods were tested using two-sample t-test with significance set at 0.05.

Results: CHW reporting increased from pre-Ebola by 8% (p-value=0.29) intra-Ebola and 19% (p-value=0.012) post-Ebola. Compared to the pre-Ebola period, in the post-Ebola recovery period, there was a significant increase in the mean monthly reported RDTs of 35% (p-value=0.020); malaria treatments 66% (p-value<0.001); and pneumonia treatments increased by 80% (p-value=0.004). Conversely, the mean monthly diarrhoea cases treated decreased by 20% (p-value=0.16) in the post-Ebola period.

Conclusion: The resiliency demonstrated by the CHW programme during and immediately after the Ebola outbreak has been sustained in the post-Ebola recovery period. Continued programme investments in supportive supervision and financial incentives for CHWs will be critical to ensure uninterrupted contribution towards Sustainable Development Goal 3.
Keywords
Universal Health Coverage, Sustainable Development Goals, health systems, SORT IT, operational research

This article is included in the TDR gateway.

This article is included in the Disease Outbreaks gateway.

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Competing interests: No competing interests were disclosed.

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Introduction
The effect of the 2014–2015 West African Ebola outbreak on Community Health Worker (CHW) services in Kenema district, Sierra Leone, was assessed through a retrospective cross-sectional study comparing CHW reporting and services before (June 2013–April 2014), during (June 2014–April 2015) and post-outbreak (November 2015–April 2016)1. The study found CHW reporting completeness and reported treatments for malaria increased post-Ebola, while those for pneumonia and diarrhoea returned to pre-outbreak levels. Results showed CHWs stopped performing Rapid Diagnostic Tests (RDTs) during the Ebola period and did not resume until after the outbreak. The study recommended additional investigations into preliminary positive trends in the early post-Ebola period to determine if these post-outbreak tendencies represent a resumption of pre-Ebola CHW programme performance or a continued progression. Therefore, we aimed to understand whether health system performance was sustained 18 months after the outbreak by comparing CHW system performance (reporting completeness, reported diagnosis and treatment services among reports received) in Kenema district in the pre-, intra- and post-Ebola recovery periods for children under five years.

Methods
This was a retrospective cross-sectional study using aggregate CHW programme data from Kenema district, Sierra Leone. Details of Kenema and the CHW programme were previously described1. The study population included all CHW programme reports from Kenema Peripheral Health Units (PHUs) during the pre-(June 2013–April 2014), intra-(June 2014–April 2015), and post-Ebola recovery (June 2016–April 2017) periods. Data during the month of May 2014 were excluded to prevent potential spill-over effects across periods. Consistent months were deliberately chosen to allow for seasonal comparison across the three periods.

CHW programme data were extracted from the electronic Ministry of Health and Sanitation (MoHS) District Health Information Systems (DHIS2), which is aggregated from monthly summary sheets submitted by PHU supervisors. Data on the following variables were extracted per month: facility reporting completeness; reported malaria RDTs; treatment for malaria, diarrhoea and pneumonia. In this study we defined CHW reporting completeness as number of facilities with fully (100%) complete reporting for CHW monthly summary sheets over the total number of expected facility reports. We imported data into STATA v14.2. We produced descriptive summary statistics and examined statistical differences between periods using two-sample t-test, with significance set at 0.05.

The Sierra Leone Ethics and Scientific Review Committee (dated 18 December 2018) and the Ethics Advisory Group of the International Union Against Tuberculosis Lung Disease (UAG number 65/18) provided ethics and institutional approval. Since aggregate programme data were used, participant consent was not sought.

Results
Proportion of PHUs reporting complete reports
Figure 1 shows the proportion of facilities with CHW complete reports monthly in the pre-, intra- and post-Ebola recovery periods. The number of PHUs submitting complete CHW reports ranged between 39–129 (27–89%) and 98–134 (68–92%) in the pre- and intra-outbreak periods respectively. Conversely, in the recovery period, 136 (94%) facilities consistently completed reports each month.

Mean monthly RDTs, malaria, diarrhoea and pneumonia cases reported
Figure 2 shows trends across pre-, intra- and post-Ebola recovery periods for CHW programme performance indicators. Table 1 shows that the mean monthly reported RDTs had an increasing trend in the pre-, intra- and post-Ebola recovery periods, with increases of 11% intra-Ebola and 35% (p-value=0.012) post-Ebola compared to the pre-Ebola period. The mean monthly malaria treatments reported trends similar to RDTs with increases of 31% (p-value=0.026) and 66% (p-value=0.020) intra-Ebola and post-Ebola, respectively.

The mean monthly diarrhoea treatments reported exhibited a downward trend, in the pre- and intra-Ebola periods, followed by a small uptick in the post-Ebola recovery period. However, compared to the pre-Ebola period, overall monthly mean reported treatments significantly decreased by 42% (p-value=0.013) in the intra-Ebola, while the reduction in the post-Ebola recovery period was not statistically significant (p-value=0.16).

The mean reported monthly pneumonia treatments declined by 11% intra-Ebola but grossly increased by 80% (p-value=0.004) during the recovery period compared to the pre-Ebola period (Table 1).

Discussion
Our study results indicate a general trend of the CHW programme in Kenema district sustaining comparable performance levels into the post-Ebola recovery period as compared to pre-Ebola for reporting completeness and reported RDTs, malaria and pneumonia treatments. Comparable to results from the previous study1 and the region2, this may be due to sustained investment in key areas affecting supply and services. The Integrated Disease Surveillance and Response approach, which emphasises active community-based surveillance and completeness of reporting, was strengthened in the intra-Ebola period3. In addition, supportive supervision, a critical element to the success of CHW programmes4, was revived after the outbreak3. Finally, financial incentives for CHWs initiated during the outbreak were subsequently incorporated into the national policy in 20165. Furthermore, the CHWs have reported increased community awareness of signs and symptoms of common childhood illnesses, translating into increased demand for services5.

We found fewer missing reports in the pre- and intra-Ebola periods compared to the previous study2, most likely due to retrospective data entry into the DHIS2. While we found higher
mean reported RDTs performed in the post-Ebola period, we still observed fewer in the intra-Ebola period corresponding with the enactment of the “no touch policy,” similar to the previous report\(^1,\(^3\),\(^6\). Our results reveal an absolute decline in the reported diarrhoea treatments during the recovery period. The promotion of hygiene practices through community sensitization\(^7\) and institution of bye-laws by community stakeholders in the intra-Ebola period may have had lasting effects on behaviour and thus contributing to the reduction in reported diarrhoea treatments during the post-Ebola period\(^6\). However, the difference in reported treatments between pre- and post-Ebola periods was not found to be significant, so this trend may warrant future investigation.

Utilising pre-Ebola service levels for comparisons, while useful, still reflect benchmarks of weak systems functioning, a factor which contributed to the impact of the Ebola outbreak itself\(^8\). Therefore, it is imperative that such comparisons be evaluated in this light. Therefore, in order to achieve the vision of the Sustainable Development Goal (SDG) for good health and wellbeing beyond pre-Ebola-level benchmarks, sustained investments in supportive supervision and financial incentives for CHWs are essential for the programme.

A strength of the study is the use of complete district PHU data for the study period. Furthermore, we adhered to the Strengthening the Reporting of Observational Studies in Epidemiology guidelines for the reporting of observational data and sound ethical principles\(^9\). Primary weaknesses of our study were the use of routinely collected data, which was influenced by reporting completeness, thus restricting reporting of morbidity; lack of data triangulation; inability to validate the electronic data base against the raw data and to generalise to the national CHW programme.
Figure 2A. RDT and malaria treatments reported monthly

Figure 2B. Diarrhoea treatment services reported monthly

Figure 2C. Pneumonia treatment services reported monthly

### Table 1. Reported monthly mean values and differences across periods in reference to the Ebola outbreak for performance of Community Health Worker Programme in Kenema District, Sierra Leone.

<table>
<thead>
<tr>
<th>Reported monthly mean values</th>
<th>Pre-Ebola</th>
<th>Intra-Ebola</th>
<th>Post-Ebola</th>
<th>Period</th>
<th>Difference between pre- and intra-Ebola periods</th>
<th>Difference between pre- and post-Ebola recovery periods</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>n</td>
<td>n</td>
<td></td>
<td>95% CI</td>
<td>p-value</td>
</tr>
<tr>
<td>Reporting completeness</td>
<td>79</td>
<td>85</td>
<td>94</td>
<td>6</td>
<td>8</td>
<td>(6, 19)</td>
</tr>
<tr>
<td>RDTs</td>
<td>5873</td>
<td>6538</td>
<td>7963</td>
<td>661</td>
<td>11</td>
<td>(-1174, 2494)</td>
</tr>
<tr>
<td>Malaria treatment</td>
<td>5338</td>
<td>6994</td>
<td>8882</td>
<td>1656</td>
<td>31</td>
<td>(222, 3092)</td>
</tr>
<tr>
<td>Diarrhoea treatment</td>
<td>1083</td>
<td>627</td>
<td>866</td>
<td>-456</td>
<td>-42</td>
<td>(-106, -804)</td>
</tr>
<tr>
<td>Pneumonia treatment</td>
<td>699</td>
<td>625</td>
<td>1258</td>
<td>-74</td>
<td>-11</td>
<td>(-370, 223)</td>
</tr>
</tbody>
</table>

CI: confidence interval; RDT: rapid diagnostic test.

In conclusion, although our study established a sustained trend towards the pre-Ebola CHW service levels 18 months after the outbreak, there is need for continued investment in the CHW programme to continue gains in programme performance in order to contribute towards SDG 3.

#### Data availability

**Underlying data**


Data are available under the terms of the Creative Commons Zero “No rights reserved” data waiver (CC0 1.0 Public domain dedication).

The Sierra Leone Health Management Information Systems, the District Health Information System 2 (DHIS2), is accessible with a Ministry of Health and Sanitation (MOHS) login through [https://sl.dhis2.org](https://sl.dhis2.org/). The Directorate of Policy, Planning, and Information (DPPI) can be contacted to arrange access through Dr. Francis Smart (drfsmart@gmail.com), Director, DPPI, MOHS.

### References

PubMed Abstract | Publisher Full Text

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http://www.doi.org/10.17605/OSF.IO/2S83W
Open Peer Review

Is the work clearly and accurately presented and does it cite the current literature?

Yes
Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Partly

If applicable, is the statistical analysis and its interpretation appropriate?
I cannot comment. A qualified statistician is required.

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Yes

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Social science, health systems.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Palanivel Chinnakali
Department of Preventive and Social Medicine, Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), Puducherry, Puducherry, India

The manuscript is written well.
1. It will be better to provide some more background about the scale of involvement of CHWs during Ebola outbreak. How CHWs were involved, time points when the Ebola cases came down, post outbreak responsibilities for CHWs related to Ebola

2. Impact/severity of Ebola outbreak in the study district Kenema compared to others.

3. Study design: Instead of retrospective cross sectional study, I suggest this 'We performed trend analysis using routinely reported aggregate CHW programme data'
4. Methods: Provide information on the total population of the district, malaria and diarrhea statistics, number of health facilities, number of CHWs present during the pre-Ebola period, how they report (paper based/electronic).

5. Missing reports: present the facts in the results section and then can be brought under ‘discussion’ section

6. Reporting on number of CHWs would be good in the results section. Were there any deaths among CHWs due to Ebola?

7. What could be the possible reasons for 80% increase in reporting of Pneumonia during post Ebola period? It would be good to discuss the possible reasons

Is the work clearly and accurately presented and does it cite the current literature?
Yes

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Partly

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
No source data required

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Operational Research (Implementation Research), Tuberculosis, HIV/AIDS

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

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