Outbreak Investigation of Cholera in an Internally Displaced Persons camp in Borno State, Northeastern Nigeria – August 2017

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1. Nigeria Field Epidemiology And Laboratory Training Programme
2. Nigeria Centre for Disease Control
3. World Health Organisation, Borno Office, Nigeria
4. Borno State Ministry of Health, Nigeria
Introduction

• Internally displaced persons (IDPs) due to violence and conflict:
  – A global public health problem with relatively little international attention
  – Record breaking 38 million IDPs worldwide at end of 2014\textsuperscript{1,2}
  – 40.3 million IDPs worldwide at end of 2016
  – 2 million in Nigeria with 500,000 new displacements in 2016 alone\textsuperscript{1,2}
  – Vulnerable to epidemic prone diseases such as cholera

• Despite knowledge on major precursors of cholera in IDP camps, outbreaks continue to pose a challenge

1. UNHCR 2. IDCN
Borno State, Northeastern Nigeria

• One of 36 states in Nigeria
• Boko Haram insurgency in Northeast Nigeria:
  – Humanitarian crisis since 2009
  – 14.8 million people affected\(^3\)
  – 1.4 million IDPs living in camps across Borno\(^3\)
  – 32 IDP camps in Borno as at 2016\(^4\)

Map of Nigeria highlighting Borno State

3. WHO 4. NEMA
Muna Garage IDP camp

- Located in Jere local government area:
  - At outskirts of Maiduguri, the capital of Borno State
- 21,384 people in 4,147 households
- Makeshift accommodation
- Food handouts
- Communal boreholes
Outbreak notification

• On 26th August 2017, Borno State Epidemic Preparedness and Response Committee reported a suspected outbreak of cholera in Muna IDP camp, Jere, Borno State

• We were deployed from Nigeria Centre for Disease Control to Borno State on 4th September, 2017
Objectives

• To confirm the outbreak
• To characterise the outbreak
• To identify the risk factors for cholera in the outbreak
• To institute control measures
Descriptive study

• **Case definition**: We defined a suspected case as any IDP in Muna Garage IDP camp, who presented with acute watery diarrhea and dehydration between 14th August and 20th December, 2017.

• **Data on suspected cases**:
  – Collected using line listing forms
  – Analysed by time, place and person
Analytical study

• Design: unmatched case-control
  – Case: Any IDP living in Muna Garage IDP camp, who presented with acute watery diarrhea and dehydration between 14th August and 23rd September, 2017
  – Control: Any IDP living in Muna Garage IDP camp, without acute watery diarrhea and dehydration between 14th August and 23rd September, 2017

• Cases were identified at the cholera treatment centre and oral rehydration points
• Controls were enrolled from the community
Sample size determination

• Estimated sample size of 161 cases and 161 controls was calculated based on the following parameters:
  - Prevalence of treating drinking water among healthy IDPs: 23%\(^5\)
  - Ratio of cases to controls: 1:1
  - Power of 80%
  - Level of significance (\(\alpha\)): 5%
  - 95% Confidence level
  - Odds ratio to detect: 2

5. Istifanus et al, Archives of Medicine and Surgery, 2016
Data collection and analysis

• Risk factor data collection:
  - Interviewer administered structured questionnaires

• Data analysis:
  - Bivariate
  - Multivariate (logistic regression)

• Ethical considerations:
  - Informed consent from participants
  - Confidentiality maintained
Laboratory analysis

• Specimen collected:
  – 47 stool samples were collected

• Laboratory methods:
  – Rapid diagnostic tests (RDT)
  – Culture using thiosulphate-citrate-bile salts agar (TCBS)
Results

• Index case:
  - A 5 year old female
  - Onset of symptoms on 14th August, 2017

• Number of cases: 1,345
  - Attack rate 6.3%
  - Median age 9 years (interquartile range 4 – 27 years)
  - Most affected age group was 0 - 4 years; 395 (29.4%)
  - Females were 739 (55%)
  - Number of deaths: 15; case fatality rate (CFR) 1.1%
Epidemic curve of reported Cholera cases in Muna Garage IDP camp, Borno, 2017

Number of cases

Epidemiological week

Dead
Alive
Epidemic curve of reported Cholera cases in Muna Garage IDP camp, Borno, 2017

Number of cases

Epidemiological week

Dead
Alive

Vaccination
Epidemic curve of reported Cholera cases in Muna Garage IDP camp, Borno, 2017

- Dead
- Alive

Vaccination

Outbreak ends

Epidemiological week

Number of cases

0 50 100 150 200 250 300 350 400 450 500
32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51
Age and gender characteristics of cases and controls in Muna Garage IDP camp, Borno, 2017

<table>
<thead>
<tr>
<th>Variables</th>
<th>Cases</th>
<th>Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>10 years</td>
<td>33 years</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>±7.2 years</td>
<td>±10.5 years</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>101 (54.9%)</td>
<td>143 (73.7%)</td>
</tr>
<tr>
<td>Male</td>
<td>83 (45.1%)</td>
<td>51 (26.3%)</td>
</tr>
</tbody>
</table>
## Association between exposure factors and Cholera outbreak in Muna Garage IDP camp, Borno, 2017 (1/2)

<table>
<thead>
<tr>
<th>Exposure in last 10 days prior to illness</th>
<th>Cases (%)</th>
<th>Controls (%)</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attended social gathering</td>
<td>54 (28.9%)</td>
<td>5 (2.5)</td>
<td>12.7 (5.0 – 33.0)</td>
</tr>
<tr>
<td>Ate from another household</td>
<td>31 (16.6%)</td>
<td>4 (2.0)</td>
<td>8.5 (3.0 – 24.7)</td>
</tr>
<tr>
<td>Ate from food vendors</td>
<td>43 (23.0%)</td>
<td>8 (4.1)</td>
<td>6.2 (2.9 – 13.7)</td>
</tr>
</tbody>
</table>
Association between exposure factors and Cholera outbreak in Muna Garage IDP camp, Borno, 2017 (2/2)

<table>
<thead>
<tr>
<th>Exposure in last 10 days prior to illness</th>
<th>Cases (%) n=187</th>
<th>Controls (%) n=197</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stored drinking water in containers without cover</td>
<td>36 (19.3)</td>
<td>23 (11.7)</td>
<td>1.6 (1.1 – 2.9)</td>
</tr>
<tr>
<td>Contacted anyone who had diarrhoea</td>
<td>23 (12.3)</td>
<td>16 (8.1)</td>
<td>1.7 (0.8 – 3.3)</td>
</tr>
<tr>
<td>Travelled</td>
<td>13 (7.0)</td>
<td>5 (2.5)</td>
<td>2.2 (0.8 – 6.4)</td>
</tr>
</tbody>
</table>
Binary logistic regression of exposure factors for Cholera in Muna Garage IDP camp, Borno, 2017

<table>
<thead>
<tr>
<th>Exposure in last 10 days prior to illness</th>
<th>AOR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attended social gathering</td>
<td>19.0 (5.8 – 62.0)</td>
</tr>
<tr>
<td>Ate from another household</td>
<td>17.0 (4.0 – 72.0)</td>
</tr>
<tr>
<td>Ate from food vendors</td>
<td>15.4 (5.2 – 45.3)</td>
</tr>
<tr>
<td>Stored drinking water in containers without cover</td>
<td>7.6 (3.0 – 19.4)</td>
</tr>
</tbody>
</table>
Cholera RDT results of stool specimens of reported Cholera cases among IDPs in Borno, 2017

<table>
<thead>
<tr>
<th>Results</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>n= 47</td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>29 (61.7)</td>
</tr>
<tr>
<td>Negative</td>
<td>7 (14.9)</td>
</tr>
<tr>
<td>Inconclusive</td>
<td>11 (23.4)</td>
</tr>
</tbody>
</table>
Cholera culture results of stool specimens of reported Cholera cases among IDPs in Borno, 2017

<table>
<thead>
<tr>
<th>Results</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>12 (41.4)</td>
</tr>
<tr>
<td>Negative</td>
<td>4 (13.8)</td>
</tr>
<tr>
<td>Pending</td>
<td>13 (44.8)</td>
</tr>
</tbody>
</table>
Discussion (1/2)

• Cholera remains a public health problem in IDP camps

• Eating outside the home and from food vendors were risk factors in this outbreak:
  – Consistent with findings in Sudan, Uganda and Haiti \(^6\)
  – Food vendors not meeting minimum food hygiene standards
  – Reveals gaps in public health inspection of food establishments

• Attending social gatherings was not identified as a risk factor for cholera outbreak among IDPs in Sudan\(^7\)
  – Our study was conducted just after the Muslim festive period

Discussion (2/2)

• Storing drinking water in containers without cover:
  – Presumed contamination by making it easy to place hands into containers
  – Narrow neck containers might have prevented spread of cholera in India
  – Contamination of stored drinking water during washing or other water use related activities may reflect low rations of water in the IDP camps
  – However, dirty storage water containers were identified as a risk factor for a cholera outbreak at a camp in Kenya

Study limitations

• Misclassification of cases:
  – The age group mostly affected (less than 5 years) usually have other differentials that fit case definition for cholera

• Misclassification of controls:
  – Some controls might have developed immunity to cholera
  – Controls were not tested for cholera

• Self reporting (social desirability) bias:
  – Risk communication activities had commenced before our study
Conclusions

• This was a confirmed cholera outbreak
• Epidemic curve points to a single source transmission
• Independent risk factors for the outbreak suggest poor food handling and water hygiene practices
• Rapid detection and response might have contributed to the low CFR
• Reactive oral cholera vaccination probably impacted on ending the outbreak
Public Health Actions (1/2)

- Coordinated available resources to respond to outbreak
- Mass sensitisation of IDP communities on preventive measures
- Disinfected affected households
- Chlorinated household water supplies and distributed water treatment tablets
- Initiated improved clean water supply
- Renovated and built camp latrines
- Distributed soaps in households and strategic places for hand washing
Public Health Actions (2/2)

- Disposed refuse and positioned trash bins at designated points
- Supportive supervision of State surveillance officers:
  - Promoted enhanced case-based surveillance
  - Monitored daily/weekly case counts and attack rates
- Trained health care workers on:
  - Case finding, RDT use; and reporting
  - Adherence to standard case management
- Micro plan for reactive vaccination:
  - Developed and executed
Recommendations

• Borno State Ministry of Health
  – Intensify health promotion and education
  – Register and periodically screen food vendors
  – Provide adequate clean water supply
Acknowledgements

• Nigeria Centre for Disease Control
• Government of Borno State, Nigeria
• Cohort 9 residents, Nigeria FELTP
• US CDC
• WHO
Thank you for your attention
Photo gallery