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An assessment of the emergency response among health workers involved in the 2010 cholera outbreak in northern Nigeria

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Cholera; Emergency response; Healthcare workers; Nigeria

Summary
Background: The 2010 cholera outbreak in northern Nigeria affected over 40,000 people, with a case fatality rate (CFR) of ≥3.75%. We assessed the emergency response of health care workers (HCWs) involved in case management.
Method: This was a cross-sectional study with data collected through a self-administered questionnaire. Data entry and analysis were performed using Epi Info software.
Results: A total of 56 HCWs were interviewed. The mean age was 31 years (SD ± 8.16 years). The majority of the HCWs (80%; n=45) were aged 18–39 years. Most were community health extension workers (60%), and 3.6% (n=2) were medical doctors. Many of the HCWs had less than 2 years of work experience (42%). Additionally, 82% of the respondents had <1 week of cholera emergency response training, and 50% of the HCWs managed >20 suspected cases of cholera per day. Although 78% of HCWs
Introduction

Cholera is a diarrheal disease caused by infection of the intestine with the bacterium *Vibrio cholerae* type 01 or 0139 in children and adults, with variability in the type and severity of symptoms among those infected. Acute watery diarrhea was observed in approximately 20% of cases, and in an additional 10–20%, severe watery diarrhea with vomiting was observed. In the absence of active case management, severe dehydration can result from the rapid loss of a large quantity of fluids and salt [1].

*V. cholerae* is typically transmitted through the fecal–oral route from contaminated water and food. A persistent risk of cholera has been observed in some areas, and sporadic attacks occur throughout the world, particularly in areas where there are challenges related to water supply, sanitation, food safety and hygiene [1]. However, in the developing world, cholera is a key indicator of a lack of social development, and it remains a key public health concern [1].

Cholera epidemics in Nigeria can be traced back to 1961, but the first major epidemic, affecting 22,931 people with 2945 deaths and a CFR of 12.8%, was reported in 1971. However, between 1973 and 1990, there were minimal reports of cholera cases across the country. In 1991, another massive wave occurred, affecting 59,478 people with a CFR of 12.9%, predominantly in northern Nigeria. A review of the cholera cases observed from 1991 to the present suggests that cholera has become endemic in Nigeria. The major risk factors identified are poor access to a safe water supply, poor access to proper sanitation facilities and chronic malnutrition [2].

The 2010 cholera epidemic in Nigeria is believed to be one of the worst cholera outbreaks in Nigeria in 20 years. This outbreak was reported to have affected over 40,000 Nigerians by October 2010, resulting in ≥1500 deaths and a case fatality rate (CFR) of ≥3.75% [3]. The north-eastern region of the country was the most affected. The Red Cross in Nigeria reported that over 80% of those affected were women and children. The World Health Organization (WHO) attributed the unusually high cholera incidence to seasonal factors combined with poor hygiene conditions and population movements in the area, which are regularly affected by small outbreaks [3].

In response to this outbreak, the Nigerian Institute of Medical Research Emergency Response Team (NIMRERT), Yaba, Nigeria, visited the three north-eastern states of Bauchi, Borno and Gombe to support the states’ efforts at controlling the outbreak (by providing relief materials). The team also assessed the epidemics with an evaluation of public health interventions for the outbreak and provided research support for the laboratory evaluation, isolation and typing of the circulating strains of *V. cholerae* in this region [4].

It is pertinent to reiterate that in a controlled cholera epidemic, the CFR should not exceed 1% [1]. Therefore, a CFR in excess of 1%, as in most African states, suggests a failure in the case management of those infected, poor provision of water and sanitation and a dearth of emergency response and preparedness to contain the epidemic.

The current responses to cholera outbreaks tend to be reactive, taking the form of an ad hoc emergency response. This approach may mitigate the associated mortality, but it fails to prevent cases of cholera because controlling a cholera epidemic requires the prompt medical treatment of cases. Therefore, a balanced orchestration of prevention, preparedness and response activities is required in an efficient surveillance system. This is paramount in preventing a future occurrence and controlling outbreaks [1].

Therefore, the above discourse formed the rationale for this study, which aimed to assess the emergency response of healthcare workers involved in the case management of individuals involved in this epidemic in the health facilities visited by the emergency response team during the epidemics in the aforementioned 3 north-eastern states of Nigeria.

reported the practice of universal safety precautions, 32% (n=18) knew HCWs who developed symptoms of cholera during the epidemic, most of which was believed to be hospital acquired (78%). We also found that 77% (n=43) of HCWs had no access to the required emergency response supplies.

**Conclusion:** Inadequate training, a lack of qualified HCWs and a limited supply of emergency response kits were reported. Therefore, the government and stakeholders should address the gaps noted to adequately control and prevent future epidemics.

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Cholera outbreak emergency response in Nigeria

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Methodology

This was a cross-sectional study aimed at assessing the emergency response among healthcare workers involved in the case management of patients in this epidemic. The study was conducted in September and October 2010 during the 2010 cholera outbreak. The healthcare workers interviewed included doctors, nurses, laboratory scientists, community extension workers and hospital attendants, most of whom were observed at cholera treatment centers in rural areas. The data were collected using a self-administered questionnaire designed to collect demographic information, information on previous experience and training in cholera case management and the availability and use of universal safety tools. The questionnaires were pretested using a similar population in a pilot study, and a revised version was used to collect the study data.

This study was nested in the intervention by the Nigerian Institute of Medical Research Emergency Response Team (NIMRERT), which visited three north-eastern states of Nigeria in 2010 during the peak of the cholera epidemic to assess the epidemics, evaluate public health interventions for the outbreak and provide research support for the laboratory evaluation, isolation and typing of the circulating strains of *V. cholerae* in this region. Ethical approval for this study was obtained from the Nigerian Institute of Medical Research Institutional Review Board prior to the commencement of the survey.

Healthcare workers observed on site at cholera treatment centers who were willing and able to give informed consent were enrolled in the study. Healthcare workers who did not want to participate were excluded from the study. The few HCWs who refused to participate in the study were either observed during the ‘in-between’ shift period or had a pressing clinic demand at the time our team visited their facility. Data entry and organization were performed with Microsoft Excel, and data analysis was performed using Epi info software.

Results

A total of 56 participants were enrolled in this study. The mean age of the study participants was 31 years (SD ± 8.16 years); 80% (*n* = 45) were 18–39 years of age, and only 20% were older than 40 years of age. The study population was 64% male (*n* = 36), and the majority of respondents practiced Islam (76.8%). Of the different categories of health care workers interviewed, 66% (*n* = 33) were community extension workers, and 42% (*n* = 21) of those had worked for at least 2 years (Table 1).

Over 90% (52/65) of the participants were directly involved in patient case management during the epidemics, but 36.5% (19/52) of these HCWs were not trained in cholera case management; however, the majority was trained in cholera case management. A total of 45% (15/33) were trained for 2–7 days, and 60.6% (20/33) were trained by a government agency. Fifty percent (26/52) of the healthcare workers indicated seeing more than 20 patients per day. Although 76.8% (*n* = 43) of HCWs felt overworked, 38.5% (*n* = 20) felt personally motivated to continue providing emergency care (Table 2).

Approximately 78% (*n* = 43) of the respondents indicated that they practiced some form of universal safety precaution methods, with over 50% using gloves (*n* = 23) and hand washing (*n* = 22). During the epidemic, 66% (*n* = 35) of health care workers indicated a lack of knowledge of the clinical presentation of cholera. Healthcare workers who knew of other healthcare workers who had become infected with cholera during the epidemic attributed it to hospital acquisition in 78% (*n* = 14) of cases (Table 3).

Healthcare workers who were trained in cholera emergency response (OR = 3.2; *p* = 0.09; CI: 0.78–13.44), those who were not overworked

| Table 1 Socio-demographic characteristics of the health workers. |
|-----------------|-----------------|-----------------|
| Characteristics | Frequency (*N* = 56) | Percentage |
| Age             |                  |                |
| 18–28           | 27               | 48             |
| 29–39           | 18               | 32             |
| ≥40             | 11               | 20             |
| Sex             |                  |                |
| Male            | 36               | 64.3           |
| Female          | 20               | 35.7           |
| Occupation      |                  |                |
| Hospital attendant | 3            | 5.4           |
| Laboratory scientist | 6       | 10.7          |
| Doctor          | 2                | 3.6            |
| Nurse           | 12               | 21.4           |
| Community extension workers | 33   | 58.9         |
| Religion        |                  |                |
| Islam           | 43               | 76.8           |
| Christianity    | 13               | 23.2           |
| Years of practice (years) |      |                |
| 1–2             | 21               | 42             |
| 3–5             | 13               | 26             |
| 6–10            | 7                | 14             |
| >10             | 9                | 18             |
Table 2  The attitude and competence of healthcare workers involved in the emergency response.

| Attitude and competence                                      | Frequency | Percentage |
|---------------------------------------------------------------|-----------|------------|
| Directly involved in case management                          |           |            |
| Yes                                                           | 52        | 92.9       |
| No                                                            | 4         | 7.1        |
| Trained in cholera case management \(n=52\)                   |           |            |
| Yes                                                           | 33        | 63.5       |
| No                                                            | 19        | 36.5       |
| Duration of training \(n=33\)                                 |           |            |
| 1 day                                                         | 8         | 24.2       |
| 2–7 days                                                      | 15        | 45.4       |
| \(\geq 1\) week                                               | 5         | 15.2       |
| No response                                                   | 5         | 15.2       |
| Source of training \(n=33\)                                  |           |            |
| Government organized training                                 | 20        | 60.6       |
| NGO organized training                                        | 2         | 6.1        |
| On the job                                                    | 5         | 15.1       |
| No response                                                   | 6         | 18.2       |
| Number of patients seen daily by healthcare worker \(n=52\)  |           |            |
| 1–10                                                          | 11        | 22         |
| 11–20                                                         | 15        | 27.8       |
| 21–40                                                         | 19        | 36.1       |
| \(\geq 40\)                                                   | 7         | 13.9       |
| Felt over worked                                              |           |            |
| No                                                            | 12        | 21.4       |
| Yes                                                           | 43        | 76.8       |
| No response                                                   | 1         | 1.8        |
| Personally motivated to continue rendering emergency care     |           |            |
| No                                                            | 28        | 53.9       |
| Yes                                                           | 20        | 38.5       |
| No response                                                   | 5         | 9.6        |

Table 3  The knowledge and practice of universal safety precaution (USP) and personal protective equipment during the epidemic.

| Universal safety precaution (USP) knowledge and practice      | Frequency | Percentage |
|---------------------------------------------------------------|-----------|------------|
| Currently practice USP                                        |           |            |
| No                                                            | 12        | 21.8       |
| Yes                                                           | 43        | 78.2       |
| Type of USP practiced: \(N=43\)^a                            |           |            |
| (1) Chlorine solution                                         | 14        | 32.5       |
| (2) Hand washing                                              | 22        | 51.1       |
| (3) Used gloves                                               | 23        | 53.4       |
| Knowledge of health worker who developed signs and symptoms of Cholera during the epidemic | | |
| No                                                            | 35        | 62.5       |
| Yes                                                           | 18        | 32.1       |
| No response                                                   | 3         | 5.4        |
| Believed that the health worker’s cholera infection could be hospital acquired: \(n=18\) | | |
| No                                                            | 4         | 22.2       |
| Yes                                                           | 14        | 77.8       |

^a Each USP is a percentage of total 43 responses.
Discussion

This study evaluated the emergency response of healthcare workers involved in the case management of cholera-infected patients during the large outbreak in north-eastern Nigeria in 2010. Most of the healthcare workers interviewed were residents in the rural areas in which most of the cholera cases occurred.

In this study, we found that the healthcare workers involved in the epidemic were overworked, and this most likely affected their commitment to emergency care, with resultant poor patient management. These data are in agreement with observations during a cholera outbreak in rural Guinea-Bissau, in which healthcare workers were overwhelmed by the number of cases presenting at their facilities [5]. However, contrary to what we noted in northern Nigeria, the healthcare workers in Guinea-Bissau were able to maintain the CFR at a low level.

Emergency response training is key to epidemic control, but in the developing world, most of the healthcare workers involved in case management are either poorly trained or not trained at all, as discovered in the studied areas. This assertion is supported by the study which found that 77% of healthcare workers indicated a lack of the equipment necessary to control and prevent cholera. An additional 77% were satisfied with the medical intervention and government involvement in the control of the epidemic compared to previous cholera outbreaks (Table 4).

Although 77% (n = 40) of healthcare workers indicated a lack of the equipment necessary to control and prevent cholera, more than 77% (n = 41) were satisfied with the medical intervention and government involvement in the control of the epidemic compared to previous cholera outbreaks (Table 5).

Various challenges in patient care management were reported, including a lack of funding, a lack of emergency response kits, inadequate supplies of the required materials and consumables, inadequate training in emergency response and an inadequate supply of trained manpower. In the overall assessment of the emergency response to the outbreak, the respondents believed that the government should provide safe water, engage in more health promotion campaigns (particularly in rural areas), make the required medical equipment and supplies available to emergency response workers, scale up their prompt intervention and ensure better case management of cholera patients.
supported by an Asian study on the assessment of primary health center disaster preparedness after the earthquake in Padang Pariaman, West Sumatra, Indonesia, in 2009 [6]. They also noted that the lack of requisite resources and poorly trained medical personnel contributed to a poor emergency response. In a report of a cholera outbreak in Kenya in 2008, limited staffing of health facilities and a paucity of medical supplies were noted to be the major contributing factors to the high mortality observed during the outbreak [7]. However, different modes of training could be used if they are well tailored to the needs of the local population, as reported in diarrhea case management in Guatemala, in which distance learning and the tutoring model were used [8].

The use of personal protective equipment (PPE) and infection control has been documented in the management of cholera epidemics in northern Nigeria [9]. This study suggested that simple water supply and hand hygiene practices, including point-of-use chlorination and safe water vessels and hand washing with soap, could help to reduce the risk of transmission in both the community and health centers. However, despite the use of PPE, there were reported cases of cholera infection among health care workers involved in case management during the epidemic. This could be due to breakthrough infection at times when the health care workers were overwhelmed and did not use PPE or because of the non-availability or non-use of PPE. A similar occurrence was reported in Hong Kong, where the breakthrough transmission of severe acute respiratory syndrome (SARS) occurred among many hospital workers despite infection control measures during the SARS outbreak in 2003 [10].

Cholera epidemics are closely associated with poverty and poor socioeconomic development. Recent outbreaks in the developing world have shown that natural disasters, such as heavy flooding and earthquakes, have caused the worst cases

| Table 5  | Epidemic response preparedness and evaluation of medical intervention in the present epidemic. |
|----------------|--------------------------------------------------------------------------------------------------|
| Emergency response and evaluation of intervention | Frequency | Percentage |
| Availability of necessary equipment | | |
| No | 40 | 76.9 |
| Yes | 12 | 23.1 |
| Rating of medical intervention in the outbreak | | |
| Excellent | 10 | 18.2 |
| Satisfactory | 31 | 56.4 |
| Fair | 10 | 18.2 |
| Poor | 4 | 7.2 |
| Challenges encountered in providing care* | | |
| Lack of funding | 26 of 46 | 56.5 |
| Lack of equipment | 21 of 46 | 45.7 |
| Inadequate supplies | 24 of 46 | 52.2 |
| Inadequate training | 31 of 46 | 67.4 |
| Inadequate manpower | 31 of 46 | 67.4 |
| Observations/recommendations | | |
| Government should provide safe water supply | | |
| No | 4 | 13.3 |
| Yes | 26 | 86.7 |
| Government should do more health education | | |
| No | 12 | 40 |
| Yes | 18 | 60 |
| Government should provide equipment and funding | | |
| No | 19 | 63.3 |
| Yes | 11 | 36.7 |
| Need for prompt intervention | | |
| No | 5 | 16.7 |
| Yes | 25 | 83.3 |
| Better management of the outbreak | | |
| No | 2 | 6.7 |
| Yes | 28 | 93.3 |

* Respondents could choose more than one answer.
in recent times [11,12]. Such situations are similar to the lack of adequate supplies of potable and safe water and poor sanitary conditions experienced in northern Nigeria. Therefore, epidemic control should be initiated and maintained by the government at different levels, namely by the local, state and federal governments. The healthcare workers interviewed in this study believed that the government should be at the forefront to provide safe water, engage in more health promotion campaigns (particularly in rural areas) and make the required medical equipment and supplies available to emergency workers.

The adequacy of patient care during this epidemic could not be ascertained because of the high CFR. This result further reinforces the fact that only a few medically qualified high-ranking staff were observed in the health centers in which the cases were managed. Additionally, it is clear from the study that most of the young health care workers fell into the category of community health extension workers with limited expertise. This situation is similar to what was discovered during the management of cholera epidemics among Rwandan refugees in Goma, Zaire, where the lack of appropriate case management led to a high CFR [12]. Therefore, there is a need to mobilize experienced and more medically qualified health-care workers to rural areas during emergency outbreaks.

The major limitation of this study is that it is not representative of the emergency response system in Nigeria because this study was performed mostly in the rural areas of the north-eastern geopolitical region of the country; therefore, there is a need for comparison with other geopolitical zones of Nigeria. Generalization of this study’s findings should be cautiously performed in relation to other developing countries.

Conclusion

This survey demonstrated that healthcare workers in the studied areas were overwhelmed during the epidemic, with little or no emergency response training. Additionally, these workers lacked access to the required kits and supplies and the motivation required to handle the heavy workload observed during the epidemic. Therefore, there is a need to scale up emergency response training in these disaster-prone areas and mobilize skilled health care personnel in the event of a massive medical emergency, with the attendant supply of the requisite emergency response kits and supplies by the government. Additionally, there is a need for strengthening the collaborative efforts of the tiers of the government, non-governmental organizations and the private sector to adequately control and prevent epidemics.

Authors’ contributions

David A. Oladele (DAO) contributed to data collection/manuscript development and review, Kolawole S. Oyedoji (KSO) and Francisca Nwaokorie (FN) contributed to data collection and manuscript review, Mary-Theresa Niemogha (MTN) and Moses Bamidele (MB) contributed to data collection, Adesola Z. Musa (AZM) contributed to data analysis/manuscript review, Adeniyi K. Adeneye (AKA), Tajudeen A. Bamidele (TAB) contributed to data collection/field work/manuscript review, Michael Ochoga (MO), Kehinde A. Akinsinde (KAA) contributed to data collection/field work, Bartholomew I. Brai (BIB), Emmanuel A. Omonigbehin (EAO), Toun W. Fesobi (TWF), Stella I. Smith (SIS), Innocent A. Ujah (IAU) contributed to manuscript review.

Conflict of interest statement

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Competing interests: None declared.

Ethical approval: Ethical approval for this study was obtained from the Nigerian Institute of Medical Research Institutional Review Board prior to the commencement of the survey.

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Appendix A. Glossary

1. Community extension worker:
   - Healthcare workers trained to augment the effort of doctors and nurses, particularly in primary health centers in rural areas, where they serve as the first contact with patients
and provide referrals to secondary and tertiary health facilities.

2. Emergency response:
   - This is the aggregate decisions and measures taken to contain or mitigate the effects of a medical emergency and prevent further loss of life. It is typically the first and immediate response.

3. Healthcare workers (HCWs):
   - All people providing healthcare (involved in identifying, preventing or treating illness or disability).

4. Hospital attendants:
   - Personnel involved in patient care by assisting nurses and doctors. They were also involved in sanitation in cholera treatment centers and some measures of infection control.

5. Nigerian Institute of Medical Research Emergency Response Team (NIMRERT):
   - A group of interdisciplinary professionals/researchers with a mandate to carry out the public health/epidemiology evaluation of medical emergencies and provide research support in the form of the laboratory evaluation, isolation and typing of the circulating strains of causative agents of the epidemic.

6. Personal protective equipment (PPE):
   - Refers to protective clothing, helmets, goggles or other garments or equipment designed to protect the wearer’s body from injury, hazard or infection for job-related occupational safety and health purposes.

7. Universal safety precaution:
   - Refers to the practice in patient care of avoiding contact with patients’ bodily fluids through wearing nonporous articles, such as medical gloves, goggles and face shields.

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