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# CONTROL AND PREVENTION OF CHOLERA TRANSMISSION IN LOW RESOURCE CLINICAL SETTING

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## ABSTRACT

**INTRODUCTION:** Cholera is a serious Public Health Emergencies of International Concern (PHEIC). The recurrence of outbreaks depicts lack of appropriate control and prevention, thereby contributing to high morbidity, mortality and socioeconomic burden. The clinical setting, aside from treatment of the infected, plays a big role in the ultimate prevention and control of the disease.

**AIM:** This article highlights the necessary prevention and control practices in low-resource clinical settings.

**METHODOLOGY:** We extracted relevant articles from various databases such as PubMed, Google Scholar and African Journal Online(AJOL) and summarized them.

**RESULT:** Cholera caused by the organism, *Vibrio cholera* is of great global burden and majority of cases are in poor and low resource setting like Nigeria, where there are challenges with water supply and sanitation. The key preventative and control strategy in clinical setting include clinical and administrative policy toward cholera prevention and control, rapid case identification, compliance with Standard Precaution, adoption of Transmission Based Precautions for patient isolation, contact tracing and treatment, effective case referral system, cholera education and enlightenment of health workers and the community.

**CONCLUSION:** With the current wave of cholera in many countries, there is need for health practitioners to upgrade their skills in both clinical and infection prevention and control practices.

**KEYWORDS:** Cholera, Nigeria, Clinical setting, Infectious disease, infection control.

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## INTRODUCTION

Cholera is not a new disease, in the last two centuries, it has caused seven pandemics and still ravages many communities globally, particularly in Africa and Asia.<sup>1</sup> Mortality in recent times in certain communities have approached alarming rates witnessed during one of the highlighted pandemics experienced a hundred year ago; an example is the outbreak in Zimbabwe between 2008–2009.<sup>2</sup> Currently the disease is considered a Public Health Emergencies of International Concern (PHEIC).

Aside the enormous implication on the community setting, it poses a serious challenge in clinical settings especially the

predisposition to infection in advent of an epidemic among the health workforce (HWF), leading to high morbidity and mortality among the overburdened health workers.<sup>4-6</sup>

Furthermore, in some communities the disease is endemic thus exposing the HWF constantly to the risk of the disease. For example in Democratic Republic of Congo (DRC), about 9% of the country's population live in areas where the incidence of the disease is higher than 1/1000.<sup>-4</sup>

We write to highlight the necessary prevention and control practices in low-resource clinical settings due to the potential effect on the health workforce and health system during emergence of an epidemic or the endemic pattern in some regions.

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## HISTORY

Cholera causing organism-*Vibrio cholerae* was first isolated by Italian anatomist, Filippo Pacini, in 1854 from histological examination on the intestinal mucosa of autopsied cholera infected patients while Robert Koch, a German physician in 1883 also confirmed the disease is caused by this bacillus while working in Egypt and India.<sup>7</sup> The disease was discovered to be associated with contaminated water by British physician, John Snow (father of Epidemiology) in 1854 during the outbreak of cholera epidemic at Broad Street Pump in London.<sup>7</sup>

## EPIDEMIOLOGY

There is a high global burden of the disease, according to World Health Organisation (WHO), who had reported 1.3 to 4.0 million cases annually and about 21 000 to 143 000 deaths.<sup>8</sup>

In 2011, a resolution was adopted at the 64th World Health Assembly to recognize the re-emergence of cholera as a weighty public health threat requiring a comprehensive and integrated control.<sup>9</sup> That same year, WHO reported cumulative cholera cases of 589, 854 with 7,816 deaths in 58 countries (case fatality rate(CFR) of 1.3%); this was 85% higher than 2010 report.<sup>10</sup> Out of the 58 countries reported for cholera epidemics, 27 were African countries. Globally, 33 countries recorded cholera deaths while 23 out of the 33 countries emanated from Africa, this represented 53% of the total global deaths.<sup>10</sup> Two American countries, Dominican Republic and Haiti, were responsible for 41% of total global death. Majority of the deaths were clustered in low resource countries where there were poor access to healthcare services, water, sanitation, hygiene and poorer sewage management.<sup>10</sup>

A large number of the cases in recent times arise in sub Saharan Africa with Nigeria contributing a significant amount.<sup>8,11</sup> Deaths attributed to cholera were 5,127 out of 154,910 cases reported in Nigeria between 2004 to 2016 with a CFR of 3.3%.<sup>12</sup> Nigeria had the

highest cholera cases within West and Central Africa regions in 2014, with 35,996 cases representing 39% of total in the region.

There are recently reported outbreak among internally displaced people of refugee camps in North East and other communities within Kwara State in the North Central zone.<sup>13</sup> According to Nigeria Centre for Disease Control (NCDC), cholera in 2015 was accountable for 5,301 cases with 29 laboratory confirmed, 186 deaths (3.51% CFR) across 101 LGA in 18 states and Federal Capital Territory (FCT).<sup>14</sup> In 2016, it accounted for 768 cases and 32 deaths (4.17% CFR) across 57 Local Government Area (LGA) in 14 states. In 2017, between week 1 to 34 (August 21 - 27), cholera was responsible for 1,198 cases and 32 deaths (2.67% CFR) across 47 LGA in 16 states; comparable to 2016, week 1 to 34 (August 22 - 28), cholera was associated with 402 cases and 13 deaths (3.32% CFR) across 34 LGA in 11 states. The pattern between 2015 and 2016 showed an impressive decrease, but between year 2016 and 2017, within 1 to 34 weeks, showed significant increase in reported cases (suspected or probable), deaths and spread across LGA and states.

Cholera is transmitted through consumption of contaminated food or water, with the sewage of an infected person or people. Provision of safe water, healthy sanitation and good hygienic practices are essential in preventing and controlling cholera particularly at the community level.<sup>15</sup>

## MICROBIOLOGY

Cholera is an acute diarrhoeal disease, caused by a comma (or curved) shaped gram negative bacterium called *Vibrio cholerae*.<sup>16</sup> There are above 200 serotypes categorized by the lipopolysaccharide O antigen on their cell surface, but 2 serotypes, O1 and O139, are known to cause epidemic and pandemic cholera. Serotype O1 is subsequently divided into Classical and El tor biotypes, both known for the cholera toxin (CT) and toxin-co-regulated pilus (TCP), the virulent factors.<sup>16</sup>

The bacteria can be isolated and identified from stool specimen through:

- Rapid Diagnostic Test, beneficial for quick identification and monitoring during outbreak cases, with about 24 developed since 1990, but limited by sensitivity and specificity.<sup>17,18</sup>
- Microbial culture using thiosulfate citrate bile salts sucrose (TCBS) agar, agar of choice, and others; this is the gold standard and essential for antimicrobial sensitivity to track antibiotic resistance species.<sup>17</sup>
- Molecular characterization using Polymerase Chain Reaction, still at the early stage with many tools utilising the technology being developed.<sup>19,20</sup> This has higher sensitivity and specificity in addition to rapidly diagnosis of the disease even with low quantum of bacteria load in sample. It uses PCR detection based on magnetic nanoparticles for rapid detection of bacterial DNA of cholera organism.

It is mainly Cary Blair and Alkaline Peptone Water (APW) that is used as transport medium of the sample, though there are others such as Stuart and Amies transport media, filter paper and bile peptone medium.<sup>17</sup>

The prevention and control in hospital setting have some unique practices which are necessary for effective intervention, breaking the chain of transmission and reducing fatality. Aside its capacity of being an effective contagion, it has been documented to show increasing antibiotic resistance.<sup>25,26</sup>

Although, there are documented effectiveness of Quinolones (Ciprofloxacin, Norfloxacin and Ofloxacin) in treating cholera from studies conducted in Argentina, Bangladesh, India, Peru, and Thailand. However studies across Africa, Asia and America have indicated *V. cholerae* resistant strains emerging against quinolones; studies on *V. cholerae* O1 strains conducted at Infectious Diseases Hospital Calcutta, India with documented 38.8% and 25% resistance to quinolones respectively in 1999 and 2000.<sup>27</sup>

## INFECTION PREVENTION AND CONTROL

Case identification is very important especially by primary health workers, who are mostly the first responders to establish contact with infected patients, and more likely to see many of these cases.<sup>29</sup> It is therefore imperative that they are educated and empowered to ensure there is proper identification, prompt intervention and appropriate compliance with infection control standards.

Thereafter, efforts should be directed to apply Contact Precautions to prevent further transmission. Contact Precaution is the transmission based precaution applied for probable, suspected or confirmed cholera cases admitted within the hospitals.<sup>29-31</sup> Transmission Based Precautions are additional infection control practices (safety precautions), beyond standard precautions, used to prevent transmission of infectious diseases.<sup>29-32</sup> There are three types: contact, droplets and airborne based on the three major routes of transmission – contact (direct or indirect contact), droplet particles of respiratory elements between 5 and 30 µm or more (about 100 µm) and Airborne particles of respiratory aerosols below 5 µm.<sup>30-33</sup>

Ideally, a single patient room is used as the isolation room for contact precaution to admit patient, but where this is not possible, putting patients with the same disease in the same room and adhering to appropriate bed spacing of 1m or 1.5m can be adopted. The Personal Protective Equipments (PPE) used for contact precaution are hand gloves, gowns while face masks and/or goggles are used for suspicion of splashes from vomiting or diarrhoea (common presenting symptoms of cholera). Hand hygiene, through hand washing with flowing water and soap or hand rubbing with alcohol gel when appropriate, should be made a standard practice within all health facilities and its use in donning & doffing of PPE, 5 Moments of Hand Hygiene and other point of care practices should be effectively implemented.<sup>32,34,35</sup>

Care of the hospital environment is important; housekeepers or hospital cleaners trained on infection control practices peculiar to their job and specific infectious diseases should be assigned to the cleaning, disinfection and terminal decontamination of the isolation room, and subsequently monitored for compliance.<sup>33</sup> The yellow coloured medical waste bin should be used in the contact precaution isolation room; single use bed linen is preferable but when not possible, dirty bed linen should be cleaned and disinfected appropriately; while soiled bed linen should be discarded (not to be reused), after use, into the yellow coloured medical waste bin.<sup>33</sup> There should be adequate and prompt cleaning, disinfection and/or sterilization of all medial apparatus and equipment within the isolation room, whether used or unused.<sup>33</sup> Usually, the isolation room is recommended safe for further admission based on the information on the disinfectant manuals or policy guidelines of the hospital, Ministry of Health (MOH), Association for Professionals in Infection Control and Epidemiology (APIC), NCDC, WHO or other authorities on infection prevention and control. The number of staffs and relatives that access index patient's Contact Precaution Isolation Room should be limited to those who are essentially involved in the patient's care. A log book should be opened to document inflow and outflow of essential staffs and relatives visiting patients while information on notice of occurrences of symptoms peculiar to cholera must be promptly reported.<sup>33</sup>

All contacts of probable, suspected or confirmed patients should be traced and monitored for appropriate testing, restrictions and other interventions as required.<sup>33</sup>

**Referral System:** Referral of index patient to another hospital should be done cautiously to control the spread of the infectious agents. The receiving hospital should be duly informed and prepared to accept the patient by ensuring they limit the number of people establishing contact with the patient, prepare

the contact precaution isolation room before entry, delegate all staffs that will be involved in administering care to the patient to a minimally essential number, prepare their log book for monitoring inflow and outflow of personnel into patient's room and recording incidence of significant symptoms of the disease. The personnel and/or relatives involved in the transportation of the index patient from the contact precaution isolation room of referring hospital to the receiving hospital should be limited to those providing the essential services during the referral process, and fully dressed in the recommended PPE. The movement of the index patient from the admission room of referring hospital to the receiving hospital should be limited to areas less crowded, less visited and with shorter distance while competent housekeepers clean and disinfect these areas appropriately.

Awareness of cholera disease should be communicated suitably to the community while rumours and their channels are properly monitored and controlled in a socially acceptable way. An effective and efficient surveillance system, with necessary staff and resources, peculiar to infection control programs should be developed within hospitals and the local/state ministry of health in addition to neighbouring regions for proper coordination, cooperation, and collaboration for sharing data and other resources.

There is need to develop continuous training in infection prevention and control in order to build the capacity of all health workers and the public on basic infection control measures applicable while visiting the hospitals and at home. This is important to reduce and control the future occurrence of cholera.

There is need to get to that point when and where patients can politely request their care providers perform hand hygiene before establishing contact with them - basic, simple, efficient, effective, reliable and timely.

The hospital setting is very important in the prevention and control of cholera transmission. It also serves as epidemiological

sentinel to alert the public health system to new outbreak.<sup>36</sup> It is therefore necessary that this is continuously strengthened particularly at primary care level, and other care level. The role of environmental and socioeconomic factors, which Nigeria is susceptible to, no doubt contribute to it for a long time to come; therefore, it is necessary to continue to strengthen the healthcare setting to forestall transmission while not neglecting the community.

**Table 1 : Key preventive and control methods in low resource clinical setting**

- |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ol style="list-style-type: none"> <li>1. Clinical and administrative policy toward cholera prevention and control</li> <li>2. Rapid case identification</li> <li>3. Compliance with Standard Precaution</li> <li>4. Adoption of Transmission Based Precautions for patient isolation</li> <li>5. Contact tracing and treatment</li> <li>6. Effective case referral system</li> <li>7. Cholera education and enlightenment health workers and the community</li> </ol> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## CONCLUSION

With the current wave of cholera especially in Nigeria, there is need for health practitioners to upgrade their skills. This article highlights relevant prevention and control measures for cholera transmission in clinical setting applicable to low-resource settings like Nigeria.

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