International Journal of Current Advanced Research
ISSN: O: 2319-6475, ISSN: P: 2319-6505, Impact Factor: 6.614
Available Online at www.journalijcar.org
Volume 9; Issue 06(A); June 2020; Page No.22380-22384
DOI: http://dx.doi.org/10.24327/ijcar.2020.22384.4411

Research Article

INCIDENCE OF CHOLERA AFTER A MASS CAMPAIGN ORAL CHOLERA VACCINE RESPONSE DURING AN EPIDEMIC IN NORTH KIVU, DEMOCRATIC REPUBLIC OF CONGO

Stephane Hans Bateyi M.[1,2], Phillipe Aksanti B.[2], Josaphat Kakule K.[3], Nanou Yanga M.[4], Christophe Luhata L.[4] , Jeef Oyaya M[4] , Michel Kabamba N.[4], Aimé Cikomola M.B.[4] and Elisabeth Mukamba M.[4]

[1]Expanded Program for Immunization, North Kivu, Goma, Democratic Republic of Congo
[2]Department of Public Health, Faculty of Medecine, ULPG University, Goma, Democratic Republic of Congo
[3]Ministry of health, North Kivu, Butembo, Democratic Republic of Congo
[4]Ministry of Health, National Expanded Program for Immunization, Operational Research Unit, Kinshasa, Democratic Republic of Congo

A R T I C L E I N F O

Article History:
Received 24th March, 2020
Received in revised form 19th April, 2020
Accepted 25th May, 2020
Published online 28th June, 2020

Key words:
Cholera, incidence, mass compaign, Epidemic, DRC.

A B S T R A C T

Background: In addition to improving water, sanitation and hygiene (WASH) measures and optimal case management, the introduction of Oral cholera vaccine (OCV) is a complementary strategy for cholera prevention and control for vulnerable population groups. Cholera is still a major global health problem, affecting mainly people living in unsanitary conditions and who are at risk for outbreaks of cholera. The objective of our study is to assess the incidence after a mass vaccination campaign against the cholera epidemic in North Kivu Province, especially in four health zone which are near lake Kivu and Edward.

Methods: We did a cross-sectional survey in the areas included as part of the target population of the 2019 OCV campaign in North Kivu province, which was organized from May 28 to June 1, 2019. A study team collected data through a survey and in-depth interviews during two weeks (09-22 december 2019)

Results: The overall vaccination coverage with at least one dose in this four health zone was 101.5%. The highest administrative coverage provided by the Ministry of Health was observed among children under 4 years of age in the Goma health zone (188.0%). While among those aged 5 to 14, the highest coverage was that observed in the Kirosthe HZ (138.2%). On the other hand, among those over 15 years old, the Kibirizi health zone had the highest coverage, 85.1%. The incidence of cholera before the OCV mass campaign was around 45.6% against 2.4% after.

Conclusions: The findings revealed a single dose of oral cholera vaccine can be used as a means of preventing cholera during an epidemic in North Kivu.

INTRODUCTION

Cholera is caused by Vibrio cholerae and epidemics are primarily caused by serogroups O1 and O139. Serogroup O1 has two biotypes (El Tor and classical) and both biotypes can further be classified into three serotypes: Ogawa, Inaba and Hikojima. V. cholerae O1 Hikojima is an unstable form and rarely occurs in nature[1]. Cholera is a waterborne, life-threatening form of dehydrating diarrheal disease caused by the toxigenic serogroup strains of Vibrio cholerae. It remains a public health threat, as evidenced by its substantial contribution to morbidity and mortality in low-income countries[2].

Corresponding author:* **Stephane Hans Bateyi M
Expanded Program for Immunization, North Kivu, Goma, Democratic Republic of Congo

The Democratic Republic of the Congo (DRC) accounts for an estimated 189,000 (5%–14%) of the 1.34–4.01 million cholera cases worldwide annually[3]. Vibrio cholerae repeatedly reappeared in the DRC throughout the 1970s and became endemic around the Great Lakes in eastern DRC in 1978, resulting in part from favorable conditions for the bacterium's environmental survival [4]. Complex emergencies in eastern DRC have since enabled the regular spread of cholera along the lake banks and to surrounding health zones, driven by water supply interruptions, high population densities, and population movement[4].

Cholera continues to be a public health threat in many developing countries as highlighted by recent outbreaks in Angola, Zimbabwe, Haiti, the Democratic Republic of the Congo and other regions of Africa. Ensuring clean water, sanitation and hygiene constitute the main strategies for the prevention of the disease. But in endemic areas with seasonal

cholera outbreaks, these basic needs are often not met and cholera outbreaks during natural or man-made disasters are usually associated with infrastructure breakdown. In October 2009, the World Health Organization's Strategic Advisory Group of Experts on Immunization recommended that oral cholera vaccination should be considered as a reactive strategy during outbreaks, in addition to the already recommended preventive use of oral cholera vaccination in endemic areas[5].
DRC is no stranger to cholera. The disease repeatedly reappeared in DRC throughout the 1970's, becoming endemic in eastern DRC by 1978. Now, DRC makes up approximately 5-14% of annual cholera cases worldwide. In 2017, there were 53,037 cases and 841 deaths. In 2018, there were 29,304 suspected cholera cases and more than 930 deaths. According to literature, complex emergencies in eastern DRC have enabled cholera to continue its spread along the banks of the Great Lakes and into surrounding areas due to water supply interruptions, high population densities and population movement. The 2019 outbreak is affecting 20 of DRC's 26 provinces, particularly Haut-Katanga, South Kivu, Tanganyika, Haut-Lomami and North Kivu

Cholera is still a major global health problem, affecting mainly people living in unsanitary conditions and who are at risk for outbreaks of cholera. During the past decade, outbreaks are increasingly reported from more countries[6]. From the early killed oral cholera vaccine, rapid improvements in vaccine development occurred as a result of a better understanding of the epidemiology of the disease, pathogenesis of cholera infection and immunity. The newer-generation oral killed cholera vaccines have been shown to be safe and effective in field trials conducted in cholera endemic areas. Likewise, they have been shown to be protective when used during outbreak settings. Aside from providing direct protection to vaccinated individuals, recent studies have demonstrated that these killed oral vaccines also confer indirect protection through herd immunity. Although new-generation oral cholera vaccines should not be considered in isolation from other preventive approaches in countries where they are most needed, especially improved water quality and sanitation, these vaccines serve as immediately available public health tools for preventing further morbidity and mortality from cholera.

Provision of safe food and water, adequate sanitation, implementation of personal and community hygiene are considered as public health interventions to prevent and control diarrheal diseases. The most vulnerable to these diseases live in developing countries where quick and full implementation of these measures in the near future is unlikely due to lack of funds and infrastructure. In emergencies following man-made or natural disasters, such measures are unlikely to be implemented timely. Previously, vaccination has not been considered as a control measure for endemic cholera because of concerns with vaccine efficacy, availability, costs and feasibility. Failure of standard prevention and control measures in low-income countries has increased the acceptability of cholera vaccination as an additional public health prevention and control tool in resource poor settings(Philippe Cavailler , Marcelino Lucas, 2006)

Despite available data on the protection conferred by OCVs, governments may require local evidence of impact to justify an initial vaccination campaign, for advocacy, to maintain public confidence in the vaccine or to guide future decisions regarding scaling-up of vaccination or inclusion of the vaccine in their public health program. The objective of our study is to assess the incidence after a mass vaccination campaign against the cholera epidemic in North Kivu Province

METHODS

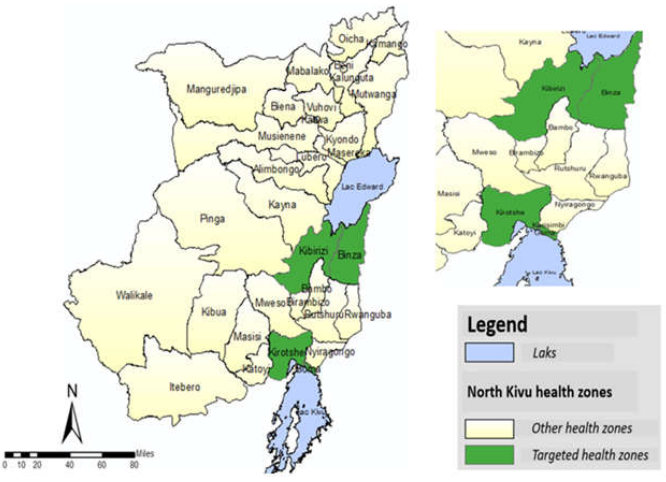
Study Design

Six months after the first passage of the OCV campaign, we carried out a cross-sectional survey in the areas included as part of the target population of the 2019 OCV campaign in North Kivu province, which was organized from May 28 to June 1, 2019.

Study Setting

The province of North Kivu is located in the Great African Rift bordered by lakes Edouard and Kivu and by the northern part of Lake Tanganyika. The climate in this region is characterized by a rainy season, from October until the end of May, and a dry season the rest of the time. From January 2000 through December 2019, reports of cholera cases and deaths were collected weekly from each health district (HD) of North Kivu provinces. Case-patients of cholera were defined as recommended by the World Health Organization (WHO): ''any person 5 years of age or older in whom severe dehydration develops or who dies from acute watery diarrhoea'', with an age limit lowered to 2 years for cases associated with confirmed cholera outbreaks ([4]. Also as recommended by the WHO, each new important outbreak was confirmed by culture and identification of Vibrio cholera O1 from stool samples [4] .

North Kivu (53,855 km2, 4,667,699 inhabitants, 19 HDs) is located in the Great Rift Valley, and border Lake Edward, Lake Kivu, and the north edge of Lake Tanganyika. In Kivu, the climate is characterized by a rainy season from October to the end of May and a dry season the rest of the year. However, the rainy season is partially interrupted by a short dryer period in January and February. The relief of the Kivu provinces is dominated by several volcanic chains. Nyiragongo, the most active volcano, is located approximately 20 kilometres north of the city of Goma (400,000 inhabitants) near Lake Kivu



Source: GIS / OVG 2018 Goma geographic system, Goma Volcanological Observatory

Figure 1 Location of health zone in the North Kivu province

Data collection

Upon arrival at the household, a list of all members was created, and one individual was randomly selected for interview. After obtaining written consent, data were collected through standardized paper-based questionnaires during face-to-face interviews in Swahili (local language). Cholera immunization status was ascertained through oral reporting (history) and vaccination cards.

The questionnaire included sections for socio-demographic status, vaccination status (card-confirmed and orally reported), and the presence of cholera in the household after the vaccination campaign mass. A study team collected data through a survey and in-depth interviews during two weeks (09-22 december 2019)

Data analysis

Data was analyzed using SPSS 23.0 software.

Ethical consideration

All respondents gave written consent before participating in the study. The research review committee and the ethics review committee of the provincial health division of North Kivu Province approved the study.

RESULTATS

Table I Socio-demographic characteristics interviewed after a community mass vaccination campaign in North Kivu Province.

Demographics of respondents	Effective	Percentage
Sex		
Male	187	50.4
Feminine	184	49.6
Age		
18 to 24	128	34.5
25 to 34	122	32.9
35 to 44 years	81	21.8
45 to 55	34	9.2
Over 55	6	1.6
Marital status		
Married	207	55.8
Single	120	32.3
Divorced	41	11.1
Widowers	3	0.8
Religion		
Catholic	110	29,6
Protestant	150	40,4
Muslim	87	23,5
other (	24	6,5
Professional activities		
Trader	120	32.3
Farmer	218	58.8
Artisan	26	7.0
Health professional	1	3
Other (Teacher)	6	1.6
Seniority in the residential environment		
Less than a year	13	3.5
Two years	27	7.3
Three years	61	16.4
Over 3 years	270	72.8
Household size		
1-5	133	
6-10	166	
11-15	72	

It appears from this table that over half, or 50.4% of respondents were male sex and 49.6% female. In relation to age, 34.5% of respondents aged between 18 and 24 years; 32.9% between 25 and 34 years and 1.6% were over 55 years. Regarding marital status, 55.8% were married, 32.3% of single and 0.8% widowers. Regarding religion, the majority of respondents 40.4% are Protestant, 29.6% Catholic and 23.5% of Muslims. In connection with seniority in the place of residence, 72.8% of respondents have already more than 3 years, 16.4% have already been 3 years in zones and a minority of respondents have already done within a year or 3.5%. In reading this table, we find that 44.7% of respondents have an average size of 6 to 10 people, while 35.8% had a size of 5 persons and 19.4% between 11 to 15 people in the housework.

OCV coverage

The results of the highest administrative coverage provided by the Ministry of Health were observed among children under 4 years of age in the Goma health zone (188.0%). While among those aged 5 to 14, the highest coverage was that observed in the Kirosthe HZ (138.2%). On the other hand, among those over 15 years old, the Kibirizi health zone had the highest coverage, 85.1%. The overall vaccination coverage with at least one dose in this four health zone was 101.5% (fig 1).

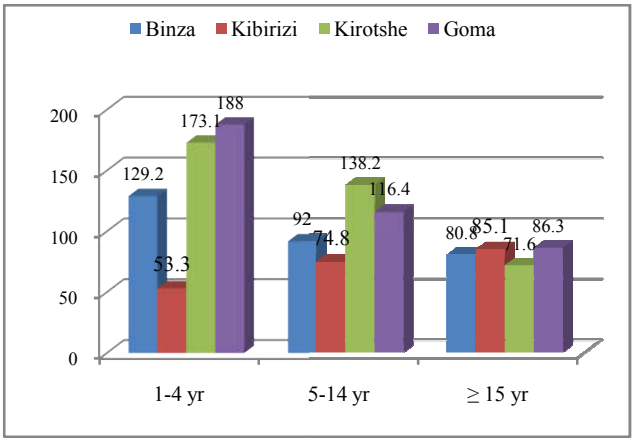


Fig 1 Vaccination coverage (%) by age in the areas targeted for vaccination in 2019.

Table 2 Incidence of cholera before and after the vaccination campaign in the 4 health zones in North Kivu Province

cholera cases presence in the household	Before the mass campaign		After the mass campaign	
	Effective	Percentage	Effective	Percentage
Yes	169	45.6	9	2.4
No	202	54.4	362	97.6

It appears from this table that the incidence of cholera before the mass campaign was around 45.6% against 2.4% after.

DISCUSSION

The aim of this study is to assess the pre and post vaccination incidence of the inhabitants against the cholera epidemic in the Province of North Kivu .The overall vaccination coverage with at least one dose in this four health zone was 101.5%. In other similarly challenging African setting, authors have reported a higher vaccine coverage with at least one dose of more than 70% from OCV campaigns, such as from Guinea (Luquero *et al.*, 2013) [10], Malawi [11] and from Beira, Mozambique [7]. Nonetheless, during the OCV campaign in Nampula all OCV doses were used and the administrative coverage was higher than 100% in all neighbourhoods except for Carrupeia and Natikiri [12].

When OCV is deployed on a large-scale in an endemic area, particularly with the aim of disease elimination, the annual incidence of cholera during the period before and after deployment of the vaccine could be compared to show vaccine impact, as has been done for other vaccine[5]. Our result show that the incidence of cholera before the mass campaign was around 45.6% against 2.4% after. The effectiveness of one dose of oral cholera vaccine is likely to depend on historical population-level exposure to cholera, with immunologically primed populations likely to benefit more than those who have never had cholera before. It is known that indirect effects of OCV play an important role in reducing disease transmission in the community. Recent mathematical models suggest that vaccinating at least 50% of a population exposed to Vibrio cholerae could reduce the incidence of cholera disease by up to 88% in the first year following vaccination

However, a cause-and-effect relationship would be difficult to establish since cholera outbreaks are unpredictable even over a multi-year time horizon and other factors such as improvements of water supply and sanitation, changes in socio-economic status or environmental factors affecting V. cholerae ecology [13]may decrease disease transmission.

Omowunmi Aibana *et al*. demonstrates that an OCV campaign with a strong public health education component was associated with increase in knowledge of cholera transmission, preventive measures, and methods of treating water. We also observed significant improvement in health practices essential for prevention of waterborne diseases after the vaccine campaign[14]. This may explain in our context a decrease in the incidence of cholera after these mass vaccination campaigns. It is known that indirect effects of OCV play an important role in reducing disease transmission in the community. Recent mathematical models suggest that vaccinating at least 50% of a population exposed to Vibrio cholerae could reduce the incidence of cholera disease by up to 88% in the first year following vaccination[15].

While long-term cholera control or elimination will likely depend on tackling cholera in areas with persistent transmission, it is during epidemics that the cholera burden is most devastating[16]. In the 21st century, with means available to both prevent and treat cholera, we should not accept thousands of cholera deaths reported every year. OCVs might not be a perfect outbreak response tool, but we must strive to use all available effective interventions and explore innovative ways to deliver them to those most at risk to prevent avoidable deaths today.
Limitation

CONCLUSION

This study was conducted in four health zone which is near Lake Kivu and Edward to assess the incidence after a mass vaccination campaign against the cholera epidemic in North Kivu Province. This showed that the incidence of cholera before the mass campaign was around 45.6% against 2.4% after. The findings revealed a single dose of oral cholera vaccine can be used as a means of preventing cholera during an epidemic in North Kivu.

Disclosure of potential conflicts of interest

No potential conflict of interest was reported by the author

Reference

1. Momba M, Azab El-Liethy M. Vibrio cholerae and Cholera biotypes. *Glob Water Pathog Proj*. 2019;(March 2018). doi:10.14321/waterpathogens.28
2. Wahed T, Kaukab SST, Saha NC, *et al*. Knowledge of, attitudes toward, and preventive practices relating to cholera and oral cholera vaccine among urban high-risk groups: Findings of a cross-sectional study in Dhaka, Bangladesh. *BMC Public Health*. 2013;13(1):1. doi:10.1186/1471-2458-13-242
3. Ingelbeen B, Hendrickx D, Sande M Van Der, Mossoko M. Recurrent Cholera Outbreaks , Democratic Republic of. 2019;(April):2008-2017. doi:10.3201/eid2505.181141
4. Bompangue D, Giraudoux P, Piarroux M, Mutombo G, Shamavu R. Cholera Epidemics , War and Disasters around Goma and Lake Kivu : An Eight- Cholera Survey. *PLoS Negl Trop Dis*. 2009;3(February):e436. doi:10.1371/journal.pntd.0000436
5. Deen J, Ali M, Sack D. Methods to Assess the Impact of Mass Oral Cholera Vaccination Campaigns under Real Field Conditions. 2014;9(2). doi:10.1371/journal.pone.0088139
6. Lopez AL, Gonzales MLA, Aldaba JG, Nair GB. Killed oral cholera vaccines: history, development and implementation challenges. *Ther Adv Vaccines*. 2014;2(5):123-136. doi:10.1177/2051013614537819
7. Philippe Cavailler , Marcelino Lucas, Valerie Perroud, Margaret McChesney, Sonia Ampuero, Philippe J Guérin, Dominique Legros, Thomas Nierle, Claude Mahoudeau, Bruno Lab, Pierre Kahozi, Jacqueline L Deen, Lorenz von Seidlein, Xuan-Yi Wang, Mahesh Puri, Mo C-LC. Feasibility of a Mass Vaccination Campaign Using a Two-Dose Oral Cholera Vaccine in an Urban Cholera-Endemic Setting in Mozambique. *Vaccine*. 2006;24(22):4890-4895.
8. Luquero FJ, Grout L, Ciglenecki I, *et al*. First Outbreak Response Using an Oral Cholera Vaccine in Africa: Vaccine Coverage, Acceptability and Surveillance of Adverse Events, Guinea, 2012. *PLoS Negl Trop Dis*. 2013;7(10). doi:10.1371/journal.pntd.0002465
9. Ciglenecki I, Sakoba K, Luquero FJ, *et al*. Feasibility of Mass Vaccination Campaign with Oral Cholera Vaccines in Response to an Outbreak in Guinea. 2013;10(9):3-6. doi:10.1371/journal.pmed.1001512
10. 1Ciglenecki I, Sakoba K, Luquero FJ, *et al*. Feasibility of Mass Vaccination Campaign with Oral Cholera Vaccines in Response to an Outbreak in Guinea. *PLoS Med*. 2013;10(9):3-6. doi:10.1371/journal.pmed.1001512
11. Sauvageot D, Saussier C, Gobeze A, *et al*. Oral cholera vaccine coverage in hard-to-reach fishermen communities after two mass Campaigns, Malawi, 2016. *Vaccine*. 2017;35 (38):5194-5200. doi:10.1016/j.vaccine.2017.07.104
12. Baltazar CS, Rafael F, Langa JPM, *et al*. Oral cholera vaccine coverage during a preventive door-To-door mass vaccination campaign in Nampula, Mozambique. *PLoS One*. 2018;13(10):1-13. 1/journal.pone.0198592
13. Emch M, Yunus M, Escamilla V, Feldacker C, Ali M. Local population and regional environmental drivers of

cholera in Bangladesh. *Environ Heal A Glob Access Sci Source*. 2010;9(1):1-8. doi:10.1186/1476-069X-9-2

14. Aibana O, Franke M, Teng J, Hilaire J, Raymond M, Ivers LC. Cholera Vaccination Campaign Contributes to Improved Knowledge Regarding Cholera and Improved Practice Relevant to Waterborne Disease in Rural Haiti. *PLoS Negl Trop Dis*. 2013;7(11):1-8. doi:10.1371/journal.pntd.0002576
15. Dimitrov DT, Troeger C, Halloran ME, Longini IM, Chao DL. Comparative Effectiveness of Different Strategies of Oral Cholera Vaccination in Bangladesh: A Modeling Study. *PLoS Negl Trop Dis*. 2014;8(12):1-8. doi:10.1371/journal.pntd.0003343
16. Luquero FJ, Rondy M, Boncy J, *et al*. Mortality Rates during Cholera. 2016;22(3):2010-2011.

How to cite this article:

Stephane Hans Bateyi M *et al* (2020) 'Incidence of Cholera After A Mass Campaign Oral Cholera Vaccine Response During an Epidemic in North Kivu, Democratic Republic of Congo', *International Journal of Current Advanced Research,* 09(06), pp. 22380-22384. DOI: http://dx.doi.org/10.24327/ijcar.2020. 22384.4411

****