International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 7 Issue 5, September-October 2023 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Determinants of Full Dose of Oral Cholera Vaccine Uptake in Tiko and Limbe Health Districts

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ABSTRACT

Cholera is an acute, profuse watery diarrhea ("rice-water stools") resulting from the consumption of food or water contaminated by toxigenic strains of the bacterium Vibrio cholerae. Due to frequent outbreaks of cholera in Cameroon, the government of Cameroon introduced the oral cholera vaccine (OCV) in 2015. The objective of this study was to assess the determinants of the full dose of OCV uptake in Tiko and Limbe Health Districts (HDs). A cross-sectional household-based survey study was conducted in which a multistage sampling technique and simple random sampling (SRS) were used to select Health Areas (Has), quarters and households respectively. In every household selected, data were collected on socio-demographic characteristics and information about OCV, from a randomly selected household member of age 21 years and above. Data on socio-demographic characteristics and information about OCV were collected using a modified standardized questionnaire. Oral cholera vaccine uptake was compared among different socio-demographic characteristics using Chi-squared test with significance level set at P <0.05. Overall, coverage rate of OCV was low, 48.6% (180/370), and it was based on those who were aware of OCV 85.1% (435/370) and had their vaccination cards. The main source of information was health worker (62.2%). Some of the determinants of non-acceptance of the first and second doses of OCV were: respondents thought OCV was Covid-19 vaccine; absent when the vaccination team visited the house; no faith in the vaccine; vaccination team did not visit households; and no faith in Cameroon's health system and government. The main determinants for OCV acceptance were the fact that participants considered cholera to be a serious disease, and their willingness to prevent it. The adverse events for the first and second doses were palpable, 18% and 11% respectively. Conclusively, determinants that contributed to the low uptake of OCV were identified and the most peculiar one was the fact that community members perceived the cholera vaccine to be a cover-up for the coronavirus vaccine.

How to cite this paper: Lepasia Arnold Fonge | Akoachere Jane-Francis | Esemu Seraphine "Determinants of Full Dose of Oral Cholera Vaccine Uptake in Tiko and Limbe Health Districts" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-7 | Issue-5, October 2023, pp.966-979, URL: www.ijtsrd.com/papers/ijtsrd60062.pdf

IJTSRD60062

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KEYWORDS: *Digital India, Electronic Banking, Internet Banking, Financial Innovation, Technology*

INTRODUCTION

Cholera is an acute diarrhea disease caused by toxigenic strains of the gram-negative bacterium Vibrio cholerae (Clements *et al.*, 2017). Only 1-25% of persons infected by V. cholerae develop symptoms. About 10-20% of those who become symptomatic experience severe disease after an incubation period of ranging 1 to 5 days. Cholera is characterized by watery diarrhea ("rice-water stools"), and vomiting, leading to rapid dehydration (WHO, 2017). About 1.4 billion people are at risk of cholera in endemic countries (Ali *et al.*, 2012).

Background to the study

Control of cholera in sub-Saharan Africa is a major challenge. This is because access to safe water and sanitation remains low, about 61% and 30%, respectively (WHO, 2012). Access to clean water and adequate sanitation remain the mainstays of preventing both endemic cholera and cholera outbreaks, and health education can promote the adoption of appropriate hygiene practices (Antarpreet *et al.*, 2013). The provision of an adequate supply of potable water and sanitation are long-term measures as they require huge investments.

Cholera has two major routes of transmission; from aquatic reservoirs in the environment (Primary transmission) and secondly, from previously infected individuals (Secondary transmission). The primary transmission initiates an outbreak and the secondary transmission causes an epidemic in endemic areas. Contaminated water is the main route of transmission in endemic areas, although transmission can occur via food contaminated by Vibrio cholerae (Edward *et al.*, 2016).

Antibiotics have been recommended for the treatment of some hospitalized patients. Antibiotics commonly used for cholera are tetracyclines, fluoroquinolones, and macrolides. Most V. cholerae are resistant to chloramphenicol, co-trimoxazole, and furazolidone which are therefore no longer used (WHO, 2018).

Due to the recurrent cholera outbreaks, the WHO has recommended the use of oral cholera vaccine (OCV) in addition to improving access to water, sanitation, and hygiene (WASH), as measures to reduce the public health burden of cholera in affected countries. Oral cholera vaccines have different protective efficiencies, for example Shancho, has a protective efficiency of 66% while the Dukoral OCV has a direct protective efficiency of 79% after complete dose (Khatib *et al.*, 2012). These vaccines are available for international use. From the values, efficacy is not high enough but for the vaccine to have an impact, people must be willing to accept it.

The Strategic Advisory Group of Experts on Immunization (SAGE) working group (McDonald, 2015), defined vaccine hesitancy as a behavior, influenced by several factors including issues of confidence (do not trust vaccine or provider), complacency (do not perceive a need for a vaccine, do not value the vaccine), and convenience (access). Vaccine-hesitant individuals are a heterogeneous group who hold varying degrees of indecision about specific vaccines or vaccination in general. They may accept all vaccines but remain concerned about vaccines, some may refuse or delay some vaccines, but accept others; some individuals may refuse all vaccines (Mcdonald, 2015). A review of vaccine hesitancy suggests community effectiveness may depend on particular features of setting, health problems, and vaccine (Patrick et al., 2015).

Due to frequent outbreaks of cholera in Cameroon and the challenges in meeting the WASH needs of inhabitants, the government of Cameroon introduced OCV in 2015. The 2020 outbreak further persuaded the Cameroon government to administer OCV in five endemic regions in the Country; the Far North, North, South, Littoral, and South West. In the South West region, OCV was administered in two HDs: THD, and LHD. In the LHD, OCV was administered only in Mabeta head area (HA). Distribution was in all head areas (HAs) in the THD because most of the HAs have poor WASH conditions and access to health care services is poor. In addition, the THD is the gateway to the South West region and shares a boundary with the Littoral Region that had recorded outbreaks in 2020. The lone death in the THD traveled to Tiko from Douala. Some HAs in THD and the Mabeta HA have several creeks, estuaries, and salt marshes which are favorable grounds for *V cholerae*. These factors contributed to the distribution of OCV in THD and LHD since the people in these HDs are at high risk of cholera outbreaks.

The first dose of OCV was distributed in Tiko and Limbe HDs in August 2020, and the second dose was administered six months later, (that is March 2021), as an intervention to curb cholera disease.

Statement of the Problem

Cameroon reported its first cholera cases in 1971. Since then, the disease has been occurring periodically with an increase in the number of cases and deaths. These increases have resulted in case - fatality rate (CFR) that transcend the WHO's threshold of less than 1% if the disease is properly managed (WHO, 2012). The outbreak of cholera caused untold losses to thousands of inhabitants in affected communities, ranging from a long period of hospital stay, panic, and deaths.

In November 2019, there was a cholera outbreak in the South West Region of Cameroon, which started in the Bakassi Health District (BHD) and later spread to other head HDs including; Tiko, Limbe, Buea, and Ekondo Titi (WHO, 2020b). The outbreak in the Tiko Health District (THD) started in February 2020, fifty-two cases and one death (5-year-old) were reported (WHO, 2020b). In the Limbe Health District (LHD), the outbreak occurred in Mabeta health area (HA), where 46 cases and 4 deaths were recorded (Mabeta Integrated Health Center, 2020). Because the burden was larger in the THD and LHD compared to other affected HDs in the South West Region, the Ministry of Public Health launched a cholera vaccination campaign in these two HDs, to prevent and control infection. Despite this, the vaccine was not taken by all inhabitants of these HDs.

Research Objective

This study was aimed at assessing the determinants of full dose OCV uptake in two purposively sampled Health Districts (HDs) in the Southwest regions of Cameroon, notably Tiko and Limbe HDs. These two HDs were targeted because no study has been conducted to evaluate the coverage of OCV and identify the factors that determine uptake.

The study was guided by two specific research objectives and one research hypothesis.

Specific objectives

1. Determine OCV coverage in THD and Mabeta HA in LHD.
2. Identify the factors that determine OCV uptake, in the study areas.

Research Hypothesis

The oral cholera vaccine uptake in Tiko and Limbe health districts was low and was influenced by certain factors.

Significance of the Study

The results of this research will inform policies with respect to Cholera interventions, in order to reduce the disease burden and the resulted mortality, and socio-economic impact on the population and national development at larger.

Methodology

Research Design

The study employed a cross-sectional household-based survey design. It was carried out from the 2nd - 15th of August 2021.

Area of Study

The study was conducted in Tiko and Limbe Health Districts, two of the four HDs in Fako Division, South West Region of Cameroon. These are the only HDs where OCV was distributed in the South West region in 2020 and 2021.

Tiko health district has a total surface area of 484 km, an elevation of 64m above sea level and is located between Longitude 8.6°10'E and Latitude 4°5.2'N. Tiko was originally called "Keta" by the Bakweris. Tiko has a coastal equatorial climate with daily temperatures ranging from 28°C to 33°C. It has two major seasons: the rainy season (March to October) and the dry season (November to February). Soil types include the sandy alluvial and volcanic with high agricultural potentials. Agriculture is the major source of living of the majority of inhabitants of the Tiko HD. The main watercourses in the THD include Rivers Mungo, and Ombe. The THD is bounded to the North by Buea, South by Bonaberi, West by Limbe, and East by Dibombari. It is made up of 8 Health Areas (HA) namely; Holforth, Kange, Likomba, Mutengene, Mondoni, Mudeka, Missellele and Tiko Town (Ngum et al., 2021) with about 90 communities and 21 health facilities. As of 2017, Tiko was estimated to have a population of 151,109.

The Limbe Health District (LHD) is situated in the tropical rain forest of the Congo Basin between Latitude 4° 01' 27.12" N and Longitude 9° 12' 53.64" E. It is bounded to the North by the Buea health district, to the East by Mbonge Health District, South by the Atlantic Ocean, and the West by the Tiko health district. LHD is made up of highlands that form part of the Cameroon range of active volcanic mountains. Many rivers are meandering between the valleys and gorges. These features are attractive eco-touristic sites but with the potential of disaster leading to emergencies. Limbe HD covers an area of 185 km2 and has a population of 202,831 inhabitants. Its climate is typically equatorial with annual rainfall exceeding 4000 mm, temperatures ranging from 23 °C to 32 °C, and 80% relative humidity. LDH has eight health areas namely: Batoke, Bojongo, Bota, Idenau, Mabeta, Moliwe, Seaport, and Zone II. This study was carried out only in the Mabeta HA, where the full dose of OCV was distributed. Mabeta is located at longitude N 4° 0' 7' and E 9° 17' 8" of the equator. It is characterized by outgrown vegetation, thickets of rubber and palm plantation, stagnant water, flooding, poor water, hygiene and sanitation (WASH), and the presence of creeks and salt marshes which are favorable grounds for *V. cholerae*. Mabeta has a population of 7,267 inhabitants.

Population of the study

This study targeted people of both sexes, aged twenty-one years and above that were residing in THD and Mabeta HA in LHD. Likomba was excluded because the data collection instrument was trial-tested there.

Inclusion criteria

This study included residents of the participating HAs of age 21 years and above, who took the OCV and those within the same age range who refused to take the OCV, and who gave consent to participate.

Exclusion criteria

Individuals 0-20 years, those who were not present in the HAs when OCV was distributed as well as those without their vaccination cards were excluded from the study.

Sample size determination and Sampling methods

Sample size determination

The sample size for this study was calculated using the formula; $n_0 = Z^2 P (1-P) / e^2$ (Cochran, 1977). Where n_0 = sample size, $Z^2 = 1.96$ for 95% CI, P= 50%, the prevalence of OCV coverage in a previous study carried out in Somalia (Mutaawe *et al.,* 2020) and e^2 = tolerable error = 4.7%. $n_0 = 1.96^2 \times 0.5 (1-0.5) / 0.047^2 = 434.7$. A minimum of four hundred and thirty-five (435) households were sampled in the participating 6 HAs in the two HDs.

Sampling methods

A multistage sampling technique and simple random sampling (SRS) were used to select the HDs, the HAs, quarters and households respectively (WHO,

2008). HDs were sampled purposively. Participating HAs were selected using simple random technique. Five of the 8 HAs were selected by SRS. Random selection was done by writing the names of the HAs on a separate piece of paper, which was then placed in a box and thoroughly mixed before selection. The following HAs were randomly selected; Tiko town, Holforth, Mutegene, Missele, Mudeka. Mabeta HA was the lone HA in the LHD where OCV was administered thus it was just adopted. In each HA, quarters were selected using simple random sampling method. A list of all the quarters were collected from the Has in the THD and LHD. For each HA, numbers representing the quarters were written on pieces of paper, folded, and then shuffled. The selection of the number of quarters was proportionate to the total number of quarters in the HA. For example, for a HA with twenty quarters, after the shuffling, nine quarters were randomly selected while for HAs with seven quarters, three quarters were randomly selected.

To select the different households, the Expanded Program on Immunization (EPI) random walk methods was used, where a central location near the approximate geographical center of the quarter was chosen, such as a market or a mosque, and then the enumeration team randomly selected a direction by spinning a bottle on even ground and walked in that direction counting the number of houses until the edge of the quarter was reached. A household number between one and the total number of houses counted along the directional line was randomly selected and this became the first selected household to visit. The second household was the one nearest to the first, and so on in any direction within the directionally-sampled cluster (WHO, 2008).

Validity and Reliability of Instrument

Construct validity was check by ensuring that the measures under investigation relate with one another in a way that is consistent with theoretically derived hypothesis.

To ensure content validity, the questionnaire was checked by the researcher, his supervisor, a colleague and the statistician to make sure the indicators were adequately labelled and could appropriately measure the characters under study. Generally, above 0.75, CVI is satisfactory (Nana, 2018) and in the context of this study, the judges validated the final instrument making a CVI of 1.

To ensure face validity which is the kind ascertained when little or nothing is known about the research variables, the questionnaire was checked by judges listed earlier, the investigator and participants during the trial testing of the instrument for clarity and visibility.

Data collection

Data was collected using standardized paper-based trial-tested questionnaire adapted from previous studies on OCV coverage (Cynthia *et al.,* 2018; Mutaawe *et al.,* 2020). The pseudo-pilot study was done in Likomba, one of the HAs in THD. Thirty questionnaires were trial-tested. It took 15-20 minutes to administer a questionnaire. The interview was done face-face. Three students from Maflekumen Higher Institute / School of Health Sciences Tiko were recruited and trained by the investigator for three days, on data collection. Among other things, this training enabled them to translate all the questions from English to Pidgin English to ease communication with respondents who could not speak or understand the English language. They worked alongside the lead investigator. In every household selected, the interviewer collected data on socio-demographic characteristics and information about OCV, from a randomly selected household member of age 21 years and above. Information such as: the number of OCV doses taken, why one dose and not two was taken and why none was taken by those who did not take any. Data on vaccination acceptability (reasons for taking the OCV, why they preferred to take the vaccine), OCV campaign awareness (whether the participants were informed or not, and through what means or channel), and adverse events following immunization (AEFI) were collected.

Data management and analysis

Data were entered using EpiData Version 3.1 (EpiData Association, Odense Denmark, 2008). Epidata gives room to entry customization and has an internal consistency checked function that helps minimize entry errors. Data were analyzed using the Statistical Package for Social Sciences (SPSS) Standard version, Release 21.0 (IBM Inc. 2012). Data was made essentially of categorical variables that were described using frequency and proportions. Oral cholera vaccine uptake was compared among different socio-demographic characteristics using Chi-square test of Equality of Proportion.

Ethical Considerations

Ethical clearance was obtained from the Faculty of Health Sciences (FHS) Institutional Review Board (IRB) of the University of Buea. Administrative authorization was obtained from the Regional Delegate of Public Health for the Southwest Region and the District Medical Officer (DMO) of Tiko and Limbe HDs.

Findings

Sociodemographic characteristics of participants

A total of 435 selected individuals from different households were interviewed. Those from Tiko HD

were 87.1% (379/435) and 12.9% (56/435) were from Mabeta HA in Limbe HD. In Tiko HD, participation was as follows from the five health areas surveyed: 22.8% (99/435) were from Tiko Town, 20.9% (91/435) from Holforth, 23.0%, (100/435) from Mutegene, 11.5% (50/435) from Missele, and 9.7% (42/435) from Mudeka.

The majority of respondents 43.4%, (189/435) were of age 31-40 years. The sample was well stratified with respect to sex, though males 46.7% (203/435) were lesser than females 53.3% (232/435). Among the females, 5.5% (24/435) were pregnant. Households were relatively large with Half of the participants 50.3% (219/435) living in house of size 5-10 persons.

Most of them 35.2% (153/435) had primary education; domestic employees were dominant 29.9% (130/435); Christians were 92.9% (404/435) and single 45.7% (199/435). They obtained drinking water mainly from shared stand pipe tap 69.7% (303/435). Only 0.2% (1/435) of respondents used bottled water (Mineral water) and the same proportion used rainwater as their source of drinking water.

With regards to sanitation, 45.1% (196/435) defecated in a latrine with a slab while 16.1% (70/435) used a flushing toilet. Some respondents however practiced open defecation in the bush 9.4% (41/435), some in the sea 0.7% (3/435) and stream 0.7% (3/435) while 1.8% (8/435) used an open pit (Table 2).

Table 1: Socio-demographic characteristics of household respondents

N=435

	Demographic parameter	Frequency	Percentage
Health district	Tiko	379	87.1
	Limbe	56	12.9
Health Area	Tiko Town	99	22.8
	Holforth	91	20.9
	Mutegene	100	23
	Missele	50	11.5
	Mudeka	42	9.7
	Mabeta	53	12.2
Age of participants	21-30	112	25.8
	31-40	189	43.4
	41-50	72	6.6
	51-60	41	9.4
	61+	21	4.8
Gender	Male	203	46.7
	Female	332	53.3
Pregnancy status	Yes	24	5.5
	No	208	47.8
Household size	1-4	191	43.9
	5-10	219	50.3
	11+	25	5.7
Education	Never been to school	47	10.8
	Primary	153	35.2
	Secondary	121	27.8
	High school	58	13.3
	University	56	12.9
Main Occupation	Not active/Retired	28	6.4
	Business/Trader	107	24.6
	Domestic employee	130	29.9
	Farmer/Fishing	104	23.9
	Medical/teacher	20	4.6
	Student	8	1.8
	Administrator	10	2.3
	Street vendor	28	6.4

Religion	Christian	404	92.9
	Muslim	18	4.1
	African Traditional Religion	3	0.7
	None	10	2.3
Marital status	Married	187	43.0
	Single	199	45.7
	Divorced	6	1.4
	Co-habiting	24	5.5
	Widow/Widower	19	4.4
Source of drinking water	Shared tap	303	69.7
	Water from well piped into the house	19	4.4
	Borehole water	75	17.2
	Stream, Spring	75	17.2
	Bottled water (mineral water)	1	0.2
	Rainwater	1	0.2
Type of Toilet	Latrine without slab	120	27.6
	Latrine with slab	196	45.1
	Open-pit	8	1.8
	Flushing toilet	70	16.1
	Bush around	41	9.4
	Sea	3	0.7
	Stream	3	0.7

Awareness, Card availability, and Sources of information of OCV

Among the 435 respondents 85.1 % (370/435) were aware of OCV (Table 2). Of this, 48.5% (180/370) had OCV cards to prove they had been vaccinated. The majority of respondents heard about OCV from health workers 62.2% (230). Others heard from Town Crier/Quarter head 46.5% (172), Social mobilizers, 25.1% (93), family members/friends' 22.2% (82), village leaders 8.1% (30), Radio/TV 6.8% (25), school 5.1% (19), religious leaders 1.6% (6), Cell phone messages 1.4% (5) and Newspapers 0.5 % (2).

Table 2: Awareness, Card availability, and Sources of information of OCV

Aware of OCV	N	Percentage
Yes	370	85.1%
No	65	14.9%
Total	435	100.0%
Cards availability	**N**	**Percentage**
Yes	180	48.6%
No	190	51.4%
Total	370	100.0%
Sources of information	**N**	**Percentage**
Health worker	230	62.2%
Town crier/quarter head	172	46.5%
Social mobilizers	93	25.1%
Friends/family members	82	22.2%
Village leaders	30	8.1%
Radio/TV	25	6.8%
School	19	5.1%
Religious leaders	6	1.6%
Cell phone messages	5	1.4%
Newspaper	2	0.5%

Overall OCV coverage rate

The coverage rate was based on those who were aware of OCV and had OCV card as prove of being vaccinated. Of the 370 participants who were aware of OCV, only 180 presented cards as evidence of vaccination. Thus, OCV coverage rate was 48.6% (180/370) (Table 3).

Table 3: Overall OCV coverage

N= 370

		N	percentage
Coverage rate	Yes	180	48.6%
	No	190	51.4%
	Total	370	100.0%

Doses taken by participants

Among the 180 respondents who took OCV, 48.3% (87/180) took one dose while 51.7% (93/180) took two doses.

Determinants of the uptake of the first dose of OCV in THD and LHD

Participants advanced several reasons for taking the first dose of OCV (Figure 1). The majority (72.4%) took it because they considered cholera to be a serious health problem, 62.1% (54) said they were told it will prevent them from cholera, 31.0% (27) were told it is good to take OCV, 25.3% (22) heard there was an outbreak while 9.2% (8) saw others taking OCV and that is while they took it. Other reasons for taking the vaccine were; having faith in the health system/government (4.6%), were encouraged by health personnel (4.6%), forced by the household heads to take the vaccine (4.6%), they wanted to travel abroad (4.6%), it was mango season (3.4%), job requirements, as the employer required OCV cards (1.1%).

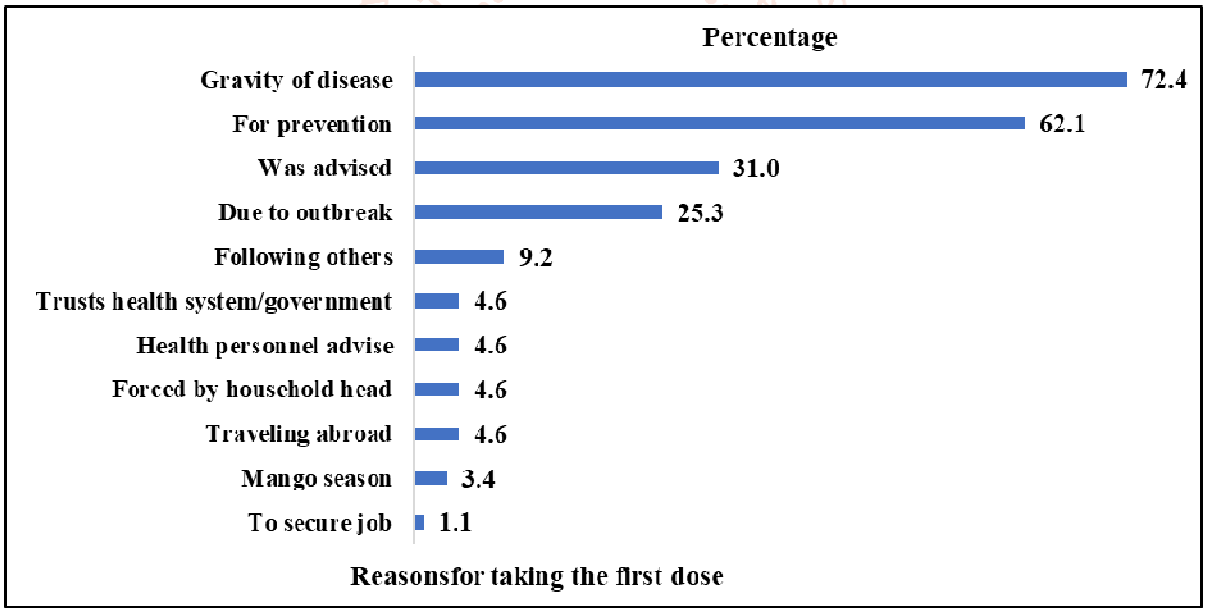


Figure 1: Determinants of the uptake of the first dose of OCV in the study areas

Contributing factors for not taking the first dose of OCV

The majority of the respondents believed it was covid-19 vaccine 44.2% (84). Some were not aware of OCV 24.2%, (46), absent when the vaccination team came 21.6% (41) had no faith in the vaccine 17.4% (33). Other reasons were; vaccination team did not visit household 6.8% (13), had no faith in Cameroon's health system and government 6.8% (13), head of household did not authorize them to take the OCV 4.7% (9), not in a good state of health to take the vaccine 2.1% (4), not motivated with money to take the vaccine 1.1% (2), and, was aware of the campaign but date and time of the vaccination team visit was unknown 0.5% (1) (Figure 2).

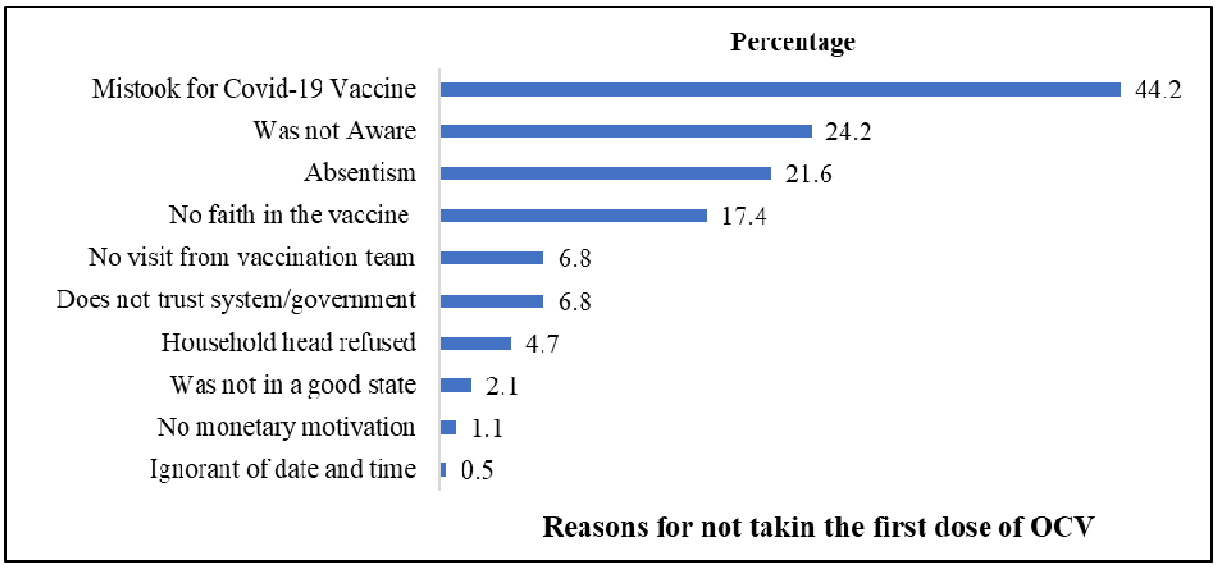


Figure 2: Reasons for not taking the first dose of OCV

Factors that determined the uptake of the second dose of OCV in THD and LHD

The majority of respondents 44.7% (42) took the vaccine because they were told that it is good, 43.6% (41) reported they took it because they were told that complete dose of OCV gives more protection than taking just a single dose, 42.6 % (40) considered cholera to be serious while 21.3% (20) took it because they heard there was an outbreak. Other reasons for taking the second dose were; they saw others taking it 6.4% (6), had faith in the health system and government 6.4% (6), did not experience any adverse event with the first dose 5.3% (5), OCV was one of the requirements needed for a job by their employer 5.3% (5). One respondent reported that he was encouraged by a friend to take the second dose and still another respondent took it because the vaccination team campaigned in their school 1.1% (1) (Figure 3).

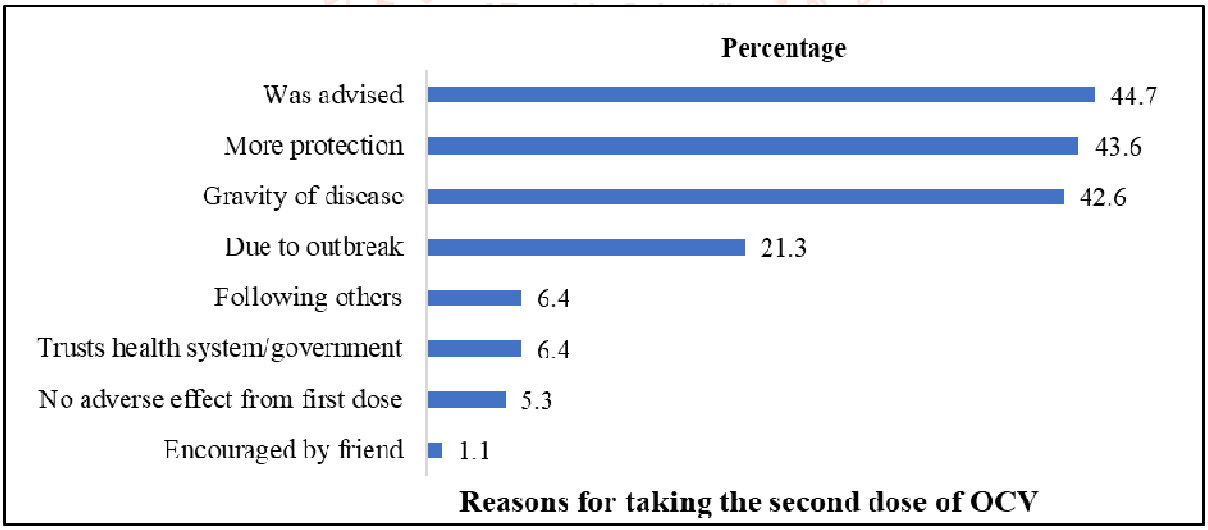


Figure 3: Reasons for taking the second dose of OCV

Reasons for not taking the second dose of OCV

Most of the respondents, 70.4% (126) thought it was covid-19 vaccine. Some reported they were absent when vaccination team came 29.1% (52), did not have faith in the vaccine 15.6% (28), had no faith in health system/ government 13.4% (24), were not authorized by the head of house to take it 11.2% (20), not aware of the OCV campaign 10.1% (18), vaccination team did not visit the houses 8.4% (15) of the respondents. A few participants 6.1% (11) were not aware that OCV require two doses, date and time of vaccination team visit was unknown 2.2% (4), still 2.2% (4) were not in a good state of health to take OCV while 0.6% experienced adverse events after taking the first dose and so did not take the second OCV (Figure 4).

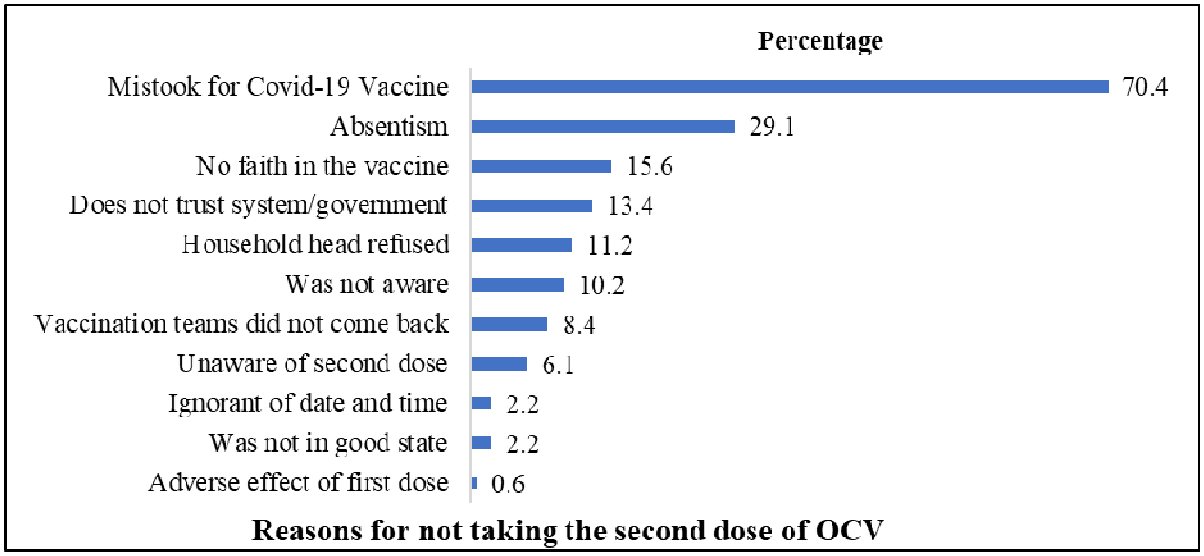


Figure 4: Reasons for not taking the second dose of OCV

Adverse events experienced by those who took first dose of OCV

Only a few respondents 19.5% (17/87) experienced adverse events after taking the first dose of OCV (Table 4). Adverse events reported were: nausea was experienced 6.9% (6/87), vomiting 3.5% (3/87) and while 3.5% (3/87) reported headache. Weakness and fever were reported by 2.3% (2/87) respectively while 1% (1/87) reported dizziness.

Table 4: Adverse Events experienced after taking the first dose of OCV

N=87

Adverse Event	Yes	
	n	%
Dizziness	1	1
Weakness	2	2.3
Fever	2	2.3
Vomiting	3	3.5
Headache	3	3.5
Nausea	6	6.9
Total	17/87	19.5

Adverse events experienced after taking the second dose of OCV

Of the 93 participants who took the second OCV dose, only 10.8% (10/93) experienced adverse events (Table 6). Adverse events reported were; nausea 5.4% (5/93), fever 2.2% (2/93), headache 2.2% (2/93), and abdominal pain 1% (1/93) (Table 5).

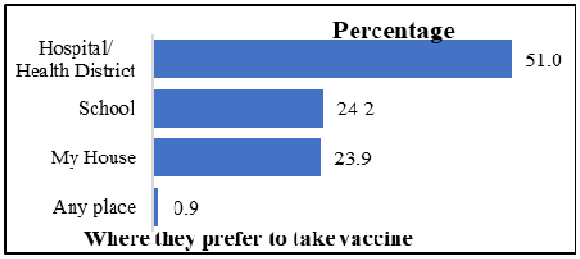
Table 5: Adverse events experienced after taking the second dose of OCV

N=93

Adverse Event	Yes	
	n	%
Abdominal pain	1	1
Headache	2	2.2
Fever	2	2.2
Nausea	5	5.4
Total	10/93	10.8

Preferred locations for the uptake of OCV

Respondents indicated the following as their preferred location to take OCV: hospital (51%), any place (24.2%), home (23.9%), and school (0.9%) (Figure 5).

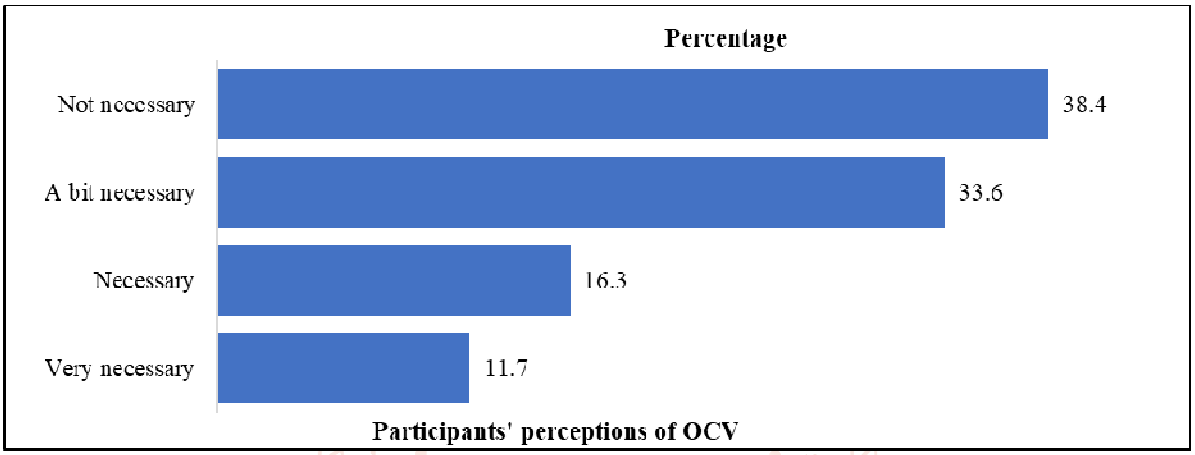


N=443

Figure 5: Preferred locations for the uptake of OCV

Participants perception of OCV

The majority of the respondents 38.4%, (167/435) regarded OCV as necessary 38.4%, (167/435) and very necessary 33.6%, (146/435). The rest considered OCV to be a bit necessary 16.3%, (71/435) and not necessary 11.7%, (51/435) (Figure 6).



N=435

Figure 6: Participants' perception of OCV

Association of OCV uptake with socio-demographic characteristics of respondents

Table 7: Association of OCV uptake with socio-demographic characteristics of respondents

N= 370

Predictors	Categories	Did you take any of the OCV doses		N	χ^2 -test
		Yes	No		
Health district	Tiko	45.5% (147)	54.5% (175)	322	**χ^2 =12.599 P=0.000**
	Limbe	72.9% (35)	27.1% (13)	48	
Health Areas	Tiko Town	58.0% (47)	42.0% (34)	81	**χ^2 =64.288 P=0.000**
	Holforth	48.0% (36)	52.0 % (38)	74	
	Mutegene	16.7% (16)	83.3% (80)	96	
	Missele	71.8% (28)	28.2% (11)	39	
	mudeka	62.9% (22)	37.1% (13)	35	
	Mabeta	73.3% (33)	26.7% (12)	45	
Age group	21-30	55.7% (34)	44.3 (61)	36	χ^2 =2.465 Df=2 P=0.292
	31-40	55.7% (98)	44.3 (78)	61	
	41-50	56.8%(25)	43.2% (19)	176	
	51-60	47.5% (19)	52.5% (21)	44	
	61+	32.7% (16)	67.3% (33)	40	
Gender	Male	45.2% (75)	54.8% (90)	49	χ^2 =1.806 Df=1 P=0.179
	Female	52.2% (107)	47.8% (98)	205	
Pregnancy status	Pregnant	57.9% (11)	42.1% (8)	19	χ^2 =0. .273a P=0.602
	Not Pregnant	51.6% (96)	48.4% (90)	186	
Household size	1-4	44.3% (70)	55.7% (87)	157	χ^2 =2.525 P=0.283
	5-10	52.4% (100)	47.4% (91)	191	
	11 and above	54.5% (12)	45.5% (10)	22	

Level of education attainment	Never been to school	69.0% (20)	31.0% (9)	29	χ^2 =6.642 P=0.156
	Primary	51.1% (68)	48.9% (64)	132	
	Secondary	44.0% (48)	56.0% (61)	109	
	High School	43.1% (22)	56.9% (29)	51	
	University	59.0% (24)	41.0% (25)	49	
The main occupation of Head of House	Not active/retired	56.5% (13)	43.5% (10)	23	**χ^2 =14.909 P=0.037**
	Business/Seller	34.8% (32)	65.2% (60)	92	
	Administrator	33.3% (3)	66.7% (6)	9	
	Farmer/Fishing	50.0% (50)	50% (50)	100	
	Medical physician/teacher	56.3% (9)	43.7% (7)	16	
	Student	60.0% (3)	40.0% (2)	5	
	Domestic employee	60.2 % (62)	39.8% (40)	102	
	Street vendor	43.5% (10)	56.5% (13)	23	
Religion	Christian	47.0% (164)	53.0 (184)	348	**χ^2 =10.646 P=0.014**
	Muslim	77.8% (7)	22.2% (2)	9	
	African traditional religion	66.7% (2)	33.3 (1)	3	
	None	90.0% (9)	10% (1)	10	
Marital status	Married	53.4% (87)	46.6% (75)	162	χ^2 =8.012 P=0.091
	Single	42.8% (71)	57.2% (95)	166	
	Divorcee	60.0% (3)	40.0% (2)	5	
	Free union	70.0% (14)	30.0% (6)	20	
	Widow/Widower	41.2% (7)	58.8 (10)	17	

Acceptance of OCV was significantly dependent on the health district whereby more participants from Limbe (72.9%) took OCV compared to Tiko (45.5 %.). There was a significant difference in OCV uptake with respect to health area. Uptake was significantly higher in Mabeta health area (73.3%) compared the other health areas investigated (χ^2 = 64.288, P = 0.00). Mutegene had the least uptake of OCV (16.7%). There was no significant difference in OCV uptake with respect to age (χ^2 = 2.465, P = 0.292), gender (χ^2 = 1.806, P = 0.179), level of education (χ^2 = 6.642, P0.156), and marital status (χ^2 = 8.012, P = 0.091). There were significant differences in vaccine uptake for occupation (χ^2 = 14.909, P = 0.037) and religion (χ^2 = 10.646, P = 0.014) (Table 7).

Discussion

This study determined OCV coverage rate (48.6%) and the factors that influenced OCV uptake in Tiko and Limbe HDs. The findings of this study were compared to that of other studies with similar objectives. Majority of the participants were aware of the OCV mass vaccination campaign (85.1%). This is similar to the results of previous studies in Mozambique (82.7%), Haiti (87 - 96%), Nigeria (90%), and Guinea (95.7%) (Cynthia *et al.,* 2018; 2015; Moise *et al.,* 2015; Luquero *et al.,* 2013).

The main sources of information were obtained from health workers (62.2%) and Town crier/Quarter head (46.5%). This was similar to that of earlier study carried out in Haiti, where 52.2% of respondents obtained information on OCV campaign through criers (Sharp et *al.,* 2020). The least sources of information were; cell phone messages (1.4%) and newspapers. This could be due to the fact that, the health districts studied are in rural areas with almost half of the participants having primary education or no education, hence could not read newspapers, or health related messages sent to their phones. From our findings, policy makers should lay more emphases on the use of health workers and town criers or quarter heads to disseminate information about OCV administration.

Although over three-quarter (85.1%) of participants had heard of OCV, only less than half (48.6%) had proof of vaccination. This contradicts previous reports from Haiti and Guinea, where (50 -60%) confirmed vaccine status by card and vaccination cards retention for adults was (74.8%) respectively (Sharp et *al.,* 2020; Luquero *et al.,* 2013).

Fewer participants took two doses (48.3%) than those who took one dose (51.7%). This coverage rate is similar to the 49.7% OCV uptake reported in Zanzibar (Schaetti *et al.*, 2015). But lower compared to the 75.9% reported in Guinea (Luquero *et al.,* 2013). The low coverage could be due to the fact that there was a large gap of eight months between the administration of the first and second dose of OCV instead of two weeks. Thus, people must have forgotten about the second dose since they had been previously informed that the second dose would be administered two weeks after the first dose and

simply avoid it for some of the reasons mentioned in this study. Furthermore, the low uptake of OCV (48.6%) could be ascribed to the community's reluctance to be vaccinated as 85.1% of participants were aware of the OCV campaign.

Oral cholera vaccine campaign was conducted following the EPI house to house strategy, which has been shown to result in an increase in vaccination uptake in countries like Nigeria and Somalia (Mutaawe *et al.,* 2020; Micheal *et al.,* 2017). Many of the respondents (44-71%) thought that OCV was the covid-19 vaccine, since OCV campaign coincided with the time Covid-19 vaccination campaign was ongoing. Various conspiracy theories against the Covid-19 vaccine during that period, where renounced medical practitioners like Doctor Thomas Cowan had spread misleading information about Covid-19 linking with 5G wireless technology (Adama *et al*., 2020). Such fake news spread all over the social media in different WhatsApp groups, Facebook, Instagram etc (Adama *et al*., 2020) and could have contributed to the very low OCV uptake and probably the uptake of other vaccines that were distributed at that same period.

Mabeta HA, had the highest OCV uptake compared to HAs in Tiko HD. This could be attributed to poor internet network in Mabeta HA, where few people have access to social media. It is therefore, possible that most people in this HA did not get these conspiracy theories. Other deterrent factors reported by participants were absence when the vaccination team visited the house, no faith in the vaccine, vaccination team did not visit households, no faith in Cameroon's health system and government. Not receiving authorization from the head of household, not in a good state of health to take the vaccine also contributed negatively to the poor OCV uptake rate. These results are similar to the report of a study carried out in Mozambique where respondents gave similar reasons for not taking OCV (Cynthia *et al.,* 2018).

Majority of the participants (42-73%) took the first and second doses of OCV because they considered cholera to be a serious disease, were told complete dose will give maximum protection, and it will prevent them from cholera. Similar reasons were given in earlier studies carried in Kenya, Zanzibar, and Mozambique (Sundaram *et al.,* 2013; Cynthia *et al.,* 2018; Schaetti *et al.,* 2015). Other reasons given by participants for taking the first and second doses of OCV are: They were told it is good to take it; there was an outbreak; had faith in vaccination; they were encouraged by health personnel; forced by household head; traveling abroad; mango season; no adverse effect was experienced after taking the first dose; and to secure a job.

Among the respondents who took first and second doses of OCV, 18% and 11% respectively experienced adverse effects. Side effects reported were nausea, headache, abdominal pain, fever and vomiting for the leading ones. Similar findings were reported in previous studies carried in Mozambique and Thailand (Cynthia *et al.,* 2018; Phares *et al.*, 2016). Some of the side effects such as nausea, vomiting and abdominal pains could be attributed to irritation of the gastrointestinal tract caused by OCV. No study was found to ascertain this fact.

In our study, majority of participants (52.0%) preferred to be administered OCV in the hospital. This is similar to the report of a study in Mozambique (Cynthia *et al.,* 2018), where participants preferred to receive OCV in public health centers. On the contrary, in another study in Mozambique, almost all participants (96.7%) preferred taking OCV at home.

With regard to OCV uptake, the majority of the respondents still considered vaccines as being a necessary intervention method for curbing diseases.

With respect to factors associated to OCV uptake, no association was observed with age, gender, pregnancy status, household size, level of education, and marital status. The associations between these predictors and uptake of either of the OCV doses were not statistically significant (age group, P=0.292; Gender, P=0.179; pregnancy status, P=0.602; household size, P=0.283; level of education, P=0.156, and marital status; P=0.091). Our findings contradict the report of a study in Uganda where level of education was significantly associated with OCV uptake (P=0.03) (Bwire *et al.,* 2020).

More participants in household size 5-10 took OCV compared to those in household size 1-4 and >11, though the difference was not significant (P=0.283). Our findings are similar to reports of a previous study in Mozambique, where no significant association between age group, gender, and OCV uptake was reported (Cynthia *et al.*, 2018). Nevertheless, there was a significant association between those who took at least one dose of OCV with the following predictors: Health districts (P=0.000); Health Areas (P=0.000); Occupation (P=0.037), and Religion (P=0.014).

Conclusions

Based on the findings of this study, we concluded that oral cholera vaccine coverage rate (48.6%) in Tiko and Limbe health districts was low, and that the determinants of uptake of OCV were identified and noteworthy is the fact most participants thought oral

cholera vaccine was the coronavirus vaccine that is why they refused to take the vaccine. Therefore, covid-19 likely contributed to OCV hesitancy in the targeted HDs. The participants who took OCV were motivated by the fact that, they considered cholera to be a serious disease and were told that it is good to take the vaccine.

These findings will go a long way to inform policy makers to conduct pre-campaign qualitative research to understand behavioral determinants of vaccine acceptability and to educate the population on the type, purpose and importance of the vaccine that will be administered to them. This will boost their confidence, combat complacency and increase convenience for them to get vaccinated without fear of any conspiracy theory about OCV and thereby increasing coverage rate.

Recommendations

There should be intense sensitization on mass vaccination by using health workers and town criers or quarter heads, for sufficient duration of time before the OCV administration. Moreover, during the administration of OCV, they should be many supervisors on the field to assist health workers in educating the population on the type, purpose and importance of the vaccine that they are taking; this will help increase OCV coverage rate.

Perspectives for further research

Similar studies should be conducted in other health areas in the country where OCV was distributed.

A pre-campaign study should be carried out to ascertain the people's perception of OCV.

A study should be carried out in these health districts on Knowledge, attitude, and practice on cholera and cholera vaccines.

Another study should be carried out to verify the impact of covid-19 on the hesitancy of OCV.

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