Knowledge andChallenges in Cholera Control in TheTiko Health District of Cameroon: Community Perspective.

ABSTRACT

Aims: The incidence of cholera has increased steadily since the year 2000. The persistent presence of this disease in this community is probably due to poor socio-economic status, poor knowledge, on cholera prevention and control measures. The aim of this study was to evaluate the community's knowledge on the cause, transmission, predisposing factors, diagnosis, treatment, and prevention/ control strategies used to combat cholera and to propose solutions for the reduction of the incidence in the Tiko Health Area.

Study design: It was a cross-sectional descriptive study.
Place and Duration of Study: The study was carried out in Tiko from January to July 2021

Methodology: The study involved 420 adults (>18years) participants. .Data was collected using structured questionnaires, entered in EpiInfo version 17.3, cleaned with Microsoft Excel 2013, analyzed with R version 3.6.1 and the results were presented on tables and bar charts. A confidence interval of 95% was used and comparison for significance was done using the chi square test.

Results: The average age of the participants was 35 years ± 2years**.** For the definition of Cholera, 345 (82.1%) could correctly identify that cholera is a bacterial infection while 17.9% could not. On modes of transmission, majority of the participants (72.62%, n = 305) indicated that drinking contaminated water was the main mode of transmission and few (10.1%, n = 45) indicated the consumption of unwashed fruits and vegetables. Most of the participants (89.3%, n = 375) indicated that anyone could contract the disease and a majority (68.8%, n = 289) said they will willingly accept cholera vaccines as a preventive measure while improving on hygienic measures.

Conclusions: Community Members of Tiko Health District had good knowledge in relation to prevention and control of cholera. Community participation in relation to proper hygiene is the major way to reduce the spread of the disease.

Key words: cholera, causes, transmission, pre-disposing factors, prevention/control, community.

1.1Introduction

Cholera remains a global threat to Public Health and an indicator of inequity and lack of social development [1]. *Vibrio cholerae,* the causative agent of cholera has been responsible for seven pandemics since 1817 and its exact origins are still unknown. Cholera can spread rapidly producing profuse diarrhea, vomiting and fluid and electrolyte losses and is associated with high morbidity and mortality even though cases often present with mild symptoms [2, 3]. The incidence of cholera has increased steadily since the year 2000, culminating in 317,534 reported cases worldwide including 7,543 deaths with a case fatality rate of 2.38% [4]. Cholera is prevalent in Africa, Asia, and parts of the Middle East, and Sub-Saharan Africa is broadly affected by many cholera epidemics [5, 6]. In Cameroon, the burden of cholera has increased during the past decades with 4026 in 1991, 5796 in 1996, 8005 in 2004 [7], and 10.759 in 2010 [8].

The reasons for this threat have been known to be high risk areas which include peri-urban slums [9, 10] with lack of basic infrastructure, poor socioeconomic status, humanitarian or environmental crisis [11], civil disruption, refugee camps and internally displaced persons [12]. The major risk occurs in overpopulated communities and refugee settings [13] characterized by poor sanitation, unsafe drinking water and increased person-to-person transmission [14]. The disease occurs when water or food contaminated with the *Vibrio cholerais* ingested.

Community prevention/control strategies for cholera have several dimensions. Surveillance is done to promptly detect and report cholera especially in endemic countries [15] through a mechanism of detecting, reporting and verifying suspected cases in order to limit spread. Information sharing among neighboring regions, countries, and organizations like the WHO to help mobilize resources and control outbreak is another strategy [16, 17, and 18]. Improved hygiene and sanitation involving provision of adequate clean

and treated drinking water, proper waste disposal, and sewage systems can help to reduce the burden of the disease. Health education about the disease is necessary and the population needs to be alerted whenever there is an outbreak [18]. Prompt diagnosis and effective treatment of people suspected of having cholera could be done in order to promptly and appropriately manage the condition to prevent death and curtail spread of the disease [18]. The use of vaccine administered in emergency situations to people living in areas affected by cholera, and travelerscan to prevent infections [16, 17]. Individual protectionsmeasures can be used and people living or traveling to affected areas can be advised to drink only boiled or treated water, avoid food from street vendors, avoid raw and undercooked food, do frequent hand washing with soap and water or use alcohol based rubs. In 2017, WHO put in place the Global Task Force on Cholera Control (GTFCC) to improve capacity development, coordination and implementation of evidence based cholera control strategies [18]. WHO also established a stockpile of cholera vaccines and respond kits to ensure a prompt response in case of outbreak. The prevention of disease occurrence was also done by targeting cholera 'hotspots'. This component not only identifies at risk areas, but also implements certain control measures, large scale use of cholera vaccines, effective technical support and resource mobilization, strong community and cross border engagement [18].

Unfortunately, communities often face some major challenges in the prevention/control of cholera and these include: Poor socio-economic status of the population [19]; insufficient funding; lack of political will; unexpected events such as natural disasters and civil unrest; and insufficient vaccine supplies. Typical high risk areas of cholera epidemics and deaths include peri-urban slums where basic infrastructure is not available and camps for internally displaced people where the minimum requirements of clean water and sanitation are not met [19, 20]. Areas like refugee camps and urban slums, where people live in close proximity with little or no access to clean water and sanitation facilities are at a very high risk of experiencing a cholera epidemic [17].

Access to potable water in both rural and urban centers in Cameroon is a great concern [19]. Studies carried out in Douala, Cameroon reported that wells could be reservoirs of *Vibrio cholerae* [21, 22]. However, the risk factors for cholera outbreaks in Cameroon have not been systematically evaluated, even though studies have reported that the greatest risk occurs in overpopulated poor communities characterized by open defecation, poor hygiene and sanitation, poor drinking water supplies, environmental degradation and increased person-to-person transmission [22, 23, 24]. The 2020 cholera epidemic in the Tiko Health District of the South West Region of Cameroon which affected 72 people and killed one person, was transmitted by people returning from Manoka, an Island in the cholera "hot zone" in Douala Cameroon [25, 26].

Limited studies on cholera have been conducted in the South West Region. One study was done in 2015 by Nsagha et al. on the assessment of the risk factors of cholera epidemic in the Buea Health District after a cholera outbreak in the Buea Health District [19]. Hence, it is necessary to investigate the community's knowledge on cholera, its prevention/control, challengesand proposed solutions for cholera in the Tiko Health District. This will help identify gaps, recommend evidence-based cholera epidemic guidelines that will help the population prevent/control cholera, generate policies that will produce actions that can help alleviate poverty and human suffering, and also promote ongoing research that regularly reports the rate of socio-economic development of our communities. This is the motivation behind the proposed study.

It should be noted that prevention of cholera occurrence was also done by targeting cholera 'hotspots'. This component not only identifies the risk areas, but also implements certain control measures, introduces large scale use of cholera vaccines, puts in place effective technical support and resource mobilization, and introduces strong community and cross border engagement. WHO also supports public authorities in endemic countries to have a mechanism for integrated disease surveillance and response (IDSR).

The ways the communities perceive and use these measures have been found to vary from place to place. These variations are sometimes due to factors like limited knowledge on cholera and its prevention/control measures, low socioeconomic status, overcrowded communities with poor hygiene and sanitation, unsafe drinking water supplies, open defecation and insufficient infrastructure [12, 14, 16, 18].

The control measures may not also be known by some community members. Where they are known, the approach may be faulty and at other times, there could be a lot of challenges that need to be addressed like

insufficient funding, lack of political will, poor governance, civil unrest, irregular cleaning of coastal waters (which is the entry point of the disease in this community), and natural disasters which lead to different causes of cholera in different parts of the world [12].

In Cameroon, cholera remains a threat to public health. This is evidenced by the cholera outbreak in the Mayo Oulo's Health zone in 2018; the cholera outbreak in the North and Far North regions in 2019; the cholera outbreak affecting two regions (South West and Littoral); the recent cholera epidemic in the Tiko Health District in February, 2020 with a total of 72 cases and 1 death; and the most recent outbreak in the Buea Health District. The total number of affected districts in the South West Region is fouri.eBakassi, EkondoTiti, Tiko, and Buea Health Districts [24].

To prevent/control cholera outbreaks, the population requires thorough and continuous education, encompassing skills, good levels of preparedness of the various health districts, continuous and sufficient good water supply, environmental sanitation, in the short, medium and long term, planning and implementation measures [4, 6, 17]. This study will enable the population of this health district to receive mandatory education that will improve their knowledge, attitudes and practices with regards to cholera prevention. This will help boost their confidence in handling future cholera outbreaks correctly for better outcomes. This underscores the necessity of the study.

Regular community diagnosis by community workers can provide information about cholera which may be useful in making policies that may result in interventions and can significantly improve the health and living conditions of the population. Cholera has come to prominence and has been a global burden since its first pandemic in the 19th century (1817). Since then, several measures have been put in place to reduce or halt its spread as well as morbidity and mortality. Target 3.3 of the United Nations Sustainable development goals (SDGs) states that by 2030, we should end the epidemics of Acquired Immunodeficiency Syndrome (AIDS), tuberculosis (TB), malaria and neglected tropical diseases (NTDs), and combat hepatitis, waterborne diseases and other communicable diseases. Improved socio- economic status, good environmental restructuring, improved hygiene practices, environmental sanitation (especially regular cleaning of the beaches/ coastal waters) and safe drinking water supplies are indispensable in the prevention of cholera epidemics. There are currently medications that can cure a person with cholera and a vaccine that can prevent the disease even though it does not confer life immunity. The antibiotics currently in use are available, affordable and effective, not only in treating patients with cholera, but also helping individuals who are at risk of being infected with the disease.

The main objective of the study was to determine the knowledge, prevention/control, challenges and proposed solutions by community members in relation to cholera in the Tiko Health District.

It is hoped that the results of the study will be useful in generating policies that will produce actions that can help develop effective disease monitoring systems. It will also promote ongoing research that regularly reports the rate of socioeconomic development of our populations, and efficiently control the spread of epidemics, and eventually prevent future outbreaks.

2.0 MATERIALS AND METHODS

2.1. Study period and study Area

This study was limited to the Tiko Health District of Cameroon and involved 420 participants of ages 21 years and above. It lasted for a period of six months (March to May, 2021).

Tiko is situated at 4.15^0 North Latitude 9.24^0 East Longitude in Fako- Division. It has a population of 157.784 inhabitants, living within a surface area of 4.840km^2, and 421 people will participate in the research. Tiko is bounded to the North by Buea; South by the Atlantic Ocean; East by Dibombari (Littoral Region), and West by Limbe. Tiko is 60 km from Douala [27], the economic capital of Cameroon and it is the chief town of the Tiko Health District. The main towns of this health district are Tiko, Mutengene, Missellele and Mudeka.

The district has 8 health areas, a District Health Service and a District Hospital. A good portion of the district is occupied by the plantations of the Cameroon Development Corporation (CDC). It is cosmopolitan with many ethnic groups including Bakweri (indigenes), Bamileke, Balondo, Metta, Bayangi, Dschang, among others. A good number of people from other regions and foreigners, especially from Nigeria, Equatorial Guinea and Gabon live here. The main occupation is agriculture. Almost all ethnic groups in Cameroon are represented in Tiko, attracted by the fertile volcanic soil and the Cameroon Development Corporation, a giant agricultural complex that seconds the state of Cameroon in employment. The district is accessible by road and by sea which enables the population to interact with people from Douala and other areas. It is also swampy, dirty beaches which are never cleaned thus favors the introduction and transmission of diseases including the *Vibrio cholerae* which causes cholera from other coastal areas in the "cholera belt" (Bakassi, EkondoTiti, Tiko, Douala, Kribi).

The low socio-economic status of the majority of the population aggravated by the socio-political crisis in the North West and South West Regions, the financial crisis in the CDC, scarcity and poor drinking water supplies, poor housing, poor environmental sanitation and poor waste disposal, overpopulation, open defecation, and the hot climate that favors the propagation of vectors (flies) are some of the factors that may be associated with the cholera epidemic in the Tiko Health District, and the region as a whole. The health district is characterized mostly by plains that hold water which, combined with poor sanitation go to favor transmission of cholera infection. The two Regional hospitals of Limbe and Buea are very close by, thus easing referral of severe cases of diseases.

The location of this district within the "Cholera Belt" (Bakassi, Kribi, Manoka, and Douala) predisposes it to cholera epidemics, like the one in February 2020. The persistent occurrence of cholera in this "Belt" makes it imperative for this study to be carried out in this health district.

2.2. Study Design

A cross-sectional study design was used, in which Knowledge, prevention/control, challenges, and proposed solutions for cholera in the Tiko Health District was determined, for better outcomes. It was an observational study that examined the relationship between a disease and an exposure among individuals in a defined population at a point in time. This is significant because it measures exposures exposure and outcome at the same time.

2.3. Study Participants

This included individuals, twenty-one years and above, who had been living in the Tiko Health District for at least six months before the administration of the questionnaires. Participants were asked to score their knowledge on cholera, its prevention/control measures, challenges and proposed solutions on a scale of 10. A score of zero represented complete ignorance and no knowledge, and proposed solutions, and 10 for complete knowledge. The data was used to determine participants' knowledge, prevention/control, challenges and proposed solutions for cholera in the Tiko Health District.

2.4. Inclusion Criteria

These are community members who have been living in the Tiko Health District for at least 6 months before the administration of the questionnaires.

2.5. Exclusion Criteria

These were participants who had been living in the Health District for at least 6 months but were not available for some reason, by the time the questionnaires were administered. Also excluded were eligible persons who refused to take part in the study.

2.6. Sample Size

A total of 420 participants took part in the study. The Cochrane formula was used to determine the sample size as follows:

Minimum sample size (n) = $Z^2 pq/e^2$

Where;

- Z is the Z value found in a Z table.
- e is the desired level of precision (the margin of error).
- p is the proportion of the population who have the attribute in question, for an unknown population and with proportion having the attribute being unknown, we use 0.5.
- q is 1 – p.

The data was analyzed and the results were presented at 95% Confidence level, implying Z = 1.96 and e = 0.05. Substituting the above therefore, the minimum sample size will be 366 participants. However, a sample of 420 was used to maximize coverage.

2.7 Sampling Technique

A convenient/in situ sampling technique was used. Recruitment of participants took place in selected communities of the Tiko Health District. These communities were arranged in clusters (health areas) and 4 out of the 8 health areas were then randomly selected. The names of the 8 health areas were written on small pieces of papers, which were then twisted and shuffled. After which 4 of the health areas were randomly selected. In this case, each individual was chosen entirely by chance and each member of the population had an equal chance of being selected. Next, participants were conveniently selected based on their availability and willingness to participate in the study.

Participants were met in their various homes in the evenings and on "Ghost Town" days. This ensured that a majority of them were present, and did not disrupt the work schedules of the researcher assistants.

2.8 Data Collection Tools and Techniques

Data was collected by the main researcher and assisted by ten trained research assistants working at selected health institutions, and community workers who are bilingual and competent in pidgin language. These assistants were selected and trained at their various selected health areas. The purpose of the study was explained to these assistants, as well as the consent form, and how it was to be used. There were questions to validate their understanding. The questionnaire was pre-tested in the Bonassama Health District in Douala, and the first ones to be used for data collection from the first few participants, were checked to ensure the assistants understood how to fill the forms. Thereafter, the consent forms were given to the assistants for data collection. The questionnaires were in English and were translated verbally when need arose. The questionnaires were administered by the trained research assistants. However, in cases where a participant demonstrated the wish and ability to self-administer the questionnaire, he or she was allowed to do so. The questionnaire had four sections as follows:

Section A was on Socio-demographic data which included the participant's nationality, gender, age, level of education, marital status, occupation, Religion and monthly income.

Section B dealt with knowledge of community members on the definition, cause; transmission, predisposing factors, prevalence, diagnosis, and treatment of cholera.

Section C handled knowledge of community members on the prevention/control of cholera.

Section D was on challenges and proposed solutions by community members in relation to the prevention/control of cholera.

2.9 Data Analysis

After data was collected, compilation was done following the objectives of the thesis. Then the data was entered in EpiInfo version 17.3, cleaned with Microsoft Excel 2013. Analysis were performed on the collected data included demographic analysis to see the categories of participants who took part in the study, a reliability analysis to determine the reliability of the measuring instrument, and a descriptive analysis describing participant's responses and each variable used in the study. Finally, the data was analyzed with R version 3.6.1, and the results were presented on tables and bar charts. Chi Square test

was used for relationship between variables and significance was set at P≤ 0.5. All data was analyzed at the 95% confidence interval.

3.0RESULTSAND DISCUSSION

3.1 RESULTS

3.1.1 Demographic Characteristics of the Study Population

The study involved 420 participants with 84.8% (n= 356) being Cameroonians and 15.2% (n= 64) being foreigners. The proportion of female and male participants was 44.5% (n= 233) and 55.5% (n= 187) respectively.The average age among the study participants was 35 ± 2years, a majority of the participants were in the age group 27- 32years (21.4%, n = 90) and the minority were ≥ 63years (2.9%, n = 12). For level of education, 25 (6.0%) participants had no formal education, 136 (32.4%)had primary, 217 (51.6%) had secondary and 42 (10.0%) had tertiary education. With regards to marital status, there were 208 (49.5%) married participants, 206 (49%) were single, and 6 (1.5%) participants were divorced.As concerns occupation, the majority of the participants were self employed (n = 204, 48.6%), and the minority were retired (n= 3, 0.7%). With regards to religion, there were 381 (90.7%) Christians, 28 (6.7%)Muslims and 11 (2.6%) pagans. With respect to monthly income, most people (n = 329, 78.3%) earned less than 50.000frs a month (Table 1).

3.1.2 Knowledge of community members on cholera

3.1.2.1 Knowledge of community members on the definition of cholera

Of the 420 participants contacted for their knowledge on cholera, the majority (82.1%, n = 345) of the participants said that cholera was a disease resulting from infections with bacterial agents and the minority of the population (17.9%, N = 75) did not know the cause of cholera. They

Table 1: Socio-demographic characteristics of the study population

Variables	Categories	Frequency (n)	Percentage (%)
Sex	Male	187	44.5
	Female	233	55.5
	21 – 26	63	15.0
	27 – 32	90	21.4
	33 – 38	83	19.8
Age (years)	39 – 44	79	18.8
	45 – 50	48	11.4
	51 – 56	26	6.2
	57 – 62	19	4.5
	≥ 63	12	2.9
	Total	**420**	**100**
Nationality	Cameroonian	356	84.8
	Foreigner	64	15.2
	Total	**420**	**100**
Level of Education	No formal education	25	6.0
	Primary education	136	32.4
	Secondary education	217	51.6
	Tertiary education	42	10.0
	Total	**420**	**100**
Marital Status	Married	208	49.5
	Single	206	49
	Divorced	6	1.5
	Total	**420**	**100**
Occupation	Employed	96	22.9
	Unemployed	117	27.8

	Self- employed	204	48.6
	Retired	3	0.7
	Total	**420**	**100**
Religion	Christians	381	90.7
	Muslims	28	6.7
	Others	11	2.6
	Total	**420**	**100**
	< 50,000	329	78.3
	50,000 – 100,000	62	14.8
Monthly Income (frs CFA)	100,001 – 150,000	11	2.6
	150,001 – 200,000	11	2.6
	200,001 – 250,000	1	0.2
	> 250,000	6	1.4
	Total	**420**	**100**

attributed it to a strange disease whose cause was unknown, or indicated that they had no idea (figure 1).

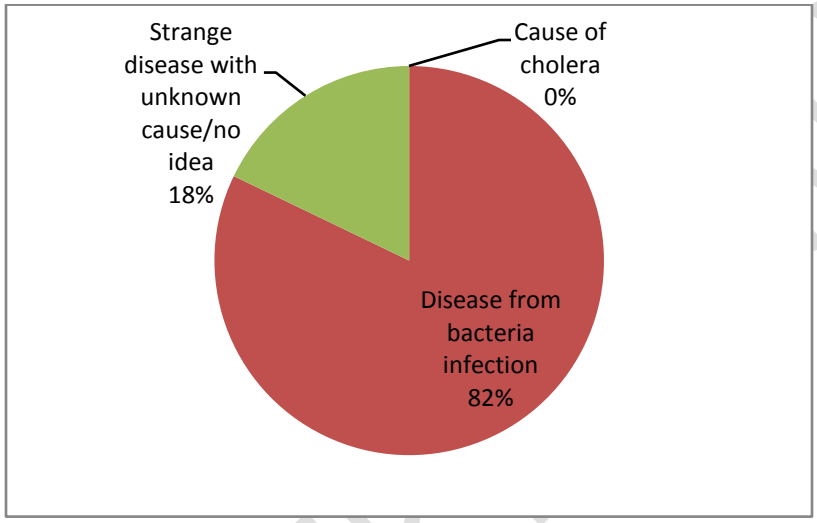

Figure 1: The definition of cholera among community members

There was a significant difference ($P < 0.001$, $\chi^2 = 32.16$) in the respondents knowledge on the definition of cholera in relation to their level of education with the most knowledgeable people being those with secondary education (43.6%, n = 183) and the least being those with no formal education (2.3%, n = 10) as shown in table 2.

Table 2: The definition of cholera among community members in relation to level of education

The definition of cholera	**Level of Education**				**Chi Square P-value**
	No formal education n (%)	**Primary n (%)**	**Secondary n (%)**	**Tertiary n (%)**	

Disease resulting from bacterial infection	**N = 345**	15 (3.6)	118 (49.1)	183 (43.6)	29 (6.9)	$\chi^2 = 32.16$ P < 0.001
Strange disease with unknown cause/ no idea	**N = 75**	10(2.3)	18 (4.3)	34 (8.1)	13 (3.1)	
Total	**420 (100%)**	25 (5.9)	136 (32.4)	217 (51.7)	42 (10.0)	

3.1.2.2 Knowledge of community members on the causes of cholera

Of the 420 respondents that were assessed, 335 (79.7%) indicated that cholera is caused by bacteria and 54 (12.9%) said that it is caused by virus. Few respondents (3.8%, n = 16) said cholera is caused by spiritual attacks, and a minority (3.6%, n = 15) had no idea (figure 2).

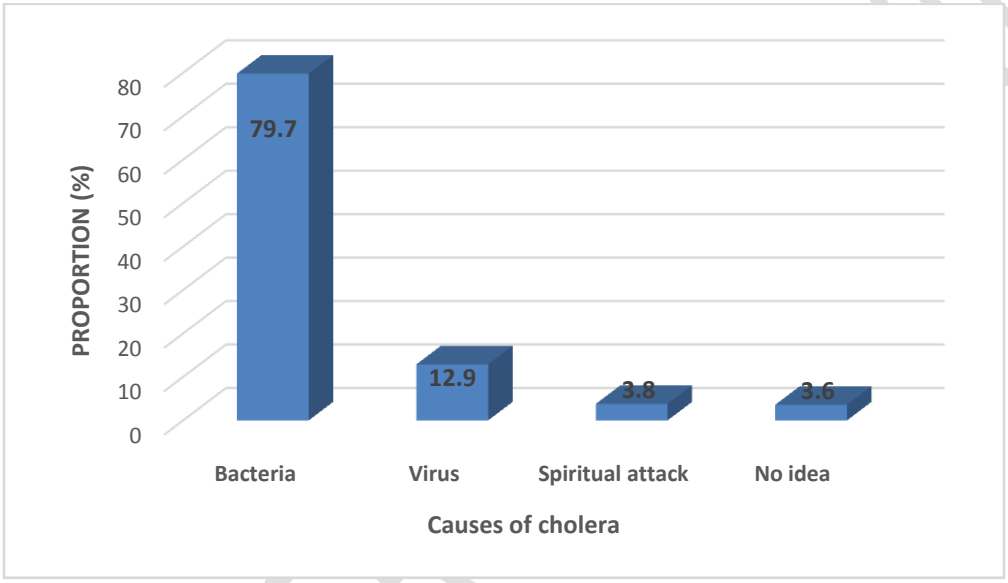

Figure 2: Respondents' knowledge on the cause(s) of cholera

With respect to educational level, the majority of the respondents who identified bacteria as the cause of cholera had attained secondary education (n = 178, 42.4). Most of those who said that they had no idea where people with primary education (1.4%, n = 6). There was a significant difference in the level of knowledge on the transmission of cholera with respect to educational level (P = 0.009, $\chi^2 = 21.82$) as shown in table 3.

Table 3: The cause of cholera among community members in relation to level of education

Cause of Cholera		**Level of Education**				**Chi Square P-value**
		No Education n (%)	**Primary n (%)**	**Secondary n (%)**	**Tertiary n (%)**	
Bacteria	N = 335	15 (3.6)	105 (25)	178 (42.4)	37 (8.8)	$\chi^2 = 21.82$
Virus	N = 54	4 (0.95)	17 (4.0)	30 (7.1)	3 (0.7)	
Spiritual attack	N = 16	2 (0.5)	8 (1.9)	4 (0.95)	2 (0.5)	P = 0.009
No idea	N = 15	4 (0.95)	6 (1.4)	5 (1.0)	0 (0.0)	

Total	**420 (100%)**	25 (5.9)	136 (32.4)	217 (51.7)	42 (10.0)

3.1.2.3 Knowledge on the modes of transmission of cholera among community members

In relation to transmission of cholera, most of the respondents (72.6%, n = 305) indicated that cholera could be contracted from drinking contaminated water. The minority (27.4 %, n = 115) indicated that poor source of drinking water was not a means of transmission. Most people understood that eating contaminated food could pre-dispose them to cholera (53.8%, n = 226) as opposed to those who did not know (46.2%, n = 194). A majority could identify that consumption of unwashed fruits and vegetables could pre-dispose people to cholera (46.9%, n = 197). A few people said that the pre-disposing factor was witchcraft (1.0%) and a few had no idea (1.2%) as indicated in table 4.

Table 4: Knowledge on the modes of transmission of cholera among community members

Transmission of the disease	**Options**		**Total**
	YES (%)	**NO (%)**	
Ways of contracting cholera			
Drinking water from contaminated sources	305 (72.6)	115 (27.4)	420 (100%)
Eating contaminated food	226 (53.8)	194 (46.2)	420 (100%)
Eating fruits that have not been properly washed	197 (46.9)	223 (53.1)	420 (100%)
Through witchcraft	4 (1.0)	416 (99.0)	420 (100%)
No idea	5 (1.2)	415 (98.8)	420 (100%)

3.1.2.4 Knowledge on who can contract cholera

Out of the 420 respondents contacted, 6.2% (n = 26) indicated that only adults could contract the disease, 3.1%, (n = 13) indicated that only children could contract the disease**,** 1.4% (n = 6) said only old people and 89.3%, (n = 375) said that anyone could contract the disease (figure 3).

With respect to educational level, most of the people who had attained secondary education indicated that everyone could contract the disease (n = 217, 51.7%). Most of those who said that only children could contract the disease had attained only primary education (1.2%, n = 5). The chi Square test showed that level of education significantly influenced the community's perception on who could be affected by the disease (P = 0.041) as shown in table 5.

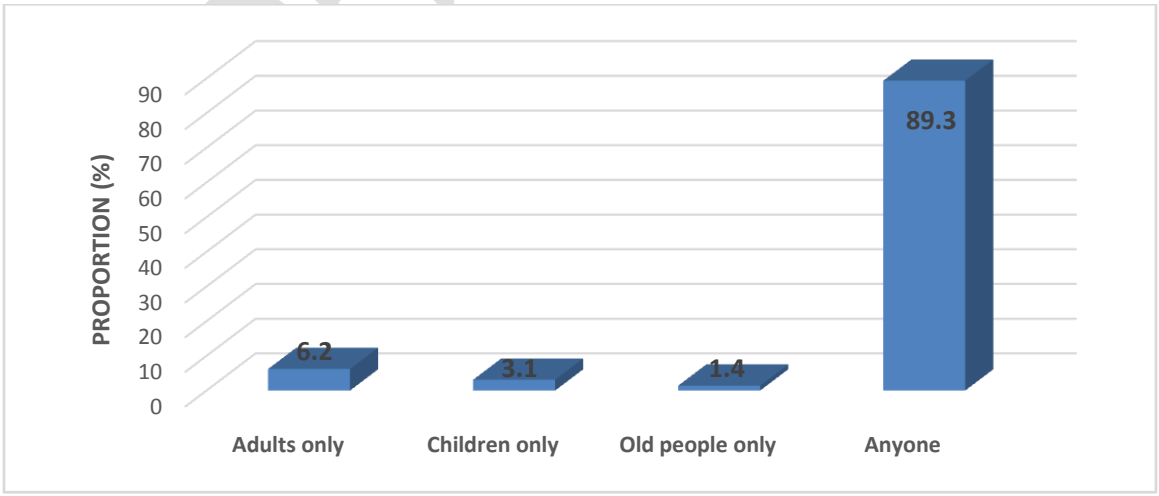

Figure 3: Respondents' knowledge on who can contract cholera

Table 5: Respondents knwolege on who can contract cholera in relation to level of educational level

People susceptible to cholera		Level of Education				Chi Square P-value
		None n (%)	Primary n (%)	Secondary n (%)	Tertiary n (%)	
Adults only	N = 26	0 (0.0)	11 (2.6)	14 (3.3)	1 (0.2)	$\chi^2 = 7.55$
Children only	N = 13	3 (0.7)	5 (1.2)	4 (0.95)	1 (0.2)	P = 0.041
Old people only	N = 6	1 (0.2)	0 (0.0)	3 (0.7)	2 (0.5)	
Everyone	N = 375	21 (0.05)	120 (28.6)	196 (46.7)	38 (9.0)	
Total	**420 (100%)**	25 (5.9)	136 (32.4)	217 (51.7)	42 (10.0)	

3.1.2.5 Community member's knowledge on cholera's predisposing factors

With respect to the factors that predispose people to cholera, 115 (27.42%, CI = 23.3 – 31.84%) indicated that poverty was a predisposing factor. In relation to poor hygiene, 312 (74.3%, CI = 69.9 – 78.2%) of the respondents accepted that poor hygiene can predispose a person to cholera. A minority of the respondents said that civil unrest and wars 16 (3.8%, CI = 2.4 – 6.1%) can predispose people to cholera and another small fraction 8(1.9%, CI = 0.09 - 0.37%) indicated that they had no idea on the predisposing factors (table 6).

Table 6: Knowledge of community members on the predisposing factors of cholera

Question	Options YES (%)	Confidence interval at 95%	NO (%)	Total
Factors that can predispose a person to cholera				
Poverty	115 (27.4)	23.3 – 31.84	305 (72.6)	420 (100%
Poor hygiene and sanitation	312 (74.3)	69.9 – 78.2	108 (25.7)	420 (100%)
Overcrowding	114 (27.1)	23.11 – 31.59	306 (72.9)	420 (100%)
Wars/ civil unrest	16 (3.8)	2.4 – 6.1	404 (96.2)	420 (100%)
No idea	8 (1.9)	0.09 - 0.37	412 (98.1)	420 (100%)

3.2.6 Knowledge of community members on the management of cholera

For the ways in which cholera could be managed, 340 (46.13%, CI = 76.9 – 84.4%) supported the idea of using medications from the hospital for treatment of cholera, 138 (18.73%, CI = 28.5 – 37.5%) said receiving medicines from a health worker was the best management strategies. Also, 106 (14.38%, CI = 21.3 – 29.6%) respondents insisted that praying is the preferred means of managing the disease, 146 (19.81%, CI = 30.4 – 39.4%) indicated that they had no idea about managements and 7 (0.95%, CI = 0.8 – 3.4%)people preferred other forms of treating the disease such as the use of natural herbs/herbal drugs (table 7).

Table 7: Knowledge of community members on the management of cholera

Questions	Responses		No (%)	Total (%)
	Yes (%)	Confidence interval at 95%		
Management strategies for cholera				
By use of medicine from a hospital	340 (46.13)	76.9 – 84.4	80 (53.87)	420 (100%
By use of medicine from a health worker	138 (18.73)	28.5 – 37.5	282 (81.27)	420 (100%)
By praying	106 (14.38)	21.3 – 29.6	317 (85.62)	420 (100%)
By use of ORS	146 (19.81)	30.4 – 39.4	274 (80.19)	420 (100%)
No idea/others	7 (0.95)	0.8 – 3.4	413 (99.05)	420 (100%)

3.1.2.7 Knowledge of community members on the incidence and previous occurrence of cholera in Tiko

With regards to knowledge on the occurrence of cholera, most respondents, (n = 295, 70.2%) said cholera had occurred in the community, and 125 (29.8%) said it had never occurred.

Of the 295 respondents who said cholera had occurred in the community, 39 (9.2%) said children were the most affected, 29 (6.9%) said adolescents, and 174 (14.1%) respondents said adults were the most affected. Also, 16 (1.3%) said old people and 37 (8.8%) said all age groups were affected. As concerns the sexes that were most affected during the outbreak, 30 (7.1%) respondents said males, 71 (16.9%) said females, 192 (45.7%) said both sexes were mostly affected, and 2 (0.5%) said they had no idea.Again when asked about the number of people who died during the outbreak, 12 (2.9%) participants said 1-5, and 283 (67.3%) said they had no idea.When asked about the location of death, 12 (2.9%) participants said the people died in the hospital, while 283 (67.4%) had no idea.See table 8 for details on the occurrence of cholera in this community.On the question on what caused the death, 5 (1.2%) people accused purging, 7 (1.7%) said cholera itself, and 283 (67.4%) had no idea.

Table 8: Knowledge of community members on previous occurrenceof cholera in the community

Aspects of Knowledge	Responses		Confidence interva at 95%
	Frequency (n)	Percentage (%)	
Previous occurrence of cholera in this community			
Yes	295	70.2	65.7 - 74.4
No	125	29.8	25.6 - 34.3
Total	**420**	100	
Most affected people during the period of occurrence			
Children	39	9.2	6.9 - 12.4
Adolescents	29	6.9	4.9 - 9.7
Adults	174	41.4	36.8 – 46.2
Old people	16	3.8	2.4 – 6.1
All ages groups	37	8.8	6.5 – 11.9
Total	**295**	**70.2**	65.7 - 74.4
Most affected sex during the period of occurrence			
Male	30	7.1	5.0 - 10.0
Female	71	16.9	13.6 - 20.8
Both sexes	192	45.7	41 – 50.5
No idea	2	0.5	0.1 – 1.7
Total	**295**	**70.2**	65.7 - 74.4
Estimated number of deaths			

0 – 5 persons	12	2.9	1.6 – 4.9
No idea	283	67.4	62.8 – 71.7
Total	**295**	**70.2**	65.7 – 74.4
Place were death occurred			
Hospital	12	2.9	1.6 – 4.9
No idea	283	67.4	62.8 – 71.7
Total	**295**	**70.2**	65.7 – 74.4
The cause of death			
Purging	5	1.2	1.6 – 4.9
Cholera itself	7	1.7	0.8 – 3.4
No idea	283	67.4	62.8 – 71.7
Total	**295**	**70.2**	65.7 – 74.4

3.1.3Knowledge of community members on the prevention and control of cholera

3.1.3.1 Awareness of the cholera vaccine among community members

A majority of the respondents (85.2%, n = 358) indicated that they had heard of the vaccine and only a minority (14.8%, n = 62) had not heard of the vaccine before (figure 4).

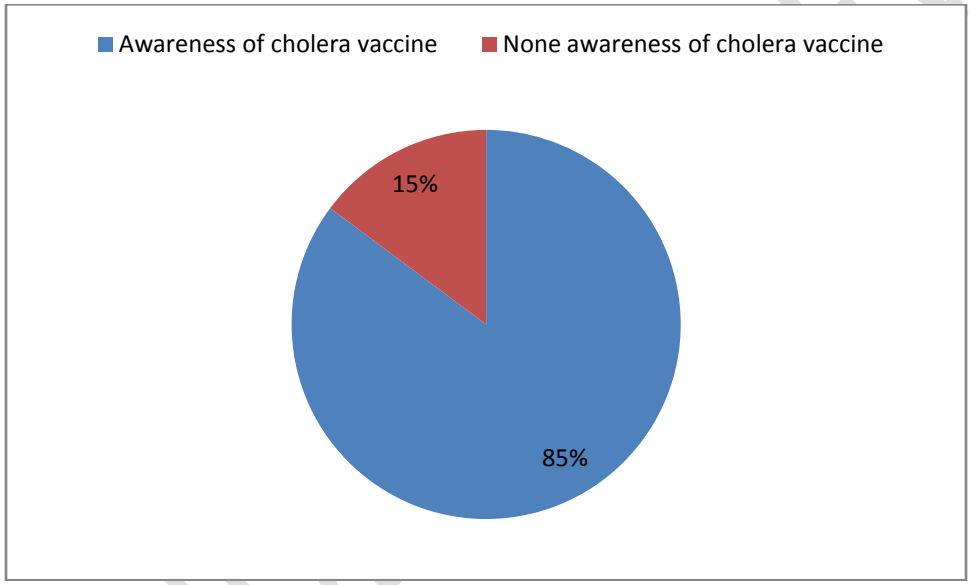

Figure 4: Community members' awareness on cholera vaccine

Out of the 358 respondents who stated that they had heard of the vaccine, 289 (80.7%) of them indicated that they had received the vaccine and 69(19.3%) stated that they have not received the vaccine (figure5).

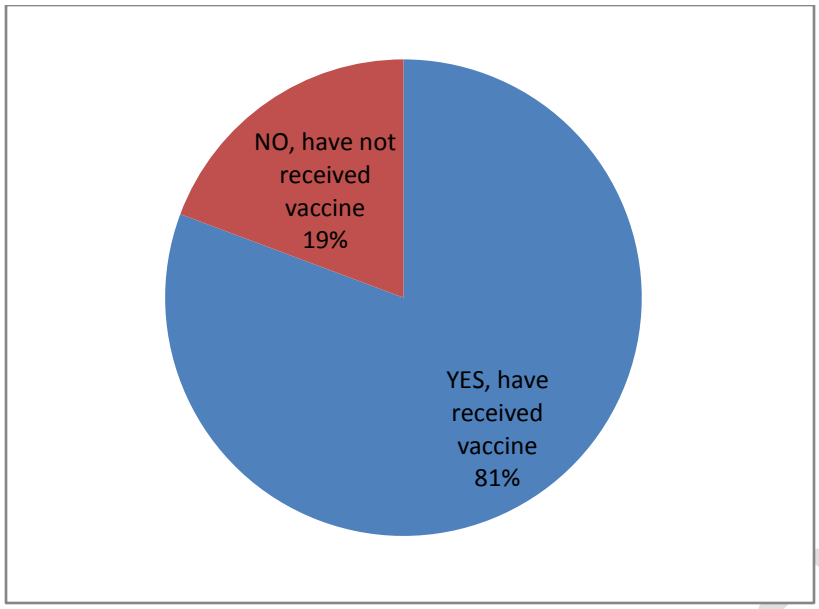

Figure 5: Reception of cholera vaccine by respondents

3.1.3.2 Community members' attitude towards vaccination

Out of the 420 respondentscontacted, 289 (68.8%) said they will accept vaccinationand 131 (31.2%) said they will not accept the vaccine as can be seen on figure 6.

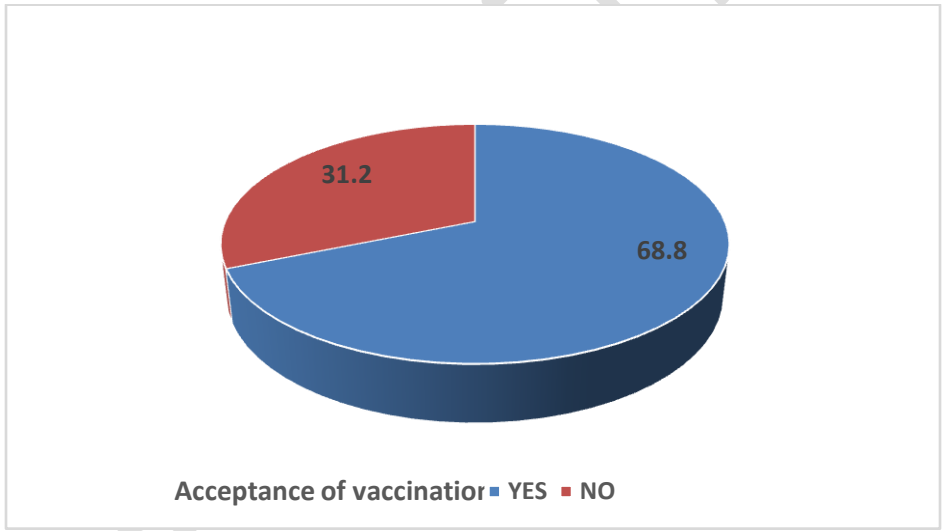

Figure 6: Community members' level of cholera vaccine' acceptance

3.1.3.3 Reasons why community members will accept or reject cholera vaccine

From the 289 (68.8%) participants who said they will accept the vaccine, the following reasons were advanced: it increases immunity (n = 63, 15%, CI = 11.9 – 18.7%), it kills microbes (n = 27, 6.4%, CI = 4.5 – 9.2%), it prevents the disease (n =196, 46.7%, CI = 42.0 – 51.5%), and 3 respondents had no idea. With

regards to why community members will reject the cholera vaccine, 131 (31.2%) people responded and 34 (8.1%, CI = 5. 9 - 11.1%) of them said they didn't like vaccines, 35 (8.3%, CI = 6.0 - 11.4) said vaccines kill, 42 (10%, CI = 7.5 - 13.2) said vaccines have severe side effects, and 16 (3.8%, CI = 2.4 - 6.1) said vaccines are contaminants. See table 9 for more details.

Options	Frequency (n)	Percentage (%)	Confidence interval at 95%
Reasons why they can accept cholera vaccination			
It increases immunity	63	15	11.9 – 18.7
It kills microbes	27	6.4	4.5 – 9.2
It prevents the disease	196	46.7	42.0 – 51.5
No idea	3	0.7	0.4 – 1.9
Sub-Total	**289**	**68.8**	64.2 – 73.1
Reasons why they can reject cholera vaccination			
Do not like vaccines	34	8.1	5. 9 - 11.1
Vaccines kill	35	8.3	6.0 - 11.4
They have severe side effects	42	10	7.5 - 13.2
They are contaminants	16	3.8	2.4 - 6.1
Sub-Total	**131**	**31.2**	2.7 - 35.8
Total	**420**	**100**	64.2 - 73.1

Table 9: Reasons why community members will accept/ reject cholera vaccine

3.1.3.4 Knowledge on preventive and control measures against cholera among community Members

As per theknowledge on preventive measures, 272 (65.5%) were for the opinion that safe water source/conservation could prevent cholera, 276 (66.7%) said good hand washing practices, 244 (58.1%) said vaccination, 40 (9.5%) were for the use of antibiotic prophylaxis as shown in table10.

Concerning why there should be actions to prevent cholera, a majority of the respondents (36.2%, n = 152) said the measures if applied would kill microbes, increase immunity and prevent the ingestion of pathogens. A few respondents (2.9%, n = 12) had no idea.

In relation to the intensification of preventive measures, most people (29.5%, n = 124) indicated that it should be done in towns, 20.7% (n = 87)said in markets, 24.8% (n = 104) said in churches, 16.5% (n = 68) said it should be around streams, 6.0% (n = 25) said it should be everywhere, and1.2% (n = 5) said they had no idea.

With regards to identifying control measures, 79.5% (n = 334) indicated that reporting to hospital early when one has cholera was the best control measure. Some (41.7%, n = 175) indicated that accepting to take all medications was the best measure and a few (6.0%, n = 25) indicated that they prefer to receive treatment at home.

On the question on why participants think the above options are control measures, some (20.2%, n = 85)responses pointed to the fact that control measures help contain the disease, 62.6% (n = 263) were for the option that these measures prevent spread to other people, 3.3 14 were of the opinion that they cannot be re-infected, 17.1% (n = 72)pointed to the option that the measures help cure the sick person.

On how effective the control measures were, 51.2% (n = 215) were for the fact that the measures could stop the disease, 45.7%(n = 192)said there will be a reduction of the severity of the disease as shown in table 10.

Table 10: Community members' knowledge on preventive and control measures against cholera

Cholera preventive measures	Yes (n) (%)	No (n) (%)	Total
Preventive measures			
Safe water sources/conservation	272 (64.8)	148 (35.2)	420 (100%)
Good hand washing practices	276 (65.7)	144 (34.3)	420 (100%)
Vaccination	244 (58.1)	176 (41.9)	420 (100%)
Antibiotic prophylaxis	40 (9.6)	380 (90.5)	420 (100%)
Use of prayers	96 (22.9)	324 (77.1)	420 (100%)
Reasons for actions to prevent cholera			
They kill microbes	80 (19.1)	340 (80.9)	420 (100%)
It increases immunity	72 (17.1)	348 (82.9)	420 (100%)
It prevents ingestion of pathogens	103 (24.5)	317 (75.5)	420 (100%)
All are correct	152 (36.2)	268 (63.8)	420 (100%)
No idea	12 (2.9)	408 (97.1)	420 (100%)
Where preventive measures should be intensified			
In towns	124 (29.5)	296 (70.5)	420 (100%)
In markets	87 (20.7)	333 (79.3)	420 (100%)
In churches	104 (24.8)	316 (75.2)	420 (100%)
Around streams	68 (16.2)	352 (83.8)	420 (100%)
Everywhere	25 (6.0)	395 (94.0)	420 (100%)
No idea	5 (1.2)	415 (98.5)	420 (100%)
Control measures			
Reporting to hospital early	334 (79.5)	86 (20.5)	420 (100%)
Accepting to take all medications	175 (41.7)	245 (58.3)	420 (100%)
Accepting proper disposal of feces	171 (40.7)	249 (59.3)	420 (100%)
Prayers	97 (23.1)	323 (76.9)	420 (100%)
Receiving treatment at home	25 (6.0)	396 (94.0)	420 (100%)
No idea	8 (1.9)	412 (98.1)	420 (100%)
Reasons for choice of control measures			
They contain the disease	85 (20.2)	335 (79.8)	420 (100%)
Prevent spread to others	263 (62.6)	157 (37.4)	420 (100%)
I cannot be re- infected	14 (3.3)	406 (96.4)	420 (100%)
Cures the sick person	72 (17.1)	348 (82.9)	420 (100%)
Others	8 (1.9)	412 (98.1)	420 (100%)
Efectiveness are the control measures			
They stop the disease	215 (51.2)	205 (48.8)	420 (100%)
Reduce the severity of the disease	192 (45.7)	228 (54.3)	420 (100%)
Prayer is the only effective measure	12 (2.9)	408 (97.1)	420 (100%)
Medicines are ineffective	10 (2.4)	41 (97.6)	420 (100%)
Others	11 (2.6)	409 (97.4)	420 (100%)

3.1.4. Challenges encountered, and proposed solutions of community members in relation to thePrevention and control of cholera in the Tiko health district

3.1.4.1Challenges faced by community members in the prevention and control of cholera in the Tiko Health District

As to what makes prevention and control of cholera very difficult, 32% said the lack of good toilets, 19% indicated the lack of good water supply, 25% said difficulties with environmental sanitation and 22% said poor and insufficient water supply as shown in figure 7.

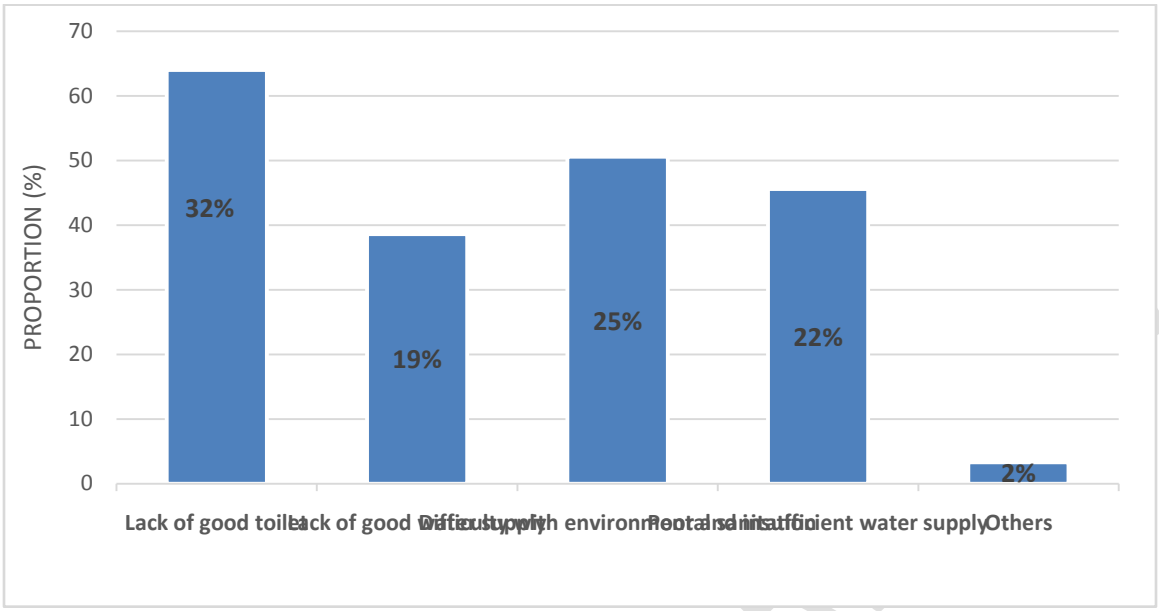

Figure 7: Challenges faced by community members towards cholera prevention and control.

3.1.4.2 Solutions to overcome difficulties faced with the prevention/control of cholera

As concerns proposed solutions by community members to the challenges a majority of the respondents said the Tiko urban council's intervention in environmental sanitation and community support to improve awareness were the best options. A minority said that creation of self reliance groups for self support and sourcing for funds from local companies/NGOs was option to overcome the challenges as shown in table 11.

With regards to people that are principal leaders in reducing these challenges, most of the people said that health committee members and community health workers were suppose to be the main people at the frontline. See table 11.

Table 11: Solutions to overcome challenges linked to cholera prevention and control in the Tiko Health District

Options	Yes (%)	No (%)	Total
Ways to overcome difficulties in cholera management and prevention			
Community support to improve ignorance of the disease	256 (61.0)	164 (39.0)	420 (100%)
Tiko urban council's intervention in environmental sanitation and continuous and regular supply of portable water	250 (59.5)	170 (40.5)	420 (100%)
Creation of self-reliance groups for self-support in prevention and control measures	143 (34.0)	277 (66)	420 (100%)
Sourcing for funds from local companies, NGOs, elites, business people etc. in order to put in place general prevention and control measures	96 (22.9)	324 (44.1)	420 (100%)
Principal leaders to help reduce the challenges in managing and controlling cholera			
Health committee members and community workers	289 (68.8)	1341(31.2)	420 (100%)
Administrative authorities	193 (46.0)	227 (54.0)	420 (100%)
Corporations, industries and NGOs	154 (36.7)	266 (63.3)	420 (100%)
Health authorities	115 (27.4)	305 (72.6)	420 (100%)

Cameroon water company (CAMWATER)	131 (31.3)	289 (68.8)	420 (100%)

3.2 DISCUSSION

This study was carried out in Tiko Health District, S.W. Region,Cameroon. The majority of the participants were in the age group 33-38 years. Most of the participants were Cameroonians (84.8%n = 356) and few were Nigerians (15.2%, n = 64). There were more females than males, the majority had secondary education, were married, self employed, were Christians and earned less than 50.000 FRS CFA per month.

In relation to community knowledge on cholera, a majority of participants correctly said it is a bacterial infection. The cause of cholera is water contaminated with the *Vibrio cholerae,*which is a bacteria. This finding is in line with the findings of a study by Ncubet al. in 2016 [28] that assessed the knowledge, attitudes, and practices regarding cholera preparedness and prevention in South Africa.A few of them talked about viral infection and some said it was a spiritual disease. Most often strange diseases that easily cause death are often related to spiritual issues especially in communities were educational levels are low.

Concerning community knowledge on modes of transmission, drinking water from contaminated sources and eating contaminated food were indicated as the main modes of transmission. These results fall in line with findings of a study in 2015 by Nsagha et al. [19] on the risk factors of cholera epidemic in the Buea Health District in Cameroon and another study by Debes et al., in North Cameroon [29]. Some participants also talked of eating fruits that have not been properly washed. This is in line the reports published by the Centers for Disease Control and Prevention in 2014 on the risk factors for cholera outlined.

In relation to community knowledge on who can contract cholera, a great majority of respondents said anybody can contract the disease. This could be explained by the fact that households and communities often have a common source of water. As such contamination of the water source can result to infections of anyone irrespective of age or gender [30]. Also fruits and vegetables are sold and bought from the local markets. These products are consumed by all members in the community. So contamination can be a common source of infection if not properly washed and/or cooked before consumption [31].

On assessing risk factors for cholera, responses suggested poor hygiene, poverty and overcrowding and this result is in line with a study carried out in 2014 by Davies-Tyre, et al. in Southern Ghana [32] indicating the poor hygiene is mostly implicated during cholera outbreaks. Poverty is closely related to poor hygiene since it can lead to overcrowding, too many people using the same toilets, and lack of finances to purchase detergents needed for proper disinfection.

As concerns community knowledge on the management of cholera, some respondents indicated that hospital management was the best option.This result corresponds to the findings of W.H.O. in 2021 [33] in relation to the global burden of cholera epidemics in endemic countries. Some respondents indicated that they could manage the condition by receiving medications from a health worker. Surprisingly, some respondents had no idea on the management of cholera. This was considered a problem in the community because sensitization had been going on in the Tiko Health area in relation to cholera.

Regarding knowledge of community members on the incidence and previous occurrence of cholera in the community, majority of the participants indicated that they were aware that cholera had occurred in their community before and that adults were mostly affected. In this study, more men were reported to be affected than women. This contradicts the findings of Griffiths et al. in 2021 in Haiti who reported that more women are likely to be affected by cholera than men [11]. Also, few participants confirmed that about 1-5 people died during the last cholera outbreak in Tiko. This corresponds to the article published by Cameroon Tribune in Febuary 2020 on cholera outbreak in Tiko [24]. This poor level of knowledge among the participants is understood because most deaths occur in hospitals and the exact cause of death may not be known by the community since diagnosis are supposed to be kept confidentially. The community will depend on presenting signs and symptoms which could be mistaken considering the fact that many other diarrhea diseases can be mistaken for cholera by community members who are not health practitioners.

On the awareness of community members about the cholera vaccine, most participants said they knew about the vaccine, and most had received it, and they said they were still willing to take it another dose if provided. This showed that once proper education is given in relation to health issues, positive response rate is higher. Very few respondents had never heard of the vaccine, and had never received it. Some (31.2%, n = 131) said they were not willing to receive the vaccine if distribution was to be done. This could be explained by the fact that some people generally resist drugs and vaccines as a result of ignorance or traditional beliefs.

When asked for reasons why they will accept or reject the vaccine, most said they were convinced that vaccines prevent the disease. For those who indicated that they will reject the vaccine, their reasons included severe side effects, fear of death resulting from the vaccine and some said that they didn't like vaccines. All of these reasons could be understood because vaccines were prepared to boost the immune system and prevent infections [34]; however, some vaccines can have severe side effects. The results on vaccination agrees with records from the Tiko Health indicating that mass vaccination was done following an epidemic of cholera in August 2016 and Febuary 2020 [24].

On the assessment of knowledge on prevention/control measures, respondents indicated good hand washing practices, safe water sources/conservation, and vaccination respectively.The findings correspond with those of another study carried out byDunoyer et al. 2012 [35]indicating the main preventive measures against cholera.

When asked why there must be actions to prevent cholera, the responses mostly given were' the actions help kill microbes, increases immunity, and prevent ingestion of microbes'. In relation to where the preventive measures should be intensified, most respondents indicated that towns and churches could be good target sites. The result about intensifying these measures agrees with an earlier finding of a study by Beau in 2011 in Haiti [35] and Bertuzzo[36].

With regards to community members' knowledge on control measures, most people indicated that going to the hospital early when infected with cholera was the best option. This option is understood because hospitals are specialized for attending to different types of patients. So early diagnosis ensures prompt treatment and reduces death rates. Proper waste disposal was also given as a control measure because it prevents spread of diseases to others.

As concerns the assessment of challenges faced, proposed solutions, and who they thought are principal leaders in mitigating these challenges, there were more responses for lack of good toilets, hence lack of proper feces disposal. This finding corresponds to those of a study carried out Columbara [37] and Olanrewaju[38]on cholera in a rapidly urbanizing environment. Some respondents indicated that difficulties with environmental sanitation/unhygienic environment were a factor that could pre-dispose people to cholera, because people just dump waste materials everywhere. This is because there is no functioning waste collection and disposal system in this community. These go to contaminate food, streams, and rivers, and when the population consumes these, they are contaminated. Also, poor and insufficient water supply was indicated as a challenge.

For the proposed solutions, community members indicated favor of community support to improve ignorance of the disease, some called on the Tiko urban council to improve on environmental sanitation, and ensure continuous and regular water supply to the community, and some chose the creation of self reliance groups for self support in prevention and control measures. These strategies are good because they will not only prevent cholera but will also prevent other communicable diseases.

On who should be the principal leader in reducing the challenges, respondents indicated thatthe health committee members and community workers, some said administrative authorities, others said corporations, industries, and NGOs, while somesaid the Cameroon utilities corporation (CAMWATER) for a solution to the challenges encountered. However, the effective fight against cholera will require the participation of all community members.

The findings identified some lessons that are essential in enhancing the prevention and control of cholera. The transmission route for the *Vibrio cholerae* in this area is by sea, because Tiko is in the "cholera Belt"

(Kribi, EkondoTiti, Douala, Tiko), and this is due to factors that favor the microorganism to thrive like dirty beaches and coastal waters which are never cleaned and disinfected.Also, Poor and insufficient drinking water sources, poor infrastructure, open defecation and no waste collection/disposal system, are all possible routes for the transmission of cholera.

The time of cholera outbreak and distribution, is usually around the time the seasons are changing, (towards the end of the dry season, and the beginning of the rainy season) thus this is predictable.

Thirdly, that adequate and continuous health information to the people regarding the mode of transmission, and simple but effective prevention/control measures can help reduce infection and death.

The study identified the need for evidence-based community participation through the health committees, community workers, social groups, and community leaders in order to help in the implementation of prevention and control of cholera infections.

4.0 CONCLUSIONS

The majority (82.1%, n = 345) of the participants knew that cholera was a disease resulting from infections with bacterial agents. There was a significant difference ($P < 0.001$, $\chi^2 = 32.16$) in the respondents knowledge on the definition of cholera in relation to their level of education. Most of the respondents (72.6%, n = 305) indicated that cholera could be contracted from drinking contaminated water. Poverty and poor hygiene were identified as predisposing factors. Most people (n = 340, 46.13%, CI = 76.9 – 84.4%) supported the idea of using medications from the hospital for treatment of cholera.A majority of the respondents (85.2%, n = 358) indicated that they had heard of the vaccine and only a minority (14.8%, n = 62) had not heard of the vaccine before and most had received the vaccine.As per the knowledge on preventive measures, 272 (65.5%) were for the opinion that safe water source/conservation could prevent cholera, 276 (66.7%) said good hand washing practices, 244 (58.1%) said vaccination, 40 (9.5%) were for the use of antibiotic prophylaxis. As to what makes prevention and control of cholera very difficult, 32% said the lack of good toilets, 19% indicated the lack of good water supply, 25% said difficulties with environmental sanitation and 22% said poor and insufficient water supply.A majority of the respondents said the Tiko urban council's intervention in environmental sanitation and community support to improve awareness were the best solutions to the challenges faced.

Following the findings of the study, we believe that the Tiko urban council could implement a waste collection and disposal system, and implement effective clean-up campaigns days in order to improve on environmental sanitation. The council should also organize continuous cleaning and disinfection of the coastal areas and waters, in order to prevent entry of the *Vibrio cholerae* into the health area since Tiko is in the "cholera Belt". Also, the Tiko council could increase the sizes, the pipes supplying water to Mutengene health area, and also extend the water supply to the rest of the district.The government could re-start the training schools for sanitary inspectors to ensure proper hygiene and sanitation of our communities.

CONSENT

Study participants were approached, and their consents sought for inclusion in the study. The purpose, content, and duration of the study was explained to all the participants in English, French, or Pidgin. They were made to understand that they could withdraw from the study without any penalty, and that all the data provided were to be treated with utmost confidentiality.

ETHICAL APPROVAL

Administrative and ethical clearances were obtained from the Regional Delegation of Public Health (RDPH) Buea (84/MINSANTE/SWR/RDPH/PS/631/931) Ethics Committee of the Faculty of Health Science of the University ofBuea (Recu No.1465-05, 2021) and the District Health Service, Tiko (No. 29/MINSANTE/RDPHSW/THD/196).

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COMPETING INTERESTS

Authors declare that there is no competing interest. The research was done in harmony.

AUTHORS' CONTRIBUTIONS

JLNN designed the work, supervised the data collection and edited the manuscript.
NAM participated in designing the work, collected the data and wrote the draft manuscript.
NBB did the data entry and data analysis.

REFERENCES

1. W.H.O. "Updated Global Burden of cholera in Endemic Countries: (World Health Organization 2021).
2. Ali M, Nelson AR, Lopez AL, Sack DA. Updated global burden of cholera in endemic countries. PLoSNegl Trop Dis. 2015; 9: eooo3832.
3. Mohammad A, Anna LL, Young AY, Young EK, Binod S, Brian M.. The global burden of cholera. Bull World Health Organ. 2012;90(3):209. doi:10. 2471/BLT.11.093427.
4. Amicizia D, Burden of typhoid fever and cholera: Similarities and differences, Prevention strategies for European travelers to endemic/epidemic areas. Prev Med Hyg. 2019.
5. Ajoke OA, Solayide AA, Francisca ON, Mary-Theresa N, Akitoye OC. Cholera epidemiology in Nigeria: an overview. Pan Afr Med J. 2012; 12:59.
6. Bwire G. Cross-Border Cholera Outbreaks in Sub-Saharan Africa, the Mystery behind the silent illness: PLoS One. 2016
7. World Health Organization. Cholera in Cameroon. Available at: http://www. who.int/csr/don/2004_06_15/en.
8. World Health Organization. Cholera (2014). Available at: http://www.who.int/ entity/wer/2015/wer9040.pd
9. Kigen HT. A Protracted cholera outbreak among residents in an urban setting, Nairobi County, Kenya, 2015. Pan Afr Med J 2020.
10. Dunkle SE, Mba-Jonas A, Loharikar A, Fouche B, Peck M, Ayers T, et al. Epidemic cholera in a crowded urban environment, Port-au-Prince, Haiti. Emerg Infect Dis. 2011; 17 (11): 2143-6. http://dx.doi.org/10.3201/eid 1711.110772.
11. Griffiths K. Delineating and analyzing locality-level Determinants of cholera, Haiti.Emerg Infect Dis. 2021
12. World Health Organization. Cholera fact sheet. Available at: http://www. who.int/mediacentre/factsheets/fs107/en/.
13. Baron S, Jean Lesne, Sandra Moore, Emmanuel Rossignol, StanislasRebaudet, Pierre Gazin, Robert Barrais, Roc Magloire, Jacques Boney, and Renaud ,Piarroux. 2013. "No Evidence of significant Levels of Toxigenic V.Cholerae 01 in the Haitian Aquatic Environment During the Rainy Season." PLOS Currents Outbreaks Sept 13: 114.doi: 1. 1371/currents. Outbreaks. 7735b392bdcb749baf5812d296d331e.
14. Khonje A, Metcalf CA, Diggle E, Mlozowa D, Jere C, Akesson A. Cholera outbreak in districts around Lake Chilwa, Malawi: Lessons learned. Malawi Med J. 2012; 24(2):29–33.
15. Alam-Meer T, Thomas A Weppelmann, Chad D Weber, Judith A Johnson, Mohammad H Rashid, Catherine S Birch, Babette A Brumback, Valery E Madsen Beau De Rochars, J Glenn Morris, and Afsar

Ali. 2014. “Monitoring Water Sources for Environmental Reservoirs of Toxigenic Vibrio Cholerae O1, Haiti.” *Emerging Infectious Diseases* 20 (3): 356–63.
16. Cholera vaccines: WHO Position Paper-August 2017 http://apswho.int/iris/bitstream/10665/258764/1/ (WER9234-477-498.pdf)
17. Azman AS,Luquero FJ, Rodrigues A, Palma PP, Grais RF, Banga CN, Grenfell T B, and Lessler J. 2012. “Urban Cholera Transmission Hotspots and Their Implications for Reactive Vaccination: Evidence from Bissau City, Guinea Bissau.” *PLoS Neglected Tropical Diseases* 6 (11): e1901. doi:10.1371/journal.pntd.0001901.
18. Global Task Force on Cholera Control. Ending Cholera: A Global Roadmap to 2030. Annency, 2017
19. Nsagha DS., Atashili J, Fon P.N. *et al,* Assessing the risk factors of cholera epidemic in the Buea Health District Cameroon. BMC Public Health 15, 1128 (2015). https://doi.org/10.1186/s2889-015-2485-8
20. International Medical Corps: Basic Facts on Cholera. Available at: https:// internationalmedicalcorps.org/sslpage.aspx?pid=475. Accessed19th May 2015.
21. Akoachere JF, Tatah K, Kwedjeu C, Mbuntcha P. 2014. “Water Sources as Reservoirs of Vibrio Cholerae O1 and Non-O1 Strains in Bepanda, Douala (Cameroon): Relationship between Isolation and Physico-Chemical Factors.” *BMC Infectious Diseases* 14 (421): 1–10. doi:10.1186/1471-2334-14-421.
22. Akoachere JF,Kihla T, Masall TN, and Njom HA. 2013. “Multidrug Resistant Toxigenic Vibrio Cholerae O1 Is Persistent in Water Sources in New Bell-Douala, Cameroon.” *BMC Infectious Diseases* 13 (January): 366. Doi:10.1186/1471-2334-13-366.
23. Jane-Francis TKA, Christelle KP. Water sources as reservoirs of Vibrio cholerae O1 and non-O1 strains in Bepanda, Douala (Cameroon): relationship between isolation and physico-chemical factors. BMC Infect Dis. 2014;14: 421. doi:10.1186/1471-2334-14-421.
24. Cameroon Tribune (February, 2020). Cholera outbreak in Tiko Health District, Cameroon. Article in Cameroon tribune written by Nkeze.
25. Alexander R, Benita A, Lucas K, Freda M, Berry R, Enoch P, et al. 2012. Cholera risk factors, Papua New Guinea. BMC Infec Dis. 2012;12:287.
26. Ali M, Lopez AL, You YA, Kim YE, Sah B, Maskery B, et al. The Global Burden of Cholera. Bull World Health Organization. 2012; 0:209-218 A. [PMC free article] [Pubmed] [Google Scholar].
27. Tiko health District. Cohort files and cholera records of the Tiko Health District (personal communication).
28. Ncub A, Jordan AJ, Mabela BM: Assessing the Knowledge, Attitudes and Practices regarding cholera preparedness and prevention in GaMampuru, Limopo, South Africa. Jambia 2016: 8: 1-9
29. Debes AK,Ateudjieu J, Guenou E, Ebile W, Sonkoua IT, Njimbia AC, Steinwald P, Ram M, and Ssck DA. 2016. “Clinical and Environmental Surveilance for Vibrio Cholerae in Resource Constrained Areas: Application during a 1Year Surveillance in the Far North Region of Cameroon.” The American Society of Tropical Medicine and Hygiene: 537-43. Doi: 10. 4269/ajtmh.15-0496.
30. Beau De Rochers, Valery EM, Julie Tipret, Molly Patrick, Lara Jacobson, Kamil E Barbour, David Berendes, Diana Bensyl, et al. 2011. “Knowledge, Atitudes, and Practices Related to Treatment and Prevention o Cholera, Haiti, 2010.” Emerging Infectious Diseases17 (11): 2158-61.
31. Kuitcha D, Ndjama J, Tita AM, Lienou G, Kamgang KBV, Ateba BH, et al. Bacterial contamination of water points of the upper Mfoundi watershed, Yaounde, Cameroon. Afr J Microbiol Res. 2010; 4(7):568-74.
32. Davies-Tyre BBK, VanotooL, YabaniJB, and Kwkye-MacleanC. 2014. “Socio-Economic factors Associated with Cholera Outbreak in Southern Ghana: A Case-Control Study.” Value in Health 17 (3): A128.
33. World Health Organization, 2020. Facts Sheet on cholera.
34. Beau De Rochers, Valery EM, Tipret J, Molly P, Jacobson L, Barbour KE, Berendes D, Bensyl D, et al. 2011. “Knowledge, Atitudes, and Practices Related to Treatment and Prevention o Cholera, Haiti, 2010.” Emerging Infectious Diseases17 (11): 2158-61.
35. Dunoyer J, Sudre B, Rebolledo J, and Cottavoz P. 2013.”Le Choler Transfrontalier En Sierra Leone et Guinee, et Guinee En 2012 et es strategies D’ntervention Associees.” Action Contre la faim-Force. Humantarin. Info/system/files/documents/fles/Repot cholera-2013.pdf.
36. Bertuzzo E, Mari L, Righetto L, Gatto M, Casagrandi R, Blokesch M, et ale. Prediction of the spatial evolution and effects of control measures for the unfolding Haiti cholera outbreak. Geophys Res Lett. 2011; 38: 15. Doi: 1. 129/211GLO46823.

37. Colombara DV, Cowgill KD, Faruque ASG. Risk factors for severe cholera among children under five in Rural and Urban Bangladesh, 2000-2008: a hospital-based surveillance study PLoS One. 2013; 8 (1):e54395. Doi: 10. 1371/journal.pone.0054395.
38. Olanrewaju OE, Adepoju KA: Geospatial Assessment of cholera in a Rapidly urbanizing Environment. J Environ Public Health 2017;2017; 6847376