

CONFERENCE PROCEEDINGS

September 6-8, 2024
Vancouver, Canada



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Conference Proceeding

September 06-08, 2024 – Vancouver, Canada

Format: Electronic Book

ISBN: 978-1-998259-45-8



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ABSTRACT

Antenatal care is a medical and general care provided to pregnant women during pregnancy. It is aim at meeting both psychological and medical needs of pregnant women within the context of health care delivery system. The study investigated pregnant women’s knowledge and attitude towards antenatal care services at Obuasi S.D.A. Hospital. Three research objectives and questions were formulated to guide the study. The literature was conceptually, empirically and theoretically reviewed based on the main variables under study. The study adopted a descriptive and explanatory design and the sample size was 300 pregnant women attending antenatal care at the Hospital from January – May, 2016. The instrument for data collection was a structured questionnaire. The study revealed that majority of the respondents had good knowledge and favorable attitude towards antenatal care. Additionally, the result indicated that attitude and knowledge of pregnant women negatively and positively predict the utilization of ANC services respectively. However, attitude of pregnant women showed a higher negative impact on the utilization of ANC services than combining it with interest of pregnant women. The study recommended that publicity on the effectiveness of antenatal care should be encouraged by health practitioners. Again, health practitioners should treat patients as unique individuals without any favoritism in order to encourage the utilization of ANC.

Keywords – Antenatal, conceptually, complications, attitude

INTRODUCTION

Appropriate antenatal care is one of the pillars of Safe Motherhood Initiatives, a worldwide effort launched by the World Health Organization (WHO) and other collaborating agencies aimed to reduce the number of deaths associated with pregnancy and childbirth. It highlights the care of antenatal mothers as an important element in maternal healthcare as appropriate care will lead to successful pregnancy outcome and healthy babies. All pregnant ladies are recommended to go for their first antenatal check-up in the first trimester to identify and manage any medical

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complication as well as to screen them for any risk factors that may affect the progress and outcome of their pregnancy (Rosliza and Muhamad, 2011).

Pregnancy and childbirth are natural processes, which in most cases come to good end even without any intervention; however, in a relatively high proportion of pregnancies, there are complications of which are life threatening in nature and can lead to maternal. Most of these complications may be anticipated, since risk factors are present (Ochola-Ayaya, 2009).

In Ghana, maternal mortality rates are very high, that is, 230 per 100,000 live births (GHS, 2007). Maternal mortality ratio reflects the rate of death of women from pregnancy to puerperium and it is the most important indicator used for evaluating the effectiveness of safe motherhood services (RCH, 2008). The pattern of causes of maternal deaths as estimated by WHO shows that hemorrhage (24.8%) is the leading cause followed by infection (14.9%), unsafe abortion (12.9%), eclampsia (12.9%) and obstructed labor (6.9%). This pattern may vary in different healthcare facilities although other direct causes such as the delay model account for (7.9%) of the total maternal deaths, while (19.8%) is attributed to indirect causes like malaria, hepatitis, anemia etc. (WHO and UNICEF, 2008).

Additionally, Expectant mothers in the urban areas utilize antenatal services better than their counterparts in the rural areas who have the problems of accessibility to MCH services; some pregnant mothers in the rural area may have basic knowledge of the importance of antenatal services but due to problems of accessibility to health facilities will hinder them from such services (Igbokwe, 2008). Also, inadequate knowledge concerning health related matters usually lead to negative attitude towards the health issue. (Igbokwe, 2012) It is indicated that urban and rural locations have great impacts on the utilization of antenatal services, (Igbokwe, 2012)

In developing countries most women are faced with serious pregnancy related health risks. This situation is a major concern to many governments in developing countries as well as international organizations. Within Africa, Ghana is ranked with a maternal mortality ratio of 500 deaths per 100,000 live births (UNICEF, 2010). The high maternal and prenatal mortality rates were considered consequences of poor control during pregnancy and labour (GHS, 2006). Nevertheless, a pregnant woman should report to any health facility anytime she feels unwell or experience any complication. However, according to the Ghana Health Service (2006) annual report of Reproductive and Child Health Unit, the average number of antenatal visits was 3.4 in 2012 and 3.3 in 2014. In addition, there was a fall in the number of women who attended at least four visits from 62% in 2014 to 58.5% in 2015.

Antenatal care service coverage recorded in 2015 at Obuasi S.D.A.Hospital, the study area, shows 43.3% (310) out of 611 respondents with average visit of 3 per client, which is low compared with an average of 4 per client especially with the NHIS and free antenatal care services. Late teenagers recorded 12.3% (82) of the total antenatal registrants. Out of the 611 pregnant women, 22.7% were registered with anemia. That evidence demonstrated that, despite Ghana's strategic

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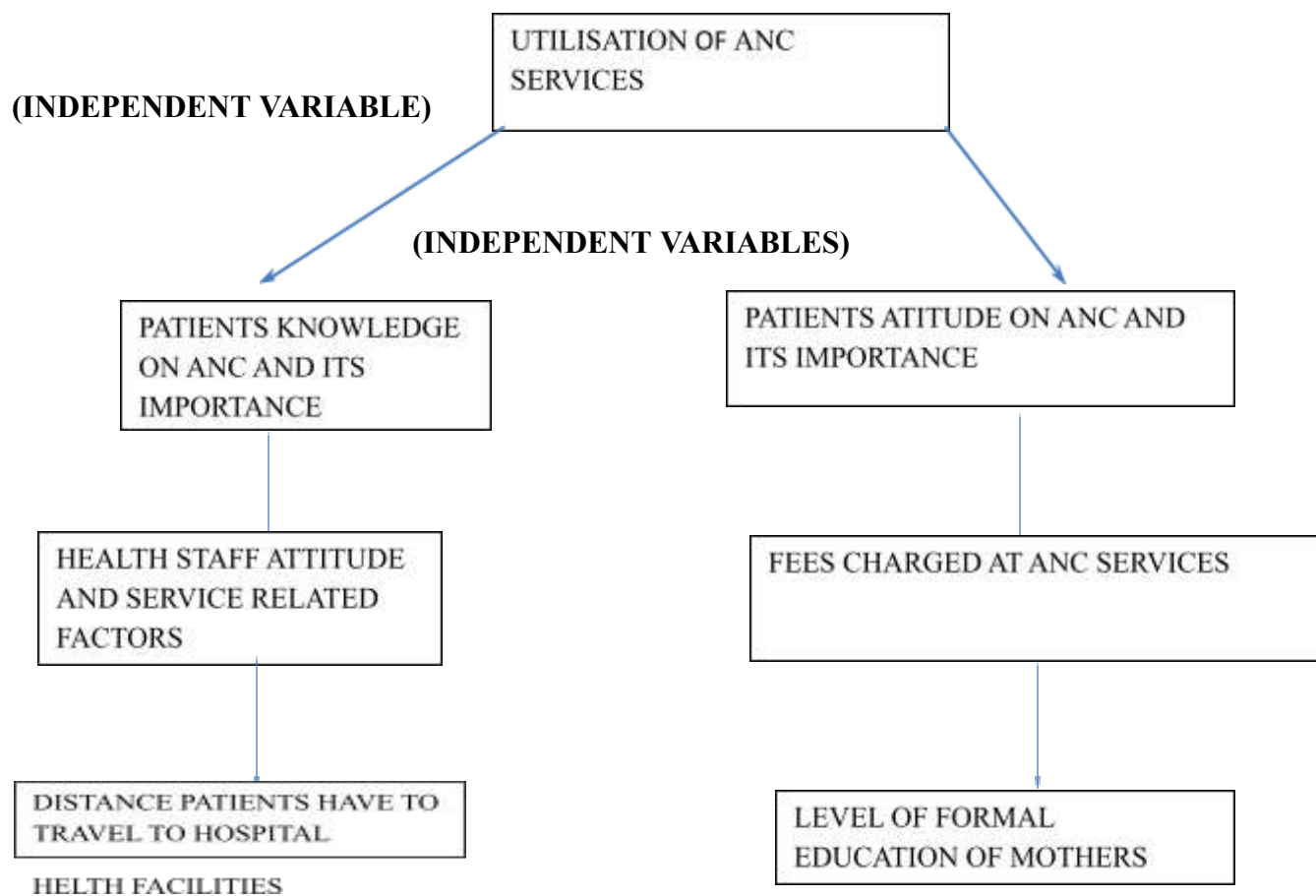


policies of which free ANC care and delivery, implementation to smoothing antenatal care services, prevention and management of unsafe abortion, family planning, and labour and delivering care, postnatal care and health education. Pregnant women in Ghana are still reluctant to utilize antenatal care service. Therefore, it is very imperative to carry out research in the area of knowledge and attitude of pregnant women towards utilization of antenatal care services.

Objective of the Study

1. To assess how knowledge and attitude of pregnant women influence the utilization of ANC service at Obuasi S.D.A. Hospital.
2. To examine the level of knowledge of pregnant women towards utilization of ANC service.
3. To examine the attitude of pregnant women towards utilization of ANC service.
4. To establish the impact of knowledge and attitude of pregnant women in the utilization of antenatal care services.

10 Conceptual frameworks



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RESEARCH FINDINGS

Table 1: Research population

	Category of respondents	Population
Pregnant women	Reproductive age group	400

Table 2: Research sample size

	Category of respondents	Population
Pregnant women	Reproductive age group	300

Table 3: Knowledge of pregnant women towards Antenatal Care Service.

ITEMS	PERCENT YES (%)	PERCENT (%) NO
1. Detection of Pregnancy service is given at ANC	80	20
2. Antenatal care services are needed when pregnant	93	7
3. Maternal health service is given at ANC	67	33
4. Foetal death, maternal death, asphyxia and many more are some of the health implications of not following ANC	73	27
5. Mothers should get ANC services during pregnancies at the health facility	85	15
6. ANC services are given at health institutions and private clinics	65	35

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7. ANC services are given at health institutions and traditional attendant	66	34
8. ANC services should be accessed with a minimum of four visits	74	26
9. ANC services should be accessed as soon as pregnancy is confirmed	33	67
10. ANC services are necessary for every pregnant woman	63	37

Table 4. Attitude of Pregnant Women towards Antenatal Care Services

Key: SA-Strongly Agree A-Agree N-Neutral D-Disagree SD-Strongly Disagree

Attitude	SA%	A%	N%	D%	SD%
1. Much time is spent at ANC visits by pregnant women	60	20	18	2	
2. I get intimidated by health practitioners anytime I visit antenatal care	44	26	18	12	
3. I get intimidated by co-patients anytime I visit antenatal care	6	1	5	18	70
4. Cultural factor does not permit me to follow ANC	9	21	10	60	
5. Religious factor does not permit me to follow ANC	2	4	12	82	
6. Not satisfied with the service given at the ANC visits	2	8	20	70	
7. Should antenatal care services be encouraged?	80	10	9	1	

Recommendations

1. Nurses and Midwives in both the hospital settings and in the community should engage women of reproductive age both the non-pregnant and the pregnant in education concerning the importance of ANC and when to initiate the care.

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2. Educational programmes on ANC services should be encouraged through the social media especially on the televisions and radio stations to enhance effective participation of women in antenatal care service when pregnant.
3. Suggestion boxes should be placed in the various health facilities precisely the ANC clinics to aid in clients expressing their concerns and grievances.
4. Necessary actions such as being queried or scolded when a negative attitude is spotted among health providers.
5. Strict monitoring of services rendered to clients should be conducted by health care authorities to correct and prevent poor attitudes of health care providers hence ensuring quality care provider client relationship.
6. Necessary resources should be employed at the ANC clinics to enhance more effective, quality and fast delivery of services.

CONCLUSION

Antenatal care (ANC) is the care a woman receives throughout her pregnancy to ensure that both the mother and child remain healthy. A healthy diet and lifestyle during pregnancy is important for the development of a healthy baby and may have long-term beneficial effects on the health of the child. Almost 90% of maternal deaths occur in developing countries and over half a million women die each year due to pregnancy and childbirth related causes (Laishram, 2013). Globally, 180million pregnancies occur each year, 8million suffer pregnancy related complications and more than half (585, 000) a million die (WHO2004). More than 400,000 occur in developing countries and the risk of dying is highest in Africa. In addition to maternal death, women experience more than 50million maternal health problems annually. As many as In Ghana, complications during pregnancy and childbirth are leading causes of death and disability among women of reproductive age. A total of 995 institutional maternal deaths were recorded in 2007. This represents a 4.0% increase over the 957 maternal deaths reported in 2006. . During the last 10 years the lowest maternal mortality ratio has been fluctuating between 186 /100,000 live births and then 277.1/100,000 live births (2007).

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Abstract

The negative impacts of zoonotic diseases such as rabies on human and animal population cannot be overemphasized. In this case report, rabies was confirmed in a 4-year-old male Nigerian indigenous dog kept as a pet in Umuahia, Abia State. The dog, previously friendly, was reported to display a sudden change in behavior, and had bitten two children and several other dogs without provocation. Upon report to Khola Vet Services a Private Veterinary Clinic within the location, the dog was quarantined, euthanized and brain sample was sent to the National Veterinary Research Institute (NVRI), Vom, Nigeria. Direct fluorescent antibody test (DFAT) was used to detect rabies virus in the sample and it was confirmed positive. This outcome further confirms the endemicity of rabies in Nigeria, thus the need for continuous implementation of public awareness and eradication strategies.

Keywords: zoonotic, rabies, pet, DFAT

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Abstract

Background

As of October 9, 2023, diphtheria has been noted to be re-emerging in four African countries: Algeria, Guinea, Niger, and Nigeria. 14,587 cases with a case fatality rate of 4.1% have been reported across these regions, with Nigeria alone responsible for over 90% of the cases. In Taraba State Nigeria, the index case of Diphtheria was reported on epidemic week 34, August 24, 2023 with 75 confirmed cases found 3 months after the index case and a case fatality of 1.3%. We described the distribution, trend and common symptoms found during the Outbreak.

Methods

The Taraba State Diphtheria Outbreak line list on the Surveillance Outbreak Response Management & Analysis System (SORMAS) for all its 16 local government areas (LGAs) was analyzed using descriptive statistics (graphs, charts and maps) for the period between 24th August to 25th November 2023. Primary data was collected through the use of case investigation forms and variables like Age, gender, date of disease onset, LGA of residence, and symptoms exhibited were collected. Naso-pharyngeal and oro-pharyngeal samples were also collected for Laboratory confirmation. The most common diphtheria symptoms during the outbreak were also highlighted.

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Results

A total of 75 Diphtheria cases were diagnosed in 10 of the 16 LGAs in Taraba State between 24th August to 25th November 2023, 72% of the cases were female with the age range 0-9 years having the highest proportion of 34 (45.3%) , the number of positive diagnosis reduces with age among cases. The Northern part of the State had the highest proportion of cases 68 (90.7%) with Ardo-Kola LGA having the highest 28 (29%). The remaining 9.2% of cases is shared among the middle belt and southern part of the State. The Epi-curve took the characteristic shape of a propagated infection with peaks at the 37th, 39th and 45th epidemic weeks. The most common symptoms found in cases were fever 71 (94.7%), pharyngitis 65(86.7%), tonsillitis 60 (80%), and laryngitis 53 (71%).

Conclusions

The number of confirmed cases of Diphtheria in Taraba State Nigeria between 24th August to 25th November 2023 is 75. The condition is higher among females than male and mostly affected children between ages 0-9 with the northern part of the state most affected. The most common symptoms exhibited by cases include fever, pharyngitis, tonsillitis and laryngitis.

Keyword: Diphtheria outbreak, Nigeria, Taraba state, Trend, Epidemiology

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ABSTRACT

Background and Objective: Since the first cholera outbreak in the South West Region in 2011, the Limbe Municipality has registered recurrent outbreaks which suggest that cholera remains a public health threat in this area. This study sought to assess the different cholera preventive measures put in place at selected secondary and high schools and the Cholera Treatment Center (CTC) used as a pilot center in the Limbe municipality and the challenges faced in implementing them.

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Methods: The study employed a descriptive cross-sectional approach with data generated through questionnaires, focus group discussions (FGD), key informant interviews and semi-structured interviews. SPSS Version 26.0 was used for data analysis and the Chi-square test to determine significant differences in the level of implementation of cholera preventive measures.

Findings: Out of 440 respondents, 361 (82 %) did not accept getting vaccinated. Disinfection of classrooms was very low 62 (14%). Regular use of hand sanitizers was very significant ($p=0.013$ -95% CI). None of the surveyed schools met the standards of the World Health Organisation. Findings from this study revealed that, 526 (27.3 %) of cholera cases recorded at the CTC were from students and teachers. Challenges faced included limited financial resources 344 (86%), limited WASH kits 264 (60%), security challenges at the CTC and difficulties in separating patients from their relatives.

Conclusion: The study revealed that, the level of implementation of cholera preventive measures in schools is moderate (51.5%) and high (85%) at the CTC. The study recommends strengthening of WASH services in schools.

Keywords: Cholera; Implementation; Preventive measures; Cholera risk; Challenges; School.

INTRODUCTION

Cholera is a severe form of diarrhea disease, which is caused by the ingestion of food or water contaminated with the bacterium *Vibrio cholerae* (Reeves, 1998). It is one of the most rapidly virulent and fatal bacterial diseases known for its pandemicity and extreme manifestation (Rancourt, 2013). The infection is often asymptomatic or exhibit only mild diarrhea but severe cases are characterized by sudden onset of profuse watery diarrhea, nausea, and vomiting. This massive loss of fluid can lead to dehydration and death within hours if left untreated (WHO, 2019). According to Their World (2018), all schools in Zambia were shut down in order to combat the cholera outbreak. In 2009, the authorities in Tanzania's northeastern district of Handeni ordered the closure of schools following a cholera outbreak that resulted in 12 deaths (The New Humanitarian, 2009). Access to safe water and improve sanitation facilities has eliminated cholera transmission of *Vibrio cholerae*, the causative agent, in high-income countries (Echenberg, 2011).

The risk of cholera outbreak in Cameroon remains high. This is explained by the massive population exchange with neighboring countries and persistent cholera outbreaks in these neighboring countries like Nigeria, Central Africa Republic and Chad coupled with limited access to water, sanitation and hygiene (Munier A. *et al.*, 2017; Kaas R.S *et al.*, 2016 in Ateudjieu *et al.*, 2019). Studies carried out by Nsagha *et al.* (2015), has revealed that a number of demographic and socioeconomic factors including age, gender and social status are also known to play a crucial role to cholera infection. Base on their research findings, there were more female (58.2 %) cholera cases than male (41.2 %). Since most women are engaged in domestic activities, it exposes them to this infection. Also, cholera was mostly reported from students (42.5 %) than from other occupations.

A study by Manjong-Kofete *et al.* (2021) on WASH practices in schools, Cameroon, reported that none of the schools met WHO WASH standards. According to the International Medical Corps (2022) cholera situation report, the Limbe Municipality reported the highest cholera cases in the

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south west region during the recent cholera outbreak with a total of 1885 cases reported as of April, 2022.

Among these cases, were students and staff from schools in the Limbe Municipality. This study sought to assess the different cholera preventive measures in schools, the various cholera risk factors and investigate the challenges involved in the implementation of cholera preventive measures in secondary and high schools in the Limbe Municipality. This information is intended to support UNICEF, UNESCO and the Government of Cameroon’s efforts in reducing the spread of this disease in schools and the global fight towards ending cholera by 2030.

MATERIALS AND METHOD

A. Study Site

The city of Limbe is located between latitudes 3°20” North and 4°15” North of the equator and between longitudes 8°15” East and 9°35” East of the Greenwich Meridian. It is located along the coastal area of Fako Division, South-West Region of Cameroon (Fig. 1). It has beautiful coastal beaches, historic monuments, a botanic garden, and a wildlife center. It is not only an international tourist destination but the major petroleum and agricultural hub of Cameroon.

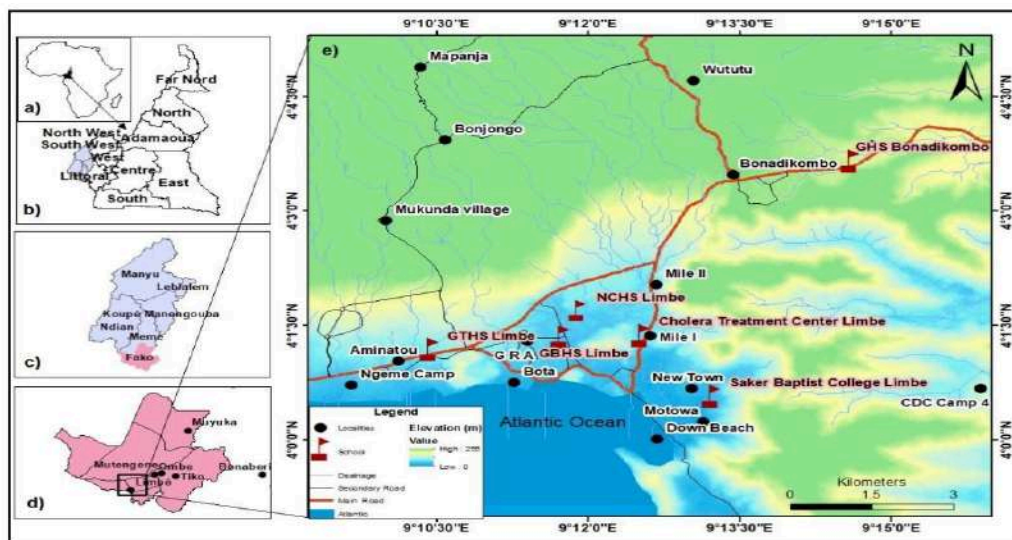


Figure 1: Map of Study Area showing the study sites highlighted in pink

Today, the city of Limbe is a host to majority of persons displaced internally by the ongoing anglophone crises. This has led to an increase in the number of school-goers in the Limbe municipality. The student concentration multiplies the chances of disease propagation. According to International Medical Corps Situation Report, 2022, the subsequent overcrowding has led to a rise in cases as documented, by which reported a cumulative number of 4,980 cases identified at the end of April 2022, with 49 % (2,469) in Limbe and 31 % (770) in Tiko health districts.

B. Research Design

The study was approved by the Department of Environmental Science, University of Buea and the Regional Delegation of Public Health, South West Region. The study employed a descriptive

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cross-sectional approach with data generated through questionnaires, focus group discussions (FGD), key informant interviews and semi-structured interviews. The municipality was carved out into five sections (north, south, east, west and centre) and one school was purposely randomly selected taking into consideration the location and type of school such as government, lay private and confessional schools. Purposive systematic sampling was used to collect data from the schools under survey. Five secondary schools were selected from; government secondary schools (2 from the general education and 1 from the technical sector), 1 from lay private secondary schools and 1 from denominational secondary schools. This study was carried out from May to June, 2022.

C. Questionnaire Survey

Quantitative data was collected by means of questionnaires consisting of closed-ended questions. The questions were designed in order to identify the different cholera preventive measures in schools, assess the cholera risk contributing factors and investigate the challenges faced in implementing cholera preventive measures in schools. For each school, a minimum of 15 questionnaires were distributed to students per class, 10 to teaching staff and a minimum of 5 to administrative staff. Each questionnaire comprised of four sections: socio demographic section; cholera preventive measures; cholera risk factors and the challenges faced in the implementation of cholera preventive measures.

D. Focus Group Discussion

To address the specific objective for the lower classes, a focus group discussion was conducted with students from two classes (forms one and two) in each school. Ten (10) students were randomly selected from the different classes with the aid of a school authority for the chosen classes. Focus group discussion data was collected with the help of a recorder and was stored in an SD card for protection. The majority of the focus discussion group was made of students from a class that was free at the time of the research. This arrangement was as a result of the time constraints with some class teachers not willing to let go of their teaching time for the research.

E. Key Informant Interviews

To address the specific objective for the CTC, a key informant interview was conducted with key informants from the Cholera Treatment Center. Four (4) key informants were conveniently selected. The Key informant interview followed a focused KI-Interview guide which consisted of four questions cutting across the specific objectives of the study.

F. Semi-structured interviews

In order to quantitatively analyse the different WASH practices in the schools under survey, semi structured interviews were administered to school administrative staff. The interview followed a focus semi-interview guide which consisted of 8 questions cutting across the different WASH practices in schools. Site visit-walk through inspection of WASH practices in schools was also carried out.

G. Data Analysis

The data collected from the field was entered into Excel (version 2019) and exported into SPSS (Version 26.0) for cleaning and analysis. The statistics were set to a frequency distribution with percentages displayed on tables and graphs. The Chi-squared test carried out established the association between categorical variables. P- Values less than 0.05 were considered statistically significant on a 95% confidence interval. The statistical analysis was conducted using SPSS (statistical package for social sciences) version 26.0.

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For the qualitative data from FGD and key informant interviews, the recorded interviews were first transcribed. The transcripts were read slowly in order to separate the data set into smaller meaningful parts and each portion was then labeled with a unique code. The coding was done for all the data sets using constant comparison with the transcribed text. The codes were then combined and themes developed. Tables were used to summarize the emerging codes from constant analysis. The NVIVO 15 Statistical software was used to arrange data for coding.

RESULTS

A. Socio-demographic characteristics of respondents

The socio-demographic information obtained during the research included; gender, age, school responsibility, level of education, religious affiliation and name of school (Figure 2). The dominant gender was female, accounting for 62 %. To continue, students ranked top school responsibility totalling 81 %, teachers 12 % and administrators 5 %. The study involved 5 different schools involving 3 government schools: G.B.H.S Limbe had 24% participation rate, G.H.S Bonadikombo 24% and G.B.T.H.S Limbe 18%. Among the five schools surveyed, a lay private institution was included, N.C.H.S (20%). A single confessional institution featured in the study (S.B.C Limbe) with a participation rate of 11% (Figure 2).

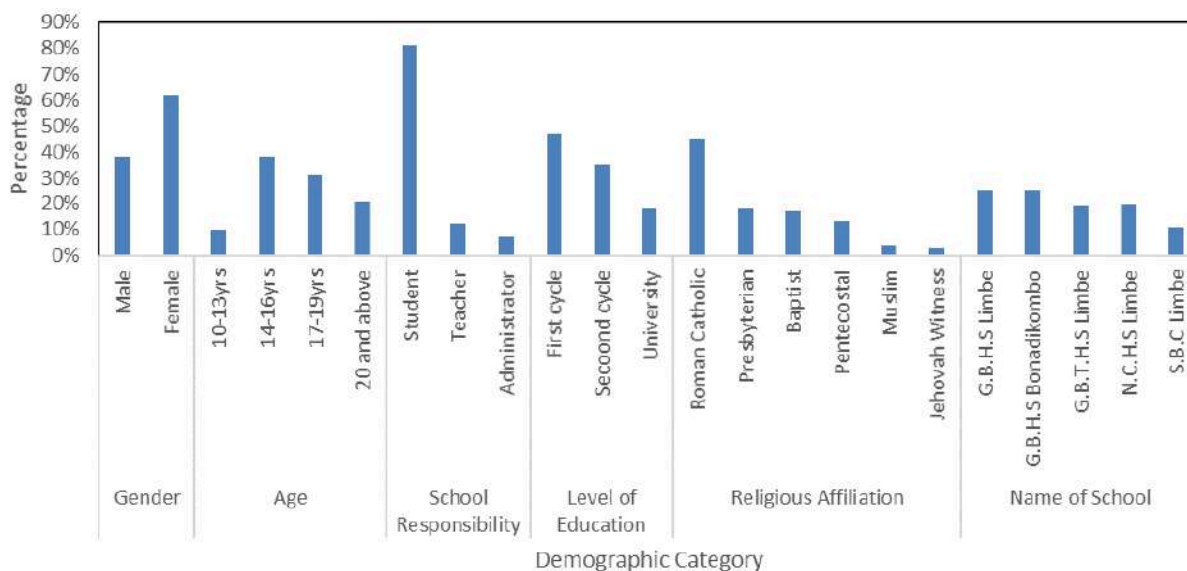


Figure 2: Socio-demographic characteristics of respondents

Findings from the line listing (epidemiologic database) showed that, 526 (27.3%) of cholera cases recorded at the Cholera Treatment Centre (CTC) were from students and teachers than from other occupations. Majority of the student/teacher cholera cases were reported from Motowoh, Mile 2, Mile 4, Isokolo, New Town etc. 57 % (298) of student/teacher cases were female while the male accounted for 43% (228). Results from the line listings also revealed that, the cholera outbreak affected all the age groups. Most cases were found among those between the ages of 15-25 years and the least among were those in their sixties and above.

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A. Different cholera preventive measure practices according to school.

At G.B.H.S Limbe, 76 % of the participants did not accept getting vaccinated against the cholera disease (Figure 3). For washing points, 88% of the respondents accepted that they have washing points while 60% of them accounted for regular cleaning of hands with soap. 60% of the participants accepted that counselling is of great help to fight cholera. 60% of the respondents consented that there is no disinfection of classrooms whereas 18% of them accepted that disinfection of classroom is not often.

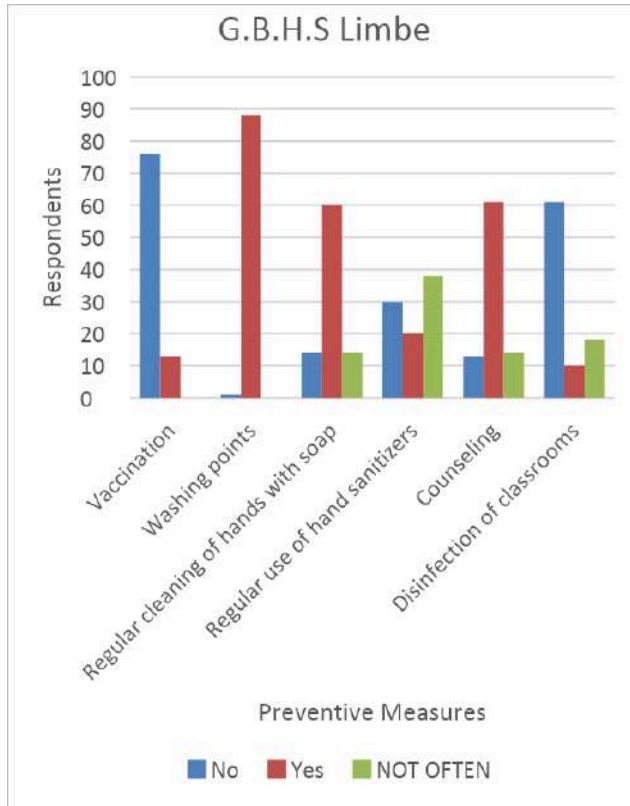


Figure 3: Different cholera preventive measures practiced at G.B.H.S Limbe

At G.H.S Bonadikombo, 77 % of the participants did not accept getting vaccinated against the cholera disease (Figure 4). For washing points, 88% of the respondents accepted that they have washing points while 68% of them accounted for regular cleaning of hands with soap. 68% of the participants accepted that counselling is of great help to fight cholera. 10% of the participants consented that there is disinfection of classrooms.

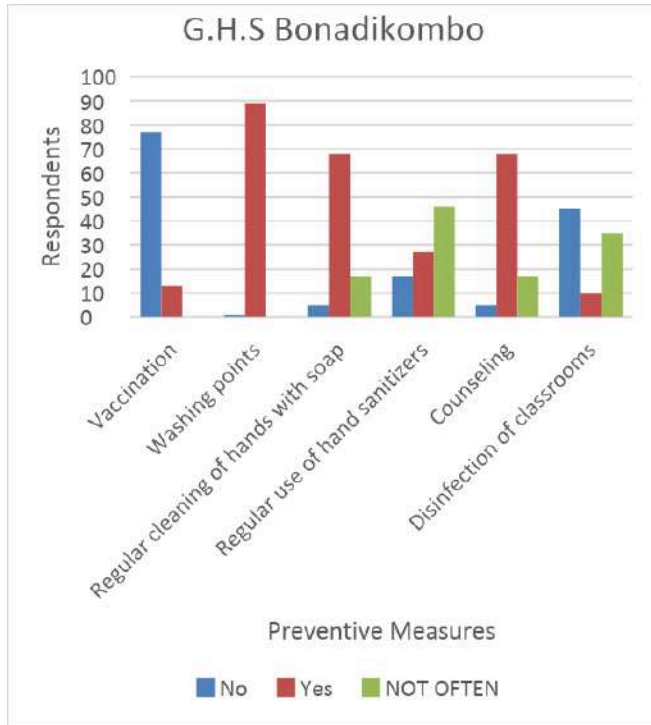


Figure 4: Different cholera preventive measures practiced at G.H.S Bonadikombo

At G.B.T.H.S Limbe, 55 % of the participants did not accept getting vaccinated against the cholera disease (Figure 5). For washing points, 3% of the respondents did not accept that they have washing points while 50% of them accounted for regular cleaning of hands with soap.

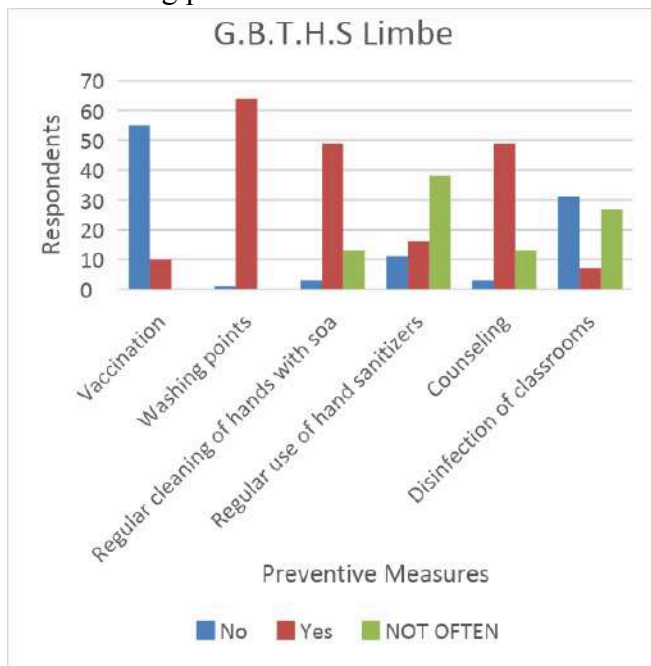


Figure 5: Different cholera preventive measures practiced at G.B.T.H.S Limbe

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At N.C.H.S Limbe, 12 % of the participants accepted getting vaccinated against the cholera disease (Figure 6). For washing points, 3% of the respondents did not accept that they have washing points while 50% of them accounted for regular cleaning of hands with soap. 50% of the participants accepted that counselling is of great help to fight cholera. 10% consented that there is disinfection of classrooms whereas 18% attested that disinfection of classroom is not often.

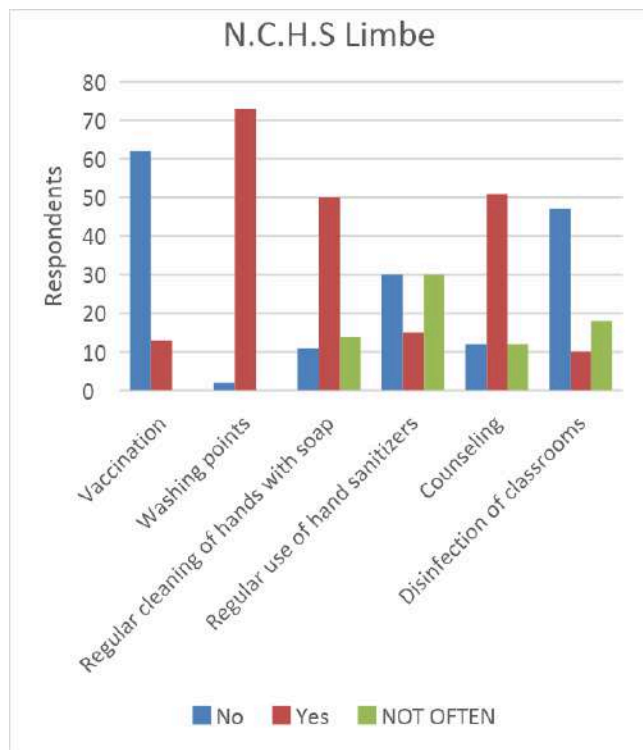


Figure 6: Different cholera preventive measures practiced at N.C.H.S Limbe

At S.B.C Limbe, 28 % of the participants accepted getting vaccinated against the cholera disease (Figure 7). For washing points, 84% of the respondents accepted that they have washing points while 76% of them accounted for regular cleaning of hands with soap. 76% of the participants accepted that counselling is of great help to fight cholera. 32% of the respondents consented that there is disinfection of classrooms whereas 32% attested that disinfection of classroom is not often.

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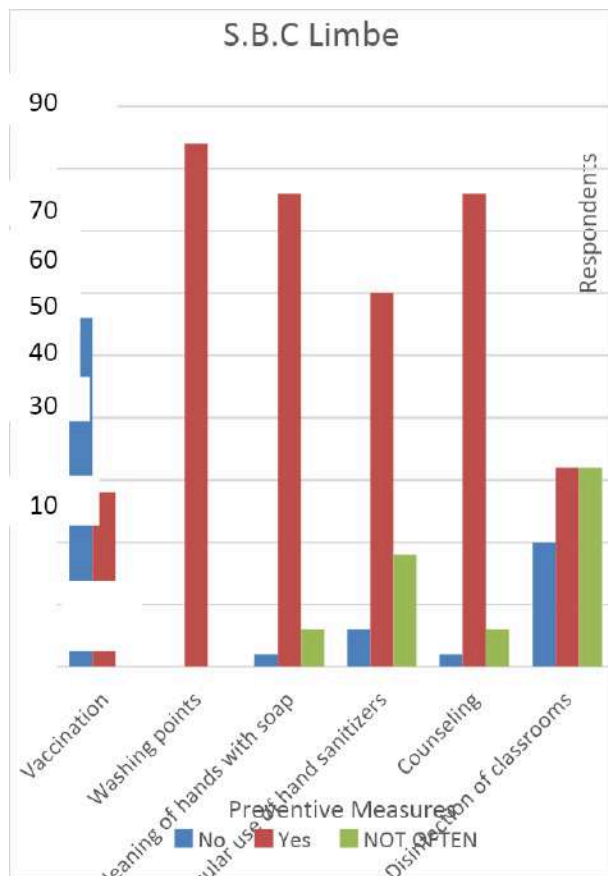


Figure 7: Different cholera preventive measures practiced at S.B.C Limbe

A. Significance between schools

Another aspect surveyed under this objective was the variation of cholera preventive measures in schools among the five schools and 6 variables. The results showed that there was a significant difference for the regular use of hand sanitizers (P=0.013-95% CI), counselling (P=0.003-95% CI) and the disinfection of classrooms (P=0.041-95% CI).

Results from the FGD on investigation on the cholera preventive measures showed that majority of the respondents wash their hands regularly. Secondly, about half of the respondents across the five different schools under survey acknowledged that they boil water before drinking. However, few respondents noted that they practiced food hygiene and sanitation. In addition, vaccination and disinfection of the school environment was noted by very few respondents across the five schools.

B. Cholera preventive measures practiced at the Cholera Treatment Centre (CTC)

Key informant interview using four participants was used to collect information at the Cholera Treatment Center (CTC) in Limbe. The results from the interview revealed that there are 3 main cholera preventive measures practiced at the CTC which are: case management, personnel preventive measures, and other personal preventive measures.

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For case management, all the participants consented that the CTC is isolated from the hospital and the patients are separated into severe, moderate and mild tents. Majority of the respondents attested that there is regular disinfection of pathways for admitted patients, treated patients and decontamination of the materials of treated patients before they leave.

For personnel preventive measures, the participants consented to have been vaccinated and also cited that they

all had personal protective equipment (PPEs) comprising of a pair of boots, short sleeve jacket to facilitate washing of hands up to mid arm or elbow and a pair of long trousers.

More so, PPEs like gloves for drug administration, apron and hand washing sites with chlorine has been provided.

For other personal preventive measures, participants noted that their patients had stool/vomiting buckets which were disinfected with chlorine before and after it was emptied.

A. Assessment of cholera risk factors in schools

An assessment was conducted for 6 cholera risk factors in the five selected schools within Limbe municipality. From the results, 94% of the respondents accepted having first aid units in their schools while 6% said that first aid units are unavailable in their schools. Hence this indicated that the risk of contraction is low (Table 1).

Table 1: Cholera risk factors in schools

Cholera Risk factors in schools	Yes		No	
	Frequency	Percentage	Frequency	Percentage
First aid unit	338	94	23	6
Health club	236	65	125	35
Water scarcity	186	52	175	48
Sensitization campaign	110	30	251	70
Hand washing with soap before and after meals	338	94	23	6
Supply of fried or cooked food stuff	336	94	25	6

The washing of hands with soap before and after meals constituted a risk factor in the study. Here, 94% accepted their high practice of it while only a disproportionate 6% refused not practising it. This indicated that the risk is very low. In all, the supply of fried or cooked food stuff in school canteens boosted the assessment of cholera risk factors. This unveiled an exponential 94% adherence rate by participants to buying the supplies as against a 6% uninterested number in the purchase of fried or cooked stuff (Table 1). By this, the risk of contraction is very high. A further assessment was made on the different sources of potable water used in schools and CAM water (45 %) and community water (35 %) stood out to be the major sources of water used. The type of latrines available for students in schools was also assessed which revealed that 35% of the participants noted that pit latrines are their only sources of human waste disposal, 16% flushing toilets and 445% noted that they used both (Figure 4.4).

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In terms of how food was served in these schools 39 % attested that fork or spoons were used, 30 % cited plastics bags and 22 % of the participants cited all the above while just 6 % of the participants were served food with the use of bare hands in the school restaurant or refectory (Figure 8). These findings could be interpreted as representing a situation of low risk to cholera transmission/contraction in the 5 different schools sampled.

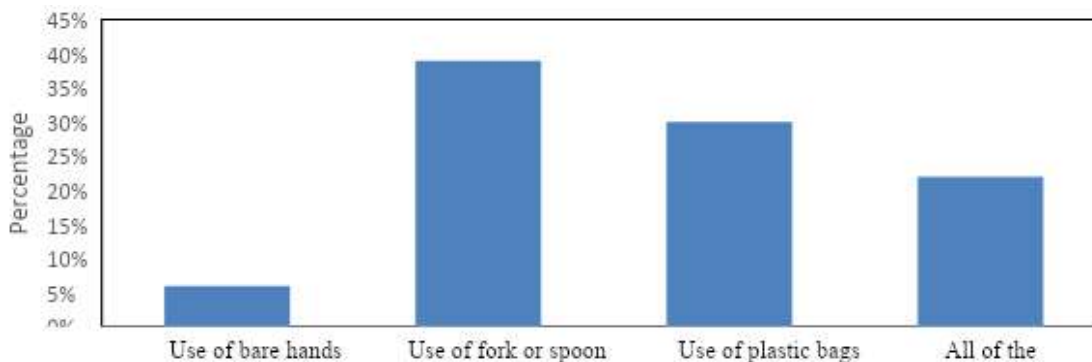


Figure 7: Methods used in serving food in school restaurants/refectory/canteen

All the participants of the FGD across the five schools noted that their school operated a health unit. Majority of the participants noted that CAMWATER was the main source of water while a minority noted that borehole and community water were the major sources of water used in their schools. All the participants of the FGD sessions noted that they washed their hands before and after eating. Majority of the comments on water scarcity showed that most of the participants affirmed that there was water scarcity. Moreover, investigation on the rate at which students bought fried and cooked food from the school restaurants showed that majority of the participants bought fried/cooked food daily and weekly while few of the respondents noted that they bought food stuff on monthly bases or not often. An investigation on how food was served in the school restaurants/canteens showed that food was mostly served using the spoon, fork and plastic papers. Very few respondents noted that food was served with the use of bare hands. All participants from the five schools noted that they used pit latrines whereas very few respondents noted that they used flushing or both flushing and pit latrines. As concerns the cleaning of latrines, most of the respondents noted that cleaning was done on a daily bases.

A quantitative analysis of the various WASH practices in the five schools under survey was carried out. Findings from this study revealed that G.B.H.S Limbe with a population of about 3800 students and staff had just 11 washing points. N.C.H.S Limbe had 14 washing points while G.H.S Mile 4 recorded the lowest number of washing points (11). Saker Baptist College had the highest number of washing points (42). Most of the washing points in the surveyed schools lacked soap. The surveyed schools each had at least one toilet facility, pit latrine being the most common. The toilet facility in all the five schools under survey was gender-segregated. An inventory of the number of compartments or drop holes in the five schools surveyed was established. From our findings, Saker Baptist College which is a boarding school had the highest number of drop holes while N.C.H.S Limbe, a lay private institution, recorded the least. However, none of the schools met the WHO standard ratio of 1:25 for girls and none provided male urinals, anal cleansing materials, or accessibility for the physically challenged; defecation on toilet floors and in the open field was common. To continue, an investigation of the number of beds in the health unit was

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carried out and our findings revealed that most of the schools had just a single bed in the health unit.

A. Challenges faced in the implementation of cholera preventive measures in schools

An assessment of the challenges faced in implementing cholera preventive measures was conducted for the five schools within the Limbe municipality and the Cholera Treatment Center.

Perception about cholera

The results presented in Table 2 showed that majority of the participants had a good knowledge of the causes of cholera since majority disagreed on conspiracy, superstition, witchcraft and the fact that it doesn't exist. These results showed that there is a high probability of the respondents to practice the cholera preventive measures.

Table 2: Perception of cholera in schools

Perception	Disagree (%)	Strongly Disagree (%)	Agree (%)	Strongly Agree (%)
Superstition	54	42	3	1
Conspiracy	56	40	3	1
Disease caused by the Cholera Vibrio bacteria	6	1	41	52
It does not exist	47	51	1	1
Witchcraft	52	40	3	5

Prevention and control challenges

An investigation on the control challenges was conducted and the results showed that 86% of the respondents agreed/strongly agreed that limited financial resources are a challenge in the implementation of cholera preventive measures. 60% of the participants agreed/strongly agreed that limited WASH kits are a challenge for the effective implementation of cholera preventive measures.

From the FGD survey carried out on the challenges faced in implementing cholera, it revealed that limited financial resources was the main prevention measure, followed by water scarcity, limited WASH kits and lastly, religious beliefs.

Challenges involved in the implementation of cholera preventive measures at the CTC

The key informants at the CTC Limbe, mentioned that security challenges, Limited financial, material and personnel resources (e.g. limited boots, some were mismanaged and others stolen by colleagues) were some of the challenges faced in implementing cholera preventive measures at the center. Another challenge mentioned was the difficulty involved in separating patients from

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their relatives. They also stated that they had limited cleaners who were being overworked without motivation. Another major challenge was that patients did not respect instructions as they tend to move into safe zones.

DISCUSSION

Much is known about the general mechanisms of cholera transmission, risk factors and effective interventions for prevention and control of this disease. Despite the detailed understanding of the bacteriology, epidemiology, and public health aspects of cholera for more than a century, it continues to be an important public health problem among many developing countries and vulnerable communities. The WHO recommends improving access to clean water and sanitation, good waste management, food safety practices and hygienic practices to prevent the transmission of cholera. Oral cholera vaccines should be used in combination with improvements in water and sanitation to control cholera outbreaks and for prevention in areas known to be high risk for cholera (International Medical Corps, 2022). Another key tool used in disease control is education.

The findings from the study show that females were the most affected, which contradicts the findings in a study conducted by Opare *et al.* (2012) in the East Akim Municipality in Ghana which reported that males were more affected than females probably due to the involvement of some of them in the brisk small-scale mining activities in the area which exposed them to the index case through direct contact or sharing of contaminated water source. However, our study supports the findings of (Curtis *et al.*, 2000; Nsagha *et al.*, 2015) who reported more female cases than males as most women and girls have heightened risk of coming into contact with a high infectious dose of cholera through their domestic roles in taking care of sick family members, cleaning latrines, fetching and handling untreated water and preparing contaminated raw food.

The study revealed that, the cholera outbreak affected all the age groups. Most cases were found among those between the ages of 15-25 years and the least among were those in their sixties and above. The findings however contradict the study by Curtis *et al.* (2000) who reported that age group 20-30 years was mostly affected age group.

Results from the line listing (epidemiologic data base) showed that, 526 (27.3%) of cholera cases recorded at the CTC were from students and teachers than from other occupations such as business; 350 (20.2%), housewife; 189 (15.4%), fishing; 140 (11.6%) etc. However, our studies were similar to Nsagha *et al.* (2015) who reported that 14 (42.5 %) of cholera cases were reported from students than from other occupations such as teachers, housewife, business etc. This can be explained by the fact most women are engaged in domestic activities which expose them to the cholera infection.

Assessment of cholera preventive measures

Our findings are similar to a study on The Evaluation of Effectiveness of Cholera Prevention and Awareness Campaign in Students Based on Kirkpatrick Model by Afshin (2017). The study assessed regular hand washing with water and soap before and after the campaign and from the pretest results, 68 % of the participants consented that they wash their hands regularly with water and soap. These results are similar to our findings as 94% of the participants established the fact

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that they wash their hands regularly with water and soap before and after eating. Hygiene behavior such as hand washing with soap and clean water was found to be an effective way to prevent cholera from multiple routes (faecal oral route).

Washing points were present in all the schools surveyed and at the CTC with an average number of 8 washing points per school all of which were for both boys and girls. Our findings are similar to a study by Antwi-Agyei *et al.* 2017 on WASH in Schools; results from a process evaluation on the National Sanitation Campaign in Tanzania who revealed that of the 70 schools, more than half (52.9%) had one or more hand washing stations, with an average number of six, majority of these were functional for both boys (91%) and girls (88%). Our study also revealed that 38% of the hand washing points had soap available for students which is similar to the findings of Antwi-Agyei *et al.* 2017 who reported that 35% of the washing points had soap for students. Overall, most of the washing points were limited as per the population of the schools

Assessment of cholera risk factors in schools

Based on our findings on cholera risk factors in schools and the CTC, the result showed that 48% of the participants drank water from the CAMWATER source while the rest depended on community water sources, boreholes and mineral water. These findings contradict the study of Nsagha *et al.* (2015) on assessing the risk factors of cholera epidemic in the Buea Health District of Cameroon, who found out that 95.5 % of the respondents used CAMWATER as the main source of drinking water. The difference between this study and ours is the fact that their study targeted cholera cases/non-cases at the Buea health district whereas our study targeted students, staff and personnel's of secondary schools and the CTC. Further cholera risk in the five schools under survey could be exacerbated by the scarcity of water as 53% of the participants consented that they experience water scarcity in school.

Our results are similar to a study by Manjong-Kofete *et al.* (2021) on WASH Practices in Schools, Cameroon who reported that the surveyed schools each had at least one toilet facility, pit latrine being most common but none met the WHO standard ratio of 1:25 for girls. Furthermore, our study contradict a study by Antwi-Agyei *et al.* 2017 on WASH in Schools; results from a process evaluation on the National Sanitation Campaign in Tanzania, who reported that 20% of the schools met the WHO standard ratio of 1:25 for girls.

Only 30% of the participants consented that they have benefited from the cholera sensitization campaign in school, this shows that there is a need to organize awareness and sensitization outreach programs in schools as a study by Afshin (2017) revealed that students' knowledge on how cholera can be transmitted and prevented was high after awareness raising and sensitization campaigns.

Investigate challenges faced in the implementation of preventive measures

Abdulkareem *et al.* (2015) in a study on The Impact of Educational Program for Secondary School Students about Cholera Disease in Basra City, South of Iraq, assessed the knowledge of students about cholera and their findings showed that majority of the students have good knowledge of cholera. This agrees with our results and the findings of (Nsagha *et al.*, 2015; Nauja *et al.*, 2018) who found a good knowledge of cholera among participants. The proportion of respondents with good knowledge of cholera was very high probably because in most cholera

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epidemic communities, the governments use health education through mass media as the major preventive method against cholera.

Our results are in line with the findings of Sanjukta and Nirmal (2019) who reported that limited supply of OCVs and the non-availability of WASH kits in communities are some of the challenges faced in implementing cholera preventive measures.

LIMITATIONS OF THE STUDY

The core limitation of this study was the limited timeline, scope and funds required to scale-up the research methodology and target more schools to assess the effective implementation of cholera preventive measures in secondary and high schools. Out of the ten (10) schools that were selected, five (5) of them rejected the research on their school premises citing preparation for the General Certificate of Education Examination and time constraints. This was because the research period took place close to the end of year for non-examination classes and the fast approach of the General Certificate of Examination (GCE).

CONCLUSION

Summarily, the level of implementation of cholera preventive measures in secondary and high schools in the Limbe municipality is moderate (51.1%) whereas it is high at the CTC (85%).

Our findings also revealed that water scarcity in G.B.H.S Limbe, G.H.S Bonadikombo, G.B.T.H.S Limbe and N.C.H.S Limbe was a risk contributing factor. Also, the results of this study revealed that the numbers of washing points per the population of the schools surveyed are limited. Moreover, out of 86 washing points in the surveyed schools, only 33 had soap/detergents. To continue, surveyed schools each had at least one toilet facility, pit latrine being the most common. The toilet facility in all the five schools under survey was gender-segregated. However, none of the schools met the WHO standard ratio of 1:25 for girls. Another contributing risk factor identified was limited facilities at the school health units. Furthermore, movement of cholera patients to safe zones and the closeness of cholera patients to their relatives were some of the cholera risk factors identified at the CTC.

The main challenges faced are limited financial resources, limited WASH kits and lack of awareness and sensitization campaigns. At the CTC, security challenges (insufficient security personnel's), limited financial, material and personnel resources (e.g. limited boots, some were mismanaged and others stolen by colleagues) were some of the challenges faced.

ACKNOWLEDGEMENTS

The authors wish to register their appreciation for the inputs of Prof. Veronica E. Manga (University of Buea) and Dr. Donatus Layu of the Catholic Relief Services. Many thanks equally go to the field assistant, study participants and institutions for their terrific assistance in providing the data for the study.

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<p>Sher Ali (Author) <i>Research Centre for Reservoir Resettlement, Three Gorges University</i></p> <p>Ribesh Khanal (Co-Author) <i>Holmes Institute</i></p>	<p>The Influence of Environmental Regulation on Technological Advancement in New Emerging Industrial Zones in China.</p>
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Abstract

In the contemporary landscape of China's industrial development, the interplay between environmental regulations and technological innovation in new emerging industrial zones has become a subject of considerable interest and importance. With a growing emphasis on environmental protection within China, understanding how regulatory measures influence technological advancements in these zones is crucial. This paper delves into this dynamic relationship by analyzing panel data from 2011 to 2021, focusing on 120 listed companies operating within new emerging industrial zones. Utilizing the Generalized Method of Moments (GMM) estimation technique, the study aims to uncover the impact of environmental regulations on the technological innovation of these companies. GMM is a robust econometric method particularly suitable for analyzing dynamic panel data, making it well-suited for this investigation. The empirical findings of the analysis reveal a positive correlation between environmental regulations and technological innovation within new emerging industrial zones. This suggests that stricter environmental regulations are associated with greater levels of technological innovation among the companies studied. Such results highlight the pivotal role those regulatory frameworks play in driving innovation towards environmentally sustainable practices. This study contributes to the understanding of how regulatory interventions shape industrial dynamics, particularly in the context of environmental sustainability. Demonstrating the positive influence of environmental regulations on technological innovation, underscores the importance of policy frameworks in steering industrial practices towards more sustainable trajectories. The implications of these findings are significant for China's industrial landscape. As the country continues to prioritize environmental protection and sustainability, fostering innovation through regulatory measures can accelerate the transition towards greener industrial practices. This aligns with broader global efforts to address climate change and environmental degradation, positioning China as a key player in the evolution towards more sustainable industrial development.

Keywords: Environmental sustainability, Environmental regulation, Technology innovation, environmental protection

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Abstract

A large-scale of hydropower projects have profoundly changed the water flow velocity, thereby damaging of fish habitats, and altering fish swimming behavior. Grass carp (*Ctenopharyngodon idella*) show significant adaptations to varying water velocities, essential for their survival and foraging behavior. The fish swimming behavior characteristics have been widely investigated under various environmental and hydrodynamic conditions. However, to the best of our knowledge, no research work has been reported in the available literature to understand the underlying mechanism shifting fish swimming behavior changes in the response of different water flow velocity. Therefore, the current study aimed to expose *C. idella* to different water velocities to unveil the gene expression using transcriptomics analysis. The fish was divided into four groups including 0 BL/s (Control), 0.5 BL/s, 1.5 BL/s, and 2.5 BL/s. The findings showed the water velocities significantly altered swimming behavior. Additionally, transcriptomics analysis revealed that differential expressed genes (DEGs) were identified and functionally annotated and revealing key pathways associated with changed behavior pattern. The Enrichment analysis

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resulted significant variation of rich factors in all groups including behavior ($p < 0.05^{***}$), skeletal system development ($p < 0.05^{***}$), hormone activity ($p < 0.05^{***}$), muscle contraction ($p < 0.05^{**}$), locomotion ($p < 0.05^*$), and swim bladder development ($p < 0.05^*$). Moreover, some genes were identified for enzymes and hormones, which could play a direct or indirect role during swimming behavior. The current study possibly provides valuable insights into the molecular mechanism underlying fish swimming behavior.

Keywords: Grass carp; Swimming behavior; Gene expression; Calcium signaling pathway; Hormonal changes.

<p>Nadia Monjezi (Author) <i>Plant Science Department, McGill University</i></p> <p>Donald L. Smith (Co-Author) <i>Plant Science Department, McGill University</i></p>	<p>Novel Bioactive Metabolites of Devosia sp. Strain SL43: Implications for Sustainable Agriculture.</p>
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Abstract

Synthetic fertilizers have improved crop yields but raised sustainability concerns. This has shifted the focus to eco-friendly biofertilizers from active microbes that support plant growth and stress responses. However, their effectiveness can be inconsistent under stress. Recent research highlights microbial biostimulants, particularly cell-free supernatants (CFSs) from plant growth-promoting rhizobacteria (PGPR), as promising solutions for enhancing plant resilience to stressors like soil salinity. Another important aspect is identifying and understanding the molecular mechanisms of novel bacterial-derived metabolites that influence host plant physiological and morphological traits.

This could enhance microbial inoculant technology and increase agricultural productivity and nutritional quality in a more sustainable way. Notable bacterial-derived signal compounds, such as lipo-chitooligosaccharides (LCOs) and thuricin 17, regulate plant responses to environmental stresses and improve growth metrics. Despite these advances, there is a gap between research and practical application. This study aimed to extract, isolate, and evaluate potential novel bioactive compounds from *Devosia* sp. strain SL43 to stimulate seed germination under saline conditions, providing sustainable alternatives for agricultural productivity. Using 1-butanol as the solvent, active compounds are extracted and characterized from *Devosia* sp. strain SL43. Crude extracts undergo HPLC analysis on a Vydac C18 column, and major peaks are tested for bioactivity in germination experiments. Results indicated that the first major HPLC peak, at 8 minutes, increased soybean germination by 14.29% under control conditions and 28.40% under 125mM NaCl, highlighting its

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effectiveness. Additionally, peaks at 2 and 17 minutes significantly enhanced germination under salt stress by 32.18% and 39.73%, respectively. These findings emphasize the agricultural application potential of these three peaks, which have been identified as the most effective for further research. Further work is needed to identify bacterial-derived signal compounds that regulate plant stress responses and growth.

Keywords: biofertilizers, microbial biostimulants, plant growth-promoting rhizobacteria (PGPR), soil salinity, bacterial-derived metabolites

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