Epidemiology of typhoid fever among Students and Staff of tertiary Education institution

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Abstract: **The aim of the study was to assess the epidemiology of typhoid fever among students and staff of a tertiary Educational institution. The study was conducted at a Tertiary Education Institution in Kaura Namoda, Zamfara State, North West Nigeria. It is a tertiary Coeducational institution consisting of students and staff mainly from Northwest Nigeria. Data was collected using a prevalidated modified typhoid and paratyphoid fever questionnaire by considering all possible variables according to information developed on the basis of relevant literature. Four hundred students and 400 staff (all above 18 years) of the polytechnic were drawn using simple random sampling method from a total population of 6222 (sample size calculated using Yamane Method). Quantitative, cross sectional research was conducted to find the determinants of typhoid fever, to also determine whether or not multi-drug resistance to routine antibiotics used in treating typhoid fever exist among the study population, and to develop clinical and public health guidelines for effective management of the disease. The study findings revealed that unsafe drinking water in a form of sachet water is an important vehicle in typhoid fever transmission among the study population. Self-medication and poor vaccination coverage were likely found to be the factors responsible for Multi-Drug Resistance in study samples that show resistance. However, no association was found between the two study groups. At the end of the study, the researcher, with the help of Panel of experts, developed clinical and public health guidelines using Delphi's technique for effective management of typhoid fever within the study setting.**

Key words: **Epidemiology; staff; students; tertiary educational institution; typhoid fever**

I. INTRODUCTION

Enteric fever is a systemic infection caused by the human-adapted pathogens *Salmonella enterica* serotype Typhi (*S Typhi*) and *S enterica* serotype Paratyphi (*S Paratyphi*) A, B, and C. These organisms are important causes of febrile illnesses in crowded and impoverished populations with inadequate sanitation that are exposed to unsafe water and food and also pose a risk to travellers visiting countries of endemicity (Crump & Mintz 2010:241).

Global estimates for the burden of typhoid fever (defined as symptomatic infection with *S Typhi*) are published regularly (26.9 million cases of typhoid fever were reported in 2010). However, detailed local surveillance data from endemic regions remain poor (Wain, Hendriksen, Mikoleit, Keddy & Ochiai 2015:1136)

Mortality rates in patients with typhoid fever who are not given specific antibiotics can be as high as 26%, although earlier work described mortality rates of 10% or lower that were associated with careful management including strict adherence to a milk diet (Wain et al 2015:1139).

The introduction of chloramphenicol (in 1948), ampicillin (1961), co-trimoxazole (1970s), and third-generation cephalosporins and fluoroquinolones, such as ciprofloxacin and ofloxacin (1980s), reduced the mortality of typhoid fever considerably. However, multidrug-resistant strains that were resistant to all three first-line antimicrobial drugs emerged in the 1980s, followed by strains resistant to fluoroquinolones in the 1990s (Wain et al 2015:1139).

In Africa, with the emergence of the *S Typhi* strains with multidrug resistance and decreased ciprofloxacin susceptibility is now an important issue (Wain et al 2015: 1140).Rates of multidrug resistance vary, for example, 30% in the Democratic Republic of the Congo, 63% in Ghana, 70% in Kenya, and 100% during an outbreak along the Malawi - Mozambique border (Wain et al 2015:1141

Contaminated water and food are important vehicles for the transmission of typhoid fever. Historical surveillance data suggest that enteric fever was endemic in Western Europe and North America and that rate decreased in parallel with the introduction of treatment of municipal water, pasteurisation of dairy products, and the exclusion of human faeces from food production (Crump & Mintz 2010:242). At present, enteric fever prevention focuses on improving sanitation, ensuring the safety of food and water supplies, identification and treatment of chronic carriers of *S Typhi*, and use of typhoid vaccines to reduce the susceptibility of hosts to infection (Crump & Mintz 2010:242).

Similarly, in another research conducted on patients receiving care at a military Hospital in Minna, Niger State, Northwest Nigeria by Adabara, Ezugwu, Momojimoh, Madzu, Hashiimu and Damisa (2012:1) the result showed that isolates of Salmonella typhi were resistant to ceftriaxone, cefixime, amoxicillin, amoxicillin, Ciprofloxacin, and augmentin which are the common drug of choice routinely used in the study area. They were, however, sensitive to ofloxacin and chloramphenicol even though the latter is no longer used for the treatment of typhoid fever on account of an adverse reaction.

In this study context, many patients present to the polytechnic clinic with symptoms of typhoid fever. After confirmation through laboratory investigation, patients undergo treatment

with first and second line typhoid fever antibiotics. However, most of them only have partial improvement from their initial symptoms. The repeats of Widal and blood culture tests show the presence of typhoid fever.

Therefore, this study intends to find out the determinants of typhoid fever, and whether there is presence of Multidrug Resistance to routine antibiotics used for the treatment Typhoid Fever and its associated factors among the study population.

Lastly, to develop guidelines to influence good clinical and public health policy based on the research findings.

II. MATERIALS AND METHODS

Study population

Research population is defined as a particular group of individuals or elements, who are the focus of research (Burns & Grove 2011:342). The target population in this study was students and staff (Teachers, and supporting staff) of a Tertiary Education Institution in Kaura Namoda, Zamfara State, North West Nigeria. The polytechnic is a tertiary Coeducational institution offering National Diploma and Higher National Diploma in Engineering, Arctechtural technology, Building technology, Management, science laboratory technology, mathematics, and computer science consisting of students and staff mainly from Northwest Nigeria (Kaduna, Zamfara, Katsina, Kebbi, Sokoto, Kano, Jigawa).

Study context

The study area in which the students and staff are resident in is Kaura Namoda, a local government area of Zamfara state North West Nigeria. It has an area of 868 Km square and population of about 281,367 (National Population Commission 2006). The town is the Northern railway terminus that links North to South. There is low literacy rate among the people of the area especially women partly due to cultural beliefs.

Ethical considerations

The study protocol was submitted to the UNISA Higher degree Committee for ethical approval. In addition each respondent was well informed about the aim and potential benefits and risks (similar that of any patient with typhoid fever presenting to a hospital) of the study and their informed consent and confidentiality was ensured. The trained research assistants were educated through a seminar about obtaining informed consent for the purpose of this research. The right to confidentiality was the cornerstone of this research because of the sensitivity of the subject. Therefore, four components of ethics were considered: autonomy, justice, beneficence, non-maleficence were taken into consideration throughout the study.

Simple random sampling

In this sampling technique all possible subsets of the population are given an equal probability of being selected (Anol 2012:67).

The study sample was calculated using the YAMANE method (Singh 2014:15) that is

$n=N/1+ N(e)^2$

Where n is the sample size, N is the population size, and e is the margin of error taken at 50%.

Therefore,

N=4122 for students and N=2100 for staff

$n=4122/1+4122(0.05)^2$

n=4122/1+4122(0.0025)

n=4122/1+10.305

n=4122/11.305

n=364.617 approximately n=365 students

Hence, 365 students was required as a minimum sample for the study.

For staff, N=2100

Therefore,

n=2100/1+2100(0.0025)

n=2100/6.25

n=336 staff was required minimum sample for the study

Hence, in a total population of 6222 (comprising of 4122 students and 2100 staff) 400 students and 400 staff were selected using simple random sampling respectively.

Source for the population size was from the health insurance registration which is mandatory for all students and staff.

III. STUDY DESIGN

A quantitative design was chosen since the study used measurable variables using a systematic way of investigation to explain, predict, and control typhoid fever among the study population.

The study was carried out in three phases. In two phases, quantitative data was collected, analysed, and interpreted to answer the research hypothesis.

Data collection method

The researcher collected data by use of self-administered questionnaires with the help of research assistants in cases where the respondents need guidance in understanding questions (Annexure D). A self-administered questionnaire offers an advantage of an increased response rate. It is cost effective and allows a researcher to assist those who cannot read (Debois 2016:2).

A Pilot study was conducted by the researcher in a group of students and staff other than the targeted sample at the Federal polytechnic clinic, Kaura Namoda, between November to December, 2017. The outcome of the pilot study show high incidence of typhoid fever with moderate resistance to commonly used antibiotics for empirical therapy (ciprofloxacin and Amoxicillin).

The questionnaire was distributed to the students and staff by ten trained field workers each having at least a Diploma in Medical/science laboratory technology after explaining to them the aim of the study. Those who need assistance were guided by the research assistants.

Research assistants refers here to those whose main role is face-to-face engagement with participants, who usually speak the participants' first language, who are from or live in the study areas, and whose work entails moving around the study areas or health facilities (Molyneux, Kamuya & Madiega 2013:1).

In the context of this study, the research assistants were ten in number each having at least a National Diploma in Medical/science laboratory technology. Closed ended self-administered questionnaires were distributed to the study sample by the researcher assisted by the research assistants between January to May, 2018.The study population were randomly selected from patients (Staff and Students) presenting at the polytechnic clinic, Kaura Namoda, with suspected cases of typhoid fever.

The research assistants explained to participants the purpose of the study, obtained informed consent, and guided the participants in answering the questionnaire where necessary. The research assistants also helped in obtaining results of the Widal test as well as blood culture and sensitivity tests and kept records of it appropriately.

The questionnaire has two parts.

The **first part** assessed the determinants and outcome of typhoid fever/Multi-drug Resistance Typhoid Fever among the study population. This was achieved through the answers given by the respondents using a pre-validated questionnaire. The answers from the questionnaire were used to determine the factors leading to the development of typhoid fever/ Multi-drug Resistance Typhoid Fever and the appropriate public health policy and clinical practice needed to influence policy.

The **second part** determined the incidence of Multi-drug Resistance Typhoid Fever among the study population. The Widal test, blood culture and sensitivity test were used to determine the presence or absence of typhoid fever as well as the sensitivity profile of the *Salmonella* spp to the recommended first and second line drugs used for treating typhoid fever.

The data collection setting was a comprehensive primary health facility which provides medical and surgical care to staff and students of the polytechnic. The facility has a functional medical laboratory that runs microbiological, haematological, and chemical pathology tests. It has a male, female, maternity, and amenity wards. It also has a labour room, theatre room, injection room and a dressing room. Other structures are the National Health Insurance Scheme (NHIS) office, consulting rooms, nursing stations, pharmacy unit, medical record unit and staff offices.

Blood sample for the Widal test and blood culture and sensitivity test were taken through venepuncture by 4 trained phlebotomists at a medical laboratory of the polytechnic clinic. The Widal test was performed by laboratory technicians working at the laboratory unit of the federal Polytechnic, Kaura Namoda, using the Widal test reagent from AGAPE®. The results from the Widal test were confirmed by the laboratory scientist. The minimum inhibitory concentration of antibiotics used in order to determine sensitivity pattern using Mueller Hinton agar by dose diffusion method using the National committee for clinical laboratory standard manual of antimicrobial susceptibility testing were (NCCLS 2005:339) Ampicillin 10µg/disc, cotrimoxazole 25µg/disc, ciprofloxacin 5µg/disc, ceftriaxone 30µg/disc, azithromycin 15µg/disc, chloramphenecol 30µg/disc.

The results from the blood culture and sensitivity test were used to determine the rate of occurrence of new cases of typhoid fever as well as if there is emergence of Multidrug resistance typhoid fever within the study population.

IV. RESULTS

Phase 1

Age distribution

The sample of 800 respondents (400 students and 400 staff) was composed of 308 (77.00%) students and 23 (5.75%) staff respondents aged between 18-24, 63 (15.75%) students and 55 (13.00%) staff respondents were aged 25-31, while 21 (5.25%) students and 138 (34.50%) of the respondents were aged between 32-38 years respectively. Eight (2.00%) of the students and 187 (46.75%) of the staff respondents were aged between 39 and 45.
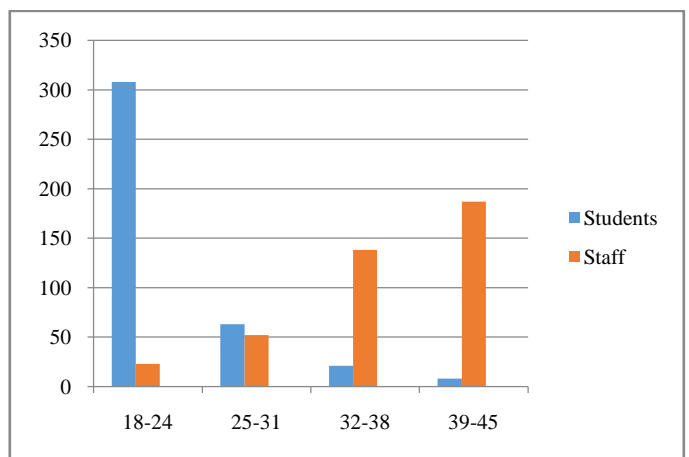

Figure 1.0 Age distribution (Students N=400) (Staff N=400)

Sex distribution

Out of the total 400 student respondents, Male respondents account for 72.00% which is higher than female respondents which account for 28.00%. Male staff respondents were 79.00%, while female staff respondents were 21.00%.
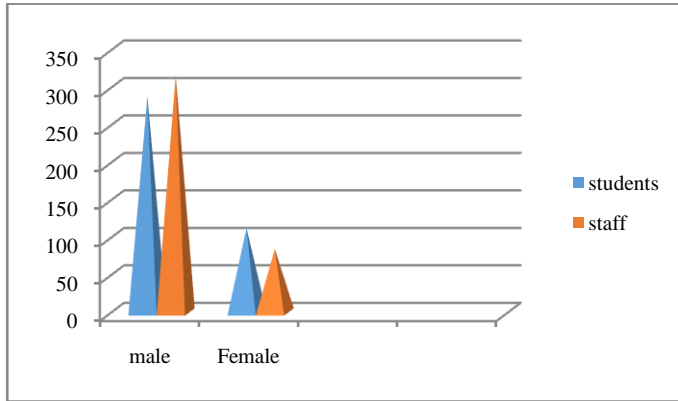

Figure 1.1 Sex distribution (Students N=400) (Staff N=400)

Location

Three hundred and seven (76.75%) of the study students population reside on campus, while 93 (23.25%) reside off campus. Four hundred (100%) of the staff respondents reside off campus.
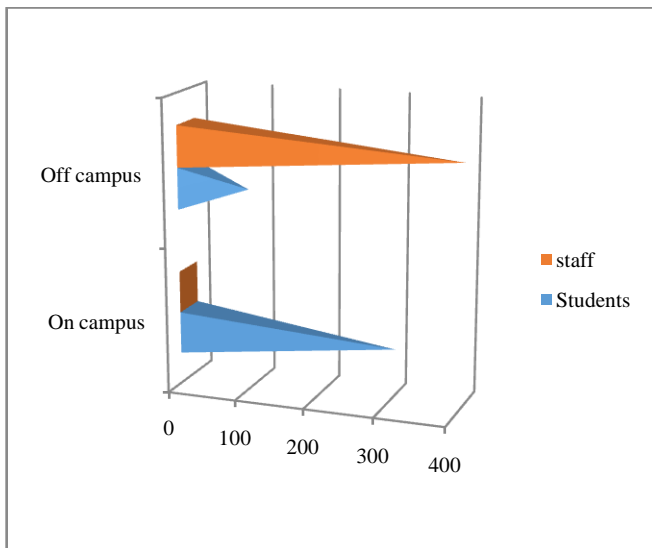

Figure 1.2 Location (Students N=400) (Staff N=400)

Source of drinking water

Sachet water was the major source of drinking water for the respondents accounting for 228 (57.00%) for students and 312 (78.00%) for staff respectively, Bore hole water was the source of drinking water for 149 (37.25%) of the students respondents and 64 (16.05%) of staff respondents respectively. Twenty (5.00%) and one (0.25%) of the students respondents rely on tap water and bottled water for drinking respectively. Only six (1.50%) and five (1.25%) of the staff respondents drink tap and bottled water respectively.
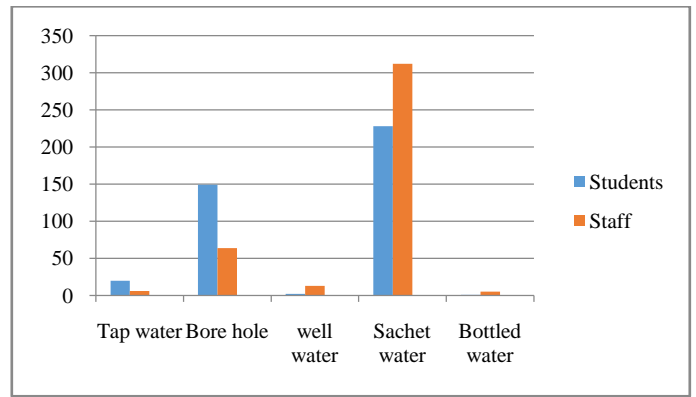

Figure 1.3 Source of drinking water (Students N=400) (Staff N=400)

Self-medication

Three hundred and fourteen (78.50%) of the student respondents admitted that they took self-medication before reporting to the hospital while 86 (21.50%) admitted that they did not take self-medication. Three hundred and seventy (92.50%) of the staff respondents took self-medication before reporting to hospital while 30 (7.50%) did not take self-medication.
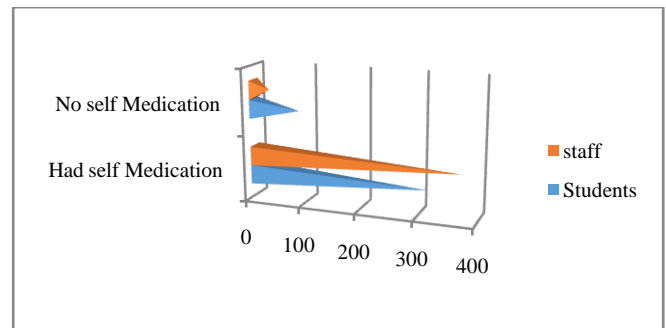

Figure 1.4 Self-medication (Students N=400) (Staff N=400)

Vaccination history

Only 3 (0.75%) of the student respondents had been vaccinated against typhoid fever while 397 (99.25%) did not ever had vaccination against typhoid fever. Three hundred and eighty six (96.50%) of staff respondents had never been vaccinated against typhoid fever while only 14 (3.50%) of the staff had been vaccinated.
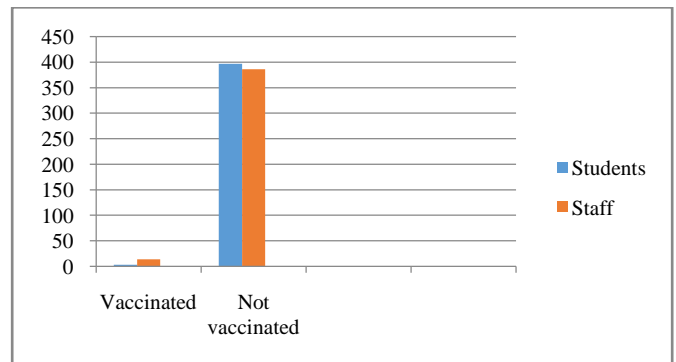

Figure 1.5 Vaccination history (Students N=400) (Staff N=400)

Clinical presentation

Fever was the highest clinical presentation by the respondents 336 (84.00%) for students and 318 (79.50%) for staff, 312 (78.00%) of students and 278 (69.50%) of staff presented with headache, 328 (82.00%) of students and 213 (53.25%) of staff presented with abdominal pain, 234 (58.50%) of students and 103 (23.75%) of staff presented with vomiting, and 136 (34.00%) of students and 88 (22.00%) of staff reported with diarrhoea.

Table 1.1 Clinical presentation

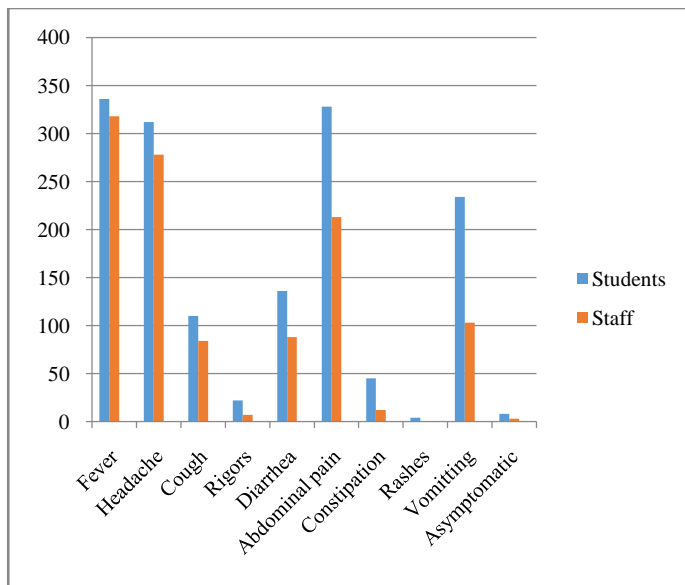| Symptom	Frequency	Percentage	Frequency	Percentage
	Students		Staff	
Fever	336	84.00	318	79.50
Vomiting	234	58.50	103	23.75
Headache	312	78.00	278	69.50
Abdominal pain	328	82.00	213	53.25
Diarrhea	136	34.00	88	22.00
Constipation	45	11.25	12	3.00
Cough	110	27.50	84	21.00
Rash	4	1.00	0	0
Rigors	22	5.50	7.00	1.75
Asymptomatic	8	2.00	3	0.75

Figure 1.6 Clinical presentation (Students N=400) (Staff N=400)

- Phase 2

V. RESULT OF WIDAL TEST

Three hundred and sixty eight (92.00%) of the 400 student respondents have significant titre while 32 (8.00%) of the respondents have titre that is not significant. Three hundred and forty three (85.75%) of the staff respondents had significant Widal test result while 57 (14.25%) have Widal test that was not significant.

Table 1.2 Widal test result

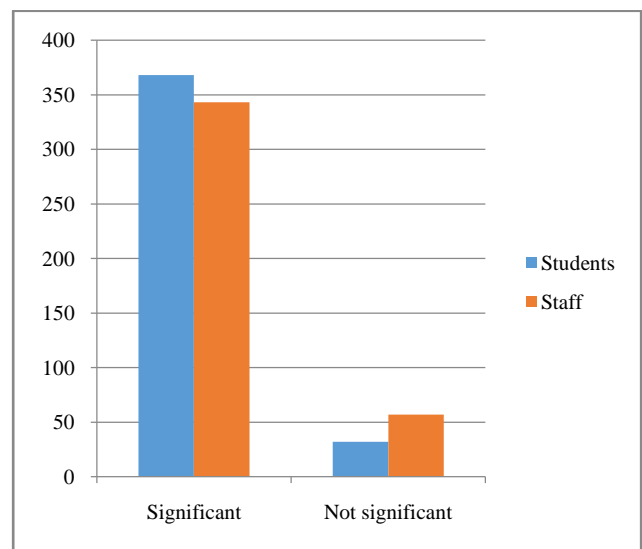| Widal test result	Frequency Students	Percentage Students	Frequency Staff	Percentage Staff
Significant titre	368	92.00	343	85.75
Not Significant	32	8.0	57	14.25

Figure 1.7 Widal test result (Students N=400) (Staff N=400)

Antibiotic sensitivity and resistance pattern for Salmonella typhi and Salmonella para typhi among students and staff

Ceftriaxone has the highest sensitivity pattern as all the 400 (100%) students' samples and 396 (99.00%) of staff samples were sensitive to it.

351(87.75%) of student's sample and 312 (78.00%) of staff sample were sensitive to cefixime, 214 (53.50%) of student's sample and 112 (28.00%) of staff sample were sensitive to Ciprofloxacin, 303(75.75%of student's sample and 301 (72.25%) of staff sample were sensitive to chloramphenecol,

159 (39.75%) of student's sample and 196 (49.00%) of staff sample were sensitive to Azithromycin .

One hundred and thirteen (28.25%) student' sample and 83 (20.75%) staff sample were sensitive to Amoxicillin, while only 41(10.25%) of the student's sample and 23 (5.75%) of staff sample was sensitive to Cotrimoxazole.

Table 1.3 Antibiotic sensitivity and resistance pattern for Salmonella typhi and Salmonella para typhi among students and staff

| Antibiotic	Frequency	Percentage	Frequency	Percentage
	Students Sensitive		Students Resistance	
Ceftriaxone	400	100.00	0	0
Cefixime	352	87.75	49	12.25
Chloramphenecol	303	75.75	97	24.25
Ciprofloxacin	214	53.50	186	46.50
Azithromycin	159	39.75	241	60.25
Amoxicillin	113	28.25	287	71.75
Cotrimoxazole	41	10.25	359	89.75
Antibiotic	Frequency	Percentage	Frequency	Percentage
	Staff Sensitive		Staff Resistance	
Ceftriaxone	396	99.00	4	1.00
Cefixime	312	78.00	88	22.00
Chloramphenecol	301	75.25	99	24.75
Ciprofloxacin	112	28.00	288	72.00
Azithromycin	196	49.00	204	51.00
Amoxicillin	83	20.75	317	79.25
Cotrimoxazole	23	5.75	377	94.25
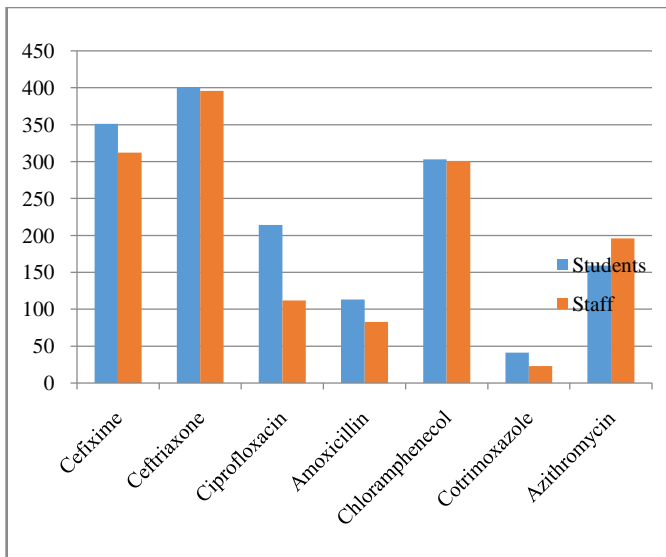
Figure 1.8 Antimicrobial sensitivity pattern to *S Typhi and S Paratyphi*

(Students N=400) (Staff N=400)

Hospital Admission

Out of the 400 student respondents, 22 (5.50%) were admitted to the school health centre for treatment, while 378 (94.50%) were treated as outpatients. Similarly, 19 (4.75%) of the staff were admitted for treatment while 381(95.25%) of staff were treated as outpatient.
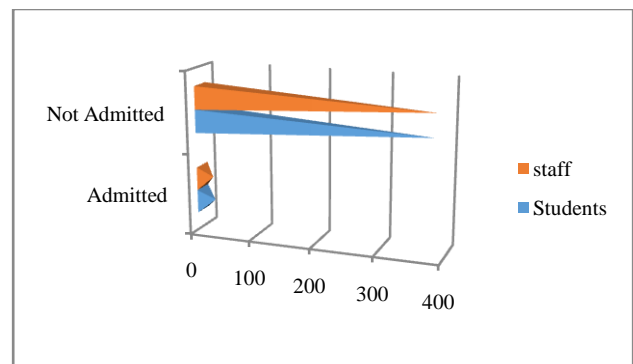

Figure 1.9 Hospital admission (Students N=400) (Staff N=400)

Preliminary Antibiotic given for treatment

Chloramphenecol was the highest preliminary antibiotic treatment given, accounting for 180 (45.00%) for students and 211 (52.75%) for staff prior to the result of blood culture and sensitivity test. Ceftriaxone was given to 15 (3.75%) of students and 22(5.50%) of staff, Azithromycin 14 (3.50%) for students and 47 (11.75%) for staff, Amoxicillin 68 (17.00%) for students and 25 (6.25%) for staff, Ciprofloxacin 110 (27.50%) for students and 95 (23.75%) for staff, and Cotrimoxazole 13(3.35%) for students and none (0) for staff.

Table 1.4 Preliminary antibiotic treatment

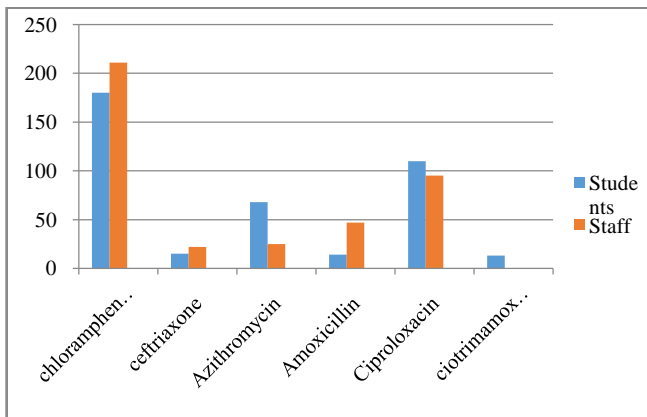| Antibiotic	Frequency	Percentage	Frequency	Percentage
	Students		Staff	
Ceftriaxone	15	3.75	22	5.50
Chloramphenecol	180	45.00	211	52.75
Ciprofloxacin	110	27.50	95	23.75
Azithromycin	68	17.00	25	6.25
Amoxicillin	14	3.50	47	11.75
Cotrimoxazole	13	3.25	0	0.00

Figure 1.10 Preliminary anti biotic treatment

(Students N=400) (Staff N=400)

VI. DISCUSSION

Age distribution

The predominant age group was 18-24 (77.00%) among students while the predominant age group among staff was 39-45 accounting for 48.75%. This could be attributed to the fact that the study was carried out in an Educational institution where students within the age group of 18-24 are found. This is in line with another study carried out in a college of Education clinic, Akwanga, Nasarawa state, North central Nigeria, where the age range having the highest prevalence of typhoid fever for a 3 year period (2005, 2006, 2007) were those between 21-30 year age group.

Sex distribution

Male respondents were higher than the female respondents, 59.5 % and 40.5% respectively. This could be due to cultural beliefs in most communities in Africa where girl child Education is considered unimportant. Therefore, their enrolment in schools is low accounting for higher number of male compared to female respondents in this study (school-based).

In 2011, 8.3% of female were enrolled in tertiary Education in Nigeria compared to 11.76% male enrolment (UNESCO 2013).

Location

Of the student respondents, 76.75% were residing on campus while only 23.25% of them reside off campus. All staff respondents reside off campus because no accommodation is made available to them on campus. Considering the fact that the study was carried out among staff and students where all staff and some students reside off campus, it is not surprising that the highest number of respondents were residing off campus. This is in agreement with a study carried out to determine the satisfaction level of hostel facilities in Nigerian Polytechnics which shows a 66.6% student dissatisfaction level (Sawyerr & Yusof 2013:306).

Source of drinking water

The highest proportion of respondents (both students and staff) used sachet water as their source of drinking water accounting for 57.00% and 78.00% for students and staff respectively. In almost all parts of Nigeria, sachet table water prepared by small-scale entrepreneurs using sealed polythene bag for storage after simple purification method, is being used as source of drinking water. The small-scale entrepreneurs need to undergo evaluation of their factories for suitability of production by National Agency for Food, Drugs, Administration and Control (NAFDAC) after which they are registered for production and consumption. However, some of the factories produce their sachet water without certification by NAFDAC. Therefore, it is possible for some of the respondents to consume this type of sachet water. NAFDAC, as an enforcement agency, need to checkmate these water

production factories regularly (without notice) to ensure safety of the general public.

Borehole water was the second largest source of drinking water for both students and staff accounting for 37.255 and 16.00% respectively. This is being drilled by individuals who sold the water from it to water vendors in 25 litres gallons. Some of the water vendors keep their gallons in an unhygienic manner making their water not safe for consumption.

About 70 million Nigerians out of 171 million lacked access to safe drinking water in 2013. Many schools in Nigeria also lack private toilets and safe hand washing facilities (UNICEF 2013).

Paired t test

Statistical significance: false

P=1.0

Calculated t Value=0.0

Critical t Value=2.7764

Table 1.5 Paired student t test for source of drinking water

	Students	Staff
Mean	80.0	80.0
SD	103.1867	131.9754
SEM	46.1465	59.0212
95% CI of mean	(-48.12) - (208.12)	(-83.87) - (243.87)
N	5	5

Self-medication

Of the student respondents, 78.50% took medication before reporting to Hospital while only 21.50% of them did not take medication before reporting to hospital. A percentage of 92.50% of staff took self medication prior to reporting to Hospital while only 7.50% did not. Internationally self medication is the most common and obvious contributing factor to antibiotic resistance (Rather, Kim, Vivek, Bajpai & Park 2017:808-812). This act of self-medication could be a factor that contributes to antimicrobial resistance in this study.

Vaccination history

Vaccination is the single most important strategy in controlling the spread of infectious diseases. In this study, only 0.75% and 3.50% of the students and staff respondents were vaccinated against typhoid fever respectively. Among them none was vaccinated for a booster dose (live typhoid vaccine) within the last five years (CDC 2017). This shows the lack of typhoid fever vaccination coverage which may contribute to the spread of the disease within the polytechnic community.

Clinical presentation

Fever, abdominal pain, and headache were the highest symptoms reported by the student respondents accounting for

84.00%, 82.00%, and 78.00% respectively. While the staff predominant symptoms are fever 79.50%, headache 69.50%, and abdominal pain 53.75% .Headache is the second most presenting symptom in staff while abdominal pain is the second most presenting symptom in students. These symptoms are none specific to typhoid fever. Misdiagnosis therefore, could easily be done without appropriate investigation. Many cases of typhoid fever are missed or misdiagnosed as malaria due to the non-specificity of these symptoms (Onyekwere 2007:76-79).

Misdiagnosis of typhoid fever might lead to improper treatment which in turn results in worsening of symptoms and manifestation of complications (Onyekwere 2007:76-79).

Paired t test

Statistical significance: true

P=0.0078

Calculated t Value=-3.4039

Critical t Value=2.2622

Table 1.6 Paired student t test for clinical presentation

	Students	Staff
Mean	153.5	118.6
SD	137.4944	120.9262
SEM	43.4796	38.2402
95% CI of mean	(55.14) - (251.86)	(32.09) - (205.11)
N	10	10

Widal test result

Of the student respondents, 92.00% have significant titre while 8.00% have titre that is not significant. Of the staff respondents, 87.75% have significant titre, while 14.25% have titre that is not significant. The higher number of significant titre among students compared to staff could be as result of water and food consumed by the students which have low hygienic status compared to that consumed by staff. This is because students most often patronise roadside food vendors for feeding where the food and water is questionable. This is in agreement with a study carried out at a Tertiary Education Institution at Akwanga, Nasarawa state, North central, Nigeria, in which 73% of the students have significant Widal titre with the likely implicating factors being consumption of unhygienic food and drinks like cow milk, sobo (hibiscus) and patronage of food vendors (Ishaleku, Sar & Houmsou 2011:139).

Antibiotic sensitivity pattern

Ceftriaxone, cefixime, chloramphenecol, and ciprofloxacin were antibiotics with the highest sensitivity profile among students accounting for 100%, 87.75%, 75.75%, and 53.50% respectively, while ceftriaxone (99.00%), cefixime (78.00%), chloramphenecol (75.25%), and azithromycin (49.00%) has the highest sensitivity pattern among staff. The antibiotics

used for empirical therapy were chloramphenecol, ciprofloxacin, and amoxicillin. Therefore, ceftriaxone was not used. It is known that for Multidrug resistant typhoid fever (MDRTF), ceftriaxone and ciprofloxacin can be combined for treatment (Brusch 2018:6). This is in agreement with a study on antibiotic susceptibility pattern of Salmonella typhi and para typhi in a tertiary care hospital where resistance was found in trimethoprim sulphamethoxazole, and amoxicillin, while chloramphenecol had 100% sensitivity (Poudel, Shrestha, Pradhan, Akpota & Mahato 2014:1-4).

Azithromycin show intermediate sensitivity (49.00%) for staff. This antibiotic has not been used for empirical therapy in this study population. This is in line with a study in which 46% of the blood culture samples were sensitive while 21% shows intermediate sensitivity (Choudhary, Gopalakrishnan, Nambi, Ramasubramanian, Abdulghafur & Thirunarayan 2013:800-802).

The susceptibility pattern of ceftriaxone, ciprofloxacin, chloramphenecol, and azithromycin in this study shows that these drugs are still useful in treatment of typhoid fever. Combination therapy could also boost chances of recovery from typhoid fever. Ceftriaxone was highly sensitive, thus its use could be advocated in this setting especially in severe and suspected MDRTF.

Hospital admission

Of the student respondents, 94.50% were treated as outpatients and 5.50% were treated as in patients while 95.25% of staff was treated as out-patients and 4.75% were treated as in-patients. Although most cases of typhoid fever present as uncomplicated, it is important to keep serious cases for observation at least pending the outcome of the investigation (blood culture) as it has been observed that most admitted patients respond well to treatment and improve within 3-5 days, but may take several weeks before discharge (NHS 2018)

Preliminary antibiotic treatment

The majority of the study population were given empirical treatment with chloramphenecol (45.00%) for students and (52.75%) for staff, ciprofloxacin (27.50%) for students and (23.75%) for staff, amoxicillin (17.00%) for students and 6.25% for staff. It is known that there has been multi-drug resistance to most first line drugs used for the treatment of typhoid fever as reported in a study where ciprofloxacin and Amoxicillin were resistant while Chloramphenecol was 100% sensitive (Poudel et al 2014:1-4). This shows that chloramphenecol may still be useful in treatment of typhoid fever.

Paired t test

Statistical significance: false

P=1.0

Calculated t Value=0.0

Critical t Value=2.5706

Table 1.7 Paired student t test for preliminary antibiotic treatment

	Students	Staff
Mean	66.667	66.667
SD	67.8931	77.714
SEM	27.7172	31.7266
95% CI of mean (-4.58.83)-(137.92) (-14.89) - (-148.22)		
N	6	6

DEVELOPEMENT OF CLINICAL AND PUBLIC HEALTH GUIDELINE USING DELPHI TECHNIQUE

Ten expert (10) panel were chosen for the development of the guideline comprising of four (4) medical doctors, two (2) laboratory scientists, two (2) senior nurses (Chief nursing officers), and two (2) pharmacists . None of them was informed by the researcher about the involvement of the other so as to remove bias.

Twenty-five (25) statements were circulated to the members of the expert panel using open-ended questionnaires developed by the researcher after reviewing the study for round one (1) voting. They were asked to agree or disagree with the statements.

Round 1

Twenty five (25) statements were circulated to the expert panel for round one voting with anonymity of the panel members maintained by not disclosing their identities among themselves.

After voting ended for round one (1), ten (10) statements were accepted without modifications while fifteen (15) statements did not reach consensus. At the end of the round, ten (10) statements were incorporated into the final document (figure 1.11). The result at the end of round one (1) was circulated to the panel experts but no face to face discussion was held.

Round 2

At the beginning of round two (2), fifteen (15) statements were circulated to panel members for the 2nd round of voting. Three (3) statements were accepted without modifications, ten (10) statements were omitted, while two (2) statements did not reach consensus. At the end of the round, three (3) statements were incorporated in to the final document (figure 1.11). The result at the end of round two (2) was circulated to the panel experts but no face to face discussion was held.

Round 3

Panel members were invited for discussion and ratification of the final consensus document. At the beginning of this round, two (2) statements were presented for discussion, one (1) statement was accepted without modification, one (1) new statement was developed, and one (1) was omitted. At the end of round three (3), two (2) statements were incorporated in to the final document (figure 1.11).

At end of discussion by the panel members, fifteen (15) consensus statement documents was unanimously agreed comprising of five (5) domains; screening, investigation, physical examination, treatment, and public health intervention. Each of these was paired with matching consensus statements (table 1.11).
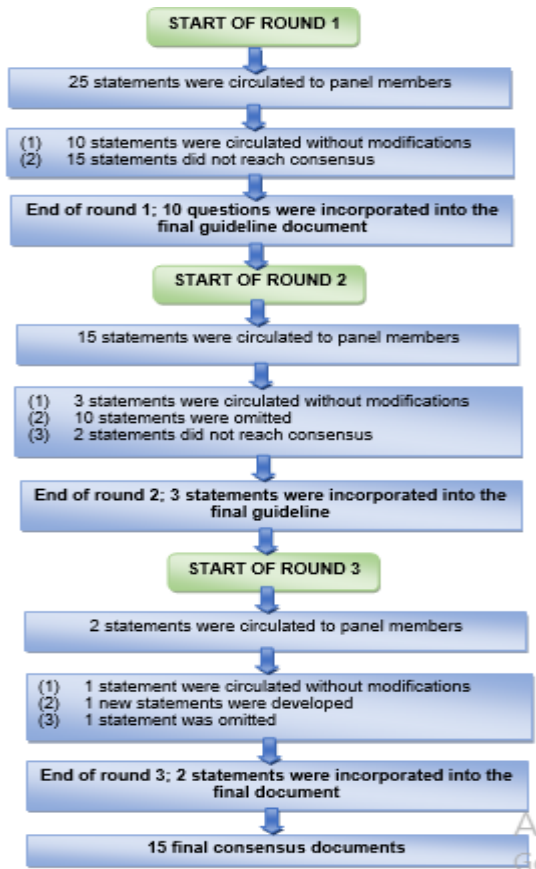

Figure 1.11 Schematic design of Delphi technique used in developing guideline

Clinical and public health guideline for the diagnosis, treatment and prevention of typhoid fever

Clinical and public health guidelines for the diagnosis, treatment, and prevention of typhoid fever

The consensus of the expert panel was that the patient needs to be screened thoroughly for typhoid fever by asking the following questions during history-taking (table 5.1).

- Ask for residence of student
- Ask for source of drinking water
- Ask for proper toilet facility
- Does he/she patronise food vendors
- Ask for clinical symptoms; Fever, abdominal pain, vomiting, loose watery stool, headache

The minimum laboratory investigations should include;

- Felix Widal test
- Malaria parasite test

- Blood culture and sensitivity test when suspicious of MDRTF

The student or staff should be physically examined by performing interventions as reflected in Table 5.1

- Thorough inspection
- Measuring of temperature
- Abdominal examination

The treatment of the student or staff begin with empirical therapy using the following antibiotics (table 5.1)

- Cefixime
- Chloramphenecol
- Ciprofloxacin or other flouroquinolones
- Azithromycin

Specific antibiotic sensitive drug should be used from the result of blood culture and sensitivity if there is no response to empirical therapy.

The following advice with regard to public health intervention should be given before discharging the patient to prevent reoccurrence and MDRTF:

- Advice on consumption of safe and clean drinking water and food
- Avoidance of self-medication
- Recommend typhoid fever vaccination for the student or staff

Table 1.8 Clinical and public health guideline for the diagnosis, treatment and prevention of typhoid fever

Clinical domain	Consensus statement	
Screening	1	Ask for residence of student or staff
	2	Ask for source of drinking water
	3	Ask for proper toilet facility
	4	Does he/she patronise food vendors
	5	Ask for clinical symptoms; fever, abdominal pain, vomiting, loose watery stool, headache
Investigations	6	Felix Widal
	7	Malaria Parasite
	8	Blood culture and sensitivity when suspicious of MDRTF
Physical examination	9	Inspect the patient
	10	Measure the temperature
	11	Perform abdominal examination
Treatment	12	Start with empirical therapy Using; Cefixime, chloramphenecol, ciprofloxacin/other flouroquinolones or azithromycin
	13	Use blood culture and sensitivity result to treat if there is no response from empirical therapy

	14	Advice patient on the need for clean safe Drinking water and food (NAFDAC registered sachet and bottled water /food) as well as avoidance of self-medication
Public health intervention	15	Recommend typhoid fever vaccination when patient recover

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