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Original Research Article

Risk Factors Influencing Typhoid Fever Occurrence among the Adults in Maina Slum, Nyahururu Municipality, Kenya

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Abstract: The Objective of this study was to investigate the risk factors influencing the occurrence of typhoid fever among the adults in Maina slum within Nyahururu municipality in Laikipia County. Located in Maina slum in Nyahururu municipality, the study relied on descriptive cross sectional design. The researcher used open ended and closed structured questionnaires, key informant interviews and Observational to collect data. Simple random sampling and systematic random sampling were used. The prevalence of typhoid was found to be 6.3%, indicating that the risk factors are still persistent and there are no effective control measures in place. The risk factors included low education level, leaking drainage systems, the type of houses used; water pollution and eating food from commercial kiosks were established. The effective water and sanitation interventions in place were connection of piped water in Maina slum for individuals to connect to their houses, provision of health facilities and application of health education to the residents. The study concludes that typhoid fever increased by 1.3% in duration of five years from 2005 to 2009. The findings also show that 198 (56.6%) residents of the study area do self diagnostic.The findings of this study could be significant to health sector in the county and beyond in understanding the management of the typhoid fever, so as to save lives claimed by the disease.
Keywords: Typhoid Fever, Prevalence, occurrence.

INTRODUCTION

Typhoid fever (a potential life threatening illness caused by a bacterium Salmonella *Typhi*) is among the waterborne diseases killing approximately five million babies annually and make one sixth of the world population ill. Typhoid is still common in the developing world, where it affects about 12.5 million persons each year. In Kenya the prevalence of typhoid fever is less than one per cent annually. In Maina slum it was reported that in 2005 the prevalence rate was at five per cent. This makes the place a potential area for to study the occurrence of the disease. The problem in Maina slum was high prevalence of typhoid fever. Hospital record showed that typhoid prevalence was 5% in 2005 [1] which is higher than the National typhoid prevalence which is less than 1%. When pathogenic agent gains access to water and when consumed by a person who does not have immunity to the disease the transmission occurs [2] Typhoid outbreaks do occur if control and preventive measures are not taken in a timely manner. Poor waste disposal and hygiene of workers in food handling and preparation activities would provide an obvious infection route. The situation is complicated in that some people may be carriers of typhoid so that although they exhibit no outward signs of the disease their excreta contain the pathogens. Incorrect reporting of data could give a wrong impression on the prevalence of typhoid in the area of study. The reporting was made on the basis of clinical diagnosis without any medical laboratory tests done. Clinical diagnosis is not reliable because it is based on symptoms, and some diseases could present the same in terms of signs and symptoms. Self diagnosis could lead to misdiagnosis and improper treatment. Mostly the treatments were self treatment through buying drugs from the counter. This could bring about drug resistance in the future. If diagnosis is correct and treatment is not accurate, the disease may thrive and cause an increase in prevalence of typhoid fever.

The occurrence and severity of typhoid fever

Typhoid fever is still common in the developing world, where it affects about 12.5 million persons each year [3]. Visiting or living in areas where the disease occurs is a risk [4]. An estimated 17 million cases of typhoid fever and 600,000 deaths occur worldwide, annually [5]. Globally, there are four billion cases of diarrhea among children; cholera water borne bacteria infected 120,000 people in 2002 and in the same year there were 50,000 cases of guinea worm in thirteen African countries.

Six million people are blind because of trachoma and twelve million people are infected with

typhoid annually [6]. Eighty percent of typhoid fever cases reported in Nyahururu District Hospital are from Maina slum [7]. This is an indication that typhoid fever is a disease of public health importance in this slum. Typhoid fever (enteric fever) is a septicaemic illness characterized initially by fever, brycardia, splenomegally, abdominal symptoms and rose spots, which are clusters of pink macules on the skin. Complications such as intestinal hemorrhages of perforation can develop in untreated patients or when treatment is delayed [8]. Typhoid fever is treated using antibiotics. A person will usually recover in 2-3 days with prompt antibiotics treatment. People who do not get prompt medical treatment may continue to have fever for weeks or months and as many as 20% may die from complications of the infection [9]. Typhoid is caused by *Salmonella typhi,* which is exclusive to humans and may lead to severe symptoms in the digestive system in the second phase of the illness. Without therapy the illness may last between three to four weeks and death ranges between 1% and 30% [10]. Persons with typhoid fever usually have a sustained fever as high as 103^0 to 104^0F ($39^0$to 40^0 C). The diagnostic test for typhoid is the demonstration of antibodies to *Salmonella typhi* in blood [11].

Risk Factors associated with occurrence of typhoid fever

Water Contamination

The bacterium *Salmonella typhimurium* lives inside humans. The bacterium lives and multiplies in the blood stream and digestive tract of infected persons. Transmission is through contaminated feaces in water or food [12]. Faecal pathogens are frequently transferred to the water borne sewage system, through flush toilets and pit latrines subsequently contaminating surface and ground water [13]. In regions with poor sanitation, the bacteria often spread after water supplies are contaminated by humans' waste [14].

The principal carrier of typhoid bacteria is water. Water can be extremely dangerous when it becomes the vehicle of the transmission of disease. The principal sources of water contamination are man, animal and bird excreta [15]. Untreated sewage is dangerous to public health because it contributes to environmental water, land and air pollution. Discharging highly polluting waste into a body of water has negative effects on human, animal and plant life. Too many pollutants reduce the self-purification capacity of water, especially at the point of mixing and, they promote excessive growth of aquatic plants. Polluted waters are aesthetically unacceptable because they emit unpleasant oduors[16].

Pathogenic organisms that cause typhoid fever enter into the water as a result of a damaged or faulty sewer or water pipes, excreta soaking through the surface solid into subsoil water, deep well contaminations due to faulty construction, maintenance or personal carelessness and contamination of animals or birds particularly seagull [17]. When water mixes with sewage can cause diarrhea and other waterborne diseases [18], which are the prime cause of premature deaths worldwide, especially for young children [19]. Increase in urban population may lead to an increased risk in food and water supply contamination [20].

Health carriers of typhoid disease

Since Salmonella typhi bacteria live in humans, it is only humans who can be carriers. Persons with typhoid fever carry the bacteria in their bloodstream and intestinal tract. In addition, a small number of persons, called carriers, recover from typhoid fever but continue to carry the bacteria. Both ill persons and carriers shed *Salmonella typhi* in stool [21]. When people who are carriers of typhoid fail to wash their hands thoroughly with soap and clean water after defeacation they risk passing the causative organism to others.

Sanitation practices

Sanitation refers to the safe collection, storage and disposal of various wastes resulting from human activities. These include solid wastes, refuse and liquid wastes effluent from sewage works, kitchen sink and even hazardous waste from industries. It also refers to the general maintenance of the human environment in a safe condition free from pollution. It involves the behaviour change and availability of adequate facilities that ensure a hygienic environment [22].

In many developing countries there exists a high prevalence of water and sanitation related diseases causing many people to fall sick or even die [23]. Feaces can be the source of much sickness in the community if it is accessible to flies, fingers, and fluid and eventually to food. This is referred as the five-F connection [24]. This pathway is known as the faecal-oral route of disease transmission [25].

In order to combat diseases caused by inadequate sanitation more efficiently installation of sanitary excreta facilities should be encouraged with measures taken to dispose of wastes [26]. In regions of the world where sanitation and garbage disposal are lacking, typhoid fever continues to destroy life [27]. Moreover, the rapid increase in the population combined with a massive migration to urban areas has led to the formation of urban centres of high population density in many countries. The increase in urban population has occurred at such a pace that it has outstripped the development of the health related infrastructure including basic sanitation

Lack of hygiene

Transmission is by contact with contaminated water and food through food handlers, sewage, contamination of drinking water or food. Large epidemics are most often related to faecal contamination of water supplies or street foods [28].

Therefore, typhoid fever is more common in areas where hygienic practices are not observed and with poor sanitation practices. Infection with *Salmonella typhi*results in development of fever and other signs and symptoms [29]. Typhoid fever can also be spread through irrigation of crops using sewage contaminated with *Salmonella typhi*. Humans are the only natural hosts of *Salmonella typhi*[30]. Food and water is rendered unfit for human consumption when contaminated with *Salmonella typhi*[31] and many naturally occurring water sources are liable to such contamination at some point [32]. Typhoid fever is spread in faecally contaminated food and water and often comes in epidemics; hence it is one of the dangerous infections [33].

Informal settlement

A report by UNDP in 2001 showed that majority of urban populations is tenants in informal settlements where basic services such as water and sanitation are inadequate. Visiting or living in areas where the disease occurs is a risk [34].

Preventive measures in place for typhoid control

Food and Personal hygiene

Hygienic practices include food and personal hygiene. Food hygiene is concerned with all measures necessary for ensuring the safety, wholesomeness and soundness of food at all stages of production, preparation, marketing and distribution [35]. Although food is a basic human need it can sometimes cause a number of illnesses arising from pathogenic and toxic substances, which find their way into food through contamination or spoilage [36]

Hand washing practices

People should wash their hands after visiting toilets, before and after eating foods in order to prevent typhoid fever since hygiene is the best method of preventing it (typhoid fever) and many other bacterial diseases [37]. People should wash their hands with soap and hot water before handling food items. Using soaps kills the typhoid bacteria [38]. One of the key ways to stop the spread of typhoid fever is to promote and practice good hygiene. Even where there is excellent sanitation, disease will spread rapidly if hygiene is poor [39]. Proper hand hygiene is important in preventing further spread in hospitals. The Kenyan Public Health Act, chapter 242, provides that infectious diseases should be controlled and prevented.

Immunization and treatment

Vaccination of high-risk populations is considered the most promising strategy for the control of typhoid fever [40] but control of typhoid fever outbreaks is mainly by sanitation and not immunization [41]. Usually the prevention of enteric disease comprises basic sanitary and hygiene measures, including purifying water supplies, improvising water delivery and sewage control, supplying hand washing facilities, construction and use of latrines, boiling water and supervising of food handlers [42]. National decisions concerning strategies to control typhoid fever should be based on thorough analyses of age- specific incidence on groups at particular risk of infection and on cost benefit aspects of the planned control measures [43]. Typhoid fever can be prevented and is treated with antibiotics such as chloramphenicol, ampicillin, tetracycline, co-trimaxazole, trimethoprim-sulfamethaxaole and ciprofloxacin [44]. Within the hospital setting, infected people are cared for in isolation.

Waste disposal

Household refuse can be a real threat to health if proper arrangements are not made for its disposal. Each home must therefore practice appropriate methods of rubbish disposal [45]. To improve sanitation it is necessary to provide simple facilities, which are cheap and easily made by any family and also help people understand the importance of using them[46]. The hygienic disposal of excreta is important because the infective organism for typhoid fever leaves the body in the feaces and some in urine. 58.9% of households in Rift valley province use traditional pit latrine, and access to sanitation facilities are important determinants of health status [47]. In Laikipia District, 72.9% of households have pit latrine as the main human waste disposal [48]. The Ministry of Health in its National Health Sector Strategic Plan targets to increase provision of safe water and improve sanitation in rural areas by 30%. A key factor in disease prevention among children is an efficient means of sanitary disposal. Sanitary conditions in any human settlement have a direct impact on the prevailing environmental and health standards of the inhabitants. At National level of 83% of households had access to decent sanitary facilities such as main sewer and pit latrine by 1999 [49]. Sanitation on the other hand remains a major challenge in Kenya, largely due to inadequate provision and poor management of existing facilities [50]. According to the 2002-2008 Kenya National Development Plan, there are 142 gazetted urban areas in Kenya of which only 30 per cent had a sewerage system posing serious environmental and health problems. Latrines are used to break the transmission of diseases associated with human waste disposal [51].

Provision of clean treated water

Nyahururu water and Sanitation Company Limited is the one which carry out waste disposal in Maina slum and was incorporated as a private company in accordance with the company Act Cap 456 of the Laws of Kenya in February 2002 and became fully functional by July 2003. The objective of the company was to provide quality affordable water and expand water distribution and sewerage networks in order to deliver sewerage services to all consumers. The company is also improving on water revenue collection since the company was started, consumers' complaints

have reduced drastically and billing is up to date and the rate of payment has increased, boosting the revenue collection up to 30 percent. Water theft has reduced from 70 per cent to 40 per cent. The management of the company claims that water quality has improved, hence reducing water borne diseases [52].Nyahururu water and sanitation services have been expanded to provide water to places such as Kibathi, Laikipia campus and MairoInya. The company plans to take over Marmanet water supply, Nyahururu / Gatimu water scheme and Leshau / Karago-ini water projects. The company also plans to extend the existing sewerage treatment works. The company was formed as a result of water sector restructuring process that is on going according to the Water Act, 2002.

In summary there are three key hygienic practices which are paramount to prevention of typhoid fever [53]. Disposal of feaces particularly those of young children, babies and ill people should be carefully and quickly be disposed off. People washing their hands regularly with soap and water particularly after defecating, after handling babies feaces, before feeding and eating and before preparing food for the germs on their hands are removed or killed.Maintaining drinking water free from faecal contamination, the source of water must be protected and drinking water boiled and stored in a clean covered container to prevent post faecal contamination

STUDY FINDINGS

Awareness of respondents about typhoid as a preventable disease

It was evident that a majority (98%) of the respondents knew that typhoid fever was preventable while 2% did not. These results suggested that the majority of the respondents were aware that typhoid was not a disease that was unpreventable. Despite that awareness the disease continued to be among the top ten diseases in Maina slum. (Table 1)

Table 1 Frequencies of some selected variables

Knowledge of typhoid	**Frequency(N=350)**	**Percentage (%)**
Typhoid	309	88.3
Malaria	14	4.0
Bilhalzia	26	7.3
Others	1	0.4
Total	**350**	**100.0**
Awareness		
Aware on typhoid prevention	343	98.0
unaware on typhoid prevention	7	2.0
Total	**350**	**100.0**

PREVALENCE OF TYPHOID

Occurrence of typhoid fever

In Kenya less than one per cent of the population suffered from typhoid fever. This means that nationally typhoid fever as a disease is not as prevalent as it is in Maina slum. The results in Figure 1 show that majority (63%) of the study population said they had suffered typhoid episode during their lifetime, while minority (37%) did not. Out of 220(63%) only 121(34.57%) showed medical cards as an evidence of suffering while 77(22%) showed a medical card and a medical laboratory results which were positive in nature but had since recovered from the sickness. The remaining 22(6.3%) showed positive medical laboratory results and were on medication during the time of data collection hence the prevalence of typhoid in the area. The sick people were responding well on medication as prescribed to them by the health professionals. These results showed that it was necessary to study and find out risk factors influencing the occurrence of typhoid fever in Maina slum among the adults (GOK, 2007). The fact that 6.3% prevalence occurred in 2009 as compared to 5% prevalence in 2005, it is important to note that the methods used were different hence it cannot be said that the difference was 1.3% within the four years. The diagnostic method used in 2005 was clinical while the one used in 2009 was medical laboratory tests. The tests could sometimes as well be inaccurate while the reagents could also be expired.

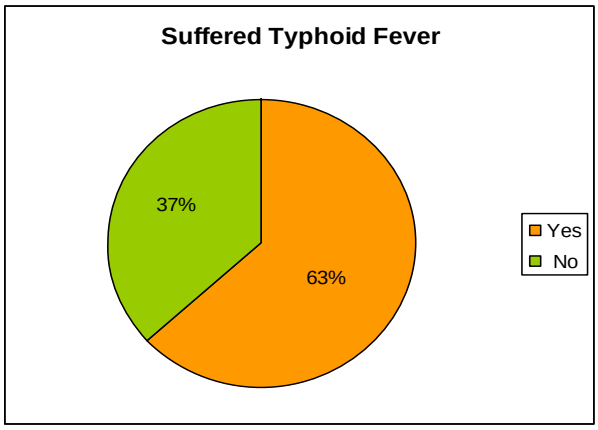

Fig-1: The claim of typhoid suffering in lifetime in Maina slum.

Typhoid occurrence and sex

The results from this study revealed that males and females who suffered typhoid in their lifetime were

almost the same. This is an indication that females and males were equally at risk and therefore both sexes were equally vulnerable. This explains that sex is not a predisposing factor toward suffering from typhoid. The result also indicates that control of typhoid should be aimed at both the females and males for effective typhoid control. (χ^2 = 1.638 df = 1 p=0.424) (Table 2)

Typhoid occurrence and the level of education

The study results reveal that the susceptibility of suffering from typhoid was more to those with low level of education than those who had attained a higher level of education. This meant that education played a key role in the prevalence of typhoid in Maina slum. In table 2 it is shown that the higher the level of education the more the typhoid occurrence decreased among the adults as in primary, secondary and college levels respectively. This meant therefore that, there was a significant relationship between suffering from typhoid and educational levels. This shows that education is a predisposing factor on typhoid among the adults in Maina slum (χ^2=9.835 df=3 P=0.020) (Table 2)

Typhoid occurrence and occupation

In table 2 is indicated that self-employed and un-employed people had suffered from typhoid fever in lifetime for both categories were above 65%. These results showed that there was no significant difference between suffering and occupation status for whatever the status of employment one was, typhoid would still strike if control measures were not taken (χ^2=5.168 df=2 p=0.075)(Table 2)

Typhoid occurrence and age

The findings presented in table 2 showed that age determined the prevalence of typhoid and its patterns. The majority (73.1%) aged 38-47years suffered from typhoid than others in other age brackets in lifetime. This could be due to low immunity. There was therefore a relationship between suffering of typhoid and age disparity. This meant that age was a predisposing factor on typhoid fever in Maina slum (χ^2 = 10.345 df = 3 p= 0.016) (Table 2)

Table 2 Frequencies of some selected variables showing the occurrence of typhoid fever

Sex	**Independent variables**	**Perceived typhoid**	**Did not suffer typhoid**	**Total (N=350)**	**Chi-square Statistic**
	Males	107(30.57%)	57(16.29%)	164(46.86)	χ^2= 1.638
	Females	113(32.28%)	73(20.86%)	186(53.14)	df=1
	Total	220(62.85%)	130(37.15)	350(100.00%)	P= 0.424
status Education	Primary	123(35.14%)	79(39.1%)	202(57.71)	χ^2=9.835
	Secondary	79(22.57%)	37(31.9%)	116(33.14)	df=3
	Non formal	10(28.57%)	14(58.3%)	24(6.86)	P=0.020
	College	8(2.29%)	**0**	8(2.29%)	
	Total	220(62.85%)	**130(37.15)**	350(100.00%)	
Occupation	Self-employed	99(28.29%)	52(14.86%)	151(43.14%)	
	Un-employed	99(28.29 %)	51(14.57 %)	150(42.86)	χ^2=5.168
	Employed	22(6.29 %)	27(7.71%)	49(14.00%)	df=2
	Total	220(62.85%)	130(37.15%)	350(100.00%)	P=0.075
Age in years	18-27	54(15.43%)	31(8.86%)	85(219%)	χ^2=10.345
	28-37	62(17.71%)	60(17.14%)	122(34.86%)	df=3
	38-47	87(24.86%)	32(9.14%)	119(34.00%)	P=0.016
	Above 47	17(4.86 %)	6(1.71%)	23(6.58%)	
	Total	220(62.85)	130(37.15)	350(100.00%)	

RISK FACTORS ASSOCIATED WITH OCCURRENCE OF TYPHOID

Many factors were found to be associated with the occurrence of typhoid fever in the study area. Some of the major factors established are discussed below.

Table 3 Comparison of some Independent variables with occurrence of typhoid fever

Independent variables		Claim of suffering	No claim of suffering	Total (N=350)	Chi-square statistic
Water sources	Tap	118(33.71%)	65(18.57%)	183	χ^2= 2.431
	Spring	10(2.90%)	3(0.86%)	13	df=3
	River	90(25.71%)	59(16.86%)	149	p=0.488
	Roof	2(0.57%)	3(0.26%)	5	
	Total	**220**	**130**	**350**	
Unavailability of treated water at household level	Without treated water	55(15.71%)	110(31.43%)	165	χ^2=2.622 df=1, p=0.003
	With treated	73(20.86%)	112(32%)	185	
	Total	**128**	**222**	**350**	
Distances from water	Above 14m	75(21.43%)	45(12.86%)	120	χ^2= 1.386
	9-14m	63(18%)	34(9.71%)	97	df=3,
	5-9m	55(15.71%)	32(9.14%)	87	p=0.709
	0-4m	25(7.14%)	21(6%)	46	
	Total	**218**	**132**	**350**	
Water storage facilities	Did have	129(36.86%)	101(28.86%)	230	χ^2=2.431
	Did not	91(26%)	29(8.29%)	120	df=3
	Total	**220**	**130**	**350**	p=0.488
Human waste disposal	Disposed	134(38.29%)	83(23.71%)	217	χ^2=1.129
	Did not	86(24.57%)	47(13.43%)	133	df=1
	Total	**220**	**130**	**350**	p=0.288
Solid waste disposal	Disposed	109(31.14%)	24(6.86%)	133	χ^2= 0.529 df=1
	Not	111(31.71%)	106(30.29%)	217	p=0.467
	Total	**220**	**130**	**350**	
Drainage system	Leaking	120(319%)	51(14.57%)	171	χ^2 = 8.028
	Water polluted	35(10%)	22(6.29%)	57	df =3
	Smell	65(18.57%)	57(16.29%)	122	p= 0.045
	Total	**220**	**130**	**350**	
Usage of pit latrine	In use	100(28.57%)	40(11.43%)	140	χ^2= 0.587
	Not in use	120(319%)	90(25.71%)	210	df=1
	Total	**220**	**130**	**350**	p= 0.444
Nature of houses	Permanent	20(5.71%)	10(2.86%)	30	χ^2=6.202
	Semi-permanent	13(3.71%)	20(5.71%)	33	df=2
	Temporary	187(53.43%)	100(28.57%)	287	p=0.045
	Total	**220**	**130**	**350**	
Eating commercial food in food Kiosks	Ate food	99(28.29%)	41(11.71%)	140	χ^2=372
	Did not eat	121(34.57%)	89(25.43%)	210	df= 1
	Total	**220**	**130**	**350**	p=0.034

Drinking water Source

Results in table 3 showed that 54.6% of the respondents obtained drinking water from the tap, while 39.6% from the river, 4.6% got water from the river while 1.7% from the roof harvesting. There was no guarantee that someone would not suffer from typhoid after drinking water from specific sources. There was no difference between water sources and suffering of typhoid fever in Maina slum. Water sources were not influencing the occurrences of typhoid in Maina slum (χ^2=2.431 df= 3 p= 0.488) (Table 3)

Untreated tap water

The results in table 3 shows that greater number (57%) of those who suffered from typhoid had no tap water though those with water connection equally

suffered from the typhoid disease a little bit (43%). It was also observed that among those who claimed to have connected to tap water (45%) were dry taps, disconnected due to non-payments of bills though water was purchased from nearby water kiosks built through the CDF initiative. There was a significant difference between disconnection of tap water and typhoid fever (χ^2 = 2.622 df= 1 p= 0.003) (Table 3)

Water storage facility

In this study it was evident that 37% had water storage facilities while majority 63% had none. Those with water storage facility still suffered from typhoid fever. There wasno significant relationship between water storage facility and typhoid fever (χ^2 = 2.431 df = 3 p = 0.488) (Table 3)

Human waste disposal

Eighty three percent (83%) of the residents disposed their human wastes in a pit latrine while 17% did not. Those who disposed off their wastes in a latrine were almost five times more than those who did not, yet they suffered from typhoid as well. There was no significant difference between waste disposal and typhoid fever occurrence (χ^2=1.129 df=1 p=0.288) (Table 3)

Solid wastes disposal

In this study 38% of the solid wastes were disposed off compared to 62% which remained indisposed. The results show that 39% of those who disposed wastes suffered from typhoid and 61% did not dispose off the wastes, yet they did not suffer typhoid. This shows that waste disposal is not a guarantee that whoever disposes waste do not suffer from typhoid fever. Wastes that are free from *Salmonella typhi* are unable to transmit typhoid fever even when indisposed. There was no relationship between waste disposal and suffering of typhoid (χ^2=1.529 df= 1 p=0.467) (Table 3)

Pit latrines usage

The findings indicated that 60% of the pit latrines were not in use because they were filled compared to 40% which were in use. Those whose pit latrines were not in use still suffered typhoid fever just as those whose latrine were in use. These results show that usage of pit latrines was not an independent control measure toward typhoid fever for it was not effective on its own without other measures coming into play. There was no significant relationship between usage of latrines and prevalence of typhoid fever. During usage of a pit latrine one can easily contaminate his hands with germs that causes typhoid hence latrine usage was not a cause of occurrence of typhoid prevalence in Maina slum (χ^2= 0.587 df=1 p = 0.444) (Table 3)

Leakingdrainage systems

The finding of this study revealed that 47.1% of drainage system was leaking, 36% were smelly and 16.9% contaminated some water sources. During rainy seasons the situation is worse as it was observed because of the water stagnation and offensive smell accelerated by the season. The surface water is contaminated by the water runways and if that water was used for drinking without any form of treatment, it becomes a prime suspect of the cause of the typhoid fever. Generally drainage systems were defective in nature. There was a relationship between thedefectiveness of the drainage system and the occurrence of typhoid fever (χ^2=8.028, df =3 p= 0.045) (Table 3)

Nature of the houses

It was evident from the study that majority (78.29%) lived in temporary houses, 15.14% in semi-permanent houses while minority (6.57%) lived in permanent houses. This indicated that three-quarter of the Maina slum residents could not afford neither a semi- permanent nor a permanent house. Those respondents who were staying in temporary houses were the most infected with typhoid. There was a significant relationship between poverty levels depicted by the nature of houses in place and the prevalence of typhoid fever (χ^2 = 6.202 df = 2 p= 0.045) (Table 3)

Contaminated food

The results in table 3 show that eating commercially prepared foods was a risk factor to typhoid infection. Those who suffered after eating food in those food premises were 70.7% as compared to 57.6% of those who did not suffer from typhoid. The food handlers were also at risk of getting typhoid and it is necessary for them to be medically examined. There was a significant relationship between eating commercially prepared foods and occurrence of typhoid fever (χ^2 = 372 df =1 p= 0.034) (Table 3)

Conclusion

In conclusion though this study found out that 198(56.7%) had suffered in one time or another in lifetime from typhoid fever while 6.3% were suffering from typhoid and were on medication by 2009 it could not be true. Since by 2005 the prevalence was reported to be at 5% the difference cannot be said it was 1.3% because the methods used were different in typhoid diagnosis. The reporting also from the hospital could have been erroneous due to the methodology used which was based on clinical signs and symptoms with no laboratory test done to confirm. This signified that most of the people in Maina slum did self diagnosis through experience because 198(56.7%) had no empirical evidence to show that they had suffered from typhoid. Those who visited Maina slum dispensary for diagnosis between 2005 and 2009 had themselves diagnosed clinically for lack of a medical laboratory in the place. Clinical diagnosis could have been inaccurate and on the other hand can be contradicted with other diseases with similar signs and symptoms. The outcome could not be fully relied on for methods used in

diagnosing typhoid were not similar. It was evidenced from the study results that treated water at household level was available at 53% in household level. Low education level ($\chi 2$ =9.835 df=3 p=0.020) were some of the causative factors toward contracting typhoid infection, and leaking drainage systems was associated with prevalence of typhoid ($\chi 2$=8.028, df=3, p= 0.045).

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