

Original Research Article

The Effectiveness of Preventive and Control Measures put in Place to Curb Typhoid Fever Occurrence among Adults in Kenya

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Abstract: Typhoid is a disease of public health importance which affects people of all walks of lives in urban, per-urban and rural areas in Kenya. It is estimated that globally about 17 million cases of typhoid fever occur causing 600,000 deaths. 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. The general objective of the study was to determine the effectiveness of preventive and control measures put in place to curb typhoid fever occurrence in Kenya. The study design was descriptive cross sectional design. The method used to determine the prevalence of typhoid was a laboratory diagnostic method. The data collection methods used included open ended and closed structured questionnaires, key informant interviews and observational checklist while sampling methods used were simple random sampling and systematic random sampling. The results showed that the prevalence of typhoid was 6.3%. The effective water and sanitation interventions in place were connection of piped water in Maina slum to individual's houses, provision of health facilities and application of health education to the residents among others. This study concludes that typhoid fever increased by 1.3% in duration of five years from 2005 to 2009. Measure put in place in Maina slum were found to be relatively effective in the management of the typhoid fever.

Keywords: Typhoid Fever, Preventive, control measures

INTRODUCTION

Typhoid fever (enteric fever) is a septicaemic illness characterized initially by fever, bradycardia, splenomegally, abdominal symptoms and rose spots, which are clusters of pink macules on the skin. Without typhoid there would be no loss of manpower and instead, there will be more productivity with good health. *Salmonella* infections are usually spread through the faecal-oral route through contaminated water, food and poor sanitation. These infections include typhoid and paratyphoid [1]. In the past, water contaminated by human sewage was responsible for many typhoid fever outbreaks, paratyphoid fever, and cholera. Waterborne outbreaks have become rare, following the improvement in water supply, though still common in countries with primitive sanitation and water supply [2] leading to high treatment costs and deaths [3].

In the US, about 400 cases occur each year and 70 percent of these are acquired while traveling internationally. Typhoid fever is still common in the developing world, where it affects about 12.5 million persons each year [4]. Visiting or living in areas where

the disease occurs is a risk [5]. An estimated 17 million cases of typhoid fever and 600,000 deaths occur worldwide, annually [6]. 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. Twelve million people are infected with typhoid annually [7]. Eighty percent of typhoid fever cases reported in Nyahururu District Hospital are from Maina slum [8]. This is an indication that typhoid fever is a disease of public health importance in this slum.

Maina slum being densely populated is potentially a high-risk area for typhoid outbreak. In Maina slum the prevalence of typhoid fever was estimated to be five percent by the year 2005 despite provision of treated water, and sanitation services by Nyahururu Municipal Council [9]. Eighty percent of typhoid fever cases reported in Nyahururu District Hospital are from Maina slum. This is an indication that typhoid fever is a disease of public health importance in this slum. The effects of typhoid fever range from

negative socio-economic impact to the majority of the patients who require several weeks to recover, and hence is a major public health concern [10]. In addition of typhoid having a direct socio-economic effect [11] to those infected and affected, typhoid drugs are also expensive and thus the effectiveness of measures put in place to prevent it is imperative.

LITERATURE REVIEW

Typhoid fever is still common in the developing world, where it affects about 12.5 million persons each year [12]. Visiting or living in areas where the disease occurs is a risk [13]. An estimated 17 million cases of typhoid fever and 600,000 deaths occur worldwide, annually [14]. Globally, there are four billion cases of diarrhea among children; cholera infected 120,000 people in 2002 and in the same year there were 50,000 cases of guinea worm in thirteen African countries [15]. Six million people are blind because of trachoma and twelve million people are infected with typhoid annually [16].

Complications such as intestinal hemorrhages of perforation can develop in untreated patients or when treatment is delayed [17]. 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 (Levine, 1990). 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% [18]. Persons with typhoid fever usually have a sustained fever as high as 103⁰ to 104⁰F (39⁰ to 40⁰ C). The diagnostic test for typhoid is demonstration of antibodies to *Salmonella typhi* in blood [19].

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 feces in water or food [20]. Faecal pathogens are frequently transferred to the waterborne sewage system, through flush toilets and pit latrines subsequently contaminating surface and ground water [21]. In regions with poor sanitation, the bacteria often spread after water supplies are contaminated by humans' waste [22].

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 [23]. 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 odors[24].

Pathogenic organisms that cause typhoid fever enter into the water as a result of a damaged or faulty sewer or water pipes and 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 [25]. When water mixes with sewage it has high potential to cause diarrhea [26]. Water borne diseases are the prime cause of premature deaths worldwide, especially for young children [27]. Increase in urban population may lead to an increased risk in food and water supply contamination [28].

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 [29]. When people who are carriers of typhoid fail to wash their hands thoroughly with soap and clean water after defecation 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 [30]. Poor sanitation practices are a cause of bacterial, viral, protozoa and helminthic infections [31].

In many developing countries there exists a high prevalence of water and sanitation related diseases causing many people to fall sick or even die [32]. Feces 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 [33]. This pathway is known as the faecal-oral route of disease transmission [34]. 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 [35]. In regions of the world where sanitation and garbage disposal are lacking, typhoid fever continues to destroy life [36]. Moreover, the rapid increase in the population combined with a massive migration to urban areas has led to the formation of urban centers 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 [37]. 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 [38]. 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* [39]. Food and water is rendered unfit for human consumption when contaminated with *Salmonella typhi* [40] and many naturally occurring water sources are liable to such contamination at some point [41]. Typhoid fever is spread in faecally contaminated food and water and often comes in epidemics; hence it is one of the dangerous infections [42]. The majority of urban populations are tenants in informal settlements where basic services such as water and sanitation are inadequate [43]. Visiting or living in areas where the disease occurs is a risk [44].

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 [45]. 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 [46].

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 [47]. People should wash their hands with soap and hot water before handling food items. Using soaps

kills the typhoid bacteria [48]. 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 [49]. 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 [50] but control of typhoid fever outbreaks is mainly by sanitation and not immunization [51]. 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 [52].

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 [53]. Typhoid fever can be prevented and is treated with antibiotics such as chloramphenicol, ampicillin, tetracycline, cotrimaxazole, trimethoprim-sulfamethaxazole and ciprofloxacin [54]. 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 [55]. 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 [56]. The hygienic disposal of excreta is important because the infective organism for typhoid fever leaves the body in the faeces 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 [57]. In Laikipia District, 72.9% of households have pit latrine as the main human waste disposal [58]. 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 [59]. Sanitation on the other hand remains a major challenge in Kenya, largely due to inadequate provision and poor management of existing facilities [60]. According to the Kenya National Development Plan [61] 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 [62].

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 [63]. 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 ongoing according to the Water Act, 2002.

In summary there are three key hygienic practices which are paramount to prevention of typhoid fever [64]. Disposal of faeces 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 faeces, 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

RESULTS AND DISCUSSION

Hand washing and occurrence of typhoid fever

The results from this study indicated that 69.7% of the respondents practiced hand washing, 30.3% did not.

The respondents stated that they did not wash their hands due to either lack of enough water, cost of water, had never suffered from typhoid before and due to hunger of food. Hand washing had no influence of the prevalence of typhoid fever. This could be as a result of lack of using the soap during hand washing ($\chi^2=2.423$; $df=3$ $p=0.489$).

Improvement of Food Premises and Food Handling

In this study 56.6% suggested that health educating the food handlers on hygienic practices was the way forward towards improving the food premises, 24.3% suggested that there was need of public health officers' involvement, 19.1% said taking the food handlers to court who did not comply with health regulation was the solution. The above show that all the respondents were in agreement that improvement of food premises and handling of food was paramount towards control of the prevalence of typhoid. This means that lack of improvement of the food premises and handling of foods would contribute to high prevalence of typhoid fever ($\chi^2 = 5.211$; $df=3$ $p=0.157$).

Health Education

The results revealed that 98% had heard about typhoid fever through a health education session and the rest 2% had not. These results show that health education was being carried out immensely as a typhoid preventive measure in Maina slum. Lack of health education was a risk factor towards the prevalence of typhoid fever ($\chi^2=4.025$; $df=1$ $p=0.045$).

Domestic water Treatment in Maina slum

A greater number (63.3%) boiled water before drinking. There were also other forms of domestic water treatment which were practiced in Maina slum by individual household. The finding further pointed out that, typhoid prevention is not fully done for there were 33.9% respondents who did not treat their drinking water before drinking. Domestic water treatments in Maina slum were not effective interventions in control of typhoid fever for there was no significance between the treatments and the prevalence of typhoid fever ($\chi^2=2.707$ $df=2$ $p=0.258$).

Protection of underground surface water

A smaller number (44.4%) had protected their water sources. This show that there was minimal effort done towards the water protection in prevention of water contamination and ultimately prevention of typhoid fever in Maina slum by the respondents. The findings further showed that protection of underground water sources was not a priority to Maina slum dwellers hence protection of the water sources had no influence on control of prevalence of typhoid fever ($\chi^2=1.152$ $df=1$ $p=0.283$).

Tap water cost reduction

A majority (57%) of the residents did not afford tap water services, 43% afforded. This suggested that tap water was not affordable to facilitate proper hygiene practices thus making prevention of typhoid in Maina slum difficult throughout the year. The cost of water would not have any influence on typhoid prevalence. These results shows that there was no statistical relationship between cost of tap water and prevalence of typhoid fever ($\chi^2=1.561$ df=1 p=0.212)

DISCUSSION

Occurrence of Typhoid fever in Maina slum

The findings of this study showed that 63% of the residents had suffered from typhoid fever in one or more times in their life time, and only 37% had not. This is a clear indication that typhoid fever is prevalent in Maina slum. These results showed that those with low level of education were more than 50% and they suffered from typhoid episodes in their lifetime more than those with higher level of education. The elderly people were more vulnerable to typhoid as 87% (38-47years) fell sick from typhoid. This could be due to low immunity with old age. This suggests that likelihood of getting infected with typhoid was high to an individual with a prolonged stay in this slum as opposed to newcomers in the slum. These results concurred with the findings of [72] who found out that visiting or living in areas where typhoid fever occurs is a risk factor. The employed suffered the least though the un-employed and the self-employed suffered equally (28.28%) from typhoid. The success of control of typhoid fever would focus on the age limit and brackets. Both gender suffered from typhoid similarly. This means that the best strategy in control of typhoid fever would be to target both males and females adults because all were at risk of contracting typhoid.

CONCLUSIONS

In conclusion, it was evident that there was a typhoid fever occurrence in Maina slum at 63% while the prevalence was at 10% during the time of the study. This signifies that water and sanitation intervention measures in place are ineffective in reduction of typhoid fever prevalence which has doubled from 5% in 2005 to its current status. Intervention measures should be intensified by all the line government ministries for typhoid fever prevalence doubled from 5% to 10% despite water and sanitation intervention measures being in place.

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