International Journal of Medical, Medicine and Health Sciences
ISSN: 2517-9969
Vol:12, No:9, 2018

The Impact of Open Defecation on Fecal-Oral Infections: A Case Study in Burat and Ngaremara Wards of Isiolo County, Kenya

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***Abstract*—**The practice of open defecation can be devastating for human health as well as the environment, and this practice persistence could be due to ingrained habits that individuals continue to engage in despite having a better alternative. Safe disposal of human excreta is essential for public health protection. This study sought to find if open defecation relates to fecal-oral infections in Burat and Ngaremara Wards in Isiolo County. This was achieved through conducting a cross-sectional study. Simple random sampling technique was used to select 385 households that were used in the study. Data collection was done by use of questionnaires and observation checklists. The result show that 66% of the respondents disposed-off fecal matter in a safe manner, whereas 34% disposed-off fecal matter in unsafe manner through open defecation. The prevalence proportions per 1000 of diarrhea and intestinal worms among children under-5 years of age were 142 and 21, respectively. The prevalence proportions per 1000 of diarrhea and typhoid among children over-5 years of age were 20 and 20, respectively.

***Keywords*—**Fecal-oral infections, open defecation, prevalence proportion, sanitation.

I. Background

HUMAN excreta can contain over 50 known bacterial, viral, protozoan and helminthes pathogens [1]. Poor human excreta disposal and lack of adequate personal and domestic hygiene have been implicated in the transmission of many fecal-oral diseases including cholera, typhoid, cryptosporidiosis and *Ascaris lumbricoide,* among others [2].

An estimated 2.6 billion people in the world lack access to improved sanitation facilities, such as a basic pit latrine, a toilet connected to a piped sewer system or a septic tank, or a composting toilet [2]. Globally the number of people practicing open defecation (OD) is about 1.8 billion [3]. As a result of the large-scale practice of OD in relation to other factors, the death rate of children globally is shocking and horrific, since one child is dying in every 15 seconds [4]. Although the majority of those people who lack access to sanitation are ultra-poor and poor in the world, it is interesting that those who are not poor also practice OD [3].

In sub-Saharan Africa and Southern Asia, sanitation coverage is 31% and 33%, respectively [2]. Looking at the regional statistics, the situation is worse with approximately 215 million people in sub-Saharan Africa engaging in OD which has led to high transmission of diarrheal diseases [5]. This is the state despite the milestones made in provision of the water and sanitation facilities. As a result of this, there was a need to further understand the underlying causes of some of the risky sanitation behaviors such as insanitary disposal of faeces.

According to [6], it is estimated that 60% of Kenyans has access to improved sanitation facilities. About 18% of the population in Kenya practice OD. Kenya is not on track in achieving the sanitation development goal target of 79% for sanitation coverage. Access level to sanitation in Kenya is low and this indicates that some people still practiced OD especially in the rural areas where people do not have access to sanitation at a household level and it remains to be a major challenge in Kenya even after increasing the number of sanitation facilities [7].

Human excreta can contain over 50 known bacterial, viral, protozoan and helminthes pathogens [8] Poor human excreta disposal and lack of adequate personal and domestic hygiene have been implicated in the transmission of many fecal-oral diseases including cholera, typhoid, hepatitis, polio, cryptosporidiosis and *Ascaris lumbricoides* among others [9]. These pathogens may be transmitted through the ingestion of contaminated food, water or other beverages, by person-to-person contact and by direct and indirect contact with infected faeces. Human excreta-transmitted diseases predominantly affect children and the poor. Most of the deaths among children in developing countries occur as a result of diarrhea [10].

Several studies have revealed this interesting phenomenon where people have latrines but don't use them. For example it was found out in an Indian study that despite people living in households with latrines, they still practice OD [11]. Such discoveries highlight the need of understanding the fecal disposal behavior, opinions, taboos and beliefs on latrine use. A study by [12] also showed that people preferred defecating in the open as latrines smelled badly and that those likely to defecate openly were men, boys and children as opposed to girls and women due to cultural limitations and privacy. In the same study women believed that the faeces of infants were less harmful than adults and therefore presences of infants' faeces were not a problem. It was also found that the risks of human and animal excreta were not well understood among the households. All this brought out the importance of understanding the underlying practices of fecal disposal

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among households in Isiolo County. This was to explain such behavior as OD and the appropriate intervention strategies to ensure success.

According to [13], latrine coverage in Isiolo County was at 48%. A study on Exploring Kenya's inequality on human waste disposal by wards in Isiolo County indicated that Burat ward had improved sanitation, while Ngaremara had unimproved sanitation. According to [14], research on an integrated and nutrition survey that was done in Isiolo County revealed that 37.6% of households practice OD and the most prevalent illness affecting children under-5 years of age was watery diarrhea, affecting 10.3% of infants annually. As we compare Isiolo County and other ASAL counties in Kenya in terms of sanitation it is more of the same in latrine coverage. Therefore, there was need to evaluate the impact of OD on fecal-oral infections in Isiolo County.

II. Materials and Methods

A. Study Area

Isiolo County is located in the upper eastern region of Kenya. Isiolo County is subdivided into three administrative districts; Isiolo Central, Garbatula and Merti. The county covers an area of 25,336.1 km^2 with temperatures ranging from 12°C to 28°C. The county borders seven other counties: Samburu and Garissa to the East, Tana River to the south east, Kitui and Meru to the south west, Marsabit to the North West and Wajir to the north east. This study was carried out in two wards in Isiolo County: Ngaremara ward and Burat ward.

B. Demography and Socioeconomic Characteristics

According to the Kenya National Bureau of Statistics (KNBS) report of 2009, the population of Isiolo County was 143,294. The male population was 73,080 (51%), whereas the population of female was 70,214 (49%). This county is inhibited by five tribes including; Samburu, Meru, Borana, Turkana and Somali.

Isiolo County is classified under Arid and Semi-Arid Lands (ASALS) in Kenya receiving less than 150 mm of rainfall annually. The type of soil in the study area is sandy soil which is saline in nature. This soil has got very low water retention capacity, thus making it difficult for the residents to engage in crop farming. Areas like Garbatulla are totally dry and no agricultural activity takes place. The communities practice animal husbandry and most of them are nomadic pastoralists moving from one place to another in search of water and pasture for their livestock, and therefore they do not have permanent sanitation facilities.

III. Results and Discussion

Between 2015 March and 2016 April, a cross-sectional study was carried out in Burat and Ngaremara wards of Isiolo County to evaluate OD and the burden of fecal-oral infection. Purposive sampling was used to select the two wards in Isiolo County. For this case, Burat and Ngaremara wards were selected. These two wards had both OD-free areas and OD areas. Simple random sampling was used to select 385 households. Questionnaires and observation schedule were used to collect data of the fecal disposal practices and prevalence proportions of fecal-oral infections. Observation schedule was used to find out whether the household owned a pit latrine or not. The households were also asked if any of their family members (aged under-5 and over-5 years) suffered from diarrhea, intestinal worms or typhoid within a period of six months, retrospectively. Descriptive statistics and frequency distribution tables were used to manage the data.

The findings show that 34% of the studied households had no latrines. This implies that the household members practiced OD, whereby they used the bush around the home or near the bush. Sixty six percent of the studied households owned latrines. It was observed that of those households (66%; n= 262) who owned latrines, 46% (n=117) of the households owned traditional pit latrine, 39% (n=99) of the households owned simple pit latrine whereas 15% (n=38) of the households owned a ventilated pit latrine**.**

According to Kenya Certification guidelines, each household in Kenya is supposed to have its own latrine and those villages that are OD-free areas should have close to 100% latrine coverage [15]. This is contrary to what we observed in the study area, since 34% of the study population had no latrine and they practiced OD. OD has adverse impacts to the health of people and also to the environment. OD results in massive fecal contamination of the environment putting people at risk of exposure to disease causing pathogens.

This study is comparable with other studies done elsewhere. The study undertaken in rural area of Ethiopia revealed that 67.7% of the studied households had latrines. This study is also in consistent to the annual report of the district health office of Bahir Dar Zuria, where the latrine coverage was 43.6% [16]. Low latrine coverage had got adverse health impact to the people. Low latrine coverage encourages OD, which in turn causes the contamination of water bodies leading to transmission of water related diseases.

The prevalence proportions of fecal-oral infections among children aged under-5 years and over-5 years are shown in Figs. 1 and 2.

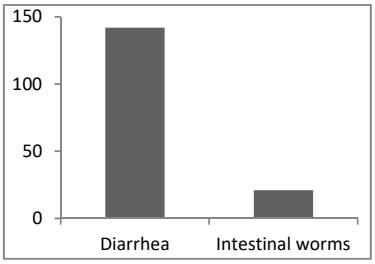

Fig. 1 Prevalence proportions per 1000 of diarrhea and intestinal worms of children aged under-5 years

Fig. 1 reveals that diarrheal disease was most prevalent among children aged under-5 years in the two wards of Isiolo County. This could be attributed to disposing of fecal matter in a manner that is not safe (OD). It is very significant for a community to have knowledge on fecal-oral infections and

also to have knowledge on how to prevent transmission of these diseases. Having the primary barriers in place is very important, since fecal matter is prevented from entering the environment. This can be done through disposing fecal matter for both young children and adults in a safe manner.

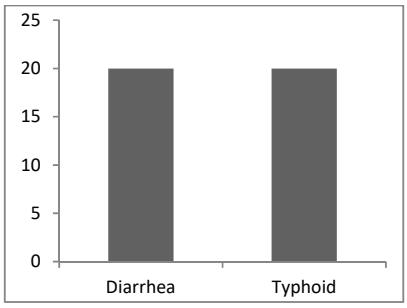

Fig. 2 Prevalence proportion per 1000 of diarrhea and typhoid among children aged over-5 years

In Kenya about 16% of deaths among children below five years are as a result of diarrhea [17]. A study by [18] on Diarrhea and malnutrition among children in Ijara District in the North-Eastern Province in Kenya indicated that 8.7% children aged under-5 years had a bout of diarrhea every month. In Kenya, the prevalence proportions of intestinal worms among children in the under-5-year age range from 12.6% to 54% [19]. Another study done in Kampala Uganda by [20] revealed that 32.8% of children aged below-5 years were found to have at least a single intestinal parasitic infection. Typhoid is a diarrheal disease which is classified under water washed diseases and is transmitted fecal-orally.

This study is in line with a study done by [21] in urban areas of Tanzania, which revealed that the prevalence of typhoid increased significantly ($P<0.0001$). The frequency of cases increased from 580-1400 cases per 100,000 in 2003 and also from 771-941 cases per 100,000 in 2007. The reason for the increase was associated with low latrine coverage, improper drainage and personal hygiene. This is in line with what was observed in the study area, since the latrine coverage was low and the prevalence rate of typhoid was higher. Diarrhea and typhoid among children aged over-5 years can be as a result of poor hygiene practices and poor fecal disposal practices among the adults. Higher prevalence of diarrhea can also be as a result of failure to wash hands at the most critical time to wash hands (such as after visiting the latrine, after changing the baby and before eating). It can also be due to disposing human excreta in an unsafe manner such as practicing OD in the fields and bushes near residential areas, which in turn contaminates the environment (soil and water).

In a study that was done in Taabo in Côte d'Ivoire by [22] revealed that the prevalence rates of intestinal worms were higher, whereby the prevalence rates of hookworm was 33.5%, *S. haematobium* 7.0%, *trichuris trichiura* 1.6%, *Schistosoma mansoni* 1.3% and *Ascaris lumbricoides* 0.8%. Parasitological examinations also detected *Entamoeba histolytica* 14.4% and *Giardia intestinalis* 15.0%. Only 20% of the households had a latrine in their household vicinity; therefore, OD was commonly practiced.

Intestinal worms among the under fives could be due their behavior of geophagia (eating of soil) and also putting everything they touch in their mouths. Eating of soil and dirt among children aged under-5 years is a risk factor for contracting intestinal worms. With OD, soil is contaminated by the pathogens causing intestinal worms. So, when infants and young children eat soil they may end up eating contaminated soils putting them at risk of contracting intestinal worms.

Another study by [23] revealed that the most common intestinal worms that infected students were *E.coli, E. Vermicularis* and *G. intestinalis.* Out of 639 students, 145 students were infected by one or more intestinal worms, 29 students were infected with more than one worm and 26 students were infected with 2-3 intestinal worms.

Intestinal worms, diarrhea and typhoid are transmitted through fecal-oral pathways that are mainly the primary routes of transmission where faeces penetrate the human environment through fluids, fields, flies, or fingers. These routes of transmission are perpetuated by inadequate sanitation and hygiene fingers, fields, floods and fluids. Therefore, fecal-oral infections can be prevented through creating effective barriers such as disposing fecal matter in a safe manner (disposing faeces and urine in a latrine) and proper hygiene practices such as washing of hands at the most critical time (after visiting the toilet, before eating and after changing a soiled baby). This study is in agreement with the study done by [24], which revealed that sanitation prevents contamination of the environment by human faeces and, therefore, to prevent transmission of pathogens that originate in faeces of an infected person, it is very important to have sanitation facilities in place, and thus, to dispose of human excreta in a safe manner. Having sanitation facilities at the household vicinity prevents contamination, since it creates a primary barrier. Faeces are enclosed in the latrine and this stops transmission of a disease. This prevents initial contact with faeces, since the human waste is prevented from being exposed to the environment. In addition, basic hygiene practices such as hand washing with soap, and provision of a safe and reliable water supply is of great significance in preventing fecal-oral infections. Washing hands after visiting the toilet creates a secondary barrier. This does prevent ingestion of faeces, as the failure to wash hands may lead to transmission of disease causing pathogens, which may lead to infections.

IV. Conclusion

The results of the study show that 66% of the studied households disposed of fecal matter in a safe manner. The common fecal oral infections in the study area were diarrhea, intestinal worms and typhoid. The prevalence proportion per 1000 of diarrhea and intestinal worms among children aged under-5 years was 140 and 20, respectively. The prevalence proportions per 1000 of diarrhea and typhoid among children aged over-5 years were 20 and 20, respectively. This study revealed that the practice of OD as a way of disposing human

excreta has an impact on the prevalence of fecal-oral infections in Ngaremara and Burat ward of Isiolo County.

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