LEVELS AND DIFFERENTIALS OF OCCURENCE OF WATER BORNE DISEASES AT MOI UNIVERSITY, KENYA

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ABSTRACT

Water borne diseases continue to be among the leading fatal diseases globally. Kenya being one of the developing Sub-Saharan countries that are mostly affected by these water related diseases due to the numerous threats that arise from unsafe water, lack of water deteriorating personal hygiene, poor water and infrastructural systems. The research assumed a census survey where all the reported incidences of waterborne diseases majorly diarrhea, Cholera, Dysentery and Typhoid among the students and the entire population around Moi University in the stated study periods were studied. The study relied on secondary data which was obtained from Moi University Clinic and from other relevant data on waterborne diseases specifically Typhoid, Dysentery, Cholera and Diarrhea. The key parameters for the study included the Cadre (that is whether the patient was a student or a civilian), waterborne related diagnosis, age in years of the patients, Gender, Frequency of occurrence of the disease (i.e. whether it's an old or new case of the disease) and month of occurrence of the disease. Derived values of tables, percentages, graphs and charts were adopted for data presentation. To determine relationship and significant differences between variables data was subjected to inferential statistics which include chi square. All the Analysis was performed using SPSS Version 25.0 and the model was tested at 5% level of significance. The data was analyzed using Chi-square to show relationship between variables. Based on gender, the number of males diagnosed with waterborne disease is higher compared to females. Of the four cadre groups, the study revealed that students are the most diagnosed with waterborne diseases at the Moi University Dispensary. Diarrhea was found to be the most reported of the four waterborne diseases under study with males being the most affected with diarrhea.

Keywords: Differentials, Dysentery, Cholera, Diarrhea, Typhoid, Waterborne Diseases.

1. INTRODUCTION

Water-Borne diseases are still a major public health and environmental concern even though the government and other agencies have employed numerous efforts and strategies to try and curb the menace. Waterborne diseases and death continue to be a worldwide burden in both developed and developing countries. Much of the world's population lack access to sufficient and safe water suppliers. According to UNICEF (United Nation Children's Fund) and WHO (World Health Organization) worldwide, 780 million people do not have access to safe water and an estimated 2.5 billion people in developing world lived without access to adequate sanitation. These diseases continue to plague most of African countries. According to WHO, lack of access to safe drinking water, together with inadequate sanitation and hygiene is a contributing factor to the 2.5 million annual deaths caused by diarrheal diseases majorly cholera, dysentery, typhoid fever and diarrhea (Kosek et al., 2003; Obi et al., 2003; Obi et al., 2004). Kenya is a low income, food-deficient country with a population of 46 million and a per capita yearly income of USD 1202. In 2007, Kenya's position on the UNDP (United Nations Development Programme) human development index was 148th of 177 countries.

ISSN: 2223-9944, e ISSN: 2223-9553
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About 58% of the population lives below the poverty line. Therefore, economic productivity is unevenly distributed between central places characterized by high population density, commercial agriculture, industries and the sparsely populated areas characterized by pastoralism and subsistence agriculture. It is also a home to a number of refugees.

Major health problems in Kenya, which could possibly be exacerbated by this crisis relate to communicable. This is because a large population does not have access to clean and safe and clean water, not just in Kenya but all over the world. According to WHO, 1.1 billion people in the world's population lack access to safe drinking water. Poor sanitation, improper waste disposal and the lack of water are a big threat to residents in Kenya.

Water borne diseases are leading causes of both childhood and adulthood morbidity and mortality. Diarrheal infections are responsible for approximately 2.5 million deaths annually in developing countries, affecting both children under five years of age and adulthoods (Kosek et al., 2003). Many diseases in Kenya have proven to be water related. And Moi University was no exception since all its occupants use water for several purposes. Due to the focus of these diseases mainly on children under the age of five, the disease has continued to attack even those over the stated age. The major causes of these diseases are hygienically related that is poor sanitation, use of unsafe water and improper disposal of wastes.

2. LITERATURE REVIEW

Waterborne diseases also known as water related diseases, are defined by WHO as any adverse effects such as illnesses, disorders, disability or even fatalities on the health of a person that changes as a result of water quality or quantity, caused either directly or indirectly (Kosek et al., 2003). Most of these diseases are contacted through ingestion, inhalation or dermal contact as a result of one being exposed to contaminated environments characterized by poor sanitation and safe water access conditions (CDC, 2001; Sobsey et al., 2002).The world has suffered fatalities as a result of these diseases that date back to the early centuries and it is noticed that they are more prevalent in third world or developing countries. The diseases that are covered in this report are cholera, typhoid fever, dysentery and diarrhea.

Globally, waterborne disease is the second highest cause of mortality both among children and adults (WHO/UNICEF, 2010). According to WHO Global Burden of disease 2004 estimates, among the waterborne diseases Diarrhea alone accounts for nearly 1.8 million deaths or 17% of under-five mortality each year in developing countries. WHO estimates that 85% to 90% of diarrhea illnesses in developing countries can be attributed to unsafe water, inadequate sanitation and hygiene practices. Diarrhoea is defined as having three or more loose or liquid stools per day or having more stools than is normal (WHO, 2009).It is a common cause of death in developing countries and the second most Common cause of infants and adults deaths worldwide (Hogue, 1996). The loss of fluids through diarrhea can cause dehydration and electrolyte imbalances. In 2009, diarrhea was estimated to have caused 1.1 million deaths in children over five years and 1.5 million deaths in children under the age of five.

Oral rehydration salts and zinc tablets are the treatment of choice and have been estimated to have saved 50 million children in the past 25 years (WHO/UNICEF, 2000). There are many causes of infectious waterborne disease (diarrhea, Dysentery, Cholera, and Typhoid Fever) which include viruses, bacteria and parasites. Nor virus is the most common cause of viral diarrhea in adults but Rotavirus is the most common cause of death in children under five years old. Adenovirus types 40 and 41 and Astroviruses cause a significant number of infections (WB, 1992). The bacterium Campylobacter is a common cause of bacterial diarrhea but infections by Salmonella,*Shigellae* and some strains of Escherichia Coli (E.Coli)

ISSN: 2223-9944, e ISSN: 2223-9553

are frequent. The organisms in the total coliform groups are called indicator organisms. Its presence in water requires an analysis of all water systems facilities and their operations to determine how these organisms entered the water system (NPHLS, 2008). E Coli is a specific species within the Coliform bacteria. Its presence indicates a strong likelihood that human or animal wastes are entering the water system (NPHLS, 2008. Amoeba usually lives in the large intestines sometimes invading walls of the intestines forming a cyst. This causes ulcerations and bleeding with bouts of dysentery occurring. In 20% of the infected cases, no symptoms show. It is fecal oral and spread through a cyst (WHO, 2010). Crypto infection is spread through fecal oral route and often through contaminated water. It affects the intestines and is usually acute. It is the organism most commonly isolated in HIV positive patients presenting with diarrhea (WHO, 2010). In the elderly, particularly those who have been treated with antibiotics for unrelated infections, a toxin produced by *Clostridium difficile* often causes severe diarrhea (NDDIC, 2007).

In sanitary living conditions where there's ample food and a supply of clean water, an otherwise healthy person usually recovers from viral infections in a few days (Kosek, 2003). However, for ill or malnourished individuals, diarrhea can lead to severe dehydration and can become life threatening. According to (Moses et al 2010), most of the pathogenic organisms that cause diarrhea and all the pathogens that are known to be major causes of diarrhea are transmitted primarily or exclusively by the fecal-oral route. Faeco-oral transmission may be waterborne, food borne or direct transmission which implies an array of other faeco- oral routes such as via fingers or fomites or dirt which may be digested by young children. According to a survey by Nisha and Nicholas (2010), despite the severe impact of diarrhea on children's health and mortality in India, only half of all children suffering from diarrhea receive treatment or medical advice. An understanding of the socio-demographic determinants for appropriate treatment of the disease is critical.

3. METHODOLOGY

3.1 Study Design

The research adopted a cross sectional design since the study focused on determining occurrence of waterborne diseases, levels and differentials of occurrence of waterborne diseases. The research predominantly focused on Typhoid, Diarrhea, Cholera, and Dysentery incidences among students at Moi University and the general population around the institution. To establish the occurrence of waterborne diseases (Typhoid, Cholera, diarrhea and Dysentery) a retrogressive study covering six year (2013 to 2019) was be used.

3.2 Target and Study Population and Sample Frame

Population refers to collection of individuals or objects having related attributes (Cooper & Schindler, 2011). We ensured the population selected was a representative.

The sampling frame describes the list of all population units from which the sample will be selected (Cooper & Schindler, 2011).Our research assumed a census survey where all the reported incidences of waterborne diseases specifically diarrhea, Cholera, Dysentery and Typhoid among the students and the entire population around Moi University between the year 2013 and 2019 was studied.

Kesses constituency has a population of approximately 84,894 People (KNBS, 2015). Moi University Main Campus has a population of about 25,000 students. The study covered all the reported cases of the disease around Moi University across all the ages between 2013 and 2019.

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3.3 Data Collection Instruments, Methods and Techniques

The key parameters for the study included the Cadre (that is whether the patient was a student or a civilian), waterborne related diagnosis, age in years of the patients, Gender, Frequency of occurrence of the disease (i.e. whether it's an old or new case of the disease) and month of occurrence of the disease. For purposes of identification and confidentiality no names was used. The data was then cleaned in preparation for analysis.

3.3.1 *Determining prevalence of waterborne diseases*

To determine the type and frequency of distribution of waterborne diseases in Moi University we reviewed disease records from Moi University Medical clinic for the period of study. The main aim was to determine which cadre category recorded a high incidence of waterborne diseases during the stated study period. Derived values of tables, percentages, graphs and charts were adopted for data presentation.

3.3.2 *Levels and differentials of occurrence of waterborne diseases*

To determine association and significant differences between variables data was subjected to inferential statistics which included Chi-square.

3.3.3 *Data management and Analysis*

For data management, data from hospital registers were coded into spread sheet and then imported to SPSS Version 25.0 software for analysis. A descriptive statistic through cross tabulation was employed to analyze the data for distribution of waterborne diseases with main statistical tools being tables, graphs, percentages, frequencies, mean (median) and standard deviation. An independent t-test was used to check for any significance seasonal difference between the numbers of cases infected with waterborne diseases. Chi Square was implemented to test for difference in the number of infected cases among age groups.

4. DATA ANALYSIS AND RESULTS AND DISCUSSIONS

Table 1: Test for Normality

	Kolmogorov-Smirnov[a]		
	Statistic	**Df**	**Sig.**
Year	0.201	3199	0.0001
Month	0.167	3199	0.0001
Age	0.281	3199	0.0001
Gender	0.345	3199	0.0001
Diagnosis	0.439	3199	0.0001
Cadre	0.425	3199	0.0001
Occurrence	0.515	3199	0.0001

a. Lilliefors Significance Correction

Test for normality

Table 1 above shows a Kolmogorov-Smirnov test for normality. The test indicates that all the variables do not follow a normal distribution, since p-value = 0.0001, is less than 0.05.

ISSN: 2223-9944, e ISSN: 2223-9553

Table 2. Distribution of Gender

Gender	Frequency	Percent
Male	1625	50.8
Female	1574	49.2
Total	3199	100.0

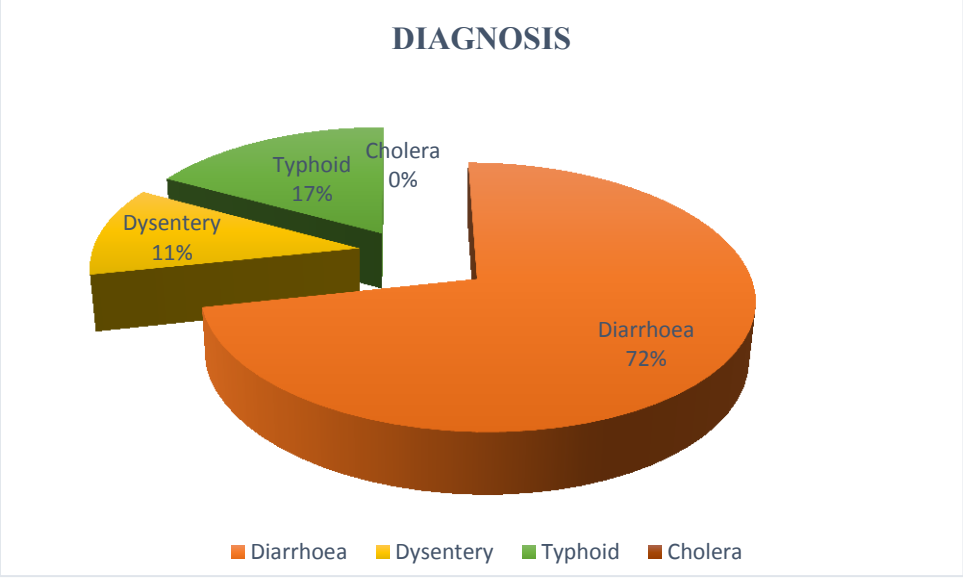
Table 2 From the 3199 sampled survey, majorities were males, 1625 (50.8%) and the minority was females, 1574 (49.2%) as indicated in the table 2 above.

Table 3: Distribution of diagnosis

Diagnosis	Frequency	Percent
Diarrhea	2293	71.7
Dysentery	363	11.3
Typhoid	542	16.9
Cholera	1	0.0003
Total	3199	100.0

Table 3 The study showed that of all the reported cases of the disease, Diarrhea indicated a large number of cases 2293(71.7%), followed by Typhoid, 542(16.9%) Cholera had the least number of reported cases with a nullable percentage of 0.0003%. The rest are shown in Table 3 above.

The pie chart below shows the simplified summary of the diagnosis.



Distribution of Diagnosis.

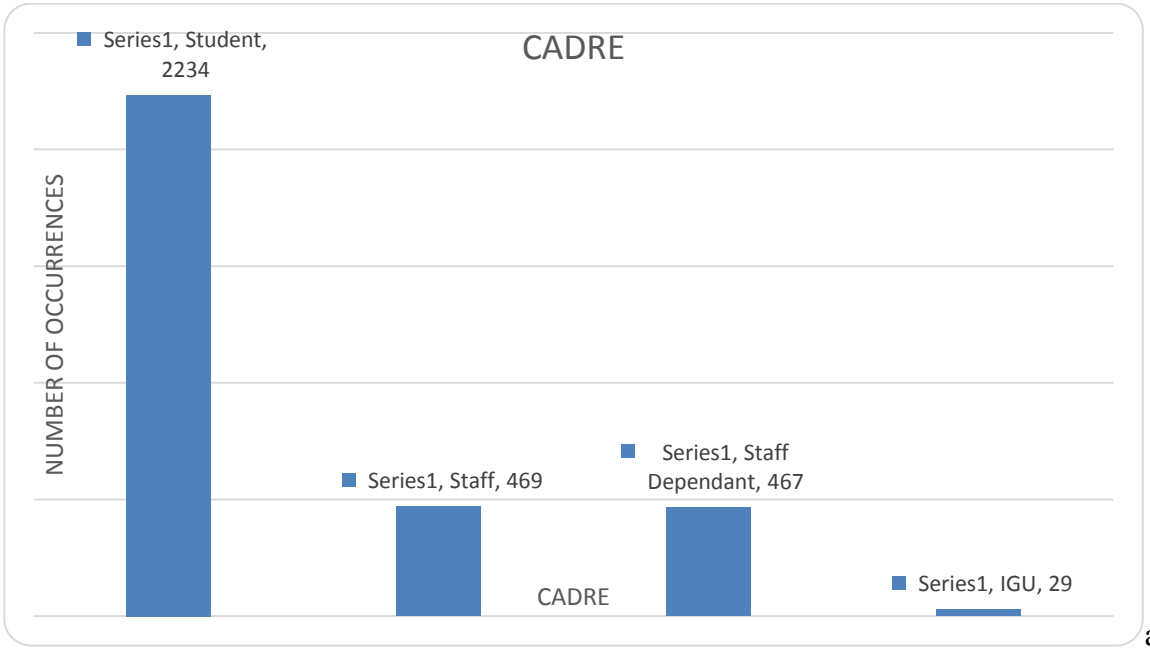
Figure 1. Pie chart representing distribution of diagnosis

Table 4. Distribution of Cadre

Cadre	Frequency	Percent
Student	2234	69.8
Staff	469	14.7
Staff Dependent	467	14.6
IGU	29	0.9
Total	3199	100.0

Distribution of Cadre

From the study on the reported cases of the diseases, students had the highest number 2234(69.8%) and the least were those in the IGU group, 29 (0.9%). The rest of the distributions shown in table 4. A simple bar chat of the findings is as shown below:



are

Figure 2. A bar graph of cadre distribution

Table 5: Distribution of occurrence

Occurrence	Frequency	Percent
First time	2735	85.5
More than once	464	14.5
Total	3199	100.0

A descriptive statistic on the occurrence of the diagnosis showed the first-time visitors as the most, 2735(85.5%) and those who had repeated cases of the disease was the lowest, 464(14.5%) as shown in the table 5 above.

ISSN: 2223-9944, e ISSN: 2223-9553

Table 6: A cross tabulation between Gender and Diagnosis

	Diagnosis					
Gender	**Diarrhea**	**Dysentery**	**Typhoid**	**Cholera**	**Total**	**Chi-Square**
Male	1191	152	282	0	1625	0.003
Female	1102	211	260	1	1574	
Total	2293	363	542	1	3199	

A cross tabulation was done between the gender and diagnosis and the outcomes presented in table 6 above. The study revealed that of the victims, males had the highest number of the reported cases in diarrhea (1191), with dysentery being (152), typhoid (282) and no reported cases of cholera. Females had (1102) reported cases of diarrhea, dysentery (211) the highest of the two groups, with the least case coming from cholera (1). A chi-square test of association between gender and diagnosis produced a P-value=0.003 which is less than 0.05, implying that there is an association between gender and diagnosis.

Table 7: A cross tabulation between cadre and diagnosis

	Diagnosis					
Cadre	**Diarrhea**	**Dysentery**	**Typhoid**	**Cholera**	**Total**	**Chi-Square**
Student	1622	297	314	1	2234	0.0001
Staff	277	47	145	0	469	
Staff Dependent	373	18	76	0	467	
IGU	21	1	7	0	29	
Total	2293	363	542	1	3199	

Tabl 7 above define a cross tabulation between cadre and diagnosis. In this case students were the most affected (2234), with diarrhea being the most diagnosed and cholera (1) being the least of all. The study also showed Income Generating Unit (IGU), 29 to be the least victims of the diagnosis with most of them having reported cases in the diarrhea (21), followed by typhoid (7) and no record on the cholera. A chi-square test of association between cadres and diagnosis produced a P< 0.05, implying that there isan association between cadre and diagnosis.

Table 8: A cross tabulation between months and diagnosis

	Diagnosis					
Months	**Diarrhea**	**Dysentery**	**Typhoid**	**Cholera**	**Total**	**Chi-Square**
January	140	19	59	0	218	0.0001
February	147	19	29	1	196	
March	187	20	33	0	240	
April	147	38	46	0	231	
May	214	34	35	0	283	
June	160	17	21	0	198	
July	86	8	31	0	125	
August	131	12	40	0	183	
September	203	29	38	0	270	
October	302	37	49	0	388	
November	375	101	99	0	575	
December	201	29	62	0	292	
Total	2293	363	542	1	3199	

ISSN: 2223-9944, e ISSN: 2223-9553

A cross tabulation between months and Diagnosis was done. The month of November reported most cases (575 of 3199) while the month of July had the fewest cases (125 of 3199).

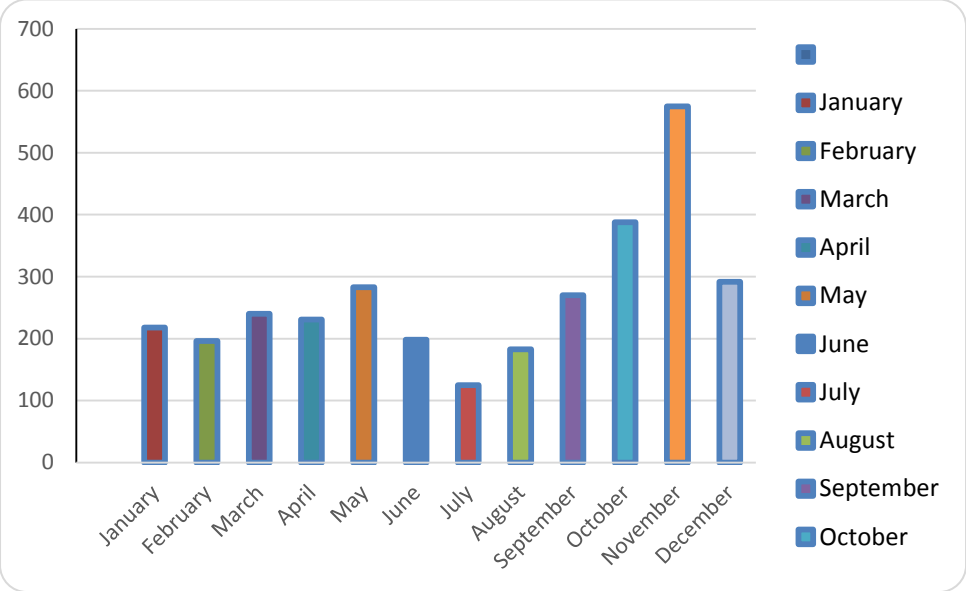


Figure 3. Graph of distribution of waterborne diseases across months

From Table 8, diarrhea had most occurrence in November (375 out of 2293) and the least in July (86 out of 2293). Dysentery is most prevalent in November (101 out of 363) and lowest reported cases were in July (8 of 363). For Typhoid, a large proportion of cases were experienced in November (62 out of 542) and June depicted the least diagnoses (29 out of 542). Across the study period, cholera only reported a single case in February. The chi-square value is less than 0.05, suggesting that there is an association between months and diagnosis. The graph shows the general distribution of waterborne diseases across months.

5. CONCLUSIONS

1. The number of students affected by the waterborne diseases is higher compared to the rest of the cadre group. Keeping in mind that most students reside within the school hostel, the high numbers can be attributed to poor hygiene in their living quarters, which may range from poor sanitation to unsafe drinking water.
2. Typhoid has a reducing trend over the years. The numbers of reported typhoid diagnoses have steadily decreased among all the four cadres. This is key to note regarding the waterborne diseases under study. Nevertheless, the same cannot be said for diarrhea, dysentery and cholera.
3. Of the sampled data, cholera reports close to 0%. It is worth noting that the numbers of reported cases of cholera are almost zero. These findings are crucial to Moi University dispensary and administration in control and prevention of water related infections.
4. Diarrhea and dysentery show a random pattern of ups and downs throughout the period under study. Dysentery is most prevalent in November and least rampant in August. On the other hand, diarrhea reports most cases in March and lowest cases in December.
5. Generally, the month of November has the highest number of reported cases of waterborne diseases among all the four cadres. In July, however, the least number of occurrences of water related diseases is observed. This is an average depiction of the distribution of the prevalence of all diseases considered under the research across the year.

ISSN: 2223-9944, e ISSN: 2223-9553

REFERENCES

[1]. CDC (Center for Disease Control and Prevention), (2001). Safe water systems for the developing world: a handbook for implementing household-based water treatment and safe storage projects, Atlanta: CARE/CD Health Initiative.

[2]. Kosek, M. Bern, C. Guerrant, R. (2003). *Division of geographic and international medicine*. USA: University of Virginia.

[3]. National Digestive Disease Information Clearinghouse (NDDIC) (2007). *Digestive disease statistics.* http://digestive.niddk.nih.gov/statistics/.htm/

[4]. NPHLS, (2008). *National public health laboratory. Food & water quality control Services*. Kenya: Nairobi

[5]. Obi C.L., Green E., Bessong P.O., De Villiers B., Hoosen A.A., Igumbor E.O., Potgieter N. (2004). Gene encoding virulence markers among E.coli isolates from dirrhoic stool samples and river sources in rural Venda communities of South Africa. *Water SA. 30*:37-42.

[6]. Obi C.L., Potgieter N., Bessong P.O., Matsuang G. (2003). Scope of potential bacterial agents of dirrhoea and Microbial assessment of quality of river water sources in rural Venda communities in South Africa. *Water, Science and Technology, 47*:59-64.

[7]. Sobsey M.D. (2002). Managing water in the home: accelerated health gains from improved water supply. WHO, Geneva, Switzerland.

[8]. UNICEF/WHO, (2009). *Diarrhea: Why children are still dying and what can be done.* September 2009. USA: UNICEF/WHO.

[9]. UNICEF/WHO, (2009). *Diarrhea diseases.* USA: UNICEF/WHO.

[10]. WHO, (2010). *Diarrhea incidences in low and middle income*. Switzerland, Geneva: WHO.

[11]. WHO and UNICEF, (2000). *Global Water Supply and Sanitation Assessment.* WHO/UNICEF. Geneva/New York, 80pp.

ISSN: 2223-9944, e ISSN: 2223-9553