

PREVALENCE OF WATER-BORNE DISEASES WITHIN THE HEALTH FACILITIES IN NAKURU DISTRICT, KENYA

APPLIED EPIDEMIOLOGY
UNIVERSITY OF NAIROBI
KENYA

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A dissertation submitted for the requirement of Certificate in Applied Epidemiology
in the Department of Community Health,
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October 2001

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ACKNOWLEDGEMENTS

We would like to give thanks unto the Supreme Personality of Godhead, Krsna, for strength and wisdom that He bestowed on us during the entire project.

Our unending gratitude goes of the South African and Ethiopian Departments of Health, and World Health Organisation, for sponsoring us. We would also like to extent our thanks all the staff members of the Department of Community Health, Faculty of Medicine, University of Nairobi, Kenya, for imparting us with the knowledge of Epidemiology.

Hlupheka Chabalala and Hailemariam Mamo

Special thanks to my sons, Miyelani Trinity, and Matimbha Haile Chabalala, and my special friend and colleague, Ms Mathabo, Joyce Phoshoko, for being my inspirations. Another special dedication to the Directorate, Communicable Diseases Control staff for their support. And encouragement.

Hlupheka Chabalala

ABSTRACT

Prevalence of water-borne diseases within health facilities in Nakuru, Kenya.

Aims and Objectives

The main aim of the study was to determine the prevalence of water-borne diseases in Nakuru, from 2000 to June 2001. The specific objectives were to determine the extent of water-borne diseases within the health facilities in Nakuru, and also to determine the proportion and types agents of water-borne diseases.

Methodology

A cross-sectional study was conducted; whereby 28 128 outpatient records were reviewed. Data was captured and analysed using Epi-Info 6.04b. The study was conducted in Nakuru Provincial General Hospital and Njoro Health Centre.

Major Findings

The total of 28 128 records were reviewed and 1 568 cases were identified as having water-borne diseases [Typhoid Fever, Gastroenteritis, Amoebiasis and Dysentery]. The overall prevalence rate of water-borne diseases was 56/1000 population for the two facilities, and 39/1000 population and 17/1000 population in the hospital and health centre respectively. Outbreaks\upsurges were observed to be seasonal, and most of these occurred in March and May each year.

Conclusions and Recommendations

The burden of these diseases is high, and water-borne diseases can be prevented at community level, instead of managing them at a tertiary hospital. Therefore, health education and provision of safe drinking water and adequate sanitation should be priority in Nakuru. outbreak or rapid response teams should be established at all levels of the health care system.

PREVALENCE OF WATER-BORNE DISEASES WITHIN THE HEALTH FACILITIES IN NAKURU, KENYA

1. Introduction

1.1 Background

Water-borne diseases are among the most recent emerging and re-emerging infectious diseases throughout the world. The emerging and re-emerging infectious diseases have recently proven to be the biggest health threat worldwide and they contribute between 70-80% of health problems in developing countries.

The most well known water-borne diseases such as cholera, dysentery, and typhoid are the leading causes of morbidity and mortality. The causative agents of water-borne diseases may be bacterial, viral and protozoal in nature, and this is true during both epidemic and endemic periods.

The burden of these diseases is most felt in almost all African countries, especially in the tropical areas of the region, including Kenya. The bulk of these have been reported from the other countries in the tropical rain forests, e.g., Tanzania, Uganda and the Central African Republic, Rwanda and Burundi, however, the extent of their problem had not been clearly defined within the health facilities in Kenya. Information from data sets compiled during numerous outbreaks in the country offer minimum light in this area.

1.2 Research Question

The research question for this study is as follows:

- “What is the prevalence of water-borne diseases within the health facilities in Nakuru District, from January 2001 to June 2001?”

1.3 Rationale

Despite the increasing workload due to water-borne diseases at all levels of the health system, there is no satisfactory documentation showing the magnitude of the problem in health facilities. The rationale of this study was divided into different reasons. Firstly, no work was done in this area of study in Nakuru; therefore, this study was aimed at investigating new knowledge that may be added into the school of knowledge in the district and country as a whole.

Secondly, the study was aimed at determining the burden of water-borne diseases in the health facilities, and as a result, the findings will be useful in planning, management and evaluation of health services in the district. The information will also provide the health system with intervention strategies to curb the problem of water-borne diseases. This study will also provide opportunities for future studies to fill in the gaps that this study could not address. Finally, on completion, this study will be published both in regional and international journals. That is, the academicians and the scientific community will benefit from the findings of the study.

1.4 Literature Review

1.4.1 Water and Sanitation in Nakuru

Accessibility of safe drinking water, particularly among the low-income communities is still a problem in developing countries. Nakuru, which is located in the African Rift Valley, in Kenya [156km from Nairobi], has been faced with declining economy and crumbling infrastructure. Water supply falls short of demand, resulting in many residents using less than what is considered sanitary [1]. Poor waste disposal mechanisms in both urban and rural areas are below satisfactory requirements, and this contribute in the pollution of water sources in the district.

1.4.2 Agents of Water-Borne Diseases

Some of the major emerging and re-emerging water-borne agents are: *Vibrio cholerae* biotype El Tor Serotype O139. This microorganism is responsible for cholera, which is a painless form of diarrhea, characterised by rice-watery stool. *Escherichia coli* O157:H7 is an emerging *E. coli* strain responsible for most dysentery cases even in developed countries [2].

Salmonella typhi is responsible for typhoid fever, and recently, resistant strains of this microorganism have been reported in most developing countries. *Giardia* and *Cryptosporidia* species are causative agents of most of the Gastroenteritis diseases reported around the world. Viral agents like *hepatitis* species are also among the worst causative agents of water-borne diseases in Africa, Asia and South America. It should be understood that there are numerous types of microorganisms responsible for water-borne diseases, besides the ones mentioned above [2].

1.4.3 Morbidity and Mortality due to Water-Borne Diseases

Water-borne diseases are "dirty-water" diseases; mainly attributed to water that has been contaminated by human, animals or chemical wastes. Worldwide, it has been shown that water-borne diseases are responsible for over 12 million deaths a year. This is mainly due to poor sanitation facilities; and unsafe drinking, washing, and cooking water [3]. Millions of people throughout the world have little access to sanitary waste disposal infrastructure or clean water. As a result, millions of people are at risk because of lack of access to safe drinking water and adequate sanitation facilities.

Diarrhoeal diseases, which are major water-borne diseases, are prevalent in many countries, mainly due to inadequate sewage treatment. An estimation of 4 billion cases of diarrhoeal disease occurs every year, causing 3- 4 million deaths among children [3]. The World Health Organisation [WHO] has reported that water-borne diseases kill more people more than any other disease in the world [4].

Swaddinwudhipong and colleagues showed that there is a strong association between shigellosis and drinking unboiled water ($p < 0.05$, odds ratio 2.8) [5]. The study showed that the inhabitants who were without adequate water supply had 7.0% attack rate. The implication of piped water was supported by faecal contamination in piped water system. This therefore demystifies the misconception that piped water is always safe for drinking especially in developing countries [5].

An outbreak in Maharashtra, India, affected 415 individuals, and all of them presented with enteric fever. This was attributed to faecal contamination of water. Poor sanitation facilities and waste disposal mechanisms can therefore be seen as one of the main contributing factors of almost all water-borne diseases [6].

Varslot and his team [1996] described an outbreak that took place in central Norway in 1994 and 1995. The epidemics were associated with contamination of drinking water by stools from Pink-footed geese. *Campylobacter jejuni* was isolated in untreated water, and 50% [n=1000] of the individuals examined were diseased. It can therefore be said that the interaction of man and domestic animals or birds poses a serious threat towards the health of humans [7].

A hepatitis E virus outbreak in Islamabad, Pakistan, in 1993-94 affected 36 705 individual, and had the attack rate of 16.3%. The breakdown in water treatment was associated with these outbreaks. The attack rate was the highest in the age group 11-30 (AR=15.3%), and the attack rate among pregnant women was even higher, 21.6%. The case fatality rate among non-pregnant women was 11.4% [8]. A study conducted on the illnesses associated with water-borne diseases showed that the following are common symptoms: abdominal cramps (80%), diarrhea (75%), appetite loss (69%), nausea (68%), and the mean duration of these diseases was 7.4 days [9].

South Africa, Malawi, Zimbabwe, Swaziland, Zambia and Mozambique had cholera outbreaks as from August to date. These outbreaks were attributed to lack of safe drinking water and adequate sanitation. By the end of June 2001, South Africa had 103 425 cases, 212 deaths

and the case fatality rate of 0.02%. This was reported as a breakthrough in the history of cholera outbreaks, because other countries has the case fatality rates of more than 20% to 50% [10].

The studies above clearly show that water-borne diseases are a serious health threat, particularly in developing countries. The WHO reported that water-borne diseases are killer number one in Africa, especially in the tropics. The studies reviewed above also addressed outbreaks in different countries, whereas this study focussed on routine data collected in the health facilities in Nakuru.

It can therefore be understood that these water-borne diseases are a great burden to the health system; however, the extent of the problem had not been determined in health facilities in Nakuru. It is against this background that this study was conducted in order to determine the prevalence of water-borne diseases within Nakuru health facilities.

2. Aims and Objectives

The overall aim of this study was:

- To determine the prevalence of water-borne diseases within the health facilities in Nakuru district from January 2000 to June 2001.

The specific objective of this study is:

- š To determine the extent of water-borne diseases reported in the selected health facilities in Nakuru district, and
- š To determine the proportion and types of agents of water-borne diseases confirmed in laboratories in Nakuru district.

3. Methodology

3.1 Study Design

The study design employed in this study was descriptive and observational in nature. Investigators therefore used a cross sectional type study in carrying out the investigation in Nakuru.

3.2 Study Population

The study population was the residents of Nakuru seeking health care services in Nakuru health facilities such as hospitals, clinics and community health centres. Nakuru is found west of Nairobi, 7 200km². The Infant Mortality Rate in Nakuru is 46/1000 live births, and the crude birth and death rates are 13.8/1000 and 6.7/1000 respectively.

3.3 Sampling and Study Sample

The estimated sample size [number of records] was calculated using the following formula:

$$n = \frac{Z^2 \times p(1-p)}{d^2} = 384 \times 78 = 3840 = 28\ 000$$

n = estimated number of records to be reviewed,

Z = 95% confidence level [1.96],

p = estimated proportion of water-borne diseases [50%],

d = precision [0.05]

Investigators were advised by the Biostatistician to use high sample size in order to increase the power and reliability of the study and its findings.

3.4 Data Collection Methods

3.4.1 Data Collection Tools and Procedures

This was a quantitative study and as a result, the measuring instruments used were quantitative in nature. A checklist modified from hospital, clinic and laboratory records was developed and used to collect quantitative data from and health facilities records [Appendix A].

Outpatients records from one hospital [Nakuru Provincial General Hospital (NPGH)], and one health centres [Njoro Health Centre (NHC)] were reviewed. Records reviewed were dated from the year 2000 up to June 2001 registers.

An Epi-Info 6.04b statistical package was used to create a checklist, and data from the records were entered directly from the records into the Epi-Info 6.0b file. Laboratory reports for the two health facilities were reviewed so as to determine the type and proportion of agents of water-borne diseases tested and confirmed from year 2000 to June 2001 in Nakuru.

4. Results and Discussions

4.1 Data Analysis

A statistical package, Epi-Info 6.04b was used to capture quantitative data, and the same programme was used to manage, process and analyse data.

4.2 Findings

The total number of 28 128 health facilities records were reviewed, 16 124 from Nakuru Provincial General Hospital [NPGH], and 11 974 from Njoro Health Centre [NHC]. However, data analysis concentrated on the records of individuals that were identified to be having water-borne diseases. Out of 28 128 records reviewed, 1 568 cases were identified as suffering from water-borne diseases.

4.2.1 Demographic Data

The two tables shown below show the frequency distribution of the individuals identified to be having water-borne diseases.

Table 4.1 Sex distribution of cases with water-borne diseases n Nakuru [n=1 568]

Sex	Number [n]	Percentage [%]
Male	752	48.0
Female	816	52.0
Total	1568	100

Table 4.1 shows the sex distribution of the cases with water-borne diseases. The table indicates that 52.0% [n=816] of the water-borne diseases victims were females, whereas 48.0% [n=752] were males. The reason for this distribution was hypothesised to be due to the fact that women's activities involve water usage in many ways, e.g. cooking washing and bathing. As a result women found to be prone to these diseases. Moreover, it has been also proved in

numerous studies the women are more likely to seek medical attention more than their male counterparts.

Table 4.2 Age distribution among water-borne diseases cases, [n=1 423]

Age	Number [n]	Percent [%]
0-19	450	31.6
20-29	400	28.1
30-39	294	20.7
40-49	148	10.4
50+	131	9.2
Total	1423	100

Tables 4.2, clearly indicates that water borne diseases are most prevalent among the younger age groups. The age group 0-19 years had 31.6% [n=450] of the total number of water-borne diseases, and is followed by the 20-29 years age group with 28.1%.

The older age group 50 and above had the least 9.2% [n=131], mainly because the number of patients that presented to the health facilities in this age group was also very low. Interestingly, only 5.8% [n=82] were under five years of age. It should be noted that the total number of cases in this table is 1 423. This is because of missing data on the variable age from the records.

4.2.2 Proportions of Water-Borne Diseases

Figure 4.1 below illustrates the proportions of water-borne diseases in the two health facilities, and these were identified as:

- Amoebiasis
- Dysentery
- Gastroenteritis
- Typhoid Fever

Typhoid fever was identified as the leading form of water-borne diseases reported in the two health facilities. Typhoid contributed up to 49.0% [n=768] of the four water-borne diseases

together. Typhoid was followed by Gastroenteritis with 29.0% [n=448], and Amoebiasis with 18.0% [n=288]. Dysentery contributed only 4.0% [n=64] of the total number of water-borne diseases.

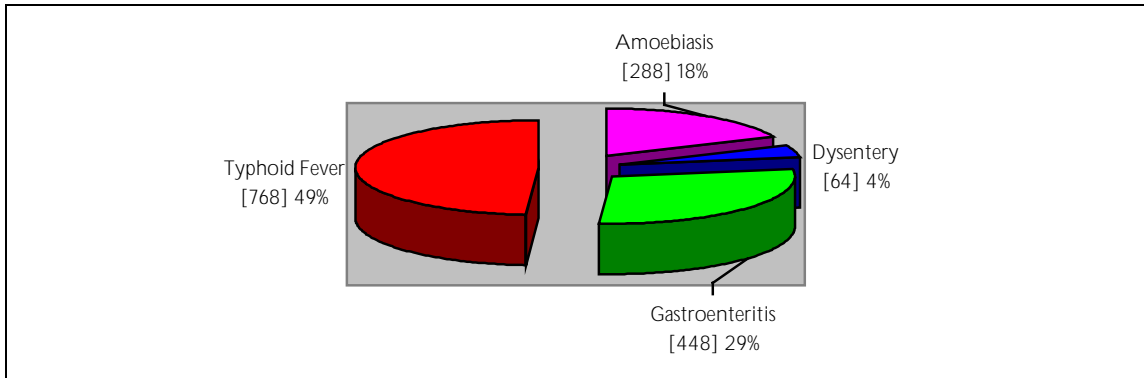


Figure 4.1 Proportion of water-borne diseases in Nakuru health facilities [n=1 568]

Personal communication with health personnel and laboratory technologists revealed that poor human waste disposal mechanisms in the district contribute towards the escalating amounts of these water-borne diseases in the district. For example, sewage in Egerton University is dumped in one of the rivers in Njoro, which is the only source of water.

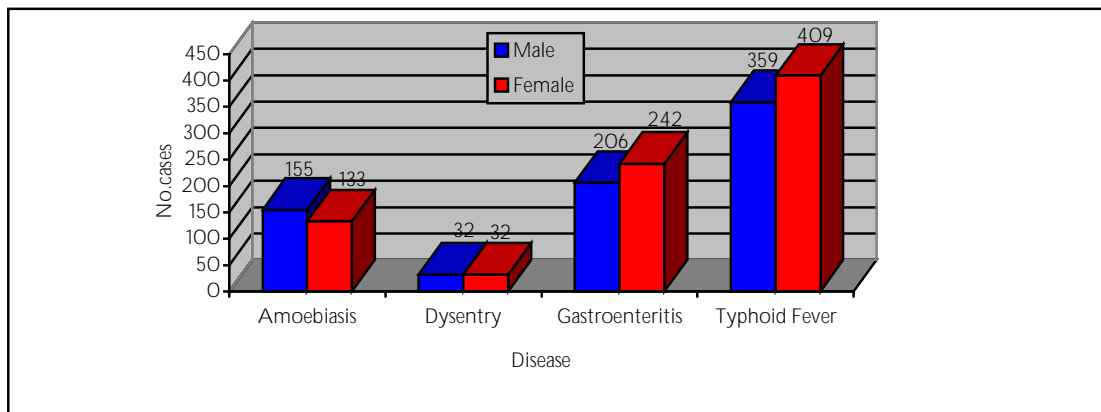


Figure 4.2 Number of water-borne diseases by sex in Nakuru health facilities [n=1 568]

Figure 4.2, above, shows the distribution of males and females by water-borne diseases reported in Nakuru Provincial General Hospital and Njoro Health Centre. As described in Table 4.1, 52.0% of females were identified as having water-borne diseases. This can also be seen clearly in Figure 4.2, particularly in so far as Gastroenteritis and Typhoid Fever are concerned. There were however more male [155] than females [133] who contacted Amoebiasis. There were an equal number of Dysentery cases between both males and females [32 each].

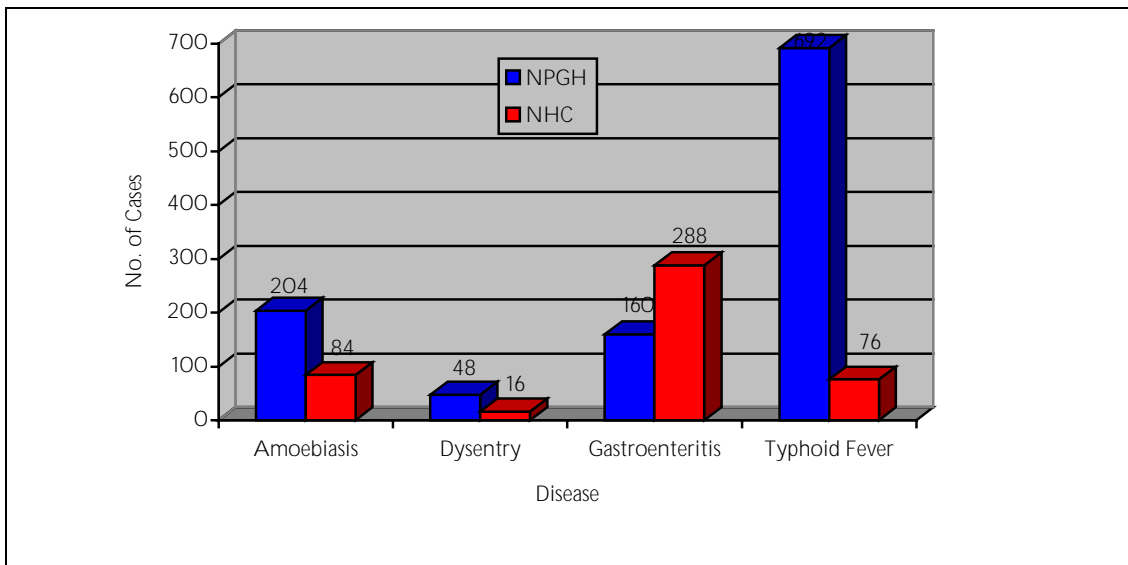


Figure 4.3 Distribution of water-borne diseases in Nakuru health facilities [n=1 568]

Figure 4.3 shows the distribution of water-borne diseases in the two health facilities in Nakuru. It is important to note here that out of 1 568 cases seen in the two health facilities, exactly 1 104 were from Nakuru Provincial General Hospital and 464 from Njoro Health Centre.

It should also be noted that this hospital is a referral hospital, whereas the health centre is at primary level. It is therefore clear that more cases were seen at the hospital; however, Njoro Health Centre had more cases of Gastroenteritis [n=288] than the hospital [n=160].

Table 4.3 Distribution of water-borne diseases by age group in Nakuru

	Amoebiasis	Dysentery	Gastroenteritis	Typhoid Fever	Total
Age Group					
0-19	84	14	209	143	450
20-29	81	14	98	207	400
30-39	46	17	62	171	294
40-49	30	6	22	90	148
50+	26	10	21	74	131
Total	267	59	412	685	1423

From Table 4.3, it can be seen that the age groups 0-19 and 20-29 were more likely to suffer from either Gastroenteritis or Typhoid Fever [$\theta^2 = 121.67$, $df = 12$, $p = 0.000$]. The older age group, over 40 years of age, had the lowest number of cases, even when the two are combined. This may be due to the fact that older people have been exposed to these diseases and have developed immunity against them.

4.2.3 General Trends of Water-Borne Diseases

The following graphs [Figure 4.4 to Figure 4.6] illustrate trends of water-borne diseases in Nakuru. The information is divided into general trends in the two facilities, and also into health facility specific information.

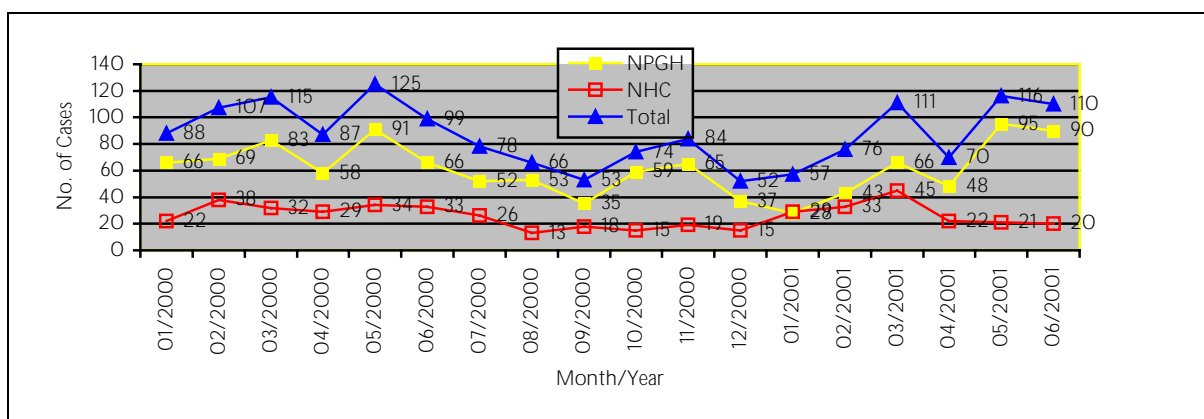


Figure 4.4 Monthly number of water-borne diseases in Nakuru health facilities [n=1 568]

Figure 4.4 illustrates the general monthly data of water-borne disease in the two health facilities. The lower graph [red] depicts monthly statistics in Njoro Health Centre, and it can be concluded that there was high number of cases report from February 2000 up to June 2000. A sharp increase was also be notice from December 2000 to March 2001.

The middle graph [yellow] depicts Nakuru Provincial General Hospital data, which is very irregular. However, two outstanding upsurges or outbreaks can be identified in May 2000, and May 2001. It can be concluded that these may have been seasonal upsurges/outbreaks in the areas. The conclusions drawn from hospital data are also true for the graph depicting the two facilities, but this is due to what is called the "cohort effect" or "number syndrome", but a clear picture will be shown in the rates section [Fig 4.8 and 4.9].

Figure 4.5 below indicates the monthly trends of the four water-borne diseases identified in Nakuru Provincial General Hospital. From the graph, Typhoid Fever stands out to be the leading cause of morbidity, and four peaks indicating outbreaks or upsurges can be seen in March and May 2000, and March and May 2001. These can also be linked to seasonal outbreaks, mainly due to climatic conditions such as rains.

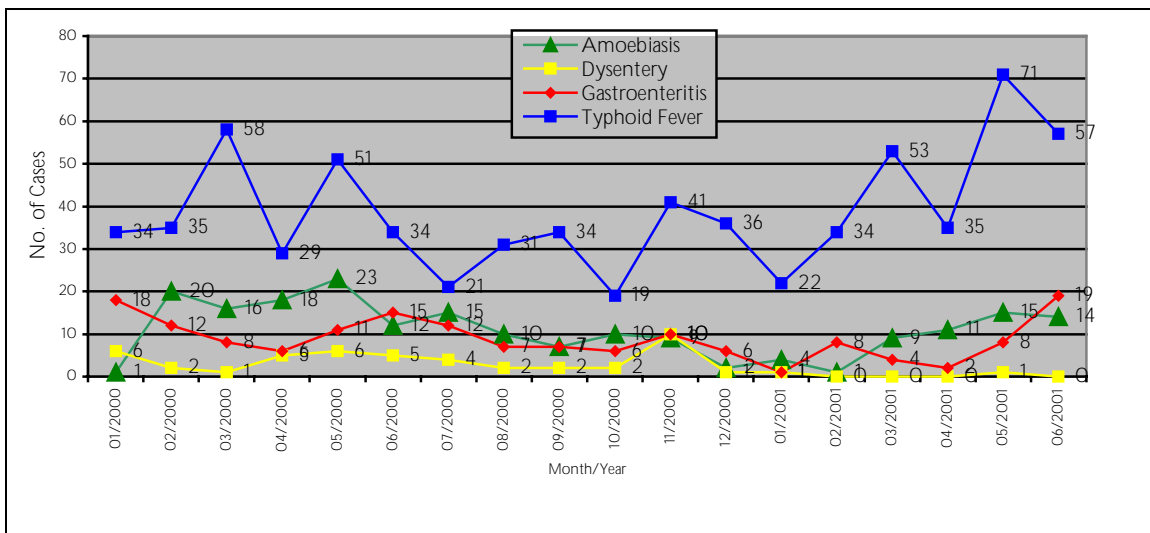


Figure 4.5 Monthly trends of water-borne diseases in Nakuru Hospital [n=1 104]

There was also an increase in the number of Amoebiasis cases from February to May 2000, and an increase is see again from February to May 2001. As in the case of Typhoid Fever, this observation may be due to seasonal and climatic conditions. Interestingly, Gastroenteritis also has two peaks in June of each of the two years, whereas high numbers of Dysentery were reported in November 2000.

These observations are very crucial in the implementation of early warning systems within the health departments or ministries. Planning and rapid response strategists may also be informed by evidence presented above.

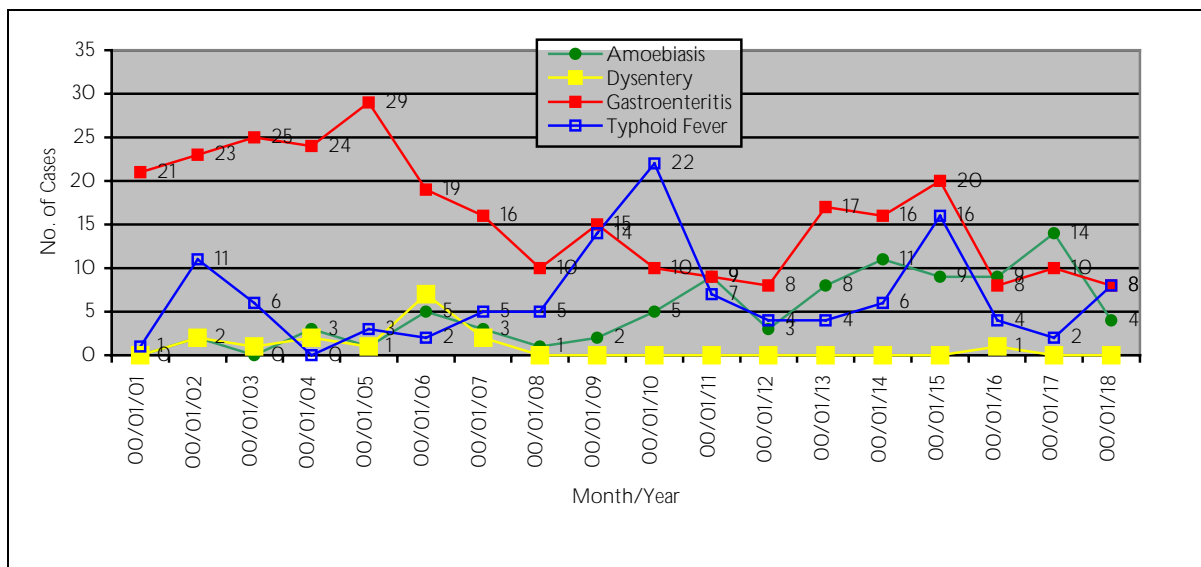


Figure 4.6 Monthly trends of water-borne diseases in Njoro Health Centre [n=464]

Unlike in the case of Nakuru Provincial General Hospital, Gastroenteritis, instead of Typhoid Fever is the leading cause of morbidity among water-borne diseases in Njoro Health Centre. An outstanding peak can be notice in May 2000, and this actually, started from March 2000. Another peak is in March 2001, and these observations strongly confirms the conclusions drawn in Figure 4.5, that most of these water-borne diseases may be seasonal in nature. Therefore preventive measures can be planned and disseminated to the affected areas prior to the onset of these upsurges\outbreaks.

Typhoid Fever is the second water-borne disease following Gastroenteritis, and upsurges/outbreaks were noticed in October 2000, and in March 2001. The prevalence of Amoebiasis was higher during May 2001. This was a built up from February, just like in Figure 4.5. No Dysentery cases were reported for the better half of 2000, until April 2001, where only one case was reported.

4.2.4 Prevalence Rates of Water-Borne Diseases

The overall prevalence rate of water-borne in the two health facilities from January 2000 to June 2001 was 56/1000 population (5.6%). However, The overall prevalence water-borne diseases in Nakuru General Hospital was 39/1000 population (3.9%), whereas, the prevalence in Njoro Health Centre was 17/1000 population (1.7%). Notice should be taken that the total number of records reviewed was 28 128, and this number was used as the denominator. However, when using the total number of records reviewed per health centre as denominators, the prevalence rates of all the water-borne diseases in these two health facilities were different. For example, the prevalence rate in the Nakuru Provincial General Hospital and Njoro Health Centre were 6.8% [n=16 244] and 3.9% [n=11 974] respectively.

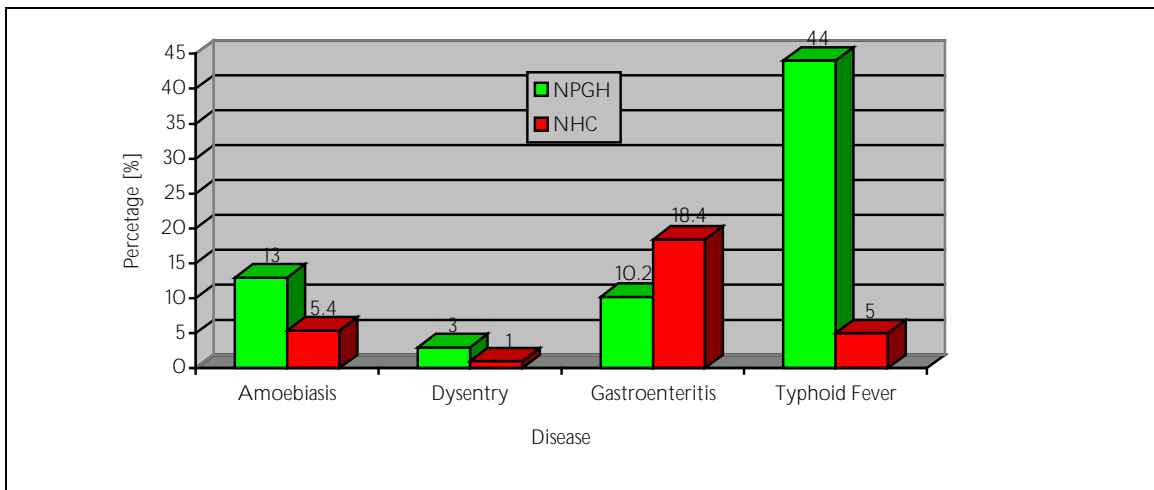


Figure 4.7 Proportion of water-borne diseases in the Nakuru health facilities [n=1 568]

Figure 4.7, above, confirms what was depicted in Figure 4.3 in terms of the proportion of water-borne diseases in Nakuru. More cases of water-borne diseases were seen in the hospital, with Typhoid Fever as the leading cause of morbidity, with the exception of Gastroenteritis, which indicated to be a major cause of morbidity in Njoro Health Centre. Dysentery appeared to be the least cause of morbidity, and contributed only 3% and 1% in the hospital and health centre respectively.

Table 4.4 Age distribution by the proportion of water-borne disease, 2000-June 2001

	Amoebiasis		Dysentery		Gastroenteritis		Typhoid Fever		Total	
	n	%	n	%	n	%	n	%	n	%
0-19	84	5.9	14	0.9	209	14.7	143	10.0	450	31.6
20-29	81	5.7	14	0.9	98	6.9	207	14.5	400	28.1
30-39	46	3.2	17	1.2	62	4.4	171	12.0	294	20.7
40-49	30	2.1	6	0.4	22	1.5	90	6.3	148	10.4
50+	26	1.8	10	0.7	21	1.5	74	5.2	131	9.2
Total	267	18.7	59	4.1	412	29.0	685	48.1	1423	100

The above table show the proportion of water-borne diseases distributed across the five age groups. This data also show that Gastroenteritis and Typhoid Fever as having the highest rate of the four diseases. Gastroenteritis contributed up to 14.7% among the 0-19 age group as compared to other age groups, whereas Typhoid Fever contributed 14.5% among the 20-29 age group. The 30-39 age group had the prevalence rate of 12.0% of the total number of cases.

The calculated monthly prevalence rate of the four diseases revealed Typhoid Fever again as the leading water-borne disease in Nakuru Provincial General Hospital [Figure 4.8, below]. The upsurges/outbreaks were in this case in March and May of each year, indicating seasonal upsurges/outbreaks of Typhoid Fever. Amoebiasis follows the trend observed in Figure 4.5.

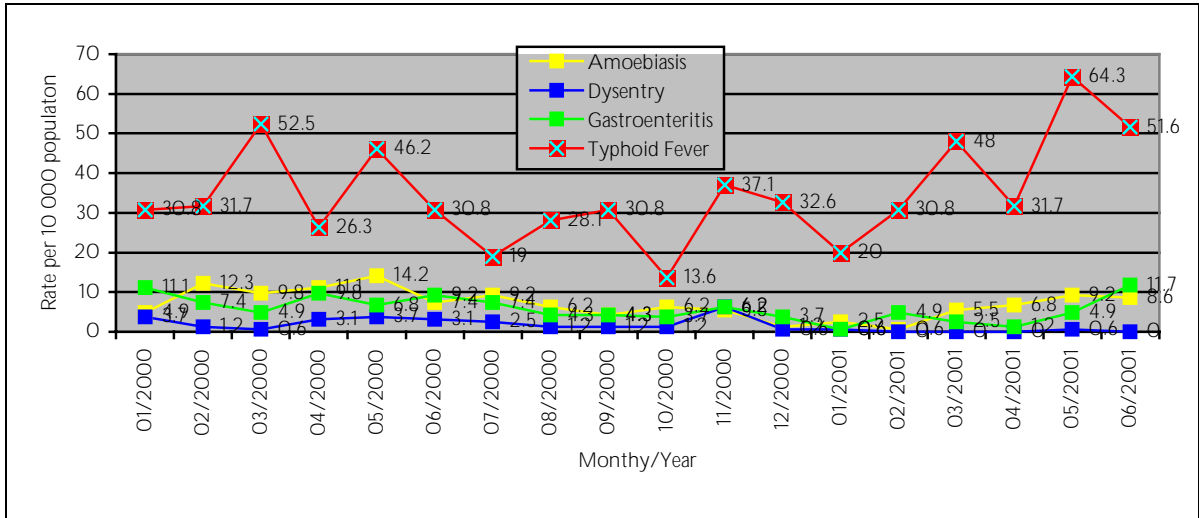


Figure 4.8 Monthly rates of water-borne disease in Nakuru Hospital, 2000-June 2001,

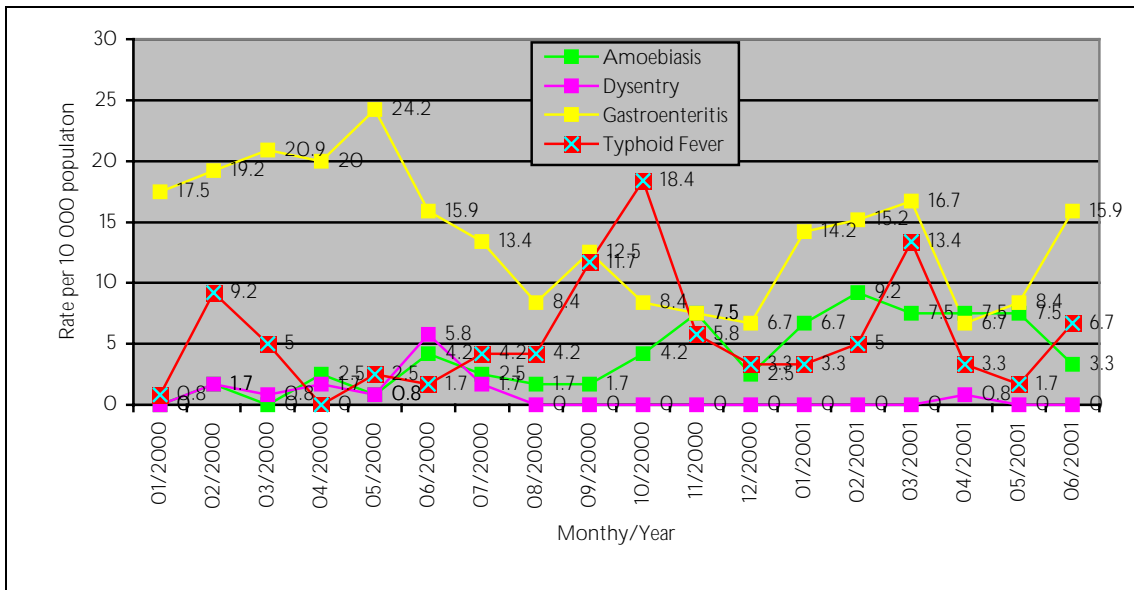


Figure 4.9 Monthly rates of water-borne diseases in Njoro Health Centre, 2000-June 2001,

The onset of Gastroenteritis upsurges/outbreaks can be traced from March to May of each year [Fig. 4.9]. Although Typhoid Fever is the second lead cause to water-borne diseases in Njoro, interventions to deal with these diseases cannot be limited only to Gastroenteritis.

Dysentery is less prevalent or posed less burden to the health system; however, this can be the source of major outbreaks in the future. These findings are useful in the sense that policy makers and outbreak response teams can be sensitised as to when upsurges and outbreaks are more likely to occur. The information presented herein suggests that these health officials need to plan rapid response activities, especially for Typhoid Fever, which already has resistant strains. This can be done at least two or three months before a sudden increase in the number of cases. Health educators and promoters as well, can use this information to promote messages on personal hygiene and proper sanitation. Resource allocation and publication activities can also be planned well prior to the onset of outbreaks.

4.3 Laboratory Results

Laboratory records were reviewed in order to determine the proportion of water-borne diseases confirmed through laboratory techniques. Table 4.5 below show the proportions laboratory confirmed cases of water-borne diseases.

Table 4.5 Proportions of laboratory confirmed water-borne diseases Nakuru

Agent	n	%
<i>E. histolytica</i>	522	33.3
<i>Giardia lamblia</i>	276	17.6
<i>Salmonella typhi</i>	1871	119.0 [49.1]

Only three causative agents of water-borne diseases were identified as *Entamoeba histolytica*, *Giardia lamblia* and *Salmonella typhi*. The leading cause of morbidity in this case was *Salmonella typhi* [119.0%]. The inflated percentage of cases is due to the fact that the number of confirmed cases on Typhoid included inpatients. However, when 1 568 outpatients were subtracted from 1 871 total number of Typhoid Fever was, 1 101 [assumed inpatients]. And about 1 871 – 1 101 equals 770, and the proportion of this number is 49.1%, and this was concluded that this is the actual proportion of outpatients that tested positive for Salmonella. The Widel technique was used instead of culture. Moreover, cases that were diagnosed clinically as Gastroenteritis may have included Typhoid Fever cases.

5. Conclusions

The tables and graphs in section 4 illustrated clearly the proportions of water-borne diseases in Nakuru. The main conclusions from this data indicate that three major microorganisms are responsible for water-borne diseases in Nakuru, and these are *Typhoid typhi*, *Giardia lamblia* and *Entamoeba histolitica*. Typhoid Fever was identified as the major cause of water-borne diseases within the health facilities, and this was followed by Gastroenteritis. Gastroenteritis covers a number of conditions, and was found to be the leading course of morbidity in Njoro Health Centre. This may be due to the fact the health personnel at health facility level are less qualified than those in the hospital to conclusively diagnose particular diseases. As a result, high proportions of Gastroenteritis in Njoro Health may be due limited and clinical diagnosis techniques, skills and knowledge.

Seasonal outbreaks or upsurges were identified both from the hospital and the health centre. It was difficult for the investigators to single out the peaks from the graphs as upsurges or outbreaks due to lack of trend data from the previous years. More data would indicate the trends of these diseases at least from the few past years. However, peaks were identified to be seasonal, particularly between March and May of each year, especially for Typhoid Fever and Gastroenteritis.

Of all the conditions on the outpatients seen in the two health facilities, 5.6% [56/1000 population] were water-borne diseases. About 3.9% [39/1000 population] was seen in the hospital and 1.7% [17/1000 population] was at Njoro Health Centre. The proportion of these diseases is high for outpatients, and these are actually preventable diseases that need not even reach the referral health facility like Nakuru Provincial General Hospital. This is an indication that there is poor water and sanitation facilities in the district [1]. Poor health promotion and personal hygienic behaviour is a major contributing factor as well. Poor health information system, especially trend data in the health facilities and laboratories pose a serious problem with regard to monitoring of diseases and planning and management of these conditions [6].

5.1 Recommendations

Given the conclusions drawn from the data in section 4, the following are the recommendation:

- Proper outpatient and inpatient surveillance systems need to be improved and monitored in Nakuru. This will contribute a great deal in improved health information system in the district, thus making it easy to implement early warning and rapid response systems for communicable diseases in Kenya.
- Prevention of water-borne diseases needs to form an integral part of the health education and health promotion in Nakuru. This will reduce the number of water-borne disease seen in health facilities, including referral facilities.
- Cost effective water purification mechanisms such as boiling and chlorination should be communicated to community members.
- Personal hygiene such as hand washing after using the toilet and before handling food should be stressed in health education messages.
- Water Affairs Ministry should be in the forefront in its duty of providing safe drinking water and adequate sanitation facilities.
- Industries and other institutions that produce a lot of human and other waste should be supervised and advised to dispose of these materials in a proper manner. Public Health Acts should be enforces, and polluters should be responsible for cleaning their waste, for example in rivers and streams.
- Further studies must be conducted in a large scale in Nakuru, whereby both health workers and community members are involved.
- Evidence-based decision making to should be encouraged, especially among policy makers.

6. References

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Appendix A

Checklist

Demographic Data

1. Hospital\Clinic Name:
2. District
3. Age\Date of Birth
4. Sex

Clinical\Laboratory Diagnosis

5. Diagnosis
6. Date of Diagnosis
7. Laboratory Confirmation
8. Sensitivity
9. Signs and Symptoms
10. Any other Comments