INFLUENCE OF IMPROVED WATER SUPPLY AND SANITATION ON THE PREVALENCE OF DIARRHOEAL DISEASES IN UASIN GISHU DISTRICT, KENYA

BY

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157/7202/2001

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF PUBLIC HEALTH AND EPIDEMIOLOGY OF KENYATTA UNIVERSITY

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SEPTEMBER, 2003
DECLARATION

This thesis is my original work and has not been presented for a degree in any other university or any other award.

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To my parents Joseph and Everlyne, my beloved wife Julie, children: Staysher and Jinaro thank you for your prayers during my studies at Kenyatta University.
ACKNOWLEDGEMENTS

In the process of carrying out my studies, I have received valuable support from several people and would wish to put on record my sincere acknowledgements. First I am greatly indebted to my supervisors Professor Alloys S.S. Orago for his professional guidance, tireless support and encouragement in the course of the study. Secondly to Dr. Isaac Mwanzo and Dr. Rekha Sharma who have put a lot of professional guidance at all levels of the study.

Sincere appreciation also goes to Mr. Alfred Langat, the Chief Public Health Officer Ministry of Health for his unwavering support and encouragement. I equally appreciate the moral and logistic support accorded to me by the District Public Health Office and particularly Mr. Gedfrey K. Maina, the District Public Health Officer, my Research Assistants Mr. Josphat Too, Mr. Benjamin Maritim and Caleb Maritim for their outstanding efforts and performance of all respondents, project staff and community members for taking their time to kindly and frankly provide information which was being sought in the study.

Finally, I am deeply indebted to my dear wife Julie for her support and courageously shouldering all the family responsibilities during the entire period of my studies at Kenyatta University.

May God bless you all.
ABBREVIATIONS USED IN THIS REPORT

AMREF: African Medical and Research Foundation
BOD: Bio-chemical oxygen demand
df: degree of freedom
DPHO: District Public Health Officer
E.H.P: Environmental Health Project
FGDs: Focus Group Discussion(s)
GOK: Government of Kenya
IDWSSD: International Drinking Water Supply and Sanitation Decade
MOH: Ministry of Health
PHC: primary Health Care
PHT: Public Health Technician
SIDA: Swedish International Development Authority
UN: United Nations
UNDP: United Nations Development Programme
UNICEF: United Nations Children Education Fund
URTI: Upper Tract Infections
WHO: World Health Organization
OPERATIONAL DEFINITIONS

Cross-sectional study
Is the study that examines the relationship between health related characteristics and other variables if interest exists in a particular point in time.

Diarrhoea episode
Passage of three or more liquid stools within a period of 24 hours in a two-week recall period.

Water contamination
Define as the access of mammalian and especially human faeces to water.

Health
As defined by WHO, is state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

Health behaviour
The combination of knowledge, practices and attitudes that together contribute to motivate the actions we take regarding health. Health behavior may promote and preserve good health, or if the behaviour is harmful, may be determinant of disease.

Household
Is a group of people leaving in the same compound or dwelling and eating from the same pot (an average home of six member).

Water sources
The place from which the household drinking had been drawn during the survey.
Sanitation

The proper disposal of refuse and human waste such as faeces and urine.

Hygiene practices

Practice of cleanliness as a way of maintaining good health and preventing diseases e.g. hand washing habits.

Access of safe drinking water

Ability to obtain 20 litres of safe drinking water within 1km walking distance.
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ABSTRACT

Diarrhoea, due to contaminated drinking water and poor sanitation is a major cause of poor health and leading cause of deaths especially among the under fives. Diarrhoeal diseases cause an average of 2.5 million deaths each year of which 80% occur among the under fives. One in every ten children die of diarrhoea before their fifth birthday, while those under the age of three years suffer an average of eight diarrhoeal episode, 10% being persistent. Access to safe water sanitation are important components in the prevention of diarrhoeal diseases. This study therefore sought to identify the influence of improved water supply and sanitation of prevalence of diarrhoeal disease in Uasin Gishu District, Kenya.

Across sectional comparative study was carried out on 500 respondents distributed proportionally to the experimental area (Soy division) and the control area (Moiben division). This study evaluated environmental interventions initiated by the community and other change agents to mitigate the effects of diarrhoea. Review of health records and bacteriological analysis of water was carried out. From the findings most respondents perceived contaminated water, poor methods of faecal disposal and poor food hygiene as the main factors associated with increased risk of diarrhoeal diseases in the study area.

A significant association was observed between occurrence of diarrhoea and status of water sources, as well as availability of latrine facilities in the area. ($x^2 = 70.979$, df=1, p=000).
Access of safe water supply in the intervention area was found to be relatively high at (84.4%) up from 22.5% before intervention. Analysis of water samples from protected source indicated that water complied with standards for safe drinking water ($t=15.08, p=0.001, df=9$). Access to safe water in the control (Moiben division) was comparatively low at 6.4% similarly, latrine coverage in the intervention area had increased from 57% five years ago to 76.6%, which was also quite significant ($Z=7.490, p=0.000$).

Access use of latrines relatively lower in the control area, which was 58.4%. There was a statistically significant difference in the occurrence of diarrhoea than the intervention area ($\chi^2=70.979, df=1, p=0.000$). More remarkable was the demonstration of the relationship between diarrhoeal incidences and the status of water sources as well as availability of faecal disposal facilities. The study concludes that the intervention have had an influence on the lowering morbidity due to diarrhoeal in the study area. It provides useful insights on the importance of environmental factors in the control of diarrhoeal diseases. It recommends that local capacity building is intensified and environmental health interventions be extended to cover other areas of the district and similarly affected places else where in Kenya.
CHAPTER 1: INTRODUCTION AND LITERATURE REVIEW

1.1. General Introduction

Access to safe water and sanitation is an important component in prevention of diarrhoeal diseases but studies show that over 3 billion people suffer from water related diseases as a consequence of unsafe water and inadequate sanitation worldwide (WHO, 1998). In the developing world, and especially Africa, water related diseases account for 80% of the disease burden, and contribute to over 5 million deaths, where it is estimated to kill over three million people every year, the overwhelming majority being children. The toll is not just in mortality, but also morbidity. One in every ten children dies of diarrhoea before reading their fifth birthday, while those under the age of three suffer an average of eight diarrhoeal episodes with 10% being persistent diarrhoea (Bern et al., 1992).

The existing problem is largely due to the low level of access to safe drinking water supply and inappropriate faecal disposal systems that increase incident of diarrhoeal diseases such as: cholera, typhoid and hepatitis A and E. The later is however not a serious problem in Africa. Mortality and morbidity rates would be greatly reduced if adequate sanitation and access to safe drinking water were available. Besides, such programmes would have maximum health benefits that would stimulate social economic development and improve the living standards of people. A household that has a better personal hygiene is likely to promote good health practices. (Faecham et al., 1979)
In Kenya, diarrhoeal diseases rank third after malaria and respiratory infections, while other common ailments include skin infections and intestinal worms. These environmental related conditions account for up to 70% on new cases in government health facilities (Kenya, Republic of, MOH 1998). In Uasin Gishu District diarrhoeal diseases are ranked alongside malaria, intestinal worms and skin ailments as major causes of ill health and deaths.

1.2. LITERATURE REVIEW

1.2.1 Diarrhoea as a public health problem

Diarrhoea, one of the leading causes of childhood mortalities is in fact not a disease in the traditional or in medical terms, but an etiological agent defined in terms of consistency of loose motions and bowel movement (WHO, 1997). Infection is usually contracted when pathogenic organisms gain access to water that is then consumed by a person who does not have sufficient immunity to the disease. It should be noted that although the disease can be water-borne it could also be spread by any other route that permits direct ingestion of faecal matter from a person suffering from the disease. Poor personal hygiene in food handling and preparation would provide an obvious infection route. The situation is further complicated by the presence health of carriers in diseases such as typhoid. Although they exhibit no outward signs of the disease, health carriers their excreta contain the pathogens.

Diarrhoea is identified by watery nature of the stool and the loss of fluid is the most important cause of death (Taylor and Develli, 1986). Associated symptoms of diarrhoea include nausea, anorexia, bloating and urgency of abdominal cramps, fever
and malaise, characterized by a least two-fold increase in the frequency of bowel movement. It is a major contributor to malnutrition through various mechanisms such as anorexia and intestinal mal-absorption (Jujal et al., 1986).

Prevention of diarrhoea requires vast, complex and expensive environmental manipulations designed to reduce ingestion or contact with faecal organisms. Access to potable water supplies, appropriate sanitation systems as well as vector control and high degree of hygiene must be widely available before a significant fall in the incidence of diarrhoeal diseases is realized (Robinson, 1989).

1.2.2 Situation analysis of water and sanitation

In much of the world, getting sufficient and potable water is daily crisis. The world has three broad classification of water; insufficient and polluted. Only 30% of all the water in the world is considered safe. Of these 75% is locked up in the ice, the remaining 25% make up atmospheric and surface water. Surface water make up less than 1% the rest is atmospheric (Grosvenor, 1986). While the measurement of health improvements is extremely difficult, rigorous studies have demonstrated conclusively that well-designed projects can make important contributions to health (Esrey et al., 1991).

Poor sanitation results in poor disposal of faecal mater thereby contaminating water bodies. In urban and rural areas, inadequate and poorly maintained sewerage systems and lack of toilet facilities lead to faecal matter reaching water bodies and exerting pressure on the BOD. Because of poverty and other critical challenges facing
developing countries, specifically in Africa, there is a decline in progress towards achieving universal access to good sanitation and safe water (WHO, 1998).

1.2.3 Two decades of international efforts towards improved water supply and sanitation coverage

Water supply and sanitation emerged as development agenda more than 20 years ago. The 1997 UN Water Conference in Marde-Planta, Argentina recommended that the 1980s should be proclaimed the IDWSSD. In preparation for the launch of the decade, the World Bank and the WHO carried out rapid assessments of water supply and sanitation sectors in more than 100 countries worldwide. This, together with WHO’s five-yearly monitoring of water supply and sanitation coverage, provided the baseline statistics against which progress in the sector is generally measured and the picture was very appalling. It was found our that 1.2 billion our of a total of third world population of 2.2 billion (China was excluded) were without access safe water, while 1.7 billion had no proper means of excreta disposal. As a result, an estimated 50 million people a year were dying from diseases directly related to poor sanitation and half of the world’s hospital beds were occupied by patients suffering from water related illness. (WHO, 1979)

An ambitious target was, therefore, set to commit all countries to achieve 100% coverage of access to safe water supplies and sanitation by 1990. Individual countries devised their own definition of “access” which, with regard to water often taken to
mean 20 litres of safe drinking water per household per day from a source within one mile (1.6 Kms). Access to sanitation was taken to mean the safe disposal of human excreta and other waste matter. Modest access to safe water supplies and sanitation was realized during the implementation decade through concerted global efforts and networking, but these felt short of the universal goal of access (UN, 1995).

1.2.4 The challenges related to poor water and sanitation provision

WHO now estimates that more than 3 billion people are without adequate means of excreta disposal. Consequently, its impact on the health, dignity and quality of life is alarming. Squalid surroundings and continuous health hazards exacerbate the effects of poverty, particularly in the overcrowded slums that occur in most countries. The WHO also estimates that 3.3 million people die every year from diarrhoeal related diseases. In addition, 1.5 million people suffering from parasitic worm infections stemming from disposal of human excreta and solid wastes in the environment (WHO, 2002).

Studies have shown that the neglect of water supply and sanitation services among the poor effects all segments of society. On top of the cost of health care and loss of productivity, the contamination of river and aquifers by untreated human wastes hinders industrial progress, slows economic growth and impacts tourists. In 1991, for instance, cholera epidemics costed Peru an estimated one billion dollars in tax, tourism and expertise, the amount would have more than paid for all water and sanitation services for all.
sanitation systems Peru needed to prevent such outbreaks from occurring (WHO, 2002).

The relationship between water and diseases has been recognized from the time of
hypocrites if not earlier in the association of marshy places with fevers (Feachem et
al., 1978). Many rural communities in the tropics have similar views and are
discriminating in their choices of drinking water. Snow was the first person to show a
precise relation of disease to water in well documented studies on cholera in 1855 and
was closely followed by Budd who demonstrated the spread of typhoid through
contaminated water supplies. Further studies carried out later confirmed similar
observations (Feachem et al., 1978). Water related diseases accounted for 38% of
illness morbidity in Kenya in 2001, while 61% cases of admissions at the Kenyatta
National Hospital were due to diarrhoea or diarrhoeal related complications (Kenya,
Republic of, MOH, 2002).

Classification diseases associated with water is based on the mechanism of
transmission routes from an old host to new hosts. Before considering water related
diseases it useful to examine the main features of communicable diseases. All
diseases require for their spread a source of infection, transmission route and
availability of susceptible living organism. Control of disease is this based on caring
for the sufferers, breaking the transmission route and protecting the susceptible host. Engineering measurers in disease control are essentially concerned with breaking the transmission route and medical measures are concerned with caring for the sick and protecting susceptors. Water-base diseases are parasitic infections of humans in which the parasites spend part of its life cycle in an intermediate aquatic host. The two most significant diseases within this category are schistosomiasis (Bilharzia) and guinea worm. Improvements in water supply can significantly reduce these infections; indeed water supply is a major focus on the efforts to achieve worldwide eradication of guinea worm. Water-borne infections include classical infections of cholera, typhoid most enteric viruses. Their pathogenic organisms are carried in water and cause infection when a susceptible host drinks the water. The infections are universally referred to as Faecal-oral diseases. Water-washed diseases are those resulting from lack of sufficient water for hygiene purposes. Diarrhoea, which is as a result of unsafe drinking water and poor state of hygiene account for the high death rates in (Kenya, Republic of, MOH, 2000).

According to a UNICEF/ Kenya, Republic of, MOH, reports 2000, one in every five children die of diarrhoea. Places reporting the highest morbidity from the diseases are Nyanza, Western and Nairobi Provinces. The report further attributes prevalence of diarrhoea in Nairobi to poor sanitation especially among the informal settlers. In the late 1990's only 37% of rural and poor peri-urban population has access to either a septic tank, flush toilet or a pit latrine. These unsanitary state undoubtedly contribute
to high intestinal worms and diarrhoeal infections reported in Kenya’s public health facilities. These diseases can easily be prevented through better sanitation, adequate and clean water and improved sense of hygiene (Kenya, Republic of, MOH, UNICEF, 2000).

1.2.6 The role of water and sanitation in prevention of diarrhoeal diseases

Provision and proper use of water supply and excreta disposal facilities are part of diarrhoeal diseases control strategies. These are the primary ways by which major reduction in diarrhoeal morbidity can be achieved, as major etiological agents worldwide of acute diarrhoeal diseases are transmitted primarily or exclusively by faecal-oral-route. Interruption of transmission may occur by preventing human or animal faeces from entering the mouth from finger through food or water by hygienic disposal of faeces.

Hygiene promotion can reduce the incidence of diarrhoea among children under the age of five by 14% - 48% (Bangui et al., 1991). On the other aspect water supply and sanitation if properly maintained and used, are reasonable strategies of prevention of diarrhoea. (Blum, 1986).

2.7 Benefits of improved water supplies and sanitation

The World Bank draft publication 1998 indicated that water supply could have several different kinds of benefits. Water is a fundamental economic resource on which people’s livelihoods depend, in addition to domestic use, households use water
for other productive activities. Health benefits from improved water supply and
sanitation arise our of the fact that some diseases like typhoid and cholera are
waterborne and are affected by bacteriological quality of drinking water. Others such
as trachoma depend on availability of water for personal hygiene. (WHO, 1998)

In general, contaminated water supplies problems of sanitation result jointly in high
morbidity from diarrhoea and other conditions such as intestinal worms, cholera,
polio and hepatitis. A study conducted in Chogoria, Meru district showed that access
to safe water was associated with a 40% drop in diarrhoeal incidences compares to
those who used unsafe water (Kenya, Republic of, MOH, UNICEF, 1995). It was
however important to determine the effects of each type of intervention.

The benefit of safe water and sanitation provision go beyond improvements of health,
well being and quality of life. Access to convenient and affordable water can save
many people time and energy and enhance their livelihood opportunities. Improvement
in sanitation will improve privacy and retain human dignity a significant and
legitimate social development concern. These less quantifiable benefits are among
advantages of water supply and sanitation most often reported by people in low
income communities.

1.2.8 The WHO diarrhoeal diseases control programme

Diarrhoea being recognized as a major public health problem in the developing world
WHO has been collaborating with member countries in activities geared towards its
control. The World Health Organization estimates indicate that every child under five years of age in developing world suffer an average of eight diarrhoeal episodes, 3.5 million die every year from diarrhoea and dehydration and over half of children experience more than 15 attacks of serious diarrhoea before their fifth-birth day (Bern et al., 1992).

Moreover repeated attacks of diarrhoea expose children to diarrhoea-malnutrition cycle and impart on the quality of life the child. Another aspect of the problem is that diarrhoeal cases in many countries of the world still account for 30% or more of hospital attendance or admissions, thereby creating a heavy burden on limited health budgets (Merson, 1999).

1.2.9 Focus on quality and quantity of drinking water

Water must be safe at the moment it is consumed and not only at the source of storage vessels and other accessories. Its quality may improve or deteriorate during storage as bacteria may gradually die off or contamination may be added. Contamination of water usually occurs between the source and the mouth as studies have shown variations in quality of water at source and the point of use (Lindslon et al., 1998).

The threshold for *coli*form in drinking water (the actual indication of bacteriological contamination of water) should be 10 *coli*form count and nil *E.coli* per 100ml of water (WHO, 1998.) Contamination at the source (tap, pond or vessels) must be kept
low in order or justify improved access to safe water. It should be complimented by hygienic handling at the individual households or point of use.

It is also intuitively clear that the quantity of water a household will actually use will somehow be related to its distance from the household and access to safe water within the household. Hygiene in the household will be improved by access to safe water supply.

The success of these interventions depends partly on giving convincing, positive proof.

1.2.10 Assessing the impact of water and sanitation on diarrhoeal diseases in the study area

A rational approach on dealing with health impacts is to first address problems associated with one of the most important impacts, namely morbidity due to diarrhoea after which attention can be turned to assessing impact on other outcomes such as nutritional status, intestinal nematodes and eye infections. Esrey’s studies cited elsewhere and earlier works by Blum and Feachem 1996 stress the enormous difficulty of managing rigorous studies that prove a health improvement is attributable to water and sanitation. Health impacts from water and sanitation interventions in general are notoriously difficult to access, as there are too many confounding variables to gain reliable information from statistics-based surveys.
1.3. RATIONALE FOR STUDY

1.3.1 Statement of the problem

Water and sanitation are some of the key elements of Primary Health Care (PHC). For this reason, most PHC are putting emphasis on provision of safe drinking water and appropriate sanitation in an effort to reduce diseases linked to these elements.

The success of these interventions depends partly on strong community participation in identifying their health related problems and finding practical solutions to them. In line with this, the Ministry of Health (MOH) secured donor support from SIDA to implement an Environmental Health Project (EHP) that covered parts of the country including the study area. The broad objectives of the projects was to strengthen and revitalize preventive health care in order to reduce incidence of preventable diseases particularly those associated with lack of portable or adequate water supply and poor sanitation (of which diarrhoea is a good indicator).

In Uasin Gishu District, the project was started on a pilot basis in Soy division and has since moved to other divisions of the district. Since its initiation back in 1995, no form of evaluation has been carried out. Thus, the effects of the project particularly on diseases associated with lack of adequate and safe drinking water; and, good sanitation particularly diarrhoea are still unknown.
There is, therefore, the need to examine the effect the interventions has had on diarrhoeal diseases and make appropriate recommendations where necessary, as well as draw lessons from its shortcomings.

1.3.2 Research question

Does improved access to safe water supply and sanitation has any effect on the prevalence of diarrhoeal diseases?

1.3.3 Justification for the study

Incidence of diarrhoea continue to burden families and communities through frequent sickness, hospitalization and even deaths. Similarly, seeking medical attention is an expensive undertaking for the many poor families and this may not even guarantee recovery. Therefore, there is need to come up with alternatives that are cost effective, accessible and acceptable to the communities.

The study therefore sought to investigate the influence of these interventions particularly in diarrhoea. The findings will be useful for all the stakeholders in reviewing the strategies, improving on the shortcomings and extrapolating the interventions to other areas. It will also provide a useful tool for researchers for future evaluations.

1.4 Null hypothesis

Improved access to safe water supply and sanitation does not effect prevalence of diarrhoeal diseases.
1.5 OBJECTIVES OF THE STUDY

1.5.1 General objective

To establish the influence to improved access to safe drinking water and sanitation on the prevalence or diarrhoeal diseases in Uasin Gishu District, Kenya.

1.5.2 Specific objectives

(a) To identify the causes of diarrhoea as perceived by the community in the study area.

(b) To identify the sources of water and sanitation availability of facilities initiated by the communities in the study area.

(c) To compare prevalence of diarrhoea among residents in the experimental area (Soy division) with access to improved water supply and sanitary facilities and those without the facilities in the control (Moiben division) are.
CHAPTER 2: MATERIALS AND METHODS

2.1 Study area

This study was carried out in Soy and Moiben divisions of Uasin Gishu District, Rift Valley Province, in the Republic of Kenya. The choice of Uasin Gishu was prompted by several reasons but more specifically by:

(a) The study area is one of the districts implementing an environmental health project with the aim of reducing prevalence of diarrhoeal, which is a major public health concern not only in the district but the entire country.

(b) The researcher had prior knowledge of the district, being his home district and also having been part of the team that implemented the project, had an interest in highlighting the outcome of the projects.

2.1.1 Physical description and rainfall pattern

Uasin Gishu district is one of the eighteen districts in the expansive Rift Valley Province of Kenya. It extend between longitudes 34° 50' and 35° 50' East and 0° and 03' and 00 55' North. The district shares common borders with Trans Nzoia district to the East, Koibatek district to the south, Nandi North district to the West and Lugari district to the North-West (Fig. 1). The total area of the district is 3,278 square kilometers, which is slightly more than 2% of the area of the province (Kenya, Republic of, MOH, 2000). The district receives high and reliable rainfall of between 900mm-1000mm annually.
2.1.2 Demographic and settlement pattern

The district has a population of 622,205 people (Kenya, Republic of, CBS, 1999), with a growth rate of 2.3%. The population structure shows that male out-number female in all age aggregates with a female/male ratio 100:103, the population is culturally and ethnically heterogeneous the district having formerly been the white highlands and having had late migrant population from all the corners of the country.

2.1.3 Economic potential

The main source of livelihood is agriculture (farming) and animal husbandry. Nearly all the main crops do well, with wheat and maize farming being most important sourced for the provision of the basic needs in the district. It supplies food, employment opportunities, and revenue collection base and sustain most of the milling facilities. However, industries that were grounded are slowly being reactivated and this will create more employment and strong economic base for the district.

2.1.4 Disease pattern and distribution

The district is service by a well developed health services infrastructure with referral hospital, a district hospital as well as eighteen health centres and sixty nine dispensaries runned by the government and several others by the private sector. The most prevalent diseases are malaria 33%, respiratory infections 24%, and water borne infections 17% among other conditions (Kenya, Republic of, MOH, 2000)
Fig. 1. MAP OF UASIN GISHU DISTRICT INDICATING THE STUDY AREA
2.2. Study Population

The study population comprised of the residents of Uasin Gishu District particularly those from Soy and Moiben divisions. Out of this population a sample was identified in each household, where the heads or their spouses were interviewed. If the were absent their representatives were interviewed provided they aged 13 years of age or above, and had stayed with the family for a period of at least six months preceding the research, this ensured that the respondent was fully accustomed to the family and would give reliable information.

2.2.1. Ethical considerations

The clearance to carry out the research was obtained from Kenyatta University ethics committee. Once in the field, further clearance was obtained from the District Commissioner and the District Medical Officer of Health, Uasin Gishu District. Informed consent was obtained verbally from all the study subjects before the interviews; and participation in the study was voluntary.

2.2.2 Inclusion criteria

(a) All the consenting heads of households (mother or father) in both the experimental and control areas.

(b) Any other member of the family aged at least 13 years and having lived with the family for at least six months and was willing to participate in the study.

(c) Community own resource persons who were willing to participate in the study were recruited for the FGDs.
2.2.3 Exclusion criteria

(a) Any person who was not a member of the community under the study.

(b) Any heads of household or their representatives not willing to participate in the study.

2.3. The study design

This was a cross-sectional, comparative study whose purpose was to access the effects of improved access to safe water and appropriate sanitation on prevalence of diarrhoeal diseases. In Uasin Gishu District, Soy division formed the experiment group, while Moiben division represented the control. The survey utilized both descriptive and analytical component.

The second phase involve water sampling for Bacteriological analysis.

2.3.1 Sampling method

Uasin Gishu was purposively selected because it was implementing an environmental health project targeting provision of clean and safe water supply and improved sanitation. The experimental group was similarly selected purposively since it was the pilot area of the project. The control was selected because of the low coverage in safe water supply and sanitation. The other five divisions were left out due to their superior infrastructure, which included connection to piped water supplies and few cases of diarrhoeal diseases.

Locations covered were selected through simple random numbers using random sampling tables. Households were sampled by systematic sampling from the household data (previous census data acted as a sampling frame).
2.3.2 Sample size determination

The sample size was determined using the following formula:

\[ n = \frac{Z^2pq}{d^2} \]

(aas used by Fisher et al., 1998)

Where:
- \( n \) = sample size (where POP. < 10,000)
- \( Z \) = Standard normal deviate (1.96) which corresponds to 95% confidence interval
- \( P \) = Proportion of the target population estimated to have a particular characteristic (in this case level of immunization)
- \( q \) = 1 - \( P \)
- \( d \) = degree of accuracy desired for the study = 0.05
- \( D \) = design effect = 2

Thus:

\[ n = \frac{1.96^2 \times 8.3 \times 17 \times 2}{d^2} \]

\[ = 434 \]

But a sample of 500 was taken in order to strengthen the representative ness and take into account any possible dropouts. The sample was distributed proportionate to the population in the study area and control.

2.4 Methods of data collection and research instruments

The Principal Researcher with the assistance of three trained research assistants did data collection. Pre-testing of the data collection tools was done before the actual survey to ascertain the feasibility of the instruments. Pre-testing was carried out in Soy division. In total twenty questionnaires were administered and one focus group
discussion held. The exercise was meant to determine if the questions were acceptable, ask-able, answerable, analyzable and applicable to enable the interviewers discern, alter or detect any questions that were being misinterpreted and sensitive to be asked without offending the respondents. The pre-testing locations were, however, not selected in the actual survey.

The study employed both quantitative and qualitative data collection techniques. The instruments administered for collecting data from the field included, questionnaires, focus group discussions, observations and checklist. Three Public Health Technicians (PHTs) were recruited as research assistants and trained for period of two days. The training was basically to understand the questionnaires, discussion guide, interviewing and observation techniques that were to be employed in the selection of the study subjects and also filling of the questionnaires. The administration of various research instruments were administered as follows:

2.4.1 Questionnaires

The questionnaires were administered by the Principal Researcher and the Research Assistant to the households' respondents. Some 500 questionnaires were administered and the entire number analyzed after cleaning.

2.4.2 Focus Group Discussions

A total of four focus group discussions were conducted in both experimental and control areas, two in each respect, with twelve selected participants. The Principal Researcher conducted the FGDs and the Research Assistants took down the notes. The proceedings were also tape-recorded. The purpose of the FGD was to find out
their understanding on diarrhoea and relationship with improved access water 
supplies and appropriate sanitation, their sources of water, methods of excetra 
disposal and check on other intervention put in place by the same communities.

2.4.3. Checklists
The checklists were aimed at establishing any factors and behaviours, which could explain any cause of ill health and to collaborate with any information given during the interview. The information were noted in notebooks and filled in specifically prepared checklist forms. Both the principal Researcher and his Research Assistants carried these out.

2.4.4. Review of health records
This was aimed at getting information from health facilities on disease pattern and distribution and as well as reports on water quality control from water office

2.4.5. Water sampling for analysis
Collection and preparation of samples were carried out following WHO recommended procedure adopted in the country in 1994 whereby;
A total of eighteen samples were collected. 11 samples were from the protected spring in the experimental area, and 7 more from the unprotected sources in the same area. Further eight samples were collected from the comparison area. The said sources were randomly distributed to the various sources within the research areas reference being made to the leeward sites of latrine facilities.
2.4.5.1. Samples from protected springs

The outlets were plugged and the pipe was sterilized by heating using cotton wool immersed in methanol, the plug was then removed and water was allowed to run freely for 4-5 minutes to cool the pipe. The sample was then aseptically collected taking care not to contaminate the sample from the direction of the flow and filled \( \frac{3}{4} \) way to the sampling bottles; the bottles were then tightly sealed. The procedure applied for all the protected springs sampled. Two samples were taken from each source.

2.4.5.2. Samples collected from the unprotected springs

The samples were collected from the deeper parts of the spring away from the banks. This was done in the direction of the flow and all aseptic procedures were followed. Two samples were taken from every sampled source.

2.4.5.3. Preparing the samples for analysis

The samples were packed and dispatched to the analyst with the following information; names and address of the person requesting the examination, the type of sample, date and time of sampling, source of the sample and the exact point the sample was taken and whether the sample was treated or not and reasons for sampling. The sample was transported in a media (Stuarts) to preserve the sample,
then transported in an icebox. The analyst did analysis within six hours. The results were released on triplicate format.

2.5. Data management and analysis

Data collection in the field was continually supervised and quality controlled by the Principal Researcher. The raw data from questionnaires were coded and entry done using SPSS programme. Once entered, data were thoroughly cleaned and analyzed by use of SPSS statistical package and used scientific calculator to do other simple calculations. Both descriptive and analytical data was used. Frequencies and proportions were calculated and presented in a tabular form. Measures of central tendency such as mean, medium and mode computed. Cross tabulation was done to establish relationship between variables as well as use of Z-test and chi-square was used to establish associations. Comparison on quality of water quality and set standards was validated using the t-test. Other information from in-depth interviews was analyzed manually using qualitative methods through grouping and ranking method. The findings were presented using tables, pie charts, bar diagrams and histograms. Other findings have been presented as text.
CHAPTER 3: RESULTS

This chapter presents the results obtained from 500 (250 from each division) respondents in both experimental (Soy division) and control (Moiben division) areas, views expressed in the focus group discussions and information gathered through observations as well as review of health records.

3.1. Socio-demographic characteristic of the respondents

3.1.1. Distribution of the respondents by sex and marital status

Out of the (500) respondents drawn from both divisions, over three quarters 381 (76.2%) were females and 119 (23.8%) were males (Figure 2).

Majority 181 (76%) of the respondents in Soy division were married those that were single were 152 (20.8%), 10 (4%) were separated while a small group of 7 (2.8%) were widowed. In Moiben division more than three-quarters 191 (76.4%) were married, 44 (17.6%) were single, 9 (3.6%) were separated from each other and 6 (2.4%) were widowed, (4%) were separated from each other and 7 (2.8%) were widowed (Figure 3)
The study group ages ranged from 16 – 65 years with mean age of 26 years. The 10-

Fig. 2. Distribution of the Respondents by sex (n=500)

![Pie chart showing sex distribution]

23.80%

76.20%

Fig. 3. Marital status of the respondents (n=250 per division)

![Bar chart showing marital status]

Proportion of respondents (%)  

Marital status of respondents

Married  | Single  | Separated | Widowed

72.4%  | 20.8%  | 17.6%  | 4%

2.8%  | 2.4%  | 3.6%  | 4%
year age interval was used because of the wide range of the ages of the study subjects. In Soy division the majority 94 (37.6%) was in the group 26 – 35 years, 69 (27.6%) were in the age group 36 – 45 years. The others 54 (21.6%) were aged between 16 – 25 years, 18 (72%) aged 46 – 55 years and a few 15 (6%) were aged 56 – 65 years. In Moiben division the majority 108 (43.2%) were in age group 26 – 35 years, 100 (40%) were aged between 36 – 45 years, the other 20 (8%) were aged 16 – 25 years, 18 (7.2%) were in age group 46 – 55 the rest 4 (16%) were aged above 55 years (Figure 4).

3.1.3. Distribution of the study subjects by level of education

In reference to the level of education 136 (54%) in Soy, 116 (46.4%) in Moiben divisions had attained primary education. Another 63 (25.2%) in Soy and 96 (38.8%) in Moiben divisions had attained secondary education and 41 (16.4%) in Soy and 28 (11.2%) in Moiben division had no formal education. (Table 1)
Fig. 4. Distribution of respondents age groups (n= 250 per division)

<table>
<thead>
<tr>
<th>Age group of respondents</th>
<th>Soy</th>
<th>Moiben</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-25</td>
<td>21.6</td>
<td>8</td>
</tr>
<tr>
<td>26-35</td>
<td>37.6</td>
<td>43.2</td>
</tr>
<tr>
<td>36-45</td>
<td>27.6</td>
<td>40</td>
</tr>
<tr>
<td>46-55</td>
<td>7.2</td>
<td>7.2</td>
</tr>
<tr>
<td>56+</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level</th>
<th>Soy Number</th>
<th>Soy Proportion</th>
<th>Moiben Number</th>
<th>Moiben Proportion</th>
<th>Totals Number</th>
<th>Totals Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>41</td>
<td>16.4</td>
<td>28</td>
<td>11.2</td>
<td>69</td>
<td>13.8</td>
</tr>
<tr>
<td>Primary</td>
<td>136</td>
<td>54</td>
<td>116</td>
<td>46.4</td>
<td>252</td>
<td>50.4</td>
</tr>
<tr>
<td>Post secondary</td>
<td>10</td>
<td>4</td>
<td>9</td>
<td>3.6</td>
<td>19</td>
<td>3.8</td>
</tr>
<tr>
<td>Totals</td>
<td>250</td>
<td>100</td>
<td>250</td>
<td>100</td>
<td>500</td>
<td>100</td>
</tr>
</tbody>
</table>
3.1.4. Distribution of respondent by religion

Protestants were 142 (56.4%) and 67 (26.8%) in Soy and Moiben divisions respectively and the same applies to Catholics 66 (26.4%) and 115 (44%). Another 105 (21%) in both divisions did not subscribe to any of the mainstream faiths and 5 (1.2%) in Soy division were Muslims (Figure 5).

3.1.5 Distribution of the respondents by occupation

About seven in every ten 342 (68.4%) respondents were farmers, 106 (21.2%) were in gainful employment and a smaller proportion 52 (10.4%) were in business (Figure 6).
Fig. 5. Distribution of respondents by religion (n= 250 per division)

<table>
<thead>
<tr>
<th>Religion of respondents</th>
<th>Soy</th>
<th>Moiben</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protestants</td>
<td>56.4</td>
<td>27.2</td>
</tr>
<tr>
<td>Catholics</td>
<td>28.4</td>
<td>44.1</td>
</tr>
<tr>
<td>Muslims</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>None</td>
<td>14.6</td>
<td>26.8</td>
</tr>
</tbody>
</table>

Fig. 6 Distribution of respondents by main sources of income (n= 250 person division)

<table>
<thead>
<tr>
<th>Occupation of respondents</th>
<th>Soy</th>
<th>Moiben</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmers</td>
<td>76.4</td>
<td>60.4</td>
</tr>
<tr>
<td>Salaried</td>
<td>13.6</td>
<td>28.8</td>
</tr>
<tr>
<td>Business</td>
<td>10</td>
<td>10.8</td>
</tr>
</tbody>
</table>
3.2 COMMUNITY PERCEPTION ON CAUSES OF DIARRHOEA

3.2.1 Knowledge of the study subjects on diarrhoea

It was found out in group and ranking that the respondents 468 (94%) in both the divisions had sufficient knowledge of diarrhoea, the information was further corroborated by a series of FGDs carried out in the divisions. In Moiben division (control) about nine in every ten people 217 (92.3%) said diarrhoea was a major health problem with only 18 (6.2%) saying it was not a problem.

There was no significant difference in the level of knowledge in the two divisions ($Z = 0.04$, $P = 0.0608$)

3.2.2. The age groups mostly affected by diarrhoea

When asked which age group was mostly affected the majority 103 (83.1%) in Soy and 174 (78%) in Moiben said it mostly affected children. A proportion of 13 (10.5%) and 40 (17.9%) in Soy and Moiben divisions respectively said it affected everybody. Those who said it only affected adults were 8 (6.4%) and 9 (4.0%) in Soy and Moiben respectively (Figure 7)

One recall during the past two weeks if they had experienced any diarrhoea episodes 78 (28%) respondents in Soy division said they had experienced at least an episode while 164 (65.6%) in Moiben division had experienced episodes of diarrhoea in their families

Cases of diarrhoea where therefore more prevalent in Moiben (control) than in Soy division, and there was a statistical significance between the two divisions.

($Z = 4.39$, $P = 0.0028$).
Fig. 7 Categories of respondents mostly affected by diarrhea (n=250 per division)
3.2.3 Perceived risk factors to diarrhoeal morbidity

The respondents perceived six causes of diarrhoea but in varying magnitude, poorly cooked food was frequently mentioned as the main causes of diarrhoea in Soy division 162 (64.8%), 114 (45.6%) mentioned dirty water, 115 (46%) faecal disposal, 68 (27.2%) germs, 3 (1.2%) witchcraft, another 30 (12%) mentioned other causes eg included eating from a neighbour and suffering from other conditions like malaria.

In Moiben division contaminated food was frequently mentioned, 211 (84.4%). About 201 (80.7%) identified faecal disposal, 148 (58%) dirty water, 79 (31.6%) germs, 13 (5.2%) witchcraft and 11 (4.4%) other risk factors (Figure 8).

3.2.4. Community knowledge on prevention of diarrhoea

On gourpning and ranking of responses, it was found out in Soy division most of the respondents 163 (65.2%) indicated that access to safe water supply was the best way of preventing occurrence of diarrhoea, 142 (56.8%) said it was through paper disposal of faecal matter, 107 (42.8%) reported it was through homestead hygiene. A small proportion indicated personal hygiene 67 (26.8%) and 28 (11.2%) others.

In Moiben division (control) majority 215 (86.0%) indicated safe disposal of faecal matter, 205 (82.0%) indicated use of safe water. Another big proportion of respondents 147 (58.8%) indicated homestead hygiene, 90 (36%) of them indicated personal hygiene, 18 (7.2%) other. There was no significant difference in the level of knowledge on prevention in the two divisions. (Figure 9).
Fig. 8 Perceived risks factors to diarrhoea morbidity (n=250 per division)

<table>
<thead>
<tr>
<th>Modes of transmission</th>
<th>Soy</th>
<th>Moiben</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dirty water</td>
<td>65</td>
<td>84.4</td>
</tr>
<tr>
<td>Poor faecal disposal</td>
<td>45.6</td>
<td>80.7</td>
</tr>
<tr>
<td>Germs</td>
<td>46</td>
<td>58</td>
</tr>
<tr>
<td>W/Craft</td>
<td>1.2</td>
<td>3.1</td>
</tr>
<tr>
<td>Others</td>
<td>1.2</td>
<td>4.4</td>
</tr>
</tbody>
</table>

Fig. 9 Respondent knowledge on prevention of diarrhoea (n=250 per division)

<table>
<thead>
<tr>
<th>Methods of prevention</th>
<th>Soy</th>
<th>Moiben</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safe Water</td>
<td>65</td>
<td>82</td>
</tr>
<tr>
<td>Poor faecal disposal</td>
<td>56.8</td>
<td>86</td>
</tr>
<tr>
<td>Homestead hygiene</td>
<td>42.8</td>
<td>58.8</td>
</tr>
<tr>
<td>Personal hygiene</td>
<td>26.8</td>
<td>36</td>
</tr>
<tr>
<td>Others</td>
<td>11</td>
<td>7.2</td>
</tr>
</tbody>
</table>
3.2.5. Finding from observation and views expressed during the focus group discussions on causes of diarrhoea

A wide range of facts came to the fore during the discussions. The respondents listed the main causes of ill health in both divisions to be malaria, diarrhoea, typhoid, common flu, stomachache without diarrhoea and scabies. Four participants in the discussion group indicated to have just recovered from a bout of diarrhoea and went ahead to list the vital signs of the disease. One participant indicated that diarrhoea was characterized by frequent passing out of loose stool from 3–4 times in a day, stomachache and general weakness of the body and in case of children it was characterized by sunken eyes and skin elasticity. They were however in agreement that even though diarrhoea affected everybody children were the most affected. They enumerated drinking dirty water from unprotected sources, poor disposal of faecal matter, dirty food and dirty environment as some of the causes of diarrhoea. The FGDs also suggested ways in which diarrhoea can be prevented and this included through construction and use of pit latrines, access to and boiling of drinking water, keeping the compound clean and maintaining general hygiene in the household.

3.3. Water supply and sanitation intervention initiated by the study subjects

3.3.1 Main water sources in Soy and Moiben divisions

The main sources of water in the two divisions are springs, shallow wells and seasonal streams. A few people utilized rainwater harvesting as a main source of water. In both places 225 (45%) of the respondents get their water from springs, 212
(42.5%) get water hand dug wells, 51 (10.2%). A small proportion of 27 (5.4%) and 3 (6%) got water from water tanks and boreholes respectively. Rainwater harvesting facilities cited mostly were the 7000 – 15000 litre ferrocement tanks.

3.3.2 Distance from water source

In Soy division about two thirds 169 (67.6%) of the respondents got their water from a distance of less than 1 kilometre with 47 (18.8%) getting their supplies within their compounds. Respondents getting from within a distance of between 1.2 kilometres were 59 (23.6%) and only 22 (8.8%) were getting from a distance above two kilometres. In Moiben division, about six in every ten respondents 155 (62%) got water from distance of less than 1 kilometre, with 74 (29.6%) getting them from unprotected shallow wells within their compounds. The respondents who got water from a distance of more than 2 kilometres were about 11%. Both divisions have a mean distance of about 0.7 kilometres from their water sources.

3.3.3. Status of water sources

More than eight (8) in every ten respondents got water from sources that had been protected from contamination, only 39 (15.6%) got their supplies from unprotected sources. This is an indication of a very significant increase of 61.9%. During the baseline survey only 22.5% of the community got water from protected sources. (Z=9.243, P=. 0028).
In Moiben division only 26 (10.4%) got water from protected sources while most respondents 22 (89.6%) used water from unprotected sources. Difference in populations getting access to protected water sources in the two locations was significant.

\(Z = 9.518, P = .000\).

### 3.3.4. Methods of water storage at the household

Respondents adopted various ways of storing water once they reach their homes, the storage was specifically for water meant for drinking.

Storage of water in traditional pots was the most preferred method in both divisions with about three-quarters of respondents 185 (74%) in Soy and 178 (71.2%) in Moiben division using the pots. An equal number of respondents 36 (14.4%) in both locations used jericans. Those who stored water in buckets were 27 (10.8%) and 36 (13.6%) in Soy and Moiben. An insignificant number stored their water in drums which were not covered. The checklist indicated that at least 80% of the receptacles were covered and kept clean.

### 3.3.5. Action taken by the respondent to make water safe at the household

Respondents applied various mechanisms at the house level to make drinking water safe. Those who said they boiled were 153 (61.2%) in Soy and 30 (12%) in Moiben filtered water to remove visible dirt. A few put by use of purpose made cloth chlorine
tablets while others did not carry any treatment after fetching. There was however no significant difference in proportion not taking action at home among those drawing water from unprotected in the two locations.

3.3.6. Effects of the water sources on diarrhoeal diseases

Asked if their sources of water had any effect on diarrhoea, about 142 (57%) in Soy division said their sources were safe and therefore not likely to spread diarrhoea, while 107 (43%) said it could spread diarrhoea. About four fifths 207 (83%) of the respondents from Moiben division who did not access water from protected sources indicated their water was likely to spread diarrhoea while the remaining 43 (17%) could not commit themselves.

3.3.7. Water sampling for bacteriological analysis

The researcher took 18 samples of water from both the experimental and comparison areas springs and from unprotected ones. The aim of the exercise was to carry out an assessment on the quality of water especially the bacteriological quality. The results indicated a wide variation between water from protected sources and from unprotected sources. The results from the unprotected sources indicated high degree of faecal contamination as indicated by presence of *E. coli*. This however could not rule out any contamination from other extrinsic sources as the results indicated high *E-coli* contamination. It was also found out that even though some sources of water had been protected contamination still occurred due to poor maintenance of the
springs, the degree of contamination was not statistically significant \( (t = 1.6899, \text{df} = 9, \ P = .900) \)

Comparison between qualities from protected sources and the set standards <25 coliform per 100 ml and Nil E.coli indicated that the quality of water complies with the set standards of Nil E.coli/100ml. The quality of water from the protected sources differed statistically from those from unprotected sources \( (t = 15.08, \text{df} = 9, \ P = .001) \).

(Table 2)
Table 2: Results of water samples analysis from the experimental area
N = 18

<table>
<thead>
<tr>
<th>Sample No</th>
<th>Status</th>
<th>Coliform count (per 100 ml)</th>
<th>E. coli count (per 100 ml)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Unprotected</td>
<td>225</td>
<td>20</td>
<td>.361</td>
</tr>
<tr>
<td>02</td>
<td>Unprotected</td>
<td>550</td>
<td>40</td>
<td>1.781</td>
</tr>
<tr>
<td>03</td>
<td>Protected</td>
<td>10</td>
<td>2</td>
<td>.2052</td>
</tr>
<tr>
<td>04</td>
<td>Protected</td>
<td>4</td>
<td>2</td>
<td>1.0251</td>
</tr>
<tr>
<td>05</td>
<td>Unprotected</td>
<td>17</td>
<td>5</td>
<td>.223</td>
</tr>
<tr>
<td>06</td>
<td>Protected</td>
<td>0</td>
<td>0</td>
<td>.000</td>
</tr>
<tr>
<td>07</td>
<td>Unprotected</td>
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<td>35</td>
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</tr>
<tr>
<td>08</td>
<td>Protected</td>
<td>11</td>
<td>0</td>
<td>.0067</td>
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<td>09</td>
<td>Protected</td>
<td>17</td>
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<td>.0089</td>
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<td>11</td>
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<td>.001</td>
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<td>12</td>
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<td>0</td>
<td>0</td>
<td>.000</td>
</tr>
<tr>
<td>13</td>
<td>Unprotected</td>
<td>206</td>
<td>128</td>
<td>2.161</td>
</tr>
<tr>
<td>14</td>
<td>Unprotected</td>
<td>5</td>
<td>0</td>
<td>.003</td>
</tr>
<tr>
<td>15</td>
<td>Protected</td>
<td>110</td>
<td>8</td>
<td>.261</td>
</tr>
<tr>
<td>16</td>
<td>Protected</td>
<td>0</td>
<td>0</td>
<td>.000</td>
</tr>
<tr>
<td>17</td>
<td>Protected</td>
<td>0</td>
<td>0</td>
<td>.000</td>
</tr>
<tr>
<td>18</td>
<td>Protected</td>
<td>10</td>
<td>0</td>
<td>.000</td>
</tr>
</tbody>
</table>

(t=16.899, df=9, P=.900)
3.3.8. **Finding from the focus group discussions on accessibility to water**

The main water sources identified during the above discussions were; springs, wells and rainwater harvesting. In control seasonal rivers were also identified. Fetching of water from the sources was mainly by 20 litre jerricans, which was then transported to the household on the backs. This represented a significant increase in latrine coverage in comparison to the coverage during the baseline survey.

On reaching home water was stored in traditional pots, this is after being filtered and in some instances, boiling is done. Some discussants feared boiling water since they thought it would loose taste. Those getting the water from protected sources especially springs reported that they did not boil water since the advice from the implementers indicated the water was free from pathogenic organisms.

Two of the FGDs especially in the control (Moiben divisions) reported problems accessing clean water owing to long distances, unprotected sources and lack of proper storage tanks. They suggested that small water tanks of capacity of about 200 litres were very ideal. Each family used an average of 60 litres a day. Water from unprotected springs and wells have to be collected early in the morning before it gets contaminated.
3.4 Sanitary intervention put in place by the respondents

3.4.1. Latrine coverage

With regard to provision of faecal disposal facilities 194 (77.6%) in Soy and 140 (58.1%) in Moiben division had access to pit latrines. This represented a significant increase in latrine coverage in comparison to the coverage during the baseline survey, which stood at 57.6%.

In regard to latrine use 156 (79.2%) in Soy and 132 (88%) in Moiben division said all the family members used, 38 (20.8%) in Soy and 8 (12%) in Moiben division said only adults used the facilities.

3.4.2. Reasons given by the respondents for lack of latrines

Respondents cited several reasons for lack of latrines, approximately 28 (51.9%) respondents in Soy division and 47 (43.5%) in Moiben division cited difficult terrain while 22 (40.7%) and 36 (33%) in both divisions respectively cited lack of money. A small proportion of 4 (7.4%) in Soy and 25 (23.1%) in Moiben division cited cultural reasons, but could not specify further.

3.4.3. Latrine coverage by type

The study showed that traditional type of latrines constructed of temporary materials was predominant. Those who had traditional type of latrines were 134 (69.1%) in Soy and 129 (92.1%) in Moiben divisions, 60 (29.9%) and 11 (8%) of the respondents had put up VIP latrines in Soy and Moiben divisions respectively. (Figure 10).
Fig. 10 Latrine coverage by type (n=334)

<table>
<thead>
<tr>
<th>Type of latrines</th>
<th>Proportion of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIP</td>
<td>29.9</td>
</tr>
<tr>
<td>Traditional</td>
<td>69.1</td>
</tr>
<tr>
<td>Traditional</td>
<td>92.9</td>
</tr>
</tbody>
</table>

- [Soy] - [Moiben]
TABLE 3. Relationship between hand washing and occurrence of diarrhoea

<table>
<thead>
<tr>
<th>WASHED HANDS AFTER LATRINE USE</th>
<th>HAD EXPERIENCED DIARRHOEA</th>
<th>EXPERIENCED NO DIARRHOEA</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO</td>
<td>1.49 (66.8%)</td>
<td>117 (33.2%)</td>
<td>266 (53.2%)</td>
</tr>
<tr>
<td>YES</td>
<td>74 (33.2%)</td>
<td>160 (66.8%)</td>
<td>234 (46.8%)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>223</td>
<td>277 (100%)</td>
<td>500 (100%)</td>
</tr>
</tbody>
</table>

\(X^2 = 22.7762, P=0.28\)

No significant difference in diarrhoea between those who washed hands and those who don't.

TABLE 4. Relationship between use of latrine and occurrence of diarrhoea

<table>
<thead>
<tr>
<th>LATRINE</th>
<th>YES</th>
<th>NO</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>Exposed had disease</td>
<td>Exposed and had in disease</td>
<td>158 (31.6%)</td>
</tr>
<tr>
<td></td>
<td>(39.2%)</td>
<td>58 (36.7%)</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>Not exposed not had diarrhoea</td>
<td>Not exposed</td>
<td>342 (68.4%)</td>
</tr>
<tr>
<td></td>
<td>(63.3%)</td>
<td>(60.8%)</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>234</td>
<td>266</td>
<td>500</td>
</tr>
</tbody>
</table>

\(X^2 = 70.979, P=0.00\)

Significant relationship observed

Having no latrine there is risk of diarrhoea whereas having a latrine means not exposed to risk of diarrhoea.
3.4.4. Promotion of hygiene through hand washing habits by the respondents

Hand washing after visiting latrines was practiced by 55% of the respondents in Soy division and 33.6% of those in the control (Moiben division).

Cross tabulation carried out between those who wash hands and those who did not wash hands after using the facility and occurrence of diarrhoea found out that there was no significant association in occurrence of diarrhoea in their families.

\[(x^2 = 22.765, \text{ df } 1, \text{ } P = 0.28)\]

Comparison made between those who had latrines and those who didn’t have on the occurrence of diarrhoea in their families was statistically significant.

\[(x^2 = 70.979, \text{ df } 1, \text{ } P = 0.000)\] (Table 3)

Hence presence of a latrine and subsequent use is important in the prevention of diarrhoea as those who didn’t have latrines reported significantly more cases of diarrhoea (Table 4)

3.4.5. Improvement of sanitation through refuse disposal

Refuse disposal was mainly carried but through burning by 110 (44%) in Soy and 97 (38.8%) in Moiben division. About 88 (35.2%) and 62 (24.8%) in Soy and Moiben division respectively used refuse pits. A small proportion of 51 (20.4%), 91 (36.4%) adopted composting especially in their gardens in the two divisions respectively. The remaining discarded their refuse without following any conventional method.
3.4.6. Views from the focus group discussion and observations on sanitation

A lot of information was gathered which showed that there is an association between use of latrines and occurrence of diarrhoea in a household. The majority of respondents from both the experimental and control group appreciated provision of sanitary facilities and the eventual use. This can be noted in the significant increase in the number of latrines in the experimental area by about 2000% in a short period of under five years. Even in the control where the project has not been implemented an impressive 588.1% had access to latrines.

Through some visits it was, however, noted that most of the latrines were in a very poor state and could become potential sources of disease. The FGDs brought out sharp gender concerns on provision of latrines with some women in ¾ of the discussions complaining that men were reluctant to provide latrines in their homesteads. The reasons being, majority of them do not stay home most of the time, and that they can access these facilities either in the shopping centres or neighbourhood.

3.5 Comparison of prevalence of diarrhoea in the experimental (Soy) and control (Moiben) divisions

3.5.1 Respondent experience on diarrhoea episodes

During the survey, respondents were asked if they had experienced any diarrhoeal episode in the past two weeks prior to the survey. Only 78 (28%) in Soy and 164
(65.6%) in Moiben division had experienced at least an episode of diarrhoea in their households. 8360 (55.0%) cases of diarrhoea were recorded in 1996, 1167 (17.7%) diarrhoeal cases among 6500 and 1786 diarrhoeal cases among 10,114

Cases of diarrhoea were found to be more prevalent in Moiben (control) as compared to Soy division. There was a statistically significant difference in the occurrence of diarrhoea with Moiben suffering more episodes. As indicated by respondents and general verification—the facilities serving the two areas (Table 5)  

\( Z.005 = 8.416, P = 000 \)  

Comparison in the two divisions using a 2 x 2 tables indicated that Moiben division has more cases of diarrhoea compared to Soy division. The difference in terms of infections was statistically significant.  

\( \chi^2 = 70.979, df = 1, P = .000 \) (Table 6)  

**3.5.2 Morbidity records of disease trends in the facilities serving the two divisions**  

An extensive review of health records was carried out at the District Health Information Office, Ziwa Health Centre and Kabobo Dispensary from the experimental area and Moiben Health Centre and Chepkanga Dispensary from the comparison area. Two facilities were taken from each division; Records were also perused at district public health office. It was however, difficult to access up to date records for the period under review as the researcher was informed that patients attended facilities only when drugs are available, a more frequent trend. In Soy there were 4113 (26%) diarrhoeal cases among 15781 patients treated in 1997, 3613 (20%)
48

diarrhoeal cases among 1997 patients treated in 1998, 4163 (33%) diarrhoeal cases against 12600 among patients treated in 1999, 3169 (17%) diarrhoeal cases in 1999 among 18631 patients treated in 2000, and 1769 diarrhoeal cases among 16034 patients treated in 2001. In Moiben division, 6429 (40%) diarrhoeal cases were treated against 16211 patient treated in 1997, 7984 (60%) cases among 13240 patients treated in 1998, 5301 (45%) against 1692 patients treated in 1999, 6469 (28.7%) cases among 18563 patients treated in 2000 and 2969 (30%) among 10032 patients treated in 2001.

Moiben division treated more patients suffering from diarrhoea compared to Soy division (Table 6).

The top ten conditions attended in the facilities in the study are were: malaria 33%, URTI 24%, diarrhoeal diseases 17%, intestinal worms 8%, skin diseases 16%, U.T.I 3%, ear infections 2%, eye infections 2%, pyrexia of unknown origin 1% and accidents in order of morbidity.

The proportion of diarrhoea cases treated in facilities have undergone a downward trend from 26% of total cases treated in 1997 to a lower figure of only 11% seen in 2001. This could have been influenced by the interventions that have been pursuit in the past five years. Incidences of unreported cases cannot, however, be ruled out.
TABLE 5. Comparison of diarrhoeal cases by division

<table>
<thead>
<tr>
<th></th>
<th>SUFFER</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Soy Division</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental count</td>
<td>70</td>
<td>180</td>
</tr>
<tr>
<td>% Within kind of respondents</td>
<td>(28%)</td>
<td>(72%)</td>
</tr>
<tr>
<td>% Total</td>
<td>(14%)</td>
<td>(36%)</td>
</tr>
<tr>
<td>Moiben Division</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control count</td>
<td>164</td>
<td>86</td>
</tr>
<tr>
<td>% Within kind of respondents</td>
<td>(65.6%)</td>
<td>(34.4%)</td>
</tr>
<tr>
<td>% Total</td>
<td>(32.8%)</td>
<td>(17.2%)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>238 (46.8%)</td>
<td>266 (53.2%)</td>
</tr>
</tbody>
</table>

TABLE 6. Morbidity trends in Soy and Moiben Division

<table>
<thead>
<tr>
<th>Year</th>
<th>Soy Division</th>
<th>Moiben Division</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Diarrhoeal cases</td>
<td>Total records examined</td>
</tr>
<tr>
<td>1997</td>
<td>4113 (26%)</td>
<td>15781</td>
</tr>
<tr>
<td>1998</td>
<td>3613 (20%)</td>
<td>17994</td>
</tr>
<tr>
<td>1999</td>
<td>4163 (33%)</td>
<td>12600</td>
</tr>
<tr>
<td>2000</td>
<td>3169 (17%)</td>
<td>18631</td>
</tr>
<tr>
<td>2001</td>
<td>1769 (11%)</td>
<td>16034</td>
</tr>
<tr>
<td>TOTAL</td>
<td>16829 (22%)</td>
<td>76040</td>
</tr>
</tbody>
</table>

Source: MOH Uasin Gishu
3.5.3 Records of Laboratory results of stool samples analyzed between 1997 – 2001

Review of the laboratory records on stool microscopy was carried out to try and identify the commonest pathogens detected in stool examinations. It was found out that of the total 16,364 stools analyzed between 1997 – 2001, 1 had at least some 26% pathogen identified positive. The common of the pathogens identified were *Entamoeba histolytica* (61.9%), followed by *Ascaris lumbricoides* (21.4%), hookworms (8.8%) and *Giardia lamblia* (4.9%). Others were Taenia tapeworms, (1.7%) *haemenelepsis nana* and *Trichurus trichura* both (0.3%) and *Strongyloides species* (0.2%). Fig. 41

Records on water samples reflected only samples carried out in the year 2000 and 2001 *E-coli* contamination varied from 4-56 count from the springs sampled. Others springs were however free from *E-coli* pathogens.
Fig. 11 Pathogenic organism identified in the laboratories in the two divisions

Source: MOH Uasin Gishu District (2001)
CHAPTER 4: DISCUSSION

4.1 Socio-demographic information

A wide body of literature shows that diarrhoeal diseases still causes suffering and deaths particularly in developing nations. Yet they can be prevented using simple environmental measures that can be affected at the community level (AMREF, 1996).

The magnitude of the disease especially among the under fives is a major public health concern. A baseline study conducted in 1995 in Uasin Gishu District indicated that Moiben and Soy divisions had the highest incidence of diarrhoeal disease in the entire district and this was the main reason for the interventions. However, Moiben division has not been covered. The study therefore aimed at establishing whether improved water supply and sanitation as a result of the project intervention has had any effect on prevalence of diarrhoeal disease in the area.

Occurrence of diarrhoea can be influenced by many other factors and for this reason, areas with closely similar factors that is; social, economic and cultural were selected for comparison purposes. Since the two divisions are closely similar, any variations in occurrence of diarrhoea can closely be associated with the only variation between the two divisions, that is, improved water supplies and sanitation in Soy division. This was further confirmed by the fact that significant association was observed between occurrence of diarrhoea and the status of water sources, as well as the coverage of sanitary facilities.
Those who relied on water from unsafe sources more cases of diarrhoea than those with access to safe water. The same applied to those who did not have latrines. The study also attempted to identify the causes of diarrhoea from the respondent’s own perception, identified sources of water and sanitary facilities put up by the communities and compared prevalence of diarrhoea in the two divisions.

A total of 500 respondents consisting 250 respondents from each of the two divisions were interviewed, females were the majority 76.2% while male were 23.8% with mean age of the 26 years. Females were the majority probably because they remain at home as the adult males go out in search of salaried employment. Being caretakers at home, they have a lot of influence on homestead hygiene and may maintain up to date information on the health status of their families. The average age (26 years) of the respondents meant that they were adults and the information they gave can be relied upon. This was further reinforced by the fact that over 80% of the respondents had acquired at least a basic form of education.

As regards occupation, the majority were farmers (68%), as Uasin Gishu is largely an agricultural zone and most people depend entirely on one form of agriculture or another as a source of livelihood.

4.1.2 Perceived causes of diarrhoea

The findings concur with those made by Kangethe (1996). In that study over 90% of the respondents had good knowledge on diarrhoea. Musembi (2000) found more less the same results in terms of knowledge in studies carried out in Kitui District. There
was, however, no significant ($P = 0.0658$) difference in knowledge between the two divisions despite (Soy) having had exposure through implementation of E.H.P. The two divisions however differed significantly ($P = .000$) in terms of perception of the disease as a major health problem. Thus, in Soy the majority did not see diarrhoea as a problem. In terms of ranking the diseases in order of severity people in Soy reported malaria to be severe problem while in Moiben they thought diarrhoeal diseases posed serious threats to the community. Educational strategies are particularly important for most of the interventions, but may not be sufficient since such knowledge must be transformed into changes in behaviour to produce any improvement. Children were reported to be mostly affected (83%) in Soy and (78%) in Moben divisions. These findings show that although improvement to water supply and sanitation is important to everybody, children are found to be the most vulnerable to preventable diseases that result from lack of safe water and poor sanitation. This may as well be the case as a study carried out by Bern (1992) found out that about 3 million children die every year from diarrhoeal disease and dehydration and that; over half experience more than 15 attacks of serious diarrhoea before the age of five.

Perceptions of the main risk factors of a particular disease determine subsequent actions. The findings in this study indicate that contaminated water was one of the main causes of diarrhoea in both Soy (45.6%) and Moiben (58%) division. This was mentioned in addition to contaminated food and poor faecal disposal methods. In Line with documented evidence by Bradley (1977 and Feachem (1978) found out that...
water and sanitation affect transmission in a variety of ways; One is through water-borne transmission, in which feacally contaminated drinking water transmit the disease – causing organisms directly to the new host. Contaminated drinking water can lead to dramatic epidemics, in which large numbers of people are simultaneously exposed to infection. The second way is through water-washed transmission, that is, transmission encouraged by poor hygiene due to insufficient quantities of water washing. Where water is scarce, it is very difficult to maintain clean hands, clean hands, clean food and a clean household environment essential to control many of the other routes of faecal-oral transmission. All these conditions play a crucial role in the study area.

Since perceived causes point to the action taken to control diarrhoea, it was noted that much of the efforts made through project interventions in Soy and individual efforts in Moiben divisions, were directed towards improving access to quality drinking water, sanitary faecal disposal and improved homestead hygiene. The level of Knowledge on prevention of diarrhoea was not different in the two locations but was ranked differently. Similarly action on prevention was attributed to consistent hygiene education and advice from public health personnel, the community and individual sense of hygiene.

In Soy division 88% of respondent had taken action both at household and communal level to control diarrhoea. The major activities cited included construction of pit
latrines, protection of water source from contamination and putting up rainwater harvesting facilities. The community and other stakeholders in water and sanitation activities implemented these activities. Organized groups particularly women groups were the main agents involved in implementation of these activities. It is inferred here that in contrast to Moiben division where interventions are few, the activities in Soy division have been largely influenced by "Environmental health Programme", where effective sensitization, demonstration and incentives were offered through the project. The incentives included transfer of technology by offering training to local artisans, mobilization and identification of local resources.

It findings clearly indicate that respondents connected the activities they had undertaken with the reduction of diarrhoeal morbidity in their areas. Those who had no access safe water supplies associated diarrhoea morbidity in their areas to their water sources and poor sanitary situation. This was further collaborated by the indepth focus groups discussions. As reported by Esrey (1990) provision of safe water and good sanitation has a direct bearing on the health of the recipients of such services. But this has to be accompanied with changes in hygiene behaviour. Musembi and Kangethe make similar observations. An important point made by Kangethe is that change ought go encompass improved way of life style, improved privacy (for those who use latrines) and other economic factors. These changes greatly reduce diarrhoeal infections.
4.1.3 Sources of water and sanitation facilities in the study area

Marked improvement in status of safe water supply was observed in Soy with 84.4% getting water from sources that had been protected from contamination. Moiben division compared poorly in this regard, with only 10.4% of the respondents accessing water from safe sources. Sources of water in the two divisions include springs; shallow hand dug wells, seasonal streams and rivers. The difference in proportion of the status of source was very significant ($P = 0.0028$).

The findings also indicate that the proportion of protected water sources cited by the respondents in the experimental area had increased from 22.5% to 84.4% a significant increase of over 60% there was, therefore a very significant statistical increase ($P = 0.000$). Improved access to safe water is generally believed to reduce transmission of various infections and parasitic diseases even though it may be difficult to pinpoint accurately the effects of each intervention. In Soy division only 50% of the respondents indicated to have suffered diarrhoea in a two-week period under review while over 90% had suffered in Moiben division a place with little intervention. This shows that when sources are protected from contamination more people may even afford to travel long distances to get clean water for drinking. Ngugi (1996) shows this connection in an evaluation of KEFINGO a donor funded community based water and sanitation project in Western Province of Kenya.
The mean distance of water source was about 0.7 kilometre in every division. This means people got their water within reasonable distance (the universal definition of “access” to water puts it at 2 kilometres within the homestead). An average number of daily trips to the water sources varied from between 2.5 – 3.5. The number of trips to the source of was partly therefore related to the conventional container size, presence of water within the compound improved access and therefore consumption. Studies found out that when water is not readily accessible or available, women and girls have to waste three to four or even more hours a day fetching water. This has been found to be certainly true for some African countries. There is also an important gender dimension, where by improved water supply and sanitation provides particular benefit of women and girls because they not only do the bulk work of carrying water but often suffer harassment and indignity where they have to use open fields for defecation where latrines are not available. It was found out that this extra duty affected school enrolment in Tanzania and Mozambique, countries where gender roles still weigh much as women and girls Lindslong et al.,(1998).

In the course of the research 8 samples of water were collected from both protected and unprotected sources in the experimental area. The samples were analyzed by the National Public Health Laboratories presence of contamination. The results indicated a wide variation between water from protected sources and those from unprotected sources. The unprotected sources indicated a very high degree of faecal contamination. This was confirmed by the presence of E-coli, a standard parameter
for measuring faecal contamination of water. The study also found out that even though some sources had been protected, contamination still occurred. But the degree of contamination was not statistically significant ($P=0.06$). This however calls for investigation as to the possible source of contamination. Since *E-coli* has parameter may not be water tight. The reason being development of water safety at source requires a strong emphasis on maintenance ad should include assessment of critical control points in water supply system in which contamination is likely to occur. This will serve of focus attention on operating (fetching or other fittings in the system) water supplies in such a away as to minimize risks rather than relying on assessing the quality at the point of delivery. Studies conducted by NETWAS (2000) reported that a water sample taken randomly from either a tap, protected spring, lined up well or a container in a household in rural Kenya has nine out of ten chances of testing positive for the presence of *E.coli*, the bacteria that be the case by indicates water contamination with pathogens of faecal origin.

Kirimi (2002) observed the same among the poor urban households especially the informal settlements where hygiene standards are low. He noted that good quality water tends to deteriorate progressively owing to unhygienic handling the process of transport, storage and at a point of use and that treated water is increasingly being recontaminated from a clean source en route to the glass and mouth.
The use of pit latrines was mentioned as the method of faecal disposal in both places. The study noted the presence particularly of traditional pit latrines in most homes in the research sites. One reason for this trend as observed by Kangethe (1997) and Musembi (2000) is that the latrines provide a viable avenue for faecal disposal.

Regarding access to latrine 77.6% in Soy and 58% in Moiben indicated to be using latrines for faecal disposal. In Soy particularly the access represented a significant increase in latrine coverage in comparison to the period before the interventions. As noted elsewhere, the findings suggest a close observation between sustained health education behaviour modification.

The findings of this study specifically that of the intervention area compares well with the current national coverage for urban dwellers at 79% and far above that of rural and informal settlement at 41%. The proportion of VIP latrines has not picked phase despite one of the projects objectives was to promote access to VIP latrines. Studies by AMREF (2000) found out similar results in their studies in Kwale and Kilifi districts despite enormous resources put in place to adopt the promote V.I.P latrines. It can be inferred here that even though they did not state, respondents in Soy division could be having similar reasons. That aside the increase in latrine coverage was mainly due to the influence of the project. Distribution of latrine slabs as indicated by the project staff could in itself be an incentive promoting latrine construction. The facilities were found to be clean and properly used in both divisions. Focus group
discussions revealed that both adults and children used in both divisions. Focus group discussions revealed that both adults and children used the facility. The drop in diarrhoeal cases in the experimental area can be attributed to provision and use of latrines. Van Damme 919850 documented studies showing that improving sanitation can reduce diarrhoea by more than 2%, but noted that these will vary with pre-intervention measures and household education level (Van Damme, 1985)

There was about 20% difference in hand washing habits by the respondents of two divisions. Those from Soy (55%) indicated they washed their hands after defecating while in Moiben (33%) indicated they washed their hands. Studies by AMREF found out that for there to be marked improvement in health, provision of excreta disposal facilities must be accompanied by behaviour change among the users to be able to realize good hygiene. This study found out that, hand washing is behaviour change that is little appreciated and requires a little bit of time and consistent education. The study found no correlation between hand washing habits after visiting latrines and occurrence of diarrhoea. The science behind hand washing is that infections that are transmitted by ingestion of faecally contaminated water can also be spread by more direct contact between the mouth and the faeces. Studies by Khan (1992) observed that hardware (latrines) in itself cannot improve health very much, what matters is the way in which it is used and the ways in which it may promoted changes in hygiene related behaviour. In some cases, this change is fairly automatic; people across the world need little encouragement to increase the amount of water they are for washing
once it is readily available at the household level. In other cases, however a significant amount of time and effort is required to alter hazardous practices that are considered "safe", or are simply not thought about. Esrey (1992) in his study observed substantial investment have been made in water and sanitation hardware, but hygiene behaviour in these areas often remains a substantial risk to health. In many cultures for example, the excreta of young children is considered safe and free from any contamination and therefore not treated with the same hygienic concern as the excreta of adults. Children are the main victims of faecal oral diseases, and consequently remains major reservoirs of infection. This means that the faeces of children are more infectious than those of adults, as they are more likely to contain the disease causing organisms (WHO, 1996).

Where sanitation is poor, faecal matter can often be a significant fraction of "solid waste". In Lucknow, for example, DFID funded studies on sanitation and solid waste estimated that the contents of "dry latrines" contributed 30-40 tonnes/day or 5% of the total mass of the solid waste chain. (WHO, 1998)

4.1.4 Prevalence of diarrhoea in the experimental and comparison areas

Variation in occurrence of disease in the two divisions was further observed during FGDs the respondents in Moiben division said apart from malaria, diarrhoea and typhoid were ranked second and third. In Soy division even though diarrhoea is...
mentioned among the diseases affecting the community it was ranked much lower in the disease pattern.

The morbidity trends in Moiben division averaged 38% while that of Soy it was 22% over a period of 5 years span. The proportion of diarrhoeal cases in Soy division has dropped from 26% in 1997 to 1% by the year 2001. This 15% decrease can be attributed to improved water supply and sanitation in the intervention area. The findings from this study correlates with those of Musembi (2000) and Kangethe (1997) and studies by Kenya, Republic of, MOH /UNICEF (1992), associated access to safe water with 405 drop in diarrhoeal incidence in comparison with those who used unsafe water in Chogoria, Meru district.

Esrey and Polash (1989) in another study to determine the impact of improved water supply and sanitation on *Ascariasis*, diarrhoea and *Dracunculiasis* observed a medium reduction on diarrhoea.

A recent analysis of data from demographic and health surveys conducted in 8 countries demonstration that improvement in sanitation and safer water supply had a greater impact on diarrhoea prevalence than any other intervention (Esrey, 1996). The provision of sufficient amount of water for good hygiene practices, may be as or more important than simply providing good quality water. Installation of sanitary hardwares such as borehole and latrines should be combined with appropriate promotion of the use of this facilities and relevant behaviour. But to be effective these
actions should be part of the large-scale efforts to improve social economic and environmental conditions.

The observed 15% decline of diarrhoeal cases in Soy division and a significant 255 variation in prevalence of the disease between the two division can therefore be similarly be attributed to the effects of improved water supply and sanitation activities implemented in Soy division.
CHAPTER 5: ASUMMARY OF CONCLUSIONS

(a) The main risk factors of diarrhoea as perceived by the respondents are contaminated food, contaminated water and improper faecal disposal methods. This established that there was significant association status of water sources, presence of latrines and occurrence of diarrhoea in the area.

(b) The study found out that the main sources of water were springs. A significant number in the experimental area where protected.

(c) The proportion of the community with access to safe water supply in the intervention area was 84.4% up from 22% in 1995 (before intervention). In control area access is still very low (6.4%). The conclusion drawn from the findings is that, the interventions has significantly contributed to increased access to safe drinking water in Soy division over a period of six years.

(d) Reduction in cases of diarrhoeal diseases was observed in the experimental area. This is largely due to interventions instituted by the project in the interviewing period. This has lead to reduction of diarrhoeal diseases as evidenced in the said study area.
CHAPTER 6: COMMENDATIONS AND SUGGESTIONS FOR FUTURE RESEARCH WORK

6.1 RECOMMENDATIONS

(a) Increased access to safe drinking water and sanitation has brought about remarkable reduction in cases of diarrhoeal diseases in the intervention area. The activities of the project should therefore be extended not only in Uasin Gishu, but also other areas similarly affected.

(b) The project has been effective in increasing the access to safe drinking water. To sustain this requires full participation of the community in protection of sources and their maintenance.

(c) Continuous health education should be carried out especially on hygiene promotion.

There is need for:

(d) Regular monitoring of protected water sources through bacteriological analysis by the concerned authorities should be made a routine exercise to monitor water quality.

6.2 SUGGESTIONS FOR FUTURE RESEARCH WORK

Further investigation should be carried out in the following area:

(a) To establish to what extent knowledge practice and attitude can influence provision of intervention facilities.

(b) Factors influencing hygiene and sanitary habits of the community.
(c) Carry out cost effect analysis between primary health care activities versus
conventional medicine and, advice policy makers appropriately.
REFERENCES

African Medical and Research Foundation (AMREF, 1996). Health Promotion through water and sanitation, Nairobi, Kenya.


Bangui, J; Ballazar J. and Young, B (1991) Case control studies of effects of Environmental Sanitation on diarrhoea morbidity, methodological implication of field studies in Africa and Asia. Journal Epidemiol Int. 17, 42-47


APPENDICES

APPENDIX 1: RESEARCH INSTRUMENTS

A. STRUCTURED INTERVIEWER SCHEDULE

LOCATION: _______________________

SUB LOCATION: ___________________

VILLAGE: _______________________

HOUSEHOLD CODE: ______________

DATE: ___________________________

SOCIAL DEMOGRAPHIC DATA

1. Sex of the respondent

   (a) Male ( )

   (b) Female ( )

2. Marital status

   (a) Married ( )

   (b) Single ( )

   (c) Separated ( )

   (d) Widow (er) ( )

3. Age in years (as at last birthday) __________________________

4. Educational level attained

   (a) None ( )

   (b) Primary ( )
(c) Secondary ( )
(d) Post secondary ( )

5. What is your religion? ( )
   (a) Non religious ( )
   (b) Catholic ( )
   (c) Protestant ( )
   (d) Muslim ( )
   (e) Others (specify) ________________________

6. (i) What is your main occupation? ( )
   (a) Farming ( )
   (b) Salaried (gainful employment) ( )
   (c) Business ( )
   (d) Others (specify) ________________________

   (ii) What are some of diseases that occur commonly here?

   (iii) Could you rank them a group of illness?

   (iv) Which of these diseases could be associated with water?

7. Do you know of groups of illnesses known as diarrhoea? (a) Yes ( ) No ( )

8. If yes in question 7 above, is diarrhoea a problem in this area? (a) Yes ( ) No ( )

9. If yes in question 8 above, who is the most affected? (a) If yes in No. 8 above, who is the most affected?
10. Has any member of your family suffered from diarrhoea in the past two weeks?

(a) Yes ( )  
(b) No ( )

11. What causes diarrhoea?

(a) Germs ( )  
(b) Dirty food ( )  
(c) Dirty water ( )  
(d) Improper faecal disposal ( )

12. How can diarrhoea be prevented?

(a) Personal hygiene ( )  
(b) Homestead hygiene ( )  
(c) Use of pit latrine ( )  
(d) Don’t know ( )  
(e) Others (Specify) ____________________

13. What activities have you undertaken in your home or area to control diarrhoea?

(a) None ( )  
(b) Protected water sources ( )  
(c) Construction of pit latrines ( )
14. Who else is involved in the implementation of these activities?

(a) Community ( )
(b) Health personnel ( )
(c) Health personnel and community ( )
(d) Others (specify) ____________________________

15. In what ways have these activities influenced the trend of diarrhoea in your household?

WATER SUPPLY

16. What is your main source water?

(a) Well ( )
(b) Borehole ( )
(c) River ( )
(d) Others (specify) ____________________________

17. How far is your water source?

(a) Within the compound ( )
(b) Less than 1 kilometre ( )
(c) 1-2 kilometres ( )
(d) More than 2 kilometres ( )

18. Is the water source protected from contamination?

(a) Yes ( )
(b) No ( )
19. Do you think the water source has any effect on occurrence of diarrhoea?
   (a) Yes ( ) No ( )

20. How is water at home stored? ( )
   (a) Jerrican ( )
   (b) Bucket ( )
   (c) Pots ( )
   (d) Drums ( )
   (e) Others (specify) ____________________________

21. How do you make drinking water safe?
   (a) Boiling ( )
   (b) Filtering ( )
   (c) Chemicals ( )
   (d) Nothing
   (e) Others (specify) ____________________________

22. Is there a latrine for the family?
   (a) Yes ( ) No ( )

23. If yes in question 22 above, who uses the latrines?
   (a) Adults ( )
   (b) Children ( )
   (c) All members ( )
   (d) Others (specify) ____________________________
24. If no, what is the main reason?

(a) Lack of money ( )
(b) Cultural reasons ( )
(c) Difficult terrain ( )
(d) Others (specify) ______________________

25. Do you wash your hands after using the latrine?

(a) Yes ( ) (b) No ( )

26. How do you dispose off your refuse?

(a) Refuse pits ( )
(b) Burning ( )
(c) Composting ( )
(d) Others (specify) ______________________

27. What interventions in your community have been put in place to reduce the prevalence of diarrhoea?

__________________________________________

28. In your opinion what is the effects of these interventions since they were instituted?

__________________________________________
B. CHECK LIST FOR HOUSEHOLD

WATER SUPPLY

1. Storage of drinking water
   (a) In covered vessel ( )
   (b) Not covered ( )

2. Cleanliness of container
   (a) Clean ( )
   (b) Not clean ( )

3. Source of water
   (a) Protected ( )
   (b) Unprotected ( )

4. Rain water harvesting facility
   (a) Water jar ( )
   (b) Ferro cement ( )
   (c) Masonry tank ( )
   (d) Others (specify) _______________________

SANITATION

5. Type of latrine
   (a) None ( )
   (b) Traditional ( )
   (c) VIP Latrine ( )
   (d) Others (specify) _______________________
6. Latrine structure
   (a) Permanent structure ( )
   (b) Semi permanent ( )

7. Condition of latrine
   (a) Satisfactory ( )
   (b) Unsatisfactory ( )

8. Cleanliness of compound
   (a) Clean ( )
   (b) Not clean ( )

9. Refuse disposal system
   (a) Crude dumping ( )
   (b) Refuse pit ( )
   (c) Composting ( )
   (d) Others (specify) ___________________________
C. FOCUS GROUP DISCUSSION GUIDE FOR KEY COMMUNITY ACTORS

1. Knowledge about diarrhoea
   - What are the common diseases in the community?
   - How would you rank these diseases in your community?
   - Which of these diseases may be associated with water?
   - Is diarrhoea a problem in this area?
   - What are the signs and symptoms of diarrhoea?
   - How can diarrhoea be prevented?

2. What are the conditions of the source of water?

3. Is the water supply adequate?

4. Preventive measures at/of source of contamination

5. Methods of excreta disposal

6. Use and none-use
   - Users of the methods
   - Adequacy

7. Obstacles to latrines used
   - Communities' recommendations and interventions
   - Solid waste management
   - Other positive hygiene measures

8. What in your opinion is the effect of these interventions of the prevalence of diarrhoea diseases?
D. HEALTH FACILITY CHECKLIST

Name of health facility: 

Designation of the respondent: 

Services offered:
1. 
2. 
3. 
4. 

Top five (5) diseases treated:
1. 
2. 
3. 
4. 
5. 

TOTAL
DIABETOSAL
MORBIDITY
CASES
Trend of diarrhoeal disease in the past five (5) years

<table>
<thead>
<tr>
<th>YEAR</th>
<th>TOTAL MORBIDITY</th>
<th>DIARRHOEAL CASES</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Major cause of diarrhoeal diseases from laboratory tests.

1.  
2.  
3.  

- Other causes
- Measurers put in place, people involved
- Recommendations
Appendix 2: BASELINE DATA E.H.P. WATER AND SANITATION PROJECT-SOY DIVISION UASIN GICHU DISTRICT (reproduced from project reports – UG/SIDA VOL. 2 (18) 1997)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>940</td>
</tr>
<tr>
<td>Sex respondents</td>
<td></td>
</tr>
<tr>
<td>- Males</td>
<td>62%</td>
</tr>
<tr>
<td>- Females</td>
<td>38%</td>
</tr>
<tr>
<td>Marital Status</td>
<td></td>
</tr>
<tr>
<td>- Married</td>
<td>91.5%</td>
</tr>
<tr>
<td>- Single</td>
<td>2.5%</td>
</tr>
<tr>
<td>- Widowed</td>
<td>6.0%</td>
</tr>
<tr>
<td>Educational status</td>
<td></td>
</tr>
<tr>
<td>- Non formal education</td>
<td>18%</td>
</tr>
<tr>
<td>- Primary education</td>
<td>55.3%</td>
</tr>
<tr>
<td>- Secondary Education</td>
<td>26.7%</td>
</tr>
<tr>
<td>Occupation</td>
<td></td>
</tr>
<tr>
<td>- Farming</td>
<td>73.7%</td>
</tr>
<tr>
<td>- Business</td>
<td>3.7%</td>
</tr>
<tr>
<td>- Salary</td>
<td>22.3%</td>
</tr>
<tr>
<td>- Others</td>
<td>0.3%</td>
</tr>
<tr>
<td>Main water sources</td>
<td></td>
</tr>
<tr>
<td>- Springs</td>
<td>45.1%</td>
</tr>
<tr>
<td>- Wells</td>
<td>28.3%</td>
</tr>
<tr>
<td>- Piped</td>
<td>14.6%</td>
</tr>
<tr>
<td>- Wells/springs</td>
<td>12%</td>
</tr>
<tr>
<td>Distance of water sources</td>
<td></td>
</tr>
<tr>
<td>- In compound</td>
<td>22.3%</td>
</tr>
<tr>
<td>- Less than 1 km</td>
<td>64.3%</td>
</tr>
<tr>
<td>- More than 1 km</td>
<td>13.3%</td>
</tr>
<tr>
<td>Status of water source</td>
<td>Protected: 22.55%</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Latrine structure</td>
<td>Permanent: 9.7%</td>
</tr>
<tr>
<td></td>
<td>Temporary: 17.7%</td>
</tr>
<tr>
<td>Waste disposal methods</td>
<td>Refuse pits: 25.8%</td>
</tr>
<tr>
<td></td>
<td>In garden: 63.7%</td>
</tr>
<tr>
<td>Type of purification done</td>
<td>Boiling: 20%</td>
</tr>
<tr>
<td></td>
<td>None: 75.5%</td>
</tr>
<tr>
<td>Water storage at home</td>
<td>In pots: 61.6%</td>
</tr>
<tr>
<td></td>
<td>Masonry tanks: 4.7%</td>
</tr>
<tr>
<td></td>
<td>Others: 17.9%</td>
</tr>
<tr>
<td>Latrine coverage</td>
<td>57.6%</td>
</tr>
<tr>
<td>Types of latrines</td>
<td>Water closets: 2%</td>
</tr>
<tr>
<td></td>
<td>Ordinary pits: 71%</td>
</tr>
</tbody>
</table>
Use of latrines

- By all members = 87.5%
- Adults only = 8.2%
- Separate latrines = 4.3%

AUSTRALIA

A study conducted in the area was found to be remarkably high (84.4%) up from 17.2% in 1990. This indicates that there was a significant increase in the availability of latrines facilities in the area. The study also revealed that in the previous year, the availability was only 4.5%. However, it is important to note that the information has improved from 17.2% to 84.4%.
Appendix 3: Abstract for the Postgraduate Conference – Kenyatta University

Title of the paper: Effects of safe water supply and sanitation on the prevalence of diarrhoeal diseases in Uasin Gishu District Kenya
Author: Kimutai E. Chumo
Forum: Post-graduate student seminar
Venue: Kenyatta University
Dates: August 2003

ABSTRACT

Diarrhoea, due to contaminated drinking water and poor sanitation is a major cause of poor health and a leading cause of death especially among the under-fives. Diarrhoeal diseases cause an average of 2.5 million deaths each year of which 80% occur among the under-fives. One in every ten children die of diarrhoeal episodes, 10% being persistent. Across sectional - comparatives study as carried out on 500 respondents distributed proportionally to the experimental (Soy division) and the control (Moiben division). The study evaluated environmental interventions initiated by the community and other change agents to mitigate the effects of diarrhoea. Review of health records and bacteriological analysis of water was carried out.

A significant association was observed between occurrence of diarrhoea and status of water sources, as well as availability of latrine facilities in the area ($\chi^2 = 70.979$, df = 1, $p=0.00$). Access to safe water supply in the intervention area was found to be relatively high (84.4% up from 22.5%). Samples from protected sources indicated that water complied with standards for safe drinking ($t=15.08$, $p=0.001$, df=9). Access to safe water in the control area is still low at 6.4%, latrine coverage in the intervention has increased from 57% to 76.5% in the past five years ago in the control it is only 58.4%. There was a statistically significant differences in the occurrence of diarrhoea in the two divisions with the control area reporting five times more cases of diarrhoea than the intervention area ($\chi^2 = 70.979$, df=1, $p=0.000$). More remarkable was the demonstration of the relationship between diarrhoeal incidences and the status of water sources as well as availability of Faecal disposal facilities.

The study concludes that the intervention have had an effect on lowering diarrhoeal morbidity in the area. It provides useful insights on the importance of environmental factors in the control of diarrhoeal diseases. It recommends that local capacity building is intensified and environmental health interventions be extended to cover other areas of the district and similarly affected places in Kenya.
Appendix 4

Interview Consent Form

1. I am a student from Kenyatta University doing a masters degree program and I am carrying out a research on the Influence of water and sanitation on prevalence of diarrhoeal diseases in Uasin Gishu District as part of my studies.

2. I request your consent for the interview which is purely for an award of a MPHE degree.

3. Note that there is no monetary gain in participation, and participation is voluntary.

Thank you for your cooperation

Name: Edwin Kimutai
ID No.: 5276089

Consent by Respondents

Respondents Name: ___________________________________________________________

Signature: ________________________________________________________________

Date: _______________________________________
Appendix 5: Sanitation Facilities

Researcher pointing at the vent pipe on the V.I.P. latrine

Researcher looking at one of the traditional pit latrines
Appendix 6
Types of Water and Sanitation Facilities in the Project Area

(a). The researcher showing one of the protected springs
Water and Sanitation Facilities

(b). The researcher drawing water from a lined up well

(c). The researcher interviewing a consumer of water from a protected well