

CAUSES OF MORTALITY AMONG THE FISHERMEN IN LAKE VICTORIA,
KENYA

By

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A thesis submitted in the partial fulfillment for the requirement of the degree of
Master of Public Health and Epidemiology in School of Pure and Applied Sciences
of Kenyatta University.

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*Cause of mortality
among the fishermen*




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DECLARATION

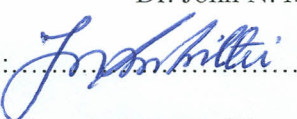
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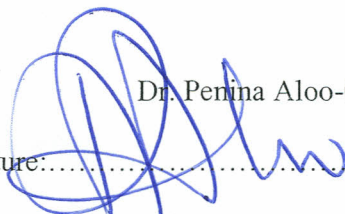
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DEDICATION

To my dear and devoted wife, Scholarstica, with love and my children: Abuje Pauline, Opemo Kevin and Achieng' Laureen and to the memory of all dead and alive fishermen in Kenya.

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TABLE OF CONTENTS

TITLE	I
DECLARATION.....	II
DEDICATION.....	III
ACKNOWLEDGEMENTS	IV
LIST OF TABLES	IX
LIST OF FIGURES	X
ABBREVIATIONS	XI
ABBREVIATIONS	XI
ABSTRACT.....	XII
CHAPTER ONE	1
1.0 INTRODUCTION AND LITERATURE REVIEW	1
1.1 General introduction	1
1.2 Literature review	2
1.2.1 Occupational health and safety	2
1.2.2 Economic contribution of fishing industry	5
1.2.3 Factors contributing to occupational health hazards in fishing industry	6
1.2.4 Accidents.....	7
1.2.5 Diseases.....	13
1.2.6 Cause specific mortality assessment.....	16
1.3 Statement of the Problem.....	19
1.4 Justification	20
1.5 Hypotheses	21
1.6 Objectives of the study.....	22
1.6.1 General objective	22

1.6.2 Specific objectives	22
CHAPTER TWO	23
2.0 MATERIALS AND METHODS	23
2.1 Study area.....	23
2.2 Fishing boats/vessels.....	23
2.3 Fishing gear.....	24
2.4 Sampling methods.....	24
2.4.1 Sampling of the beaches	24
2.5 Field interviewers.....	25
2.6 Ethical consideration.....	26
2.7 Verbal autopsy	26
2.8 Ascribing causes of death by clinicians.....	27
2.9 Assessment of final diagnosis.....	28
2.10 Inclusion criteria	28
2.11 Data management.....	28
3.12 Data analysis	29
CHAPTER THREE	30
3.0 RESULTS	30
3.1 Demographic and socio-economic characteristics of the study population	30
3.2 Causes of death	32
3.3 Major causes of death	32
3.4 Differences in causes of death among the fishermen within the riparian districts.....	32
3.5 Cause-specific mortality by age group	35
3.5 Broad classification of causes of death by district of residence.....	37
3.6 Broad classification cause – specific mortality by age group.....	38

3.6 Broad classification cause – specific mortality by age group.....	38
3.7 The distribution of causes of death attributed to chronic illnesses.....	39
3.8 Drowning fatalities by type of vessels/ boats and propulsion	39
3.9 Proportion of deaths due to drowning by fishing gear.....	40
3.10 Age specific mortality by district of residence	42
3.11 Risk factors associated with fishing.....	44
3.11.1 Proportion of deaths by smoking and alcohol consumption.....	44
3.11.2 Demographic and socio-economic factors associated with cause-specific mortality among fishermen.....	46
3.11.3 Comparison of deaths attributed to HIV-related infections by age group using age group 15 – 19 years as baseline.....	48
3.12 Mortality causes in relation to districts.....	48
3.12.1 The association between deaths attributed to HIV-related infections and district of residence.....	48
3.12.2 Risk factors associated with drowning among fishermen in riparian districts along Lake Victoria - Kenya.....	51
3.12.3 A summary of the results of multiple logistic regression analyses on the proportion of deaths derived from verbal autopsy of deceased fishermen in riparian districts of lake Victoria, Kenya	52
CHAPTER FOUR.....	54
4.0 DISCUSSION	54
4.1 Causes of mortality among fishermen in Lake Victoria – Kenya.....	54
4.1.1 Broad classification of causes of death.....	57
4.1.2 All-cause mortality by age and district	58
4.2 Risk factors associated with mortality among the fishermen	59
4.3 Mortality causes in relation to riparian districts	61
4.3.1 The association between deaths attributed to HIV related infections and district of residence	61

4.3.2 Risk factors associated with drowning among fishermen in riparian districts	62
CHAPTER FIVE.....	65
5.0 CONCLUSIONS	65
5.1 RECOMMENDATIONS.....	65
REFERENCES.....	67
APPENDICES	75
Appendix 1: Riparian districts around Lake Victoria	75
Appendix 2: Respondent's consent form.....	76
Appendix 3: Verbal autopsy questionnaire.....	77
Appendix 4: Coding of diseases causing death among fishermen in Lake Victoria - Kenya.....	91

LIST OF TABLES

Table 1: Socio-demographic characteristics of the study population	31
Table 2: Cause-specific mortality by district among the fishermen in Lake Victoria, Kenya	34
Table 3: Cause-specific mortality by age group among the fishermen in Lake Victoria, Kenya.....	36
Table 4: Broad classification of causes of death by district among the fishermen in Lake Victoria	37
Table 5: Broad classification of causes of death by age group among fishermen in Lake Victoria, Kenya.	38
Table 6: Causes of death attributed to chronic illnesses among fishermen in Lake Victoria, Kenya	39
Table 7: Drowning fatalities by type of boat and propulsion among fishermen in Lake Victoria	40
Table 8: Proportion of deaths by smoking and alcohol consumption habits among fishermen in Lake Victoria	44
Table 9: Logistic regression analysis of cause-specific mortality among fishermen in Lake Victoria by demographic and socio-economic characteristics	46
Table 10: Logistic regression analysis of HIV-related infections as a cause of death among fishermen in Lake Victoria by age group.....	47
Table 11: Logistic regression analysis of HIV-related infections as a cause of death among fishermen by district of residence	49
Table 12: Logistic regression analysis on drowning among fishermen in Lake Victoria, Kenya	50
Table 13: A summary of the results of multiple logistic regression analyses on the proportion of deaths derived from verbal autopsy of deceased fishermen in Riparian Districts of Lake Victoria, Kenya	52

LIST OF FIGURES

Figure 1: Proportion of deaths due to drowning by fishing gear among fishermen in Lake Victoria,
Kenya 41

Figure 2: Age specific mortality by district of residence among fishermen in Lake Victoria, Kenya 43

ABBREVIATIONS

AIDS	Acquired immuno-deficiency syndrome
FAO	Food and Agricultural Organization
GoK	Government of Kenya
HIV	Human immunodeficiency virus
ICD	International Classification of Diseases
ILO	International Labour Organization
LVEMP	Lake Victoria Environmental Project
NIOSH	National Institute for Occupational Safety and Health
NRC	National Research Council
NSW	National Survey of Work Site
SAS	Statistical Analysis Software
SMR	Standardized mortality ratio
PTB	Pulmonary Tuberculosis
UNDP	United Nations Development Programme
UNFPA	United Nations Fund for Population Activities
US BS	United States Bureau of Statistics
VA	Verbal autopsy
WHO	World Health Organization

ABSTRACT

The fishing industry plays an integral role in socio-economic development in Kenya. The working environment of fishermen however is characterized by a wide variety of occupational hazards. Mortality attributed to work related diseases or accidents and injuries are poorly reported in Kenya. Most of the reported cases are in the formal sectors, while the informal sectors such as fishing, where most Kenyans are employed, are largely ignored. The objective of the study was to determine the causes of mortality and identify factors that influence mortality among Kenyan fishermen in Lake Victoria. A two-year retrospective mortality survey using verbal autopsy was carried out among fishermen in the eight riparian districts of Lake Victoria, Kenya on fishermen deaths occurring between August 1998 – July 2000. Differences in the proportions of deaths within the riparian districts were determined by using chi square. Descriptive Statistics were used to calculate the proportions of mortality by disease. Differences in the associations between categorical variables were assessed using Logistic Regression analysis. The study successfully followed up a total of 3058 deceased fishermen. The mean age at death was 33 years (SD: ± 9.5) and a median of 32 years ranging between 15 – 54 years with the peak mortality reported among fishermen aged 25 - 29 years (19.8%) followed by those aged 30 – 34 years (19.3%). The findings reveal that the major causes of death were: HIV – related infections (33.8%), drowning (14.3%), pulmonary tuberculosis (12.4%), and malaria (10.4%). Factors influencing HIV – related mortality were: age group ($p = 0.0025$), districts of residence (Busia, Kisumu, Migori and Suba) all of which had similar p value (<0.0001). The risk factors associated with deaths due to drowning were: age group ($p = <0.0001$), use of a combination of sails and paddles ($p = <0.0001$), use of paddle ($p = 0.0003$), secondary education ($p = <0.0001$) and drinking of alcohol ($p = 0.0012$). Strategies must be identified that would prevent HIV – related infections and drowning among fishing community.

CHAPTER ONE

1.0 INTRODUCTION AND LITERATURE REVIEW

1.1 General introduction

Most adults spend almost one fourth of their time at work and many of them are exposed to dust, chemicals, noise and other work place hazards (Levy and Wagman, 1988). While the right to life is fundamental to every human being, 1.2 million men and women are deprived of the same by occupational and work related diseases yearly. Conservative estimates show that worldwide; workers suffer 250 million occupation accidents and 160 million occupational diseases each year with the majority of the deaths and severe injuries taking place in developing countries. In such countries, a large number of workers are involved in primary and extractive activities such as agriculture, logging, fishing and mining, which form some of the world's most hazardous industries (Somavia, 1999).

Between 1998 –2003, 560 fatal and 7637 non-fatal injuries attributed to occupation were reported by the (GoK, 2003) These figures are however under estimated due to poor reporting system, concentration of the industrial inspectors in towns, only those who need compensation reported the death of their relative (s) to the Directorate of occupational health and safety service, and the inspection are mainly done in the formal sectors. Thus, most of the country's work places which are found in the informal sectors like fishing, agriculture, transport injuries and other areas where workers are exposed to more risks are ignored (GoK, 2003).In Kenya therefore there is no proper reporting system or policy guiding reporting of the occupational deaths, or diseases. This implies that many of the fatal accidents and other diseases are not reported and hence the need to conduct a study to establish cause-specific mortality among fishermen in Lake Victoria - Kenya.

1.2 Literature review

1.2.1 Occupational health and safety

The knowledge that a man's health can be intimately connected with his occupation became apparent at an early stage of social and industrial upheaval (Waldron, 1997).

Occupational environmental safety, as one of the factors that would contribute to ill health, was ignored till 1700, when the first comprehensive review on occupational disease was established (ILO, 1934).

During industrial revolution in Britain, industries sprawled over the countryside without any proper planning and tended to concentrate in the areas where there were readily available sources of energy and raw materials. This brought with it a lot of diseases that resulted in death of employees. The deaths were identified with the following occupations: company directors, electronic engineers, deck and engine room ratings, coal workers, leather product makers, labourers in ceramic, glass industries and textile industries (Waldron, 1997).

In the same study, Waldron (1997) noted that non malignant diseases such as tuberculosis, diabetes, vascular lesion of central nervous system, chronic rheumatic heart disease, coronary heart disease, angina, hypertension, pneumonia, bronchitis, duodenal ulcer and nephritis were more common causes of death among married men. As a result of the pathetic conditions in mines and factories, which led to many deaths, a series of Acts of Parliament were therefore passed in the early part of nineteenth century, designed to ensure safety at work. Medical Factory Inspectorate Act of 1898, and many others were passed to improve the condition of employment.

In the United States, the onset of industrial revolution brought with it the same upheavals similar to the ones in Britain and created public concern related to safety problems.

In 1867, Massachusetts created the first department of factory inspection in the nineteenth century by enacting the first job safety law, which required guards for textile spinning machinery (Lavenstein, 1988).

The Knights of Labour, the leading labour organization in 1870's and 1880's demanded that measures be put in place that would ensure safety of those who were engaged in mining and manufacturing, building, industries and for identification for injuries. By 1900, most of the heavily industrialized states had minimal legislation dealing with employment hazards (Lavenstein, 1988).

It has been pointed out that occupational diseases and injuries have higher propensity leading to permanent disability. A research survey carried out between 1991 and 1999 in the United States of America (U.S.A) revealed that 58% of those who had occupational diseases and 17% of the injured ended up with permanent disability. The results of the study showed that males were more affected (67.5%) compared to their female counterparts (NSW, 1999).

Unfortunately, there are several factors that make occupational diseases difficult to recognize. First, there is a long period between initial exposure and onset of signs and symptoms. Consequently, this makes cause-effect relationship difficult since there are many and varied occupational and non-occupational hazards which most workers are exposed to. Secondly, many problems including diseases and injuries do not come to the attention of health professionals and employers. Such injuries are therefore not included in routine data collection systems. Thirdly, some medical diseases or signs and symptoms recognized by health professionals or employers as work-related are not reported because the association with work is equivocal and reporting requirements are not strict, resulting in under-reporting.

Finally, many if not all the occupational medical diseases and problems are preventable; therefore their persistence implies that some individuals or groups are legally and economically responsible for creating or perpetuating them (Levy and Wagman, 1988). In the struggle to ensure safe and healthful working conditions for both men and women, Occupational Medicine was “born” which had started as early as sixteenth century in Britain, but has now spread all over the world (Waldron, 1997). Along with the occupational medicine came, Occupational Health and Safety Department, this is enacted, by the parliament of many countries.

The major roles of these departments in conjunction with ILO include: recognition of work related diseases, establishment of the correct diagnosis and approach to treatment of the affected individuals, prevention of recurrence of diseases, assurance that the affected workers receive economic compensation legally due to them and, discovering new relationships between work exposure and disease. Apart from the occupational diseases that workers die from, fatal occupational injuries contribute significantly to the occupational mortality. According to census of fatal occupational injuries done in fifty countries which also included some states in USA, occupational fatal injuries were higher among fabricators and non-skilled labourers (47%), transport and material moving occupations, motor vehicle operators, construction labourers and machine operators, precision production, craft and repair (16%), managerial and professional speciality (13%), technical sales and administrative support (10%), and finally, farming, forestry and fishing (8%) (US Bureau of Labour Statistics, 2002).

Whereas mental disorders (depression, anxiety and other psychological and psychiatric conditions) due to occupational stress is currently contributing significantly to fatal injuries at work place, it has been noted that these disorders have also become major occupational

diseases (NSW, 1999). In the study carried out between 1996 and 1999 in U.S.A, mental disorders, on the average, contributed to 17.6% of all occupational diseases.

Most of these were reported in the following industries: finance and insurance (66.7%), education (54.3%), health and community services (43.3%) (NSW, 1999).

1.2.2 Economic contribution of fishing industry

Fishing industry provides livelihood to approximately 100 – 200 million people worldwide, of whom 95% live in the developing countries (Konstapel and Noorts, 1995). In 1995, the fisheries industry supported over 34000 fishermen with estimated 238,000 dependants. A further 526,000 Kenyans are involved in selling fishing inputs, fish handling, processing and marketing. Thus the industry gives economic support to over 798,000 Kenyans directly and indirectly (GoK, 1995).

Overall, the industry accounts for 25% of the country's total employment in the informal sector and 14.5% of the country's total employment (Bokea and Ikiara, 2000). Though Kenya is a coastal state with marine coastline of 640 kilometers and marine fishing industry, Lake Victoria still dominates the fishing industry with 94% output, the marine has only 3% while rivers, dams and other lakes like Turkana, Baringo and Naivasha contribute the remaining 3% (GoK, 2000; Bokea and Ikiara, 2000). The annual catch from the lake amounts to 25% of the total catch from Africa Inland Fisheries (FAO, 1995). Apart from employment, the industry provides 50% of the animal proteins consumed worldwide by human beings with Africa alone accounting for 19% (Myers, 1997). In Kenya, the fishing industry provides the cheapest animal protein to all ethnic groups regardless of their creed and socio-economic status.

Between 1998 – 2000 Kenyans earned Kshs. 15 billion and a further foreign exchange of about Kshs. 3.6 billion from the fishing industry (GoK, 2000). The financial income

originates from; fin fish, shellfish, and crustaceans, which are intended primarily for human consumptions.

By-products such as oil, frames (skeletons), skin, shell, fish bladder (maws), and liver, on the other hand, find their way to various markets both locally and internationally where they are used to make soaps, animal feeds, fertilizers and medicine, among others (Grainger, 1993; Bokea and Ikiara, 2000). The industry therefore plays an integral role in socio-economic development in the countries concerned including Kenya. However, the nature of the work exposes fishermen and their families to exceptionally high risk of accidents and illnesses, which can be either fatal or non-fatal (Grainger, 1993).

1.2.3 Factors contributing to occupational health hazards in fishing industry

Fishing has consistently been ranked the riskiest occupation in the United States since 1992 when Bureau of Labour statistics started publishing fatality rates by occupation. The working environment of commercial fishermen is characterized by a wide variety of occupational hazards (US Bureau of Labour Statistics, 2002). In a study done in North Carolina, it was observed that fishing occupation, despite its modernization, is still carried out under unchangeable environmental conditions and is associated with higher rates of fatal and non-fatal occupational injuries worldwide (Loomis *et al.*, 2001). It has also been observed that fishing takes place often in hostile marine environments where vessels, except in very calm weather, are constantly in motion. In rough weather, the vessel motion may be extreme and unpredictable. For example, on the deck fishermen are exposed to the rough weather of the sea, fishing gear, other equipments and even to the catch itself (ILO, 1999).

A comparison between fatality in the fishing industry and fatality reported in other occupations in Australia between 1982 and 1984 shows that the fatality rate for fishermen

was 143/100,000 person-year, which was 18 times higher than the fatality of all the work force (Driscoll *et al.*, 1994). In Denmark from 1989 to 1996, the rate was 25 to 30 times higher than the rate for those employed on the land.

In United States, in 1996, the death rate was estimated at eight times that of persons operating motor vehicles for a living, sixteen times higher than fire fighting and police work force, and over forty times the national average. In Tunisia in the rate was double the national average by 1994(ILO, 1999). As it appears, fishing has consistently proven to be hazardous occupation. From the literature available, the major contributing factors to a high mortality among the fishermen are the fatal accidents and diseases (ILO, 1999).

1.2.4 Accidents

Fishermen do suffer high rates of non-fatal injuries including cumulative musculoskeletal injuries, injuries to fingers and hands related to use of winches, machinery and knives (US-BS, 2002). Besides these, other injuries like contusion, bruise, swellings, lacerations and fractures have been reported too (Jensen, 1996).

It is estimated that fishing has a worldwide accident fatality rate of 80 per 100,000 workers or approximately 24,000 deaths annually. Causes of fatal injuries in fishing industry may be grouped under: extreme weather, vessels, human error, culture and attitude, fatigue, age, type of fishing and snake bite (ILO, 1999).

Though not an occupational cause of death, suicides have also been noted as common causes of death among fishermen. In a study among Polish fishermen, suicide featured prominently as one of the causes of death (Jeremin *et al.*, 1997; Neutel, 1989).

1.2.4.1 Extreme Weather

Extreme weather conditions are crucial factors responsible for deaths due to drowning, super cooling of the body and even mechanical injuries (Jaremin *et al.*, 1997).

A study in Canadian Atlantic Coast of Nova Scotia, New Brunswick and Prince Edward Island indicated that adverse weather conditions leading to capsizing, sinking, foundering of the vessels may result in drowning of fishermen (NIOSH, 1994; Hasselback and Neutel, 1990).

Sixty two per cent of all the vessels working in Alaska capsized because they were operating in rough weather (NIOSH, 1997). Studies done in Australia and New Zealand showed that bad weather was the primary cause of 53% and 61% of fatal deaths, respectively (Driscoll *et al.*, 1994).

1.2.4.2 Vessels (Boats)

Many deaths of fishermen have been associated with vessel casualties. According to the estimates in the United States of America, 57% fatalities are directly related to vessel casualty due to capsizing, sinking, foundering collision and instability (Spitzer, 1999). According to a study done in Australia where 68% of deaths were due to accidental drowning, non sea-worthy vessels featured prominently as one of the contributing factors (Driscoll *et al.*, 1994). According to data collected between 1995 and 1997 from 18 countries namely: Argentina, Brazil, Canada, Cuba, Denmark, France, Germany, Ireland, Morocco, Netherlands, Norway, Poland, Slovenia, Spain, Sweden, United Kingdom, Vanuatu and Hong Kong and China, causes of fatalities due to vessel casualties included foundering (53.3%), wrecking or stranding of the vessels (19.9%), capsizing (13.9%), collision (71%) (ILO, 1999).

The other vessel related factors which lead to fatal accidents include: non-availability or lack of adherence to structural guidelines, classification society rules and similar standards during vessel design and construction or conversion, general non-availability of stability data for each vessel and inadequate material condition of vessels and equipment, especially

machinery, alarm system, and survival equipment (National Research Council (NRC), 1991).

1.2.4.3 Human errors

Due to economic and competitive pressures, the fishermen are prone to take uncalculated risks. Usually, the vessels are not adequately maintained or repaired. Moreover, there is poor judgment exercised as to when and where to go fishing leading to unwarranted accidents and deaths (North Pacific Fishing Vessels Owners Association, 1997).

Inadequate and/or lack of the floating devices, insufficient training in ship board safety, especially regarding cold survival techniques and the use of life-saving equipment have contributed steadily to fatal accidents among fishermen (NIOSH, 1997; NIOSH, 1994). In another study done in Australia, inadequate use of personal floating devices and inexperience were associated with death (Driscoll, 1994).

Furthermore, drunkenness has been reported as a major contributing factor to human errors leading to accidents including drowning of fishermen when they go ashore (Grainger, 1993; NRC, 1991).

After operating through a traditional technology under specific local condition for a long time, the fishermen have inherited time proven responses to crisis at the sea in relation to weather perception. As a result, they have evolved through ages of operating traditional technology under specific local conditions. However, the introduction of modern technologies into traditional systems has in many cases upset traditional ways of doing things. Lack of appreciation of limits of modern technology by the fishermen has led to the taking of undue risks such as assuming the out-board motor will always work.

This is often exacerbated by shortcomings in technical training in engine operation and maritime training in navigation, use of electronic aids and safety equipment in first aid and correct response in emergencies.

Another factor is a mistrust of modern weather forecasting system and, perhaps even more so, of those who convey the information. A warning from the shore-side official with no fishing experience may not be believed (ILO, 1999). The payment of wages in the fishing industry is done mainly by sharing the catch. The share system is motivating and creates a sense of team spirit and gives everyone a stake in the result. However, this method can also cause fishermen to accept poor working conditions and long working hours (Bloch, 1992). In order to increase their income, the fishermen will ensure that the gear is in use for as long as possible. This can lead to hasty maneuvering and adoption of unsafe practices. The working rhythm, which is controlled by the size of the catch, the length of the trip, the length of the haul and the compromised quality requirements of the machinery, may be an important factor in contributing to accidents (Barrey, 1992).

In another study, incapacitations through drugs and alcohol, inadequate physical condition and inexperience have equally contributed to fatal mortality (NRC, 1991).

1.2.4.4 Culture and Attitude

Though fatality and injury rates remain high, certain dangers inherent in working at sea will always remain and cannot be eliminated probably because some fishermen's negative attitudes towards safety and towards the regulations established to improve it. Many fishermen have a different perception of danger. Elements of risk are inherent in almost every decision made by individual fisherman. Decisions on when and where to go fishing, whether to head for shelter, what gear to use, whether or not to change the fishing spot, which direction to set their gear, when and where to land their catch, all take into account the weather changes, condition of fishing vessel and equipment as well as the condition and dexterity of the crew (ILO, 1999). However, all these depend on the fisherman's culture, individual attitude, experience and skills.

Fishing is highly competitive and therefore highly successful fishermen enjoy tremendous prestige among the fishing folks and their communities. Consequently, prestige considerations may motivate fisherman to take unnecessary risks (Poggie *et al.*, 1995).

1.2.4.5 Fatigue

Several studies of fishing safety and many investigations of accidents involving fishing vessels have cited fatigue as a contributing factor to casualties. Fatigue has been defined as “a reduction in physical and/or mental capability as a result of physical, mental or emotional exertion.

It may impair nearly all-physical abilities including strength, speed, reaction time, coordination, decision-making or balance (Maritime Safety Committee, 1998). A study conducted on working patterns on fishing vessels examined the time within a working shift when accidents occurred. It was observed that after a few hours of work there was a progressive reduction in the probability of accidents. Accidents occurred more frequently when work continued beyond eight hours (Marugan & Pintos, 1992). The results of study conducted in Spain showed that there was a direct relationship between accidents and hours of work. The researchers noted that “fundamental cause of accidents was the excessively long hours of work which characterizes the fishing industry. The sad fact is that, in any type of fishing, fishermen work 15 to 20 hours a day without a break regardless of the type of fleet” (Garcia, 1992). In a study carried out in Poland, physical over strain, extremely long working times (12 to 16 hours a day), stress, the thermoregulations and disturbances were associated with 20% of accidents among the deep-sea fishermen (Jaremin *et al.*, 1997). The “share system” is also a contributing factor to fatigue. The system creates incentives for minimizing the number of crewmembers; the fewer the fishermen sharing the catch, the more pay for each.

Where as fishing is very good there is tendency to continue, despite excessive working hours and physical exhaustion (ILO, 1999).

Generally, the length of time that a vessel spends at sea depend on several factors, including; the number of hauls, technology involved, the availability and maintenance of both fish-finding and fish catching equipment, the frequency of equipment breakdown, the experience of the captain and availability of fish. Since workers want to get to the shore as fast as possible and make money on a trip, they will push themselves to the limit when fishing is good. They will work beyond their regular work shift, and push their equipment to the limit in order to bring the large catches of the fish which results in fatigue and increased risk of accidents (Binkley, 1995).

New technology can often alleviate fatigue by reducing the physical exhaustion of the crew. In a study carried out in Spain, it was observed that the introduction of new containers for storing catch on deep sea wet trawlers increased the hours of work for the same tonnage of fish (Andro and Leroy, 1992). On some improved vessels the best seating consists of a padded bench with a vertical padded backrest a long the bulkhead. There are no comfortable accommodation where the off duty crew can get proper rest so that they come on duty as fresh as possible (ILO, 1999).

1.2.4.6 Age

The results of a mortality study among commercial fishermen of Atlantic Canada showed that younger men aged less than 44 years experienced mortality due to accidents was 1.5 times higher than their older counterparts (Neutel, 1989). In another study among the Polish deep sea and boat fishermen, the results revealed that accidents were more frequent among those fishermen aged 20-39 years compared to those who are between 40-59 years (Jaremin *et al.*, 1997). In Iceland, a study revealed that the greatest number of drowning occurred among the seamen aged between 20 and 24 years. However, the mortality

attributed to drowning was highest among those aged 45 and 54 years (Rafnsson and Gunnarsdottir, 1992).

1.2.4.7 Type of Fishing

Fatality rate varies substantially by type of fishing (NIOSH, 1991). In the Alaskan crab fisheries, 30 fatal events resulted in 61 (42%) of all fatalities. In the salmon fishery in Alaska, out of 26 accidents, there were 23 fatalities. Ten of the 26 salmon-related fatalities occurred after falling over-board, half of them in calm waters (NIOSH, 1997)

1.2.4.8 Snake bite

In studies done in North West Malaya between 1957 and 1961 among the sea users, fishermen were cited as more likely victims of snake bite. Eighty percent of the sea users who were bitten by snakes were fishermen, the majority (88%) of whom died between 4 – 6 hours after the incident (Reid, 1975).

1.2.5 Diseases

A part from injuries associated with fishing, consumption of fish contaminated with chemicals results in a wide spectrum of cancers, which also lead to morbidity and mortality (Svensson *et al.*, 1995; Lynge, 1990; Fair Weather, 1991). Disorders such as skin diseases and wounds take unusually longer to heal while varicose veins become more prominent as a result of long sitting. Contact with diesel used to power the boats may cause dermatitis, while highly mechanized vessels contribute to occupational hearing loss due to noise. In addition, solar keratitis, otitis media and tympanic membrane perforation have also been reported (Puertas, 1998; Casson *et al.*, 1998). Other diseases that are commonly found among the fishermen include fatal poisoning, asphyxia, cardiovascular illnesses,

respiratory diseases and waterborne diseases. Most of these can be managed at a minimum cost, but they continue to interfere with the fishing industry causing greater economic loss (Grainger, 1993).

1.2.5.1 Cancer

Fishermen are prone to cancer of different parts of the body. In a study done among commercial fishermen in Atlantic Canada, cancer was found to be significantly high. Cancer of pancreas was leading with standardized mortality ratio (SMR) of 1.90, followed by stomach cancer (SMR of 1.42) and cancer of nervous system. Other cancers that were found but with low SMR included cancer of lungs and cancer of intestines (Neutel, 1989).

Among Swedish fishermen, cancer of the stomach and squamous cell skin and lip cancer were found to be elevated due to fatty fish contaminated with chemicals which included organochlorine compounds (polychlorinated biphenyls, polychlorinated dibenzo-p-dioxins, and polychlorinated dibenzofurans) and carcinogenic substances known as arsenic which was commonly found in smoked fish (Svenson *et al.*, 1995).

In the same study, cancer of the lips was also cited to be rating high among fishermen in Denmark (Lyng, 1990). In another study, there was an excess of death from cancer of liver and kidney (Rafnsson and Gunnarsdottir, 1994). The greatest health hazard among the fishermen in Italy was cancer of the lungs, which was linked to long hours of smoking in the sea (Mastrangelo *et al.*, 1995).

1.2.5.2 Cardiovascular Diseases

Cardiovascular diseases among fishermen range from simple forms like varicose veins to more complicated disorders that involved the heart (Jaremin *et al.*, 1997). Among the Polish fishermen who died between 1985 and 1994, 80% died from circulatory diseases,

especially myocardial infection and ischaemic heart disease (Jaremin *et al.*, 1997).

Ischaemic heart disease was also found to be a significant cause of excess death among the Icelandic fishermen (Rafnsson and Gunnarsdottir, 1994).

Among the fishermen from Urk in Italy, hypertension prevalence occurred with significantly high mortality (Heetveld *et al.*, 1992)

1.2.5.3 Respiratory Diseases

Laboural disability due to respiratory causes, occupy the third place in global population and the first place is in high sea fishermen (Marco *et al.*, 1995). Respiratory diseases among fishermen range from simple allergic reaction like sinusitis to major disorders and infections which could lead to difficulties in breathing and death. In Italy, a study carried out among the fishermen of deep sea concluded that obstructive bronchitis and chronic sinusitis are the chronic disorders among fishermen (Casson *et al.*, 1998). On the other hand, bronchitis and emphysema were reported to be the cause of high mortality among Danish fishermen (Jensen, 1996).

1.2.5.4 Diseases of the Digestive System

Most of these conditions are functional and caused by irregular hours of work, excessive spicing of foods, nervous tension, consumption of alcohol at high rate and eating cold food (Puertas, 1998). Other findings have revealed that fishermen suffer from other diseases of digestive system, especially gastritis and duodenitis (Tomaszunos *et al.*, 1988).

1.2.5.5 Water -borne diseases

Due to the nature of their working environment, fishermen are likely to suffer from various types of water-born diseases namely diarrhoeal infections due pathogenic bacteria,

intestinal helminthes like hookworm and protozoan such as amoeba. In a study done in Norway between 1854 and 1883, typhoid among other diseases contributed significantly to morbidity and mortality among fishermen compared to other water borne diseases (Sandvik, 1993).

In a study done along river Niger Delta, prevalence of hookworm was higher among the fishermen compared to other occupations (Udonsi and Imabibi, 1992).

1.2.6 Cause specific mortality assessment

Information on causes of death is extremely important for policy making, planning, monitoring and evaluation of health programmes (Murray and Lopez, 1997). Information on causes of death in developing countries is based on records from government health institutions which are irregularly submitted to the relevant authorities (Mizra *et al.*, 1990). Attempts have been made to come up with tools, which will adequately assess the causes of death in developing countries some of which have proved useful. The following are some of the tools that have been used with success.

1.2.6.1. Verbal Autopsy

Verbal autopsy (VA) is an epidemiological tool that is widely used to ascribe causes of death from information obtained from bereaved relatives, caretakers or close friends of the deceased person (Snow *et al.*, 1992; Chandramohan *et al.*, 1998). After its development, the tool as a method of assessing deaths was recommended by WHO as a bold step to break a way from the concept of the dependability on doctor's report on cause of death. VA thus uses lay reporters to conduct the interviews (WHO, 1994a). Since its development VA has been used extensively with success in the study of causes of death among both adults and children in developing countries (Baqui *et al.*, 1998; Chandramohan *et al.*,

1998; Snow *et al.*, 1993). No study on cause specific mortality has, however, been conducted, using VA to ascribe causes of death among fishermen in Africa.

Following the fact that information on cause of death among adults in sub-Saharan Africa is scanty and that the data available consist mostly of extrapolations and out right guesses, it was suggested that verbal autopsy would contribute to understanding about the cause of death among adults (Kaufman *et al.*, 1997).

Verbal autopsy was used to assess the deaths among adults in Ghana, Tanzania and Ethiopia simultaneously (Kaufman *et al.*, 1997). In this study the specificity by physicians fell below 95% only for acute febrile illness, tuberculosis and AIDS. Sensitivity and positive predictive values however varied widely both across the sites and between causes. In spite of the variation in sensitivities and specificities regarding causes of death ascribed through VA compared to the health facility deaths used as gold standard, VA is still considered the most appropriate tool that can be used in rural areas where the majority of deaths occur at home (Kaufman *et al.*, 1997).

In the absence of the verbal autopsy, there are other methods of assessing causes of mortality within a community where doctors are not available though they too have their own limitations.

Adult VA has been validated on deaths occurring at hospitals in Tanzania, Ethiopia and Ghana. Specificity of VAs by physicians fell below 95% only for acute febrile illness and TB/AIDS. Sensitivity was more than 75% for tetanus, rabies, injuries and TB/AIDS and ranged between 60% – 74% for diarrhoea, acute abdominal conditions and acute febrile illness. When the communicable diseases were combined in a single group, the sensitivity was 82% and specificity 78%. For the group of noncommunicable diseases, the corresponding sensitivity was 71% and specificity of 87%. Overall, VA by a panel of physicians performed better than an opinion-based algorithm (Chandramohan *et al.*, 1998).

1.2.6.2. Civil Registration

Civil registration has been adopted in countries with limited resources because it is a routine system and identifies deaths automatically without additional and recurrent costs (WHO, 1994a).

Since 1968, the registration of deaths has been compulsory for the entire population in Kenya (Principal Registrar, personal communication). Births and deaths that occur in Kenya are legally required to be registered within six months from the date of occurrence (Laws of Kenya, Cap 149). The Kenya Government in conjunction with the United Nations Fund for Population Activities (UNFPA) launched a programme to upgrade the vital registration system in 1982, in three districts of Central and Western provinces. Before upgrading of the registration of deaths, assistant chiefs were remunerated for the deaths they reported to District Registrar of Births and Deaths. This practice stopped because some assistant chiefs falsified some deaths. The deaths were also difficult to verify because they were not entered in the registry (Principal Registrar, personal communication).

The new system has avoided this problem through the assurance of serialized burial permit forms that are completed in duplicate and notification forms forwarded to District Registrar of Births and Deaths Office where the reported deaths are then serialized.

Identification of causes of deaths among adults through death certificate was carried out in South Africa between 1914 and 1995 and the results showed increasing trend in reported deaths. This tool was found to be reliable especially if used consistently (Kleinschmidt, 1999). In a study done in Cameroon between 1991 and 1992, to evaluate vital registers, the method was found to be inaccurate source of causes of infant deaths (Ndong *et al.*, 1994).

A study conducted at the Kenyan coast (Kilifi) between 1992 and 1993 where civil registration had been in operation, a comparison between it (civil registration) and active

surveillance revealed underreporting of deaths from civil registration, particularly childhood deaths to the civil authority (Mungala and Snow, 1994).

However, a comparison demographic study on civil registration conducted among under five years old children revealed that compared to VA, causes of death reported through civil registration were less useful for health policy issues (Arudo *et al.*, 2003).

1.2.6.3 Routine health services surveillance

Cause specific mortality surveillance can also be conducted in health facilities. Development of national systems for collection and interpretation of mortality and morbidity has been an important component of WHO recommendation (Phillips-Howard, 1993). The data are collected routinely from each level of health care system and communicated centrally for analysis and interpretation. Results from a study conducted in former Zaire using this method revealed that the minimum population based malaria mortality rates (4.0 per 1000 person years) was highest for children aged less than 1 year of age (Greenberg *et al.*, 1989). However, hospital surveillance cause specific mortality may not be useful to determine death rates unless all deaths occur in the hospitals. In many countries in the developing world, majority of the population do not have access to health facilities, therefore, cause-specific mortality may not be representative (Burstorm *et al.*, 1995).

1.3 Statement of the Problem

Commercial fishing as an occupation is known all over the world as one of the most hazardous in terms of work-related mortality (NIOSH, 1997; NIOSH, 1994). However, most of the reliable information that is available to us is from the developed countries. In Kenya, the districts bordering Lake Victoria (Riparian districts) are holo-endemic malarial zones and have been having regular epidemics of waterborne diseases; including cholera,

typhoid, bacillary dysentery and schistosomiasis (GoK, 2000). The magnitude, extent and consequences of these diseases and other hazards related to fishing in Kenya have not been properly determined.

Besides, information concerning the lifestyle and risk factors associated with mortality among fishermen are also not clearly known. Policies and other relevant measures such as life saving equipment, trained emergency response personnel, and living conditions at the beaches are not well articulated.

1.4 Justification

Fishing industry is very important because it provides 50% of all animal protein consumed by human beings worldwide compared to proportion obtained from beef and poultry combined, of which 19% is consumed by African people (Myers, 1997). In Kenya, the industry is increasingly providing cheap source of high protein which can be afforded even by those who are economically disadvantaged. From 1980, there has been increased fish consumption among Kenyan ethnic groups, who otherwise did not consider fish as staple food (Bokea and Ikiara, 2000). Employment is the second avenue through which, fishing provides livelihood. Food and Agriculture Organization of the United Nations (FAO) estimated that livelihood of 100-200 million people, 95% of whom are living in developing countries, directly or indirectly depend on the fishing industry (Konstapel and Noort, 1995).

Foreign exchange earnings from fishing have been growing steadily from annual average of 2.5% between 1975 and 1985, to 303.7% between 1996 and 1999. The government of Kenya earns a substantial amount of revenue through licensing of fish processing factories, animal feeds, and annual registration of boats (vessels), insurance of traders, license, export certificates and bureau of standards. Between 1991 and 1997 the government earned 42.4 million from these sources. Lake Victoria alone produces 94% of the total fish

harvested in the country being handled by 49,000 registered fishermen, and another 24,500 who are unregistered (Bokea and Ikiara, 2000).

Though an important economic sector in the country, the fishing industry policies and other relevant measures such as life saving equipment, trained emergency response personnel, lack of communication equipment and congested unhygienic living conditions at the beaches have not been addressed. This, in part, can be attributed to lack of information on cause-specific mortality among fishermen and the risk factors associated with such causes of death. This study was therefore aimed at identifying cause specific mortality and the risk factors associated with the causes of death among fishermen.

1.5 Hypotheses

1.5.1 There is no difference between the proportion of deaths caused by communicable diseases among the fishermen compared to due to non-communicable.

1.5.2 There is no difference between the proportion of deaths caused by accidents /injuries among the fishermen and compared to non-communicable diseases.

Riparian districts do not differ with respect to the proportion of death among the fishermen caused by accidents /injuries compared to communicable diseases.

1.6 Objectives of the study

1.6.1 General objective

To identify the major causes and establish factors associated with mortality among Kenyan fishermen in Lake Victoria

1.6.2 Specific objectives

The specific objectives were to:

- 1) Identify the causes of mortality among the Kenyan fishermen in Lake Victoria, Kenya
- 2) Establish factors associated with mortality among the Kenyan fishermen in Lake Victoria.
- 3) Compare mortality among the fishermen within the riparian districts in Kenya.

CHAPTER TWO

2.0 MATERIALS AND METHODS

2.1 Study area.

Lake Victoria (Appendix 1) is the second largest fresh water body after The Great Lakes of America, but the largest in Africa with an area of 69,000 km². The lake is shared by Tanzania (49%), Uganda (45%) and Kenya (6%). It is situated between 31⁰ E and 35⁰ E longitude, 1⁰ N and 3⁰ S latitude (Appendix 1). The Kenyan waters which is 4,128 km² extends from Sio Port in Busia District on the North through Bondo, Kisumu, Nyando, Rachuonyo, Homa Bay, Suba and Migori to the South. The shoreline is approximately 400 km with 293 fish landing beaches of which 208 are gazetted. It has a total of 23,000 fishing vessels with approximately 70,000 fishermen of whom 50% are not registered by the respective beaches (GoK, 1999). The riparian districts have a total population of 2,679,000 out of which 2.6% are fishermen. About 51% of the population is women (CBS, 2000). The riparian districts are inhabited by the Luhya tribe in Busia District to the north, Abasuba in the Suba District 1-eastern while the rest are occupied by Luo tribe.

2.2 Fishing boats/vessels

This entails the methodology (ies) employed in exploiting a fishery. The techniques of fishing vary from place to place and are determined by several factors, targeted species being the most important. The devices used in this exercise can be categorised into two: those used to access fishing grounds or in transporting catch to the landing site and, those used in the actual capture of fish. Crafts/boats in Lake Victoria fisheries have evolved quite significantly from a single log, rafters, dugout canoes all through to large planked boats and non-planked boats. Depending on locality, same craft may be referred to by different names, or may have a slight structural or operational modification. Commonly used crafts in Lake Victoria along the eight riparian districts include, sesse, Taruma and Karua.

2.3 Fishing gear

A fishing gear refers to any device, used to capture fish from the water. It may be a net, a hook, any type of trap, be it traditional or modern, plus all the accessories that go with this. Craft refers to the device used to access the fishing ground. It may be a single log or planked boat.

2.4 Sampling methods

2.4.1 Sampling of the beaches

The study covered fishermen in the study area who worked in either of the beaches within the districts between August 1998 to July 2000, and during which they met their deaths. All the eight riparian districts were included in the study to form clusters and to address possible variations of the risks and risk factors that contributed mortality among the fishermen. There are a total of 293 landing beaches of which 208 are gazetted. The number of gazetted beaches and registration of vessels and fishermen per district guided the selection. Stratified sampling method using an interval of four beaches was used giving a total of 52 beaches. The vessels where fishermen worked before death were identified through snow ball sampling, and random sampling using the registration numbers of boats in the sampled beaches. It is at this level that those who were close to the deceased were identified and interviewed

2.4.1.1 Population sample size calculation

Sample size was calculated according to Fishers *et al* (1998).

Thus;
$$N = Z^2 pqD/d^2$$

Where
$$N = \text{Sample size}$$

$$Z = \text{Standard normal deviate (1.96 which correspond to 95\% confidence interval)}$$

p = Proportion of the target population estimated to have particular characteristics prevalence is unknown, therefore, 50% was used.

$$q = 1 - p$$

$$d = \text{Degree of accuracy} = 0.05$$

$$D = \text{Design effect} = \text{the 8 riparian districts}$$

Therefore

$$N = \frac{(196^2 \times 0.5 \times 0.5)}{0.05^2}$$

$$= 384.16 \text{ which is approximately 400 to the nearest.}$$

Each district therefore had a sample of 400 deceased.

2.5 Field interviewers

Verbal autopsy questionnaires were issued to 6 research assistants per beach. The interviewers were identified through the beach leaders. The interviewers who were Form four leavers with a minimum qualification of Grade C were trained for two days by the researcher on how to conduct the VA interviews. They were members of the community and were fluent in the local language, the first language of the interviewee. The training included: the use of appropriate vernacular, techniques of talking to the bereaved families and the implementation of the VA questionnaire. The team interviewed caretakers or close friends of the deceased fishermen. Once the deaths were reported to the researcher through the beach leaders, the researcher allocated the deaths to the VA team for follow up for detailed description of events surrounding the death in order to validate the event. Efforts were made to conduct the interviews within two years of the fisherman's death.

2.6 Ethical consideration

Data security procedures to protect the identity of the deceased and the respondents were implemented during VA interviews. Respondents were fully informed of these confidentiality issues at the outset of the interview.

The respondents were given detailed description of study prior to commencement and it was explained to them that their participation was voluntary, and that no information given would be divulged to anyone other than the research staff.

The interviewers were also trained on how to show empathy to the bereaved relatives during the interviews in order to reduce the level of stress as such interviews remind respondents of their departed loved ones. In the event of any signs of distress during the interview, the interviewers were instructed to refrain from further questioning and only proceeded if the respondent desired. The participants were also informed that there were no direct benefits from the study (Appendix 2). Permission for the research was given by Ministries of Education, Science and Technology.

2.7 Verbal autopsy

A modified version of VA tool designed by Chandramohan (1998) was used (Appendix 3). The sections that were retained in the questionnaire included: demographic data of the deceased, circumstance of death, summary of the main sign and symptoms reported by respondent, list of hospitalization, specific questions about cause of death unrelated to illness and, specific questions to elicit signs and symptoms of the final illness. Additional lifestyle, type of vessels, fishing gears and type of propulsion questions were included in the questionnaire after consulting with the Fisheries Department. The questionnaire was then translated into Luo and Bunyala.

2.8 Ascribing causes of death by clinicians

Once the interviews were done, the questionnaires were given to three physicians who reviewed each questionnaire and independently ascribed a probable cause of death. Where at least two physicians agree on a cause of death, this would be considered as the final cause of death. In case all the three disagreed on a cause of death, the cases were reviewed by the panel of three clinicians and where possible, a cause of death arrived at.

Three copies of the VA questionnaire were made in order for the clinicians to arrive at the probable cause of death. Each form had a space for the clinicians to enter the probable diagnosis. The three clinicians independently reviewed copies of the VA information from each of the cases reported by the VA team from August 1988 to July 2000 to provide their opinions as to what condition caused the death of each fisherman. The stated signs and symptoms leading to the death of the fisherman were reviewed by the clinicians who assigned cause of death. The clinicians were provided with similar coding sheets (Appendix 4).

The list also had a code for indeterminate cases which were often the case when the interviewee gave very little information that could not lead to specific diagnosis. Each ascribed a single cause of death except where this was not possible. A diagnosis was considered to be reached if at least two clinicians agreed on a cause of death.

If all the three disagreed on a cause of death or where there was more than one cause of death assigned by a clinician, the questionnaire was reviewed by the panel and where possible a diagnosis was reached by consensus.

Cause of death was coded by the researcher using International Classification of Diseases (ICD 10) taken from the Nyanza Provincial Records and Information Department.

2.9 Assessment of final diagnosis

Final causes of death were assigned by programming using SAS™ for Windows version 6.12. Where at least two clinicians agreed on a cause of death this was considered as a final diagnosis. Since single diagnosis was allowed per case the total number of causes of death was similar to the total number of deaths successfully followed up.

2.10 Inclusion criteria

The study identified deceased fishermen in the study area who worked in the beaches and residents of the riparian districts and who died between August 1998 and July 2000.

The inclusion criteria for the study were: all gazetted beaches along the shores of Lake Victoria, vessels (boats) registered by fisheries department, deceased male fishermen aged 15 to 55 years whose death fell within the study period and, fishermen who were registered members of a given beach for at least 6 months and had worked in the given vessel for a minimum of three months before death.

2.11 Data management.

Single data entry was performed on the VA data using Fox Pro™ version 6 software with in-built error checks. Data were validated and the cleaning process was performed on the computerized data by running logical checks and error listings using SAS™ for Windows version 6.12.

Data on ascribed causes of death by clinicians were entered in a separate file after coding. Data entry was done using Fox Pro™ version 6 with in-built checks against erroneous entry of data. The clean VA screens were then merged using SAS™ System for Windows version 6.12 software with the expert reviewers' file based on filing numbers.

3.12 Data analysis

Analysis of data was conducted using SASTM for Windows version 6.12. Differences in the proportions of deaths within the riparian districts were determined by calculating the confidence interval and the summary chi square statistic using Mantel Haenszel stratified cross-tabulations and values < 0.05 were considered statistically significant. Descriptive Statistics were used to calculate the proportions of mortality by disease. The proportions of mortality using total causes of death; where the denominator was calculated based on the total number of deaths. SASTM for Windows version 6.12 was used to calculate point estimates and confidence intervals for odds ratio. Differences in the associations between categorical variables were assessed using Logistic Regression analysis. The Logistic Regression model was fitted to compare the association of causes of death and demographic, socio-economic factors, as well as fishing related factors. The model was controlled for age and/or district of residence as was appropriate.

CHAPTER THREE

3.0 RESULTS

3.1 Demographic and socio-economic characteristics of the study population

The socio-demographic characteristics of the deceased fishermen who were followed up in the eight districts: Busia, Bondo, Kisumu, Nyando, Rachuonyo, Homa Bay, Suba and Migori are therefore illustrated in Table 1. Differences in the proportions of deaths per district were not statistically significant ($\chi^2 = 5.7$, $df 7$, $p = 0.57$). The age range was between 15 and 54 years. Overall, most of the deceased (68.8%) were married. Out of this number, over 90% were living with their wives. More than two-thirds of the fishermen had attained primary level of education. Less than a fifth of the deaths were reported to the registrar of births and deaths as required by the government. About 70% of the deaths occurred at home, 15.6% in the lake, 6.6% at the beach and 9.0% in the health facility. With the exception of deaths attributed to drowning, only 36.6% of those who died were hospitalized during the illness preceding death. Among deaths that occurred in the lake, 98.0% were as a result of drowning.

Table 1: Socio-demographic characteristics of the study population

Characteristics	(n=3058)	%
District#:		
Busia	400	13.1
Bondo	387	12.7
Kisumu	399	13.1
Nyando	369	12.1
Rachuonyo	378	12.4
Homa Bay	363	11.9
Suba	362	11.8
Migori	400	13.8
Marital status:		
Single	729	23.8
Married	2104	68.8
Divorced/Separated	157	5.1
Widowed	68	2.2
Living with wife*:		
Yes	1953	92.8
No	151	7.2
Level of education:		
Not attended	346	11.3
Primary	2055	67.2
Secondary	657	21.5
Place of death:		
At home	2133	69.8
Health facility	276	9.0
At the beach	203	6.6
In the lake	446	15.6
Issuance of burial permit:		
Yes	536	17.5
No	2489	81.4
Don't Know	32	1.1
Hospitalized before death#:		
Yes	959	36.6
No	1654	63.1
Don't know	8	0.3

*954 missing cases were those who were single, divorced/separated or widowed

#Excludes 437 deaths attributed to drowning

3.2 Causes of death

A total of 3200 questionnaires were sent out with each district receiving 400 forms. The VA field interviewers successfully followed up a total of 3058 deceased fishermen. The remaining 142 interviews were not conducted because the relatives declined to provide the information on what led to the death of the deceased as they were still going through the process of grief. Expert review was completed for all the 3058 questionnaires. There was agreement between the independent diagnoses of at least two clinicians for 2858 (94.1%) of cases reviewed. The remaining 200 (5.9%) VA diagnoses were agreed on by consensus of the panel of the three physicians after reviewing the VAs on a case-to-case basis. Only one diagnosis was allowed per death reported.

3.3 Major causes of death

Of the 3058 deaths assigned by verbal autopsy, 33.8% and 14.3% of the deaths were due to HIV related infections and drowning, respectively. This was followed by PTB (12.4%) and malaria (10.4%). Heart conditions and neoplasms, on the other hand contributed to 1.6% and 1.1%, deaths in that order. Over 52.2%, 37.5% and 10.5% of fatal cases of drowning were reported in boats that operated during the day, at night and both day and night, respectively (Table 2).

3.4 Differences in causes of death among the fishermen within the riparian districts

Apart from Busia District, verbal autopsy attributed most of the deaths that occurred among the fishermen to HIV related infections with Suba District reporting the highest proportion of deaths (47.0%) (Table 20). Drowning was the leading ascribed cause of death in Busia but second in Bondo, Kisumu and Nyando Districts.

In Busia and Suba districts, HIV related infections (20.3%) and malaria (11.6%), respectively ranked as second most important major causes of death. However, malaria was among the top four causes of death in all the districts.

Assigned causes of death under 'other' as the main category included: snake bite (13), diabetes mellitus, hepatitis and fire/burns (9), renal failure (7), poisoning and epilepsy (5), liver cirrhosis and lightening (3), elephantiasis, rabies, paralysis due to space occupying lesion (2), peptic ulcer with renal failure, asthma, gun-shot, septicaemia and intestinal obstruction (1).

Injuries caused by animals were due to; hippopotamus (17) and crocodiles (16) contributed to 33 deaths. All the fatal crocodile attacks were reported in Busia district while hippopotamus attributed deaths were reported in all the districts except Homa Bay and Migori. The 19 suicidal deaths were attributed to rat-rat poisoning (10), hanging by rope (5) and poisoning by unknown chemicals (4).

Table 2: Cause-specific mortality by district among the fishermen in Lake Victoria, Kenya

Cause of death	District								Total (%)
	Busia (%)	Bondo (%)	Kisumu (%)	Nyando (%)	Rachuonyo (%)	Homa Bay (%)	Suba (%)	Migori (%)	
HIV related infections	81 (20.3)	140 (36.2)	100 (25.1)	120 (32.5)	120 (31.8)	129 (35.5)	170 (47.0)	174 (43.5)	1034 (33.8)
Drowning	108 (27.0)	66 (17.1)	34 (8.5)	22 (6.0)	55 (14.6)	57 (15.7)	41 (11.3)	54 (13.5)	437 (14.3)
PTB	28 (7.0)	72 (18.6)	90 (22.6)	93 (25.2)	34 (9.0)	28 (7.7)	12 (3.3)	22 (5.5)	379 (12.4)
Malaria	42 (10.5)	30 (7.8)	58 (14.5)	42 (11.4)	30 (7.9)	43 (11.9)	42 (11.6)	31 (7.8)	318 (10.4)
Cholera	19 (4.8)	16 (4.1)	16 (4.0)	8 (2.2)	22 (5.8)	33 (9.1)	39 (10.8)	28 (7.0)	181 (5.9)
Gastro-enteritis	17 (4.3)	14 (3.6)	33 (8.3)	23 (6.2)	32 (8.5)	14 (3.9)	16 (4.4)	21 (5.3)	170 (5.6)
Pneumonia	24 (6.0)	14 (3.6)	23 (5.8)	20 (5.4)	16 (4.2)	19 (5.2)	19 (5.3)	17 (4.3)	152 (5.0)
Schistosomiasis	22 (5.5)	3 (0.8)	3 (0.8)	14 (3.8)	10 (2.7)	13 (3.6)	6 (1.7)	6 (1.5)	77 (2.5)
Heart conditions	13 (3.3)	10 (2.6)	9 (2.3)	1 (0.3)	10 (2.7)	2 (0.6)	0 (0.0)	3 (0.8)	48 (1.6)
Neoplasms	6 (1.5)	3 (0.8)	9 (2.3)	3 (0.8)	8 (2.1)	1 (0.3)	1 (0.3)	3 (0.8)	34 (1.1)
Injuries caused by animals	20 (5.0)	5 (1.3)	2 (0.5)	2 (0.5)	3 (0.8)	0 (0.0)	1 (0.3)	0 (0.0)	33 (1.1)
Meningitis	2 (0.5)	5 (1.3)	3 (0.8)	7 (2.0)	6 (1.6)	3 (0.8)	1 (0.3)	4 (1.0)	31 (1.0)
Typhoid fever	1 (0.3)	4 (1.0)	1 (0.3)	3 (0.8)	2 (0.5)	3 (0.8)	3 (0.8)	8 (2.8)	25 (0.8)
Assault	4 (1.0)	0 (0.0)	2 (0.5)	0 (0.0)	10 (2.7)	5 (1.4)	1 (0.3)	3 (0.8)	25 (0.8)
Road traffic accidents	2 (0.5)	2 (0.5)	3 (0.8)	4 (1.1)	1 (0.3)	3 (0.8)	1 (0.3)	4 (1.0)	20 (0.7)
Suicide	2 (0.5)	0 (0.0)	1 (0.3)	1 (0.3)	6 (1.6)	0 (0.0)	2 (0.6)	7 (1.8)	19 (0.6)
Others*	9 (2.3)	3 (0.8)	12 (3.0)	6 (1.7)	13 (3.4)	10 (2.8)	7 (2.0)	15 (3.8)	75 (2.5)
Total	400 (100)	387 (100)	399 (100)	369 (100)	378 (100)	363 (100)	362 (100)	400 (100)	3058 (100)

*Others include: epilepsy (5); snake bite (13); diabetes mellitus (9); poisoning (5); elephantiasis (2); renal failure (7); intestinal obstruction (1); fire/burns (9); hepatitis (9); paralysis due to space occupying lesion (2); peptic ulcer with renal failure (1); liver cirrhosis (3); asthma (1); gun-shot (1); rabies (2); lightning (3); septicaemia (1).

3.5 Cause-specific mortality by age group

Causes of death were also analysed by age group (Table 3). The leading cause of death among the youngest age group (15 – 19 years) was drowning (27.3%) followed by HIV related infections (24.6%). The leading cause of death among the rest of the age groups was attributed to HIV related infections with those aged between 40 and 44 years claiming the highest proportion of deaths (42.5%). From age 20 – 39 years, drowning was the second most important cause of death. Whereas, PTB was the second leading cause of death among the older age group (40 – 54 years), it was third in rank among those aged 15 – 19 and 25 – 39 years. Deaths due to gastro-enteritis and cholera were more common between age 20 – 44 years. A more or less similar trend could be seen in causes of death attributed to pneumonia and schistosomiasis except that there was a decline in the number of deaths reported from age 40 and above. The highest proportion of deaths due to heart conditions (3.7%) was recorded among the oldest age group (50 – 54 years). The same pattern was seen in deaths attributed to neoplasms (4.1%).

Table 3: Cause-specific mortality by age group among the fishermen in Lake Victoria, Kenya.

Cause of death	Age groups in years								
	15-19 (%)	20-24 (%)	25-29 (%)	30-34 (%)	35-39 (%)	40-44 (%)	45-49 (%)	50-54 (%)	(%)
HIV related infections	27 (24.6)	128 (28.3)	195 (32.3)	198 (33.6)	155 (34.1)	152 (42.5)	94 (38.7)	85 (34.6)	1034 (33.8)
Drowning	30 (27.3)	102 (22.6)	95 (15.7)	81 (13.7)	65 (14.3)	33 (9.2)	12 (4.9)	19 (7.7)	437 (14.3)
PTB	13 (11.8)	37 (8.2)	66 (10.9)	76 (12.9)	47 (10.3)	51 (14.3)	50 (20.6)	39 (15.9)	379 (12.4)
Malaria	11 (10.0)	56 (12.4)	64 (10.6)	57 (9.7)	45 (9.9)	29 (8.1)	28 (11.5)	28 (11.4)	318 (10.4)
Cholera	6 (5.5)	30 (6.6)	39 (6.5)	34 (5.8)	32 (7.0)	24 (6.7)	7 (2.9)	9 (3.7)	181 (5.9)
Gastro-enteritis	6 (5.5)	24 (5.3)	30 (5.0)	36 (6.1)	25 (5.5)	25 (7.0)	12 (4.9)	12 (4.9)	170 (5.6)
Pneumonia	7 (6.4)	19 (4.2)	36 (6.0)	33 (5.6)	24 (5.3)	7 (2.0)	14 (5.8)	12 (4.9)	152 (5.0)
Schistosomiasis	1 (0.9)	15 (3.3)	11 (1.8)	17 (2.9)	14 (3.1)	6 (1.7)	4 (1.7)	9 (3.7)	77 (2.5)
Heart conditions	1 (0.9)	5 (1.1)	10 (1.7)	5 (0.9)	8 (1.8)	6 (1.7)	4 (1.7)	9 (3.7)	48 (1.6)
Neoplasms	0 (0.0)	5 (1.1)	4 (0.7)	7 (1.2)	4 (0.9)	2 (0.6)	2 (0.8)	10 (4.1)	34 (1.1)
Injuries caused by animals	2 (1.8)	6 (1.3)	10 (1.7)	7 (1.2)	4 (0.9)	1 (0.3)	1 (0.4)	2 (0.8)	33 (1.1)
Meningitis	1 (0.9)	2 (0.4)	5 (0.8)	11 (1.9)	6 (1.3)	3 (0.8)	0 (0.0)	3 (1.2)	31 (1.0)
Typhoid fever	1 (0.9)	1 (0.2)	9 (1.5)	4 (0.7)	5 (1.1)	2 (0.6)	2 (0.8)	1 (0.4)	25 (0.8)
Assault	0 (0.0)	7 (1.6)	5 (0.8)	5 (0.9)	3 (0.7)	2 (0.6)	1 (0.4)	2 (0.8)	25 (0.8)
Road traffic accidents	1 (0.9)	5 (1.1)	3 (0.5)	2 (0.3)	1 (0.2)	5 (1.4)	2 (0.8)	1 (0.4)	20 (0.7)
Suicide	1 (0.9)	2 (0.4)	5 (0.8)	4 (0.7)	3 (0.7)	2 (0.6)	2 (0.8)	0 (0.0)	19 (0.6)
Others*	2 (1.8)	8 (1.8)	17 (2.8)	13 (2.2)	14 (3.1)	8 (2.2)	8 (3.3)	5 (2.0)	75 (2.5)
Total	110 (100)	452 (100)	604 (100)	590 (100)	455 (100)	358 (100)	243 (100)	246 (100)	3058 (100)
Total	110 (100)	452 (100)	604 (100)	590 (100)	455 (100)	358 (100)	243 (100)	246 (100)	3058 (100)

*Others include: epilepsy (5); snake bite (13); diabetes mellitus (9); poisoning (5); elephantitis (2); renal failure (7); intestinal obstruction (1); fire/burns (9); hepatitis (9); paralysis due to space occupying lesion (2); PUD with renal failure (1); liver cirrhosis (3); asthma (1); gun-shot (1); rabies (2); lightning (3); septicemia (1).

3.5 Broad classification of causes of death by district of residence

The leading causes of death in the riparian districts were communicable diseases (77.8%)
Accidents and injuries and in particular, unintentional injuries were the second in rank
(17.9%). Intentional accidents, which were mainly suicidal in nature, accounted for less
than 1% of the deaths (Table 4).

Table 4: Broad classification of causes of death by district among the fishermen in Lake Victoria

District	Causes of death				Total (%)
	Communicable diseases	Non-communicable diseases	Accidents and injuries		
			Unintentional	Intentional	
Busia (%)	240 (60.0)	21 (5.3)	137 (34.3)	2 (0.5)	400 (100)
Bondo (%)	298 (77.0)	15 (3.9)	74 (19.1)	0 (0.0)	387 (100)
Kisumu (%)	328 (82.2)	25 (6.3)	45 (11.3)	1 (0.3)	399 (100)
Nyando (%)	331 (89.7)	7 (1.9)	30 (8.1)	1 (0.3)	369 (100)
Rachuonyo (%)	274 (72.5)	25 (6.6)	73 (19.3)	6 (1.6)	378 (100)
Homa Bay (%)	286 (78.8)	5 (1.4)	72 (19.8)	0 (0.0)	363 (100)
Suba (%)	309 (85.4)	2 (0.6)	49 (13.5)	2 (0.6)	362 (100)
Migori (%)	312 (78.0)	13 (3.3)	68 (17.0)	7 (1.8)	400 (100)
Total (%)	2378 (77.8)	113 (3.7)	548 (17.9)	19 (0.6)	3058 (100)

3.6 Broad classification cause – specific mortality by age group

Communicable diseases again were the major causes of death in all age groups followed by unintentional injuries (Table 5). In absolute numbers, reported deaths due to communicable diseases rose gradually from age group 15 – 19 reaching its peak among those aged 30 – 34 years. The reverse was true of deaths attributed to unintentional injuries with peak mortality in age group 20 – 24. The proportion of deaths due to non-communicable diseases was highest (8.9%) among the older fishermen (50 – 54 years).

Table 5: Broad classification of causes of death by age group among fishermen in Lake Victoria, Kenya.

Age groups (years)	Causes of death				Total (%)
	Communicable diseases	Non-communicable diseases	Accidents and injuries		
			Unintentional	Intentional	
15-19 (%)	74 (67.3)	1 (0.9)	34 (30.9)	1 (0.9)	110 (100)
20-24 (%)	312 (69.0)	13 (2.9)	125 (27.7)	2 (0.4)	452 (100)
25-29 (%)	455 (75.3)	21 (3.5)	123 (20.4)	5 (0.8)	604 (100)
30-34 (%)	468 (79.3)	18 (3.1)	100 (17.0)	4 (0.7)	590 (100)
35-39 (%)	356 (78.2)	17 (3.7)	79 (17.4)	3 (0.7)	455 (100)
40-44 (%)	301 (84.1)	10 (2.8)	45 (12.6)	2 (0.6)	358 (100)
45-49 (%)	212 (87.2)	11 (4.5)	18 (7.4)	2 (0.8)	243 (100)
50-54 (%)	200 (81.3)	22 (8.9)	24 (9.8)	0 (0.0)	246 (100)
Total	2378 (77.8)	113 (3.7)	548 (17.9)	19 (0.6)	3058 (100)

3.7 The distribution of causes of death attributed to chronic illnesses

Out of the 82 deaths attributed to chronic illnesses, verbal autopsy assigned more than half (43) of the deaths to heart failure, 15 to cancer of the stomach, 9 to cancer of the lungs and 4 deaths to cancer of the oesophagus (Table 6). Seven out of the 9 who died as a result of lung cancer were smokers while there was only one death attributed to cancer of the mouth.

Table 6: Causes of death attributed to chronic illnesses among fishermen in Lake Victoria, Kenya

Chronic illnesses	Number	%
Heart Conditions:		
Heart failure	43	52.4
Renal failure secondary to CCF	3	3.7
Hypertension	2	2.4
Neoplasms:		
Cancer of the stomach	15	18.3
Cancer of the lungs	9	11.0
Cancer of the oesophagus	4	4.9
Cancer of the legs	3	3.7
Cancer of the prostate glands	2	2.4
Cancer of the mouth	1	1.2
Total	82	100.0

3.8 Drowning fatalities by type of vessels/ boats and propulsion

Of the 437 deaths attributed to drowning, 63.8% were on Sesse boat while the lowest proportions of cases of fatal drowning were reported in Karua boat (14.2%). Most of the fatal incidences of drowning were on boats propelled by paddles (45.1%) with Sesse boats recording the highest proportion of deaths (55.2%). Taruma boats propelled by outboard motor recorded the least proportion of cases (15.6%) of fatal drowning (Table 7).

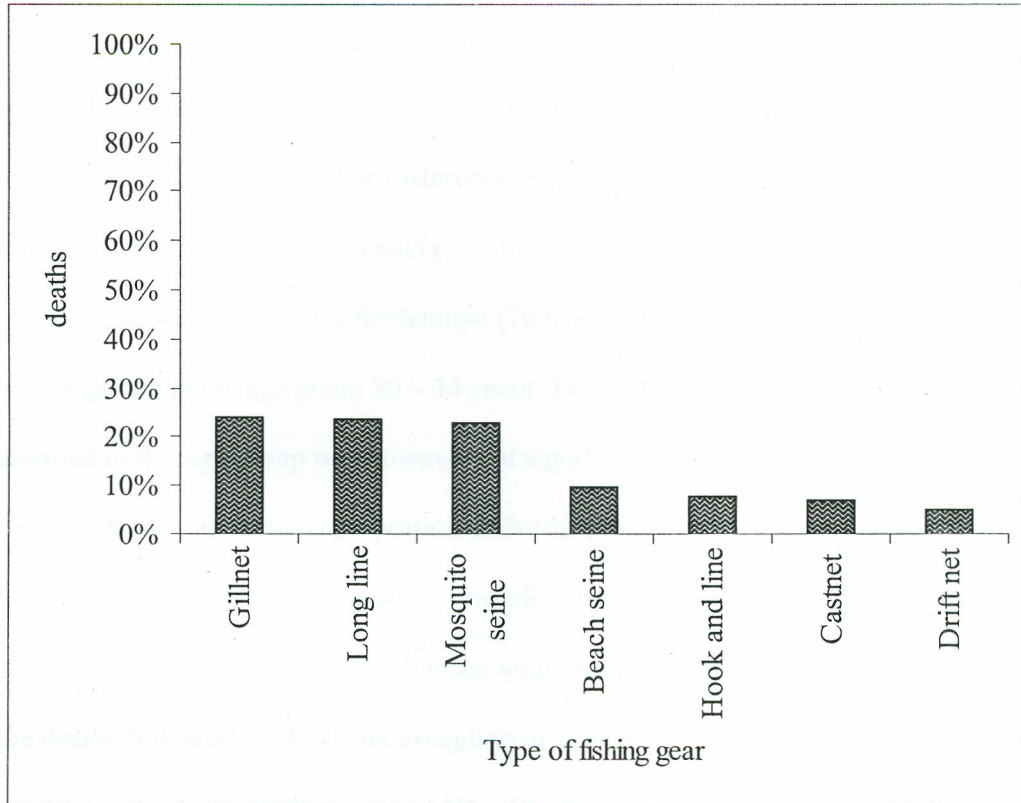
Table 7: Drowning fatalities by type of boat and propulsion among fishermen in Lake Victoria

Method of propulsion	Type of craft			Total (%)
	Sesse (%)	Taruma (%)	Karua (%)	
Outboard motor	0 (0.0)	15 (15.6)	0 (0.0)	15 (3.4)
Paddles	154 (55.2)	25 (26.0)	18 (29.0)	197 (45.1)
Sails	15 (5.4)	0 (0.0)	31 (50.0)	46 (10.5)
Sails/Paddle	110 (39.5)	56 (58.3)	13 (21.0)	179 (41.0)
Total	279 (100)	96 (100)	62 (100)	437 (100)

3.9 Proportion of deaths due to drowning by fishing gear

The highest proportion of deaths attributed to drowning, which was reported on boats using, gillnet (24.0%), longline (23.8%) and mosquito seine (22.7%) were comparable (Fig 1). All the three fishing gears were used in deep lake fishing. Fishing gears that were used close to the shore such as beach seine (9.8%), hook and line (7.8%), castnet (6.9%) and drift net (5.0%) had the lowest proportion of deaths.

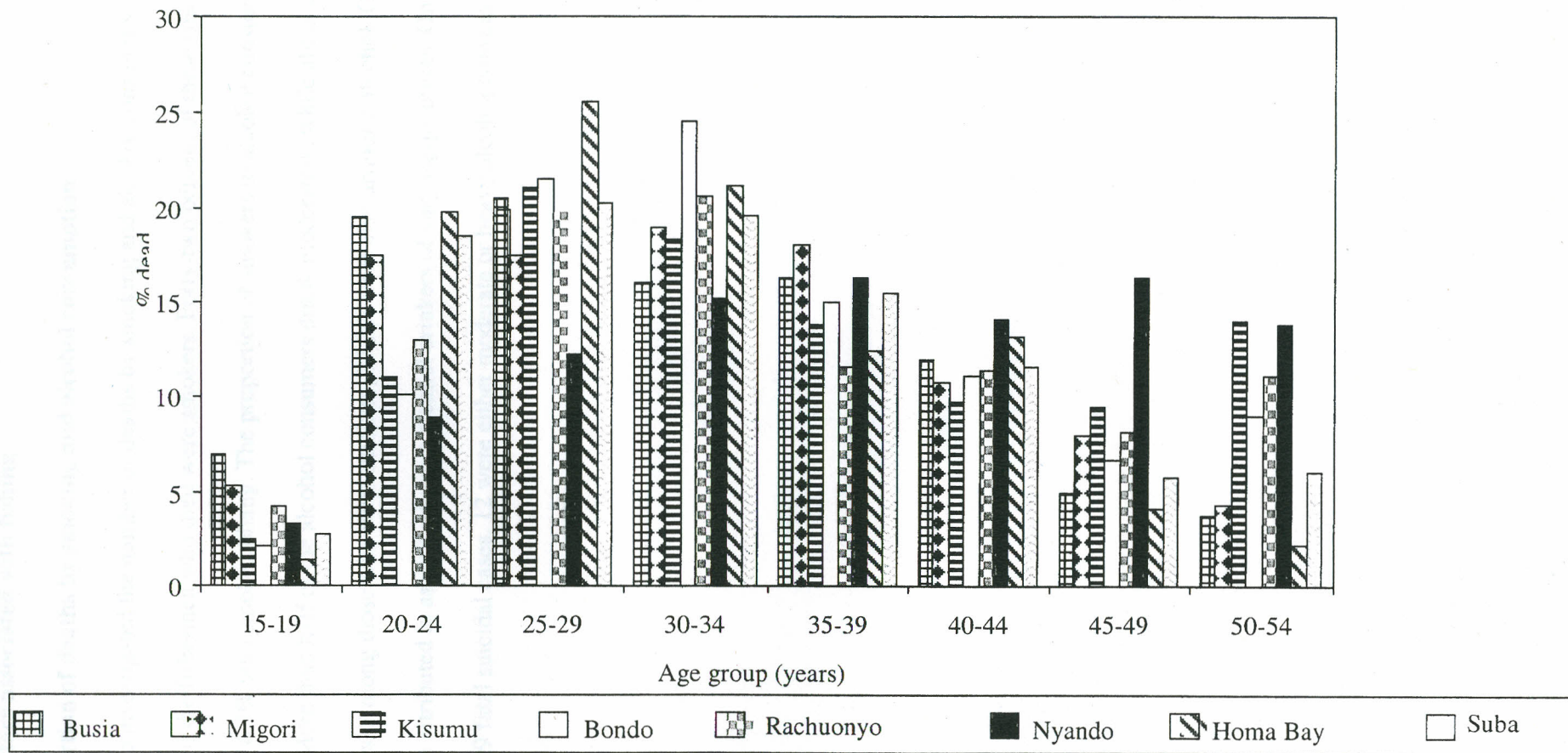
Figure 1: Proportion of deaths due to drowning by fishing gear among fishermen in Lake Victoria, Kenya



3.10 Age specific mortality by district of residence

Peak mortality was reported among fishermen aged 25 - 29 years (19.8%), closely followed by the next age group, 30 – 34 years (19.3%). Highest proportions of deaths were reported in the age group 25 – 29 years in Busia (20.5%), Kisumu (21.1%), Homa Bay (25.6%) and Suba (20.2%). The difference in proportion of deaths reported in this age group was however not significant ($\chi^2 = 10.1$, df 12, $p = 0.6$). This contrasts with Migori (19.0%), Bondo (24.6%) and Rachuonyo (20.6%) where the leading proportions of deaths were reported in the age group 30 – 34 years. The difference in proportion of deaths reported in this age group was however not significant ($\chi^2 = 12.8$, df 8, $p = 0.1$). In Nyando, however, an equal proportion of deaths (16.3%) occurred among fishermen aged 35 – 39 and 45 – 49 years (Figure 2). Overall, more than half of the deaths were registered among those aged between 20 – 39 years with the age group contributing to 68.7% of all the deaths followed up. With the exception of Kisumu District, the lowest proportion of deaths occurred among the youngest (15 – 19 years) and the last two oldest age groups, 45 – 49 and 50 – 54 years.

Figure 2: Age specific mortality by district of residence among fishermen in Lake Victoria, Kenya



3.11 Risk factors associated with fishing

3.11.1 Proportion of deaths by smoking and alcohol consumption

The study also investigated the number of deaths by smoking and alcohol consumption (Table 8).

Almost 60% of the fishermen who died were smokers. Forty-two percent of these smoked cigarettes compared to 16.7% who smoked bhang. The proportion of smokers to alcohol consumers was comparable. More than half of the alcohol consumers drunk moderately, while about a third was heavy drinkers. Among those who were smokers, 79.3% were also drinking alcohol. Out of 25 cases of death attributed to assault, 18 were alcohol drinkers of varying quantities. On the other hand, of the 19 fatal suicidal cases, 12 were either moderate or heavy alcohol consumers.

Smoking	No.	%
Not applicable		
Yes	18	72
No	7	28
Don't know	0	0
Type of incident	No.	%
Light	9	36
Moderate	9	36
Heavy	7	28

* 18 were smokers and 7 were non-smokers.

12 were non-alcohol consumers.

Table 8: Proportion of deaths by smoking and alcohol consumption habits among fishermen in Lake Victoria

Lifestyle	Number	%
Smoker		
Yes	1799	58.8
No	1252	40.9
Don't know	7	0.2
Substance smoked*		
Cigarette	1287	42.1
Bhang	510	16.7
Not applicable	1259	41.2
Alcohol		
Yes	1832	59.9
No	1214	39.7
Don't know	12	0.4
Type of drinker#		
Light	332	18.1
Moderate	920	50.2
Heavy	580	31.7

* What is smoked not stated in 2 cases; Total 3056

1226 were non-alcohol consumers

3.11.2 Demographic and socio-economic factors associated with cause-specific mortality among fishermen

Further analysis on the association between demographic and socio-economic factors related to cause-specific mortality was done using logistic regression (Table 9). There was no association between being married, single, level of education and dying from HIV related infections. After controlling for age, malaria (OR: 0.1; 95% CI 0.1 – 0.2) and schistosomiasis infections (OR: 0.2; 95% CI 0.1 – 0.3) were significantly associated with lower proportions of death due to HIV-related infections. On the other hand, PTB-related infections were significantly associated with higher proportions of HIV-related deaths, again controlling for age (OR: 3.9; 95% CI 3.3 – 4.6).

Significant associations, controlling for age, were noted between night fishing and malaria (OR: 1.7; 95% CI 1.3 – 2.1) and use of driftnet as fishing gear and schistosomiasis (OR: 3.6; 95% CI 2.0 – 6.8). The association between smoking and lung conditions (OR: 1.2; 95% CI 1.0 – 1.5) which included pneumonia, lung cancer, PTB and bronchitis was however weak ($p = 0.07$).

In logistic regression controlling for the district of residence, the odds of dying from HIV related infections among fishermen age between 20 – 34 years was significantly lower (OR: 0.8; 95% CI 0.7 – 0.9) compared to the rest of the other age groups. Again controlling for district of residence, the odds of dying from other accidents which excluded drowning for the same age group was 1.4 times compared with the rest of the age groups. The odds increased by 0.2 when all accidents were included.

Table 9: Logistic regression analysis of cause-specific mortality among fishermen in Lake Victoria by demographic and socio-economic characteristics

Outcome	Explanatory variable	Yes	No	%	OR	95% CI	P value
Malaria*	Night fishing	182	136	57.2	1.7	1.3 – 2.1	<0.0001
Schistosomiasis*	Driftnet	13	65	16.7	3.6	2.0 – 6.8	<0.0001
Lung conditions*	Smoking	247	145	63.0	1.2	1.0 – 1.5	0.07
HIV related infections#	Age group 20 - 34	521	513	50.4	0.8	0.7 – 0.9	0.0025
Accidents excluding drowning#	Age group 20 - 34	81	49	62.3	1.4	1.0 – 2.1	0.05
Accidents/injuries #	Age group 20 - 34	359	208	63.3	1.6	1.4 – 2.0	<0.0001

* Controlling for age

Controlling for district where death occurred

3.11.3 Comparison of deaths attributed to HIV-related infections by age group using age group 15 – 19 years as baseline

Compared with age group 15 – 19 year (Table 10) which had the lowest proportion of deaths attributed to HIV related infections (24.6%), the odds of dying from the same infections was 2.3 times higher among fishermen aged 40 – 44 years ($p = 0.001$) and 1.9 times for those aged 45 – 49 years ($P = 0.01$). Marginal significant differences were noted among fishermen aged between 30 – 39 and 50 – 54 years ($P = 0.06$). No significant difference in the odds of dying from HIV related infections was seen in the proportion of deaths among those aged 20 – 24 and 25 – 29 years.

Table 10: Logistic regression analysis of HIV-related infections as a cause of death among fishermen in Lake Victoria by age group

Explanatory variable*	OR	95% CI	p value
20 – 24	1.2	0.8 – 2.0	0.428
25 – 29	1.5	0.9 – 2.3	0.108
30 – 34	1.6	1.0 – 2.5	0.065
35 – 39	1.6	1.0 – 2.6	0.057
40 – 44	2.3	1.4 – 3.7	0.001
45 – 49	1.9	1.2 – 3.2	0.010
50 – 54	1.6	1.0 – 2.7	0.061

*Age group 15 – 19 years used as baseline

3.12 Mortality causes in relation to districts

3.12.1 The association between deaths attributed to HIV-related infections and district of residence

The study also examined the association between deaths attributed to HIV-related infections and the deceased fishermen's district of residence compared with the rest of the districts (Table 11). Busia

(OR: 0.5; 95% CI 0.4 – 0.6) and Kisumu (OR: 0.6; 95% CI 0.5 – 0.8) districts were both significantly associated with lower proportions of mortality due to HIV-related infections. Suba (OR: 2.0; 95% CI 1.5 – 2.4) and Migori (OR: 1.7; 95% CI 1.3 – 2.0), on the other hand, were significantly associated with higher proportions of death due to the same infections, again controlling for age. No association was, however, noted in the remaining riparian districts.

HIV related infections	District	Yes	No	%	OR	95% CI
HIV related infections	Bondo	140	894	13.5	0.5	0.4 – 0.6
HIV related infections	Kisumu	100	934	9.7	0.6	0.5 – 0.8
HIV related infections	Nyando	120	914	11.6	2.0	1.5 – 2.4
HIV related infections	Rachuonyo	120	914	11.6	1.7	1.3 – 2.0
HIV related infections	Homa Bay	129	905	12.5	1.0	0.8 – 1.2
HIV related infections	Suba	170	864	16.4	1.0	0.8 – 1.2
HIV related infections	Migori	174	860	16.8	1.0	0.8 – 1.2

Controlling for age

Table 11: Logistic regression analysis of HIV-related infections as a cause of death among fishermen by district of residence

Outcome	Explanatory variable	Yes	No	%	OR	95% CI	p value
HIV related infections	Busia	81	953	7.8	0.5	0.4 – 0.6	<0.0001
HIV related infections	Bondo	140	894	13.5	1.1	0.9 – 1.4	0.3
HIV related infections	Kisumu	100	934	9.7	0.6	0.5 – 0.8	<0.0001
HIV related infections	Nyando	120	914	11.6	0.9	0.7 – 1.1	0.3
HIV related infections	Rachuonyo	120	914	11.6	0.9	0.7 – 1.1	0.3
HIV related infections	Homa Bay	129	905	12.5	1.1	0.9 – 1.4	0.3
HIV related infections	Suba	170	864	16.4	2.0	1.5 – 2.4	<0.0001
HIV related infections	Migori	174	860	16.8	1.7	1.3 – 2.0	<0.0001

Controlling for age

Table 12: Logistic regression analysis on drowning among fishermen in Lake Victoria, Kenya

Outcome	Explanatory variable	Yes	No	%	OR	95% CI	p value
Drowning*	Age group 30-34	28	159	63.5	1.8	1.1 – 2.9	0.02
Drowning*	Police	197	940	45.1	1.7	1.3 – 2.2	0.0001
Drowning*	Sail/Veille	170	758	41.0	1.7	1.3 – 2.2	0.0001
Drowning*	Secondary education	125	655	34.2	1.7	1.3 – 2.2	0.0001
Drowning*	Day fishing	73	307	32.2	1.7	1.3 – 2.2	0.0001
Drowning*	Drinks alcohol	103	457	44.6	1.7	1.3 – 2.2	0.0001

* Controlling for district

Controlling for age and district

@ Controlling for age

3.12.2 Risk factors associated with drowning among fishermen in riparian districts along Lake Victoria - Kenya

In a logistic regression model controlling for district, there was a significant ($p < 0.0001$) association between those aged 20 – 34 years and the attribution of cause of death to drowning (Table 12). The odds of dying from drowning controlling for district of residence in boats being propelled by sail/paddle was 1.6 times higher than in other boats propelled by sails, paddles and outboard motors (OR: 1.6; 95% CI 1.3 – 2.0; $p = < 0.0001$). The odds of dying as a result of drowning, again controlling for district of residence, was however 30% lower in boats propelled by paddle alone. In a similar analysis but now controlling for age and district of residence, day fishing was significantly associated with drowning. Surprisingly, the study results revealed that secondary education after controlling for age and district, was an important risk factor in drowning (OR: 1.4; 95% CI 1.1 – 1.8). The results suggest that fishermen with secondary education may not have had enough time to master swimming and therefore more likely to drown. Further logistic regression analysis controlling for age revealed that the alcohol drinking was significantly associated with drowning ($p = 0.001$).

Table12: Logistic regression analysis on drowning among fishermen in Lake Victoria, Kenya

Outcome	Explanatory variable	Yes	No	%	OR	95% CI	p value
Drowning*	Age group 20 - 34	278	159	63.6	1.6	1.3 – 2.0	<0.0001
Drowning*	Paddle	197	240	45.1	0.7	0.6 – 0.8	0.0003
Drowning*	Sail/Paddle	179	258	41.0	1.6	1.3 – 2.0	<0.0001
Drowning#	Secondary education	125	312	28.6	1.4	1.1 – 1.8	<0.0001
Drowning#	Day fishing	228	209	52.2	1.6	1.3 – 2.0	<0.0001
Drowning‡	Drinks alcohol	283	154	64.8	1.4	1.2 – 1.8	0.0012

* Controlling for district

Controlling for age and district

‡ Controlling for age

3.12.3 A summary of the results of multiple logistic regression analyses on the proportion of deaths derived from verbal autopsy of deceased fishermen in riparian districts of lake Victoria, Kenya

Table 13 summarizes the results of multiple regression analyses on the proportion of deaths due to various causes of death ascribed through verbal autopsy. VA suggested a significant increase in the proportion of deaths attributed to malaria among those who were practicing night fishing. Driftnet was significantly associated with an increase in the proportion of deaths due to schistosomiasis while smoking was marginally associated with an increase in deaths due to lung diseases. Whereas a significantly lower proportion of deaths attributed to HIV – related diseases was reported among the deceased fishermen aged 20 - 34 years, there was a significant increase in the proportion of deaths reported among the same age group for deaths attributed to accidents excluding drowning as well as for all types of accidents.

A statistically significant increase in the proportion of deaths due to HIV – related infections was reported in Migori and Suba districts while Kisumu and Busia districts registered a significantly lower proportion of deaths attributed to the same cause.

The risk factors associated with increase in mortality due to drowning included: age group 20 – 34 years, combination of sail and paddle as propulsion method, secondary education, day fishing and drinking of alcohol. On the other hand, paddle as a method of propulsion had a lower proportion of deaths attributed to drowning.

Table 13: A summary of the results of multiple logistic regression analyses on the proportion of deaths derived from verbal autopsy of deceased fishermen in Riparian Districts of Lake Victoria, Kenya

Type of risk factor	Risk factors	Ascribed cause of death	OR	95% CI	p value
Time of fishing gear	Night fishing	Malaria	1.7	1.3 - 2.1	<0.0001
Type of fishing	Driftnet	Schistosomiasis	3.6	2.0 - 6.8	<0.0001
Life style	Smoking	Lung disease	1.2	1.0 - 1.5	0.07
Demographic	20 – 34 years	HIV-related infections	0.8	0.7 - 0.9	0.0025
	20 – 34 years	Accidents excluding drowning	1.4	1.0 – 2.1	0.05
	20 – 34 years	Accidents/Injuries	1.6	1.4 - 2.0	<0.0001
District of residence	Busia	HIV – related infections	0.5	0.4 – 0.6	<0.0001
	Kisumu	HIV – related infections	0.6	0.5 – 0.8	<0.0001
	Migori	HIV – related infections	1.7	1.3 – 2.0	<0.0001
	Suba	HIV – related infections	2.0	1.5 – 2.4	<0.0001
Demographic	20 – 34 years	Drowning	1.6	1.3 – 2.0	<0.0001
Type of propulsion	Paddle	Drowning	0.7	0.6 – 0.8	0.0003
	Sails/Paddle	Drowning	1.6	1.3 – 2.0	<0.0001
Socio-economic	Education	Drowning	1.4	1.1 – 1.8	<0.0001
Time of fishing	Day fishing	Drowning	1.6	1.3 – 2.0	<0.0001
Life style	Alcohol	Drowning	1.4	1.2 – 1.8	0.0012

CHAPTER FOUR

4.0 Discussion

Several studies on cause-specific mortality among fishermen have been conducted in the developed countries (Jaremin *et al.* 1997; Driscoll *et al.* 1997). However, in Africa, it appears that no such study has been conducted. The problem on lack of information on disease-specific mortality in developing countries is generally attributed to the levels of coverage of vital registration (especially in rural areas) and reliability of cause of death stated on the death certificate (Chandramohan, *et al.* 1998) or burial permits (Arudo *et al.*, 2003).

Overall, 90% of the deaths among the deceased fishermen followed up in this study occurred outside health facilities suggesting that cause-specific mortality based on health facility records were unrepresentative for those in the fishing industry in riparian districts, Kenya. Civil registration coverage of the reported deaths was quite dismal with less than one fifth of the deaths being issued with burial permits. In Kenya, it is a legal requirement that all deaths be notified as part of civil registration process. The burial permit is issued to the bereaved family free of charge if death is reported within six months of the event.

4.1 Causes of mortality among fishermen in Lake Victoria – Kenya

The VA field interviewers successfully followed up and conducted interviews on 3058 deaths out of the 3200 identified cases. VA was successfully used to ascribe 94.1% of the cases reviewed with the remaining 5.9% agreed on after case-by-case review by the panel of clinicians.

In this study, HIV-related infections were the leading cause of death among the deceased fishermen. The HIV prevalence was highest in Suba district and lowest in Busia. The data collected from sentinel surveillance and voluntary counseling and testing indicated that prevalence rates in the riparian districts were as high as 35%.

Homa Bay which has been reported as one of the worst affected districts had a prevalence of 34% (GoK, 2001). High levels of poverty in the riparian districts have contributed to the spread of HIV. On the shores of Lake Victoria fishing is the main occupation. However, customs bar women from venturing into the lake to fish (Ochieng 2002).

Taking advantage of this, fishermen have imposed an unwritten rule on the female fishmongers – “No sex, no fish”. Fishermen demand for sex for fish supply. Since the fishmongers and the fishermen have multiple sexual partners, it is likely that this practice might have contributed to the increased number of HIV related deaths among fishermen (Ochieng, 2002).

Age-specific HIV prevalence shows that about 25% of deaths occurred among those aged 15 – 19 years then rises gradually to a peak of 42.5% among those aged 40 – 44 years and then declines.

Whereas the GoK (2003b) results (8.6%) confirm peak HIV prevalence among the same age group (40 –44 years), the present study showed a relatively higher prevalence probably because fishermen are among the HIV high-risk group. In the same national survey, Nyanza Province where all the districts, except Busia, fall in had HIV prevalence levels of 10.6% among men aged 15 – 49 years above the national average (4.5%).

In this study HIV-related infections was significantly associated with lower proportion of deaths due to malaria, while in other studies no association has been found between malaria and HIV (Tswana *et al.*, 1999). In one study, HIV infection was significantly associated with fever but not falciparum- parasitaemia (Nwanyanwu *et al.*, 1997).

The results of the current study suggest that among fishermen there was high prevalence of HIV and underestimation of malaria cases. In addition, a significantly lower proportion of deaths due to schistosomiasis were associated with HIV-related deaths.

This can be explained by the results from other studies that suggest that HIV infection limits schistosome development (N’Zoukoudi-N’Doundou *et al.*, 1995). The finding from the current study indicating association between PTB and HIV has been confirmed by other studies conducted

in Rwanda, Democratic Republic of Congo and Zambia (WHO, 1994b). HIV infection breaks down the immune system thus making PTB become active. One of the ways in which fishing safety and health problems are qualified and quantified is through deaths directly attributed to one cause such as drowning.

In this study, drowning was the second leading cause of death. In other studies of fishing fatalities, the primary cause of death was drowning (ILO, 1999; Driscoll *et al.* 1997). With the inclusion of deaths attributed to animal injuries, assault, road traffic accidents and suicide, accidents and injuries contributed to 17.5% of the deaths. The data in this study is insufficient to allow detailed investigation of factors such as the length of time the vessel had been at sea, the size of the crew, the experience of crew members, the availability of safety equipments and the type of clothings being worn at the time of the incident. This study is the first detailed study of cause-specific mortality in fishing in Kenya and has shown accidents/injuries being one of the leading causes of death among fishermen.

Though Lake Victoria is situated in malaria endemic region, malaria was ranked fourth among the major causes of death. However, health facility in-patient mortality shows that the leading cause of death in all the riparian districts was malaria (GoK, 2002). Since the majority of the deceased fishermen died out of health facilities, the in-patient report may not reflect the true picture on causes of death among fishermen.

Schistosomiasis accounted for a small proportion of reported deaths but still was among the top ten major causes of death among deceased fishermen.

A study done along the shores of Lake Victoria (Kisumu District) in an adult population of car washers with high occupation exposure similar to those in the fishing industry showed that even after treatment with praziquantel before entry into the study, about 86% of the study group

experienced *Schistosoma mansoni* reinfection (Karanja *et al.* 2002). Two other studies done in Lake Kariba in Zimbabwe (Chimbari *et al.*, 2003) on the prevalence and morbidity of schistosomiasis among fishermen concluded that fishermen had a higher prevalence of this particular infection compared to school children or farmers. The high prevalence of schistosomiasis among fishermen could be due to long water contact activities.

4.1.1 Broad classification of causes of death

The analysis of causes of death using broad classification indicates that communicable diseases had the predominant share, primarily HIV related infections followed by PTB and malaria. These results suggest that infectious diseases are still the major causes of death in third world such as Kenya, that have not experienced epidemiologic transition, and in particularly, the fishing industry. Logistic regression analysis controlling for district suggest that, the odds (OR: 0.4; 95% CI 0.2- 0.7) of fishermen aged 18-50 years dying from non-communicable diseases was significantly lower compared to the odds of dying from the same causes among those aged less than 18 or 50 years and above ($p=0.0003$) Among non-communicable diseases, heart conditions contributed to more than half of the deaths in this category with the rest being attributed to neoplasms. In contrast, in developed countries, non-communicable diseases are the leading causes of death among fishermen with heart condition predominating (Jaremin *et al.*, 1997) In this study, stomach cancer showed a higher proportion of deaths among non-communicable diseases. The life-style and working conditions of many fishermen may be expected to tax the stomach, considering the diet high in fat and fried food and large quantities of alcohol (Neutel, 1989). Dietary habits like high salt and smoked food intake have been associated with an increased incidence of stomach cancer (Howson *et al.*, 1986). However in this study, a significantly higher proportion of deaths among the deceased fishermen were attributed to communicable compared to non-communicable diseases.

As regards external causes, intentional and unintentional accidents and injuries accounted for about 18.5% of deaths. Unintentional causes were due to drowning, injuries caused by animals, more specifically, hippopotamus fatal attacks (33), assault (25), road traffic accidents (20), snake-bite (13), fire/burns (9), poisoning (5), lightning (3), rabies (2) and gunshot (1). Slightly more than half of the drowning fatalities were reported in boats that operate during the day. Fishing operations can take place anywhere from very close to shore in protected bays to far out in the lake which is open to strong winds. During the day, there is high water turbulence which may contribute to increased incidences of capsizing of boats leading to drowning of the fishermen.

Apart from road traffic accident and dog bite (rabies), 17.9% of the deaths were fishing-related indicating the permanent character of hazards pertaining to work in the boats. Intentional accidents and injuries were solely due to suicide. Similar findings have been reported in other studies where accidents and injuries were reported to be responsible for about 10% of deaths among fishermen (Jaremin *et al.*, 1997).

4.1.2 All-cause mortality by age and district

Mortality was recorded in all age groups with peak mortality reported among fishermen aged 25-34 years. This compares with peak mortality reported in Kenya where the highest proportion of deaths was in the same age group (GoK, 1998). Generally, age group of 20-39 years contributed more than half (68.7%) of all the deaths recorded. Similar findings were reported among the Danish commercial fishermen where all cause mortality was highest in the age group between 20-34 years (Jensen 1996).

The result, however, contrasted with the findings of two studies conducted among fishermen in Atlantic Canada (Neutel, 1989) and Polish (Jaremin *et al.*, 1997) where all-cause mortality among fishermen was highest in those aged 40 years and above.

The difference could be attributed to the causes of death in the study area which is mainly due to communicable diseases such as HIV related infections compared to non-communicable diseases as well as accidents and injuries commonly experienced in the developed world.

4.2 Risk factors associated with mortality among the fishermen

Controlling for age, analysis on the association between the demographic factors related to cause specific mortality using logistic regression revealed a marginal significant decrease in the proportion of deaths reported among singles compared to the married. Fishing communities are at an increased risk of contracting HIV due to the socio-economic dynamics of their trade, including mobility, prolonged periods of separation from their families and disposable incomes (UNDP, 1998). The married fishermen stay away from their spouses, hence higher chances of engaging in extra-marital sex. Lake Victoria fishermen do sought female company after returning from a night's fishing.

This contains an element of sex-related cultural practice as well as an element of commercial sex work: impoverished women trading sex for a portion of the catch (Vick, 2000). The majority of those who are single are in the 15 – 19 years age group which is known to have the lowest prevalence of HIV (GoK, 2003b).

Again controlling for the district of residence, there was a significant decrease in the proportion of fishermen aged 20 – 34 years whose deaths were attributed to HIV related infections compared to the rest of the other age groups.

Research in Kenya suggests that the median age at first sexual intercourse is currently 16 years for men and their sexual behaviour puts many of them at risk of HIV infection (GoK, 2001). The median age at first marriage is 25 years for men. However, once infected with the HIV it may take years before the disease AIDS develops (GoK, 1998).

In this study, there was a marginal significant increase in the proportion of the married whose deaths were attributed to HIV related infections compared to singles. The odds of dying from HIV related infections was 2.3 fold higher among fishermen aged 40-44 and 1.9 times for those aged 45 – 49 years. The average time for the infection with HIV until the development of AIDS is 3 to 10 years, although it can be either shorter or longer. Once an adult develops AIDS, time to death varies from a few months to two years without antiretroviral treatment (WHO, 1994b). The results of this study suggest that those in the 20 – 34 years are probably still in the asymptomatic stage and that is why the proportion of deaths attributed to HIV-related infections for this age group is lower.

In the same age group, however, the proportion of deaths attributed to accidents and injuries was significantly higher compared to the rest of the age groups. Most of the reported deaths due to accidents and injuries were attributed to drowning. Overall, this age group comprised slightly more than half (53.8%) of the deaths reported. Jaremin *et al.*, (1997) also showed that in the group of seamen and deep-sea fishermen in the age 20 – 30 years, accidents were the only cause of death. Age group 20 – 34 is the prime age in the fishing industry and one would expect the “healthy worker effect” to favour this age group.

From the public health point of view the high accident mortality that has been noted in this productive age group associated with this occupation is of concern. A significant proportion of malaria deaths was associated with night fishing. Female *Anopheles* mosquito that transmits malarial parasites is most active at night. Thus night fishing exposes fishermen to a higher risk of mosquito bites and hence malaria infection.

A significantly higher proportion of deaths due to schistosomiasis was related to driftnet fishing gear. Although fishing using driftnet is mainly practiced in the deep lake, the fishermen dive into the waters to adjust the nets so that the trapped fish do not escape. At the same time, the nets sometimes drift towards the shores (Personal communication), which harbour snails infected with

schistosomes that could infect the driftnet fishermen who come into frequent direct contact with the waters.

A marginal significant increase in the proportion of deaths due to lung conditions was observed among the fishermen who were smokers. Long fishing trips may result in lifestyle changes such as increase in tobacco consumption and use of illicit drugs (Grainger, 1993). ILO survey (1999) indicates that many fishermen suffer from respiratory diseases including lung cancer. Lung conditions may be related to smoking among fishermen (Rafnsson and Gunnarsdottir, 1992).

4.3 Mortality causes in relation to riparian districts

4.3.1 The association between deaths attributed to HIV related infections and district of residence

Logistic regression analysis of HIV related infections among fishermen by district of residence controlling for age shows that Busia and Kisumu reported a significantly lower proportion of deaths. In contrast, Suba and Migori districts reported significantly higher proportion of deaths attributed to HIV related infections. Whereas a government survey on HIV prevalence by district (GoK, 2001) shows that Busia district had the lowest prevalence of HIV (20%), the rest of the districts had prevalence ranging between 27% – 28% with Kisumu and Nyando leading with 28%. Based on the previous government documented survey which was conducted around the time that this study was done, results therefore suggest that fishermen in Suba (47.0%) and Migori (43.5%) districts experience a comparatively higher HIV prevalence. This could be attributed to lack of awareness on HIV / AIDS infections because most of the beaches especially in Suba are so much in the interior where most of these fishermen are isolated from the rest of the world. Secondly, cultural practices could still intact in these districts including wife inheritance hence higher prevalence of HIV/AIDS.

4.3.2 Risk factors associated with drowning among fishermen in riparian districts

The findings in the current study show a significant increase in the proportional mortality attributed to drowning among fishermen aged 20 – 34 years compared with the rest of the age groups. Similar results were found in a study conducted in Iceland where the greatest number of drowning occurred among those in the same age bracket (Rafnsson and Gunnarsdottir, 1992). The finding may confirm the explanation advanced by ILO (1999) which suggests that young fishermen may not only lack traditional survival skills but may also feel less vulnerable to accidents than the elders who though less skilled in operating the vessels, have more experience in the marine environment.

Other risk factors associated with increased proportion of deaths due to drowning were boats using sails and paddles and day fishing. Boats alternating sails with paddles usually go for deep lake fishing where the boats are exposed to rough weather and the fishermen prone to fatigue (ILO, 1999). In contrast, there was a significant decrease in the proportion of deaths attributed to drowning on boats propelled by paddles compared to the rest. This could be explained by the fact that these particular boats are mainly used for fishing near the shores where they are shielded from strong winds. The relationship between day fishing and drowning can be attributed to turbulence of the waters due to strong winds which is commonly experienced during the day. Alcohol, too, was reported as being associated with drowning. A survey in north-east Scotland revealed that the frequency of treatment for alcoholism was higher among fishermen than in other people. Drunkenness is a major contributory cause of accidents, including drowning, to fishermen (Grainger, 1993). A more surprising finding was the significant increase in the proportion of deaths due to drowning among fishermen who had achieved secondary school education compared to other levels of education.

Although this relationship has not been reported anywhere, the results suggest that the secondary school leavers probably do not have adequate skills necessary for survival especially when the boats capsize compared to primary school leavers.

Most fishing vessel casualties are the result of human error. Moreover, even when casualties have been the result of equipment failure or bad weather, the human factor has often played a part. For example, maintenance and repair may have been inadequate or there may have been poor judgment exercised as to when and where to go fishing. Faced with economic and competitive pressures, fishermen are prone to take calculated risks (ILO, 1999). In view of the liabilities that confront boat operators today, however, careful risk management is crucial for business success, not to mention survival. An emergency in the lake is like a snowball: it grows. At first, one or two things go wrong and the fishermen can probably cope with those. Suddenly, however, the team may have more things to deal with at once, and unless the crews are well prepared and trained, disaster strikes (North Pacific Fishing Vessel Owners Association, 1997).

Overall, the results from this study show that about 96.3% of the deceased fishermen died from communicable diseases and accidents and injuries combined. This is a major public health concern since these conditions are preventable. Accidents and illnesses in the fishing industry are costly. The fishermen bear pain and loss of income and sometimes even lose their lives. The family shares in this suffering as well as in the stress that comes from knowing that fishing is a dangerous profession. The employer, community and country may have to bear part or all of the costs of hospitalization as well as costs associated with search and rescue operations. There is need to focus on what can be done to prevent accidents leading to death or injury as well as other aspects of health. The nature of fishing operations places fishermen far from immediate, professional and medical care. Adequate accommodation becomes more important the longer the vessel stays in the lake.

Accommodation includes the size, location, and quality of eating, sleeping and recreational spaces, sanitary facilities, and facilities for treatment when a fisherman is injured or becomes ill.

Other issues include ensuring adequate and regular medical fitness examination, first aid and other medical training of the crew, carriage of adequate medical equipment and clear instructions on how to use it.

1. The leading cause of death among the fishermen in all riparian districts was drowning. The second category was communicable diseases, followed by drowning.
2. Using verbal autopsy as a tool of investigation, this study reveals that, fishermen in all riparian districts along Lake Victoria experience one of the highest prevalence of HIV/AIDS infections.
3. The proportions of deaths due to accidents/injuries, crew-related, communicable (chronic) diseases were significantly different across the riparian districts.
4. The major factors that were significantly associated with drowning were: low level education, short duration of fishing, type of boat, duration of residence, density of population, socio-economic status, drinking water, use of alcohol and boat propulsion method.

5.1 Recommendations

1. The results of this study first, the need for speeding up the process of training fishermen along with riparian districts by Ministry of Health, Ministry of Fisheries in conjunction with the existing Non Governmental organizations in the riparian districts, such as the Sulu and Mbari Districts.
2. Since 90% of the causes of death among the fishermen in the riparian districts along Lake Victoria were communicable diseases, the Ministry of Health, Ministry of Fisheries, up to the local level, should consider the impact of these communicable factors to these areas.

CHAPTER FIVE

5.0 Conclusions

1. The leading cause of death among the fishermen in all riparian districts along Lake Victoria under broad category was communicable diseases, followed by drowning
2. Using verbal autopsy as a tool of investigation, this study reveals that, fishermen of the riparian districts along Lake Victoria experience one of the highest prevalence of HIV/ADS infections.
3. The proportions of deaths due to accidents/injuries, communicable and non-communicable (chronic) diseases were significantly different with in the riparian districts.
4. The major factors that were significantly associated with mortality among Kenyan fishermen of Lake Victoria included time of fishing, type of fishing gear, district of residence, demographic data (age), socio-economic status (education), life style (smoking and taking alcohol) and boat propulsion method

5.1 Recommendations

1. The results of the study reflect the need for speeding up HIV preventive activities among fishermen living in the riparian districts by, Ministry of Health, Ministry of Livestock and Fisheries in conjunction with the existing Non Governmental Organizations operating along the riparian districts, and more so, in Suba and Migori districts.
2. Since 96% of the causes of death among the fishermen of the riparian districts Lake Victoria are preventable, Ministry of Health, together with the Ministry of Livestock and Fisheries urgently need to work on policy guidelines on the prevention of the predisposing factors to these mortalities.

3. International codes and guidelines on occupational safety and health produced by ILO and other organizations should be enforced in the fishing industry by Ministry of Livestock and Fisheries in Kenya in order to improve on the standards of safety and health.

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APPENDICES

Appendix 1: Riparian districts around Lake Victoria



Fig. 3: Riparian districts around Lake Victoria.

Appendix 2: Respondent's consent form

In signing this document, I am giving my consent to be interviewed by a member of this research project on mortality and causes of death among fishermen. I understand I will be asked questions related to my late husband /son /brother /friend /employee whose occupation was fishing before his death. The interview will take about an hour to complete.

I have been informed that the interview is entirely voluntary and that after the interview begins, I can refuse to answer any specific question or decide to terminate the interviews at any point. I have been told that my answer to the questions will not be given to any one and no reports of this study will ever identify me in any way.

This study will help develop better understanding of the experiences of the fishermen and the services that can be most helpful to them. I understand that the results of this research will be given to me if I ask for it and that Mr. Otieno Opemo (*K.U.P.O Box 43844 Nairobi, Zoology Dept.*) is the person to contact if I have any question about the study or about my rights as a study participant.

Signature:

Date:

Interviewers Name:

Appendix 3: Verbal autopsy questionnaire

VERBAL AUTOPSY: ADULT MORTALITY

File No. _____ /
 Date of Interview _____ / ____ / ____
 District _____
 Division _____
 Location _____
 Beach _____

1.0 Identifier and Demographic Data of Deceased

Names

1.1.1 Christian Name:

1.1.2. Surname:

1.1.3. Father's Name:

1.2 Sex (1= Male)

1.2.1. Date of Birth: _____ / ____ / ____

1.2.2. Date of Death _____ / ____ / ____

1.2.3. Age at Death
 (Years).....

1.3. Marital Status (1= Single, 2= Married, 3= Divorced /Separated, 4= widowed)

If married:

1.3.1 Did he live with his wife? (1= Yes, 2= No)

Address (Usual domicile)

District:

Division:

Years of formal Education:

(1= Not attended, 2= Primary, 3= Secondary, 12= Others Specify)

Was he a smoker? (1= Yes 2= No)

1.6.1 If yes what was he smoking? (1= Cigarette, 2= Bhang,
 12= Others Specify)

1.6.2 For how long? (Years)

History of drinking alcohol (1= Yes, 2= No, 9= Heavy)

1.7.1 If yes, How much?(1=Light, 2=Moderate, 3=Heavy)

Name of Vessel he worked in before or at death:

1.8.1 Type of the Vessel (Craft):

(1= Sesse 2= Taruma , 3=Karua, 4= Dug out, 12= Others

specify)

1.8.2 Registration No. of the vessel:

1.8.3 Type of propulsion: (1= inboard motor, 2= outboard motor, 3= paddles, 4= Sail, 5=sail and paddles)

1.8.4 Type of fishing (gear) (1=Fillnet, 2=Long line, 3=Beach seine, 4=Castnet, 5= Hook and Line, 6 = Trawlers, 7=Mosquito seine 10=drift net, 11=setnet)

1.8.5 Name of the owner of the vessel:

1.8.6. Time at fishing (1=Day 2=night 3=Day & Night)

Medical History Related to and circumstances of death:

2.1 Where was the deceased at the time of death: (1= at home, 2= health facility, 3= at the beach, 12= others specify)

If health facility, give name and address:

2.1.2 If health facility, was the death certificate issued? (1= Yes, 2= No, 9=DK

2.1.3 If Yes, ask to see the cause:

File No. /
Date of Interview / /

Cause of death (1):

Cause of death (2):

2.1.4 If the answer to 2.1.2. is No. then:

2.1.4.1. Did you have a burial notification form: (1=Yes 2=No. 9=DK):

2.1.4.2. If Yes, ask to see and record the Serial No:

2.1.5. What cause of death was stated in the burial permit

2.1.5.1 If no burial permit, do you know the cause of death? (1=Yes, 2=No, 9= DK):

2.1.5.2 If yes, what was the cause(s) of death?.....

.....

2.1.5.3 Ask whether he had any of the following illnesses:(1= yes, 2= No, 9=DK, 12=Others Specify)

File No. /
Date of Interview / /

Hypertension

Heart disease

Diabetes

Tuberculosis

Epilepsy 

HIV/AIDS

Schistomiasis

Others Specify

2.1.5.4 For how long (Months) 8=N/A

2.1.6 Was the deceased hospitalized before death? (1= Yes, 2= No, 9=DK)

File No. /
Date of Interview / /

2.1.6.1. If yes, in which health facility?

Name:(8=N/A).....

2.1.6.2. For how long (days)

2.1.6.3. Did the diseased undergo any surgical operation during his hospitalization?
(1= Yes, 2=No, 9=DK, 8=N/A)

2.1.6.4. If yes, number of days before death: (8=N/A)

2.1.6.5. Did you know what the operation was? (1=yes, 2=No.)

2.1.6.6. If yes specify the operation.....

Summary of Main Symptoms and Signs Reported by RESPONDENT

Symptoms	Duration (Days)	Frequency 1= once only 2=only /off 3=continuous 9=DK	Severity 1=mild 2=moderate 3=severe
1			
2			
3			
4			
5			
6			
7			

File No.

/

Date of Interview

/ /

List of Hospitalization in the Past one Year

(Write in most recent at top list)

Name of Hospital	Day /Month / Year	Comments
1		
2		
3		
4		
5		
6		

3 Specific causes of death unrelated to illness

3.1. Was the diseased involved in an accident shortly before death?

(1= Yes, 2= No, 9= DK)

3.1.1 If yes what was the source of accident?

(1=drowning, 2=road /motor, 3= fire /burns, 4= animal injury, 5= snakebite, 12= others specify, 8=N/A)

3.1.2. If yes specify days before death.....(8= N/A)

3.2. State where the accident occurred:

(1= at work, 2= at home, 3=on the road, 12= others specify,

8=N/A)

3.2.1. If at work what time of the day was it? (1= day, 2= night, 8=N/A)

3.3. Organs of the body injured during the accident:

3.3.1. Head (1= Yes, 2=No, 8=N/A)

File No. / /

3.3.2. Chest (1= Yes, 2=No, 8=N/A)

3.3.3. Abdomen (1= Yes, 2=No, 8=N/A)

Date of Interview / /

3.3.4. Limbs (1= Yes, 2=No, 8=N/A)

3.4 Could this injury sustained might have lead to his death? (1= Yes, 2= No, 9= DK, 8=NA)

4.0. Specific (Information) question to elicit symptoms and signs of the final illness:

4.1. Did the diseased ever complain of difficulty in breathing? (1= Yes, 2= No, 9= DK)

4.2. If yes, was it on:

4.2.0. Exertion (1= Yes, 2= No, 9= DK, 8=N/A)

4.2.1. Lying down flat (1= Yes, 2= No, 9= DK, 8= N/A)

4.2.2 At night that is relieved by sitting up in bed (1= Yes, 2= No, 9= DK, 8= N/A)

4.3 Did the deceased ever complain of chest pain? (1= Yes, 2= No, 9= DK,)

If yes

4.3.1. Was it persistent for several hours, (1= Yes, 2= No, 9= DK, 8= N/A)

4.3.2. Was it relieved by rest (1=Yes, 2=No, 9=DK, 8=N/A)

4.4. Did the deceased ever complain of any paleness of the lips, fingers or nails?
(1= Yes, 2= No, 9= DK,)4.5. Did he have any yellow coloration on the eyes before death?
(1= Yes, 2=No)

4.6. Did the deceased ever complain of any swelling? (1= Yes, 2=No)

If Yes,

4.6.1. Of lower limbs (1= Yes, 2= No, 8=N/A)

4.6.2. Foot /Ankle (1= Yes, 2= No, 8=N/A)

4.6.3. Of legs, foot and ankle (1= Yes, 2= No, 8=N/A)

4.6.4. Of eye lids (1= Yes, 2= No, 8=N/A)

4.6.5. Of abdomen (1= Yes, 2= No, 8=N/A)

File No. / /

Date of Interview / /

4.6.6. Of back (1= Yes, 2= No, 8=N/A)

4.6.7. Of sacrum (1= Yes, 2= No, 8=N/A)

4.6.8. Of face (1= Yes, 2= No, 8=N/A)

4.7. How many days did the deceased have swelling? (999=DK, 8=N/A)

4.8. Did the deceased ever complain of weakness or tiredness? (1= Yes, 2= No.)

4.9. Did the deceased ever complain of sudden rapid heartbeat for one hour or more?
(1= Yes, 2= No, 9=DK)

4.10. Did he ever complain of sore throat, joint inflammation and pain?
(1= Yes, 2= No, 9=DK)

4.11. Did he complain of heart attack (1= Yes, 2= No)

IF YES,

4.11.1. How many times (999= DK, 8= N/A)

4.11.2. When was the last one before death? (M/Yr, 8= N/A) /

4.12. Did the deceased have any cough? (1= Yes, 2= No, 9=DK)

4.12.1. For how long? (999=DK, 8=N/A)

4.12.2. Did he have dry cough? (1=Yes, 2=No, 8=N/A)

4.12.3. Productive cough? (1=Yes, 2=No, 8=N/A)

If yes what was the colour?

4.12.3.1. Clear and sticky? (1=Yes, 2=No, 8=N/A)

4.12.3.2. Yellow or green? (1=Yes, 2=No, 8=N/A)

4.12.3.3. Stained with blood, what was the colour? (1=Yes,
2=No, 8=N/A)

8=N/A)

4.12.3.4. Bright red, mixed with sputum /cough (1=Yes, 2=No,

File No. /

Date of Interview / /

4.12.3.5. Dark in colour, mixed with food (1=Yes, 2=No, 8=N/A)

4.13. Any offensive smell from the sputum /cough (1=Yes, 2=No, 8=N/A)

4.14. Did he have chest pain? (1=yes, 2=No)

If yes,

4.14.1. Was it increased with cough and /or deep breath
(1=Yes, 2=No, 8=N/A)
? (1=Yes, 2=No, 8=N/A)

4.14.2. Was it localized and tender

4.14.3. Where was the pain? (1= over sternum, 2=over the ribs, 12=others specify, 9=DK)

4.15. Did he have any shortness of breath (air hunger)? (1=Yes, 2=No)

If yes was it (1=continuous, 2=on and off, 8=N/A, 9 =DK)

4.15.1. For how many days? (999=DK, 8=N/A)

4.16. Did he have wheezing? (1=Yes, 2=No, 9=DK)

4.17. Did he ever complain of abdominal pain (1=Yes, 2=No)

If yes,

4.17.1. What type of pain? (1=cramp, 2=dull, 3=burning,
4=colic,
12=others specify, 8=N/A)

4.17.2. Was the pain (1=Localized, 2=migrating, 3=persistent,
8=N/A)

4.17.3. What was the severity of the pain? (1=severe,
2=moderate, 3=mild, 9=DK)

4.17.4. Where was the pain? (1=central abdomen, 2=right
lower abdomen,
3=lower abdomen, 4=left lower, 5=loin radiating to groin,
6=inguinal region, 7=testicle of the same side, 10=the whole
abdomen,
12=others specify, 8=N/A)

4.18. Did he have any heartburn? (1=Yes, 2=No, 9=DK)

4.18.1. How often? (1=constantly, 2=on and off, 8=N/A)

- File No. /
Date of Interview / /
- 2=after staying hungry,
8=N/A)
- 4.18.2. If on and off, under what circumstance? (1=after eating,
8=N/A)
- 4.19. Did he have diarrhoea? (1=Yes, 2=No)
If yes,
and off, 9=DK, 8=N/A)
- 4.19.1. How frequent was the diarrhoea? (1=continuous, 2=on
and off, 9=DK, 8=N/A)
- 4.19.2. How did the stool look like?
(1=watery, 2=loose but not watery, 3=bloody, 8=N/A)
- 4.19.3. If bloody what was the colour? (1=bright red, 2=dark
red, 8=N/A)
- 4.19.4. For how long was the diarrhoea? (999=DK, 8=N/A)
- 4.20. Did the diseased have bloody vomiting? (1=yes, 2=No, 9=DK)
If yes,
8=N/A)
- 4.20.1. Was it aggravated by meals? (1=yes, 2=No, 8=N/A)
- 4.20.2. Was the blood (1=Bright, 2=Dark, 3=Black, 8=N/A)
- 4.20.3. Did the bloody vomitus last till death (1=yes, 2=No,
8=N/A)
- 4.20.4. For how long before death (999=DK, 8=N/A)
- 4.20.5. What did the vomitus look like? (1=watery,
2=Yellowish, 3=Coffee colour,
4=Blood, 5=Faecal matter, 8=N/A)
- 4.21. Did the deceased have yellow coloration of the palm and mucous membrane?
(1=yes, 2=No)
- 4.22. Did he have distended abdomen? (1=Yes, 2=No)
8=N/A)
- 4.22.1. Did the distention develop rapidly within days or
slowly over weeks?
(1=Rapidly, 2=Slowly, 8=N/A)
- 4.23. Was the deceased able to pass urine? (1=Yes, 2=No)
If yes,

File No. /

Date of Interview / /

4.23.1. Was there any change in the urine colour? (1=Yes, 2=No, 8=N/A)

4.23.2. What was the colour of urine? (1=Dark, 2=Black, 3=Bloodstained, 8=N/A)

4.23.3. For how long was the change of colour? (999=DK, 8=N/A)

4.23.4. Was there any change in the amount of urine passed daily? (1=Yes, 2=No, 9=DK, 8=N/A)

4.23.5. For how long did he have change in the amount of urine? (999=DK, 8=N/A)

4.24. How much urine did he pass in a day? (1-Too much, 2=Too little, 3=No urine at all, 9=DK, 8=N/A)

4.25. Did he have difficulty in passing urine? (1=Yes, 2=No, 9=DK)

If Yes,

4.25.1. What type of difficulty in passing urine? (1=Unable to pass urine, 2=Continuous dribbling of urine, 3=Burning sensation while passing urine, 4=intense pain, 9=DK, 12=Others specify, 8=N/A)

4.25.2. If the deceased was not able to pass urine:

4.25.2.1. Was the retention (1=recurrent, 2=transient, 8=N/A)

4.25.2.2. Did this retention last until death? (1=Yes, 2=No, 9DK)

4.26. Did the deceased ever complain of fever? (1=Yes, 2=No, 9DK)

If yes,
8=N/A)

4.26.1. How was the fever? (1=Continuous, 2=Intermittent,

4.26.2. Did he have fever until death? (1=Yes, 2=No, 9DK)

If yes,
4.26.2.1. For how long? (999=DK, 8=N/A)

4.27. Did the deceased complain of headache? (1=Yes, 2=No, 9DK)

If yes,

2=Intermittent, 8=N/A)

4.27.1. What type of Headache? (1=Continuous,

Date of Interview

File No. /

/ /

4.27.2. For how long was the headache? (999=DK, 8=N/A)

8=N/A)

4.27.3. Did the headache continue till he died? (1=Yes, 2=No,

4.27.4. Did he have stiff neck? (1=Yes, 2=No, 8=N/A)

If Yes,

4.27.4.1. For how many days? (999=DK, 8=N/A)

4.28. Did he have change in consciousness? (1=Yes, 2=No)

4.28.1. What was the level of consciousness? (1=Confused /disoriented,
2=Unconscious, 9=DK, 12=others specify, 8=N/A)

4.28. 2. If there was change in consciousness, for how long? (999=DK, 8=N/A)

4.28.3. How did it start? (1=suddenly, 2=rapidly within days, 3=slowly over
a few days, 9=DK, 8=N/A)

4.29. Did the deceased have convulsions /Fits? (1=Yes, 2=No)

If yes,

4.29.1. How many days did he have fits? (999=DK, 8=N/A)

body, 9=DK,

4.29.2. How were the fits? (1=Repetitive jerking of the whole

12=others specify, 8=N/A)

8=N/A)

4.29.3. When fits were frequent how many per day? (999=DK,

4.29.4. How was he between the fits?

(1=Awake and conscious, 2=Unconconscious, 8=N/A)

4.29. Did he have difficulty in opening the mouth? (1=Yes, 2=No)

4.30. Did he have stiffness of the body? (1=Yes, 2=No)

If yes,

4.30.1. For how many days? (999=DK, 8=N/A)

File No. /

Date of Interview

/ /

4.31. Did he have paralysis of one side of the body? (1=Yes, 2=No)

If yes,

4.31.1. For how many days did he have the paralysis?

(999=DK, 8=N/A)

4.31.2. Did he have paralysis of the lower limb? (1=Yes, 2=No,

9=DK, 8=N/A)

4.31.3. For how many days? (999=DK, 8=N/A)

4.32. Did the deceased complain of presence of any mass in any part of the body?

(1=Yes, 2=No)

4.32.1. If any: where in the body?

(1=Abdomen, 2=Neck, 3=Face, 4=Chest 12=others specify,

8=N/A)

4.32.2. If abdomen where exactly? (1=RT Upper Abdomen,

2=LT Upper Abdomen, 3=Lower abdomen, 12=Others specify,

8=N/A)

4.32.3. For how many days? (999=DK)

4.33. Was he able to swallow? (1=Yes, 2=No)

If No,

4.33.1. For how long? (999=DK, 8=N/A)

4.34. Did he have loss of weight? (1=Yes, 2=No)

If yes,

4.34.1. How was the weight loss? (1=Slow, 2=Rapid, 3=Very

rapid, 8=N/A)

4.35. Did the deceased ever complain of skin rash before death? (1=Yes, 2=No)

If yes, what type of rash? (1=Small itchy, 2=Large pastular,

3=large itchy leaving marks after healing, 12=Others specify, 8=N/A)

File No. /
Date of Interview / /

6.0. Identification and demographic data of principle respondent

Name of the respondent:.....

Age of the respondent:.....

Sex of the respondent (1=Male, 2=Female):.....

Relation of respondent to the deceased (1=Spouse, 2=Son, 3=Daughter, 4=Father, 5=Mother, 6=Brother, 7=Sister, 11=Uncle, 14=Nephew, 10=Workmates, 13=Owner of boat, 12=Others specify).

Years of formal Education of the respondent (Yrs)

Assessment of cause of death

Name of clinical monitor:.....

Date of casualty assessment

Cause of death 1:

Cause of death 2:

Cause of death 3:

File No. /
Date of Interview / /

7.0 Remarks

.....
.....
.....
.....
.....
.....
.....

Appendix 4: Coding of diseases causing death among fishermen in Lake Victoria - Kenya.

I. COMMUNICABLE DISEASES

01 (and 53)	Multiple infection secondary to HIV/AIDS
02	Schistosomiasis
03	Gastroenteritis Secondary to HIV/AIDS
06	Amoebic dysentery
08	Pneumonia
10	Septicaemia due to cellulitis
16	Pulmonary tuberculosis
11	Malaria
13	Meningitis
14	Cholera
19	Typhoid fever
20	Acute Gastroenteritis
23	PTB with Gastro enteritis
24	PTB secondary to HIV/AIDS
25	Kaposi's Sarcoma secondary to HIV/AIDS
27	Chronic Gastroenteritis
29	PTB Meningitis
30	Malaria with Pneumonia
34	Malaria with Bacillary Dysentery
38	Schistomiasis
43	Hepatitis
44	PTB secondary to HIV/AIDS with schistosomiasis
46	PTB with bacillary dysentery
47	Pneumonia with Malaria & Schistomiasis
49	Cerebral Malaria
50	Chronic G.E/ Pneumonia Secondary to HIV/AIDS
51	Chronic chest infection (Pneumonia) H1WAIDS
52	Schistomiasis with Malaria
54	Paraplagia, Anemia and Malaria Secondary to HIV/AIDS
55	Acute Malaria with UTI
56	Malaria with Pneumonia and Anemia
58	Chronic Lymphadentis with boils secondary to HIV/AIDS
59	Chronic Malaria Secondary to HIV/AIDS
62	Cerebral Malaria with Pneumonia
64	Cholera gastritis secondary to HIV/AIDS with Schistosomiasis
65	Cholera with Malaria
67	CCF secondary to severe anemia resulting from HIV/AIDS
68	Electrolytes imbalance secondary to HIV/AIDS
69	Severe anemia secondary to chronic malaria resulting from HIV/AIDS
70	Chronic Pneumonia secondary to HIV/AIDS
71	Chronic bronchitis
72	Chronic bronchitis secondary to HIV/AIDS
75	CCF secondary to PTB resulting
76	Weeping dermatitis secondary to HIV/AIDS
79	Anemia secondary to chronic bacillary dysentery with schistosomiasis resulting

from I-HV/AIDS

- 83 Rabies
- 86 Septicemia
- 87 Chronic typhoid secondary to HIV/AIDS
- 88 Chronic Amoebic dysentery secondary to I-HV/AIDS

ii. NON- COMMUNICABLE

- 04 Epilepsy
- 12 Heart disease / Failure
- 17 Cancer of stomach
- 21 Diabetes mellitus
- 33 Renal Failure
- 32 Elephantiasis
- 35 Intestinal Obstruction
- 37 Cancer of lungs
- 39 Cancer of legs
- 45 Cancer of throat
- 48 Paralysis due to space occupying lesion (SOL)
- 57 Cancer of the mouth
- 60 PUD with Renal Failure
- 61 Renal Failure secondary to M
- 63 Hypertension
- 66 Liver cirrhosis
- 74 Asthma
- 85 Cancer Prostate

iii. ACCIDENT / INJURIES

- 05 Snake bite
- 18 Animal
- 22 Drowning
- 26 Assault
- 28 Poisoning
- 36 Suicide
- 40 Fire / Burns
- 41 Road Traffic Accident
- 80 Fish bone prick
- 81 Gun Shot
- 84 Lightening