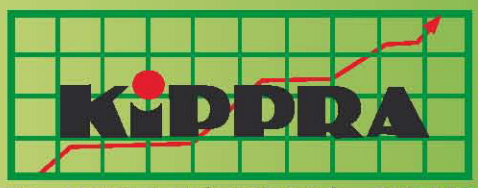
Discussion Paper Series



The KENYA INSTITUTE for PUBLIC POLICY RESEARCH and ANALYSIS

Reducing Health Emergencies of Droughts and Floods in Kenya

Rose Ngara-Muraya

DP/247/2020

THE KENYA INSTITUTE FOR PUBLIC POLICY
RESEARCH AND ANALYSIS (KIPPRA)

Reducing Health Emergencies of Droughts and Floods in Kenya

Rose Ngara-Muraya

Kenya Institute for Public Policy
Research and Analysis

KIPPRA Discussion Paper No. 247
2020

KIPPRA in Brief

The Kenya Institute for Public Policy Research and Analysis (KIPPRA) is an autonomous institute whose primary mission is to conduct public policy research leading to policy advice. KIPPRA's mission is to produce consistently high-quality analysis of key issues of public policy and to contribute to the achievement of national long-term development objectives by positively influencing the decision-making process. These goals are met through effective dissemination of recommendations resulting from analysis and by training policy analysts in the public sector. KIPPRA therefore produces a body of well-researched and documented information on public policy, and in the process assists in formulating long-term strategic perspectives. KIPPRA serves as a centralized source from which the Government and the private sector may obtain information and advice on public policy issues.

Published 2020
© Kenya Institute for Public Policy Research and Analysis
Bishops Garden Towers, Bishops Road
PO Box 56445-00200 Nairobi, Kenya
tel: +254 20 2719933/4; fax: +254 20 2719951
email: admin@kippra.or.ke
website: http://www.kippra.org

ISBN 978 9966 817 57 0

The Discussion Paper Series disseminates results and reflections from ongoing research activities of the Institute's programmes. The papers are internally refereed and are disseminated to inform and invoke debate on policy issues. Opinions expressed in the papers are entirely those of the authors and do not necessarily reflect the views of the Institute.

Abstract

Droughts and floods are becoming more frequent and increasingly severe in Kenya, with serious health ramifications. This paper discusses the nature of health risks and effects emanating from droughts and floods in prone counties of Kenya, how they affect the health of Kenyans in the prone areas, how these health risks and effects need to be dealt with in terms of prevention, preparedness, response and recovery, and the key actors and gaps in line with the international frameworks of action. The paper is based on a primary survey of households, key informant interviews and secondary information. The survey was conducted in February-March 2018 on a sample comprising 1,370 households selected with the assistance of Kenya National Bureau of Statistics from their sample frame in the prone counties, while Key Informant interviews were conducted on purposefully selected county and national government officials, non-governmental agencies, financial institutions, insurance companies and private sector institutions involved in combating health risks and effects associated with droughts and floods across 27 drought and flood-prone counties. The household data were analyzed using Stata for quantitative outputs and manual qualitative techniques for Key informant information. The findings are presented herein in charts, tables and discussions. The results revealed that both droughts and floods pose serious health risks and have immediate, short-term and long-term health effects, majorly manifested in water, air, food, dust and vector borne diseases that include malaria, cholera, typhoid, dysentery, intestinal worms, diarrhoea, hepatitis A, malnutrition, pneumonia, flu and other respiratory diseases, and mental illness, which was in concurrence with reviewed literature. The conclusion is that the health effects of droughts and floods are not effectively prevented, prepared for, or even responded to, and recovery is not effectively achieved. Moreover, the main actors in reducing these health risks and effects work independently with no coordination, leading to inefficient use of already scarce resources and continued health emergencies. The key recommendation is that Kenya needs to put in place and/or strengthen policy frameworks that guide preventive, preparedness, response and recovery measures and a coordination mechanism for reduced health risks from droughts and floods and related health emergencies for improved health and economic advancement.

Abbreviations and Acronyms

ACF	Action Against Hunger (French)
ACID	Agricultural Cooperative International Development
ADB	Asian Development Bank
ADRA	The Adventist Development and Relief Agency
ASALs	Arid and Semi-Arid Lands
CBO	Community-Based Organizations
CDC	Centre for Disease Control
CERF	Central Emergency Response Fund
CIDA	Canadian International Development Agency
CHIRPS	Climate Hazards Group InfraRed Precipitation with Station
CSG	County Steering Group
CSR	Community Social Responsibility
DFID	Department for International Development
DI	Development Initiative
DNA	DeoxyriboNucleic Acid
DRM	Disaster Risk Management
ECDC	European Centre for Disease Prevention and Control
EFA	Education for All
ESARO	Eastern and Southern Africa Regional Office
EU	European Union
FBO	Faith-Based Organization
FAO	Food and Agricultural Organization
GAM	Global Acute Malnutrition
GIWP	General Institute of Water Resources and Hydropower Planning and Design
GIZ	German International Development Agency
GoK	Government of Kenya
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
HPG	Humanitarian Policy Group
IDMC	Internal Displacement Monitoring Centre
IDP	International Development Partners
IEC	Information, Education and Communication
IFRC&RCS	International Federation of the Red Cross and Red Crescent Societies

IDRC	International Development Research Centre
ITDG	Intermediate Technology Development Group
JIKA	Japanese International Cooperation Agency
KCB	Kenya Commercial Bank
KDHS	Kenya Demographic and Health Survey
KMD	Kenya Meteorological Department
KEPH	Kenya Essential Package for Health
KEMRI	Kenya Medical Research Institute
KEMSA	Kenya Medical Supplies Agency
KIBS	Kenya Demographic and Health Survey
KIHBS	Kenya Integrated Household Budget Survey
KII	Key Informant Interview
KIPPRA	Kenya Institute for Public Policy Research and Analysis
KMTC	Kenya Medical Training College
KNBS	Kenya National Bureau of Statistics
KWS	Kenya Wildlife Service
MAM	Moderate Acute Malnutrition
MIC	Monitoring and Information Centre
MMR	Maternal Mortality Rate
MTP	Medium Term Plan
NCDs	Non-Communicable Diseases
NCPD	National Council for Population and Development
NCSH	National Comprehensive School Health
NDEF	National Drought Emergency Fund
NDMA	National Disaster Management Agency
NDMU	National Disaster Management Unit
NDOC	National Disaster Operation Centre
NGO	Non-Governmental Organization
NHIF	National Hospital Insurance Fund
NMCP	National Malaria Control Programme
NPDRM	National Platform for Disaster Risk Management
OECD	Organization for Economic Cooperation and Development
ODA	Official Development Assistance
ODF	Open Defecation Free
OVC	Orphaned and Vulnerable Children

PAHO	Pan American Health Organization
PLW	Pregnant and Lactating Women
PPPs	Public Private Partnerships
PRISE	Pathway to Resilience in Semi-Arid Economies
PTSD	Post-Trauma Stress Disorder
SAM	Severe Acute Malnutrition
SIDA	Swedish International Development Agency
SOP	Standard Operating Procedures
SDGs	Sustainable Development Goals
STH	Soil-transmitted helminthes
STI	Sexually Transmitted Infections
UAP	Union Assurance Provincial
UHC	Universal Health Coverage
UN	United Nations
UNDAC	United Nations Disaster Assessment and Coordination Team
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNHabitat	United Nations Human Settlements Programme
UNHCR	United Nations High Commission for Refugees
UNISDR	United Nations International Strategy for Disaster Reduction
UNOCHA	United Nations Office of Coordination of Humanitarian Affairs
UNU-EHS	United Nations University Institute for Environment and Human Security
UTI	Urinary Tract Infections
USAID	United States Agency for International Development
USAR	Urban Search and Rescue
WASH	Water, Sanitation and Hygiene
WFP	World Food Programme
WHO	World Health Organization
WMO	World Meteorological Organization
WSP	Water and Sanitation Programme
WWF-UK	World Wide Fund for Nature–United Kingdom

Table of Contents

Abstract iii
Abbreviations and Acronyms iv
1. Introduction 1
1.1 Background 1
1.2 The Problem 4
1.3 Study Objectives 5
1.4 Research Questions 5
1.5 Structure of the Paper 6
2. Literature on Health Risks and Effects of Droughts and Floods 7
2.1 Risks Drought and Floods Pose on Health 7
2.2 Prevention and Preparedness Measures to Reduce Health Risks of Droughts and Floods 10
2.2.1 Prevention 10
2.2.2 Preparedness to deal with health effects of droughts and floods 13
2.3 Response and Recovery Measures to Reduce Droughts and Floods Health Effects 14
2.3.1 Response to health effects of droughts and floods 14
2.3.2 Recovery measures to droughts and floods health effects 16
2.4 Coordination Mechanisms When Dealing with Health Effects of Droughts and Floods 17
3. Methodology 19
3.1 Scope 19
3.2 Study Design 20
3.3 Sample and Data Sources 20
3.4 Conceptual Framework 21
3.5 Theoretical Framework 22
3.6 Limitations 24
4. Droughts and Floods Health Risks 25
4.1 Drought Effects on Health 27
4.2 Floods Effects on Health 29
4.3 Other Related Health Risks and Secondary Effects 33
4.3.1 Risky coping strategies 33
4.3.2 Conflicts 34
4.3.3 Worsening of chronic diseases 34
4.3.4 Absenteeism from work and school 34
4.4 Regional Trends of Drought and Flood-Related Diseases 35
4.5 Gaps and Required Actions 43
4.6 Section Summary 44

5. Management of Droughts and Floods Health Risk and Effects 46
5.1 Prevention 46
5.2 Preparedness 48
5.2.1 Poor access to healthcare facilities 49
5.2.2 Cost of treatment, social protection and insurance 52
5.3 Response 54
5.4 Recovery 55
5.5 Gaps in Management Actions 56
5.6 Section Summary 57
6. Coordination Mechanisms for Reducing the Health Risks and Effects of Droughts and Floods 59
6.1 Legal and Policy Frameworks for Reducing Health Risks and Effects of Droughts and Floods 59
6.2 Coordination of Activities in Managing Health Risks and Effects of Droughts and Floods 65
6.3 Section Summary 67
7. Resources, Capacity and Policies to Reduce the Health Risks and Effects of Droughts and Floods 68
7.1 Resources 68
7.2 Capacity 71
7.3 Policy Gaps 73
7.4 Section Summary 77
8. Conclusion and Recommendations 78
8.1 Conclusion 78
8.2 Recommendations 79
8.3 Further Research 81
References 82
Annex 92

List of Figures

Figure 3.1: Areas of Kenya prone to droughts, floods and landslides 19
Figure 3.2: Conceptual framework..... 21
Figure 3.3: Threats (flooding and drought), impacts and moderating influences.....23
Figure 4.1: Diseases afflicting people during drought and floods (% of people).. 25
Figure 4.2: Regional and counties maternal deaths per 100,000 births 29
Figure 4.3: Contaminants of water wells - communication with pit latrines and other waste.....32
Figure 4.4: Kenya Adult HIV prevalence by county 33
Figure 4.5: Malaria epidemiology zones of Kenya 36
Figure 4.6: Malaria cases by county by year 36
Figure 4.7: Malaria trends by region.....37
Figure 4.8: Diarrhoeal cases in non-drought and non-flood counties.....38
Figure 4.9: Diarrhoeal cases in drought and flood prone counties 38
Figure 4.10: Diarrhoea trends by region.....39
Figure 4.11: Typhoid trends by region 2008-2016 40
Figure 4.12: Malnutrition cases by region 2004-2016 40
Figure 4.13: Pneumonia trends by region (2004-2016) 41
Figure 4.14: Intestinal warms cases by region (2004-2016) 42
Figure 5.1: Level of facility treatment was sought from for health effects of droughts and floods 49
Figure 5.2: Was treatment sought and from where? 52

List of Tables

Table 4.1: Estimated caseloads of acute malnutrition - children, pregnant/lactating women: July 2017 and February 2018 28

Table 4.2: Statistics of select health variables 35

Table 5.1: Distance and time taken to nearest health facility by county 50

Table 5.2: Expenditure on treatment by income brackets 53

Table 6.1: Classification of actors involved in reducing the health effects of droughts and floods 66

Annex Table 1: ASAL and flood prone counties selected for droughts/floods survey.....93

Annex Table 2: Incidences of droughts and floods in Kenya from 1975-2018....93

Annex Table 3: Some actors in alleviating health and related effects of droughts and floods in Kenya 95

Annex Table 4: Error in Statistical Abstract 2013 - Identical 2011 data for outpatient morbidity in under 5 and over 5-year old 96

1. Introduction

1.1 Background

The health risk from droughts and floods are high, and the effects are serious. Drought is a widespread extended period deficient of precipitation, leading to drying up of water sources and loss of both flora and fauna (Douben, nd; Nairizi, 2017). Drought has the highest frequency among all disasters, affecting over 40 per cent of the world population (Nairizi, 2017). Health is substantially affected by drought, with the effects ranging from food insecurity and malnutrition to food, air, water, dust and vector borne diseases and injuries during conflict over reduced pasture and water resources, worsening of chronic diseases, and trauma from ill-health, loss of lives and wealth (Omosa, 2005; Afifi et al., 2012; Stanke et al., 2013). Flooding occurs when normally dry land is submerged in water, rivers and other water bodies burst their banks, while run-off from very heavy rainfall falling within a short duration of time follows unusual paths, wreaking havoc along the way (WMO, 2011; Mohammed et al., 2017). The ramifications of floods on health include outbreaks of water, food, vector and air borne diseases, drowning and injuries from flood water accidents and from displaced animals, destruction of infrastructure and buildings that lead to injuries and reduced access to health facilities, which also worsens chronic illnesses and trauma associated with sickness, loss of lives and wealth (Doocy et al., 2013).

Significant parts of the world are prone to high variability in precipitation, which at times leads to drought when low, and/or storms or flooding when excessive (WHO, 2011). Many parts of Africa are arid and semi-arid, with frequent droughts and floods. Particularly, the Horn of Africa, Eastern and Southern Africa experience frequent and sometimes long seasons of drought, which are often followed by torrential rains that wreak havoc on all sectors and especially health, with some of the most affected countries being Ethiopia, Kenya, Mozambique, Namibia, Somalia, Sudan, South Sudan and Uganda, among others (Afifi et al., 2012; OCHA, 2017; IDMC, 2019). In recent years, a devastating drought was experienced in 2016/17 in the region, followed by severe flooding in Mozambique and Kenya in 2017/18 that seriously affected health through malnutrition, diseases, injuries and trauma (Reliefweb, 2016; OCHA, 2018; IDMC, 2019).

Kenya experiences regular droughts and floods episodes as detailed in Annex Table 2 (Government of Kenya, 2009; Elliott and Fowler, 2012; Venton et al., 2012; Huho, Mashara and Musyimi, 2016; Floodlist News Africa, 2018; UNICEF, 2018). During droughts, Kenyans not only experience starvation and hygiene-related diseases, but also dwindling water levels in power generation stations, resulting in power outages that affect equipment in health facilities, with serious

effects on patients (Njoka et al., 2016). Additionally, human-human and animal-human conflicts arise over water, farms and grazing grounds, resulting in serious injuries and restricted access to healthcare services (Omosa, 2005; Asaka, 2012). Flooding on the other extreme inundates homes and sweeps nearly everything in the water path, including people, animals, vegetation, property and infrastructure (roads and bridges, railway lines, airstrips/airports, communication lines, power plants/lines, water pipes, health facilities and schools among others), negatively affecting health and access to healthcare services (Stanke et al., 2013; Mbogo, Inganga and Maina, 2014; Kang'ethe, 2006). People are displaced and exposed to diseases, including malaria, cholera, typhoid, dengue fever, yellow fever, Rift Valley fever, among others, and injuries from obstacles hiding underwater (Okaka and Odhiambo, 2018). They are also exposed to dangerous animals such as snakes, rodents, crocodiles and hippos displaced by floods from their regular habitat into areas generally inhabited by people, leading to bites, attacks, serious infections and illnesses or death (Walker-Springett, Butler and Adger, 2017). Additionally, both adults and children get exposed to trauma, leading to poor mental health whose effects are either short- or long-term. The floods experienced in Kenya in early 2018 caused over 100 deaths from drowning and an upsurge of diseases caused by mosquitoes (malaria, dengue fever and chikungunya), with majority of those affected being on the recovery path from the devastating 2017 drought (OCHA, 2018). During the 2017 droughts and 2018 floods, cholera cases were experienced in parts of the country such as Mandera and Wajir counties, among other arid and semi-arid areas that make about 84 per cent of the country (Government of Kenya, 2007; 2018; Okaka and Odhiambo, 2018). Many were also displaced by floods (IDMC, 2019).

The Kenya Vision 2030 and Medium-Term Plans (MTPs) I, II and III, while reflecting on the problems associated with droughts and floods, highlight the challenge of realizing Kenya's development agenda with a huge population suffering related ill-health repeatedly (Government of Kenya, 2007; 2008; 2013; 2018). By making efforts to prevent and effectively prepare to deal with drought and floods health risks and effects, severity is reduced, giving rise to ripple effects on human capital and all sectors of the economy (Government of Kenya, 2007). Universal Health Coverage (UHC) has been given prominence in MTP III and as one of the "Big 4" agenda to be achieved by 2022. Achievements made during the second MTP period, such as reduction of malaria incidence from 32 to 22 per cent and increased use of skilled health service providers during delivery from 43 to 62 per cent (Government of Kenya, 2017) could be improved further if the effects of droughts and floods are controlled and access to facilities enhanced under all weather conditions. Such milestones would draw Kenya closer to the

achievement of the Sustainable Development Goals (SDGs) theme of 'not leaving anyone behind' and specifically Goal 3 on achieving good health and well-being.

The Constitution of Kenya (2010) Articles 43(1) and 53(1) echo the importance of health and well-being of citizens, including provision of healthcare services. Furthermore, maintaining people in good health is an enabler for human capital development to support economic activities of the country (Government of Kenya, 2010a). It is the onus of the national and county governments to guarantee this right under all circumstances, including droughts and floods related challenges by enacting relevant laws, drawing relevant policies, setting aside adequate resources for preventive, preparedness, response and recovery measures.

The Kenya National Disaster Management Policy (Government of Kenya, 2017b) stipulates the issues, required actions and processes of dealing with disasters in general. The issues highlighted in the policy include corruption and breaking building law and regulations and building on riparian areas; lack of standard operating procedures; lack of preparedness and response systems leading to uncoordinated actions; lack of contingency plans; inadequate technology to generate early warning and hazard mapping; low investment in disaster risk management; and political interference in disaster-prone areas leading to poor preparedness and mitigation. It seeks to strengthen institutions; mainstream disaster risk management and enhance effective coordination of prevention, preparedness, response, recovery of disaster risks and effects for resilience. This is to be done through institutional frameworks including National Disaster Operation Centre (NDOC), National Disaster Management Unit (NDMU), National Disaster Management Authority (NDMA), and National Platform for Disaster Risk Management (NPDRM), with another institution proposed in the policy to coordinate them all.

The Kenya health policy (Government of Kenya, 2012) stipulates that health facilities will deliver services including preventive and promotive health services, conduct disease surveillance, respond to epidemic and prepare for emergencies. The key policy objectives include addressing the health effects of disaster emergencies, disease outbreaks and injuries from violence and conflicts. It emphasizes emergency preparedness and risk management through disaster forecasting and emergency response to minimize social and economic impacts. The policy is cognizant of the exposure to diseases arising from geographical and climatic conditions in the arid and semi-arid regions, giving rise to health risks that threaten people's well-being and the economy. Consequently, to promote health and prevent health problems associated with disasters and related epidemics, priority healthcare interventions and services should include disaster preparedness and response, to be achieved through expansion of the Kenya Essential Package for Health (KEPH) to include

referral to the nearest health facility, whether public or private, for emergency health services. It also emphasizes on pre-hospital and hospital emergency care; referral ambulance services for those affected; and psychosocial support for the traumatized.

The Hyogo Framework and the Sendai Framework for Disaster Risk Reduction 2015-2030 stress the significance of having appropriate strategies to reduce disaster risks that impact on health. This includes food security assurance during drought; resilient health facilities in safe locations and functional under all conditions; social protection for the community members at risk, especially children, pregnant women, elderly, very poor and people living with disability; psychosocial support for the mentally traumatized following droughts and floods experiences; protection of key health, water, transport and communication infrastructure; and identification of appropriate land to settle the displaced. The roles of the international institutions, states and local bodies in disaster risks assessment mainstreaming; mapping and managing droughts and flood-prone areas; identifying safe areas for displacement of populations at risk while preserving ecosystems and positive cultural practices are crucial.

1.2 The Problem

Health risks of droughts and floods are known, and effects often expected. Some economies prepare to deal with them well in advance to prevent the likely health outcomes from evolving into serious emergency cases. Other economies are often caught unprepared. Ironically, every time it floods in parts of Kenya, drought follows in a few months and then another flood, making these episodes cyclical. This leads to multiple problems that directly or indirectly impact health. For example, in 2017, about 2.7 million Kenyans faced severe hunger and starvation due to drought, with some parts of the country such as Turkana North, North Horr and Mandera having over 30 per cent Global Acute Malnutrition (GAM)[1] rate while Turkana Central, Turkana South, Turkana West, Laisamis, East Pokot and Isiolo had GAM rates ranging from 15 to 29 per cent (OCHA, 2017). Several counties including Embu, Garissa, Kirinyaga, Mombasa, Nairobi, Turkana, and Wajir reported cholera, measles and watery diarrhoea outbreaks due to poor access to water during that drought, and hence poor hygiene, improper waste management, and unhygienic food handling practices. As the drought intensified, people became more food insecure due to crop failure and death of livestock from which food is obtained. Undernutrition and malnutrition ensued, with among other counties

1 Moderate Acute Malnutrition (MAM) is moderate wasting while Severe Acute Malnutrition (SAM) is severe wasting. Both MAM and SAM add up to Global Acute Malnutrition (GAM). Prevalence of wasting: <5% is acceptable; 5% to 9.9% is poor; 10% to 14.9% is serious; and >15% is critical. A GAM value of >10 % is an emergency and high prevalence rates outside of the seasonal norm are particularly a cause for concern (WHO, 2000).

Kajiado, Kitui, Kwale, Kilifi, Garissa, Marsabit, Mandera, Wajir and Turkana seriously affected (Government of Kenya, 2018). Similarly, floods experienced in 2018 killed over 100 through drowning and related accidents, cholera outbreaks affected nearly 3,000 and caused over 25 deaths in parts of Kenya. Additionally, over 260,000 people were displaced, with children and adults exposed to injuries drowning and disease (OCHA, 2018; IDMC, 2019).

Despite Kenya being well informed on the likelihood of occurrence and possible impact of droughts and floods and their adverse effects on health, the country is often caught unprepared and the events culminate into health emergencies. Kenya's ASAL counties, which are also relatively the least developed and least equipped to deal with the impacts of droughts and floods, are usually the most adversely affected. This creates a need to critically look at the health risks and effects of droughts and floods in the country and discuss ways to enhance appropriate systems to avert health-related emergencies.

1.3 Study Objectives

The general study objective is to critically examine health risks and effects emanating from droughts and floods and how to alleviate these in Kenya.

Specific Objectives:

1. Identify health risks and effects associated with droughts and floods in Kenya;
2. Examine how enhanced measures of prevention, preparedness, response, recovery, and a good coordination mechanism can alleviate the adverse health effects of droughts and floods Kenya;
3. Identify gaps in prevention, preparedness, response, recovery and coordination, and propose actions to reduce health emergencies of droughts and floods.

1.4 Research Questions

1. What are the health risks and effects associated with droughts and floods in Kenya?
2. How can enhanced measures of prevention, preparedness, response, recovery and a good coordination mechanism alleviate the adverse health effects of droughts and floods in Kenya?
3. What prevention, preparedness, response, recovery actions can be taken to reduce health risks and related emergencies arising from droughts and floods episodes?

1.5 Structure of the Paper

The paper is presented in 8 sections. Section 1 is the introduction followed by section 2 on reviewed literature. Section 3 has methodology while section 4 analyses the health risk and diseases reported by households, and distribution and trends of these diseases relative to occurrence of droughts and floods from secondary data. Section 5 has the health risks and effects management through prevention, preparedness, response and recovery measures reported by key informants. Section 6 discusses the coordination mechanisms and needed changes in guiding frameworks for efficiency in the delivery of the management measures. Section 7 discusses the gaps in resources and policies. Section 8 has a summary of the study, conclusion and recommendations.

2. Literature on Health Risks and Effects of Droughts and Floods

2.1 Risks Drought and Floods Pose on Health

Drought effects on health

Drought is a prolonged period of high heat levels, devoid of precipitation. The health problems associated with droughts are numerous and majorly include water, food, air, vector and dust borne diseases and injuries from conflicts (Stanke et al., 2013).

Most water sources dry up, rendering water-scarce during drought. Available water sources are often stagnant pools on riverbeds, mostly shared by people and animals. As water quantity reduction and quality degradation intensifies, there is an increased concentration of bacteria/pathogens in the water, especially from domestic animals (Cox et al., 2005; Cabral, 2010; Stanke et al., 2013). Urban residents also experience water scarcity during drought as sources such as dams and other reservoirs decrease drastically, and piped supply dwindles. This forces urban residents to buy water from vendors whose containers, sources and handling are often unhygienic and hence a cradle of bacteria (Opryszko et al., 2013). As the little available water is scaled to meet numerous needs, hygiene is compromised. The outcome is water-borne diseases such as cholera, typhoid, dysentery, intestinal worms and generally diarrhoeal (WHO, 2018).

The food-related health ramifications of drought are multiple. The effect may arise from contaminated food or from food insecurity. Drought results to depletions of agricultural production and rise in food prices. It also leads to death (or movement) of livestock from which food and milk are obtained especially in pastoralist communities. This leads to reduced food intake in households below the level of sufficiency, which culminates in food insecurity (Chotard et al., 2010; Mason et al., 2010; Friel et al., 2014; PRISE, 2016). Food insecurity gives rise to undernutrition, malnutrition and related conditions such as marasmus, kwashiorkor, stunting and wasting in young children. Intense hunger leads to traumatic suffering, death from starvation and/or opportunistic diseases that afflict the weakened (Omosa, 2005). Contaminated food leads to gastroenteritis infections, which could be viral (norovirus and rotavirus), bacterial (E-coli, salmonella and campylobacter) or parasitic infections.

The increased temperatures during drought in a rainy region and reduced water flow that results in stagnant pools create a favourable environment for vectors to flourish (Wu et al., 2015; WHO, 2011). Vector-borne diseases associated with drought include chikungunya, kara-azar, hantavirus, west Nile virus and plague,

among others (Githeko et al., 2000). Mosquito is a key arthropod vector that carries diseases causing pathogens. The *aedes aegypti* mosquitoes that transmit chikungunya and dengue viruses lay their eggs in water storage containers, a common phenomenon during drought (Chretien et al., 2006). West Nile virus whose prevalence increases with increasing temperatures is transmitted by mosquitoes that feed on birds (crows and columbiformes), the primary hosts of the parasite (WHO, 2017b). Sandflies (Phlebotomine) transmit leishmania parasite that causes kala-azar and thrives in drought conditions (Killick–Kendrick, 2013). Hantavirus, a rodent hosted pathogen is transmitted through air when dust containing rodent waste (urine and droppings) is blown into the air. Plague is transmitted by fleas to humans near plague-infected animals, especially rodents.

The scorching heat dries the soil into small dust particles during drought, which are then brown by the wind into the air causing air and dust borne diseases, especially respiratory diseases such as flu, bronchitis, asthma and bacterial pneumonia; skin conditions e.g. scabies; and eye infections e.g. trachoma and conjunctivitis, among others (Frumkin et al., 2008; CDC, 2018). The heat also gives rise to hyperthermia and heat stroke especially among the weak and elderly (Frumkin et al., 2008). Wildfires arising during drought cause injuries and death (Stake et al., 2013; Konrad and Knox, 2016). Due to changes in the echo-systems and life support systems, infestations of pathogens, pests and parasites affect people's long-term health status through animals, plants and other organisms (Baez, Fuente and Santos, 2009; KWS, 2009; UNISDR, 2014; Ebi and Bowen, 2016). Some cases of HIV/AIDS have been associated with drought due to migration to towns in search of alternative sources of income, which include prostitution (ITDG, 2005; Habib and Jumare, 2008). Trauma and mental health problems are also associated with loss of wealth and disruption of lives due to droughts (Stanke, 2013).

During drought, people are forced to move in search of food, water and pasture, displacement that increases exposure to other elements including conflict. The elderly and the disabled may not be able to migrate and are, therefore, more at risk of starvation (Snyder, 2018; Barbelet, Samuels and Plank, 2018). Injuries and diseases arise from people to people and/or animals to people conflicts over water and pasture (Asaka, 2012). Injuries also arise from equipment failure in health facilities due to power outages stemming from low water levels in hydro-power generation plants. Such power rationing also affects health status and causes trauma when manufacturing plants are forced to shut down, leading to job losses, which lower the ability to pay for food, health services, rent, school fees and other related goods and services (Njoka et al., 2016). Moreover, government's resources are reallocated to address drought-related emergencies, lowering its ability to meet its obligations in key sectors, including health thus affecting the health status of the population (Baez, Fuente and Santos, 2009; Stanke et al., 2013).

Floods health effects

Floods may occur for a short period, for example during flush floods or for several weeks during which still flood waters spreads out, covering expansive areas. Related health effects have three phases - immediate, short-term and long-term (Asian Development Bank et al., 2013; WHO, 2014).

In the immediate phase, injuries are more pronounced. People drown/are washed away, get electrocuted when live wires get into contact with water as electric posts fall; get injured by falling trees or collapsed buildings/wall; suffer attacks from crocodiles, hippopotamus and snake bites among other perils. In some cases, flood water covers expansive areas for days, becoming dangerous to walk through and injuries are sustained from submerged rocks and stumps (Sun et al., 2016; WHO, 2014).

In the short-term, the health effects of flooding are felt over several weeks and months, and these include water, food, vectors, and air borne diseases. Stagnant flood waters become breeding grounds for vectors such as mosquitoes, flies, worms and parasites, while bacteria also proliferate, which causes water and vector borne diseases (Tapsell et al., 2002). People get exposed to hunger, communicable disease outbreaks, infections from injuries, and mental ill health emanating from trauma especially from immediate effects (Ahern et al., 2005; WHO, 2014).

The long term effects are those felt over years following a flood event. They include disability from injuries, prolonged mental ill-health and worsened chronic diseases (Du et al., 2010; WHO, 2014; Maclean, Popovici and French, 2016). Trauma and long-term mental disorder arise from loss or separation from parents for children, loss of source of livelihood and social status, loss of homes, properties and other assets including animals and loss of physical health for adults. The post-trauma stress disorder (PTSD) is often a long-term health impact that affects individuals and the community at large (Baez, Fuente and Santos, 2009; WHO, 2011). Tapsell et al. (2002) established that floods trigger mental disorder, showing an intricate correlation between related stress and mental health that presents in any of three forms: adjustment disorder, acute-stress disorder, and post-traumatic stress disorder (Tapsell et al., 2002). They also established that intensity and period of suffering vary by gender, financial status, age, whether one is a single parent, and extent of damage suffered by the victim.

Water borne diseases arise as drinking water is increasingly exposed to contamination from sewerage, chemicals, bacteria and worms, among other risks that cause a myriad of diseases and ill-health during floods (Sun et al., 2016; WHO, 2003; WHO, 2014; 2015; UNDP, n. d.). The water borne diseases include typhoid, amoeba, cholera, rotavirus, cryptosporidiosis, bilharzia, dysentery, among other

diarrhoeal diseases (WSP, 2014). Poor sanitation is a key contributory factor (WHO, 2014).

Vector-borne diseases related to floods arise mainly from mosquitoes, snails and rodents. They include malaria, dengue virus, yellow fever, bilharzia, among others. Rodents, when seeking refuge in houses during floods, also bring with them diseases such as plague (Okaka and Odhiambo, 2018; WHO, 2014; WHO, 2018). Airborne diseases include flu, pneumonia, asthma and other upper and lower respiratory diseases arising from cold air and mold. Some of these diseases spread during floods and can become an epidemic (Brown and Murry, 2013; Mirsaeidi et al., 2016). Food-borne diseases arise mostly from contamination with aflatoxins due to dampness and other toxins coming into contact with flood water. Hunger due to lack of food is also a food-related health issue. Food fields get submerged and crops damaged, leading to food shortages. Moreover, with collapse of some key infrastructure such as access routes (roads and bridges), the food chain is distorted, raising prices and exacerbating food shortage (UN, 2008).

Floods damage houses, displacing people, exposing them further and complicating the health effects. Furthermore, access to health services is delayed when health facilities are inundated and/or damaged, which worsens health conditions.

2.2 Prevention and Preparedness measures to Reduce Health risks of Droughts and Floods

2.2.1 Prevention

The measures that prevent the events of droughts and floods from proliferating and culminating into health emergencies entail moving away from crisis to risk management and collaborating with partners towards risk reduction to protect individuals and the society (Crossman, 2018). This involves, together with all stakeholders, moving away from impact definition, costly reduction of consequential effects through recovery actions and listing of lessons learnt to identification of risks associated with occurrence, appraising options of reducing these risks, making appropriate decisions and taking actions to manage the risks. Subsequently, monitoring signs of preliminary indicators of the events and documentation of how they evolve enhances planning in preparation for eventualities, and taking appropriate actions that prevent culmination of the event into health emergencies (UNESCO, 2016; CDC, 2018). Mainstreaming disaster risk reduction into all programmes, including school curriculum and all social economic activities can majorly promote prevention of related health effects (Sinisi, 2011; World Vision, 2012; Datar et al., 2012; Maclean, Popovici and French, 2016; Knutson, Hayes and Phillips, 1998). Preventive health-

specific actions require an analysis of the urgency, those at risk and degree of likely exposure to droughts and floods-related diseases, injuries and other health effects. Understanding the most applicable interventions, associated impact if no intervention and likely risks without such intervention is imperative (Stanke et al., 2013). The responsible organs develop clear communication strategies and plans, and systematically disseminate information with key messages to the stakeholders on the likelihood of drought or floods occurrence, what effects the occurrence could have on health, and how to prevent such effects. Such plans and strategies are needed way before the drought or flooding event occurs (UNISDR, 2009; CDC, 2018; Sena and Kifle, 2006).

Prevention for drought-related risks to health

The first stage towards prevention of health effects of drought is to reduce the likelihood of a drought occurrence through environmental conservation, which ensures adequate rainfall for regular precipitation, adequate food production and constant water supply (Sena and Kifle, 2006). This also guarantees adequate water in power generation plants for constant power supply to health facilities and manufacturing industries (Government of Kenya, 2010b). Subsequently, to prevent the health effects associated with limited water during drought, there is need to sensitize the population at risk on water treatment, sanitation and hygiene, including proper handwashing, food handling, washing and cooking (WSP, 2014; Government of Kenya, 2016b).

Prevention for floods related risks to health

In addition to preventing severe climate changes through environmental conservation, vaccination of the population at risk of contracting flood-related diseases such as malaria, yellow fever and typhoid, among others, is essential for prevention. Breiman et al. (2012) underscores the importance of vaccination in prevention of disease occurrence following a study on typhoid incidence among children under 10 years conducted in Nairobi (Kibera) and Western region (Lwak). The outcome of the study indicated that incidences of typhoid are higher in urban low-income settings (over 15 times more cases per 100,000 per year) due to congestion, inadequate water, poor sanitation and hygiene, especially during heavy rains. The study concluded that vaccinating the vulnerable against these diseases significantly reduces incidences (Breiman et al., 2012). The Angola yellow fever epidemic of 2015, which arose during the rainy season, had many victims, and the spread was contained with vaccination, though inadequate resources could not allow widespread and comprehensive coverage (ECDC and EU, 2016). However, Anders and Hay (2012) observed that vaccines for some diseases such as malaria and dengue fever fail to prevent infections because “the antigenic or

serotypic variability of the organisms" increases the disease resistance to various chemicals (Anders and Hay, 2012).

Surveillance and early warning prevent/minimize exposure to natural hazards such as floods and related health problems (UNISDR, 2012; Brown and Murray, 2013). According to Linthicum et al. (1999), Rift Valley fever epidemic in East Africa always follows heavy rains episode. This can be predicted five months to the event using Pacific and Indian Oceans temperatures, and satellite data. Such predictions can be used to make necessary arrangements for immunizations before an outbreak of the disease.

The most affected community members by health effects of floods are the very poor in low lying rural areas and low income urban neighbourhoods, with very limited resources to deal. Some migrate from rural to urban areas to escape the related effects, only to face similar problems at destination, especially since they often settle in the low-income neighbourhoods, many of which are on riparian and environmentally sensitive/fragile areas (Rain et al., 2011, IDMC, 2019).

Different parts of the country have some preventive coping mechanisms, and technology is also emerging that, if adopted, will help improve health through improved sanitation and hygiene (WSP, 2014). For example, increased use of culverts in Turkana has shown that areas with loose soils can sustain pit latrines from collapsing and reduce open defecation[2]. A new technology dubbed bio sanitation has also emerged and if widely adopted, the problem of collapsing pit latrines and contamination of groundwater can be eliminated[3].

In all cases, clean drinking water is essential to health and, as WHO (2011) and Fewster (2012) contends, dispersed populations that are difficult to reach can be provided with bottled water for drinking while those in groups can be provided with easily treated bulk shipments. Although provision of tap water reduces vulnerability and associated health risks of floods, water pipes can be broken during floods or contaminated as dirty floodwater seeps into pipes, especially when no water is running in them. However, water treatment in storage facilities, and water boiling at the household level can highly curb disease outbreaks (Ali et al., 2015; WHO, 2011; WHO, 2014). Facilitation with water treatment tablets alongside treated mosquito nets, readily accessible medical care inadequately stocked and manned primary health facilities can prevent water, air and vector-borne diseases during floods (The Mentor Initiative and USAID, 2016; Niekerk and Nemakonde, 2017).

2 https://practicalaction.org/blog/where-we-work/kenya/lessons-from-turkana-on-promoting-sanitation-in-kenyas-arid-and-semi-arid-areas./

3 http://www.coastweek.com/4013-Bio-sanitation-toilets-launched-in-Kenya-to-eliminate-pit-latrines.htm.

2.2.2 Preparedness to deal with health effects of droughts and floods

Preparedness enables control of the health risks before disease outbreaks get out of hand, thus preventing health emergency situations every time there is a severe weather change (Development Initiative - DI, 2017). According to Development Initiative - DI (2017), preparedness involves "*proper analysis of risks, early warning, contingency planning, standard operating procedures (SOPs), skills building and partnerships….*" (DI, 2017:10).

The Hyogo Framework for Action (UNISDR, 2009) and the Sendai Framework for Disaster Risk Reduction (2015-2030) (UNISDR, 2015) echoed the importance of putting in place reduction strategies for the health risk associated with disasters such as droughts and floods. This includes enhancing food security for robust populations during drought; augmented health facilities that offer primary healthcare, making them flood safe; shielding of critical facilities including power plants, schools, communication centres etc to ensure they are functional at all times; intensification of social safety nets and recovery schemes especially for the vulnerable community member (the elderly, disabled, very poor), who are often more exposed; and among other actions deepening financial risk sharing mechanisms including indemnity. The strategies and plans need to be cascaded down to the national and local level, achievements measured, disbursement on risk alleviation monitored, and participatory planning and implementation done using, where possible, local solutions such as community-built dams (UNISDR, 2009; 2015). This promotes preparedness and sustainability for long-term risk reduction and resilient communities to disasters such as droughts and floods.

Preparedness for drought-related health effects

When drought is imminent, besides the material stocks, early warning information to the communities likely to be affected is paramount and essential. This is information on what is expected and how to deal with it. If for example, a heatwave is expected during drought, warnings and advice on what to do will ensure people have cooling systems or stay under shade to prevent hyperthermia, while information on the likelihood of a fire breakout will ensure people learn how to fight it, how to escape and in which direction (UNISDR, 2012; CDC, 2018).

Adequate information about likely drought event allows for adequate preparedness with emergency sources of water and food stocks near the people, essentially prior to reaching extreme hunger, starvation and disease outbreak. Starvation and hunger are the primary effects of drought, coupled with diseases arising from poor hygiene and contamination due to water shortages. Having food supplements that allow life sustenance, vaccines against immunizable diseases that are likely to break out, stocking appropriate medical supplies, and having adequate human

resources for health near the point of need becomes a must in the face of a drought. (CDC, 2018; Sena and Kifle, 2006).

Preparedness for floods-related health effects

Early warning about the likelihood of a flood event and its nature is key for preparedness at all levels (UNISDR, 2012). In a study carried out in South Africa (Ngaka, 2012), it emerged that the usefulness of early warning depends on how it is delivered, its clarity, accuracy, timeliness, reliability and cost of getting it. According to WHO (2014), for every US$ 1 used in preparation for floods, US$ 4 is saved. By creating awareness of an impending flood, people are advised to shift to higher grounds with adequate dry foods and some camping materials to ensure they do not drown, get exposed to flood waters or rain, and if they are marooned, they do not starve (Benson, 2009; Niekerk and Nemakonde, 2017). Therefore, information, service providers, supplies such as medicines, clothing, beddings, dry foodstuff and equipment are required in appropriately placed standby centres before the floods (CDC, 2018). Damages to health facilities or access routes commonly occur during floods, and hence resilience enhancement and identification of alternatives before the event is key to prevent health-related emergencies, including putting on standby high alert emergency equipment providers such as the defense forces, the police and high-risk facilities with special equipment require (UNISDR, 2009; 2015; CDC, 2018).

2.3 Response and Recovery measures to Reduce Droughts and Floods Health effects

2.3.1 Response to health effects of droughts and floods

Response follows the occurrence of droughts and flood events. How a country responds on exposure to health problems associated with droughts and floods greatly determines how lives are saved and people's ability to meet basic needs and their well-being are enhanced (UNISDR, 2009; Lubchenco and Karl, 2012; Niekerk and Nemakonde, 2017). An early warning system of related health outbreaks is essential for response and is based on communication system in place, surveillance and clinical data from facilities, knowledge of vectors, laboratory tests and use of medicines. This helps in knowing what to attribute the outbreak to for an appropriate response. "Understanding attribution will help in developing the most effective and cost-effective strategies for health system response" (Frumkin et al., 2008: 5). Response depends on the nature of the event – whether it is droughts or floods and likely health effects. Response is effected through quick distribution of necessary supplies and disease treatment activities.

Response to health effects of droughts

Stanke et al. (2013) and WHO (2011) concur that when a drought occurs, response to health effects majorly include relief food and water distribution; emergency medical services; disease surveillance, control and treatment; and sanitation and hygiene programmes. This is coupled with regular monitoring of child malnutrition, wasting and stunting, provision of specialized treatment in the most accessible facilities and distribution of supplements especially for expectant and nursing mothers and under 5 children. This requires scoping and regular data collection. Distribution of food and water is essential to minimize immediate effects, while food vouchers and cash transfer are short- and medium-term measures for maintaining some level of health for the affected. Besides food and food supplements, agricultural extension services on producing fast growing and nutritious food plants is an essential response measure to curb malnutrition in the medium term.

Response to health effects of floods

Prior information about a flooding event and the speed at which it occurs informs on its likely catastrophic nature and how it can be responded to for the lowest possible impacts (Benson, 2009; UNISDR, 2009; Rogers and Tsirkunov, 2010). When likelihood of occurrence of a flood event is known before it happens, the likely onset and intensity, those at risk, resources needed and available effectiveness of response activities is enhanced. Alerts and warnings, mode of communicating such alerts and period between the warning alert and the event is crucial for response effectiveness.

The required resources include affordable temporally facilities such as camping grounds in high points; identification and use of public facilities such as schools located in high places, reservoirs for drinking water, chlorine for water treatment, food, fuel, medical supplies, and emergency kits with blankets, some kitchen tools and sanitary products (WHO, 2003; Ali, Ali and Fesselet, 2015; The Mentor Initiative and USAID, 2016; Snyder, 2018). For effective response, disease surveillance is essential, which requires a competent team and appropriate equipment. Also necessary is training on water rescue and resuscitation from drowning. An accessible well-functioning facility and a preventive health component, through which community members are trained on first aid and how to treat minor diseases associated with floods, hygienic practices and counselling are crucial (UNISDR, 2009).

2.3.2 Recovery measures to droughts and floods health effects

Floods and droughts after-effects are wide ranging. Among the effects of floods and droughts are post-traumatic stress disorder (PTSD), displacement, exposure/shelter-lessness, a host of disease outbreaks, malnutrition, intestinal and skin infections, among others. The ability of the affected to recover from these effects and restore to the pre-event status or better depends substantially on the severity of the experience and social network connectivity of the affected and partnerships between actors in the sector and government assistance (Walker-Springett, Butler and Adger, 2017; Maclean, Popovici and French, 2016; UNISDR, 2009). Recovery workers get overwhelmed and/or traumatized when dealing with dead bodies, some of people they knew, and may themselves require treatment and/or rehabilitation (PAHO/WHO, 2004).

Post-disaster surveillance of diseases becomes critical to prevent epidemics. Resources are required to assist the affected regain some degree of functionality and normalcy. The level of preparedness before the event has a significant bearing on the recovery phase, especially where health is concerned (Sena and Kifle, 2006).

Recovery measure to droughts related health effects

The effects of drought can be so severe that livelihood is destroyed, and family members die. Whether the livelihood is agriculture or livestock-based, the losers are sometimes so traumatized leading to PTSD and mental ill health that may be lifelong (Sena and Kifle, 2006). Given that drought leads to malnutrition, with stunted and wasted children, emaciated pregnant and lactating mothers, and the elderly, provision of nutritional foods and supplements is a fundamental part of the recovery process. This also involves provision of seeds for nutritious and fast-growing crops in addition to extension services for best outcome, and social protection safety nets. Recovery also involves restocking for livestock farmers/pastoralists given that most of their animals either die in the drought or are sold for slaughter, and in some cases they are bought by the government, slaughtered and distributed as food (Longley and Wekesa, 2008).

Recovery measures to health effects of floods

Recovery from floods involves rebuilding houses damaged by floodwaters and replacing most of the furniture and other household items destroyed in the floods. The inundated items are a health risk since the dampness and in some cases chemical contamination cause respiratory infections. Disease outbreaks are often most severe in the recovery stage, especially after a flooding event. In some cases, people are rendered homeless, a period during which they are exposed to

elements of the weather and insecurity that compromises their health (Sena and Kifle, 2006). Public infrastructure becomes overstretched while recovery services, materials and resources become difficult to provide in affected areas, including locations to which people are displaced during floods. Where health facilities are damaged by floods, recovery is more difficult since it involves both reconstruction of the facilities and treatment of the sick in temporary structures (Arrow and Peto, 2005; WHO, 2014; Snyder, 2018).

Recovery from some diseases that proliferate more during floods is a major challenge. For example, typhoid is one of the most common diseases during floods, yet, H58, a strain of typhoid resistant to first and second line of antibiotics makes the disease more difficult to treat. Stronger and more expensive antibiotics must be used to treat this typhi strain. When not well treated, typhoid can cause sepsis in the patient's intestines, becoming life-threatening to the patient whose intestines become perforated and are often cut off. This strain was first observed in Pakistan, and resistance arises from bacterial DNA mutation of the typhi bacteria (Kariuki et al., 2010). Kenya comes second in prevalence of H58 typhi strain at 92 per cent with Cambodia leading (97%). Iraq follows at 91 per cent, Vietnam (84%), Thailand (75%), India (72%) and Pakistan (52%) (Dewan et al., 2013). Other African countries with high prevalence are Malawi (70%) and Tanzania (65%)[4]. Very strong and often more expensive antibiotics must be in stock during recovery from floods to treat this strain, among other diseases.

Flood victims have a significantly higher chance of experiencing post-traumatic stress disorder (PTSD). This mental health effect is associated with materials and financial losses and physical threat to lives (Sana and Khattak, 2014; Fontalba-Navas et al., 2017). Studies by Saulnier et al. (2017) and Saulnier et al. (2018) revealed that inside 4 weeks following floods, those affected experience poisoning, wounds, intestinal and skin infections and worsening cases of chronic illnesses such as diabetes. They recommended that post-event activities should be geared towards resolving these diseases, infections and PTSD.

2.4 Coordination Mechanisms When Dealing with Health Effects of Droughts and Floods

Sectoral coordination mechanisms are necessary. The health component of the mechanisms requires all relevant players, with the leader representing and reporting for all players to the wider mechanism (Benson, 2009). This is by providing any required technical inputs on health while maximizing on the

4 http://www.stoptyphoid.org/explore-the-data/explore-h58./

integration of effort and collaborative operations. The mechanism should cut across preventive, preparedness, response and recovery stages of a disaster, particularly of droughts or floods.

Flood disaster players include international agencies (UN), government agencies (police, military, government officers including health worker, teachers etc), private sector, civil society and community groups. Involvement of the local community ensures information flow and ownership of the responsibilities (IFRC and Red Cross, 2000; HPG and OCHA, 2012) through formation of committees as part of the mechanism to plan resource management and a conflict resolution mechanism (Sharifi, 2013).

An efficient and effective coordination mechanism must encompass prevention and preparation for disasters such as landslides, large storms and dam breaks, all of which cause heavy flood waves (UNHabitat, 2014; Beerens, 2007). Most collapsed building and dwellings in both urban and rural areas are often attributed to weak foundations on unstable grounds, poor building materials that cannot withstand storm waters and flooding. The efficiency of a coordination mechanism can only be guaranteed if relevant actors and all arms of government entrusted with various responsibilities are members of the coordination committees at various levels. The European Union has an outstanding and elaborate disaster coordination mechanism (Beerens, 2007) that Kenya and the region could emulate.

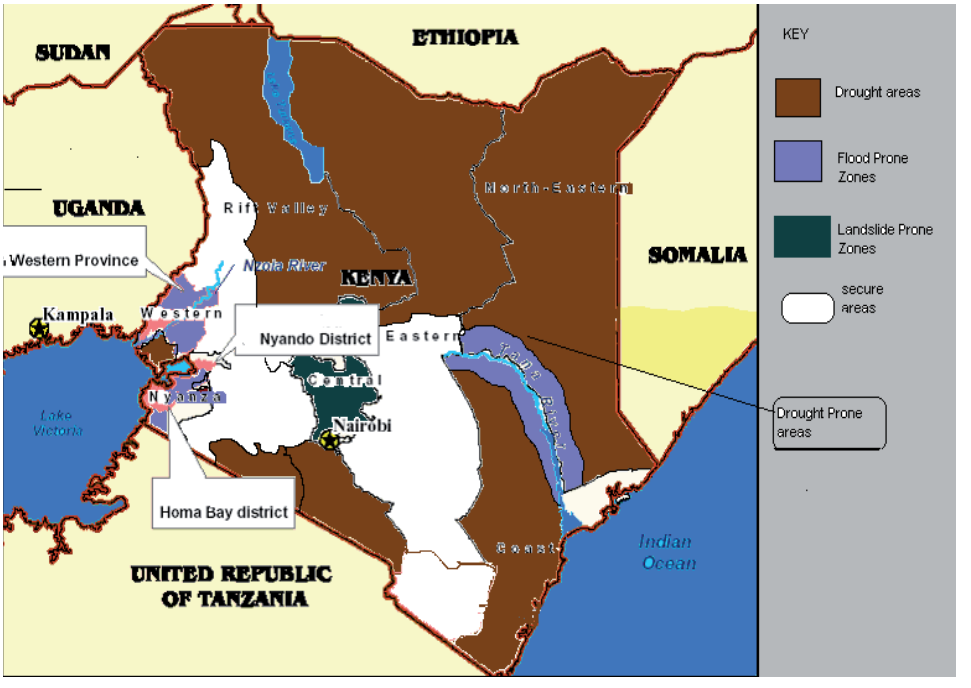
3. Methodology

This study highlights health risks and effects emanating from droughts and floods. The key focus is outbreaks and prevalence of diseases that occur during droughts and floods, which are mainly water, food, vector and air borne and how they affect individuals and communities. We then looked at the measures of reducing the risks of getting the diseases through prevention or reduce the health effects through preparedness, response, recovery and coordination mechanisms. We also looked at the national policies and international frameworks of action to deal with these calamities and action gaps that give way to continued disease outbreaks and health emergencies from droughts and floods. Recommendations are then made on how to close these gaps to reduce health risks and emergencies emanating from droughts and floods.

3.1 Scope

Significant parts of Kenya's ASALs have been experiencing droughts and floods with increased frequency and serious ramifications on health. Droughts are occurring nearly every year in these areas, often followed by floods. Some areas,

Figure 3.1: Areas of Kenya prone to droughts, floods and landslides



Source: UNDP (nd)

especially those in the downstream of major rivers (Tana, Sabaki, Nyando, Yala, Nzoia), experience serious floods. Figure 3.1 shows the areas of Kenya prone to droughts, floods and landslides. These are the main areas of focus in this study. North Western Kenya and especially West Pokot on the slopes of Mt Elgon has become a hotspot for landslides.

The counties selected for coverage are listed in Annex Table 1. Initially 28 droughts and floods-prone counties were selected for the study, which includes all the counties in the brown and blue areas in Figure 3.1. However, Wajir County could not be covered due to insecurity at the time of this study fieldwork, reducing counties covered to twenty-seven (27).

3.2 Study Design

A primary study was conducted in the 27 drought and flood-prone counties. Data was collected using a structured questionnaire for households and key informant interview guides for key players in the health and related sectors in the counties. These were National and County government officers, international development agencies, NGOs, CBOs and private companies.

Both qualitative and quantitative research methods were used for this study. Data from households was collected and analyzed using quantitative method while qualitative method was used in key informant interviews (KIIs). The household survey majorly sought data on the health problems community members in the affected areas suffer during incidences of droughts and floods, while the KII information sought out the measures taken to prevent, prepare for and respond to these health effects and recovery measures taken. Secondary information from other related studies and databases complemented the study data, especially to show trends of the reported diseases by regions and counties and how they relate to droughts and floods events.

3.3 Sample and Data Sources

The KIPPRA droughts and floods survey 2018 was conducted on a sample comprising 1,370 households made up of 2,259 members and spread across 27 counties. The clusters and the households were selected with the assistance of Kenya National Bureau of Statistics using their sample frame. Households were asked questions regarding illnesses experienced during droughts and floods, how they affect school and work, and sources and cost of treatment. Key informant interviews were conducted on measures taken to reduce the health risks and effects of droughts and floods. Information was gathered from the county and

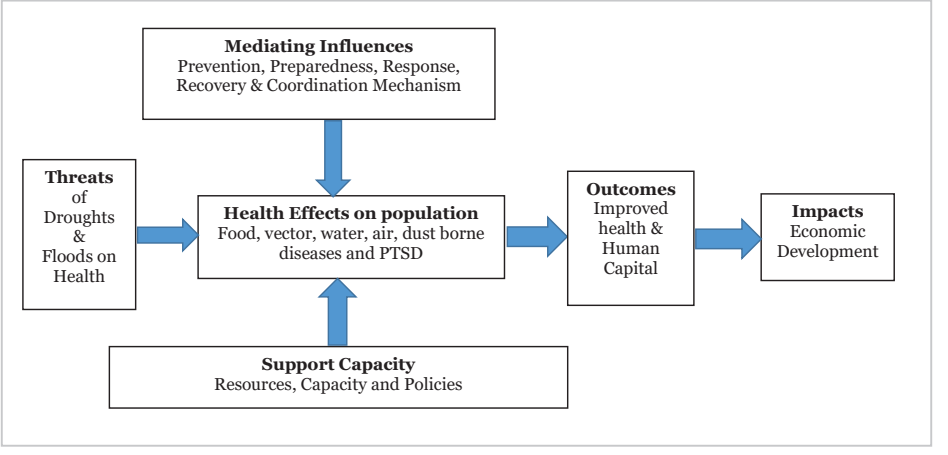
national government officials at the county, such as County commissioners, directors of public health, environment, public works, education, water and sanitation, hospital managers, government agencies such as NDMA; stakeholders in the related sectors such as non-governmental organizations (NGOs), including the Red Cross, St Johns Ambulance, World Vision; Oxfam, ActionAid, Care Kenya, Plan International, among others, and private companies such as private hospitals, insurance companies, banks and other key players on health risks and effects of droughts and floods and the role they play in reducing them. The survey was conducted in February and March 2018. To strengthen the findings, key reference was made to other data to see distribution and trends of morbidity across the country relative to occurrence of drought and flood events. The main secondary source of data was KNBS publications such as Statistical Abstracts, Kenya Demographic and Health Surveys (KDHS) and Kenya Integrated Household Budget Survey (KIHBS). Recommendations were based on outcomes of the study and the secondary data analysis.

3.4 Conceptual Framework

The conceptual framework (Figure 3.2) shows the threats of exposure to droughts and floods and the nature of likely health effects associated with the occurrence of these events. It then shows the mediating actions and support capacity that influence the outcomes on health and likely impacts on the economy.

The conceptualization borrows and builds on Tapsell et al. (2000) theoretical framework depicted in Figure 3.2. The theory is expounded to show the health

Figure 3.2: Conceptual framework



Source: Author's conceptualization, building on Tapsell et al. (2002) theory

risks of exposure to droughts and floods, health effects from occurrence of the events, actions required to reduce these risks and effects on health, the support provided by actor at all levels (before, during and after the event), the outcomes of the mediating actions, and the support and the likely impact on the economy.

The threats of droughts and floods are seen to fall on a significant part of the country as shown in the map of Kenya given in Figure 3.1, and consequently the health of the people. Mediating influences are actions required to thwart the threats or risks and reduce the impact of the events on health. These include prevention, preparedness, response, recovery and coordination mechanisms. Preventive measures are made before the event affects the health of the population, and this is done at two levels: preventing the occurrence/severity of the event through environmental interventions, and preventing the health effects through hygiene practices and vaccinations. Then there is preparedness for the events and for the health effects, which ensures that people are not caught off-guard. Response to the droughts and floods events is needed when the event has taken place and has affected people's health, and basically specifies how these health effects are handled. Recovery from the events and the health effects details how the affected population is helped to go back to the pre-event status or better, while the coordination mechanisms focus on how all these actions are conducted and the guiding frameworks for efficiency and effectiveness.

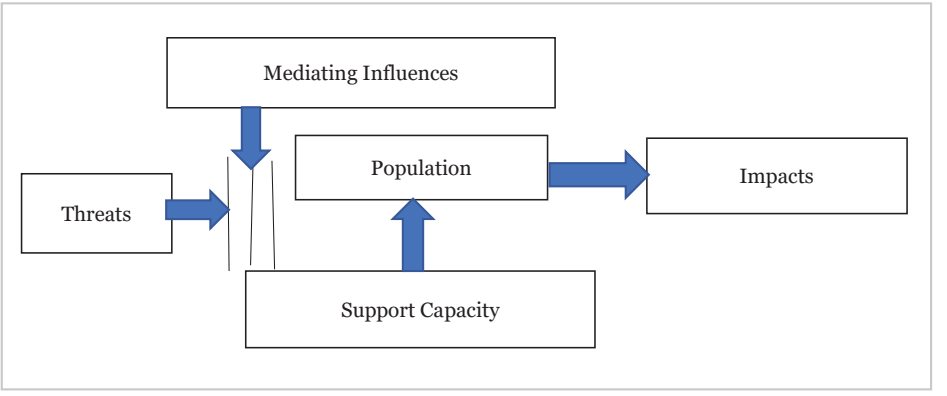
The support capacity determines how the actions listed above are implemented and how health risks and effects are reduced. The support system includes actors that take mediating actions and how they do so. In addition to national and county governments, the actors cut across development partners, UN agencies and civil society, the private sector and the community. The resources include what is required to take these actions and how they are put together. The actors are involved in support actions before the event (prevention and preparedness), during the event (response) and after the event (recovery), to help reduce the health risks, alleviate their severity of the health effects and recover from them. Their activities and resource management must be well coordinated to yield expected outcomes and impacts. There must therefore be some frameworks, principles and policies to guide the process.

3.5 Theoretical Frameworks

A model by Tapsell et al. (2002) is depicted in Figure 3.3. It shows flood impacts as net effects of threats, mediating factors and support capacity in households, communities and nation. This follows the argument that resilience to floods promotes and strengthens populations' ability to recover from related threats, while also reducing the severity of related impacts. This process highly depends on the

support systems and mediating influences and interventions. Essentially, this adds up to the monetary support and actions, including soft needs such as counselling due to mental trauma.

Figure 3.3: Threats (flooding and drought), impacts and moderating influences



Source: Tapsell et al. (2002)

This theory is in line with arguments by Phillip and Rayhan (2004), OECD and WHO (2003) and CDC (2018) who contend that vulnerability to poor health increases with poverty, level of exposure to hazards of natural events such as droughts and floods conflicts and other calamities. The process of dealing with the effects of these hazards is crucial, since exposure increases from likelihood of the hazard to when the event occurs. The associated risks are reduced through appropriate preventive, preparedness, response and recovery measures and coordination of all the actions and actors for efficient and effective outcomes and impacts. The risk reduction happens through early warning systems, resourcing and placing inputs, and preparing systems that facilitate adequate and effective response to help the affected. Ebi and Bowen (2016) concur that climate change outcomes such as droughts and floods expose the communities at risk to related health hazards in the immediate, short- and long-term period. Wu et al. (2015) looks at the totality of climate change impact on health, how temperatures, rainfall, dry weather among other climate change outcomes get pathogens transmitted to a host, leading to vector, water, food and air borne diseases, and adaptation mechanisms that help circumvent the likely effects on society. The conceptual framework in Figure 3.2 expands this theory to analyze in detail how the events unfold in the prone counties of Kenya, the health risks posed by the events, health effects following the events, activities and actors. The study seeks to propose what should be done differently to reduce the risks and adverse health effects that droughts and floods continue to have in the prone areas and the country at large.

All this requires a thorough assessment and understanding of the hazards, likely effects and severity, people affected and where they are, what actions are needed to thwart the risks and reduce the effects of droughts and floods on health, who should take these actions, what materials are required, how they can be obtained and placed, and the ultimate outcomes and impact. This starts at the macro level of action involved with policy formulation, informed by the international frameworks of action and treaties. This is followed by policy implementation at the meso level, which involves the health players at the national and county level and the entire health system from community units, dispensaries and health centres to the national referral facilities. The micro level cuts across with involvement of individual units that comprise the community, civil society, development partners, conservationists, etc who are involved right from preventive, preparedness, response and recovery level and systematically coordinated.

3.6 Limitations

The KIPPRA droughts and floods survey 2018 was to be conducted on a sample comprising 1,500 households contained in 150 clusters across 28 counties, with 10 households in each cluster. However, Wajir County was not covered due to insecurity, and some clusters including a one-building urban cluster in Kilifi were non-responsive.

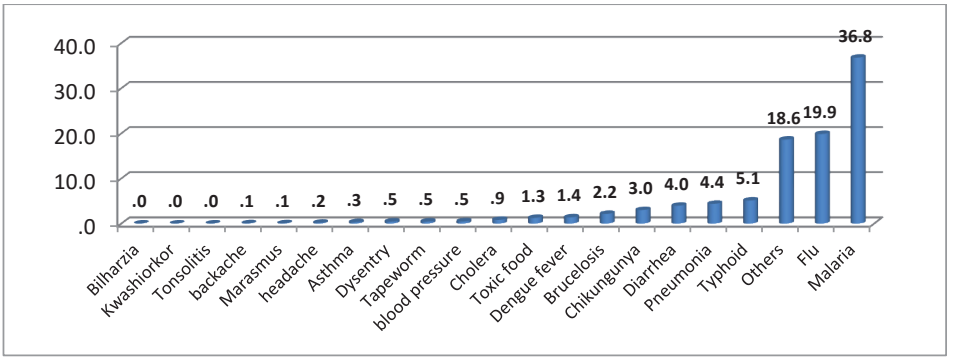
A significant amount of secondary data used in this paper was extracted from the Statistical Abstracts 2004-2017. It is important to note an anomaly in some of these publications. The morbidity data for 2011 contained in the 2013 Statistical Abstract pages 222/223 (Annex Table 4) has two tables – Out-patient Morbidity Statistics for those aged over five years, and similar data for under 5-years. The two tables bear identical data and one must be erroneous. As a result, charts analyzing trends of disease prevalence depict a sharp increase in most weather-related diseases for 2011. It is not possible to tell whether the spikes could have been higher or lower with correct data. Additionally, the 2012 and 2013 data on outpatient morbidity in the 2013 and 2014 Statistical abstracts is identical and hence the charts show no change between the two periods. KNBS attention has been called to the errors for any possible/appropriate adjustments in future editions.

Although these trends were based on absolute numbers, the assumption made in the analysis was that the population was growing at a similar rate across the regions, and hence the relative regional differences in disease incidents were not due to population growth variations but rather weather conditions.

4. Droughts and Floods Health Risks

The analysis and discussions in this chapter detail health risks posed by droughts and floods and the effects following these events. These are based on household and key informant interview (KII) responses obtained during the 2018 KIPPRA droughts and floods study, secondary data and information from the Kenya National Bureau of Statistics (KNBS), and other sources. During the survey, information was sought from households on the diseases suffered during and following the most recent drought or floods. The results are shown in Figure 4.1, which has the most reported diseases by percentage of those that were taken ill against the diseases suffered. Malaria, flu, typhoid, pneumonia, diarrhoea, chikungunya, brucellosis, dengue fever and cholera took up 78 per cent of the cases reported, with malaria having the highest prevalence at nearly 37 per cent. The 'others' category included many diseases not listed during the survey, such as leptospirosis, salmonellosis, conjunctivitis, meningitis and enteric viruses, among others.

Figure 4.1: Diseases afflicting people during drought and floods (% of people)



Source: KIPPRA (2018) Droughts and Floods Survey

These health effects are analyzed into water, food, vector and air borne diseases, with diseases associated with dust and mold falling under air borne. This categorization is shown in Box 4.1, which also shows whether the disease is related to drought and/or not. Some diseases are not clear cut in this classification; for example diarrhoea, which can be water- or food-borne during both droughts and floods. Furthermore, some diseases such as cholera, typhoid, rotavirus, hantavirus, among others, present themselves with diarrhoea.

Box 4.1: Diseases reported during the study

Category	Disease	Drought	Flood
Water Borne	Diarrhoea	X	X
	Typhoid		X
	Amoeba		X
	Cholera	X	X
	Rotavirus	X	X
	Cryptosporidiosis	X	X
	Bilharzia		X
	Dysentery	X	X
	Intestinal worms	X	X
Vector Borne	Malaria		X
	Dengue		X
	Yellow		X
	Chikungunya	X	X
Food Borne/ Shortage	Toxicity e.g. Aflatoxin; chemical contamination	X	X
	Diarrhoea	X	X
	Kwashiorkor	X	
	Marasmus	X	
	Starvation, under-nutrition, malnutrition	X	
Air (dust, dirt, mold)	Viral and bacterial pneumonia	X	X
	Meningitis		X
	Measles		X
	Flu	X	X
	Asthma	X	X
	Bronchitis	X	X
	Eye – trachoma, conjunctivitis	X	
	Jiggers	X	
	Skin - scabies	X	
Temperatures	Hyperthermia	X	
	Hypothermia		X
Trauma	PTSD (Mental illness and worsening of chronic diseases)	X	X

4.1 Drought effects on Health

The survey was conducted when most parts of Kenya were emerging from a harsh drought experienced in 2017. Households had experienced loss of crops to the harsh weather, subjecting them to extreme hunger, under-nutrition and malnutrition. The survey revealed that drought affected health through waterborne, airborne, vector borne, and food borne diseases, malnutrition and mental distress. Airborne diseases reported included mostly flu, pneumonia, asthma, and bronchitis, which arose when dust is brown by high winds, loading the air with bacteria and parasites. Vector borne diseases included malaria, dengue fever, yellow fever, trypanosomiasis and jigger infestation, among others. Jiggers and other flea-related diseases proliferate because most houses in the areas visited had dirt floors. With little water to pour during drought, the loose dirt shelters the fleas, thus increasing infestation.

The drought-related water borne diseases reported during the survey included diarrhoea, cholera, typhoid, dysentery, hookworms, trachoma, skin infections and other intestinal worms. These were mostly due to water contamination and those that spread through faecal-oral process due to poor hygiene and poor or no hand washing. Water contamination, it was noted, occurred due to shared sources, with domestic and wild animals in the ASALs. Concentration of pathogens becomes lethal with diminishing water levels in water pans, pools and other open sources. In urban areas, sewerage and chemical contamination increases during drought as pipes become dry, creating a vacuum for sewerage and wastewater to seep in. When stagnant water is shared with animals, especially during drought, it is in most cases infested with bilharzia, E-coli and other pathogens and bacteria. In cases where industrial chemicals are drained into public water sources, chemical concentration worsens with drought, which increases the harmfulness to of such water to health.

Food borne diseases reported included diarrhoea and toxicity, which arise from poor handling, washing and storage under the hot drought environment. Food contamination occurred as cooked and uncooked foods are put together, undercooking due to lack of cooking fuel and consumption of toxic wild fruits and leaves due to biting hunger and starvation. Malnutrition diseases are classified under food borne since they occur due to lack of food. Diseases reported during the survey included kwashiorkor, marasmus and starvation. The ASAL counties experience high malnutrition especially among children and the elderly due to food shortage. Parts of Kilifi, Kwale, Turkana, Baringo, West Pokot and Mandera counties get seriously exposed. Food production in most of these areas is negligible. The communities depend mainly on animal products (blood and milk) for food. They get exposed to hunger and starvation when animals die due to the harsh drought or when they migrate in search of water and pasture.

As an indication of the seriousness of hunger during drought in Kenya, the malnutrition situation in early 2018 compared to mid-2017 is shown in Table 4.1. Take note of the improvement by February 2018 in the various indicators of malnutrition due to increased food access and integrated interventions among other emergency responses following the 2017 drought.

Table 4.1: Estimated caseloads of acute malnutrition - children, pregnant/lactating women: July 2017 and February 2018

	Area	GAM 6 to 59 months	SAM 6 to 59 months	MAM U5 6 to 59 months	PLWs
1	ASAL	337,290	54,860	282,430	34,140
2	Urban	62,530	16,700	45,830	3,020
3	Total caseload February 2018 (1+2)	399,820	71,560	328,260	37,160
4	Total caseload for July 2017	420,674	83,110	337,564	39,068
5	% improvement {(4-3)/4*100}	5	13.9	2.8	5.1

GAM- Global Acute Malnutrition is sum of MAM - Moderate Acute Malnutrition and SAM- Severe Acute Malnutrition; PLW- Pregnant and Lactating Women

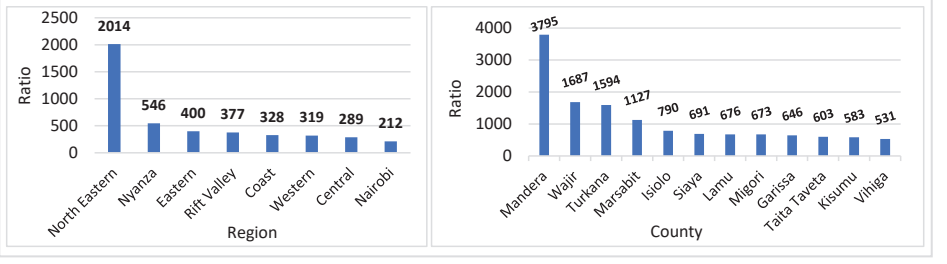
Source: Government of Kenya (2018), Kenya Food and Nutrition Security Seasonal Assessments, February 2018

Drought combined with poverty and retrogressive cultural and religious practices worsen the health situation of the people. Some cultures and doctrines discipline people to behave in a certain way or adapt certain practices that are detrimental to health. For example, in parts of Kilifi, it emerged that the people do not clear the plate of all food. With less than enough to eat during drought and in the face of hunger, this leads to undernutrition. Additionally, women are supposed to minimize the amount of salt consumed, as salt supposedly affects how their spouses like them. In Kitui County, members of kavonokia religious group do not seek health services but pray for healing. Some drought-related disease outbreaks such as measles and cholera spread quickly, killing the infected unnecessarily for not seeking medical attention fast. They also expose others to the risk of infection. In some other cases, tissue paper or its equivalent cannot be used after visiting the toilet. Instead, water is used to clean off fecal matter. In the face of water shortages, fecal matter is not entirely cleansed from the hands, yet these hands are used to prepare food and/or share from a common platter. Consequently, typhoid, cholera and such diseases transmitted through the fecal-oral process spread easily. Additional indirect effects of drought were also noted. For example, girls are forced into child/early marriages and/or pregnancies in the face of

poverty associated with drought, which compromises their health status as they birth young, with some developing fistula. Some women develop low esteem and depression since they do not have adequate water to clean themselves up when they have menses during drought.

Although some mothers in the ASALs get nutritional supplements during prenatal and post-natal clinics to help with foetus development, milk production and maternal health, it was noted that they are unable to take the entire food supplement. Instead, they are forced by circumstances to share with the family in the face of hunger during drought. Consequently, they do not get adequate concentrates, which affects their health and that of the unborn or nursing child. Since the supplements are designed to enhance resistance to diseases, this is not achieved. Both mother and unborn or nursing child become exposed and susceptible to malnutrition, stunting, wasting and opportunistic illnesses. Moreover, mothers weakened by hunger face greater difficulties during delivery, which substantially explains the high maternal morbidity and mortality in the ASALs. An example is depicted in Figure 4.2, which shows highest maternal mortality rate (MMR) in ASAL counties, with 2,014 deaths per 100,000 live births for North Eastern region, exceeding by nearly four-fold the second highest region of Nyanza and nearly 10 times the rate of Nairobi region, which had the lowest MMR. From a sample of ASAL counties, Mandera County had the highest rate followed by Wajir. Turkana takes the third place followed by Marsabit and Isiolo.

Figure 4.2: Regional and counties maternal deaths per 100,000 births



Source: National Council for Population and Development - NCPD (2015)

4.2 Floods Effects on Health

The survey affirmed that when it floods, people's health is negatively impacted. Some people drown or get injured/trapped/marooned, crops are destroyed, and animals are swept away, leading to hunger and ill health. Houses are destroyed or inundated, subjecting occupants to respiratory diseases from exposure to cold air and dampness, among other effects. Excess rainwater forms pools and enhances

vegetation growth, both of which are ideal breeding grounds for mosquitoes. The vectors thrive and with them vector-borne diseases. In some places, floodwater seeps into septic tanks filling them up. Waste oozes out into houses especially in low income urban neighbourhoods, posing a great health risk. In areas that commonly use water wells, the contaminated floodwaters communicate with the wells, loading them with bacteria. Rodents, snakes and even crocodiles are forced out of their usual habitat into dwellings and/or farms, exposing people to lethal bites and rodent borne diseases.

Floods are therefore associated with increased vector, air, water and rodent borne diseases. Vector borne diseases associated with flooding include malaria, dengue fever, yellow fever and Chikungunya, among others. These are mostly experienced during and after rainy season when the conditions are ideal for the vector proliferation and particularly still waters, overgrown vegetation and some warmth. In Rift Valley, an outbreak of Rift Valley Fever was reported in 2018. It affects animals but spreads to humans on contact with the animal fluids. Waterborne diseases linked to floods include cholera, E-coli, bilharzia, typhoid and diarrhoea, among others. Airborne diseases include flu, pneumonia, meningitis and measles, among other respiratory diseases. The cold and damp flood caused conditions also trigger chronic diseases attacks such as asthma.

Box 4.2: Chikungunya in Mombasa County

Chikungunya is a viral disease that presents itself with high fever, headache and debilitating joint aches and pains that sometimes renders the victim helpless and unable to stand without support. These symptoms are like those of malaria and dengue fever. The first outbreak of the disease was encountered in Mombasa in1982, then again in 2004/2005, 2017 and 2018. The disease is prevalent/endemic in South America and Asia. It thrives in humid high temperatures and wet areas and has no treatment other than rest, painkillers and plenty of fluids. While anopheles is the malaria causing mosquito, Aedes eagypti mosquito causes Chikungunya ands yellow, dengue and zika fevers. It has black and white spots, stays close to humans and bites during the day. It only breeds in clean water in such places as in water storage tanks and other water collection containers/receptacles. The eggs are attached on the sides of containers and have a 7day cycle. It is very difficult to eliminate the virus given it is carried in adult mosquito and in the egg such that, besides being transmitted through mosquito biting someone with the disease, some mosquitoes are hatched with the virus. To reduce multiplication of the mosquito, water tanks should be covered always to prevent adults from laying eggs in the tanks. To reduce the mosquito population, critical action needed is larvae siding, which is spraying the chemical that forms a thin layer on the water surface to ensure no air reaches the larvae, thus killing them. Spraying houses and vegetation follows to kill adult mosquitoes. Community health volunteers go door to door in Mombasa County educating people about Chikungunya disease and how it propagates, spraying and giving information, education and communication (IEC) posters/brochures /pamphlets, which have been developed on Chikungunya. In 2018 January to late February, 6 sub-county teams visited all parts of Mombasa County, giving information, coupled with extensive fogging exercise using the five fogging machines the county owns. The Chikungunya problem was suppressed, with hospitals confirming there were no new cases by March 2018 following daily surveillance. The disease last 2-7 days in the affected persons but few cases of long-term effects (3 -12 months of joint pains especially for older victims) are reported. Chikungunya cases have also been reported in Lamu and Murang'a, but this experience in Mombasa County was the worst in the country yet. Majority of those affected are in schools/workplaces.

During the floods that occurred from December 2017, outbreaks of diseases such as cholera, typhoid, chikungunya and malaria were widespread. Cholera cases were reported in various parts of the country including Garissa, Isiolo, Kiambu, Meru, Murang'a, Nairobi, Turkana, and West Pokot. Open defecation is widespread in many of these counties, a key link between poor sanitation and health effects of floods. Some counties have sandy soils that easily allow pit latrines to communicate with water wells. When it floods, waste from the pit latrines seeps through the sandy soil or rise above the ground and flows into wells, mixing with drinking water and becoming a major cause of flood-related disease outbreaks. Also reported were disease outbreaks, including urinary tract infections (UTI) and diarrhoeal diseases due to poor sanitation in many counties. Mombasa County reported a serious outbreak of Chikungunya (Box 4.2) which, it emerged, has no treatment and hence patients are prescribed painkillers, plenty of fluids and rest.

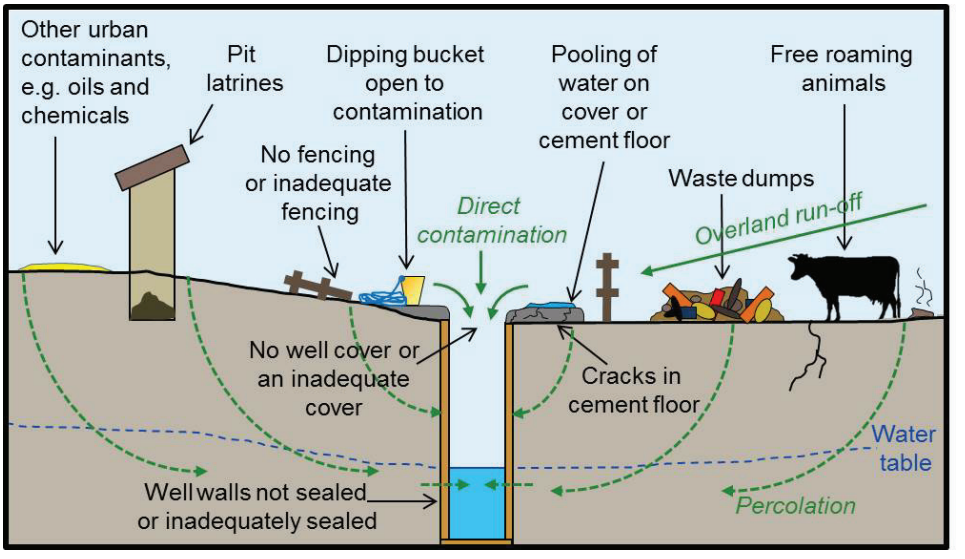
Besides diseases, flooding also leads to injuries and drowning. Injuries are obtained while walking in floodwaters and from car accidents on slippery/flooded roads. In addition to survey findings, media houses also reported serious cases of flooding, with vehicles swept away in flooded waterways in areas such as Suswa, Homa Bay, Makueni and Nyandarua and other places during the floods experienced in the first half of 2018. Houses collapsed on people killing and maiming, and landslides swept away homes and farms. Dams and rivers broke their banks sweeping everything downstream including people, animals and crops, houses and infrastructure including roads and schools. Whenever such an incident occurs, health is affected, and life is threatened or lost. Cases of deaths and injuries were reported in Magarini, Kilifi County due to flooding along the Sabaki River, in Tana River delta after Tana River broke its banks, Nyando in Kisumu County as Nyando River broke its banks, in Alego, Migori county as Sondu River broke its banks, in Budarangi after river Nzoia broke its banks, Siaya County after River Yala broke its banks and Narok town when it suffered flush floods.

Residents of Tana River County and Kilifi County and especially along the Tana River and Sabaki River deltas reported respiratory problems and water-borne diseases and skin infections following floods. Low-income urban neighbourhoods are prone to floods. In the coastal city of Mombasa, it emerged that neighbourhoods including Kalahari, Bangladesh, Kibarani, Mworoto, Magongo (Changamwe), Kisauni, Bombolulu and Magarini get flooded, with the water staying stagnant for long. The warm weather and stagnant water creates perfect mosquito breeding grounds, making these zones the worst hit by malaria. Most of the people living in these places use water from wells, which communicate with flood waters, leading to increased cholera and diarrhoeal diseases in the county when it floods.

Besides Mombasa, a serious cause of diseases during floods in the coastal region, Kisumu and Wajir emanates from contaminated water. Water wells and pit latrines communicate mostly because the water table is very high and flood water just sits on the relatively flat grounds. Domestic water samples in these places are regularly positive for E-Coli, becoming a major cause of diarrhoeal and other water-borne diseases. There is concurrence on this in various studies carried out along the coast (Tole, 1997; Mwaguni, 2002). Septic tanks and composting toilets are recommended (Maoulidi, 2010) as part of improved water and sanitation programmes.

Closely associated with the spread of diseases during floods is open defecation and poor protection of water wells. According to public health officers in some of the counties in focus, pit latrines are highly unsustainable since they often collapse given the sandy soils that become waterlogged, caving-in during floods. This discourages building pit latrines, leading to open defecation that increases the risk of diseases. Kwale County provides a good example with widespread open defecation because households fear spending money on pit latrines in fear they will cave in during floods. Figure 4.3 depicts water wells contamination scenario.

Figure 4.3: contaminants of water wells - Communication with pit latrines and other waste



Source: https://sticsdotorg.files.wordpress.com/2015/07/concmod.jpg

According to the Kwale County public health officer, efforts have been made to build public toilets in the county, but many people avoid using them in preference for the bush. Eventually, the excreta is swept into water wells during floods, yet water treatment is not as widely and effectively done. With the support of the public health

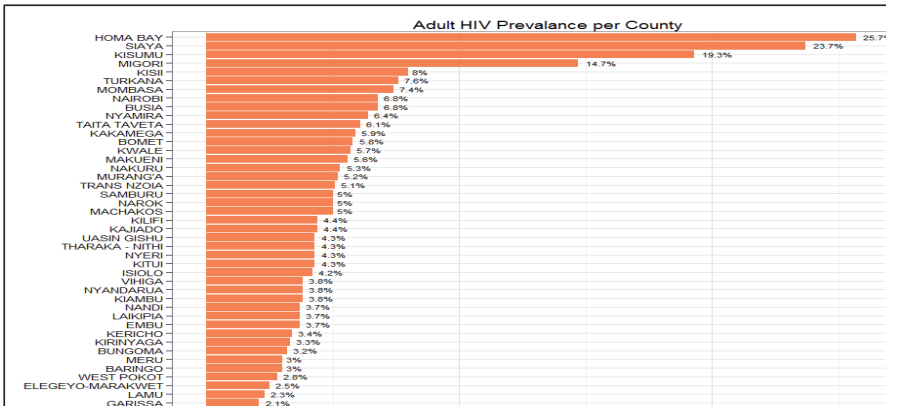
department, community health volunteers and village elders in the county sensitize people to use latrines and not to drink untreated water. Chlorine is distributed to treat drinking water in the most affected areas and households are also given up to three 20 litre water cans per week for drinking during the serious flooding season. Despite the difficulty of sustaining this, the County has a record 8 years without cholera outbreaks (since 2010) and any cases experienced were imported from other areas, including Mombasa and Tanga region (northern coast of Tanzania).

4.3 Other Related Health Risks and secondary Effects

4.3.1 Risky coping strategies

In some counties, women from drought-stricken ASAL counties move to towns to work and earn an income to support their families as a drought coping mechanism. Some work as house helps while others work as bar attendants, which at times involves prostitution. Young men also migrate with the animals in search of pasture, and some interact sexually with women in the destination places. Moreover, some of these young men leave behind wives who interact with the older men left in the villages. These sexual interactions promote the spread of sexually transmitted diseases (STIs) including HIV. Looking at documented statistics, prevalence of HIV is high in some ASAL counties such as Turkana (7.6%), Samburu (5%), Kajiado (4.4%) and Isiolo (4.2%), but very low in other ASAL counties such as Garissa (2.1%), Mandera (1.7%), Marsabit (1.2%), Tana River (1%) and Wajir (0.2%) (Figure 4.4). Clearly, cultural values and religious practices come into play in influencing these coping mechanisms.

Figure 4.4: Kenya Adult HIV prevalence by county



Source: Open Data Blog (2015)[5]

5 http://blog.opendata.go.ke/hiv-situation-in-kenya/

4.3.2 Conflicts

There are health effects of conflicts that arise over pasture and/or water during drought, leading to injuries and even death. The conflicts may be between people and other people or wild animals. The outcomes of such conflicts include death and serious injuries. Psychological problems/trauma of losing family members and close associates, fear of being attacked, displacements, loss of wealth/property, and stress while guarding farms and animals against invasion by wild animals, herders and rustlers is an important cause of PTSD.

4.3.3 Worsening of chronic diseases

Cases of chronic diseases such as diabetes, hypertension, cancer, paralysis, among others, deteriorate due to droughts and floods. During drought, there is inadequate food, yet diabetics need constant access to food otherwise they suffer hypoglycemia, which leads to confusion, faintness and even death. The same happens during floods when people go for days without food and/or medication and with no access to a health facility. When hypertensive people are exposed to stress, fear, pain, poor medication among other problems associated with droughts and floods, their blood pressure rises (hypertension) or goes down (hypotension). Those already weakened by other diseases such as cancer do not have the extra strength needed to deal with drought or flood-related stress, lack of food and medication, displacement, etc. A paralyzed person is very difficult to move with when displaced by floods and is the first to drown alongside infants and small children as able-bodied persons run to secure grounds. They are also the first to suffer starvation and malnutrition during drought.

4.3.4 Absenteeism from work and school

When people get exposed to droughts and floods' health effects, there are secondary implications to the families and the economy. Many do not earn anything for family upkeep (especially casual workers) and the economy loses on productivity. Study findings revealed that those in the labour force missed an average of 25 days in a year from work while students lost an average of 8 days (Table 4.2).

Table 4.2: Statistics of select health variables

Variable	Observations	Mean	Std. Dev.	Min	Max
School days missed per year	1,029	8.2	26.7	0	365
Workdays missed per year	900	25.2	208.5	0	365
Treatment cost	1,749	2,834	12,834	0	300,000
Medicine cost	1,684	1,989	11,869	0	300,000
Travel cost	1,689	459	2,159	0	50,000

Source: KIPPRA Drought/Floods Survey, 2017

4.4 Regional Trends of Drought and Flood-Related Diseases

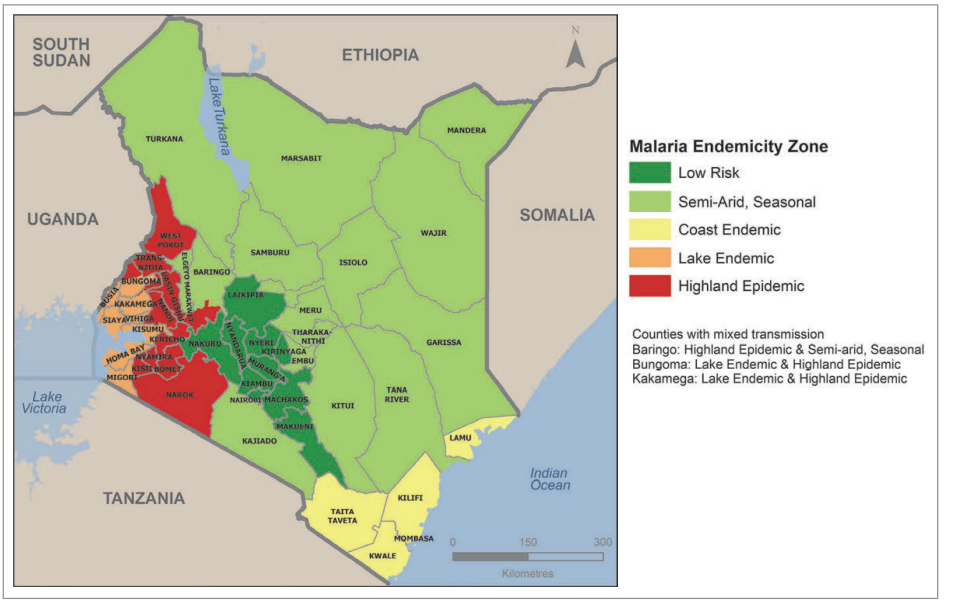
Charts in this section show prevalence and trends of various diseases by county/year or region/year. Data was compiled from various Statistical Abstracts (KNBS 2008-2017), an analysis has been done to show changes in disease prevalence against years of droughts and floods. County trends can only be analyzed from 2013 abstracts following devolution.

Malaria trends

It emerged during the KIPPRA study that an average of 37 per cent of the people in households suffered from malaria during the drought/flood in 2017. This is the same as the national average, an indication that drought or flood-prone areas are not the most affected by malaria. Figure 4.5 shows malaria epidemiological zones within the map of Kenya. Counties prone to droughts and floods were observed to have high malaria prevalence, but counties with relatively warm and wet conditions suffer higher malaria prevalence with or without floods.

From the Kenya Demographic and Health Survey 2014, malaria prevalence for select counties is as follows: the national average is 37 per cent (39% rural, 33% urban); Homa Bay and Siaya counties (over 60%), Mandera, Tana River, West Pokot, Busia and Kisumu (50-60%); and Mombasa, Kwale, Kisumu, Isiolo, Turkana (40-50%). Though neither drought nor flood counties, Migori had the highest prevalence at 74.4 per cent, Vihiga (62.8%) and Kakamega (41.8%). This is credited to Lake Victoria effect that gives rise to high rainfall, flooding and humidity in parts of Western and Nyanza regions. The coastal region has similar effects due to a combination of floods, droughts and the high rainfall from the ocean effects, and Amek et al, (2012) concur that there is increased malaria prevalence in floods-prone areas.

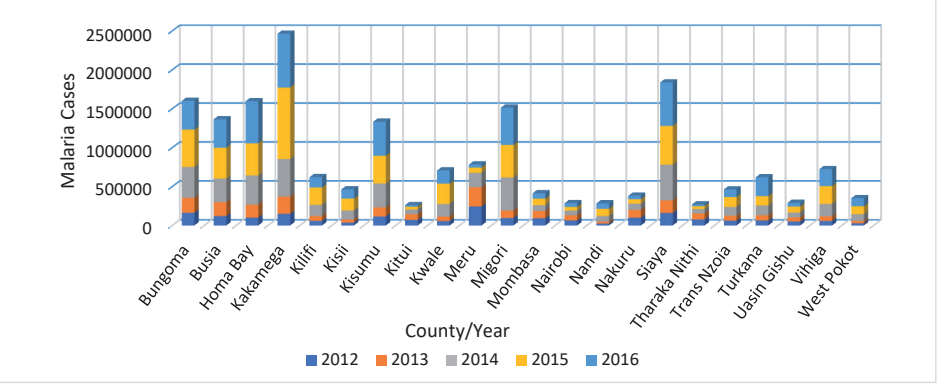
Figure 4.5: Malaria epidemiology zones of Kenya



Source: Kenya Malaria Indicator Survey 2015 (NMCP, KNBS and ICF, 2016)

Figure 4.6 shows prevalence of malaria by county from 2012 to 2016 and supports the above argument that although areas prone to both droughts and floods have high malaria incidences, areas with relatively warm and wet conditions such as Migori, Bungoma and Kakamega are highly prone to malaria.

Figure 4.6: Malaria cases by county by year

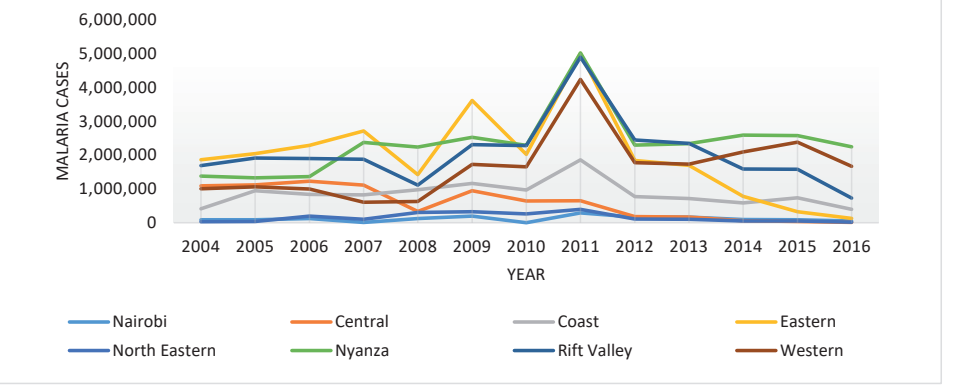


Source of data: KNBS (2013-2017), Statistical Abstracts)

Figure 4.7 shows malaria trend between 2004 and 2016 in all regions of Kenya. Major spikes occurred across most regions in 2007, 2009 and 2011 and a moderate spike in 2015. The 2007 episode followed a floods experience in 2006/7, the 2009

spike followed a floods episode in 2008/9 and the 2011 episode also followed floods experience in 2010/11. The spike is notably more pronounced in Western, Nyanza, Rift Valley and Eastern regions, where a combination of warm weather, vegetation overgrowth and stagnant water provide an ideal mosquito breeding environment, provoking high malaria prevalence.

Figure 4.7: Malaria trends by region



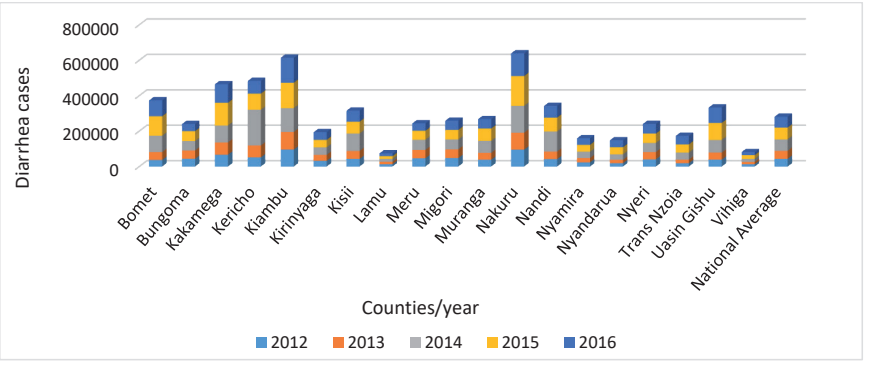
Source of data: KNBS (2008-2017), Statistical Abstracts

Reduction of health effects of droughts and floods depend closely on the nature of disease. Malaria and other mosquito-borne diseases, the study revealed, are successfully reduced through elimination of mosquito bleeding areas such as waste polythene papers, used tyres, cans, bottles, etc that hold rainwater. Larvae siding, fumigation of vegetation and use of bed nets has seen malaria incidence across the country decline considerably. However, misuse of the net was also observed.

Diarrhoea

Diarrhoea was found to be prevalent during floods and droughts. Diarrhoea happens for a wide variety of reasons, but mostly it is a hygiene and sanitation-related disease. Besides being a symptom of simple bacteria in the stomach, serious life-threatening infections associated with poor sanitation and hygiene, such as cholera, typhoid, dysentery and worms, among others, present with diarrhoea. Figure 4.8 shows diarrhoea cases in counties not associated with droughts or floods while Figure 4.8 shows the same information for drought and flood-prone counties.

Figure 4.8: Diarrhoeal cases in non-drought and non-flood counties

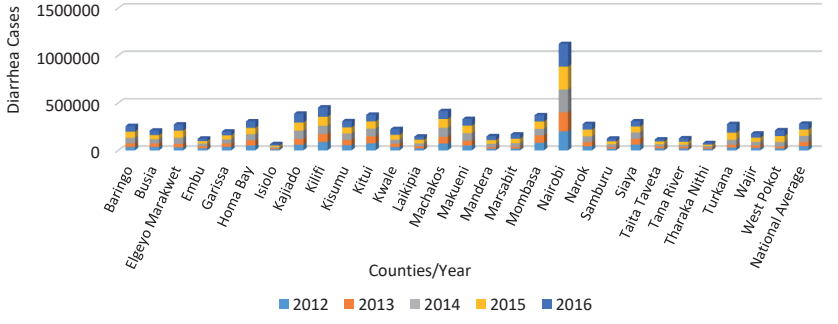


Source of data: KNBS (2013-2017), Statistical Abstracts

Notably, the prevalence of diarrhoea is high in very wet areas and in very dry areas. The problem peaks during very wet periods due to poor sanitation and contamination of drinking water. During drought, water is obtained from depleting/stagnant water points (ponds, pans and pools on riverbeds), often shared with domestic and wild animals, leading to high concentration of pathogens that cause diarrhoeal diseases. Moreover, poor hygienic practices and limited water for domestic use lead to stomach infections.

In Figure 4.9, the vertical scale is different compared to Figure 4.8 due to high numbers in Nairobi, which had accumulated about 1.1 million cases of diarrhoea over the 5-year span, with flood years 2014, 2015 and 2016 averaging 240,000 cases, the highest recorded in the country. Only Kericho surpassed 200,000 cases in 2014. Nakuru and Kiambu had very high cases of diarrhoea in the same three years. Other than Nairobi, many non-drought and floods prone counties had a higher prevalence of diarrhoea, with the more urbanized ones with low-income neighbourhoods having more cases.

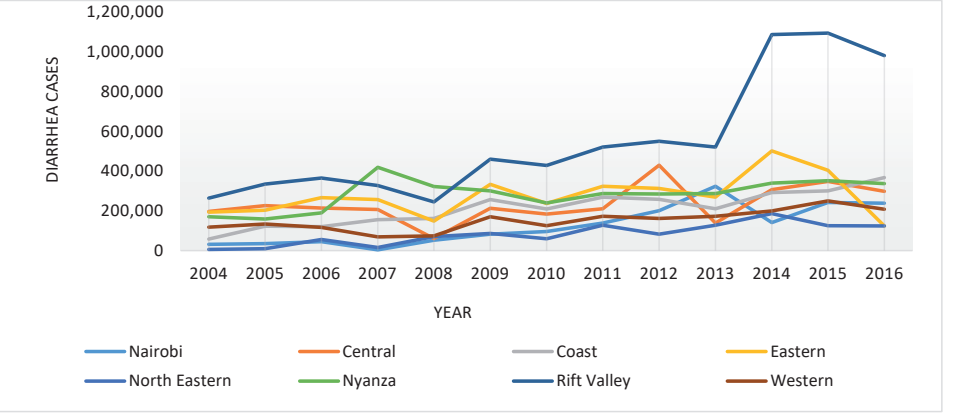
Figure 4.9: Diarrhoeal cases in drought and flood prone counties



Source of data: KNBS (2013-2017), Statistical Abstracts

Figure 4.10 shows the trend of diarrhoea prevalence by region in Kenya. Most regions experienced widespread diarrhoea cases in 2004/5 and 2006/7, during which both floods and drought occurred in various parts of the country. There were defined case increases in all regions in 2009, sharp rise in Central in 2012 and in Rift Valley and Eastern regions in 2014. These coincided with localized flooding and drought in addition to high prevalence of open defecation in North Rift as reported by Njuguna and Muruka (2017) with, among others, Turkana (88%), Samburu (75%) and Baringo (45%) of the population practicing open defecation.

Figure 4.10: Diarrhoea trends by region



Source of data: KNBS (2008-2017), Statistical Abstracts

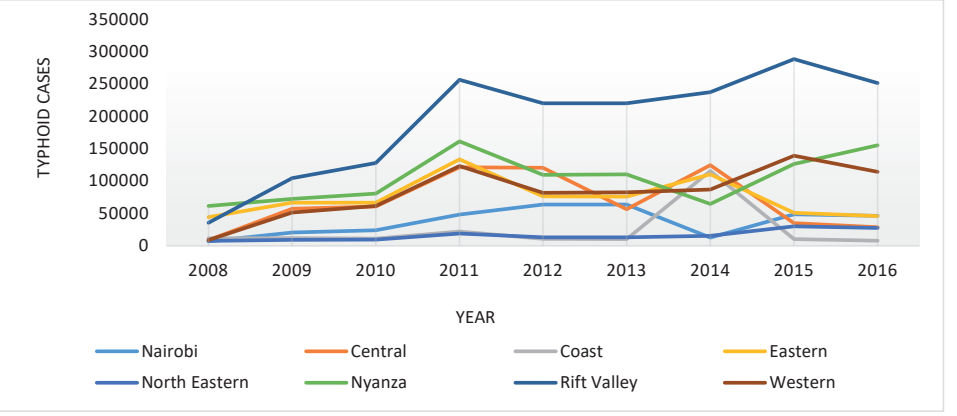
Nairobi, a flood-prone County, has exceptionally high diarrhoea cases, which is associated with cases of flooding in addition to poor sanitation and hygiene especially in the low-income neighbourhoods where water is relatively expensive, supply is often erratic and/or contaminated, with blocked/open sewer worsening the diarrhoea situation. Most coastal counties have diarrhoea cases above the national average. The region experiences heavy rainfall and flooding, and has high open defecation, with Tana River (72%), Kwale (59%) and Kilifi (43%). Wells, known to communicate with pit latrines (whose percentage of use comes next to open defecation), are a common source of water for household both for cooking and drinking at the coast and also in North Eastern region. Wajir County and especially Wajir town experiences a serious problem of diarrhoeal diseases, especially cholera, with 2015 and 2016 observed to have particularly serious outbreaks (KNBS, 2016; 2017), mostly attributed to flooding, its high water table and high open defecation (77.5%).

Typhoid

Research has shown that incidences of typhoid are higher in urban low-income settings due to congestion, poor sanitation and inadequate water access leading to

poor hygiene (Breiman et al., 2012). This is a food and water-borne gastrointestinal infection caused by salmonella enterica typhi bacteria. The KIPPRA study revealed prevalence of typhoid during floods and droughts. The trend of typhoid cases (Figure 4.11) spiked in all regions in 2011, a year that had a drought and its concomitant water shortage. Western, Rift Valley and Nyanza regions led on prevalence, with North Eastern and Eastern regions moving quite closely together.

Figure 4.11: Typhoid trends by region, 2008-2016

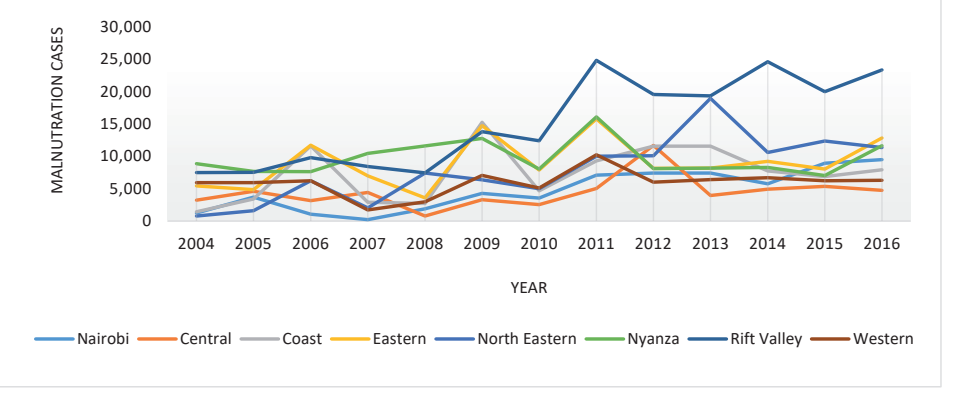


Source of data: KNBS (2008-2017), Statistical Abstracts

Malnutrition

Malnutrition emanates from dietary deficiencies, excesses and intestinal infections. Food shortage is observed during prolonged periods of drought. The KIPPRA study revealed that malnutrition occurs during droughts (Figure 4.12).

Figure 4.12: Malnutrition cases by region, 2004-2016



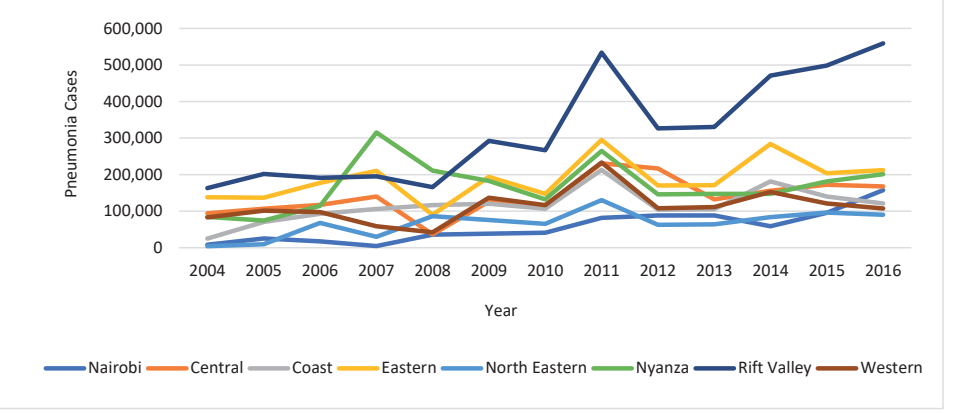
Source of data: KNBS (2008-2017), Statistical Abstracts

The trends indicate high malnutrition in 2005/6 following the 2004/05 drought that devastated most parts of the country. All regions experienced a sharp spike in 2009, improved in 2010 then spiked again in 2011, which coincides with droughts in 2009 and 2011.

Flu and Pneumonia

Flu and other respiratory diseases peak during drought due to dust, when it floods due to low temperatures and dampness. Twenty-four (24) per cent of the respondents during the survey reported they suffered flu/pneumonia during droughts and floods. KIHBS (2018) indicated a national prevalence of 28.1 per cent (urban 31.9% against 26.2% rural), with ASAL counties having a relatively high prevalence. Counties such as Kericho, Nandi and parts of Nyeri, Kiambu and Murang'a are tea zone counties, known to be very cold while Nairobi and parts of Kiambu are known to be cold and densely populated, explaining the high prevalence there. Figure 4.13 shows trends of pneumonia cases across regions. Spikes are notable in 2006/7, 2009, 2011, 2014, years that had droughts and/or floods.

Figure 4.13: Pneumonia trends by region (2004-2016)



Source of data: KNBS (2008-2017), Statistical Abstracts

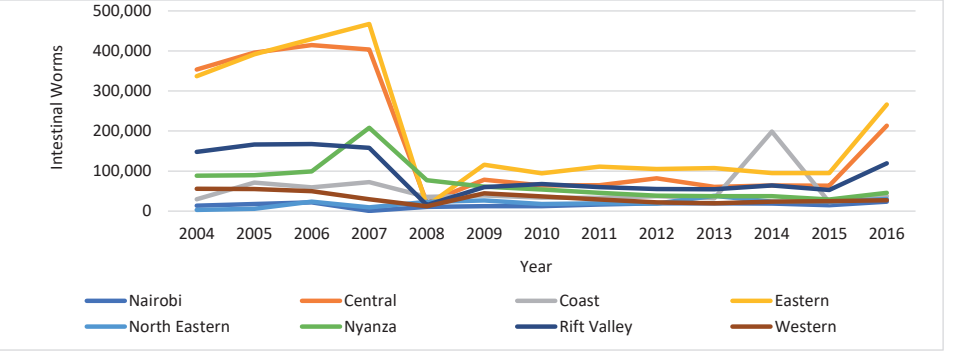
Intestinal worms

Intestinal worms such as schistosomiasis, roundworm, hookworm, whipworm and tapeworms proliferate during floods and droughts. They infect people through the consumption of food and water contaminated with faecal matter from infected humans or animals, while others such as hookworms go through the skin when walking barefoot. These worms are parasitic and even well-fed children become malnourished, anaemic and stunted if infected. Drought is associated with high prevalence of worms because hygiene gets compromised due to water scarcity -

hands are not well washed, food is not well cleaned/prepared, and water sources are shared with animals. This concurs with Miguel and Kremer (2002) that hot weather during droughts coupled with compromised hygiene due to water shortage aide worm infestation. During floods, sanitation gets compromised, with faecal matter from open defecation getting into water bodies and water wells as contaminants while others seep through the soil to the water table. Moisture during floods and compromised sanitation, especially in places where pit latrines and water wells communicate, encourages proliferation of worms. The worms thrive in hot and moist environments, with rice fields in Central region (Mwea), Nyanza (Ahero), Western Kenya (Bunyala) and Coastal regions (Tana River Delta) having high prevalence as a result. Floods have a similar effect as irrigation water, the only difference being that irrigation water stays longer in the paddies.

Figure 4.14 shows the trend in intestinal worms across Kenya regions. Central and Eastern regions had a serious case of worm infestation, which plummeted in 2008 then rose slightly and stayed in check until 2015 when it gained an upward momentum, with Eastern region remaining above the rest across time. The period 2004-2007 was characterized by severe widespread drought and hence high prevalence.

Figure 4.14: Intestinal Warms Cases by Region (2004 – 2016)



Source of data: KNBS, 2008 - 2017 (Statistical Abstracts)

The 2007 El-Nino rains flooded most parts of the country and coincided with increased intestinal worm infections. The dip in 2008 experienced in most regions, including Nyanza and Rift Valley and Coast regions coincided with increased government tempo in fighting intestinal worms through the school deworming programme. Notably, there was a surge of worms in 2015 across all regions, with Eastern, Central and Rift Valley regions spiking more while Coast had a surge in 2014. These were periods with localized flooding.

4.5 Gaps and Required Actions

Following the responses from the survey that highlighted risks to health posed by drought and floods and their continuing persistence, reference was made to international frameworks of action such as Hyogo and Sendai frameworks, and the national disaster and health policies. This helped to identify gaps and challenges that require action to reduce the persistent risks posed by droughts and floods to health and key players as guided by the frameworks and policies. Some of the gaps and challenges revealed during the survey are common across all counties while others are county-specific but outstanding enough in these counties to be highlighted. Key solutions to the challenges were proposed by the study participants.

As guided by Hyogo and Sendai frameworks of action, droughts and floods require certain actions to prevent health emergencies. These include vulnerability assessment; temporally shelters; training for first-aiders, volunteers and caregivers; continuous healthcare access for all; access to drugs for the chronically ill; health care camps; clear information for all and especially children on what to do; food security and safety information dissemination; social protection to afford food, medical services and shelter rehabilitation; diversification of income sources and generating ventures to prevent desperation and trauma due to loss of wealth; and public-private partnerships.

The vulnerable, including children, pregnant and lactating mothers, the chronically ill, the elderly and differently-abled persons get exposed to droughts and floods such that without external assistance, they suffer ill health. It emerged that the able-bodied move in search of pasture and water for the animals during droughts, leaving behind these vulnerable groups. Rather than leave the vulnerable in isolated habitats during droughts, temporary shelters in central places were proposed as ideal, where the vulnerable groups can then be fed, while the chronically ill are cared for. The children can then get vaccinated and taken to the nearest schools. Such groups are exposed to greater vulnerability when it floods, for example along a major river that flood (e.g. Nyando, Yala, Sondu, Nzoiya, Tana and Sabaki), Kisauni and Bamburi areas of Mombasa, Narok and many other places.

In all cases, there is need for early warning and assistance to evacuate. When floods are anticipated, people in flood-prone areas stay warned and encouraged to move to higher/less vulnerable grounds, social halls and in some cases tented camps and schools. However, social halls often used in urban areas are not always on safe or purposely chosen locations. Flood camps should be set up on high grounds where people living in flood-prone areas can move to and where supplies of food, water, fuel, drugs among other supplies can be delivered by governments and other

partners such as the Red Cross. Temporary shelters and camps are often set up too late if at all, and in some cases, there is no high ground for miles. Furthermore, the required resources are usually inadequate compared to the needs. This underscores the need for increased resource allocation, greater involvement of the drought and floods-prone county governments in activities before and during droughts and floods, and better coordinated response mechanism for efficient resource utilization.

Besides gaps in the assessment of vulnerability and identification of places for temporary settlement, there are gaps in prevention measures that would reduce the risk; preparedness to reduce degree of vulnerability; resources required for response and recovery; a coordination mechanism for these activities before, during and after the events, capacity to respond; and guiding law, regulations, policies and frameworks.

Mainstreaming droughts and floods health-related risks assessment, mapping and managing droughts and flood health impacts on the populations is essential. This must be done while preserving ecosystems and positive cultural practices. At all times, focus on managing the risk posed by these disasters to people's health and well-being and not the disasters themselves should not be lost. Although the government has the primary responsibility in managing these risks, opening a window for public and private participation, and local and international partnerships for greater objective realization will increase chances of success in reducing these health risks of droughts and floods.

4.6 Summary

1. Both droughts and floods pose a risk to health with water-, food-, vector-, air and dust-borne diseases, reduced access to health facilities and trauma.
2. The most common diseases that arise during a drought include those emanating from poor hygiene related as scarce water is scaled down to meet many needs; those caused by pathogens as stagnant water sources are shared with wild and domestic animals; injuries during conflict over reduced pasture and water; bacteria in the dust; worsened chronic diseases; hunger and starvation; trauma (PTSD) due to loss of lives and wealth; and risky coping strategies.
3. Disease that arise from floods are those caused by contamination of drinking water with sewage and chemicals swept into wells and reservoirs; mosquitoes that breed in still floodwaters; low temperatures and mold causing respiratory problems; electrocution, drowning and injuries in accidents caused by excess water and displaced reptiles and other animals; and trauma from displacement, loss of life and wealth.

4. The most vulnerable members of the community to droughts and floods are the aged, very young children, pregnant women, the invalid (sick and/or disabled) and the very poor.
5. International agencies, National and County governments have developed frameworks and policies to guide in the reduction of these health effects of droughts and floods, but the implementation falls short of eliminating the risks and health emergencies that emanate, making it imperative to mainstream related risk assessment and management for effectiveness.

5. Management of Droughts and Floods Health Risk and Effects

There are four categories of management activities to health effects of droughts and floods, two of which are precursors and two are posterior. Prevention and preparedness are precautionary measures taken to reduce risks and likelihood of health effects of droughts and floods, which require taking anticipatory measures to maintain health status. Response and recovery ameliorate health outcomes after the events have taken place.

Droughts and floods are injurious to community members in many ways. They cause health problems including death of people and animals, damage to flora and fauna, damage to homes, property and infrastructure among many other negative outcomes. However, the events and their effects can be made less severe if precautionary measures are taken to reduce occurrence and severity of the events and, if events have happened, to manage outcomes well with respect to health. Drought sets in gradually, giving adequate opportunities for anticipatory prevention and preparedness, to reduce the related health effects and emergencies. Similarly, floods are expected since rains are seasonal and people living along major river valleys and deltas, based on historical events and warnings from responsible authorities, can take precautionary measures to avoid exposure that affects health.

With fewer and less severe drought and floods episodes due to preventive measures, Kenya would be experiencing fewer and less severe drought and floods and related health effects. Early warning and information are essential for preventing some health effects of droughts and floods and for preparedness against their possible occurrence. With well-managed response and recovery measures, the health effects are less severe, and emergencies are prevented. During the study, it emerged that some preventive and preparedness measures are taken to reduce the occurrence of droughts and floods and the health effects that emanate. However, these were inadequate given that health emergencies during droughts and floods continue to occur.

5.1 Prevention

Prevention of likely health effects of droughts and floods is at two levels. Level one is reduction of extreme weather changes through environmental conservation while level two is prevention of likely health effects through immunizations/ vaccinations, improved sanitation and good hygienic practices, policies and planning. Moreover, early warning about onset of the events and likely severity is

usually given in the second level. Dissemination of information in most affected areas was however found to be weak. The information emerges when people have already been affected, and comes mainly from media houses. The arms of government responsible for prevention often deny there is a problem, and often blame the media for sensationalistic tendencies. This repudiation phase denies the vulnerable an opportunity for any action in preventing more exposure and serious health impact, while also delaying assistance from other actors reaching them in good time.

Poor sanitation and open defecation, use of contaminated water and unhygienic food handling, if prevented/reduced, can substantially reduce the likelihood of health effects from droughts and floods. Tree cutting for firewood and charcoal burning was reported as a key coping mechanism to alleviate financial challenges. The proceeds are used to buy food and other necessities, needs that escalate during drought. Such activities and poor farming practices such as slope tilling without benches and poor grazing practices such as bush and glass burning to get rid of ticks and other pests, lead to soil erosion and environmental degradation, exacerbating the extreme weather conditions of droughts and floods with commensurate health repercussions.

The national and county governments have been educating community members on sanitation and hygienic practices and proper farming and grazing practices, providing trees for reforestation, putting in place regulations and environmental management and employing community health workers, environmental officers and agricultural extension officers to play these educative roles. Although community members are sensitized to use latrines, be hygienic, plant and not cut trees, use alternative fuel instead of charcoal and firewood, among other practices, various hindrances to adherence and hence continued environmental degradation and health challenges were cited. The challenges included inadequate seedlings, discouragement due to damage by harsh weather and/or animals, lack of resources to buy alternative fuel for use, poverty and hunger during drought leading to charcoal burning, among others. A major intervention is therefore social protection to ensure poverty and hunger are reduced, appropriate and adequate tree seedling provided, people educated on propagation of trees, protection of the environment and benefits accrued from reforestation. These are preventive measures that reduce and eventually eliminate droughts and floods.

With respect to prevention of health effects, it was noted that infants are immunized during post-natal clinics, but adults only get tetanus immunization if they visit health facilities with injuries or for prenatal services. The majority do not seek immunization against diseases associated with droughts and floods such as malaria, cholera and typhoid, among others, yet immunization is available.

Although awareness that good hygiene practices such as regular handwashing especially after toilet visits; proper cleaning of food, utensils and surfaces; and maintaining house and general cleanliness prevents certain diseases such as diarrhoea, cholera, typhoid, hantavirus, rotavirus and many others; lack of adequate water for all these uses was cited. Many said they must economize the little water as they travel long distances to fetch to meet numerous household needs. It would take substantial sensitization on saving and reusing water to make it stretch while ensuring basic hygiene is practiced.

5.2 Preparedness

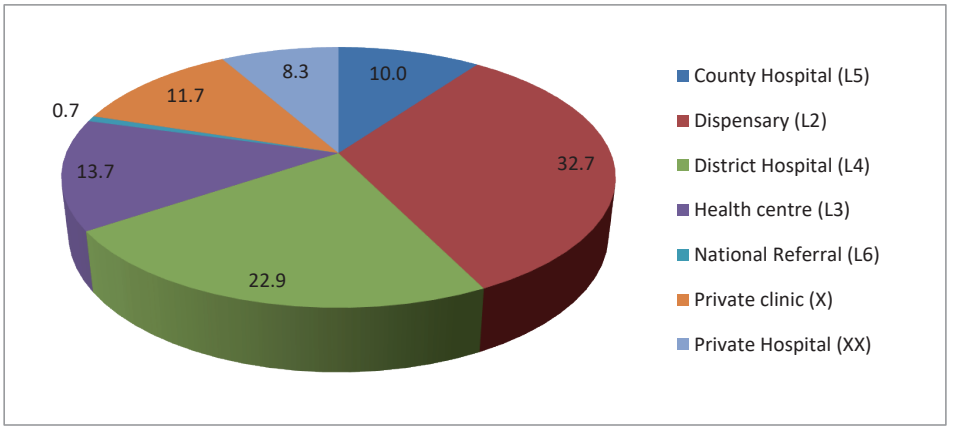
Preparedness essentially means not being found unaware. To be prepared, the basic requirement is to know what to prepare for and hence how to prepare. To prepare for the likely health effects of droughts and floods, there is need to know what health problems are likely to arise, and assess and closely monitor the situation as it unfolds. This facilitates timely placing of required materials, including drugs and other medical supplies, drinking water, food and food supplements, cooking fuels, tents and beddings closer to areas of likely need. Improved access to public health facilities from where those affected can seek treatment is a key part of preparedness to the health effects of droughts and floods.

The international frameworks of action (Hyogo, Sendai and others) outline preparedness for droughts, floods and other disasters, key among which is continuous healthcare access for all. This is paramount and requires resilient health facilities, which are in safe locations and functional under all conditions and particularly for primary healthcare provision during droughts and floods, among other disasters. Such access can best be guaranteed if health facilities are located on accessible and secure grounds in terms of distance, terrain and human to human conflict. To be safe, the facilities require constant water supply and power access, reliable access routes and communication systems that allow ambulatory access and delivery of supplies. Also necessary in these facilities are spillover capacity due to increased demand for services following droughts and floods. The health facilities and the health system must also be ready with vaccinations for both the health workers and the vulnerable communities against hepatitis A and B, typhoid, tetanus, measles, poliomyelitis among other droughts and floods-related diseases, with health care camps held regularly for early warning of likely outcomes, vaccination and dissemination of information on disease preventive measures.

As shown in Figure 5.1, this study established that public facilities most visited for the first line of treatment for health problems and outbreaks associated

with droughts and floods are those nearest to where they live. These are level 2/ dispensaries (32.7%), level 4/district hospitals (22.9%) and level 2/health centres (13.7%). However, many respondents indicated that due to various factors, they are not able to access public health facilities, with 20 per cent seeking treatment from private facilities (clinics and hospitals).

Figure 5.1: Level of facility treatment was sought from for health effects of droughts and floods



Source: KIPPRA (2017) Drought/Floods Survey

Some did not seek treatment at public health facilities, citing inaccessibility due to distance or awkward location, poor services, absent providers, lack of drugs and charges. Those that sought health care services from higher-level facilities were either referred there or did not trust the first line public facilities. Effective preparedness must ensure that first line facilities are well stocked, well equipped, adequately staffed with good services, leaving higher-level facilities to deal with serious referral cases. Further analysis on preparedness revealed the following key challenges that lead to poor preparedness:

5.2.1 Poor access to healthcare facilities

Access to healthcare facilities in most parts of the ASALs of Kenya during drought was reported as a huge challenge in the face of ill health, hunger and scorching sun. Medical facilities are few and far apart, and although mobile health facilities exist, most counties had only one, yet they are vast in area, rendering it inadequate. Poor access, coupled with cultural believes led to use of traditional attendants, medicine and home remedies, the effectiveness of which is often in question. Access to healthcare is dependent on distance and time taken to a facility in addition to infrastructure, supplies and human resources for health. Focusing on

distance, the norm for access to a health facility is a 5 km radius, reachable within one hour.

A 2017 KIPPRA study on healthcare status post-devolution established that the average distance to health facilities across the country is 3 km reachable within an average of 1 hour. An extract from that study for the 28 droughts and floods-prone counties is given in Table 5.1, showing county-specific average distances and time taken to reach health facilities. Also computed is the average time per kilometre. The counties are ranked by both distance and time taken to the nearest facility, which demonstrates that people in drier and larger counties travel further and take longer to reach public health facilities. Also given in the table is size position in terms of surface area for the 47 counties and county health facility density.

Table 5.1: Distance and time taken to nearest health facility by county

County	Distance (km)*	*Time (minutes)	Average Time taken/km*	Distance Rank	Time Rank	Size position	Facilities/ 100k pop
Busia	1.4	17.0	8.8	1	4	43	15
West Pokot	1.5	16.9	0.9	2	3	16	19
Mombasa	1.6	14.0	11.3	3	1	47	34
Nairobi	2.0	26.9	12.1	4	12	45	23
Marsabit	2.1	26.0	4.4	5	11	1	31
Taita Taveta	2.5	19.2	7.7	6	6	12	32
Siaya	2.8	21.3	5.7	7	8	36	23
Kwale	2.9	25.5	7.6	8	10	17	19
Samburu	2.9	35.7	5.8	9	16	10	35
Baringo	2.9	46.0	8.8	10	22	14	35
Tana River	3.6	43.9	12.4	11	21	5	27
Machakos	3.6	20.6	13.5	12	7	22	33
Makueni	3.6	39.5	6.1	13	19	18	36
Embu	3.6	39.0	7.7	14	17	30	36
Kisumu	3.7	21.6	5.0	15	9	30	21
Homa Bay	4.0	41.3	12.3	16	20	32	25
Kilifi	4.1	18.2	4.0	17	5	13	21
Kajiado	4.3	33.1	10.8	18	14	9	35
Tharaka Nithi	4.9	29.8	11.0	19	13	31	42
Isiolo	7.0	34.8	10.3	20	15	8	32
Laikipia	8.5	93.3	12.2	21	28	15	30
Turkana	9.1	66.8	15.9	22	25	2	20
Kitui	9.7	39.0	1.5	23	18	6	42
Elgeyo Marakwet	17.0	14.6	1.7	24	2	28	26
Narok	34.2	49.8	7.3	25	23	11	18
Garissa	35.3	60.9	1.7	26	24	4	21

Wajir	41.0	70.6	1.7	27	26	3	14
Mandera	52.6	90.4	11.0	28	27	7	10

*Source: *Mugo et al. (2018); Computation*

Residents of counties with the longest average distances to the nearest health facility such as Mandera (52.6 km), Wajir (41.0 km), Garissa (35.3 km) and Narok (34.2 km) and lower facility density such as Mandera (10 facilities per 100,000 pop) take longer to reach the nearest health facility (90 minutes for Mandera). Kitui has the best health facility density of 42 facilities to 100,000 population, which explains why it has the second least average time to the nearest facility next to Mombasa, the smallest county in surface area and with a good density of facilities (34/100,000 pop). Surprisingly, it takes longest (average 93 minutes) to reach the nearest health facility in Laikipia County despite the much shorter average distance (8.5 km) and the relatively good facility density (facilities to 100,000 pop), which requires some further enquiry to understand the underlying factors (if it not an error).

Taita Taveta County (which is hilly in some places), with a facility density of 32 per 100,000 population and an average distance of 2.5 km to the nearest facility takes longer (19.2 minutes) than flatter Kilifi with a facility density of 21 per 100,000 population and an average distance of 4.1 km but takes 18.2 minutes to reach the nearest health facility. The topography is likely to be a factor. Kwale, Samburu and Baringo have the same average of 2.9 km to the nearest health facility and facility density of 35 and 19, respectively, yet it takes almost twice the time in Baringo (46 minutes) compared to Kwale (25.5 minutes) to reach the nearest health facility. Similarly, with facility densities in Tana River (27), Machakos (33), Makueni (36) and Embu (36), these counties have the same average distance to the nearest health facility of 3.9 km, but it takes more than twice the time in Tana River to reach the nearest facility. This leads us to conclude that, besides health facility density, hilly topography and weather conditions make a difference with respect to access to health facilities for healthcare.

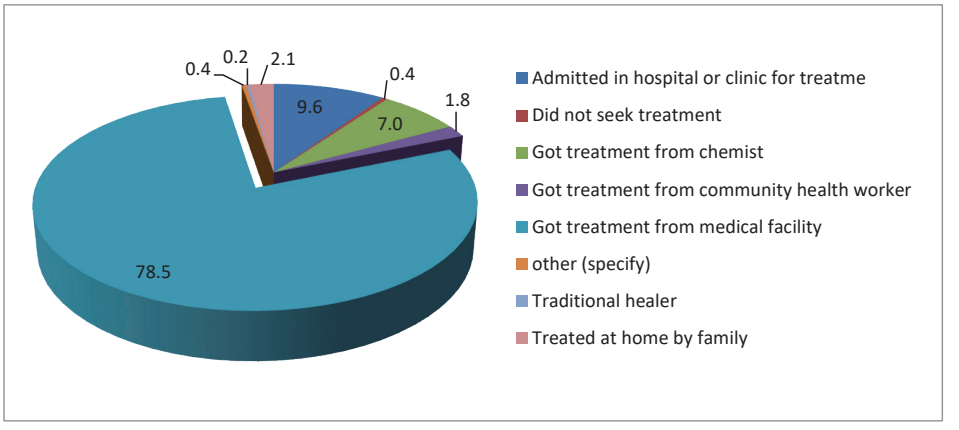
In concurrence with Mugo et al. (2018), this study established that although the number of health facilities has increased and most counties are making specific efforts to staff and equip these facilities, some of them lack all-weather access roads, making them inaccessible to ambulatory and other vehicles ferrying the sick and supplies during floods. This exacerbates illnesses while forcing women to deliver away from health facilities without skilled attendance. Floods, it emerged, hinder access to health facilities in several ways: The nearest route becomes impassable due to a broken bridge or overflowing water or a flooded path; health facility is damaged or flooded forcing the sick to either visit private facilities if they can afford or take a longer route to the facility or travel further away to the

next public facility; supplies cannot be delivered to a marooned facility, making it impossible to offer any services; too many people flock to the only accessible facility making the waiting longer and the suffering worse. On many instances, the sick do not seek healthcare services at all due to these hindrances. These are the experiences in some Mombasa County neighbourhoods including Maunguja dispensary, Bamburi and Bombolulu Health Centres that get flooded, marooned and cut off by floods. Stocks of urgently needed medical supplies become inadequate with airlifting the only alternative, yet equipment such as helicopters are not always readily available, and there are no proper landing spots, and most supplies cannot be dropped from the air due to risk of water and other damages.

5.2.2 Cost of treatment, social protection and insurance

The study revealed that some of those whose health was affected by droughts and floods sought treatment from various sources while others did not. Majority of the people (78%) that suffered ill health from effects of droughts and floods went to seek treatment from a medical facility (Figure 5.2). Close to 10 per cent got admitted since some of the illnesses were serious and life-threatening. A few (1.8%) got treated by community health workers and family members at home, while 7 per cent self-treated with medicine bought over the counter at pharmacies/ chemist. A negligible number (0.8%) did not seek treatment or sought treatment from traditional healers. The implication is that people need to be sensitized on the need to seek treatment and from the most appropriate source. Such sources must be affordable, accessible and prepared to offer adequate health services during droughts and floods.

Figure 5.2: Was treatment sought and from where?



Source: KIPPRA (2017) Drought/Floods Survey

In Kenya, treatment is expensive, yet access to affordable treatment is a key measure of preparedness. Many of those affected by droughts and floods-related illnesses could not afford treatment, either because of high travel cost to a medical facility or because of consultation charges and medicine in some of the facilities. The result is worsening illnesses and even death occurring from drought and floods health effects, with serious outbreaks when first cases are not treated fast because treatment was too expensive.

Affordability of health services is commensurate with what those needing treatment earn compared to what they need to spend. Of those surveyed, cost of treatment averaged at Ksh 2,834, with the average cost of medicine being Ksh 1,989 and transport cost averaging at Ksh 460. Out of a total of 1,565 people that reported to have sought treatment for health problems related to droughts and floods (Table 5.2), 812 (52%) earned nothing (taking note that some were dependents (children, students and the elderly). Of these that earned nothing, 440 (28%) spent between Ksh 0-500; 251 (16%) spent between Ksh 50 -1000 and 74 (4.7%) spent between Ksh 1001-2,000 in health. Ironically, of the 12 people that spent over Ksh 50,000 on treatment, 5 were earning nothing. Those earning Ksh 0-9,999 were 315 (20%) with 3 spending Ksh 50,000-100,000. Two people spent over Ksh 100,000 on treatment but earned a maximum of Ksh 25,000.

Table 5.2: Expenditure on treatment by income brackets

Income Brackets	Number of People and Expenditure on Treatment by Income Brackets										Total	%
	1	2	3	4	5	6	7	8	9	11		
Not earning	440	251	74	18	9	8	7	0	5	0	812	52
1-9,999	136	106	44	8	10	5	2	1	3	0	315	20
10,000-14,999	117	88	43	9	5	5	2	1	1	1	272	17.4
15,000-19,999	5	10	6	1	0	0	1	0	0	0	23	1.5
20,000-24,999	31	22	7	3	3	2	1	1	0	1	71	4.5
25,000-29,999	1	3	2	0	0	0	0	0	0	0	6	0.4
30,000-49,999	18	12	7	5	5	0	1	0	0	0	48	3
50,000-99,999	5	5	2	0	1	0	0	0	1	0	14	1
100,000+	0	3	1	0	0	0	0	0	0	0	4	0.3
Total	753	500	186	44	33	20	14	3	10	2	1565	100
%	48	32	12	2.8	2	1.3	1	0.2	0.6	0.1		100

Ranges of health expenditure (Ksh) represented in numbered columns: 1=1-500; 2=501-1000; 3=1001-2000; 4=2,001-5000; 5=5001-10,000; 6=10,001-20,000; 7=20,001-30,000; 8=30,001-50,000; 9=50,001-100,000; 11=100,000+

Source: KIPPRA (2018) Droughts and Floods Survey

This shows that the relatively poor are more exposed to the health effects of droughts and floods and spend a significant amount on treatment, which is way above their income. They must either borrow, fundraise or beg from relatives and other well-wishers for financial support to cover cost of treatment, which lowers their dignity and leaves them poorer. It also means they were placing a heavy burden on others. Those with better earnings are less exposed, probably because they are better placed to observe hygiene including other preventive measures to avoid exposure to droughts and floods health effects, while others can afford healthcare insurance. Provision of quality health services for all is a constitutional right and hence government facilities should be accessible to all, not only in terms of distance but also in affordability.

Enhancement of the national health insurance coverage is very important for the low-income earners, and if possible, at very low contribution to increase access to health care. Health insurance is a key preparedness option to alleviate the cost of healthcare to the household. Although this study did not get information on insurance, a previous KIPPRA study carried out in 2017 revealed that over 50 per cent of Kenya's population is now under the NHIF programme, which had 6.8 million principal members by 2017. This translates to approximately 27.1 million Kenyans if spouse and an average of 5 dependents are included. As the programme enhancement continues and as health social protection is expanded to include all vulnerable households (the very poor, the aged and the disabled), the country will be ebbing closer to the envisaged universal health coverage by 2022. This will enhance the countries preparedness to the health effects of droughts and floods, since the cost to the household will decline and the victims will access healthcare without suffering major financial setbacks.

5.3 Response

Drought and floods are associated with a host of diseases, and response requires a system that starts with the earliest signs of a famine and must be clear-cut, smooth and corruption-free to be effective in reducing the likely deterioration of health effects and preventing health emergencies. That system must be well-rehearsed, with all players on full standby when it becomes eminent that the event will happen. At all times, people's lives and safety must be the centre of focus, with saving lives and maintaining health being at the forefront of all response actions.

Most counties, it emerged, are reactional in implementing health programmes during droughts and floods emergencies. Response activities start long after the advisory is received from the meteorological department, mostly because relevant preparations and coordination meetings are irregular. This action lag delays

acquisition of supplies required to deal with the situation. Equipment such as pumps to remove water from dwellings, power saws to cut fallen trees, chemicals for larvae siding and fumigation and other supplies are hence not promptly in place. Relief food distribution is initiated late, often after the media highlights the misery of those affected by drought and floods calamity. This removes the element of emergency response and sustainability through the emergency due to unpreparedness, raising a great need to take the response planning process more seriously. The required resources and equipment such as water pumps, power saws, among others, it was proposed, should be placed in commonly identified and accessible locations.

Counties prone to floods should have an arrangement for standby rescue helicopters and/or boats for immediate action to rescue trapped people especially those caught in swift-moving/intense floods. They should also have dedicated fire fighting equipment to ensure they can put out fires without having to rely on fire engines on standby in high-risk establishments (e.g. oil refinery in Mombasa). Power technicians should always be on high alert to disconnect power lines when poles go down into floodwaters, putting at risk of electrocution all people likely to step into the floodwaters unaware of the looming danger.

5.4 Recovery

Recovery from droughts and floods effects has short-, medium- and long-term phases, all with health aspects to them. There is high interconnectedness of the various sectors, such that actions that need to be taken by each sector in the process of recovery culminate to improved people's health and well-being, thus fast-tracking the recovery process. After a drought, many of those that survive the drought are seriously malnourished and traumatized from lost lives and wealth. In the immediate and short term, they need assistance to recover their health through medical attention, water, food/food supplements relief. In the medium- to long-term, all the affected need assistance to regain their livelihood, which impacts on sustained health. ASAL pastoralists need assistance to restock with improved drought resistant animals for a sustainable source of food and nutrition, among other household needs. Farmers need assistance with improved seeds and extension services for fast-growing and drought resistant nutritional crops and appropriate planting and crop management practices that guarantee a harvest and increased yield for food security, improved health and wealth.

All the affected require continued support until they can sustain themselves. The key players in the sector, such as the Red Cross, indicated that it is cost-effective to give monetary support than food relief because it enables the beneficiaries

prioritize needs, consume preferred foods and use any extras to rebuild damaged houses and replace damaged basic amenities such as toilets for health sustenance. Besides, the money is either sent at no cost via M-Pesa with support from Safaricom or distributed through bank agents. This process should be deepened and widened to cover most social protection programmes, and it should be linked through a database to eliminate double-dipping or omissions. The choice of the household member to receive such monies should be made carefully. The Red Cross have chosen women household members because more is spent on food and less is likely to be diverted to durables and non-essential expenditures such as alcohol, a choice that resonated across actors.

5.5 Gaps in Management Actions

It emerged during the survey that poverty, cultural believes and some degree of ignorance inhibit victims from practicing preventive and preparedness measures from likely health effects of droughts and floods despite having some information. Individual resolve and cohesive community social and cultural fabrics, financial resources, thriving partnerships, government commitment and sustained momentum towards reducing exposure to droughts and floods are necessary in preventing likely health effects, yet these are inadequate, requiring deliberate and sustained effort to change that status.

Preparedness for the likely health effects of droughts and floods is at various levels, including individual, community, institutional and government. Based on expectations and information received from government and partnering institutions, individuals prepare for droughts by conserving food, water and resources to use during drought. When the saved materials get exhausted, they may move away in search of the same for family and animals or get caught and suffer the wrath of the drought. In preparation for floods, individuals enhance resilience of their dwellings but if the threat is overwhelming, they fold up belongings and move to higher grounds, or they are caught up. However, due to lack of information especially on the extent/severity and likely time of occurrence of the droughts or floods, preparedness is poor, and many are caught unprepared. Communities are comprised of individuals and hence tendencies are similar. Besides governments, actors comprising IDPs and civil society assist the communities and individuals, but in most cases they respond to the effects and not in preparedness before the events. Consequently, community members do not adequately prepare for droughts and floods and likely health effects.

The national and county governments, using predictive reports from agencies such as KMD and NDMA, among others, are responsible for conveying the

information to the people, while putting systems in place to assist as appropriate. Unfortunately, the information is not always precise and/or is not acted upon with deserved seriousness/urgency, and hence the people are often caught unprepared. The health effects of droughts and floods belongs at the top of priorities, and the responsibilities of preparing for them must be anchored at the top in government and cascaded to the individual level. The actors and private agencies that respond to the events must be encouraged to participate in the preparedness stage.

Essentially, all organs involved in drought information and relief activities at both National and County government levels require concerted action to minimize the likely health effects of drought and floods. Such organs include NDMA, Red Cross, World Vision, FAO, WFP and UNICEF, among other key players (Annex Table 3). The concerted action involves timely gathering of information on likelihood of occurrence and using the information to assess the degree and type of vulnerability by locality. This then helps in decision-making on what resources to bring closer to the people, especially food and food supplements, water, medicines and medical supplies, tents, beddings and clothing and materials for rebuilding damaged dwellings, health and related infrastructure. Such concerted action is often not forthcoming, leading to less than optimum efficiency and effectiveness of actions.

Early warning is essential for prevention and preparedness. The social media was proposed as an effective medium to effectively communicate the looming hazards of droughts or floods, likely disease outbreaks and preventive measures. The medium has become a highly effective tool for communicating alerts due to its 5 Cs “collectivity; connectedness; completeness; clarity and collaboration” (Chan, 2014). Moreover, time spent on social media today is greater than time spent listening to radio, watching TV or reading newspapers and magazines. But this medium is not being capitalized on to convey information that aids preparedness to the health hazards of droughts and floods.

5.6 Summary

1. Preventive and preparedness measures ameliorate health impacts of droughts and floods. It takes anticipatory actions to improve safety and good health. Response and recovery are reactions following the event, with the objective of reducing the impact of the event on health.
2. The key preventive measures are environmental conservation to reduce likelihood of occurrence of droughts and floods, and the onset of the diseases. Early warning messages alert people so that they can take measures to escape

the full wrath of these events, including prevention of diseases through immunization, sensitization on good sanitation and hygienic practices.

3. Preparedness entails placing resources, materials and personnel on standby and in locations of likely need in anticipation of the likely health outcomes from droughts and floods. Poor access to health facilities due to distance, terrain and low facility density, high cost of seeking healthcare services and low insurance coverage are among the hindrances to effective preparedness and hence health emergencies during droughts and floods.
4. For improved prevention and preparedness of health effects of droughts and floods, knowledge and information, resources and concerted effort by relevant government agencies and all other actors are paramount.
5. Response and recovery from the health effects of droughts and floods determine the extent to which those affected can suffer less and bounce back from the effects of droughts and floods.

6. Coordination Mechanisms for Reducing the Health Risks and Effects of Droughts and Floods

A coordination mechanism delineates all possible activities at various stages and how all actors involved can work together in an orderly process for best outcomes. There are many actors involved in the management/activities of reducing the health effects of droughts and floods, requiring a coordination mechanism for effectiveness. These activities include prevention, preparedness, response and recovery actions, which require a coordination mechanism with detailed activities and sub-activities that need to be taken before, during and after an event. The mechanism should state activities and sub-activities, goals, required resources, sources of these resources, actors, roles and responsibilities of each player, communication channels, guiding frameworks with practices, principles and guidelines and the lead or coordinating actor. With such a mechanism, the outcomes from concerted efforts of all the actors has higher chances of being efficient and effective in reducing the health risks and effects of droughts and floods. Such a coordination mechanism, to be efficient and effective, must be guided by legal and policy frameworks, spanning from the international to the local level.

6.1 Legal and Policy Frameworks for Reducing Health Risks and Effects of Droughts and Floods

The coordination mechanism for health effects of droughts and floods must be anchored in law, with policies that recognize its essence and demarcation. At the international level there is the Hyogo Framework of Action 2005-2015 (UNISDR, 2005) and the Sendai Framework for Disaster Risk Reduction 2015-2030. They recommend strategies to reduce disaster risks in general, encompassing those posed by droughts and floods on health. Such risks are ingrained in diseases and PTSD, access to health facilities and resilience, food insecurity, damage to infrastructure and assets, displacement, among others. The frameworks also state that all role players in managing these disaster risks are crucial, rights from the international institutions, state agencies, local bodies and the private sector. The roles include enhancing food security; strengthening primary healthcare facilities; safeguarding critical facilities, for example referral hospitals, power plants, communication centres, etc; intensifying social safety nets and recovery schemes; deepening financial risk-sharing mechanisms, for example, insurance; among others. According to these frameworks, the actors playing these roles must work in a coordinated manner, with well-demarcated roles and responsibilities if the common objective of reducing the health risks and suffering among the affected is to be achieved.

The Constitution of Kenya, Article 132 (a) recognizes that natural disasters such as droughts, floods, landslides, among others, pose health threats and emergencies. According to Article 241, the mandates that Kenya Defence Forces is established for include to 'assist and cooperate with other institutions' that respond to disasters. In the Fourth Schedule on devolution and functions of National and County Governments under the devolved system, disaster management is one of the few functions that both government levels share, illustrated as function 24 for the National Government and function 12 for the County Governments.

The Kenya Vision 2030 and its medium-term plans have focused on wide-ranging sectors and actions required to bring about economic development. Many of them will have long-term effects on reducing the health effects of droughts and floods, one of the prerequisites to development. Among others, these include rehabilitation and protection of water towers; water resources management programme; trans-boundary waters; water harvesting and storage programme; urban water supply and sewerage programme; rural water supply programme; irrigation and drainage infrastructure; land reclamation; and integrated regional development.

The Kenya Vision 2030 master plan and its medium-term plans have detailed the frameworks, policies and legislation that lay emphasis on coordination mechanisms, whose objective is to run the economy efficiently and achieve the objectives of the listed programmes, among other development agendas. Although these frameworks, policies and legislation do not speak to health risks and effects of droughts and floods directly, they do speak to various components with direct and indirect influence on reducing them such as disaster prevention and management, response to emergencies and social protection to ameliorate the effects. For example, there is emphasis on having a coordination mechanism for all stakeholders including national government ministries; county government departments; international development partners; non-governmental organizations, civil society actors and private entities, which should have a communication system among the various actors and policy implementation, and M&E frameworks. The aim is to develop a structure for coordination that enhances the National Government Coordination Act 2013; enhances capacity of County Governments' coordination mechanism; enhances coordination with development partners in line with global partnerships for effective development; strengthens coordination structures for better Overseas Development Assistance (ODA) absorption; enhances the Kenya National Social Protection Policy to harmonize National and County Governments' interventions; strengthens national disaster risk management coordination framework; develops and manages disaster operations and coordination policy; and upgrade early warning systems, among others.

To achieve such a coordination structure that leans towards climate change disasters, various Acts have had to be strengthened, including the Environmental Management and Coordination Act, 1999 and Wildlife Conservation and Management Act, 2013, while others have been enacted, for example the Forest Conservation and Management Act, 2016; Natural Resources Act, 2016; Water Act 2016; and Climate Change Act, 2016. The National Environment Management Authority (NEMA) has been recognition as the National Implementing Entity for the Green Climate Fund. The bottom line for all these mechanisms, frameworks and policies is to take care of weaknesses in intra- and inter-agency coordination and collaboration, aiming to minimize conflicting actions and commensurate wastage of resources, while enhancing effectiveness in service delivery and outcomes including reduction of health effects of droughts and floods.

Both National and County Governments have put in place coordination mechanism to respond directly to reducing the health effects of droughts and floods. At the national level, the government has put in place various programmes such as The National Drought Management Authority (NDMA); the Kenya Hunger Safety Net Programme (HSNP); Kenya National Agricultural Insurance Programme; and the Kenya Livestock Insurance Programme (KLIP). These cushions the people of Kenya against the health impacts, undernutrition, malnutrition and PTSD while guiding in other response activities. Sustainable Peace and Socio-economic Transformation was also initiated to deal with cross border community conflict, for example in Marsabit County at the border between Kenya and Ethiopia, mostly arising from conflict over pasture. The mechanism reduces incidences of conflict and related injuries. Moreover, the government has been putting in place intergovernmental and inter-agency technical committees that oversee response, implementation and reporting on matters appertaining. The government also works closely with UN agencies such as the World Food Programme (WFP) and UNICEF, international development partners such as the World Bank, IFRC, DfID and Non-Governmental Organizations such as the Red Cross in combating climate changes such as drought and floods predicaments and related health issues.

Kenya is a signatory to a 2006 protocol between countries in the great lakes region and also adapted a law on internal displacement in 2012, which not only addresses development, political and community conflicts triggered by displacements, but also displacement triggered by disasters such as floods and landslides (IDMC, 2015 and 2019).

At the county level, County Steering Group (CSG) Committee coordinates county disaster management matters. The committee chaired by the County Commissioners and with NDMA as the secretariat, has membership of both County and National Government representatives and other stakeholders. Different

Box 6.1: CSG case in point: West Pokot and Kilifi counties

In West Pokot County, drought-related activities are coordinated by the CSG Committee comprising key government line ministries - health, education, water, agriculture and security. The National Government gives relief food every month, targeting vulnerable groups that include people living with HIV/AIDS, schools and hunger-stricken community member across the entire county. The Assistant Chiefs and Village Elders are tasked with the responsibility of identifying persons in need of food aid. Every sub-county gives returns to the County Commissioner in terms of the food security situation in their localities and status of food aid distribution. Deficiency of resources interferes with meeting the objectives of the committee, since there is no specific budget for coordinating activities. This sometimes pushes the county to reallocate funding meant for other activities. A large proportion of the county's budget is used to retain children in school, for evacuation, food aid and other urgent supplies during droughts and floods. The County Nutrition Technical Forum brings all health stakeholders together, hosted by the Ministry of Health.

The Red Cross, a key NGO in the County, is involved in evacuation of communities during floods/ landslides. Others include World Vision and Action Against Hunger (ACF), while Sikom and Pokot women empowerment network were key CBOs in the county. Action against Hunger (ACF) is an international French NGO working through the Ministry of Health to strengthens health systems and fighting against hunger. They work with the water sector to dig boreholes in health facilities so that communities near these facilities can get water for domestic use during drought. Their interventions largely focus on response and community health sensitization outreaches. NDMA supports the forum to prepare a contingency plan for the health sector, including situation-oriented capacity building for health workers in the county.

In Kilifi County, the CSG composition is like that of West Pokot and other counties. However, the county lacks capacity to investigate and respond to some health effects of droughts and floods such as Chikungunya outbreaks that arise during and soon after floods. In responding to some cases, together with the CSG leadership, the Ministry of Health combines forces with national government, the Red Cross and the police, among others, depending on the nature and magnitude of the calamity.

county committees respond differently to droughts and/or floods events. Non-governmental actors (Annex Table 3) carry out varying activities in accordance to their mandate and the types of events they are responding to. The stakeholders/ key players include the National and County Government officers at the county, state agencies, United Nations agencies and other International Development Partners, NGOs, FBOs and CBOs.

Although CSG coordination mechanism is not health-specific, most of its activities focus on reducing the impacts of droughts and floods, such as food and water distribution, social protections and some health campaigns and outbreak responses. Health is therefore a key component of its mandate. Some counties have a subset of the County Steering Group (CSG) committee focusing on health and especially nutrition, given the effects of malnutrition on general health in drought and flood-prone counties. The root causes of health-related outcomes from droughts and floods require sustained interventions by all sectors and players

given that health is not the main driver in droughts and floods management but turns out to be a very serious outcome from the events. The sector largely relies on donations of supplies from partners such as WFP and the Red Cross during interventions.

The challenges cited by most counties included distribution of relief food and water during droughts and floods. Some counties indicated they do not get adequate relief food from the National Cereals Board. Others indicated they get the grain but do not have adequate lorries to truck the food to the areas of need, and some depend on NGOs and private firms to truck food and water. In some counties, those charged with distributing the food corruptly repackage and divert it into the market for sale. Poor coordination of activities was flagged as a major cause of these challenges, raising the need for counties to enhance their disaster coordination mechanism, with a county disaster coordination officer and a dedicated team which is well-armed with technical know-how on required actions within prevention, preparedness, responses and recovery activities to droughts and floods events.

One of the emerging proposals for a coordination mechanism was to have a team composed of national and county officers and other stakeholders under a system where they can be pulled off from regular workstations on a need basis. This coordinating system cascading right from the national level to the counties must have inter-county linkages, since droughts and floods disasters often run across counties. The National Government should start by eliminating multiple institutions with overlapping mandates, then establish an NDMA-like institutions to manage risks posed by floods. An all-disaster coordinating body for all risks should then be put in place to act as an umbrella mechanism with representation in all counties. Given its experience, an enhanced NDMA was proposed to take the place of the umbrella body, with units created to deal with each of droughts, floods and other disasters.

Although Kenya has a National Disaster Management Policy and has put in place a system of drought risk management, including National Disaster Operation Centre (NDOC), the National Disaster Management Authority (NDMA) and National Drought Emergency Fund (NDEF) geared towards ensuring efficiency and effectiveness in preventing emergencies from droughts and floods and particularly health, the system has overlapping mandates among these institutions. With such overlaps, some sit back expecting the other to act and the other does the same. Consequently, no action is taken and a health emergency ensues, baring the need to go back to the drawing board and review the mandates of these institutions to ensure they are mutually exclusive and exhaustive in terms of all that needs to be done to ensure no health emergencies during droughts

and floods. For more effective control of health impact of droughts and floods, the Government requires strong units within the agencies to deal with each of the following: health risk assessment; prevention and preparedness; emergency response; recovery and reconstruction, each with clear and mutually exclusive mandate and a well-structured health sector-specific portfolio at both National and County Government levels for comprehensive coverage and coordinated actions for reduction of health risks and effects of droughts and floods.

An efficient mode of communicating information is paramount for any coordination system. Counties, as part of this mechanism, will have to establish a communication system with a communication centre, a well-known hotline to receive reports of all types of disasters across each county, and transmit the same as appropriate. That line should be easy to remember and to access. The operators at the centre must be well trained on rerouting the information to ensure the county coordinator is quickly informed, and all who should act are quickly alerted. This is likely to reduce the time taken to respond and rescue the affected, save lives and reduce suffering/injuries. An adequate number of rescue volunteers should be enrolled and motivated enough with some stipend, including airtime to facilitate them stay in communication and send alerts when a disaster has happened in their watch areas. They should also be the conduit for warnings of a likely disaster to the people they volunteer for through short messaging services, with guiding messages on actions to take to avoid health risks.

Majority of the non-governmental actors, it was noted, make individual efforts without consultation with other players, each in line with their mandate. However, individual efforts cannot cover the full magnitude of droughts or floods-related health effects, and was seen to lead to less than optimal use of resources. A coordination mechanism at both county and national level will highly likely increase efficiency and hence the call for concerted effort and logically organized processes that can significantly reduce the health risks and effects of drought and floods. This will be achieved through information sharing, agreed actions and a common goal set, resource pooling, activity planning, among other actions. Coordination is effective in the presence of a mechanism drawn by the key actors from all relevant arms of the health sector before, during and after a flood or drought event occurs. Despite having all the stated legislations, policies, programmes and frameworks, the intended objectives of reducing health risks among other effects of droughts and floods are yet to be achieved given that the country continues to experience health emergencies. The framework's design and implementation must therefore be fast-tracked to reduce these health emergencies.

6.2 Coordination of Activities in Managing Health Risks and Effects of Droughts and Floods

In line with the constitutional requirements and functions under Schedule 4, it has been noted that both National and County Governments have constitutional functions in disaster management. The Kenya National Disaster Management Policy has outlined a system of drought risk management, and institutions including NDOC, NDMA and NDEF have been instituted and credited with the role to effectively and efficiently prevent emergencies from droughts and floods including health. The Kenya Meteorological Department (KMD) is responsible for weather forecasts and to warn the governments and Kenyans of likely floods and landslides or poor rainfall likely to lead to a drought. Following such droughts and floods' warnings, the relevant arms of National and County Governments and various actors that complement the government's role in humanitarian relief, set into motion their activities, which are majorly food, water and medical interventions. The actors are wide-ranging including National and County Governments, non-governmental organizations, private sector actors and the community. Table 6.1 shows these classifications, some of the actors involved and their key areas of intervention.

Tables 6.1 and Annex Table 3 contain many players who act at both the national and county level in reducing the health risks and effects of droughts and floods. As they carry out their mandate, they all have improvement of community members' health, lives and livelihood as the ultimate goal. However, those interviewed indicated they have minimal consultations with each other or even with government officials other than in obtaining the required licenses and security clearance when needed. Some reported meeting accidentally on the ground to carry out similar activities for the same community members the same day. Although some of the actors participate in County Steering Group (CSG) meetings, they still conduct most of their activities independent of each other. Consequently, many actions and resources in responding to the health risks and effects of droughts and floods in Kenya do not translate to optimum results due to overlapping mandates, areas of coverage and actions. When actors operate independently, a great deal of resources are wasted in overlaps and poor prioritization.

Individual efforts cannot cover the full magnitude of reducing droughts or floods-related health risks and effects. Concerted effort and well-coordinated actions would be more efficient and effective in dealing with any disaster. Moreover, collaborative and logically organized actions would significantly improve the outcomes, based on information sharing, common goal setting, collaborative activity planning and execution. Coordination is effective in the presence of a mechanism drawn by the key actors from all relevant arms of the health sector

Table 6.1: Classification of actors involved in reducing the health effects of droughts and floods

Category of agency	Institutions	Some of the activities relating to reducing the health effects of droughts and floods
National Government Ministries	Ministry of Health	Health Policy; Sanitation Policy; Preventive and Promotive Health Services; Health Education; Food and Food Handling; Health Inspection and other Public Health Services; Quarantine Administration; Curative Services; Health facilities management; National Hospital Insurance Fund (NHIF); Kenya Medical Research Institute (KEMRI), Kenya Medical Training Colleges (KMTCs), Kenya Medical Supplies Agency (KEMSA), Regulatory Bodies for Pharmacy and Medicine
	Ministry of Agriculture, Livestock, Fisheries and Cooperatives	Formulation, implementation and monitoring of agricultural legislations, regulations and policies; Supporting agricultural research and promoting technology delivery; Facilitating and representing agricultural state corporations in the government; Development, implementation and coordination of programmes in the agricultural sector; Regulating and quality control of inputs, produce and products from the agricultural sector; Management and control of pests and diseases; Collecting, maintaining and managing information on the agricultural sector
	Ministry of Environment and Forestry	Protection, restoration, conservation, development and management of the environment and natural resources for equitable and sustainable development
	Ministry of Water and Sanitation and Irrigation	Development and management of water resources, transboundary waters, water harvesting and storage, water services and sanitation regulation, dams and sanitation management
	Defense	Defend and protect the people of the Republic of Kenya and their property against external aggression and provide support to the Civil Authority as per the Law
County Departments	Health; Agriculture; Environment; Forestry; Water; Natural Resources; Security; CSG	Health delivery; Food production and security; Environment, water and other resources conservation and management; Maintaining peace; Coordinating county activities, e.g. emergency response to droughts, floods, landslides and other emergencies
NGOs	Some listed in Annex Table 3	Actors in promoting health; agricultural development for food security; water development; Emergency relief and response, etc
International Development Agencies	USAID; DfID; SIDA; CIDA, IDRC, JICA; GIZ; FAO; WFP; UNICEF; UNDP; UNEP; World Bank	Give aid/grants for the development of sectors including, health agricultural; water; infrastructure; and response to disasters such as droughts, floods and landslides, among others
Financial Institutions	Banks: KCB; Cooperative; Equity; National Insurance: Takaful; UAP	Community Social Responsibility (CSR) activities in reforestation, environmental conservation, waste management and response to disasters such as droughts and floods; Offering loans to restock, buy livestock feed and medicines, access water tanks, etc; Offer insurance services against loss of animals and other properties

Source: KIPPRA Study

before the events occur. The mechanism must define the risks and likely effects, needed action (before, during and after the event), goals, activities, required resources, sources of these resources, roles and responsibilities of each player, communication channels, practices, principles, guidelines and the lead or coordinating actor. The Government and its various arms are best placed to coordinate response activities.

6.3 Summary

1. A coordination mechanism delineates all possible activities at various stages and how all actors involved can work together in an orderly process for best outcomes.
2. Coordination of all activities related to reducing the health risks and effects of droughts and floods is essential in ensuring efficiency and effectiveness in utilization of resources.
3. A mechanism must have guiding legal and policy frameworks strictly adhered to for effectiveness.
4. Unwillingness of actors to participate in prevention and preparedness activities, poor knowledge, poverty, lack of resources, poor utilization of available resources and poor coordination of response and recovery activities lead to less than optimal outcomes, with health emergencies retarding economic growth.

7. Resources, Capacity and Policies to Reduce the Health Risks and Effects of Droughts and Floods

7.1 Resources

Inadequacy of resources required to reduce the health effects of droughts and floods was cited as a challenge at all levels from the household to the County and National Government. The constraints include financial and human resources, few and under-equipped facilities, and shortage of medical supplies, among others. Due to lack of adequate resources at the household level, preventive and preparedness measures to droughts and floods and their health effects were found to be limited, to the extent that some household members were not seeking healthcare services when suffering ill health following episodes of droughts or floods. Both National and County Governments, it was noted, do not allocate adequate funds to prevent/prepare for health risks and effects of droughts and floods disasters. County health budgets need to be enhanced if the health effects of droughts and floods are to be adequately addressed before becoming emergencies.

Although counties are usually advised to set aside funds for emergencies, and a kitty for stand-by buffer stocks of drugs, water, food, equipment and other supplies to deal with outcomes of droughts and floods, they cited lack of funds to set aside. Consequently, most health departments at the county level may not have an emergency fund for preventive care, and to respond in a timely manner to health emergencies, leading to preventable outbreaks and emergency situations. Although most actors in the health and relief sectors (listed in Annex Table 3) have sizeable resources to add on to what the county may have, they work independently, yet they all have a common goal to ameliorate health and related misery posed by droughts and floods. If all actors joined hands with the counties where they work, combined ideas, pooled resources and shared responsibilities in line with their mandates, resource crunch would reduce and usage would be more efficient, with improved accountability, transparency, and greater outcomes/effectiveness. Moreover, development partners and local private companies were seen to be interested only in response activities but have no interest in prevention and preparedness, yet these reduce the magnitude of damage and resources needed for response.

The health facilities are essential resources in reduction of health effects of droughts and floods. However, they can only play this role effectively if adequate in number and strategically located to survive any likely events, given that this is where the affected will seek emergency assistance. Although all counties have now received the 'Beyond Zero Campaign' mobile clinics to help reach far flung areas, one clinic per county was reported as inadequate in some vast counties;

for example Marsabit, Mandera and Turkana. These expansive counties indicated they need four to five mobile facilities for adequate coverage. Moreover, increased number of health facilities, including mobile clinics without human resources for health and other necessary resources does not serve the intended purpose. Workers get overwhelmed and supplies run out.

It emerged that counties have not invested adequate resources in WASH (Water, Sanitation and Hygiene) as a preventive measure, yet this saves on treatment/curative expenditure. This requires increased resources for information, education and sensitization on the importance of hygiene and cleanliness especially in schools, cascaded to households using all opportunities and avenues. This must be accompanied with treatment for drinking water, and provision of improved sanitation especially in densely populated and flood-prone areas such as low-income urban neighbourhoods.

It also emerged that most counties have not invested adequate resources to waste management, and they lack effective management systems, including recycling and reusing waste. Large cities such as Nairobi, Kisumu and Mombasa experience serious flooding, majorly due to poor drainage systems, which are clogged with waste materials such as plastic bottles and dirt. The situation improved with the ban on plastic bags, and the same need to be applied on plastic bottles, which were noted to be posing serious problems too. Moreover, investment in education on waste disposal require intensification, explaining how poor waste disposal leads to flooding and the health repercussions.

Resources are needed to inculcate such education into the curriculum, starting with the very young pupils because these will sustainably grow with the practice, and hence discouraging their parents and older siblings when disposing wrongly. Resources are also needed for serious observation of the World Environment Day and designation of a clean-up day all over the country involving students, adults, private and public institutions and government officials. This should include thorough clean up and unclogging of drainage systems, building gabions and planting trees in both urban and rural settings. This way, a positive change will be realized right from the household, schools, offices, marketplaces, villages and urban neighbourhoods. The day should also be used to sensitize people on the repercussions of poor waste management, and the event as a platform to illustrate hygienic practices and proper sanitation as preventive health, which saves on curative health needs, giving rise to a healthier and more productive population that suffers fewer and less severe episodes of droughts and floods and consequently reduces health risks and effects.

Additionally, rainwater harvesting right from the household and community level (tanks, domestic groundwater pits/ponds, community water pans) to the county

and national level (dams of all sizes) would increase water availability for improved hygiene, yet inadequate resources are invested here. Some communities insist on rain-fed agriculture and face crop failure and death of animals year after year. Basic food security and the environment are paramount for health, especially with droughts and floods health threats. Resources are needed for education and sensitization on water harvesting and used water re-use especially for growing trees and vegetables for improved nutrition and environment. To be food secure and free of malnutrition, communities should learn alternative food production methods such as *zai* or *tassa* systems, which are African traditional farming methods practiced in some relatively dry parts of the continent with great success. Besides agrarian food production, improved animals and range management capacity for animal-based food security is paramount.

In some emergencies, access and safety are compromised when specialized equipment and experts cannot reach a cite where required. Some of the equipment and experts cannot reach the scene easily/quickly/at all due to poor road networks, illegal structures and/or poorly planned neighbourhoods. For example, during a storm, walls or buildings collapse, trees or power poles fall across access roads, roads sections are swept away, bridges collapse, soil slumps and rocks dislodge into roads. All these are examples of hindrances that restrict access to health facilities, assistance and ambulances to reach people in distress needing urgent help/quick response and/or evacuation. Moreover, traffic builds up following the event, jamming up the road and preventing access by vehicles coming to remove the blockage. To circumvent such problems, more resources are needed to enhance interconnectedness with all-weather alternative routes.

Although efforts have been made to improve access routes to facilities, many are still in need of improvement while in other cases, more facilities are needed. For example, in Taita Taveta and particularly in the hilly Taveta region, a health facility may be located within a short distance but across a steep slippery slope, making it inaccessible to pregnant women (for delivery) and seriously sick persons being ferried from across the valley. The alternative circuit increases distance substantially. Facilities should not be too far to ensure easy access in the face of hunger and starvation or across a plain/valley impossible to cross during floods. Moreover, given that dispensaries, health centres and district hospitals emerged as the most used health facilities, they are required to have adequate staff, equipment, and stock of medical supplies during drought/floods seasons.

Emergencies often require specialized and expensive equipment, including tracks to ferry water and food, tents to set camps for those displaced by floods, boats and/or helicopters to evacuate people to camps/medical facilities and to deliver relief food, medical supplies and other materials to those marooned by floods. Other

equipment include power saws to cut fallen trees, pumps to remove water from homes, earthmovers to remove soil slumps, etc, yet counties indicated they lack adequate resources to acquire these equipment. With appropriate preparedness, some of these can be accessible from institutions that own some on a standby basis, with a high alert mode placed when risk increases. This is in addition to standby temporary staff to complement regular staff, who are accessible during high demand periods to man such equipment. Such resources could be sourced from agencies/service providers security forces, National Youth Service in addition to NGOs such as the Red Cross and St Johns ambulance, among others, with appropriate arrangements.

Some social protection programmes were noted in the drought and floods prone counties, meant to cushion people against hunger and other related problems. However, coverage for the vulnerable community members, including needy children (e.g. OVCs), the elderly, the very poor, differently abled and the chronically ill was inadequate and needs to be enhanced as weather conditions worsen. This requires food and non-food vulnerability assessment for need identification and urgency and capacity to handle.

7.2 Capacity

The health systems capacity to deal with disease outbreaks was noted to be low, leading to long queues during outbreaks when there is increased demand for services. This is mostly due to inadequacy of well capacitated human resources for health, yet large numbers are needed during emergencies emanating from droughts and floods. Basing on historical events, likely prevalence of related diseases and spread can be assessed to guide actions including facility capacity strengthening. Mapping out the hotspots and assessing nearby facilities' capacity to respond is as crucial as having the necessary logistics and required resources. The health department does not have emergency teams to coordinate interventions in times of droughts and floods, stemming from lack of a health sector disaster preparedness policy and relevant capacity building. Agencies that help rescue the injured during floods, especially St Johns Ambulance and the Red Cross are always on alert. They give First Aid and evacuate those in need to the health facilities, which should have the capacity to deal with the injuries in terms of human resources, equipment and supplies and spillover capacity.

Capacity of companies doing engineering works in coastal areas require strict confirmation of relevant skills before being awarded tenders if flooding and related health effects are to be reduced. It emerged that some flooding episodes and related health effects especially in coastal urban areas such as Mombasa emanate from poor

technical engineering works because some road construction companies, though well versed and experienced in building inland roads, do not competently construct coastal roads. They have been observed to apply same engineering principle in the coastal areas, maintaining the same drainage provisions and technology as with inland roads. The drains often collapse since they require deeper and more concretized trenches due to the soft nature of sandy soils and high water table at sea level. This has significantly contributed to the floods experienced in Mombasa City and the commensurate health problems. The engineers must be carefully assessed at tendering stage before being awarded tenders, and their work closely monitored by county engineers for quality control to reduce flooding, save resources and reduce the health risks and effects and health emergencies.

Regarding food security and safety information, Kenya requires food security assurance and information dissemination on food handling during drought and floods. The displaced become extremely vulnerable to food contamination because they have minimal access to clean water and sanitation. Information on utensils and hand washing, food cleaning and cooking and separation of raw and cooked foods becomes paramount. Although a strong perspective from public health officers was that community health volunteers could be trained as trainers on cooking and hygiene handling, it emerged that this has not been effectively done across the prone regions.

Technical and scientific capacity building for those charged with, among other things, recovery and rehabilitation and conducting training and evacuation drills should be done. Care must always be taken not to expose the vulnerable even more during such drills but must ensure they, alongside the caregivers, obtain knowledge, expertise and lessons in dealing health matters following droughts and floods.

Drought devastates wealth, exposing pastoralists to trauma/mental ill-health. Those living in drought-prone areas are advised to diversify income sources by venturing into alternative income-generating enterprises besides pastoralism, have more drought-resistant animals, and sell animals before they die to prevent suffering total loss of wealth during droughts. Moreover, public-private partnerships (PPPs) for the involvement of the private sector in enterprise development, in addition to early warning and preventive measures is necessary, covering awareness about related diseases, how to prevent infection and spread, and how to treat and/or give First Aid. Such capacity building programmes should be encompassed in the health sector plans as observed in the Hyogo Framework of Acton, but this has not been the case.

7.3 Policy gaps

Although Kenya has a National Disaster Management Policy, the country and the counties lack a specific policy for disaster preparedness. Moreover, with NDMA, Kenya is more prepared for drought but not for floods and associated disease outbreaks. An NDMA-like institution with a mandate to manage risks posed by floods is essential, cascaded to the counties. Such institutions should have a unit that works closely and in a well-coordinated manner with the Ministry of Health to study all aspects of health right from the risks, prevention, preparedness, response and recovery.

Health policy not adequate: The country has a Health Disaster Strategic Plan and a Health Policy. However, they fail to link the communicable and non-communicable diseases to some of the root causes such as droughts and floods. The health sector cannot fight or reduce the prevalence of diseases without due cognizance of the root impetus. The Health Policy should therefore include prevention, preparedness, response and recovery measures with respect to diseases emanating from droughts and floods for effective control and resilience, taking note that NCDs are exacerbated by exposure during these events.

Policy on fragile land and corrupt practices: Tendencies to ignore and break the law and/or bribe law keepers to look the other way were highlighted as major problems that indirectly lead to the health effects of droughts and floods. Moreover, structures that are below the required standards often are approved, and building rules and regulations are not followed. Walls and buildings are constructed across waterways and on sensitive grounds, and licenses are illegally issued to cut down trees thus causing deforestation among other ills. It is such walls and buildings that constantly pose health hazards as they cause flooding and/or collapse on people causing injuries and deaths. Policies should be enhanced and implemented to the letter to firmly ensure no construction or settlement on sensitive grounds such as river lines, stormwater says, wetlands, etc. The laws against poor construction methods and engineering works should be strictly followed to minimize the occurrence of collapsed buildings and injuries that emanate. Faulty buildings should be condemned without fear or favour. Those already living in sensitive areas and condemned buildings should be enlightened on what they need to do to minimize injuries and evacuated. County Governments should map out vulnerable areas and waterways and lift any titles to such land or buy the land and convert it to county ownership/public land, ensure no construction takes place there and prosecute corrupt officers allocating such land or allowing construction there. Such land should be set aside for forests/public parks to reduce health risks and effects of floods.

Policy on environmental conservation: National and County Governments were found to be inadequately proactive in dealing with droughts and floods, and especially their risks and effects on health. Both levels of government and all stakeholders down to communities and households, it was noted, require deliberate policies to guide in afforestation and reforestation, which will reduce frequency and severity of floods and droughts and related health risks and effects. For long-term measures of reducing health risks and effects of droughts and floods, there is need to integrate preventive measures not only in the environment policy but also in the education and health policies.

Policy of food security for nutrition and health: Food is a human right. In many cases, food security is measured based on grain, ignoring the fact that food from animals also adds to food security. In the food security policy, to reduce malnutrition and poor health especially in the ASALs, improvement in production of animals and securing animal-based food sources should be given serious consideration.

Policy on facilities: Lower hospital levels were found to be more popular for floods and drought-related illness that often require quick attention. Their popularity is partly due to their location nearer to the people and partly because they charge less as compared to higher hospital levels, which are fewer and far apart and charge more for treatment due to health effects of droughts and floods. The Ministry of Health and county health department will need to nationally roll out Universal Health Coverage (UHC) to take care of this while placing lower-level facilities at the centre of focus, adequately staffing, supplying and equipping them to save Kenyans cost of travel when seeking healthcare services. This will remove the need to patronize expensive private health facilities or higher-level public health facilities, which will not only save on cost but will also curtail the spread of contagious diseases during movement, since lower-level facilities can be reached faster and sooner given their closer proximity to the people.

Policy on displacement camps: During drought in the ASAL, able-bodied men move with the animals in search of pasture, leaving behind women, children, the elderly and the sick, who become highly vulnerable as drought intensifies. It would be very easy to provide treatment, food, water and other needs if these vulnerable members of affected communities are in accessible locations that can be termed as 'drought displacement camps', which may then be disbanded when normalcy resumes. Any diseases associated with droughts can then be prevented since, in such camps, water can be availed more easily to reduce use of contaminated water, and hygiene can be observed better hence fewer drought-related health cases. Although a disease outbreak can easily spread in such a camp, standby health workers on high alert and ready with all medical resources, including vaccines can more effectively and efficiently contain any such outbreaks.

From cyclical experiences, it is now possible to know when to expect floods, how severe they are likely to be and hotspots. In each flood-prone neighbourhood, a well-located social hall, school, church, mosque and other such public facilities on high grounds should be identified as the flood displacement camp, in preparedness for dire effects of floods especially on health and to save lives. This should then be equipped with high storage tanks and filled with treated water when a flood alert is released. In addition to water, other required materials such as camping equipment, drugs, food, blankets, treated mosquito nets and other supplies such as spray equipment and chemicals should be placed here or within accessible locations. Most floods displacement camps have inadequate toilets and emergency pit latrines, while others collapse if soil is sandy. Mobile toilets are often not available leading to sanitation challenges. If displacement camp locations are formalized, a permanent solution can be found through concrete latrines, which are preserved when camp is broken. Since episodes of drowned animals have been experienced, a livestock holding ground with feeds should also be identified and not too far off the one for people. This will give the livestock owners peace of mind and assure them of continued livelihood and food security after the floods.

Policy on immunization and sensitization on hygiene: Immunization against some of the diseases that easily break out during droughts and floods, such as measles, cholera, typhoid, hepatitis A and B should be conducted alongside health education as a preventive measure. Intensive and extensive sensitization on water handling to avoid associated health risks is paramount whether in camps or at home. Such preventive measures can save the government resources incurred on treatment besides lost lives, missed school and labour force man-hours. Areas with a high-water table such as Wajir town, Mombasa, Kwale, Kilifi, Homa Bay and Kisumu, where water wells and latrines communicate, should receive treated water or treatment tablets and education and sensitization on how to use them to minimize consumption of untreated water that causes waterborne diseases, especially during floods.

Policy on control and eradication of diseases: Heavy rainfall and flooding combined with high temperatures encourages many related health problems, including increased mosquito breeding areas. For effective preventive measures, pesticide for larvae siding and spraying the leafy areas soon after the rainy season should be availed to reduce infestation and related diseases. Community participation is critical for widest reach and for identification of hotspots. Regarding intestinal worms, the school-based programme and sensitization on sanitation and hygiene should be expanded/enhanced for eradication of worms in school going children in endemic areas. Efforts by some churches in distributing deworming tablets to their congregations should be recognized as an important strategy, emulated, deepened

and widened by encouraging all places of worship to adapt the strategy to reach adults and children not in school/during holidays.

Policy on promotion of sanitation technology: Counties should have a policy to assist households embrace bio-sanitation and culvert toilets technology. These will not only prevent resource wastage as pit latrines collapse but will also reduce diseases associated with contamination of wells and groundwater. Additionally, they will also promote biogas production, a renewable energy that promotes environmental conservation as less trees are cut, reduces diseases associated with fuel pollution, and reduces poverty from saved resources and improved health.

Policy on culture and religion: Some negative cultural/religious practices are known to affect health during droughts/floods. Sensitization for attitude change discourages some of these practices and should be enhanced. A strong unit is needed comprising educators and health professionals to educate and sensitize people on these harmful practices, which should comprise well trained community health workers and volunteers. This will help reduce some of the health effects of droughts and floods. Prosecution of those breaking health set rules will also discourage the negative practices, especially those that risk the lives of children.

Policy on improved social protection: Food and water may not reach all in need all the time and promptly, mostly due to damaged infrastructure, flooding and corruption, worsening malnutrition and health. At times, what is issued as food aid is not in the regular diet of the recipient and may not be helpful. Use of M-Pesa as an alternative to food distribution was said to reduce cost, increase speed, close the corruption points and give people the option to buy what they need/prefer to consume while promoting the local economies. Prosecution of the corrupt that misappropriate relief food and other materials resonated across all areas.

Policy on crisis versus risk management: The National and County Governments dwells more on drought and floods crisis management rather than risk managements. Proactive actions bring better results than re-active actions. Resources should be redirected from impact definition to risk identification, appraising options of reducing these risks, making appropriate decisions and taking actions to manage the risks. This will save resources spent on costly reduction of consequential effects through recovery actions and listing of lessons learnt, to actual risk reduction through understanding and undertaking the most applicable preventive interventions. Responsible government agencies should conduct continuous assessment and surveillance and be prepared way before the event by having the requisite resources on standby. This entails assessing associated costs compared to cost of impacts if no intervention is made, identifying responsible organs and developing clear communication strategies between them and the public through concerted plans and systematic information dissemination and

coordination. Key messages must dwell on likelihood of drought or floods, health risks and likely effects, preventive, preparedness, response and recovery measures, which are participatory for ownership and to harness community knowledge. Data should be well kept at all stages for ease of monitoring and evaluation.

The starting point is law enforcement. Prevention encompasses enlightening those living in such areas on what they need to do to minimize injuries. Preparedness includes enlisting agencies that would help rescue the injured, response involves giving First Aid, evacuating the injured to health facilities and assisting survivors meet basic needs. The health facilities should be ready with adequate capacity to deal with and all health needs in terms of human resources, equipment and supplies. All this should be done within a seamless coordination mechanism.

7.4 Summary

1. Resources are required to ensure the health risks and effects of droughts and floods are prevented, prepared for, responded to and recovered from. Since resources are often scarce, all players should plan and work together for most efficient and effective utilization.
2. Capacity of health facilities, human resources for health and officers responsible for coordination is essential for efficiency and effectiveness of all required actions of prevention, preparedness, response and recovery.
3. Revision of existing policies and development of new one with detailed guiding standards and principles is essential in reduction of health risks and effects of droughts and floods.

8. Conclusion and Recommendations

8.1 Conclusion

Droughts and floods have become more frequent and their health effects increasingly more severe. With drought being a prolonged period devoid of precipitation while floods can either be excessively swift water from torrential rain that causes damage in its path or still water that submerges normally dry land, livelihoods get significantly disrupted by both conditions, with serious health ramifications.

During droughts, a host of water, air, dust, vectors and food borne diseases proliferate due to poor sanitation and hygiene. Hygiene is compromised as limited water is scaled and hence hands, household utensils and surfaces and foods especially vegetables are not effectively cleaned. Moreover, as water levels in water sources decline, concentration of bacteria and pathogens increase and especially in sources shared with domestic animals. This exposes people to a horde of diseases including cholera, typhoid, dysentery, intestinal worms, eye and skin conditions, among others. High winds and dust propel bacteria, causing respiratory diseases such as pneumonia and asthma. Lack of food due to crop failure causes malnutrition (stunting, wasting, marasmus and kwashiorkor in children), wasting and weakened immunity in adults.

Floods from excessive rain lead to health risk of water, vector, air and rodent borne diseases such as cholera, dysentery, hantavirus, salmonellosis, typhoid, rotavirus, bilharzia, intestinal worms, malaria, dengue fever, rift valley fever, yellow fever, zika virus, chikungunya and upper and lower respiratory tract infections, among others. Additionally, floods cause injuries that arise from landslides, collapsed walls and buildings, obstacles while walking in water; bites from displaced crocodiles, snakes, spiders and scorpions that seek refuge in dwellings; and accidents that arise from damaged roads and bridges. Poor access to health facilities to offer or seek healthcare services worsens the health conditions.

Exposure to droughts and floods increases health risks and effects while severity of the effects depends on information flow for prevention and preparedness, available resources for response and recovery activities and moderating practices that modify the risks and absorb the outcomes, thus averting health risks and emergencies. Buffering as a response to the exposure entails social protection, dietary diversity and stocking health facilities. When droughts and floods lead to a change in functionality, response in the form of mobile health facilities, temporary shelter, relief food, water, clothes and beddings become essential. However, this turns into a disaster and a state of emergency is declared, emergency rescue and evacuation activities become necessary and can avert the health risks and effects.

This requires good coordination and resources for provision of necessary materials including household items that avert further exposure in addition to continuing with medical camps to avert delayed disease outbreaks while managing chronic diseases.

Risk assessment and management strategies prevent health effects from becoming emergencies. These include early warning and awareness creation for prevention and preparedness, quick and appropriate response for damage control, and recovery measures to bring people back to usual status or better. Therefore, to reduce the effects of droughts and floods on health, prevention, preparedness, response and recovery are key measures that must be taken. If the actors dealing with the health effects of drought and floods that include National and County Governments, international development partners, non-governmental organizations, the private sector and members of the community were acting together in a coordinated system, their actions would be more efficient and effective. This study established that although these are known facts in areas of Kenya prone to droughts and floods, there are gaps in implementing these measures. These measures have not been effectively undertaken in Kenya because government agencies and other institutions credited with prevention, preparedness, response, recovery and coordination activities to the health effects of droughts and floods are not effective due to resource inadequacy, low capacity, gaps in policies and poor implementation, corrupt practices, among others. Consequently, policies, resources and actions to deter malpractices, improved resource allocation and utilization and enhanced capacity is needed to reduce health risks and effects of droughts and floods and prevent health emergencies.

8.2 Recommendations

Poor health including health effects of droughts and floods form the central pillar of high poverty and regressive economic growth. Although health care services are necessary, they are not always readily available or accessible in areas prone to droughts and floods. If Kenya is to progress economically, health risks and effects of droughts and floods must be addressed to prevent health emergencies that prevail every time these events occur. These can be effectively reduced through increased focus on prevention, preparedness, response and recovery measures and coordination mechanisms. All these should be guided by policy-based processes for best outcomes.

Health risks: To reduce risk of health effects of droughts and floods, focus by all actors, whether governmental or non-governmental, must be wide-ranging, covering not only response and to some extent recovery, but most importantly preventive and preparedness in a coordinated system.

Prevention: Given that a key preventive measure to droughts and floods is environmental conservation, which reduces likelihood of occurrence and consequently likelihood of diseases while preventive measures to health effects of droughts and floods are early warning information, immunization, sanitation and hygienic practices, these should receive significant focus by all actors. Low knowledge, poverty, lack of resources and poor utilization of available resources inhibit putting these measures into practice. Besides environmental conservation, immunization, hygiene and sanitation measures, poverty reduction and better resource utilization are therefore preventive measures to health risks and effects of droughts and floods.

Preparedness: Given that preparedness entail placing resources, materials and personnel on standby and in locations of likely need in anticipation of the likely health risks and effects of droughts and floods, identification of such places is paramount. This should be coupled with improved access to health facilities and healthcare services and insurance coverage for effective preparedness and hence reduction of health emergencies during droughts and floods.

Response: Effective response ameliorates the health effects of droughts and floods and hence substantial effort and investment should be made in response systems. For effectiveness, there should be concerted efforts by all actors in responding to droughts and floods and related health effects.

Recovery: For full recovery from the health effects of droughts and floods, the victims must be brought to the pre-event status and better, which depends on the resources and capacity of all actors and their willingness to pool resources and work together.

Coordination: Well-coordinated actions not only lower the risks but also increase efficiency and effectiveness of the actions taken. All activities related to droughts and floods and their health effects must therefore be well coordinated to ensure efficiency and effectiveness of all the actions and utilization of resources. This must start with preventive and preparedness activities to response and recovery actions by governmental and non-governmental actors. All must work together in identifying the needs, required resources, where these will come from, share roles and responsibilities according to their mandate, identify the lead and put in place a clear communication system.

Resources: To ensure the health risks and effects of droughts and floods are prevented, prepared for, responded to, recovered from, and well-coordinated, significant resources are required. Since these are often scarce, all players should plan and work together for most efficient utilization and consequently highest possible effectiveness. Adequate resources must be allocated to the health sector

and particularly the arm dealing with reduction of droughts and floods-related health risk and effects to prevent emergencies.

Capacity: For efficiency and effectiveness, there is need to give serious attention to capacity of health facilities, human resources for health and officers responsible for policy implementation and coordination of all required actions of prevention, preparedness, response and recovery.

Policies: It is paramount to close the knowledge and information gap, resource gap, and concerted effort by all actors. For this to be possible, it is critical to revise existing policies while also developing new ones with detailed guiding standards and principles. The success of all actions depends on frameworks that guide the process as contained in policies.

8.3 Further Research

This study combined the health effects of both droughts and floods. It is only with the strength of reviewed literature that an attempt was made to two effects. Further research is required seeking more intensive information of health effects suffered during each of floods and droughts. That way, better guidance and preventive measures required for each can be established.

It would also pay great dividends to conduct further research on mitigation measures taken at the household level and how to enhance them for improved health during each of droughts and floods.

References

Afifi, T., Govil, R., Sakdapolrak, P. and Warner, K. (2012), Climate change, vulnerability and human mobility: Perspectives of refugees from the East and Horn of Africa. Report No. 1. Partnership between UNU and UNHCR. Bonn: United Nations University Institute for Environment and Human Security (UNU-EHS).

Ahern M. R., Kovats S., Wilkinson P., Few R. and Matthies F. (2005), "Global health impacts of floods: Epidemiologic evidence". *Epidemiologic Reviews*, Vol. 27: Issue 1: 36–46, https://doi.org/10.1093/epirev/mxi004. Accessed on 20th April 2019.

Ali S.I., Ali S.S. and Fesselet J.F. (2015), Effectiveness of emergency water treatment practices in refugee camps in South Sudan. Accessed on 18th September 2018 from http://dx.doi.org/10.2471/BLT.14.147645.

Amek N., Bayoh N., Hamel M., Lindblade K.A., Gimnig J.E., Odhiambo F., Laserson K.F., Slutsker L., Smith T. and Vounatsou P. (2012), "Spatial and temporal dynamics of malaria transmission in rural Western Kenya". *Parasites and Vectors*, 5: 86.

Anders K.L. and Hay S.I., (2012), Lessons from malaria control to help meet the rising challenge of dengue. Elsevier. doi: 10.1016/S1473-3099(12)70246-3. Available from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3574272/.

Arrow K. and Peto R. (2005), Saving lives, buying time: Economics of malaria drugs in an age of resistance. Office of Health Economics (OHE) Annual Lecture Thursday 10 November 2005. London: OHE.

Asaka J. (2012), Water and land conflict in Kenya in the wake of climate change: New security beat. Blog of the Environmental Change and Security Programme. Accessed on 17th September 2018 from https://www.newsecuritybeat.org/2012/09/water-land-conflict-kenya-wake-climate-change/.

Asian Development Bank, GIWP, UNESCO and WWF-UK (2013). Flood risk management: A strategic approach. ADB, GIWP, UNESCO, WWF.

Baez J., Fuente A. and Santos I. (2009), Do natural disasters affect human capital? An assessment based on existing empirical evidence. IZA, Bonn. IZA DP No. 5164

Barbelet V. Samuels F. and Plank G. (2018), The role and vulnerabilities of older people in drought in East Africa: Progress, challenges and opportunities for a more inclusive humanitarian response. London: Overseas Development Institute.

Beerens R.J.J. (2007), Urban search and rescue: Preparedness and coordination when structures collapse. Maasbracht: Coventry University.

Benson C. (2009), Mainstreaming disaster risk reduction into development: Challenges and experience in the Philippines.

Breiman R.F., Cosmas L., Njuguna H., Audi A., Olack B., Ochieng J.B., Wamola N., Bigogo G.M., Awiti G., Tabu C.W., Burke H., Williamson J., Oundo J.O., Mintz E.D., Feikin D.R. (2012), "Population based incidence of typhoid fever

in an urban informal settlement and a rural area in Kenya: Implications for typhoid vaccine use in Africa". *PLoS ONE*, 7(1): e29119. doi:10.1371/journal.pone.0029119.

Brown G. (2012), Child labour and educational disadvantage: Breaking the link, building opportunity: A review.

Brown L. and Murray V. (2013). "Examining the relationship between infectious diseases and flooding in Europe. A systematic literature review and summary of possible public health interventions". *Disaster Health Journal*, v.1(2); Apr-Dec 2013 PMC5314884.

Cabral J.P.S. (2010), "Water microbiology: Bacterial pathogens and water". *International Journal of Environment Research and Public Health*, 7: 3657-3703; doi:10.3390/ijerph7103657.

CDC (2018), Preparing for the health effects of drought: A resource guide. Washington: Centre for Disease Control.

Chan, J.C. (2014), The role of social media in crisis preparedness, response and recovery: An in-depth analysis of emerging issues and trends.

Chotard S., Mason J.B., Oliphant N.P., Mebrahtu S., Hailey P. (2010). Fluctuations in wasting in vulnerable child populations in the Greater Horn of Africa. Downloaded on 6th September 2018 from http://journals.sagepub.com/doi/abs/10.1177/15648265100313S302.

Chretien J.P., Anyamba A., Bedno S.A., Breiman R.F., Sang R., Sergon K., Powers A.M., Onyango C.O., Small J., Tucker C.J., Linthicum K.J. (2006), "Drought-associated Chikungunya emergence along coastal East Africa". *The American Journal of Tropical Medicine and Hygiene*, Vol. 76, Issue 3, 1: 405-407. Accessed on 5th February 2020 from https://www.ajtmh.org/content/journals/10.4269/ajtmh.2007.76.405?crawler=true.

Cox P., Griffith M., Angles M., Deere D. and Ferguson C. (2005), "Concentrations of pathogens and indicators in animal feces in the Sydney watershed". *Applied and Environmental Microbiology*, 71(10): 5929-5934. doi:10.1128/AEM.71.10.5929-5934.2005.

Crossman N.D. (2018), Drought resilience, adaptation and management policy (DRAMP) Framework. Bonn: UNCCD.

Datar A., Liu J., Linnemayr S., Stecher C. (2012), *The impact of natural disasters on child health and investments in rural India*. Elsevier.

Development Initiative - DI (2017), "Assessment of Kenya's preparedness to disasters caused by natural hazards: Floods, drought and disease outbreak". Nairobi, DI.

Dewan A.M., Corner R., Hashizume M and Ongee E.T. (2013), "Typhoid fever and its association with environmental factors in the Dhaka metropolitan area of Bangladesh: A spatial and time series approach". PLoS Negl Trop Dis., 7(1): e1998.

Doocy S., Daniels A., Murray S., Kirsch T.D. (2013), "The human impact of floods: A historical review of events 1980-2009 and systematic literature review". *PLOS*

Currents Disasters. Edition 1. doi: 10.1371/currents.dis.f4deb457904936b07c09daa98ee8171a.

Douben K.J., (n.d.), *Floods and droughts in international rivers*. UNESCO-IHE Delft.

Du W., FitzGerald G.J., Clark M. and Hou X.Y. (2010), Health impacts of floods. Pre-hospital and disaster medicine. Accessed on 18th September 2018 from https://www.researchgate.net/publication/44807703.

Ebi K.L. and Bowen K. (2016), "Extreme events as sources of health vulnerability: Drought as an example". *Weather and climate extremes*, 11 (2016) 95-102.

Elliott, H. and Fowler, B. (2012), Markets and poverty in Northern Kenya: Towards a financial graduation model. Nairobi: Financial Sector Deepening Kenya.

European Centre for Disease Prevention and Control - ECDC and EU (2016), Assessing the yellow fever outbreak in Angola: 10-20 May mission report. European Medical Corps mission undertaken in the framework of the European Union Civil Protection Mechanism.

Fewster E. (2012), Resilient techniques to improve WASH in flood-prone areas. Care Nederland.

Floodlist News in Africa (2018), Kenya - Number of flood deaths rises to 186 after highest rainfall in 50 years. Downloaded on 28th August 2018 from http://floodlist.com/africa/kenya-flooding-death-toll-march-may-2018.

Fontalba-Navas A., Lucas-Borja M.E., Gil-Aguilar V., Arrebola J.P., Pena-Andreu J.M., Perez J. (2017), "Incidence and risk factors for post-traumatic stress disorder in a population affected by a severe flood". Public Health, 144: 96-102. doi: 10.1016/j.puhe.2016.12.015.

Friel S., Berry H., Dinh H., O'Brien L. and Walls H.L. (2014), The impact of drought on the association between food security and mental health in a nationally representative Australian sample. Downloaded on 5th February 2020 from https://bmcpublichealth.biomedcentral.com/track/pdf/10.1186/1471-2458-14-1102.

Frumkin H., Hess J., Luber G., Malilay J. and McGeehin M. (2008), "Climate change: The public health response". *American Journal of Public Health*, Vol. 98, No. 3.

Githeko A.K., Lindsay, S.W., Confalonieri, U.E. and Patz J. A. (2000), "Climate change and vector-borne diseases: A regional analysis". *Environment and Health*. Geneva: World Health Organization.

Government of Kenya (2007), Kenya Vision 2030: A globally competitive and prosperous Kenya. Nairobi: Ministry of State for Planning, National Development and Vision 2030.

Government of Kenya (2008), Kenya Vision 2030 - First Medium Term Plan (2008-2012). Ministry of State for Planning, National Development and Vision 2030, Nairobi.

Government of Kenya (2009), Draft National Policy for Disaster Management in Kenya. Nairobi: Ministry of State for Special Programmes. Accessed on 10th May 2017 from http://www.ifrc.org/docs/idrl/765EN.pdf.

Government of Kenya (2010a), Constitution of Kenya 2010. Nairobi: Government Press.

Government of Kenya (2010b), National Climate Change Response Strategy: Executive Brief. Nairobi: Ministry of Environment and Mineral Resources.

Government of Kenya (2012), Kenya Health Policy 2012-2030. Nairobi: Ministry of Medical Services and Ministry of Public Health.

Government of Kenya (2013), Kenya Vision 2030 - Second Medium Term Plan (2008-2012). Nairobi: Ministry of State for Planning, National Development and Vision 2030.

Government of Kenya (2016a), Social protection, culture and recreation sector report. Nairobi: Government Printer.

Government of Kenya (2016b), Kenya Environmental Sanitation and Hygiene Policy 2016-2030. Nairobi: Ministry of Health.

Government of Kenya (2017), Concept note on Medium-Term Plan 2018-2022. Nairobi: Government Printer.

Government of Kenya (2017b), National Disaster Risk Management Policy. Nairobi: Ministry of Interior and Coordination of National Government.

Government of Kenya (2018a). Kenya Vision 2030 - Third Medium Term Plan (2008-2012). Nairobi: Ministry of State for Planning, National Development and Vision 2030.

Government of Kenya (2018b), National Climate Change Action Plan (Kenya): 2018-2022. Vol. 3: Mitigation Technical Analysis Report. Nairobi: Ministry of Environment and Forestry.

Habib A.G. and Jumare J. (2008), "Migration, pastoralists, HIV infection and access to care: The nomadic Fulani of northern Nigeria". *African Journal of AIDS Research*, 7(2):179-86.

HPG and OCHA (2012), Responding to natural disasters: Coordination between national armies, regional organizations, and humanitarian actors in the Asia Pacific Region. Bangkok, OCHA.

Huho J.M., Mashara J.N., Musyimi P.K. (2016), "Profiling disasters in Kenya and their causes". *Academic Research International,* Vol. 7(1). Accessed on 28th August 2018 from https://www.researchgate.net/publication/293414597_Profiling_Disasters_in_Kenya_and_Their_Causes.

IDMC (2019), Africa report on internal displacement 2019. Accessed on 29th Jan 2020 from https://www.internal-displacement.org/sites/default/files/publications/documents/201912-Africa-report.pdf.

Intermediate Technology Development Group - ITDG (2005). Impact of HIV/AIDS among pastoral communities in Kenya. Nairobi: Futures Group Europe.

International Federation of Red Cross and Red Crescent Societies - IFRC and RCS (2000), Improving coordination: Disaster preparedness training programme. Geneva: IFRC and RCS).

International Federation of the Red Cross and Red Crescent Societies - IFRC (2008), Emergency appeal: Kenya floods. Accessed on 22nd August 2018 from http://www.ifrc.org/docs/appeals/08/MDRKE007PrelimEA.pdf.

International Federation of the Red Cross and Red Crescent Societies (2010), Emergency appeal: Kenya floods. Accessed on 22nd August 2018 from http://www.ifrc.org/docs/appeals/10/MDRKE012PEA.pdf.

Kang'ethe W.G. (2006), Agricultural development and food security in Sub-Saharan Africa (SSA): Building a case for more public support. The Case of Kenya. Working Paper No. 03: Rome: FAO.

Kariuki S., Revathi G., Kiiru J., Mengo D.M., Mwituria J., Muyodi J., Munyalo A., Teo Y.Y., Holt K.E., Kingsley R.A.and Dougan G. (2010), 'Typhoid in Kenya is associated with a dominant multidrug-resistant salmonella enterica Serovar Typhi Haplotype that is also widespread in Southeast Asia". *Journal of Clinical Microbiology*, Vol. 48, No. 6. doi:10.1128/JCM.01983-09. Epub 2010 April 14.

Kenya Wildlife Services - KWS (2009), The impact of the 2009 drought on wildlife, livestock and tourism in the Amboseli ecosystem: Recommendations for prompt action and ecosystem restoration: Proceedings of the Amboseli Ecosystem worKshop. KWS, Amboseli.

Killick-Kendrick R. (2013), "The race to discover the insect vector of kala-aza". *Bulletin De La Société De Pathologie Exotique*, 106:131-137. Accessed on 5th February 2020 from http://www.pathexo.fr/documents/articles-bull/131490131.pdf.

KIPPRA (2018), Droughts and floods survey. Nairobi: Kenya Institute for Public Policy Research and Analysis.

KNBS (Various), Statistical Abstract. Nairobi: Government Printer.

KNBS (2018), Kenya Integrated Housing Budget Survey 2015-16 (KIHBS): Basic Report. Nairobi: Government Printer.

Knutson C., Hayes M. and Phillips T. (1998), How to reduce drought risk. Western Drought Coordination Council - WDCC.

Konrad C.E. and Knox P. (2018), The southeastern drought and wildfires of 2016. National Integrated Drought Information System (NIDIS), Boulder.

Linthicum K.J, Anyamba A., Tucker C.J., Kelley P.W., Myers M.F., Peters C.J. (1999), "Climate and satellite indicators to forecast Rift Valley Fever epidemics in Kenya". *Science*, Vol. 285, Issue 5426: 397-400 doi: 10.1126/science.285.5426.397.

Longley C. and Wekesa M. (2008), An analysis of Kenya's drought response system: Lessons from drought response in pastoral areas. Humanitarian Policy Group. London: Overseas Development Institute.

Lubchenco J. and Karl T.R. (2012), Predicting and managing extreme weather events.

Maclean J.C., Popovici I. and French M.T. (2016), "Are natural disasters in early

childhood associated with mental health and substance use disorders as an adult?" *Social Science and Medicine Journal*, Vol. 151: 78-91 Downloaded on 19th December 2018 from https://www.sciencedirect.com/science/article/pii/S0277953616300065.

Maoulidi M. (2010), Water and sanitation needs assessment for Kisumu City, Kenya. Conference Paper. MCI Social Sector Working Paper Series No. 12/2010, The Earth Institute, Columbia University.

Mason J.B., Chotard S., Cercone E., Dieterich M., Oliphant N.P., Mebrahtu S., and Hailey P. (2010), Identifying priorities for emergency intervention from child wasting and mortality estimates in vulnerable areas of the Horn of Africa. Downloaded on 6th September 2018 from http://journals.sagepub.com/doi/pdf/10.1177/156482651003l3S303.

Mateche D. E. (2011), The cycle of drought in Kenya a looming humanitarian crisis. Nairobi: Environmental Security Programme, Institute of Security Studies.

Mbogo E., Inganga F., Maina J.M. (2014), Drought conditions and management strategies in Kenya.

Miguel E. and Kremer M. (2002), Worms: Identifying impacts on health and education in the presence of treatment externalities. Downloaded from https://wcfia.harvard.edu/files/wcfia/files/625_worms_econometrica_12.22.02.pdf on 4th September 2018.

Mirsaeidi M., Motahari H., Khamesi M.T., Sharifi A., Campos M. and Schraufnagel D.E. (2016), "Climate change and respiratory infections". *Annals ATS*, Vol. 13 No. 8. Downloaded on 14th December 2018 from https://www.atsjournals.org/doi/10.1513/AnnalsATS.201511-729PS.

Mugo P., Onsomu E., Munga B., Nafula N., Mbithi J. and Owino E. (2018), Assessment of healthcare delivery in Kenya under the devolved system. KIPPRA Special Paper No. 19/2018. Nairobi: Kenya Institute for Public Policy Research and Analysis.

Mwaguni S.M. (2002), Public health problems in Mombasa District: A case study on sewage management. Nairobi: Nairobi University.

Nairizi S. (2017), Irrigated agriculture development under drought and water Scarcity. New Delhi: ICID.

National Malaria Control Programme - NMCP, Kenya National Bureau of Statistics - KNBS, and ICF International (2016), Kenya Malaria Indicator Survey 2015. Nairobi, Kenya, and Rockville, Maryland, USA: NMCP, KNBS, and ICF International.

NCPD (2015), Reducing maternal deaths in Kenya: Policy brief. Nairobi: National Council for Population and Development.

Ngaka M. (2012), "Drought preparedness, impact and response: A case of the Eastern Cape and Free State provinces of South Africa". *ResearchGate*, DOI: 10.4102/jamba.v4i1.47.

Niekerk D. and Nemakonde L.D. (2017), "Natural hazards and their governance in Sub-Saharan Africa". *Oxford Research Encyclopedia of Natural Hazard Science*. DOI: 10.1093/acrefore/9780199389407.013.230. Accessed on 18th September 2018 from http://naturalhazardscience.oxfordre.com/view/10.1093/acrefore/9780199389407.001.0001/acrefore-9780199389407-e-230.

Njoka J. T., Yanda P., Maganga F., Liwenga E., Kateka A., Henku A., Mabhuye E., Malik N., Bavo C. (2016). Kenya: Country situation assessment. Working paper. Nairobi.

Njuguna J. and Muruka C. (2017). "Open defecation in newly created Kenyan counties: A situational analysis". *Journal of Health Care for the Poor and Underserved*, 28: 71-78.

OCHA (2017), Horn of Africa: A call for action. UN Office for the Coordination of Humanitarian Affairs. Access on 8th April 2019 from https://reliefweb.int/report/ethiopia/horn-africa-call-action-february-2017-enar.

OCHA (2018), Flash update #3: Floods in Kenya. Downloaded on 11th April 2019 from https://reliefweb.int/report/kenya/ocha-flash-update-3-floods-kenya-04-may-2018.

Okaka F.O. and Odhiambo B.D.O. (2018), "Relationship between flooding and outbreak of infectious diseases in Kenya: A review of the literature". *Journal of Environmental and Public Health*. Accessed on 29th January 2020 from http://downloads.hindawi.com /journals/jeph/2018/5452938.pdf on.

Omosa E. K. (2005), The impact of water conflicts on pastoral livelihoods: The case of Wajir District in Kenya. Nairobi: International Institute for Sustainable Development - IISD.

Opryszko M.C., Guo Y., MacDonald L., MacDonald L., Kiihl S. and Schwab K. J. (2013), Impact of water-vending kiosks and hygiene education on household drinking water quality in rural Ghana. American Journal of Tropical Medicine and Hygiene, 88(4): 651-660.

Organization for Economic Development - OECD and World Health Organization - WHO (2003), *Poverty and health*. Paris: Organization for Economic Development and Cooperation.

Pan American Health Organization - PAHO/WHO (2004), Management of dead bodies in disaster situations. Disaster Manuals and Guidelines Series, No. 5. Washington DC: PAHO/WHO.

Phillip D. and Rayhan I. (2004), Vulnerability and poverty: What are the causes and how are they related? Bonn, ZEF.

PRISE (2016), *Kenya: Country situation assessment*. Nairobi: PRISE.

Rain D., Engstrom R., Ludlow C. and Antos S. (2011), Accra Ghana: A city vulnerable to flooding and drought-induced migration. Nairobi: UN-Habitat.

Reliefweb (2016), La Niña events impacts Eastern and Southern Africa. Blog. Accessed on 29th January 2020 from https://reliefweb.int/report/malawi/la-ni-events-impacts-eastern-and-southern-africa.

Rogers D. and Tsirkunov V. (2010), Cost and benefits of early warning. ISDR and World Bank. Accessed on 18th September 2018 from https://www.preventionweb.net/english/hyogo/gar/2011/en/bgdocs/Rogers_and_Tsirkunov_2011.pdf.

Sana R. and Khattak S.R. (2014), Prevalence of post-traumatic stress disorder in flood affected population of Banda Sheikh Ismail, District Nowshera. JPMI Vol. 28 No. 1.

Saulnier D.D., Brolin Ribacke K., von Schreeb J., (2017), "No calm after the storm: A systematic review of human health following flood and storm disasters". *Prehospital and Disaster Medicine*, 32(5): 568-579.

Saulnier D. D., Hanson C., Ir P., Alvesson M. H. and Schreeb J. (2018), "The effect of seasonal floods on health: Analysis of six years of national health data and flood maps dell". *International Journal of Environmental Research and Public Health*, 15: 665.

Sena L., Kifle W.M. (2006), Disaster prevention and preparedness: Lecture notes for health science students. Ethiopia Public Health Training Initiative (EPHTI) and USAID.

Sharifi S. (2013), Education of nomad children in the north and east of Afghanistan: Models, challenges and opportunities. Karlstad: Karlstad University.

Sinisi L. and Aertgeerts R. (eds). (2011), Guidance on water supply and sanitation in extreme weather events. WHO Regional office for Europe.

Snyder M., (2018), Displaced population and the threat of disease. Outbreak Observatory. https://www.outbreakobservatory.org/outbreakthursday-1/1/4/2018/displaced-populations-and-the-threat-of-disease.

Stanke C, Kerac M, Prudhomme C, Medlock J, Murray V. (2013), "Health effects of drought: A systematic review of the evidence". *PLOS Currents Disasters*, Edition 1. doi: 10.1371/currents.dis.7a2cee9e980f91ad7697b570bcc4b004.

Sun R., An D., Lu Wei, Shi Y., Wang L., Zhang C., Zhang P., Qi H. and Wang Q. (2016), Impacts of a flash flood on drinking water quality: Case study of areas most affected by the 2012 Beijing flood. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4945966/.

Tapsell S.M., Penning-Rowsell E.C., Tunstall S.M. and Wilson T.L. (2002), "Vulnerability to flooding: Health and social dimensions". The Royal Society. 10.1098/rsta.2002.1013.

The Mentor Initiative and USAID (2016), *Integrated vector management in humanitarian emergencies: Toolkit*. London: The Mentor Initiative.

Tole M.P. (1997), Pollution of groundwater in the coastal Kwale District. Sustainability of water resources under increasing uncertainty. Proceedings of the Rabat Symposium S1, April 1997). IAHS Publ. No. 240, Kenya, School of Environmental Studies, Moi University.

UNICEF (2018), Kenya Humanitarian Situation Report. Nairobi: UNICEF.

United Nations - UN (2008), *Achieving sustainable development and promoting*

development cooperation. New York: United Nations

UNDP (n.d.). *Kenya natural disaster profile*. Accessed on 14th September 2018 from http://meteorology.uonbi.ac.ke/sites/default/files/cbps/sps/meteorology/Project%20on%20Disasters.pdf.

UNESCO (2016), *Drought risk management: A strategic approach*. Paris: UNESCO.

UNHabitat (2014), The state of African cities 2014: Re-imagining sustainable urban transitions. Nairobi: UNHabitat.

UNISDR Africa (2012), Training package on natural hazards and early warning for training of trainers' in Kenya. Nairobi: UNON.

UNISDR (2005), The Hyogo framework of action 2005-2015. Geneva: UNISDR.

UNISDR (2009), Drought risk reduction framework and practices: Contributing to the implementation of the Hyogo Framework for Action. Geneva: UNISDR.

UNISDR (2014), Annual Report 2014. Geneva: UNISDR.

UNISDR (2015), Sendai Framework for Disaster Risk Reduction 2015-2030. Geneva: UNISDR.

Venton, C.C., Fitzgibbon, C., Shitarek, T., Coulter, L. and Dooley, O. (2012), The economics of early response and disaster resilience: Lessons from Kenya and Ethiopia. Retrieved from http://www.fao.org/fileadmin/user_upload/drought/docs/Econ-Ear-Rec-Res-Full-Report%20.pdf on 10th May, 2017.

Walker-Springett K., Butler C. and Adger N.W. (2017), "Well-being in the aftermath of floods". *Elsevier, Health and Place*, 43: 66-74.

WHO (2003), "Heterotrophic plate counts and drinking-water safety". J. Bartram, J. Cotruvo, M. Exner, C. Fricker, A. Glasmacher (eds). *Public health risk assessment and interventions: Flooding disaster in Nigeria*. Geneva: WHO.

WHO (2011), *Guidance on water supply and sanitation in extreme weather events*. Edited by Sinisi L. and Aertgeerts R. Geneva: WHO.

WHO (2013). Improved school-based deworming coverage through intersectoral coordination: The Kenya. WHO Regional Office for Africa, Brazzaville.

WHO (2014), Floods and health: Fact sheets for health professionals. Copenhagen: WHO Regional Office for Europe.

WHO (2015), Investing to overcome the global impact of neglected tropical diseases: Third WHO report on neglected diseases 2015. Geneva: WHO.

WHO (2017a), *World Health Organization fact sheet on cholera: Emergencies, preparedness and response – Disease outbreak news*. Geneva: WHO.

WHO (2017b), *World Health Organization fact sheet on West Nile virus*. Accessed on 5th February 2020 from https://www.who.int/news-room/fact-sheets/detail/west-nile-virus.

WHO (2018). *Fact sheet on drinking water*. Geneva: WHO. Downloaded on 12th April 2019 from https://www.who.int/news-room/fact-sheets/detail/drinking-water.

World Bank (2016), Kenya urbanization review. Report No: AUS8099. Washington

DC: World Bank.

World Vision International Global Health Nutrition Centre of Expertise (2012), Supporting breastfeeding in emergencies: The use of baby-friendly tents. Nairobi: World Vision International.

WSP (2014), Kenya county sanitation profiles. Nairobi: Ministry of Health.

Wu X., Lu Y., Zhou S., Chen L. and Xu B. (2015), Impact of climate change on human infectious diseases: Empirical evidence and human adaptation. Downloaded on 14th December 2018 from https://www.sciencedirect.com/science/arti Africa Report On Internal Displacement 2019 cle/pii/S0160412015300489?via%3Dihub.

Annex

Annex Table 1: ASAL and flood-prone counties selected for droughts/ Floods survey

S. No.	Code	County	S. No.	Code	County
1	101	Nairobi	15	502	Wajir
2	301	Mombasa	16	503	Mandera
3	302	Kwale	17	601	Siaya
4	303	Kilifi	18	602	Kisumu
5	304	Tana River	19	604	Homa Bay
6	306	Taita Taveta	20	701	Turkana
7	401	Marsabit	21	702	West Pokot
8	402	Isiolo	22	703	Samburu
9	404	Tharaka Nithi	23	705	Baringo
10	405	Embu	24	707	Elgeyo Marakwet
11	406	Kitui	25	709	Laikipia
12	407	Machakos	26	711	Narok
13	408	Makueni	27	712	Kajiado
14	501	Garissa	28	804	Busia

Annex Table 2: Incidences of droughts and floods in Kenya from 1975 to 2018

Year	Type	Where	Effects
1975	Drought	Widespread	16,000 people affected
1977	Drought	Widespread	20,000 people affected
1980	Drought	Widespread	40,000 people affected
1982	Floods	Nyanza	4,000 people affected
1983/84	Drought	Widespread	200,000 people affected
1985	Floods	Nyanza/Western	10,000 people affected
1991/92	Drought	ASAL districts of North Eastern, Rift Valley, Eastern & Coast regions	1.5 million people affected
1995/96	Drought	Widespread	1.41 million people affected
1997/98	Floods	Widespread (El Nino)	1.5 million people affected, epidemic of Rift Valley Fever
1999/2000	Drought	Widespread	4.4 million people affected
2002/3	Floods	Nyanza, Busia, and Tana River Basin	150,000 people affected
2002	Landslides	Meru Central, Murang'a, Nandi	2,000 people affected
2004	Landslides	Nyeri/Othaya Kihuri	5 people dead

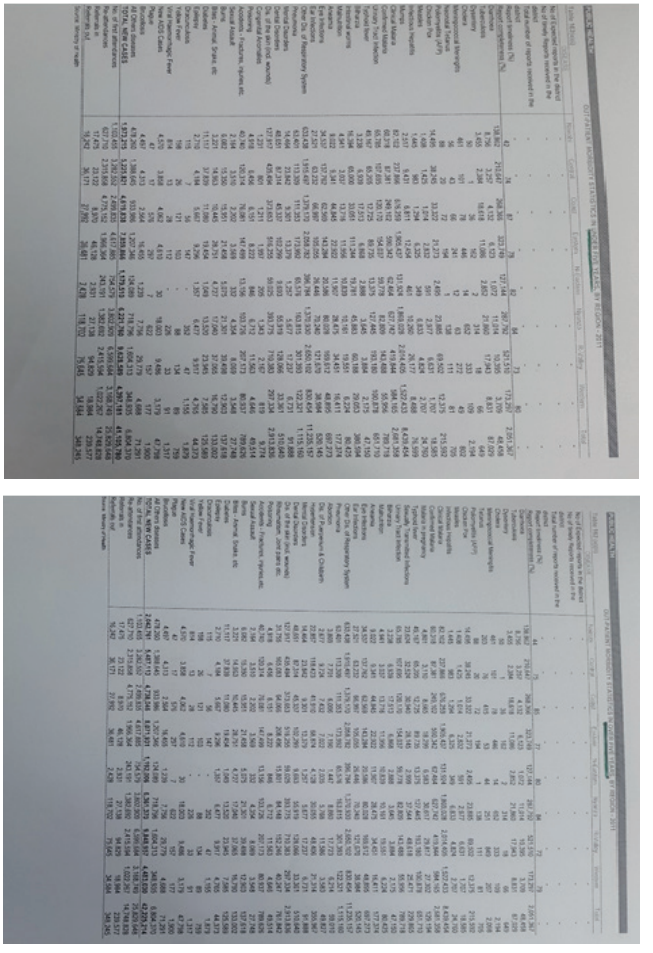
2004	Droughts	Widespread	3 million people affected and in need of relief aid for 8 months to March 2005. 70% loss of livestock in some pastoral communities
2005	Drought	Widespread	30-40% loss of livestock in Northern Kenya
2005	Drought	Widespread	2.5 million people close to starvation. Declared a national disaster
2006	Floods	Widespread	7 deaths, 6,500 people displaced
2006	Drought	Widespread	40 human lives lost and about 40% cattle, 27% sheep and 17% goats lost
2007/8	Drought	Widespread	4.4 million people affected, 2.6 million people at risk of starvation; up to 70% loss of livestock in some pastoral communities; 3.5 million in need food by September
2008	Floods	Budalangi, Rift Valley, Kitale, Makueni, Mwala/ Kibwezi	24 people killed; 2,396 affected
2009	Drought	Widespread	70-90% loss of livestock by Maasai pastoralists
2010	Floods	Budalangi, Mt Elgon, Samburu, Tana River, Turkana	73 killed, 14,585 people affected 3,000 people buried, property destroyed
2011	Drought	Marsabit, Nairobi, Turkana, Samburu	4.3 million people were in dire need of food
2012	Floods	Nyanza/Western	84 people killed, 30,000 displaced About 280,000 people affected countrywide
2012	Drought	Widespread	3.75 million people in dire of food by July 2012
2013	Floods	Tana River County	82,000 people displaced
2014	Floods	Narok Town, Nairobi City	Property and infrastructure destroyed
2015	Floods	Widespread	15 people killed, thousands displaced
2016	Floods	Nairobi, Turkana counties	26 people dead from collapsed building in Nairobi, 1,000 people in Turkana County left homeless
2017	Drought	Widespread	3.4 million people severely food insecure; 3.9 Million people in need
2018	Floods	Widespread	186 people killed, 100 injured, 800,000 affected, 300,000 displaced

Annex Table 3: Some actors in alleviating health and related effects of droughts and floods in Kenya

	Actor	Activities	Coverage
1	Action Against Hunger	Nutrition, water and sanitation	Isiolo, Kakamega, Tana River, West Pokot, Trans Nzoia, Busia, Bungoma Nairobi
2	Action Aid	HIV/AIDS, Food security, Education	National
3	ADRA	Food security, Education, Health	National
4	ACID	Maize development programme, building smallholder capacity	National
5	AMREF	Healthcare, HIV/AIDS	National
6	Care	HIV/AIDS, emergency and relief operations, smallholder commercialising activities	National
7	CARITAS	Poverty reduction; conflict resolution; gender disparity; response to disasters and emergencies; emerging needs	National
8	Catholic Relief Services	HIV/AIDS, food security, strengthening civil society, governance, education	National
9	COOPI	Water, healthcare, education, food security, Slum upgrading	Nairobi, Northern Kenya
10	Christian Children's Fund	HIV/AIDS, health and sanitation, education, childhood development, sustainable livelihood development, emergency response	National
11	Concern Worldwide	Health, education, emergency response	Nairobi, Marsabit
12	Christian Aid	HIV/AIDS, climate	National
13	EPAG - Kenya	Food security; Drought mitigation; Research, capacity building, advocacy (HIV/AIDS, FGM, youth and women empowerment, Gender equity, Livestock marketing)	Mandera, Wajir
14	Family Health International	HIV/AIDS, health services	National
15	Handicap International	Disability, health and disease prevention, income generating activities	Nairobi, Garissa
16	Handicap International	Disability, health and disease prevention, income generating activities	Nairobi, Garissa
17	Islamic Relief	Food security, WASH, health, Education, Micro-finance, Environment, Conflict Resolution	Nairobi, Mandera, Wajir, Garissa
18	Northern Aid	Food security; water, sanitation & health (WASH); peace & conflict management, and emergency response	Northern Kenya
19	Pastoralist Against Hunger	Food Security	Mandera
20	Plan International	Children Rights: marriage, labour, trafficking, FGM, violence against children	Nairobi, Machakos, Kajiado, Tharaka Nithi, Busia, Kisumu, Homabay, Mombasa, Siaya, Kilifi, Taita Taveta, Kwale, Marsabit
21	Oxfam	Education, human rights, peace building, sustainable livelihoods, food security	Nairobi, and Northern Kenya

22	Red Cross	Famine, health (blood donor services, first aid training), education related humanitarian needs, disaster and emergency response.	National
23	Safe the Children	HIV/AIDS, water and sanitation, education, food security	National
24	SIKOM Peace Network Development	Conflict management and promotion of peace	West Pokot and Turkana
25	Solidarities International	Water and food security, health, emergencies	Marsabit
26	St John Ambulance	First aid and Ambulance services	National
27	Green Belt Movement	Capacity building, environmental conservation	National
28	Trocaire	Emergency response, human rights, education, sustainable livelihoods	Kitui, Laikipia, Mbeere, Meru, Nyeri, Tana River, Tharaka and Turkana,
29	Terra Nuova	Natural resources management and conservation, urban youth	Nairobi, pastoral semi-arid regions
30	VSF - Suisse	Livelihoods, food security though camel development	Nairobi, Mandera, Isiolo
31	World Vision	Health and nutrition, education and child protection, WASH, and food security, livelihood and resilience, disaster management	35 out of 47 counties (Including all droughts and floods counties)

Annex Table 4: Error in Statistical Abstract 2013 - Identical 2011 data for outpatient Morbidity in under 5 and over 5-year old



Source: Kenya National Bureau of Statistics (2013)

ISBN 978 9966 817 57 0

Kenya Institute for Public Policy Research and Analysis
Bishops Garden Towers, Bishops Road
PO Box 56445, Nairobi, Kenya
tel: +254 20 2719933/4, 2714714/5, 2721654, 2721110
fax: +254 20 2719951
email: admin@kippra.or.ke
website: http://www.kippra.org