THE IMPACT OF CLIMATE CHANGE-INDUCED DISASTERS ON MENTAL HEALTH IN ISIOLO COUNTY, KENYA.

Peninah K. MWENDA[1]
Email address: pwcion@yahoo.com or pwcion@gmail.com.
Daniel OLAGO[1]
Email address: dolago@uonbi.ac.ke.
Fredrick OKATCHA[1]
Email address: frederickokatch@yahoo.com.
Ali Adan ALI[2]
Email address: aadan@umma.ac.ke

1 Institute of climate Change and Adaptation, University of Nairobi, P.O. Box 30197-00100, Nairobi, Kenya

[2] Umma University, P.O. Box 105734-00101, Nairobi, Kenya.
[3] Providence Whole Care International P.O. Box 945-00502,, Nairobi, Kenya.

ABSTRACT
Isiolo County in Kenya is susceptible to the effects of extreme climate events and exposure to natural hazards, and the residents have limited capacity to adapt but also suffer from related mental health conditions that rarely researched. The modelling and projections of disease epidemiology caused by climate extreme events to foster climate-mental health initiative is insufficient. The methods of data collection used included: rainfall/temperature data derived from gridded 10km of sixteen satellite meteorological stations (1984-2013); mental disorders epidemiological data (2006-2014) from the health information system, Isiolo County and in-depth observation among 60 in-patients and 121 out-patient; six focused group discussion and workshop sessions among selected sample size (N=24); key informants (N=35) and household socio-economic survey (N=288) was conducted to gather socio-economic aspects of the target population.. The quantitative data was analysed using statistical tools in Excel, SPSS version 20 while rainfall and temperature analysis was done using R software (version 3.21) and ranked mental health data using diagnostic tools criteria. Correlation analysis was done to determine the varying trajectories of sets of bivariate data and positive correlation was noted between mental disorder cases and total annual rainfall. The prevalent mental disorders included: anxiety (54%); 32% each for dissociative, sleeping, and adjustment disorders; and 39% for eating and poly-substance disorder. The mental disorder comorbidity revealed the association to disaster risks which increase mental illnesses. The study found that the prevalence rate of mental disorders was high and resilience was low. A need to develop robust environmental health procedures to diagnose mental disorders and quantify the epidemiology caused by disaster risks is vital. The study recommends mapping of mental disorder epidemiology and make it user friendly to advice policy, scale up solutions and accelerate evidence informed advocacy on adaptation and resilience mental health programme strategies.

***Key Words**: Climate Change, Disasters, Mental Disorders, Mental Health, Vulnerability.*

1.1 INTRODUCTION

The research examines the impact of climate change related disasters on mental health in Isiolo, Kenya. Mental disorders are health problems that significantly affect mood, thinking, behaviour and human interactions. Disasters caused by extreme environmental conditions tend to be fairly distinct in time and space (except for slow-onset or creeping disasters like drought (ADPC, 2017; Tsegaye, 2016). The cyclones Idai and Kenneth (2018) wreaked havoc in Mozambique, Zimbabwe and Malawi seriously demobilized people. The disasters left many people traumatized and deprived of everything including loss of dignity (Obradovich et al., 2018). Physical and mental health of the individuals and communities are affected directly due to exposure of heat waves, drought and flood disasters. Indirectly, the climate change disaster ravages physical environment making people and places vulnerable (IPPC, 2011). Between 10-15% of Kenya's population (4.6-6.9 million) suffers from mental disorders and the majority suffer from depression (Oldam et al., 2013).

These presents a situation where the immediate impacts tend to overwhelm the capabilities of the affected population (Francois et al., 2014). Psychological impact of extreme stress, in

particular traumatic natural disaster events, are on the rise precipitating suicidal ideations. Swim (2011) links these aspects of climate change with cognitive, affective, motivational, interpersonal, and organizational responses and processes. The aftermath of natural disasters, adults commonly suffer from increased mental health problems such as posttraumatic stress disorder (PTSD), depression, anxiety, and substance use. In turn, children may show anxiety, aggression, and behaviour problems (Simpson et al., 2011; Clayton, 2011). Global warming has led to development of global and national policies to manage it (Doherty et al. 2011). However, they have not been as effective as desired in stemming climate changes which are manifested in part by an increase in the frequency and magnitude of extreme climate events such as droughts and flood (CDKN, 2012). Such extreme events often result in disasters in un-prepared countries or regions. They are often traumatic because they could result in loss of lives, properties and livelihoods (Quarantelli, 2003, Gifford et.al. 2016), which may in turn affect the mental health outcomes of affected individuals, expressing as primary or secondary mental disorders. The study discussing frequencies of natural events and subsequently increases in vulnerability level due to rapid environmental degradation. This inflicts new hazards exacerbating disaster risks as a result of degraded ecosystem which weaken people's coping and recovery as depicted in the conceptual framework. The mental health related behaviours and cryptic expression analysis will be examined in relation to disaster.

The research study looks at the disaster risks and impacts of climate change as well as socio-economic characteristics which may increase or reduce their vulnerability. The uncertainties brought about by the disasters which may eventually render the communities to state of helplessness and meaningless are being examined. Vulnerability interplay with disasters may yield lingering trauma and mental wounds that might otherwise go unrecognized. This may also increase or reduce people's mental health experiencing natural disasters. How climate change extreme events could have effects on mental health is discussed. The hazards and vulnerability are analysed in relation to mental health disorders as depicted in the conceptual framework (Figure: 1.1).

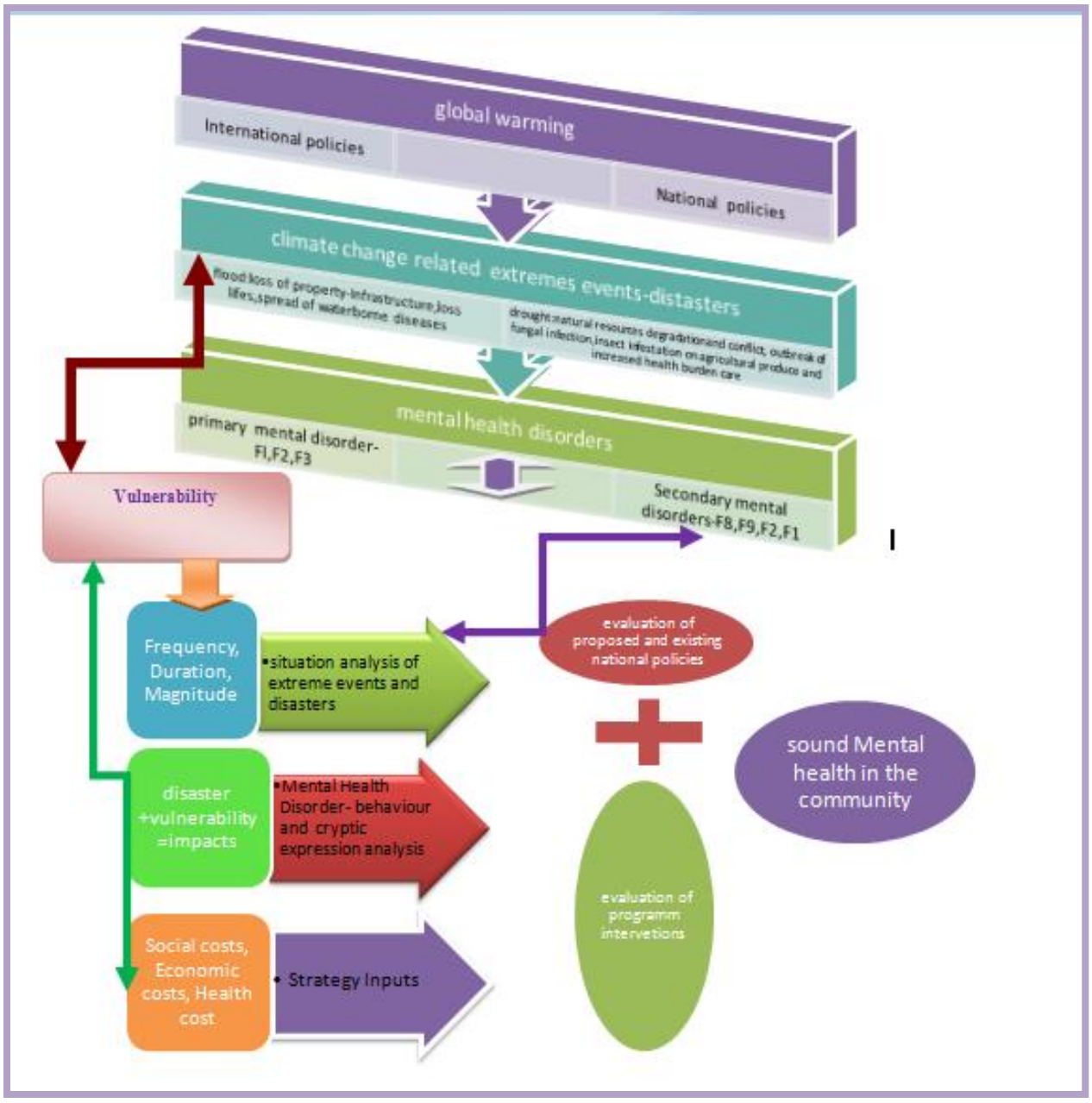

Figure 1.1: Conceptual Framework

The paper explores major psycho-pathology effects associated with climate risks and disasters. The research aimed at determining the relationship between climate change disasters and mental health in Isiolo County, Kenya.

1.2 MATERIALS AND METHODS

1.2.1 Study Design

The estimated latitude and longitudes of the area of study where rainfall and temperature data is derived have been tabulated to depict the location exact extent of sampling points (Figure 1.2). The delineated research area was purposely selected taking into consideration Digital Elevation Model (DEM) ranging from 104mm to 1947 mm which is among the main course of vulnerability to flood and drought. The data from Kenya Meteorological Station was obtained to capture trends and extreme weather variability from 1984-2013 on maximum and minimum monthly temperature and rainfall data. These were used to calculate the mean annual temperature and rainfall for sixteen (16) study sites to derive extremes variations and hazards. Besides, the mental disorder data was retrieved and summative evaluation conducted from in-depth individual and group therapies and health information systems, 2007-2014 (Delbert, 2002).

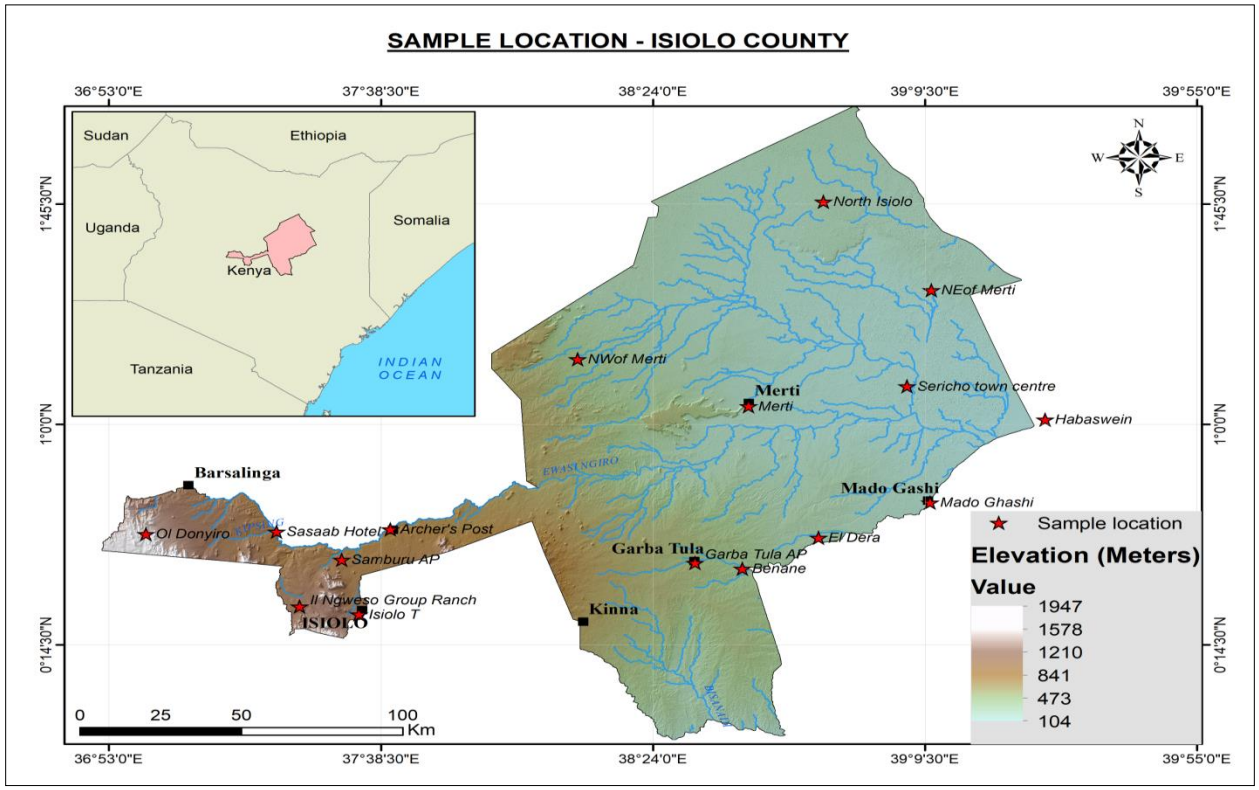

Figure 1.2 Longitudinal and cross-section sample Locations

The household survey sample size of 288 with 95% confidence level household respondents was selected using probability and non-probability sampling design (Aven, 2011). Probability sampling design deployed stratified sampling where entities were select from various distinct gender (m=154 and F=134) and education (none=93, primary=103, secondary=54, college=26 and university=11). The standard formula used is as follows (Berg, 1988; Snijers, 1992; Heckathorn, 1997).

N = Population size which was 340
Z = z-score being 2.58
e = margin of error as 0.05
p = standard of deviation as 0.5

$$\text{Sample size} = \frac{\frac{z^2 \times p(1-p)}{e^2}}{[1+z^2 \times p(1-p)e^2 \times N]}$$

$$\textbf{Sample size} = \frac{\frac{2.58^2 \times 0.5(1-0.5)}{0.05^2}}{[1+2.58^2 \times 0.5(1-0.5)0.05^2 \times 340]} = 225.048$$

The qualitative data from the wards and locations on hazards, disaster risks, vulnerabilities and mental health themes coding were developed from the survey tools to segregate empirical data in location sampling sites (Table 1.1).

Table 1.1: Location of primary sampling sites for household survey

Ward	No. of respondents	Percent	Valid Percent	Cumulative Percent
Bullapesa	23	8.0	8.0	8.0
Burat	30	10.4	10.4	18.4
Cherab	29	10.1	10.1	28.5
Garbatulla	57	19.8	19.8	48.3
Ngaremara	27	9.4	9.4	57.6
Oldonyiro	71	24.7	24.7	82.3
Wabera	51	17.7	17.7	100.0
Total	288	100.0	100.0	

Besides, workshops and focused group discussions were conducted to identify the main mental health disorders, disasters and vulnerabilities zones for eventual mapping using standardized questionnaires and eventually rank capacity vulnerability to disasters and mental health.

1.2.2 Materials

The materials used are in-depth observation guide and enhanced mental health assessment for brief intervention during individual counselling sessions. DSM-1V TR and ICD 11 WHO guidelines diagnostic tools for mental health, psychotherapy procedure and use of personal observation, photography and Excel program were also used. Besides, household interview guide was used to take notes during interview sessions and later the data was filled in against the review guide. Statistical Package for Social Sciences (SPSS) was used for quantitative data coding and cleaning before entry and further analyses.

1.2.3 Ethical Considerations

The study involved human subjects, hence followed laid down relevant protocols. The Institute of Climate Change and Adaptation letter of introduction enabled the researchers' access ethical clearance certificate from Kenya Methodist University (Ref. No. KeMU/SERC/EXT/24/2019), the Ministry of Health, Isiolo County and National Commission for Science, Technology and Innovation (Ref. No. NACOSTI/P/17/5233/16099). ICCA, ethical clearance and NACOSTI letters were used access data from private and public stakeholders such as: Ministry of Environment, Water and Natural Resources; National Disaster Management Authority, Management Unit and Operation Centre; Water Resource Authority; National Drought Management Authority; Ministry of Health and Kenya Meteorologist Department in Nairobi and Isiolo Counties. The researcher

and research assistants created and maintained rapport throughout the study duration. The participants were fully informed regarding the objectives of the study and were reassured that their answers were to be treated as confidential and used only for academic research purposes. The processes adhered to Declarations of Helsinki guidelines on conducting biomedical research by the Council of International Organization of Medical sciences (CIOMS) and that of the International Conference on Harmonization-Good Clinical Practice (ICH-GCP).

1.2.4 METHODS

1.2.3.1 Desktop studies

Secondary data was examined to derive themes on how climate change - related extremes cause disasters which eventually may impact mental health (Barbara, 2009). The rainfall and temperatures data was obtained from Kenya Meteorological Department from 1984 to 2013 ascertain the thresholds of climate change disasters risks. The climatic extremes (floods and drought) was extracted from satellite stations in Isiolo County to derive the natural hazards disasters impacting on the population. Archival client's total annual mental disorders documented in Health Information System from May 2007 to September 2014 at Isiolo Referral Hospital. The epidemiological data on mental disorders (mental health unit Isiolo referral hospital) were derived from the same dataset. This went beyond merely gathering data on variables and their relationships, and attempted to explain attitudes and behaviour on the basis of the data gathered. This data was used to compare, collate and correlate disasters and mental health in the Isiolo County.

1.2.3.2 Field work

The three psychiatric nurses gathered information during intake and screening using laid down systematic processes protocols among 60 inpatient clients individual in 2015 August/November and 2016 March/May. Oral interviews were used to gain in-depth information among 121 out-patients respondents 'in mental health units, randomly selected from areas prone to natural hazards and experiencing hydro-meteorological disasters (Berg, 1988). In-depth observation was used to diagnose mental disorders and vulnerabilities prevalent in the study area. Panel studies (two group survey) i.e. four group were done biannually to collect data concerning family history and the data ranked using criteria for DSM-1V, plus ICD 11 diagnoses with possible present or past symptomatology. The study sought to determine the prevalence of co-morbidity conditions among the clients with the following disorders: generalized anxiety disorders (GAD), alcohol and other drugs (AOD's), developmental disorder, primary sleeping disorder (insomnia), eating disorders (anorexia and bulimia) and dissociative disorders.

Focused group and workshops were conducted to identify the main mental health disorders (Charles, 2012) disasters and vulnerabilities zones for eventual mapping using standardized questionnaires and eventually rank capacity vulnerability to disasters and mental health. The opinions and views were sought among different parties either in three (3) small groups of 3-5 above and (two) 2 large groups of 11 to 20 participants from 2015 to 2016. The two (2) large groups of FGD and workshops, were held on August 19th 2015 and April 28th 2016 during dry and wet months, respectively, to be able to get varied responses on drought and floods.

Then, social-economic survey was conducted by research assistants among 288 individuals in the eight (7) wards in the two sub-counties (Table1.1) in 2014-2016, as per different season to get dynamic interactions of processes in the same spatial and temporal scale (Robert, 1978; Rebecca, 2007). The observation of sensitive factors was crucial to reflect complex relationships between natural and social phenomenon. Screen shoots of some location of climate sensitive closely linked economies such as agriculture and water.

1.2.3.3 Data analysis

The coding categories were derived directly from the text data during conventional content analysis. With a directed approach, analysis started with a theory or relevant research findings as guidance for initial codes. Correlation between disasters and mental disorders variables was done using ANOVA tool to gather whether their values alter together either positively or negatively. The assumption is that there was a direct link existing between cause (disasters) and effect (mental disorders).

Experimental research was used to establish causes (disasters as the independent variable) and effects (mental health disorders at the dependent variables). Two groups of people were compared: one experiencing disaster and one not experiencing disasters (control group). This was done during in-depth observation. Case vignettes (Reyes, 2006; Ronald, 2009) were analysed from individual clients and DSM-1V/ICD 11 diagnostic coding was used to categorize mental disorders.

Multiple cases were explored for a period of time through detailed, in-depth data collection involving various sources of information and rich in context. This approach is used by social scientists because of its popularity in psychology (Freud), medicine (case analysis of a problem), law (case law), or political science (case reports). The mental health wellness (health or illness) was measured to ascertain effects of crisis due to floods and drought disaster risks. The level of psycho-social functioning or productivity and prevalence of mental disorder comorbid recurrence was assessed. Multiple sources of information including in-depth observations, oral interviews, audio-visual material, and archival retrieval from past records, then synthesised to sum up psychosocial malfunctioning (Jane et al., 2014). Case vignettes (Reyes, 2006, Ronald, 2009) were analysed from individual clients who exhibited at least five or more symptoms for a month.

1.3 RESULTS

1.3.1 Location and Characterization of Respondents

The study findings show that most of the clients who were involved in individual counselling were from Bulla Pesa (28.3%), Wabera (25.0%), and Burat (18.3%). The Cherab and Garbatulla wards had 10% and 5% respectively, with Kinna and Kulamawe each having 2% of the clients (Table 1.1).

Also, the area largely experiences occasional flash flood, for it is surrounded by rugged topography of Mt. Kenya, Aberdare ranges, and Nyambene Hills. The observations and in-depth interviews were done on 60 patients visiting clinics and hospitals. The males were 56.7%, while the females were 43.3% of the total respondents.

The research study got significant response from the cohorts aged 21-30 years and those aged 31-50 years, a very productive age. The younger and older age groups were also represented covering approximately 2%. The study found that the education level of the respondents was 1.7% with university, 31.7% had secondary, 50% with primary, while 16.7% had no formal education. This finding is presented in simple bar graph in Figure 1.3.

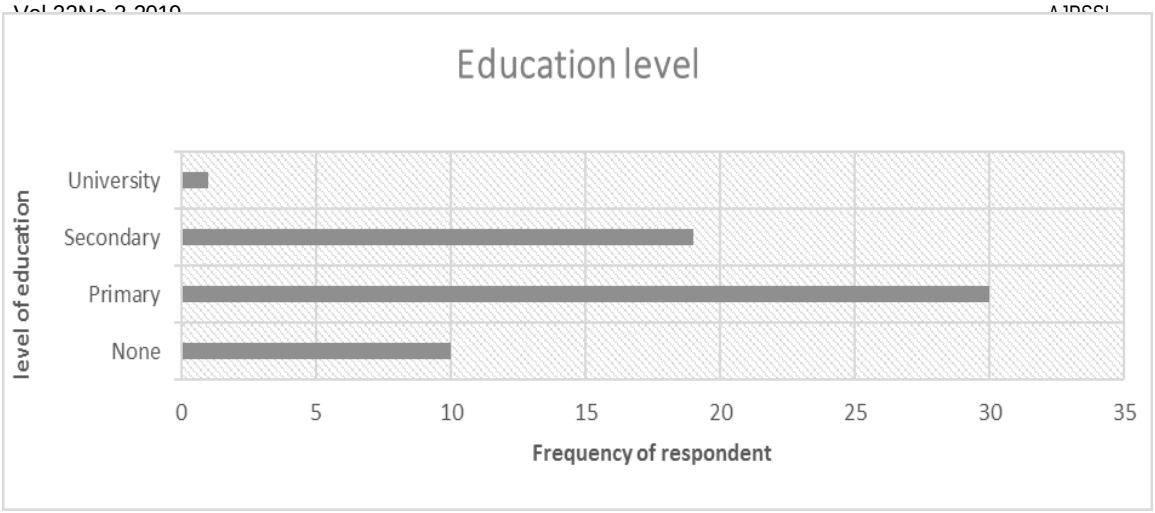

Figure 1.3: Respondents' level of education

The study results show that among the respondents who had visited mental health clinics, 53.3% were local residents, while 43.3% were non-locals but who had been staying in Isiolo County for approximately ten years and above. The study revealed that among the residents who visited mental health clinics, majority were children (45%), adult male (28.3%) followed by adult females (26.7%).

1.3.2. Climate Change Related Extreme Event Disasters and Mental Disorders

1.3.2.1 Major mental disorders categories

The disaster risks impact to human health are represented as disease at 11% and loss of human life at 3% (Figure 1.3). Interviews with the nurse psychiatrists revealed that they had in-depth counselling sessions with the 60 clients who manifested mental disorders incidences. Among them, 54% had anxiety, 32% had dissociative, eating and adjustment, and 39% had sleeping and substance use disorder co-morbidities or cryptic expressions.

Each item was rated at 45% respondents strongly agreed and 16.7% agreed that they had indicators of Generalized Anxiety Disorder (GAD), which is the most common. The generalized anxiety disorders observed among the clients were panic attacks, Posttraumatic Stress Disorder, Social phobia and Obsessive-Compulsive Disorder (OCD).

The cryptic expressions of anxiety disorders and their comorbidities (Table 1.2). The other most common comorbidities linked to anxiety with similar symptoms were major depressive disorder (MDD), substance use disorder (SUD) and bipolar Disorder (BD). It was noted that anxiety spectrum disorders such as panic attacks, phobia, PTSD and OCD can subside over a period of time with rehabilitations and (or) treatment, which reduced worries and socio-economic burden.

Table 1.2: The comorbidities and symptoms of anxiety disorders among respondents

Types of anxiety disorder	Cryptic and behavioural expressions
DSM 5-300.02 or CD-(F40–F48)	Hyper vigilance, excessive fear repetitive
Obsessive-compulsive disorders	Behavioural disturbances
Panic disorders	Irrational or unreasonable fear thought
Phobias	Impulsive images
Post-Traumatic Stress Disorder	Intense fear and discomfort
Generalized anxiety disorder	Stress related disorder, substance use

The study findings revealed that about 7% of the respondents strongly agreed and 18% agreed that they were experiencing signs and symptoms of dissociative disorder which are closely linked to historical traumas they had been dealing with especially during drought and floods. The pastoral communities in Isiolo were involved in frequent conflicts, and banditry behaviour. This is attributed to high incidences of drought and high temperatures. The aggressive

behaviour escalates the rate of criminology related to dissociative illness, triggered by the prolonged effect of climate variability and change.
The dissociative disorder is associated with increased rates of suicides and homicides, especially violence perpetrated by cattle rustlers who kill the pastoral communities mercilessly due to reduced resources, opportunities and fear of hunger, poverty and social shame. Cattle rustlers aim to achieve restocking after loss of their animals to drought, diseases and losses to other rustlers. The summaries of the types and cryptic and behavioural expressions associated with traumatic effects of extreme climate events and variability Table (1.3).

Table 1.3: Comorbidities and cryptic expressions of clients with dissociative disorder in Isiolo County

Types of dissociative disorders	Cryptic and behavioural expressions
300.6-Depersonalization disorder 300.12- Dissociative amnesia 300.14-Dissociative identity disorder	Feeling of detachment-delusions from actions feelings, thoughts and sensations-unreal (de-realization), amnesia. Multiple episodes throughout, confused wandering Hallucinations and delusions, and men especially exhibit violent behaviour (Psychotic Disorders)

The low quality of life leads to poor low food consumption. The study found that 5% of the respondents strongly agreed and 13.3% agreed that they had eating disorder. The clients attested that families and children experiencing severe traumatic natural events had eating dysfunctionalities due to elevated levels of anxiety caused by migration and food scarcity. The other coexisting conditions were depression, substance abuse and anxiety disorders.

Table 1.4: Eating disorder conditions and symptoms among the clients' sample population

Eating Disorder	Cryptic and Behavioural Expressions
307.1 Anorexia nervosa 307.51 Bulimia nervosa 307.50 Eating disorder not otherwise specified	Poor appetite Binge eating behaviour

The study results presented in Figure 1.5 show that 21.7% of the respondents strongly agreed and 31.7% agreed as having sleeping disorder. This is attributed to low quality of life associated with adverse climate related conditions which made the respondents have hopeless and meaningless lives. Sleeping disorders were also associated with poor nutrition, low socio-economic status and adverse health effects on the population. The sleeping disorders and co-morbidity Table 1.5.

Table 1.5: Sleeping disorder and associated cryptic expressions among the clients

Sleeping disorders	Cryptic and behavioural expressions
307.44 Primary hypersomnia 307.42 Primary insomnia 347 Narcolepsy 780.59 Breathing-related sleep disorder 307.45 Circadian rhythm sleep disorder 307.47 Dyssomnia NOS 327.03 Insomnia Related to Mood Disorder(ICD 9)	Uncontrolled need to sleep or not to sleep, lack of concentration, depressed mood and cognitive impairment

The survey among 39 clients revealed that 21.7% strongly agreed and 5% agreed that they had issues with alcohol and other drugs related signs and symptoms as a result of floods and drought related disaster impact which threaten crops and livestock production systems.
The survey revealed rampant polysubstance abuse (abuse of two or more drugs) of licit and illicit substances which are common in the area of study. These have precipitated clinically maladaptation addiction tendencies culminating to substance induced mood disorders-psychotic and major depression. This scenario is summarised in ICD F11-F19 (Table 1.6).

Table 1.6: Mental illness and comorbidities of substance related disorder

(F10–F19) Mental and behavioural disorders due to psychoactive substance use	Cryptic and behavioural expressions
F1x.0) Acute intoxication	Behavioural problems-craving for substance
(F1x.1) Harmful use	Mental illness or perception dysfunction-addiction
(F1x.2) Dependence syndrome	Physical illness from chronic use due to dependence which result to nervousness, mood swings (euphoria or depression) manic or hypomanic episode sleeping and eating disorders
(F1x.3) Withdrawal state	
(F1x.4) Withdrawal state with delirium	
(F1x.5) Psychotic disorder	
(F1x.6) Amnesic syndrome	
(F1x.7) Residual and late-onset psychotic disorder	
(F1x.8) Other mental and behavioural disorder	
(F1x.9) Unspecified mental and behavioural disorder	

The results show that about 20% of clients agreed that adjustment disorders are related to the disaster of floods and drought. These can mimic other disorders such as depression, anxiety, personality and substance abuse. Differential diagnoses need to happen first before diagnosing other similar symptoms. Altered general wellbeing and subsequent seasonal affective disorder (type of depression) become common during rainy seasons. These are categorized and the comorbidities summarised (Table 1.7).

Table 1.7: Adjustment disorders comorbidities and symptoms among the client sample population

Situational Disorders	Cryptic And Behavioural Expressions
309.9 Unspecified	Reckless behaviour associated with high risk of suicide and suicidal behaviour
309.24 With anxiety	
309.0 With depressed mood	Agitation and impaired functioning
309.3 With disturbance of conduct	Misconduct; truancy, vandalism, fighting
309.28 With mixed anxiety and depressed mood	Withdrawal or social isolation
309.4 With mixed disturbance of emotions and conduct	Somatic complaints: general aches and pains, trembling and twitching due to excess worry

1.3.2.1 Vulnerability to flood and drought disasters

The detailed risk exposure assessment survey was conducted in selected areas among 121 residents and identified the vulnerability to hydro-meteorological as floods and drought disasters. Risk analysis considered range of potential losses and damages to people, animals, vegetation, drainage, land use, buildings, and infrastructure in relation to hazard (threats) frequency and intensity. This allowed us to evaluate disaster situation through direct observation and verbal crosscheck in all the methods used to collect data. The assessment revealed that damage potential was high and hence the disaster probability was rated very high.

The study also revealed that there was damage to human and physical environment depending on the severity of the extreme events. It was found that families were not able to meet basic needs and had no additional income from food and water thus exacerbating underlying vulnerability. When food and water prices increase, the livestock market also deteriorates due to

the impact of drought. The major climate change extreme events disaster impacts observed and highlighted in all the forums during field work are summarized in Table 1.8.

Table 1.8: Indirect impacts of floods and droughts disaster risks on resident's mental health in Isiolo

Floods	Droughts
Bio-physical Injuries, illness or death to people and animals Soil erosion lead to development of deep gullies Dangerous location especially near river valleys Land is covered with boulders, debris and sand Destruction of natural and planted vegetation Protracted flooding destroys farmland Disrupt supply of clean water and mostly water is contaminated. Socio-economic Marginalized community Damage of livelihoods Low income levels Damage of infrastructure: homes and property, hospitals, schools, roads, bridges and electricity supply Population displacement Triggers epidemics especially water borne diseases	Bio-physical Illness, death of people and animals Vegetation: some species are endangered, forest land is impaired and loss of biodiversity, decline in crop production, scarcity of fodder crops, Drainage: reduction of surface water flow and depletion of underground water, scarcity of drinking, domestic and irrigation water, drying of water sources Soil erosion and degeneration, gullies formation and eventually land degradation Socio-economic Loss of livelihood: death of livestock and widespread crop failure Food shortage: some instances starvation, low nutritional nutrients, deaths and suicides Social cost constant migration to family and community breakups is high and increase resource conflicts Reduced school attendance by children

1.3.3 Severity of Natural Disasters in Relation to Mental Disorders

Epidemiological methods were used to measure disaster related impacts on affected population and demands for health care delivery. The types and severity of post disaster injuries, illness and death among outpatient and inpatient clients in Isiolo referral hospital for the period of 2 years revealed the level of severity as summarized in Table 1.9.

Table 1.9: Assessment of vulnerability of residents to the disaster risks in Isiolo County

Age groups	Severe	Mild	Not so severe	Total
15years and below	3	6	3	12
16-20 years	6	7	2	15
21-30 years	20	7	6	33
31-40 years	16	4	9	29
41-50 years	11	3	5	19
51 years and above	7	3	3	13
Subtotal	63	30	28	121

The study found that among the sampled 121 direct patients attending psychiatric unit, 63 patients had severe mental disorders, 30 had mild mental disorders and 28 were not severe. The Ministry of Health information systems retrieved data for Isiolo County depicts that out of 3841 clients in the year 2014, 1169 had mental illness, in the year 2013 among 2105 patients, 1156 patients had mental illness and in the year 2012 among 2591 patients, 2011 among 864, 2010 among 1118, 2009 among 550, 2008 among 687 and 2007 among 880 patients were mentally ill. The individual client mental disorder data was also extrapolated directly from psychiatric unit records and compared for validation to ascertain climate mental disorder epidemiology projections (Figure 1.2 and Figure 1.3). The officer dealing with health systems information asserted that people suffering from mental illness were so many in towns and villages since not many of them had the opportunity to access healthcare facilities. The

summary sheets for the investigated clients showed that somatic illness and mental health prevalence was very high in the County throughout the year. The most frequent physical illness and mental disorders reported by psychiatric nurse's key informants during client profiling and summaries are shown in Table 1.10.

Table 1.10: Common physical and mental illness among the client sample population in Isiolo County

Physical	Mental
Respiratory infections especially Pneumonia	Mixed anxiety and depression
Diarrheal and typhoid fever	Panic disorders
Skin diseases	Manic depressive psychosis
UTI	Depressive episodes
Dental disorders	Drug induced psychosis
Ear and eye infections	
Traffic road accidents	

1.3.4 Trends on Annual Mental Cases in Relation to Total Annual rainfall

The exposure to floods, drought and heat or cold waves extreme weather events directly or indirect pathways affects population adversely. The indirect pathways such as insufficient food may lead to retarded growth and development which can lead to serious mental health problems such as mental retardation and somatoform disorders, including increased suicidal tendencies. The correlation collated rainfall data and inpatient and outpatient facility data in Isiolo psychiatric unit enabled further deduction of the hypothesis. The time series in the Figure 1.4 show a bearing on mental disorder cases in relation to trauma exposure.

It has been noted that there is an increase in covariance (environment and health) risks due to ongoing and future climate change and the adverse impacts of such disaster risks which have increased in 21st century (Heltberg et al., 2008a). The correlation coefficient for number of health cases and annual rainfall in Isiolo is very high (r = 0.99), providing robust evidence that climate, and rainfall in particular, is a major factor influencing mental health status of the Isiolo County residents.

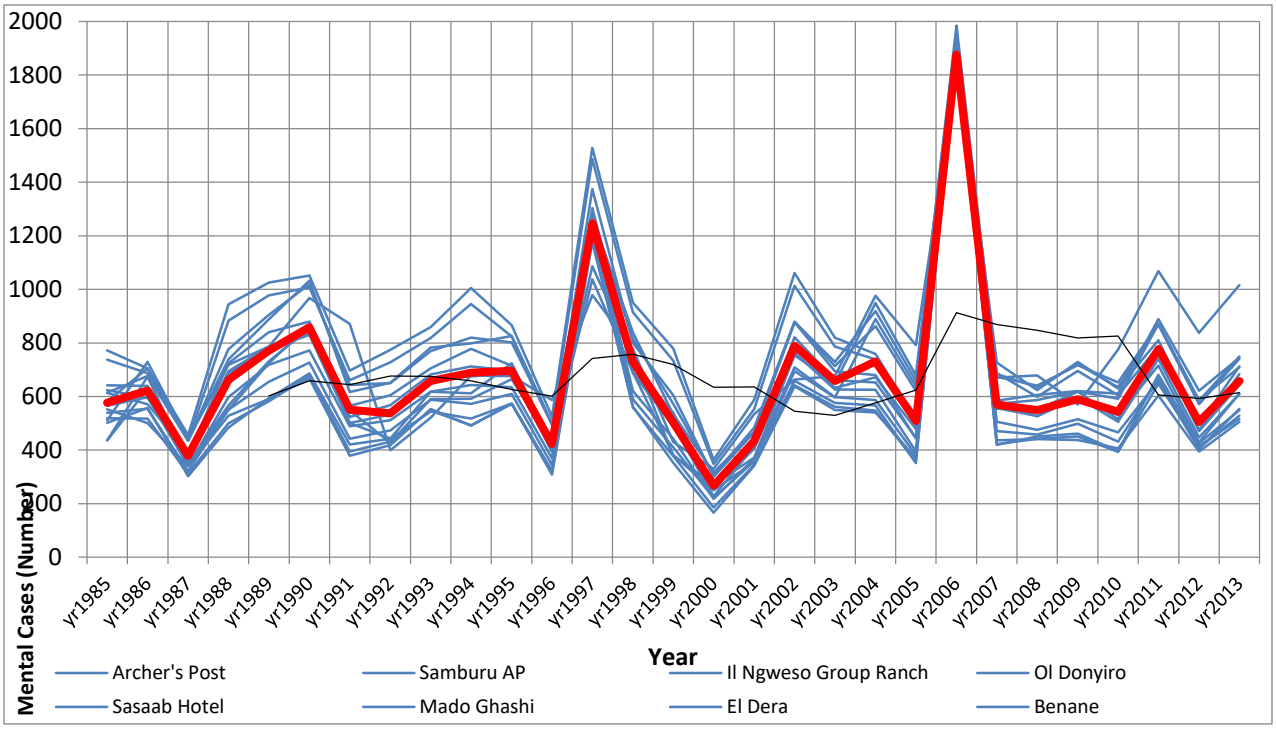

Figure 1.4: Trends on annual mental cases in relation to annual total rainfall (mm) in the year 1984-2013 period

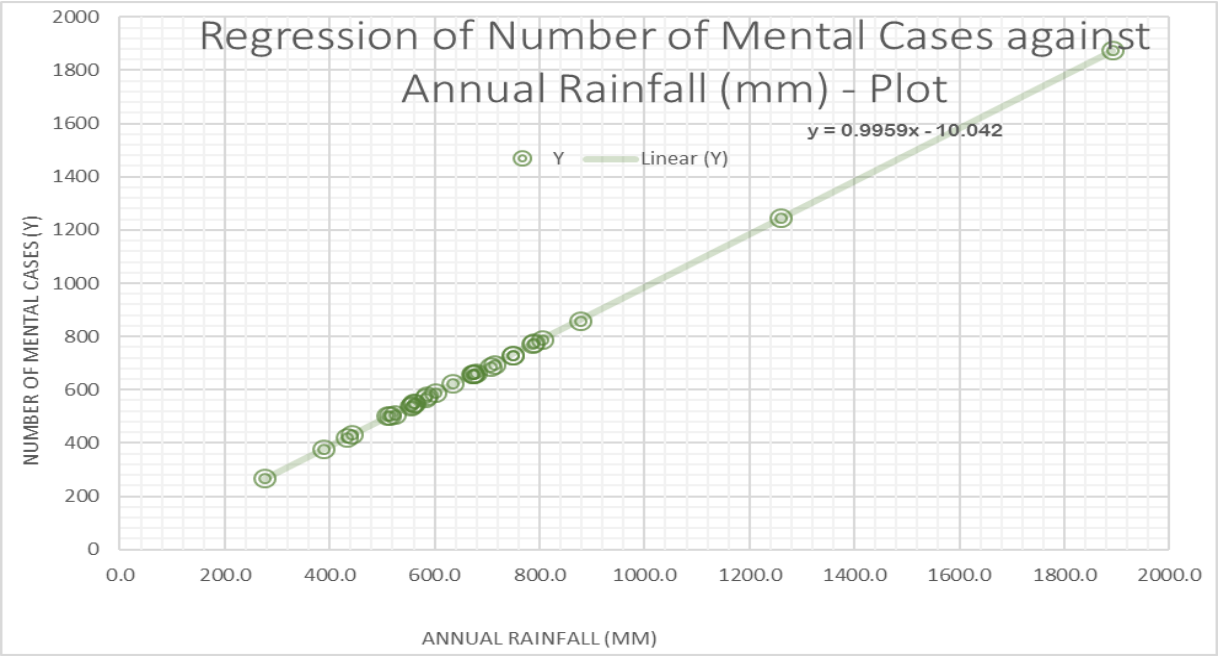

Figure 1.5: Regression of number of mental disorder against total annual rainfall

1.3.5 Mental Health Mapping in Isiolo County

The Focused Group Discussion, workshop, Key Informants and health information system archival retrieved dataset summary of mental health incidents of population at risk within the zones are shown in Table 1.11.

Table 1.11: Mental Health Incidents Summary

Areas affected	Rating
Isiolo town: Burat, Bulapesa and Wabera	10
Kinna/Garbatulla	5
Merti /Cherab	5
Oldonyiro	3

The analysis of 121 out-patients and 60 in-patients Ministry of Health information system derived psychiatric diagnoses and Focused Group Discussion synthesized mental health data to map mental disorders from the clusters consented by all participants. Geographic Information System was used to map mental disorders incidents where flood and drought disaster impacts latent variable technique to represent the ratings. The weighted centroid (centre of mass) was joined to county shape to reflect the spatial distribution of mental cases (Figure 1.6).The variation was determined by spatial distribution of sampled mentally ill clients and conclusion drawn in stakeholders focused group discussions.

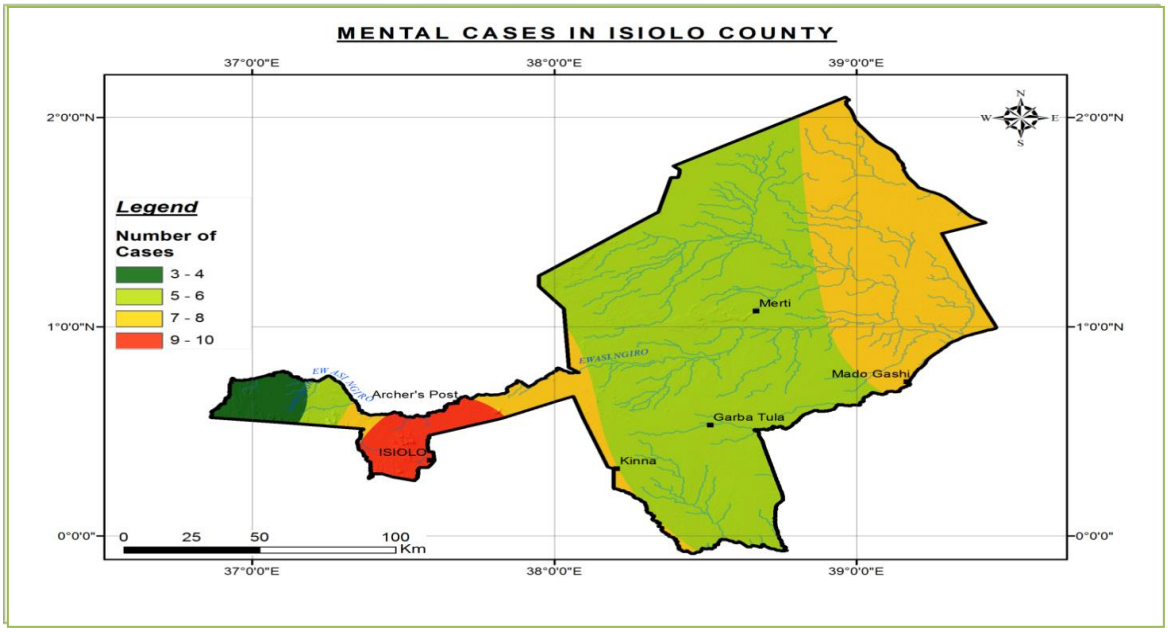

Figure1.6: Spatial mental cases mapping in Isiolo County

There was no differential spread of diagnoses because they were closely related disorders and so they were more likely to occur. A structured process in the field community mental health concept mapping involves analysis of qualitative information from quantitative data (Trochim, 1989b; Trochim et al., 1993).

DISCUSSION

1.4.1 Characteristic of Sample Population

The study looked into the details of the ability to survive events during time of a disaster. Most in-patient clients lived in plain land (Bulla pesa, Burat and Wabera), around Isiolo town (**Error! Reference source not found.**). The male clients were more affected than female clients due to limited movement of female cohort, most of whom where between ages 21 to 50 years. The client responses were mainly from primary and secondary schools, meaning that they were more willing to seek for help in the health centre. The mental health clinics were used by locals and non-locals, where children and adults sought mental health services (**Error! Reference source not found.**). The metanalysis derived projections of mental disorder epidemiology in the referral hospital from other clinics. The attribution of the mental disorder to extreme climate disaster risks was challenging due to pre-existing socio-economic vulnerabilities (Cunsolo at el., 2018). Besides, the physical health outcomes are very explicit and well understood in context of changing climate, but data has been scanty to support the preposition (Henderson et al., 2015). Most of the respondents were not aware of mental or psychological illnesses. The impact of extreme climate events on mental health are minimally known by marginalized (Hayes et al., 2018; Obradovich et al., 2018) pastoral communities.

Correlation of Disaster Risks and Mental Health

The research study assessed the severity of extreme climate events impacts on mental health. The research indicates intensity and increasing frequency of drought and floods in Kenya. This is also a replica in Isiolo County where challenges are more pronounced and aggravated by persistent poverty and degradation of environment by alternate flood/flash floods inundations and recurrent drought. The study established that the severity depends not only on the extreme risks themselves but also on predisposition and associated vulnerability (Clayton et al., 2014; Berry, 2010). The major area the respondents lived were saucer shaped plains which were

affected severely by flood and drought risks, asserts community members interviewed. The populations living near the Merelli river valleys are vulnerable to floods due to the terrain.
Greater proportions of the human population in Isiolo County are being impacted by the climate change related disasters events. There were short terms to severe prolonged drought and floods which brought socio-economic vulnerabilities. The natural disasters progressively increased environmental stressors and eventually lead to psychological impacts. This compares to World Health Organization, 1999 where a meteorological extreme event eventually becomes catastrophic disastrous event (Table 1.12).

Table 1.12: Mechanisms by which above average rainfall can affect health (adopted and modified from WHO, 1999)

Type	Description	Potential health impacts
Meteorological	Extreme event	Increased mosquito abundance or decreased if breeding sites are washed away
Hydrological	River overflows its banks	Contamination of surface water
Social	Property including crops are damaged	Contamination of surface and ground water with faecal matter and rat urine
Catastrophic floods/disasters	Floods leading to >10 killed and (or) 200 affected and government call for external assistance	Increasing risk of respiratory, allergies, cholera and diarrheal diseases, drowning deaths, injuries, psychological impacts and associated displacement of population

The construction styles with mud bricks and old settlement are less structurally resilient, but vulnerable to heavy rains and floods**Error! Reference source not found.**). The frequent flooding makes sewage systems and pipes susceptible to inundation of storm deluge for the design capacities are beyond the challenge. The compounded risks escalate bacterial infections due to crumpled household sanitation (disposal of hazardous, inorganic and organic solid or liquid waste. When the semi-permanent and temporary structures provide insufficient protection from intrusion, this generates cryptic expressions such as depressed mood and cognitive impairment, maniac and hypomanic episodes, misconducts and reckless behaviour and somatic complaints.
The progression of drought hazard to disaster is compared to WHO, 1999 where psychological disturbances were cited as potential health consequences (Table 1.13). This is in tandem with the study which links the mental health consequences to a changing global climate such as drought (Morganstein et al., 2017; Becker, 2013). The stipulated range of mental health are stress and distress, high risk coping behaviour such as alcohol use and other mental illnesses: depression and related mood, mixed anxiety drug induced, grief and stress disorders (Morganstein et al., 2017).

Table 1.13: Mechanisms by which below-average rainfall can affect health (adopted and modified from WHO, 1999)

Event	Type	Description	Potential health impacts
Drought	Meteorological	Precipitation is unusually low	Increased mosquito or decreased breeding sites when washed away
Drought	Agricultural	Drier than normal, soil moisture is no longer sufficient for growth of plants	This depends on socio-economic e.g. supportive systems and structures
Drought	Hydrological	Reduction of underground and surface water supplies, food supply and income	Food shortage, malnutrition, illness (increased risk of infection and disease) associated with inadequate water supply for sanitation and hygiene
Famine	Catastrophic: socioeconomic capacity of people to survive is adversely affected	Floods leading to >10 killed and (or) 200 affected and government call for external assistance	Death due to starvation and malnutrition Psychological disturbances associated with displaced population

The study established that health impacts of drought is worsened by disease caused by malnutrition, climate triggers of famine, environmental degradation and conflicts due to related major emergencies. Also, heat stresses, indoor and outdoor air pollution from sand storms in Isiolo are stress related concerns. The prolonged dry conditions lead to shortage of water used for cooking and hygiene. Subsequently this increases risks of faecal contamination (diarrheal diseases); water washed (trachoma, scabies); vector breeding sites (malaria) and malnutrition related.

During drought, for instance, crop failure is inevitable due to low precipitation which prompt economic hardships. The individuals and communities were exposed to life threatening circumstances which lead to development of posttraumatic stress disorders. Stress exacerbated by loss of homes and property, ecosystems and loved ones make individuals develop psychological health problems such as grief or bereavement reactions or depression. This indicated by increased rate of admission with people who have dementia, adjustment disorder, anxiety related disorders, mood disorders to mention a few. Prolonged heat waves and cold waves can result to heat rash; fainting or death may initiate or increase health problems aggravating pre-existing psychiatric pathologies.

The capacities of some pastoral communities to bounce back to resilience was another response to hazardous situations. Not all people affected by drought and floods developed mental disorders. Some section of the community could adapt by stealing of animals during drought or move to parts of Meru County which is not affected severely by the extreme events. The people who were able to detect disasters prior to the events and adopt precautionary measures were able to withstand natural hazards among the 121 outpatient clients in the study area. The psychosocial stressors can be minimized through raising awareness on the effects of extreme climate events on mental health prior to catastrophic events.

Disaster Predisposition and Mental Health

The study assessed predisposition and vulnerabilities of sample population to disaster risks. The increased temperatures and precipitation were identified as exposure pathways to extreme weather events. The level of exposure and vulnerability to hazards and (or) disaster determine mental disorders. These are Anxiety, Mood and (or) personality related Disorders (Daniel et al., 2016).

A wide spectrum of impact of climate change includes physical, mental and community health (Figure 1.9). The exposure to the individual clients included the observed threats, the effects of the damages and the uncertainty brought by the extremities of the extreme climate events (Bourge et al., 2014; Brubaker, 2011). These are summarised in three levels of psychological impacts: direct acute or traumatic effects of extreme climate events and environmental changes; indirect threats to emotional wellbeing based on observation of impacts and uncertainty of the risks and psychosocial effects such as migrations, conflicts as a result of scarcity of basic needs (Doherty et al., 2011). Susanta et al. (2015) assert that, increased temperatures are likely to aggravate rates of agitations, recklessness, suicidal ideations and suicides and migration can lead to acculturation stress. The temperature rise increases physical illnesses, which secondarily is associated to psychological distress.

The extreme climate events in Isiolo County ultimately led to rise in expenses of food and inability to purchase adequate food. Consequently, this leads to malnutrition and psychosomatic issues especially acculturation stress. Migration of individuals and communities is related to acculturation stress which the client said it is the genesis of psychiatric disorder. Household vulnerability in Isiolo County has been exuberated by flash and rain floods. The volumes of water generated exceeds the river capacity and caused high flow velocities damaging crops and properties. The communities living near Merelli River and undulating depression are susceptible to floods. The plain land and undulating area is prone to floods and occasional flash floods. The

closer the water way the higher the vulnerability to floods because extra volume of water lead to overflow inundation and consequently disaster risks. The future is blink due to projected likely increases in the frequency of extreme climate events scenarios such as raging flash floods and floods (Greenough et al., 2001). Drought on the other hand is a complex creeping phenomenon and a major climatic hazard. Drought events recur often and in recent times prolongs to the extent that devastating impacts are felt among rural communities in Kenya (Anastacia, 2014).
Extreme environmental conditions cause disasters occurring in varied duration and spatial geographical location except drought which is slow-onset or creeping disasters (Tsegaye, 2016). These overwhelm the impacted communities for the immediate effect are intense and overstretch their capabilities. The water availability during drought eventually lead to meteorological, agricultural or hydrological drought. Isiolo County has major rustling prone areas: Attan, Nakuprat, and Kipsing where 300 cattle were stolen during drought and famine disaster of 2016-2017. The analysis was derived from NDMA, Isiolo bulletin summaries for three years shown in Table 1.14.

Table 1.14: Summary of livelihoods and drought situation analysis (Source, NDMA Bulletin)

Early Warning Phase Classification for purposely random samples of selected months				
Livelihoods zones	EW phase	2014 Trend	2015 Trend	2016 trend
Pastoral all species	ALERT	worsening	worsening	worsening
Agro pastoral	ALERT	worsening	worsening	worsening
Casual waged labour	ALERT	worsening	worsening	no change
Firewood/charcoal	ALERT	worsening	worsening	worsening

The glaring evidence in this research indicate that extreme climate events has affected human physical and psychological health in Isiolo County. The natural disasters, alternate floods and drought over prolonged periods, have negatively impacted societal and economic structures that underpin mental health. The short- and long-term weather variability and extreme events increase predisposition and fragility of people and resources to disasters (Visser et al., 2014). The emergency situations as a result of disasters are characterized by chronic livelihood insecurity and long-term vulnerabilities. Significant increases in extreme climate events are linked directly and indirectly to detrimental human health (Glaser et al., 2016). The progression of floods and drought risks and hazards to disasters were gauged using fatalities and socio-economic damage. The accumulated stress levels from adverse weather and climate events made the pre-existing psychiatric vulnerability become even worse in Isiolo County.
Epidemiological studies of prevalence and incidents of mental illness (generalized anxiety mood and ADA) have been inadequately undertaken in developing countries (WHO, 2017). According to World Health Organization (WHO, 2000) the mental disorders related to climate change are estimated at 150,000 excess deaths per annum globally. The prolonged stressors of climate change, especially environmental threats due to heat and drought, torrential heavy rainfall of high intensity, flash floods and floods have led to chronic mental health disorders in Isiolo County (Figure 1.7).

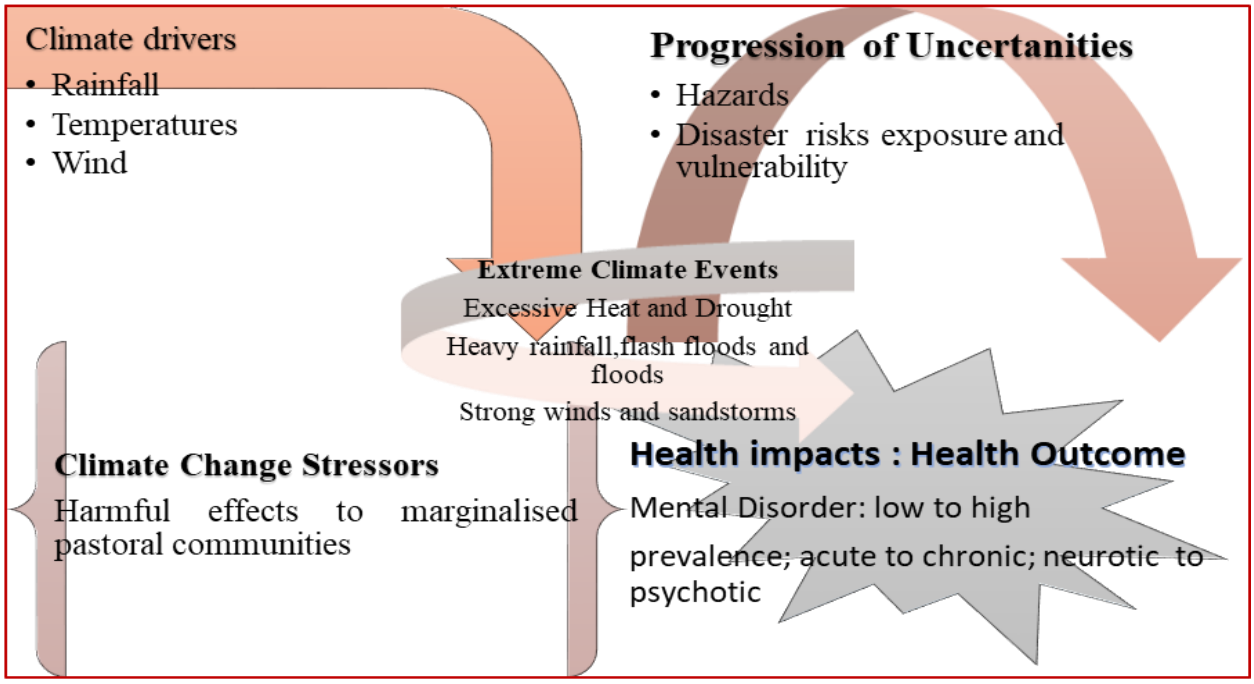

Figure 1.7: Assessment of climate change disaster risks impacts on mental health

1.3.4 Mental Disorders and Comorbidities

According to above summaries, mental disorders increase with increase in heat waves during dry seasons (Susanta et al., 2015; Hanigan et al., 2012). Psychological distress is aggravated not only by drought but also by floods. The prolonged alternate psychosomatic effects of the extreme climate events take toll on communities at large. There is a high relation between high temperatures and aggressive behaviour, which also escalates the rate of criminology. This is also associated to rates of suicides and homicides, especially violence perpetrated by cattle rustlers who kill the pastoral communities mercilessly (Focused Group Discussions derived verbatim, 2014). The family separation and breakdown due displacements makes the situations more complex, respondents in FGD insisted. The stakeholders noted a range of disorders which were common among the community, from acute and transient psychosis to relapse of bipolar disorder.

The research study got significant response from the individuals who asserted that enormous loss of livelihood, property and lives among others were experienced during floods and drought among the communities. The study sought to determine the prevalence of co-morbidity conditions among the clients with the following disorders: generalized anxiety disorders (GAD), alcohol and other drugs (AOD's), developmental or adjustments disorder, sleeping disorder (insomnia), eating disorders (anorexia and bulimia nervosa) and dissociative disorders.

GAD is as a result debilitating fear of natural disasters or life-threatening events. An earlier study in Australia reported that PTSD clients experiencing disasters impacts not only affects rescue workers (10% - 20%) but is prevalent among the clients (30% - 40%) (Javidi et al., 2012). The behavioural and cryptic expression analyses were summarized as: flash back of the events, increased arousal, acute stress reactions, and avoidance of cues to the memory of the event (DeSalvo et al., 2007; McMillen et al., 2002). The view of respondents in the study acknowledged the existence of the correlation between the challenges of extreme climate events and mental disorders.

Post-traumatic stress disorder may have co-morbid problems such as: alcohol and substance use; feelings of shame, despair and hopelessness; somatoform disorders; or physical

symptoms. These may contribute to development of other disorders such as panic, social or agoraphobia, major depressive and various types of bipolar disorders (manias and hypomania). The New Orleans workforce, equally people living near Dongting Lake in China experiencing hurricane Katrina and floods disaster risks respectively developed impairment in the quality of life and significant distress associated with PTSD (Susanta et al., 2015; Tan et al., 2004).

The other major disorders which manifested themselves in Isiolo were behavioural illness such as: attention deficit and hyperactivity disorder, defiant behaviours, conduct disorder and criminal activity. The threshold of diagnoses depended on the intensity of trauma events in their lifetime and the support systems in the community (Javidi et al., 2012). These were manifested in clients who were in age groups 20 years and below among the 121 clients investigated.

The dissociative disorders first develop from traumatic stressful situations such as hydro-meteorological disasters risks. There are three major types of dissociative disorders defined in DSM five: dissociative amnesia, identity, and depersonalization disorders. The general cryptic expressions include cognitive impairment for specific time, people and events, out of body experiencing episodes or multiple episodes as though one is a movie theatre, a sense of delusions from emotional numbness and uncoordinated actions and lack of a sense of identity. Other mental problems which manifestations are depression, anxiety and thoughts of suicide.

The most common psychoactive substances abused by clients in the study area include: depressants, hallucinogens and stimulants. The substances can range from giving individuals a relatively harmless down or boost to being deadly and extremely dangerous. The progression of usage from single episode for recreational use, circumstantial or intensified use/abuse to compulsive use (dependence) in varying frequencies are quite common in the research area. FGD participants and the KII cited boda riders a key factor to increased sale of merchandise to the idle youth in the interior of Isiolo which has increased the usage. The major contributing factor for substance abuse is very hard living conditions which render the community extremely vulnerable. Besides social environment, other causes of drug and substance abuse include genetic related addiction which exacerbate the pre-existing conditions. These have increased mental disorder incidences such as anxiety disorder, major depression and bipolar disorder.

Situational depression was exhibited by abnormal and excessive reaction to an identifiable life stressor especially floods and drought among pastoral communities in Isiolo. These were notable due to more severe than normal impairment or maladaptive reactions in social, occupation and academic functioning (Obradovinch et al., 2018; Hayes et al., 2018). The clients had difficulty in coping with major life challenges or sources of stress such as natural events and vulnerability thereof. The loss or grief leads to stress response syndrome or maladjustment*(technical term used in 2013 mental health diagnostic system) (DSM 5, 2013).

The feelings of stress, anxiety, grief, numbness, disbelief and worry during and after disaster are prevalent in Isiolo. Consequently, some individuals in the community have manifested increased anxiety, hostility and other maladaptive thinking, feeling, attitudes/behaviours. The signs and symptoms summaries are shown in Table 1.18.

Table 1.19: Common somatic and mental disorders signs and symptoms exhibited synthesis during natural disaster among sample population

Somatic signs and symptoms	Emotional signs and symptoms
Physical reactions: headache, body pains, stomach problems, skin rashes	Feeling of numbness, disbelief, guilty, sadness, anxiety or fear
Worsening chronic health problems; diabetes, hypertension	Changes of appetite
Difficulty in concentration	Low or no level of energy and activity
	Difficulty in sleeping or nightmares, upsetting thoughts and images
	Helplessness and hopelessness
	Anger, short temper fares and Isolation
	Increase use of substance use
	suicidal ideations and suicides
	Increased conflicts and aggression

The research finding established that clients had high level of symptomatology as indicated in Table 1.110. Hayes et al., 2018 ascertains that extreme heat events 'increases hospital admissions for mood and behavioural disorders' which range from stress, neurotic to psychotic disorders. They exhibited several diagnostic categories of mental disorders. Heat related disasters affects body thermoregulation and consequently impairs mental health comorbidity. The most common psychiatric co-morbidity in populations exposed to floods and drought alternate extremities included: distress, grief, anxiety and depression disorders. Other self-harming disorders are alcohol and substance abuse which mask as mood and anxiety disorders. The cohorts meet the criteria of "serious emotional disturbance". These disturbances are directly linked to immediate trauma from exposure to climate change related disasters. Additionally, climate change impacts on social dimensions takes toll on the local community.

1.5 CONCLUSION

Little is known of mental health risks as a consequences of increased hydro-meteorological related disaster risks largely in Kenya and more specifically, Isiolo County. There is existing natural disaster risks affecting mental health namely; drought, heat waves, sandy storms, heavy erratic rainfall, floods and flash floods. These have profound long-term effects on psychological wellbeing of the communities in ASAL areas. The weather-related disasters have increased vulnerability to already socio-economic disadvantaged pastoral communities. The pain, loss, worry, fear, confusion, distress and grief are symptoms of psychological mental problems exhibited by people exposed to extreme natural events in the community.

Severe and prolonged drought has a serious effect on psychological ill health. The drought situation makes temperature to rise, precipitating heat waves and sand dunes which affect the population adversely. Similarly, psychological impact of extreme stress, in particular traumatic drought disasters events, are on the rise precipitating suicidal and homicide in Isiolo County. The aftermath of drought disaster risk, adults commonly suffer from increased mental disorders such as adjustment, traumatic stress disorders, dissociative, prolonged grief and other co-occurring mood disorders. In turn, children may show anxiety, aggression, and behaviour problems (Simpson et al., 2011).

On the other hand, flood and flash flood experienced in Isiolo led to flooded houses, affected individual semi-permanent and temporary settlements, disrupted domestic utilities, and forced the population to abandon their homesteads to higher grounds. The floods disrupted school, businesses and daily routines of pastoral households. The vulnerability can be attributed to the escalated anxiety especially pain attacks due to sounds of water, impaired cognition, depression and extreme distress due to emotional wounds. The interaction between flood hazard and pastoral community vulnerability incapacitated them. The dangers of extreme climate event throw the community into emergency situations, an attribute to mental disorder.

There is need to invest in the health of suffering communities in preparedness and the immediate aftermath of tragedies to marginalized and vulnerable communities who have been devastated by natural disasters. The integration of direct and indirect pathways is critical in mainstreaming mental health issues in all policies, legislations and action plans. These will assist in developing mental health and disaster management to improve programmes intervention and research. Other precipitating causes to mental health need to be assessed and isolated.

There is need to develop robust environmental health procedures to diagnose mental disorders and quantify prevalence epidemiology through Health Information Systems. The mental disorder epidemiology during and post extreme climate events is important scientific database to advise the management interventions of mental illness. The identification and assessment of adverse extreme events is amenable to greater preparation for, as well as mitigation and adaptation to hazards and disaster risks.

REFERENCES

American Psychiatric Association (2013). *Diagnostic and Statistical Manual of Mental Disorders DSM-IV. 5th Edition.* Washington D.C: American Psychiatric Publishing,

Asian Disaster Preparedness Centre (2017). Annual Report. Bangkok 10400, Thailand. www.adpc.net/igo/category/ID116/doc/2017-mgh6kx-ADPC-annual-Report-version-2017.

Aven T. (2011). A risk concept applicable for both probabilistic and non-probabilistic perspectives. *Safety Science; 49:* 1080–1086.

Barbara D.W. (2009). Content analysis: methods, applications, and issues. *Health Care International, 13 (3):* 321-467.

Becker A.E. and Kleinman A. (2013). Mental health and the global agenda. *New England Journal of Medicine, 369*: 66-73.

Berg S. (1988). Snowball Sampling. In: S. Kotz and N.M. Johnson (Eds), *Encyclopaedia of Statistical Sciences, 8*:528-532.

Berry H.L., Bowen M.P. and Kjellstrom T. (2010) Climate change and mental health: A causal pathways framework. *International Journal of Public Health, 55 (2):* 123-132.

Bourque F. and Cunsolo W.A. (2014). Climate change: The next challenge for public mental health*? International Review of Psychiatry. 26 (4)*:415-22, doi: 10.3109/09540261.2014.925851.

Brubaker M., Berner J., Chavan R. and Warren J. (2011). Climate change and health effects in Northwest Alaska. *Globe Health Action; 4*, doi: 10.3402/gha.v4i0.8445.pub

CDKN (2012). Managing Climate Extreme and Disasters in Africa: Lessons from the IPCC SREX Report. Climate and Development Knowledge Network. www.cdkn.org/srex. Accessed June 14, 2014.

Charles E.B. (2012). *Focused Group Interview: An Under Utilized Research Technique for Improving Theory and Practice in Health Education*. Columbia University, New York, USA, 229 pp.

Clayton S., Manning C. and Hodge C. (2014). *Beyond Storms and Droughts: The Psychological Impacts of Climate Change.* Washington DC: American Psychological Association and Eco America http:ecoamerica.org /research/psychological impacts.

Consolo A. and Ellis N.R. (2018). Ecological grief as a mental health response to climate change related loss. *Nature Climate Change, 8(1),* 275

Delbert C.M. and Neil J.S. (2002). *Handbook of Research Design and Social Measurement: The Case Study.* Sage Publications, Thousand Oaks. Online ISBN: 9781412984386 doi: http://dx.doi.org/10.4135/9781412984386.n37 accessed online on 12/7/2014.

Dodgen D., Donato N., Kelly A., La Greca J., Morganstein J., Reser J., Ruzek S., Schweitzer M.M., Shimamoto K., Thigpen T. and Ursano R. (2016). Chapter 8: Mental Health and Well-Being. *The Impacts of Climate Change and Human Health in the United States. A Scientific Assessment.* U.S. Global Change Research Program, Washington, DC, 217-246. http://dx.doi.org/107930/JOTX3CH.

Doherty T.J. and Clayton S. (2011). The psychological impacts of global climate change. *American Psychologist, 66 (4):* 265-276.

Francois B. and Ashlee C.W. (2014). Climate change: the next challenge for public mental health? *Journal of International Review of Psychiatry, 26(4).* http://doi.org/10.3109/09540261.2014.925851.

Gifford E. and Gifford R. (2016). The largely unacknowledged impact of climate change on mental health. Special Issue: The Psychology of Doom. *Journal Bulletin of the Atomic Science, 72(5):* 292-297. http://dx.doi.org/10.1080 /0096342.2016.1216505.

Glaser J., Lemery J., Rajagopalan B., Diaz H.F., Garcia-Trabanino R., Taduri G. and Johnson R.J. (2016). Climate change and the emergent epidemic of CKD from heat stress in rural communities: The case for heat stress

nephropathy. *Clinical Journal of the American Society of Nephropathy, 11 (8):* 1472-1483. https://doi.org/10.2215 /CJN.13841215

Greenough G., McGeehin M., Bernard S.M., Trtanj J., Riad J. and Engelberg D. (2001). The potential impacts of climate variability and change on health impacts of extreme weather events in the United States. *Environmental Health Perspectives, 109 (Suppl 2)*: 191–198. www.ncbi.nlm.nih.gov.

Heckathorn D.D. (1997). Respondent-driven sampling: a new approach to the study of hidden populations. *Social Problems, 44(2):* 174-199.

Henderson S. and Mulder R. (2015). Climate change and mental disorders. *Australian and New Zealand Journal of Psychiatry, 49(11),* 1061. http://dx.doi.org/10.1177/0004867415610639

Hayes K., Blashki, G., Wiseman, J., Burke, S., & Reifels, L. (2018). Climate change and mental health: Risks, impacts and priority actions. *International Journal of Mental Health Systems, 12,* Article ID 28.http://dx.doi.org/10.1186/s13033-018-0210-6

Herlocker D.J., Shaaban S.B. and Wilkes S. (1993) *Range Management Handbook of Kenya. Vol II, 5. Isiolo District.* Nairobi: Republic of Kenya: Ministry of Agriculture, Livestock Development and Marketing, 158 pp.

Hewitt K. (Ed) (1983). *Interpretation of Calamity: From the View Point of Human Ecology*. Boston: Allen, 249 pp.

Howard G. (2008). *The Minds New Science: A History of the Cognitive Revolution*. Cambridge, Massachusetts: Howard Gardener, Congress Cataloguing. 422 pp.

IASC (2010). Global Protection Cluster Working Group and IASC Reference for Mental Health and Psychosocial Support in Emergency Settings. Inter-Agency Standing Committee. Geneva

ICIDP (2018). *Isiolo County Integrated Development Plan, ICIDP draft, 2018-2022*. Nairobi, Kenya.

IPCC (2014). Summary for Policy Makers. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: global and Sectoral Aspects. Working Group II Contribution to the IPCC Fifth Assessment Report of Intergovernmental Panel on Climate Change. [Field C.B, Barros V.R, and Dokken D.J, Mach K.J., Manstrandrea M.D., Bilir T.E., Chatterjee M., Ebi K.L., Estrada Y.O., Genova R.C., Girma B., Kissel E.S., Levy E.S., MacCracken S., Mastrandrea P.R. and White L.L. (Eds.)]. Cambridge, UK, and New York, NY, USA: 2014:1-32. Available at: http://ipcc-wg2.gov/AR5/images/uploads/WGIIAR5-TSFGDall.pdf. Accessed May 3, 2014.

Jamal H.H. and Zailina H. (2016). Climate change, extreme events, and human health implications in Asia Pacific region. *Asian Pacific Journal of Public Health,* https://doi.org/10.1177/1010539515599030.

Jane R., Jane L. and Carol M.N. (2014) *Qualitative Research Practice: A Guide for Social Science Students and Researchers, 2nd Edition*. Sage Publication, Los Angeles, USA, 456 pp.

Janet C. and Olivier D. (2016). “Children and climate change: Introducing the Issue”. The Future of Children. Project MUSE. 26, (1), 3-9 DOI:10.1353/foc.2016.0000. Musejhu.edu. Accessed June 22, 2019

Jayes K., Blashki G., Wiseman J., Burke S., and Reifels L. (2018) Climate change and mental health: Risks, impacts and priority actions. *International Journal of Mental Health Systems, 12(1),* 28.

Jeffry A.J., David E.B. and Robert S. (1999). Concept mapping in mental health. Uses and adaptations. *Evaluation and Programme Planning, 23(2000*): 67-75.

Jenny W. (2011). M*issouri Department of Mental Health Standard Operating Guidelines. Responding to Catastrophic Emergencies that Impact the Lives of those who Receive Services.* Missouri, U.S.A: The Department of Mental Health, 101 pp.

John M. (2011). *Qualitative Research in Counselling and Psychotherapy,* 2nd Edition. London: Sage Publication Ltd, 352 pp.

Jonathan A.S. (Ed) (2008) *Qualitative Psychology: A Practical Guide to Research Methods*. California: Sage Publication Ltd, 276 pp.

Jonathan A., Patz M.D., Howard F.M., and Tracey H. (2014). Climate Change. Challenges and opportunities for global health. *Journal of the American Medical Association, 321(15):* 1565-1580. doi:10.1001/jama.2014.13186.

Jongman B., Hochrainer-Stinger S., Fegen L., Aerts J.C., Mechler R.W.J., Botzen W., Bouwe L.M., Pflug G., Rojas R. and Ward P. J. (2014). Increasing stress on disaster finance due to large floods. *Nature Climate Change, 4*: 464-286.

Jyotsana S. (2013). Extreme weather events and mental health: tackling the psychological challenge. *International Scholarly Research Notices. 2013:7* http://dx.doi.org/10.1155/2013/127365.

Kessler R.C., Galea S., Jones R.T. and Parker H.A. (2006). Mental illness and suicidality after hurricane Katrina. *Bulletin of the World Health Organization 84*: 930-939.

Keyes C.L. (2005). Mental illness and (or) mental health? Investigating axioms of the complete state of health. *Journal Consultation in Clinical Psychology, 73(3*) 539-48 http://dx.doi.org/10.1037/0022-006X.73.3.539

Kiima D. and Jenkins R. (2010). Mental health policy in Kenya: an integrated approach to scaling up equitable care for the poor populations. *International Journal on Mental Health System, 4*:19. [PMC free article] [PubMed]

Kim K.H., Kabir E. and Ara J.S. (2014). A review of the consequences of global climate change on human health. *Journal of Environmental Science Health, 32:* 299–318.

Kjellstrom T. and McMichael A.J. (2013). Climate change threats to population health and well-being: the imperative of protective solutions that will last. *Globe Health Action, 6:* 208-216. Doi: 10.3402/gha.v6i0.20816

Kreft S., Eckstein L., Lunghans C. and Hagen U. (2014). *Global Climate Risk Index 2015: Who suffers most from Extreme Weather Events? Weather–Related Loss Events in 2013 and 1994 to 2013. Federal Ministry for Economic Cooperation and Development. Bonn, German.*

Meursing K., and Wankiiri V. (1988). Use of flow charts by nurses dealing with mental health patients: An evaluation in Lesotho. *Bulletin, World Health Organization, 66(4): 507-514.*

Molloy S.L., Dreen E.A. and Rose J.B. (2015). Extreme weather events and human health. In: *International Encyclopaedia of Public Health* (pp 7076). https://doi.org/10.1016/B978-0-12-803678-5.00151-X.

Morris J., Van O., Belfer M., Saxena S. and Saraceno B. (2007) Children and the sphere standard on mental and social aspects of health disasters. 31(1): 71−90.

Mugenda O. (2003). *Research Methods, Quantitative and Qualitative Approaches*. Acts Press. Nairobi, Kenya.

Obradovich N., Migliorini R., Paulus M.P. and Rahwan I. (2018). Empirical evidence of mental health risks posed by climate change. PNAS October 23, 2018 115(43) 10953-10958; https://doi.org/10.1073/pnas.1801528115

Ouma O.Y. and Tateishi R. (2014). Urban flood vulnerability and risk mapping using integrated multi-parametric AHP and GIS: Methodology overview and Case study assessment. *Water, 6:* 1515-1545. Doi: 10.3390/w6061515 www.mdpi.com /journal/water. Eldoret, Kenya.

Padli J., Habibullah M.S. and Baharom A.H. (2018). The impact of human development on natural disaster fatalities and damage: Panel data evidence. *Journal of Economic Research, 31 (1):*1557-1573. Scholar.google.com

Patz J. A., Engelberg D. and Last J. (2000). The effects of changing weather on public health. *Annual Review of Public Health, 21*: 271–307. Crossref, Medline.

Peter A.S., Nikolaos C., Friederike E.L., Otto Y.S., Jean-Paul V., Geert J.V., Robert V., Hans V.S., Walton P., Yiou P. and Zwiers F.W. (2016). Attribution of Extreme Weather and Climate-related Events. *Wiley Online Library, 7 (1):* 23-41.

Hsieh H.F., & Shannon S.E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research, 15(9)*, 1277–1288. https://doi.org/10.1177/1049732305276687

Simpson D.M., Weissbecker I., and Sephton S.E. (2011). Extreme Weather-Related Events: Implications for Mental Health and Well-Being. In: Weissbecker, I. (Ed.), *Climate Change and Human Well-being: Global Challenges and Opportunities,* Springer-Verlag, 57-78. Doi: 10.1007/978-1-4419-9742-5.

Smith K.R., Alistar W., Campbell-Lendrum D. Chadee D.D., Honda Q., Liu J.M., Olwoch B.R. and Sauerborn R. (2014). Human health. Impacts, Adaptation and Co-benefits. In: Climate Change 2014: Impacts, Adaptation and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group 11 to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field C.B, Barros V.R., Dokken D.J, Mach K.J., Mastrandrea M.D., Bilir T.E., Chatterjee M., Ebi K.L., Estrada Y.O., Genova R.C., Girma B., Kissel E.S., Levy A.N., MacCracken S., Mastrandrea P.R. and White L.L (Eds.)] Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Snijders T.A.B. (1993). Estimation of the size of a hidden population using snowball sampling. *Journal of Official Statistics, 10*: 53-67.

Steffen W., Hughes L. and Karoly D. (2013). *The Critical Decade: Extreme Weather*. Climate Commission, Australia.

Susanta K.P., Sidharth S. and Surrender P. (2015). Mental health effects of climate change. *Indian Journal of Occupational and Environmental Medicine, 19(1):* 3-7. Doi: 10.4103/0019-5278.156997.

Swim J.K., Stern P.C., Doherty T.J., Clayton S., Reser J.P., Weber E.U., Gifford R. and Howard G.S. (2011). Psychology's contributions to understanding and addressing global climate change. *American Psychologist, 66*: 241-250. Doi: 10.1037/a0023220.

Trochim W.M. (1989). An introduction to concept mapping: for an introduction to concept mapping: for planning and evaluation. *Evaluation and Program Planning, 12(*1): 1-16. https://doi.org/10.1016/0149-7189 (89)90016-5

Trochim W.M.K., Shern D. and Lacomb C.A. (1995). The use of the concept mapping for assessing fidelity for model transfer: an example from psychiatric rehabilitation. *Evaluation and Program Planning, 18(2):* 141-153.

UNISDR (2012). Disaster through a Different Lens: Behind Every Effect, there is a Cause. International Strategy for Disaster Reduction. Thomson Reuter's AlertNet, the BBC, Vietnam TV and Tempo in Jakarta.

Vijayalakshmi P., Ramachandra R.K. and Math S.B. (2012). Perceived human rights violations in persons with mental illness: role of education. *International Journal of Social Psychiatry, 59*: 351-364.

Visser H., Petersen A.C. and Lintvoet W. (2014). On the relation between weather-related disaster impacts, vulnerability and climate. *Climate Change, 125(3-4):* 461-477. https://doi.org/10.1007/s10584-014-1179z.

Wehner M.F., Reed K.A., Loring B., Stone D. and Krishnan H. (2018). Changes in tropical cyclones under stabilized 1.5º and 2.0º C global warming scenarios as simulated by the community atmospheric model under the HAPPI protocols. Earth System Dynamics, 9: 187-195, http://doi.org/10.5194/esd-9-187-2018.

Weems C.F., Pina A.A., Costa N.M., Watts S.E., Taylor L.K. and Cannon M.F. (2007). Pre-disaster trait anxiety and negative affect predict posttraumatic stress in youths after hurricane Katrina. *Journal of and Clinical Psychology*, 75 (1): 154-159.

WHO (2014). Review of Social Determinants and Mental Health. Available at http:www.who.int/mental/publications/gulbenkianpaper_social_determinants_of_mental_health/en/. Accessed November 10, 2017.

WHO (2016). Climate Services for Health: Improving Public Health Decision Making in a New Climate. In: Shumake-Guillemont J. and Fernande-Montoya L. (Eds). *A Case Study Draft.* Geneva, Switzerland. http://www.sadieryan.net/uploads/1/3/4/4/13440807/who-wmo_case_studies_draft_full_2.pdf

WHO (2017). *Depression and other Common Mental Disorders: Global Health Estimates.* World Health Organization, 1-2. https://doi.org/CC BY-NC-SA 3.0 IGO.

WHO (2018*). International Classification of Diseases, 11th Revision (ICD-11).* Geneva: World Health Organization.

World Bank (2013). *Building Resilience: Integrating Climate and Disaster into Development. Lessons from World Bank Group Experience*. The World Bank, Washington DC, USA, 41 pp.