

Mental health effects of climate change in Ethiopia

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MENTAL HEALTH EFFECTS OF CLIMATE CHANGE IN ETHIOPIA

A thesis submitted in partial fulfilment of the requirement for the degree of
Master of Science in International Health

by

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Table of contents

Lists of tables, figures and abbreviations, concepts and definitions	IV
<i>List of tables and figures</i>	<i>IV</i>
<i>Abbreviations</i>	<i>IV</i>
<i>Concepts and definitions</i>	<i>V</i>
Abstract	VI
Introduction	VII
1. Background information	1
<i>Geography, demography and administrative structure</i>	<i>1</i>
<i>Socioeconomic factors</i>	<i>1</i>
<i>Health Sector</i>	<i>1</i>
Mental health.....	2
2. Problem statement, justification, objectives and methods	4
2.1 <i>Problem statement</i>	4
2.2 <i>Justification</i>	5
2.3 <i>Objectives</i>	6
Main objective.....	6
Specific objectives	6
2.4 <i>Methods</i>	6
Analytical Framework: Adaption of the “causal pathway framework” and “exposure pathway diagram”	7
3.1 <i>Connections between climate change, mental health and health equity</i>	9
3.1.1 <i>Linking climate change to mental health</i>	9
3.1.2 <i>Equity</i>	10
3.2.1 <i>Current climate and climate trends</i>	12
3.2.2 <i>Climate change projections</i>	12
3.2.3 <i>Climate change vulnerability</i>	13
3.3 <i>Pathways linking climate change to mental health in Ethiopia</i>	14
3.3.1 <i>Direct effects</i>	14
3.3.2 <i>Environmental and institutional context</i>	16
3.3.3 <i>Social and behavioural factors</i>	19
3.3.4 <i>Physical health effects</i>	22
3.4 <i>Evidence of best practices of climate change strategies influencing mental health</i> ...	24
3.5 <i>Strategies and policies in Ethiopia with a relation between mental health and climate change that could be improved</i>	27
4. Discussion	29
5. Conclusion and recommendations	31
<i>Recommendations</i>	32
References	33
Annexes	43

Lists of tables, figures and abbreviations, concepts and definitions

List of tables and figures

Table 1: Ethiopia’s Health Care System	1
Table 2: Health care workforce in mental health	2
Table 3: Burden of Mental Illness in Ethiopia	3
Table 4: Parallels between core principles of IASC and MH strategies for CC	26
Figure 1: Optimal mix of different mental health services	2
Figure 2: Analytical framework: Adaption of the “causal pathway framework” by Berry et al. and “exposure pathway diagram” by USGCRP	7
Figure 3: Proposed diagram: negative feedback loops between mental health, climate change impacts & vulnerability and Health Equity	11
Figure 4: Causal process diagram for mental health outcomes of drought	17
Figure 5: IASC intervention pyramid for MHPSS	25
Figure 6: Expanded adapted framework	30
Textbox 1: Numbers of articles found and key characteristics	6
Textbox 2: Effects of climate change on agriculture	13
Annex 1: Causal relation framework	43
Annex 2: Exposure pathway diagram	43
Annex 3: Other Ethiopian strategic documents regarding CC or MH	44

Abbreviations

APHA	American Public Health Association
CC	Climate change
GDP	Gross Domestic Product
HIC	High Income Country
IDP	Internally Displaced People
IPCC	The Intergovernmental Panel on Climate Change
LIC	Low Income Country
LMIC	Low- and Middle Income Country
MH	Mental Health
mhGAP	Mental Health Gap Action Programme
MHPSS	Mental health and psychosocial support
MOH	Ministry of Health
NDC	Nationally Determined Contribution
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
PHC	Primary Health Care
PTSD	Posttraumatic Stress Disorder
UNFCCC	United Nations Framework Convention on Climate Change
SDG	Sustainable Development Goal
USGCRP	United States Global Change Research Program
WHO	World Health Organisation

Concepts and definitions

Climate change

The Intergovernmental Panel on Climate Change (IPCC) defines climate change as “any change in climate over time, whether due to natural variability or as a result of human activity” (1). This definition differs from the one of the United Nations Framework Convention on Climate Change (UNFCCC). This second definition only considers climate change as the changes that is (directly or indirectly) attributed by human activity that alters the composition of the global atmosphere (1). For this thesis the broader definition of the IPCC will be used. As this thesis mainly focuses on the effects and not the causes of climate change, this distinction is less relevant. However, when discussing matters like equity it seems important to make the distinction between the natural variation in climate and the human attribution to it, especially when looking at the distribution of causes and impacts for climate change between groups.

Climate change vulnerability

Climate change vulnerability is described as “the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes” (1). It is composed of the nature, magnitude, and rate of climate change and three system characteristics. Firstly the exposure, that is determined by the level of contact of the system with climate change impacts. Secondly the sensitivity or the degree the system is affected by these impacts. Thirdly, the adaptive capacity of the system that consist of the ability to adjust, take advantage of opportunities or to respond to consequences of climate change. Vulnerability is influenced by the determinants of health (1-3). These vulnerability factors can be determined on individual or societal level (4).

Health equity

Equity is described by the World Health Organization (WHO) as “the absence of avoidable or remediable differences among groups of people, whether those groups are defined socially, economically, demographically or geographically” (5). Health equity therefore require the absence of systematic health disparities between groups irrespective of socio-economic status, geographical location or power and prestige status (6) and differences that break ethical and human rights norms (5). Health equity indicates that every individual ideally should have a fair opportunity in reaching their maximum health potential (5).

Mental health

Mental Health (MH) problems are characterized by alterations in thinking, mood or behaviour and are associated with distress or impaired functioning. According to the WHO, mental health is “a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community” (7). This definition creates space for a continuum of MH outcomes. At the one side of the continuum stands good MH and psychosocial wellbeing. At the opposite side are the mental diseases; well-defined classifications of mental pathology as used by psychiatrists. In the middle of the spectrum is a scale of impaired mental health, not necessarily reaching the definitions of pathology but with the potential to make substantial impacts in people's lives. Part of these problems are normal psychological reactions to adversity and disaster (8,9). MH outcomes depend greatly on inter-personal and extra-personal context (10).

Abstract

Introduction

Little is known about the effect of climate change on mental health in Ethiopia. The country is vulnerable to climate change and mental health problems are underserved. This thesis analyses the impact of climate change effects on mental health in Ethiopia and provides recommendations on current strategies and policies in order to improve effective adaptation.

Methods

A literature review was performed. A combination of the “Causal pathway framework” of Berry et al. and “Exposure pathway diagram” of USGCRP was made and used to assess the pathways through which climate change is impacting mental health in Ethiopia.

Results & discussion

Complex relations define the interaction between climate change and mental health. This is closely related to inequities in determinants of health.

Climate change impacts like increased temperatures, drought and increasing weather disasters, can directly influence mental health but also indirectly through pathways of ecosystem change, water scarcity and drought, agricultural and economical impacts, poverty, food insecurity, conflict, migration and physical health effects. The combined effects are likely to have a significant impact on MH and wellbeing.

Current policies and strategies target climate change and mental health in an isolated matter. International evidence is lacking comprehensive best-practice methods. Nevertheless, approaches targeting domains of mental health effects of climate change are identified.

Conclusion

Through the accumulative effects of various pathways, climate change has the potential to significantly impact mental health. It is advised to strengthen current mental health and climate change efforts, as well as constructing a more comprehensive and integrated approach.

Keywords

Climate change, mental health, Ethiopia, equity

Word count

13107

Introduction

Somewhere along my Master in International Health, Global Mental Health caught my attention. It probably started after a spontaneous drop-in at a lecture at the London School of Hygiene & Tropical Medicine that highlighted the big inequalities surrounding Mental Health both in low- and high-income countries. This interest resulted in a couple of jobs in Psychiatry in the Netherlands. One of these jobs was at Equator in Amsterdam, where I worked with undocumented migrants suffering from PTSD. It fascinates me how wellbeing and mental illnesses are shaped by experiences and living conditions, how much of this is defined by cultural context. And how mental health subsequently has the power to determine how people live their lives.

Set on Mental Health as a topic for my thesis, the starting point for a specific focus was the book (PhD Thesis) “Borderlands of mental health” by Ventevogel that explores mental health in complex humanitarian emergencies (11). It describes how mental health is shaped by global interactions, local cultural factors, and determinants like economy and poverty. It underlines the global inequities regarding mental health. This made me wonder about the potential impact of climate change. How enormous global inequities around climate change are in addition to mental health related inequities. What is the effect of climate on low-income countries and countries that already face a multitude of challenges? How will this shape the future of these populations and how does this effect mental health?

These questions brought me back to 2016 when I was working with MSF in Somali region of Ethiopia and climate factors were very tangible. Herding animals like camels and sheep are the primary source of livelihood for the pastoralist communities here and this lifestyle seems to be completely interwoven in the local culture. Besides being dependent on their livestock for food and income, people appeared to take enormous pride in the ownership of their animals and their way of living in connection to nature. During my stay, the region suffered from severe drought. Water scarcity and animal food insecurity due to drought was reported as the primary health concern of the local rural communities in the survey my colleagues and I conducted. For some families the total water availability was down to 1.5-2 litres per person per day with similar quantities for their animals. This is far below international standards for basic survival (12). People had to migrate large distances for food and water for their animals. They were ultimately not bringing their sick and malnourished children to the hospital because they could not risk further deterioration of their animals’ health while being away. Loss of animals would further pressure the food and income insecurity for their whole family. People reported to be very worried about this situation. Although our survey did not explicitly ask for mental health concerns, it can be imagined that these stresses and harsh decisions make a significant mental health impact. Illustrated by this example is how intertwined the determinants are: drought is affecting food, livelihoods and income, but also has a relation with physical health and nutrition and decisions in health seeking behaviour with the subsequent potential to impact mental health.

In this thesis I will explore the relation between climate change and mental health in Ethiopia. I have tried to step away from the predominantly individual, specialised and medicalised settings as predominantly used in psychiatry and that are most known to me. I have strived to take a holistic view and look at it from multiple angles; to zoom out and look at the different levels of context, to look backwards and look for causes and influencing factors, to look forward for effects, consequences and implications and finally to take different seats and to look at it from different perspectives.

1. Background information

Geography, demography and administrative structure

Ethiopia is a federal parliamentary republic, nine Regional States and two City Administrations councils form the federal government structure (13,14). It is a large, land-locked country with an area of over 1.1 million square kilometres in the horn of Africa. There is a broad diversity of geographical settings. The most prominent factor in this is the altitude that ranges from -126 meters to 4,620 meters. More than half of the country lies above 1,500 meters and therefore the country can roughly be divided in the highlands and the lowlands. The highlands are predominantly located in the central portion of the country, including the capital Addis Ababa (17-19).

With a population of 109 million it is the second most populous country in Sub-Saharan Africa. It is a young population; 45% is below 15 years and the annual population growth is 2.6% (15). The current life expectancy at birth is 66 years, a 19 years increase since 1990 (16). The majority of the population lives in the highlands, partly due to the more favourable rainfall conditions and large water reservoirs (17-19). 84% of the population lives in rural areas (20).

Socioeconomic factors

Ethiopia is a low-income country with the ambition to gain the status of lower-middle-income country by 2025 (21). It targets to transform an agricultural to industrial led economy and currently has the fastest growing economy in the region. Industry (mainly construction) and services accounted for most of the economic growth. Despite this, agriculture still remains important. The agricultural sector employs 73% of the population and is the primary source of input for the industrial sector. It accounts for 37% of the national Gross Domestic Product (GDP) and contributes to more than 90% of national exports. Roughly there are 3 sub-sectors: crop cultivation in the highlands, pastoralism in the lowlands and agro-pastoralism as a mix of both in the region between high- and lowlands (15,22-25). This position of the agricultural sector is important in relation to Climate Change (CC) as will be discussed later in the thesis.

Health Sector

Ethiopia has a triple-layered health care system as shown in table 1. The General government health expenditure as a proportion of general government expenditure was 6% in 2016. This is below 15%, the level agreed upon in the Abuja Declaration. Of the total health expenditure, 28% of the budget comes from the government and 37% from households as out-of-pocket spending. This high out-of-pocket expenditure indicates high financial risks for households and barriers to accessing health services. External resources, private sector employers, private insurance schemes and others cover the remaining expenditure (26,27). Despite a declining trend, high

Layer of care	Institution	Population per unit
Primary Health Care (PHC)	Primary Hospital	60,000-100,000
	Health Centre	15,000-25,000
	Health Post	3,000-5,000
Secondary Care	General Hospital	1,000,000-1,500,000
Tertiary Care	Specialized Hospital	3,500,000-5,000,000

Table 1: Ethiopia's Health Care System.
Source: FMOH 2015 (13)

inequalities in healthcare resources are still present and hinder equal healthcare access for disadvantaged populations (6).

Mental health

People with Mental Health (MH) problems face a high level of stigma and marginalization and there is a huge service gap for delivery of adequate MH care (14). The number of trained MH professionals is shown in table 2, the Ministry Of Health (MOH) states that these numbers are “wholly inadequate” (28). Ethiopia has 2 mental hospitals and 57 psychiatric units staffed by psychiatric nurses (29).

	Total number of Healthcare providers	Healthcare providers per 100,000 population *
Psychiatrists	40	0,037
Psychiatrists in the capital	30	0,028
Psychiatrists outside the capital	10	0,009
Psychiatric nurses	461	0,423
Psychologists	14	0,013
Clinical social workers	3	0,003

Table 2: Health care workforce in mental health. *Calculated using the absolute numbers and the 2018 population. Source: FMOH 2012 (28)

In order to overcome this service gap the Mental Health Gap Action Programme (mhGAP) has been implemented as a pilot in 2011 in collaboration with the World Health Organisation (WHO). The mhGAP provides evidence-based packages of care for various priority MH conditions. Though task-sharing this service is delivered in Primary Health Care (PHC). The treatment guidelines have been adapted to the Ethiopian setting. After the pilot phase MOH is using the mhGAP model to plan substantial scale-up of MH services with integration into PHC (26,28).

This programme aligns with the WHO’s “Optimal Mix of Services”(30), visualized by a triangle with different levels of care as depicted in figure 1. This mix of services aims to deliver quality MH care, integrated at all levels of care, from local health posts, health centres, general hospitals to specialised MH services and facilities (28). It relies on the concept that most people that need care can rely on basic assistance and only few people need expensive and specialised care (30).

The data on burden of MH issues in Ethiopia is limited. There are a few studies on burden of MH problems but they are small scale (31,32) and it is not clear if these results are generalizable country-

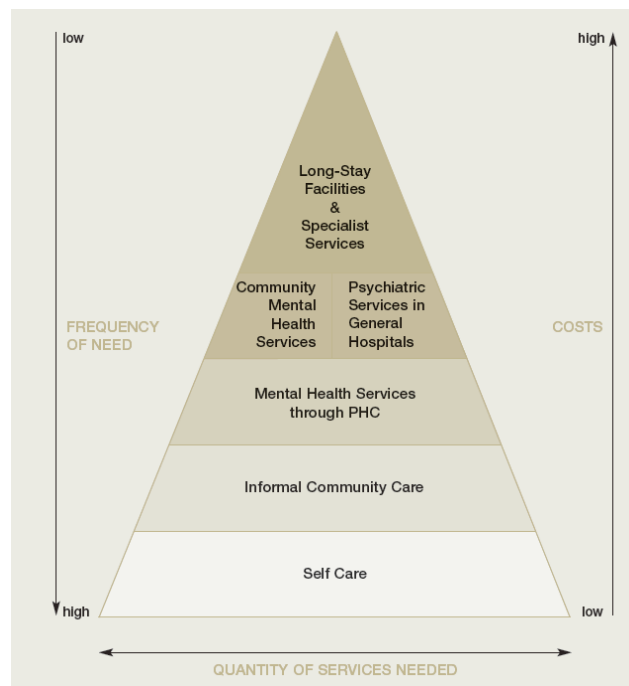


Figure 1: Optimal mix of different mental health services. Source: WHO 2003 (30)

wide. The data used in the government documentation (28) relies on the report of the mhGAP Ethiopia Working group 2010 which does not appear to be directly publicly available and its reliability therefore remains unclear. As this is still the most comprehensive information, this list is shown in table 3.

Up to now there are no laws in Ethiopia protecting the rights of people with MH problems (26,28).

Mental illness	Prevalence / Incidence (%)
Schizophrenia	0.5
Bipolar disorder	0.5
Depression	5.0
Suicide (completed)	7.7/100,000/year
Suicide attempt	3.2
Alcohol-problem drinking	2.2-3.7
Alcohol dependence	1.5
Cannabis abuse	1.5
Childhood mental illnesses	15-25*
Epilepsy	1.0
Dementia	No data

Table 3: Burden of Mental Illness in Ethiopia.

Source: FMOH 2012 (28) (Original source: Ethiopia mhGAP working group 2010 could not be retrieved)

* Especially this prevalence number is highly questioned.

2. Problem statement, justification, objectives and methods

2.1 Problem statement

There is growing concern about the effects of current and future CC on human health. The 2009 report on health effects of CC by the Lancet even states that “climate change is the biggest global health threat of the 21st century” (33). CC has a direct impact on health through rising average- and extreme temperatures, change in precipitation and the increase of extreme weather events. Furthermore, there is an indirect impact through rising ocean levels, ocean acidification, flooding, drought and wildfires. Many of these effects can already be seen. Without proper mitigation they are expected to have profound effects on existing global health challenges and inequalities (10). The WHO expects that CC will cause approximately 250.000 additional deaths per year between 2030 and 2050, from malnutrition, malaria, diarrhoea and heat stress alone (34).

CC also affects MH, through various ways. Disasters due to extreme weather events like storms and floods are becoming frequent, intense and complex. They can trigger MH problems like post-traumatic stress, depression and anxiety amongst others. Slowly progressing climate effects like rising temperatures, rising sea levels and irregular drought can change the natural ecology. This can threaten food and water supply, change the way land is used for agriculture and habitation, can weaken infrastructure and lead to population displacement. Negative MH impacts of these events include financial and relationship stress, higher risks of violence and aggression. In contrast to this, positive MH outcomes have also been described, as people get together to recover, rebuild and comfort each other during difficult times (8,9).

Nonetheless, the impact of CC on MH is often overlooked. This compares with the general lack of attention that MH receives in the global context, where mental illnesses are commonly ignored as a major health priority (35,36). As a result of major demographic, environmental, and socio-political transitions the global burden of disease attributable to mental disorders has increased worldwide and is expected to rise further in the near future. Despite this, even in developed countries, MH often stays underserved in terms of government investment and human resources compared to burden of disease. The quality of MH services is routinely worse than the quality of those for physical health. Especially in low- and middle-income countries (LMIC) access to quality MH care is low. Only 14% of low-income countries (LIC) commonly offer MH care at health facilities, policies are often absent or unsuccessful and in community public health interventions are often missing MH (37). The treatment gap for MH in developing countries is estimated at around 75% (38). People suffering from mental disorders are therefore vulnerable to suffering and disability, human right abuses, stigma and discriminating, impoverishment and premature mortality. Due to financial constraints through treatment and lost income people with MH problems and their families are at risk of marginalization (26,28,39).

MH problems are not only a burden to patients and their families but there are also high economic costs for the society related to it. These comprise direct costs that are predominantly the costs made in the healthcare system but also the indirect costs that are related to the loss of income because of mortality, disability and lost income and production due to absence because of illness. In 2010 it was estimated that these direct and indirect costs compiled to a total of \$2.5 trillion globally (40).

The Sustainable Development Goals (SDG's) highlight the importance of both the topic of CC and MH, as it touches directly with SDG 3 & 13: “Ensure healthy lives and promote

wellbeing for all at all ages” and “Take urgent action to combat climate change impacts”. Furthermore, through the integrated approach of the SDG’s, there will be a reciprocal effect on other SDG’s, for example the goals targeting poverty and inequality (39).

Ethiopia is a country that is highly vulnerable to the impacts of CC. The country scores in the bottom rank, at place 163 out of 184 countries, in the Notre Dame Global Adaptation Index (41). This index scores countries’ vulnerability to CC in combination with its readiness to improve resilience (42). Ethiopia is one of the world’s most drought-prone countries, now facing increased periods of heavy rain as well as failure of seasonal rains. It has various different climatic regions, each with its own vulnerabilities to CC, with areas susceptible to increased temperatures and drought while other areas are vulnerable to intense and irregular rainfall with subsequent risk of erosion. The adaptive capacity of the country is low because of limited livelihood options for the majority of the population, insufficient capacity to withstand disasters and cope with the prevailing consequences (21,18).

In Ethiopia Mental Disorders and Substance Use Disorders accounted for over 2 million Years Lived with Disability in 2017 (29). Depressive disorders alone are ranked second place in this listing, with a 34% increase over the last 10 years (43). Service coverage and financial protection for MH is limited and this is posing high economic pressure on patients and their families. Compared to the general population, people suffering from severe MH disorders are more prone to be unemployed, their families are at increased risk of severe food insecurity (26) and patients are at increased risk to be driven into poverty because of out-of-pocket payment for MH services (44). Correspondingly, poverty forms a barrier to MH treatment (45). The MH services are minimally reaching the eligible patient populations. This highlights the need for public health programs targeting MH (28).

2.2 Justification

Both Africa and the topic of MH are underserved in scientific literature about CC. Only 10% of climate research focuses on Africa or the Eastern Mediterranean and there are still important gaps in the evidence base of MH and CC (10). There are a few studies that investigate the relation of CC or climate related events with MH in specific settings in Ethiopia. One example is the recently published article about environmental associated distress and the dangers of CC for pastoralist MH (46). However, literature on CC and the MH for the entire country could not be found.

As agreed upon in the Paris Agreement, countries are requested to outline their post-2020 climate actions in their Nationally Determined Contribution (NDC) (47). Ethiopia sets high ambitions in its NDC by aiming to reduce carbon emissions by 64% by 2030 from the projected ‘business-as-usual’ emissions (48). Furthermore, the political will to address both the issues of CC and MH can be seen by several other policies and plans (28,49). However, the MH effects of CC do not take a significant place in these documents.

An increase of knowledge and awareness about the interaction of CC and MH would give the opportunity to anticipate and respond to a public health concern that potentially has a large impact on equity and human wellbeing. This thesis aims to fill the knowledge gap on the connections between CC and MH in Ethiopia, explore international evidence on appropriate action and find opportunities to improve Ethiopian strategies and policies in order to limit the negative effects of CC on MH.

2.3 Objectives

Main objective

To analyse the impact of climate change effects on mental health in Ethiopia and develop recommendations on Ethiopia's current strategies and policies in order to improve effective adaptation.

Specific objectives

1. To explore the connections between climate change, mental health and health equity.
2. To describe Ethiopia's climate change projections and climate change vulnerability.
3. To analyse the pathways and determinants in Ethiopia through which climate change is affecting mental health and discuss the influence of climate change on the burden of mental health problems.
4. To explore evidence of best practices of climate change strategies influencing mental health.
5. To identify strategies and policies in Ethiopia with a relation between mental health and climate change that could be improved.

2.4 Methods

A literature review was conducted with the following search method: PubMed was used as a search engine. Search terms "Climate change" AND "Mental health" as well as (Ethiopia AND "mental health") AND (drought OR climate OR ecological OR landslide OR temperature OR heat OR precipitation OR rain OR flood OR conflict OR displacement OR weather OR environment). These terms were included because they are causes or effects of CC.

Inclusion criteria were: English text, full text available through the library of Vrije Universiteit, publication date after 2000. To be included, articles had to relate to the impact of CC on MH. Worldwide studies were included as publications from Ethiopia but also Africa and low-income countries are very limited. An overview of the numbers of articles found and key characteristics are shown in textbox 1. Additional articles were found through snowballing.

326 articles were found, 2 duplicates were removed and 5 articles where the full text could not be retrieved. 218 articles were excluded based on title or abstract. 101 articles were read, 19 more were excluded based on insufficient match with the topic and lack of relevant insights or insufficient quality. 82 articles were included based on this systematic search.

Characteristics of the articles (number of articles)

Quantitative primary research articles: 24

Qualitative primary research articles: 10

Articles with a focus on low- and middle-income countries (except Ethiopia): 11

Articles on Ethiopia: 9

Articles with a focus on indigenous populations in high-income countries: 6

Articles with a focus on farmers: 5

Textbox 1: Numbers of articles found and key characteristics

Additionally, grey literature was searched via Google, with specific searches on e.g. WHO, UNFCCC, World Bank and websites of Ethiopian government for relevant documents. Search engines were searched for "climate change" and Ethiopia. Mainly

grey literature reports with an overview of CC projections for the country were selected. Ethiopian policy and strategy documents were found via Google, government websites and through documents citing relevant policy documents.

Analytical Framework: Adaption of the “causal pathway framework” and “exposure pathway diagram”

Two frameworks were found helpful in visualising the relations between CC and MH. Firstly, the “causal pathways framework” by Berry et al. (8) describe multiple causal pathways through which CC is leading to altered MH outcomes (annex 1). CC affects MH through three pathways: directly, but also indirectly with a pathway through community impacts and a pathway through physical health. Those subsequently impact MH. Physical health and MH problems influence and reinforce each other through their causal, reciprocal relationship. This all is shaped by local contextual factors (8).

Secondly, different versions of the “exposure pathway diagram” are used in the report of the U.S. Global Change Research Program (USGCRP) (3). The most general version is shown in annex 2. In the different chapters of the report this diagram is tailored more towards the topic of the chapter, including versions for health and MH.

The tailored MH framework is missing many factors that were found relevant to MH that were included in the general framework of USGCRP and also described by Berry et al (8). Therefore, the more general “exposure pathway diagram” was preferred among the options in the USGCRP report. This framework describes climate drivers that are connected to exposure pathways and can subsequently impact health. Environmental and institutional context, as well as social and behavioural context can modify these pathways and health impacts (3). Despite being visually the most schematic and structural, it was found that this framework was not the optimal to describe causal relations. It is not very clear which factors do and do not relate to each other and share a causal relation, as some contextual factors can be impacted by CC and others are not.

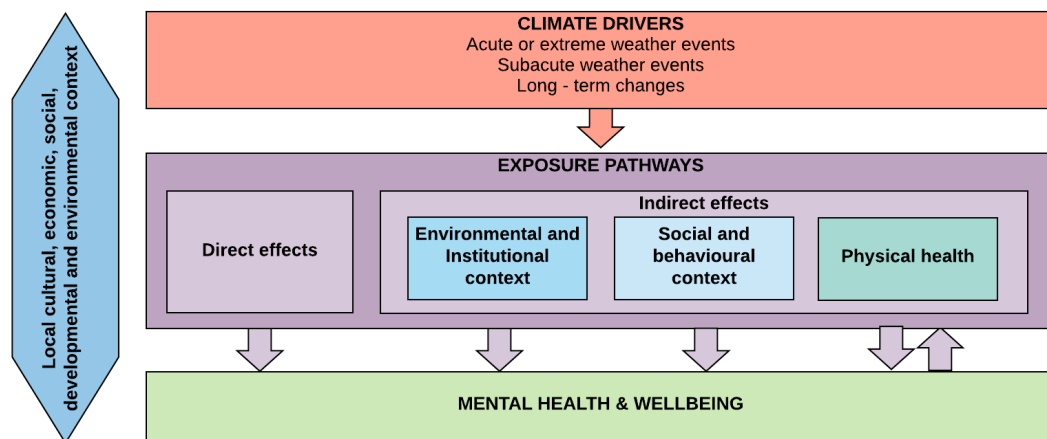


Figure 2: Analytical framework: Adaption of the “causal pathway framework” by Berry et al. (8) and “exposure pathway diagram” by USGCRP (3)

Therefore, a combination of two frameworks was made. This adapted framework is shown in figure 2. It largely uses the causal relations of the framework of Berry et al. (8) but the schematic representation of USGCRP(3). Thereby it provides more structure for the thesis while it showcases a clear view on the relations between the different factors. It largely leaves out the factors that modify the outcome but are not changed under influence of CC. Although it is also important to fully comprehend these factors in order

to understand CC vulnerability in a certain context, this is beyond the scope of this thesis and those factors will only shortly be mentioned.

The adapted framework shows the different climate drivers that can act through different exposure pathways to affect MH. The first pathway shows the direct effects on MH. The next box shows the indirect pathways, including environmental and institutional context, social and behavioural context and physical health. The two boxes with contextual factors largely replace the community factor as used by Berry et al.

The first three objectives of the thesis are structured after the framework. In objective 1 the causal relations of the framework are explained more in-depth; it is explained how the relations work in general. In objective 2 the climate drivers in Ethiopia are discussed. Current climate and trends are discussed as well as CC projections. In objective 3 the different pathways are analysed: it is described how the different climate factors and CC that are relevant to the Ethiopian context impact communities through different determinants and subsequently how they are expected to impact MH in Ethiopia.

3. Results

3.1 Connections between climate change, mental health and health equity

3.1.1 Linking climate change to mental health

Climate drivers can alter health and MH outcomes through different exposure pathways. In the area of MH, several authors further describe these exposure pathways. There is variation between authors on how exactly this is further worked out. However, they commonly share the division in the direct and indirect effects of CC on MH and the distinction between acute weather events, sub-acute weather events long-term environmental changes (8,9,50,51).

Direct effects of CC on MH can occur when people are exposed to more frequent, more intense and longer lasting climate related disasters and extreme weather. Extreme events - and disasters in particular - are common and they lead to a significant proportion of the overall health effects of CC (3). Acute or extreme weather events increase exposure to danger, injury and death, which can lead to acute and traumatic responses and increased risk of post-traumatic stress disorders amongst others. Sub-acute weather events can aggravate pre-existing MH disease through heat exposure and can increase rates of violent and aggressive behaviour. Long-term environmental changes can induce anxiety and feelings of helplessness and sadness, the loss of sense and place (solace) and grief reactions (51).

Indirect impacts of CC on MH happen through changes in social, economic and environmental determinants of MH (52). Changes in natural landscapes, disrupted food and water resources, physical health effects, change in agriculture conditions, changed land use and habitation and weakened physical and social infrastructure can increase financial and relationship stress, increased risk of violence and aggression, and displacement of entire communities (9). Furthermore, CC can affect physical health, that can subsequently impact MH or vice versa, through the causal and reciprocal relation between physical and MH(8).

MH responses to CC can be quite complex and diverse and can also involve positive outcomes. These include mental growth after a trauma, empathy, compassion, altruism and emotional resilience (8,9). Nevertheless, literature describing these positive effects is limited (4).

Implications of mental health effects for climate change vulnerability

MH problems are depleting personal resources and thereby it increases people's CC vulnerability (53); poor coping mechanisms and housing are capable to increase CC vulnerability (54) and chronic stress connected to poverty and job insecurity may worsen the negative MH effects (37). Psychological and immunological functioning are necessary to cope with adversity and this can be impaired by (even subclinical) levels of distress(55). Fritze, Blashki, Burke, & Wiseman (56) state that "vulnerable communities are beginning to experience disruptions to the social, economic and environmental determinants that promote mental health" due to the MH effects of CC. This would imply that CC is not only negatively impacting MH but also aggravates further CC sensitivity. Cooper et al. (46) underline that the CC effects on MH of vulnerable groups is not only important in relation to equity and wellbeing but it also shapes the populations' resilience to CC impacts.

The local and cultural context of mental health

Local social and cultural norms, values and beliefs determine how MH and wellbeing are manifested and perceived in different contexts (46). Many assessments, measuring tools

and interventions for MH are designed and validated in a Western context (57) and may not be one-on-one translatable to other cultural settings. Globally there is a high need for approaches better informed by local and cultural perspectives, representing local relevant idioms of distress and insight in local determinants and inequities (58).

3.1.2 Equity

Climate change & health equity

Differences in the determinants of health attribute to uneven distribution of MH risks and CC impacts that leads to health inequities (4). CC is disproportionately affecting disadvantaged groups. Through this negative impact it can subsequently further aggravates existing health inequalities; Islam & Winkel(59) argue that this can work as a vicious cycle.

Social determinants of health interact with climate factors to determine CC vulnerability and thereby affect health risks. Factors like socioeconomic- and health status, culture, gender, race, employment and educational status have been described to influence CC vulnerability (3,10,60). Marginalized groups tend to be more exposed to CC effects. Also they are more sensitive to those impacts and therefore more likely to suffer from the negative effects. Finally, inequality reduces the capacity of these groups to prepare for CC impacts and to recover from suffered damage. For example marginalized people are more vulnerable by living in disaster-prone areas like areas prone to flooding (exposure), living in housing that is easily destroyed by disaster (sensitivity) and being uninsured (adaptive capacity). This leads to unequal physical, financial, human, and social losses (59). Indigenous people, children, seniors, women, people with low-socioeconomic status, outdoor labourers, radicalized people, immigrants, and people with pre-existing health conditions are among those disadvantaged groups (60,61). On the global scale there is also a high level of inequity related to CC, as LIC are much more affected by CC and have a lower adaptive capacity than high-income countries (HIC), while HIC are a much larger contributor to CC than LIC due to their relative high emissions of greenhouse gasses (61).

Mental health & health equity

Similarly as with the relation between CC and health equity, a relation can be found where MH is influencing health inequities and vice versa. Especially poverty and social determinants related to poverty are described to be closely linked to common mental disorders and to interact in a negative cycle. Ventevogel (62) describes that social factors are a key component in the aetiology of mental disorders through “social causation”. Poor people are at increased risk of mental illness through increased stressors, social exclusion, malnutrition, obstetric complications, reduced social capital, violence and trauma (63,64). Lowered socioeconomic status and unemployment can reduce personal autonomy and increase stress, negative self-perception, insecurity and social isolation and can therefore result in a negative association with MH (56). Furthermore, the risk of mental disorders like depression, stress related disorders and alcohol and substance use is increased through social inequalities.

Conversely, the “social drift” theory describes the increased risk of people with mental illness to fall into or remain in poverty through the negative socio-economic consequences of their illness (62). Mental illness hinders the ability to learn and participate in social roles and employment. Through loss of employment and income, reduced productivity, stigma and increased health expenditure it can result in poverty. Furthermore, it can negatively impact physical health as it elevates risks of chronic non-communicable diseases (62-64).

Although a more thorough and systematic analysis of the above factors is needed, this information suggests a strong network between MH, CC impacts and CC vulnerability and health inequity. As is illustrated in the proposed diagram shown in figure 3, there are direct effects between each component. Also, through the indirect links, each factor is further affected. This would suggest a potential strong negative feedback loop aggravating poor MH, increasing health inequity and increasing CC vulnerability.

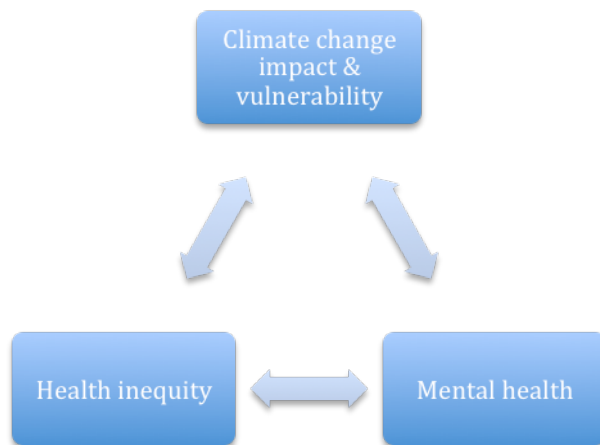


Figure 3: Proposed diagram: negative feedback loops between mental health, climate change impacts & vulnerability and health equity

3.2 Ethiopia's climate change projections and climate change vulnerability

3.2.1 Current climate and climate trends

The large differences in topography of Ethiopia are also reflected in a wide variety in climatic conditions. The lowlands have a tropical climate with average temperatures of 25°-30°C are characterized by desert-like conditions with barely 200 mm of annual rainfall along the border. The highlands have a cooler climate with average temperatures around 15°-20°C and generally receive the most rain (65).

There are three rain seasons: Kiremt (June-September), Bega (October-January) and Belg (February-May). The Kiremt rains are most important for agriculture, as they provide 50-80% of the yearly rainfall in the regions with high agricultural productivity and the main water reservoirs. Most of the severe droughts in the past are primarily caused by inadequate rain in this season (21).

Ethiopia's temperature has shown a significant and relatively steady increasing trend. It increased by 1.3°C between 1960 and 2006. The temperature rise varies per region, but has been most extreme in areas that are already dry and hot. Nationwide there has been an increase in "hot days" and "hot night" of respectively 20% and 38% between 1960 and 2003 (24). The changes in the trends of precipitation are less uniform, as different studies show different results and large year-to-year variation. On average, rainfall has been quite stable over the last 50 years. However, on a more local level the changes are extremely varying per region. The natural variability in precipitation makes it difficult to identify long-term trends (18). The El Niño Southern Oscillation is often related to years with increased drought (66)

3.2.2 Climate change projections

For Ethiopia's situation, projections for temperature are quite similar but rainfall projections are more divergent. In general, the Lowlands are prone to increasing temperatures and prolonged droughts. The Highlands are vulnerable to intense and irregular precipitation. Increases in temperature are expected in all seasons. Compared to 1975, the average expected increases are 1°C by 2030, 2°C by 2050, and 3°C by 2080, with a steep increase of "hot" days and nights during the warmest months (18,67).

Over the next 50 years the average rainfall is expected to increase with about 9% compared to 1975. However, there are large local differences with increases in some districts and decreases in others. The variability for rainfall is predicted to increase for the whole country. This makes it harder to predict rains. Changes in temperature and rainfall increase the frequency and severity of extreme events. A large proportion of the total rainfall is expected to fall during "heavy" events (18,67).

Extreme events

Ethiopia is prone to draughts, floods, landslides, pests, earthquakes and wildfires. There is a long history of droughts. Since 1970 droughts have become greater in magnitude, frequency and intensity. In the period 1900-2010 there have been twelve extreme droughts. In total over 400,000 people were killed and 54 million were affected. In 2015-2016 Ethiopia experienced the worst drought in 50 years. Most of the extreme droughts are followed by famines. Floods have occurred more often than drought, but their impact has been smaller: they have affected less people and caused fewer deaths in comparison to drought (18,21). It is anticipated that CC will lead to more extreme events; alternating severe droughts in some years and heavy rainfall leading to flooding, erosion and landslides in other years (18,67).

3.2.3 Climate change vulnerability

The groups of people that are classified as most vulnerable to the impacts of climate related disasters by the MOH are women, children, elderly, people with disabilities as well as people living with HIV/AIDS (68). The agricultural sector is one of the sectors that is highly vulnerable to CC effects (41). As this sector is important to both the national economy as well as to a significant part of the population that relies on agriculture or pastoralism for their subsistence. A more extensive description of the CC effect on agricultural capacity and agricultural vulnerability is given in textbox 2.

Climate effect on agriculture: Shifts and decreases in rainfall seasons can significantly impact Ethiopian agriculture; it can result in a loss of a growing season, can impact seedbed preparation and can hinder maturation cycles. The areas receiving enough rain for growing crops in the different rainy seasons have been contracting. Further declines of these regions are expected, although it is mentioned that there is variation between studies predicting increases or declines in the different rainy seasons. A significant proportion of these contractions have taken place in areas with high population density and areas that are already exposed to near-chronic food insecurity, like the Rift Valley, SNNPR and Oromia (18).

However, not all agricultural areas are threatened as large parts of the country and especially the Western highlands are expected to continue receiving sufficient rains (18,25). Agriculture in the wetter parts of the highlands is likely to benefit from CC until 2030 and then loose productivity. The drought prone-highlands are expected to directly and continuously suffer from decreasing productivity (23).

Changes in temperature can change agricultural temperature zones, intensify drought and boost pests and diseases (18). Projected warming due to CC will be the greatest in the south-central part of the country, aggravating drought effects with particular the potential to reduce the coffee production, a plant that best grows in cooler temperatures (25).

Climate effects on livestock: Ethiopia has an enormous livestock sector that is contributing to 16% of GDP. It is the main source of subsistence for approximately 10 million pastoralists (18). Changes in rainfall, rising temperatures, conflict, invasive species and overgrazing are factors that directly or indirectly linked to CC and are straining the sector and communities involved (109) (18). Areas receiving enough rain for pastoralism are decreasing and projections show continued decline (18,25).

Agricultural vulnerability: As less than 1% of the land used for agriculture is irrigated, Ethiopia's farmers are heavily dependent on rainfall (65). The sector mainly consists of small-scale subsistence farmers, approximately 8 million households (18). These rural household livelihoods are using traditional methods and are extremely reliant on seasonal climate cycles dominated by timing of the rains (111). Plots of family owned land are continuously reducing in size, as each generation further divides them. This leads to low productive plots that are too small for food security and adequate income. Finally, this results in insufficient means for agricultural intensification and CC adaptation (18,109). Afar, Somali, Oromia, and Tigray are Ethiopia's four most vulnerable states to CC and are also the poorest states, that rely highly on agriculture (18).

Textbox 2: Effects of climate change on agriculture

3.3 Pathways linking climate change to mental health in Ethiopia

In this chapter is explained how climate drivers are linked to MH. A picture of the Ethiopian context is given and it is described what expected CC effects in MH are in Ethiopia.

3.3.1 Direct effects

Acute or extreme weather events

Worldwide acute or extreme weather events and climate disasters are projected to become more common, powerful and complex due to CC (9)(55). After a disaster acute or traumatic stress is commonly seen. Most of this stress is self-limiting, the majority of the population recovers and can even show mental growth when safety and security is re-established (56,69). However, in some people symptoms persevere. This is related to the type and intensity of exposure to the disaster (like sustaining injury or witnessing death) and factors like relocation, personal and property losses but also determinants like age, sex, health status and socio-economic background (69). Although posttraumatic stress disorder (PTSD) is the most described MH problem in relation to disasters, it can also trigger other psychiatric disorders like depression, anxiety, complicated grief and substance abuse (9,51,56,69). These reactions are quite similar among various cultures (56).

After flooding and hurricanes, high numbers of MH impacts are reported in different contexts (9). Qualitative and quantitative studies from HIC show that damage to property or livelihoods, displacement and multiple exposure negatively influence MH outcomes after floods (70,71). Socio-economic marginalisation is a risk factor for developing MH problems after flood, it both increased likelihood of exposure as well as increased risk of developing MH problems after exposure (71). However, also positive community growth is found after floods (70). Longitudinal research after hurricane Sandy in the USA shows an association between exposure to property- and personal damage and PTSD symptoms one year after primary baseline questionnaire (but not with anxiety or depression symptoms) (72) although the large time range in which the baseline questionnaire was conducted could have influenced the quality of this longitudinal study.

Research from LMIC on disasters is more limited, but a study from Vietnam amongst 1000 coastal inhabitants shows an association between traumatic storm exposure and MH problems. This study highlights the role of poverty as an indirect link between natural events and MH problems, as financial stress proved to be the strongest predictor of MH problems in this study. Financial stress was in turn significantly associated by the number of storms experienced (37). This indicates the potential important mediating role of poverty and economical disadvantage. In a systematic review on the effects of extreme weather in developing countries Rataj et al. (57) found increased incidence of MH problems (PTSD, depression, anxiety disorder) in all 17 included studies. It is striking that the majority of those studies are missing local reference data and therefore are using global reference data. Furthermore, studies from Africa are absent. Risk factors for developing PTSD are pre-existent MH problems, prior trauma, high exposure to disaster, exposure to death or death of a relative, low educational level, female sex and destruction of property (57).

Floods and landslides are the two main extreme events that are expected to increase due to CC in Ethiopia as shown in objective 2. The population at risk for floods was

154,400 in 2010 and is expected to increase with another 248,200 people due to CC and 178,100 people due to socio-economic increase in 2030 under a high-emissions scenario (73). No studies on the MH impact of natural disasters in Ethiopia could be found. However, high prevalence of PTSD (37.7%) were reported after a man-made landslide composed of garbage killed 113 people and caused injury and the destruction of houses in Ethiopia(74). Conditions and problems other than PTSD were not researched. This prevalence is very high compared to the global PTSD prevalence rate of 0.37 % but still within the range of other global post-disaster prevalence rates (57). It could be expected that natural landslides and other disasters would also trigger increased rates of PTSD. Other effects could be negative impacts on food and water availability, infectious and vector-borne disease outbreaks and population displacement ecosystem disruption (73).

Sub acute weather events

Extreme heat and humidity in a changing climate can be linked to reduced wellbeing, increased MH problems and exacerbation of pre-existing MH diseases. Three studies including 60,000 to 2 million respondents show higher rates of reported negative MH and wellbeing during hot weather in Thailand (75), Australia (76) and the USA (55). Obradovich et al. (55) show in a large study with nearly 2 million US residents that exposure to more extreme weather, multiyear warming and tropical cyclones is associated with increased probability of MH difficulties, disproportionately affecting women and people in low-income groups. Extrapolation calculations show that a shift in temperatures from 25-30°C to above 30°C for one month could result in an increase of 2 million US residents with reported MH difficulties.

People with pre-existing MH disorders and substance abuse are prone to be more affected by extreme weather, leading to deterioration of the MH condition due to impaired thermoregulation, use of prescribed psychotropic medication and reduced coping strategies and possibilities (9,77,78).

Many studies, mainly cross-sectional have been conducted to look at the influence of temperature on behaviour and MH problems in different climate regions. These studies tend to suggest that greater variation from the mean give rise to more problems. Above average or high temperatures are linked to increased admissions mental and psychosocial problems (79) increased schizophrenia admissions (80) increased aggression in MH patients and death of patients with psychosis and dementia (78,81) and increased suicide attempts (82). However, others find increased admissions for MH problems with *lower* temperatures (83) or no temperature effect at all (84). There are studies that have linked acute weather events and high climate variability to increased suicide, suicide ideation and homicide but overall evidence about this topic is still inconclusive (9).

Due to different geographical regions it is quite difficult to generalise these results. It is not clear if these problems are transferrable to the Ethiopian context as most of the above research is conducted in HIC. However, the study from Thailand is showing that, also in tropical climates and LMIC setting, further increases of an already warm climate could have a negative impact on MH. This could indicate that MH in Ethiopia is at risk to be negatively impacted by rising temperatures and this could potentially affect both tropical and cooler temperature regions.

Long-term environmental changes

Some of the positive and overarching effects are expected as direct effects due to long-term environmental changes. Because most of these changes will (also) act through

indirect pathways, like changing ecosystems, the outcomes will be discussed later this chapter.

3.3.2 Environmental and institutional context

Eco system change

The realisation that the climate is changing and the threat this poses for current and future wellbeing of people, communities and the natural ecosystems is an important psychological and emotional stressor (3,8,9,58,85). Different terms are used to describe varieties of this phenomenon, including ecological grief, eco-anxiety or solastalgia (86).

'Solastalgia' refers to "the distress and isolation caused by the gradual removal of solace from the present state of one's home environment" (9). This poses an existential threat (85) and has an impact on mental, emotional, and spiritual health (87). These effects are expected to be most evident in settings where the natural environment carries symbolic, religious or cultural meaning for communities (88). Therefore, literature on solastalgia can especially be found in relation to indigenous populations. Because of their -often profound- cultural and spiritual connection to nature, the importance of nature for income identity and subsistence and also their vulnerability to CC (58,89).

Qualitative research in the Inuit community in Canada shows that MH is already negatively affected by the climate-induced landscape changes and the subsequent effects this has on traditional lifestyle practices (90) and that continuing traditional and cultural practices are important for MH of these communities, while environmental changes related to CC are threatening MH (91). CC is also influencing the Saami reindeer culture in the European north and is expected to further reduce socioeconomic possibilities to preserve their culture and identity. These changes pose a threat to MH and cultural wellbeing of the Saami (92).

The threat of the changing climate also manifests itself in relation to psychiatric diseases. In a sample of 50 patients with Obsessive Compulsive disorder checking subtype, 28% experience symptoms directly connected to CC (93). Similarly, a significant correlation can be found between high levels of reported concern about CC and dysphoria (94). However, it is not clear for both of above cases to what degree CC is the cause of this type of mental problems or if it is merely the divergence of symptoms from other current societal concerns to CC. In that perspective is very questionable to what extent this would occur LMIC.

In Ethiopia CC is expected to worsen degradation of ecosystems and natural resources. It is likely to cause increased desertification which is further aggravated by human activity (19). Soil degradation is intensified by short periods of intensive rain in the highlands combined with subsequent flooding of the lowlands, although these floods can also increase fertility (18). This land degradation and ecosystem change, the realisation that this is happening and the subsequent impact on local culture and identity have the potential to impact MH yet a better understanding of the context and impacts is needed.

Climate impacts on agriculture

Climate sensitive factors like the loss of arable land due to shifts in agricultural growing zones, affected growing cycles and an upsurge of pests and diseases can negatively impact agricultural output (18) as elaborated in textbox 2. However, not all of Ethiopia is expected to become climate insecure, as large areas are projected to continue receiving sufficient rain for agriculture and areas could potentially increase production (25).

Agricultural productivity, land use, water scarcity and drought, food security and economic conditions are all very closely linked. These effects will be discussed in the next few headings.

Water scarcity and drought

One of the most researched climate hazards with indirect connections to MH is drought (95). Drought impacts several determinants that affect MH. The impacts of drought are most prominent in rural and remote populations and for farmers who are depended on environmental circumstances for their income and livelihoods (9).

Drought is associated with stress through financial worries and is linked to MH problems including anxiety, distress, loss and grief (96). When food and water supplies are reduced due to long-term drought, they can impact the economic and mental wellbeing of people deriving their income through agriculture. The financial effects of land degradation also play an important effect in this situation (9). Drought and failed harvests also have a strong link with food and nutrition. Especially for people who are reliant on rainfall for their livelihood, prolonged drought is an increased MH burden (3). Because of their high reliance on the environment, farmers are more vulnerable to MH effects of CC (97). Economic stress and drought can aggravate other stressors experienced by farmers (96). Living in drought-prone locations is causing distress and continuous worry about future droughts that could disturb their income and subsistence (3).

A comprehensive analysis of the effects of drought on MH is done by Vins, Bell, Saha, & Hess (98). In this systematic review the causal relations are mapped in a diagram showing the high level of intermediary factors related to drought that ultimately can lead to a variety of MH problems. This gives a complex and web-like pattern as shown in figure 4. The two pathways where drought is causing migration and negative economic

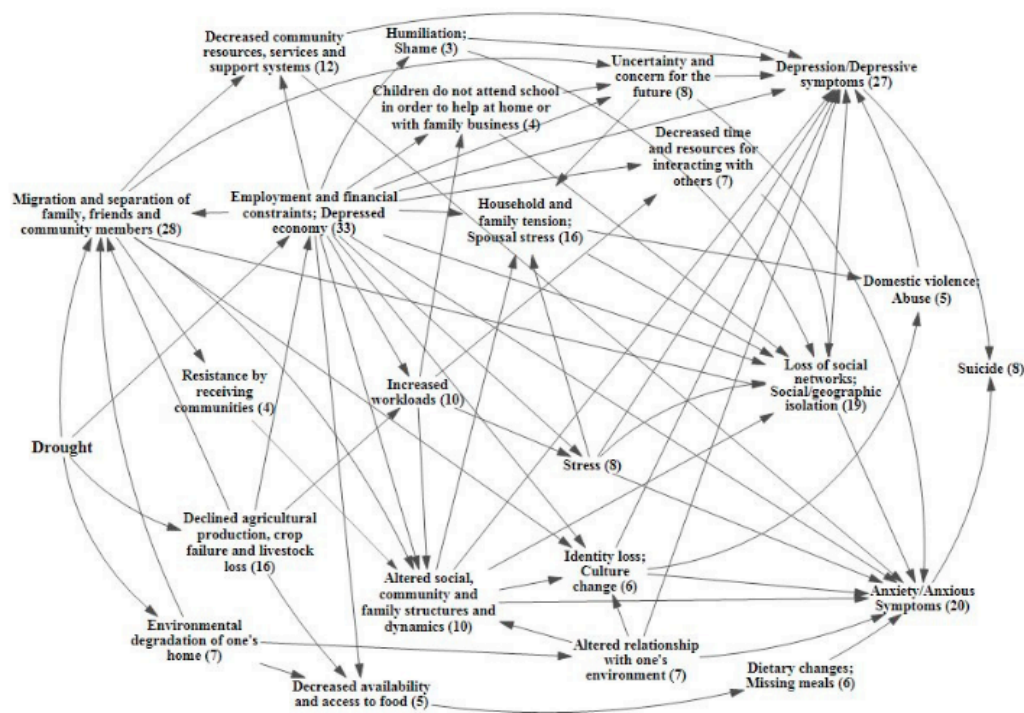


Figure 4: Causal process diagram for mental health outcomes of drought Source: Vins et al., 2015 (98)

effects are most supported by evidence. The intensity of drought and the level of impact on livelihoods in an important factor for the severity of MH impacts (98).

There are a number of studies on the effect of drought on farmers and rural populations. The majority of those have been conducted in Australia. Four quantitative studies conducted in Australia, find increased rates of MH problems (mainly stress) with increased drought in rural populations and farmers (95). However, there is large variation between the studies in the subgroups that are found to be most negatively affected: mid-aged men (99), younger and mid-aged women (100) or age under 35 (101). It is not clear from these studies how these differences can be explained. Other risk factors include experience of bigger financial hardship, living in remote locations (101). One qualitative study from Australia describes the effect of recent experienced patterns of CC on farmers. It increased worries about the weather, weakened ideas of self-esteem, increased chronic distress based on place leading to increased perceived risk of depression and suicide (102). This research shows the importance of close relation of farmers MH and their (changing) eco-system and also the importance of the connection land and identity for MH and wellbeing (102). Rural populations (in Australia) are described to suffer from relative disadvantage related to MH as MH service availability and affordability is unequally distributed (103). Due to the highly different socio-economic differences it is very unclear if these results are in any way transferrable to the Ethiopian context. However, the large differences in subgroups triggers the question what brings resilience in specific groups. This question is also relevant for Ethiopia.

Ethiopia is currently already vulnerable to droughts and 43% of the population is without access to safe water (104). CC is expected to further reduce raw water and drinking water supply by climate extremes. Not only decreased rainfall will reduce water supply, also increased rainfall can threaten safe water supply as can increase water contamination by soil erosion. These problems are aggravated by human induced practices leading to increased desertification and reduces water accessibility by population growth and land fragmentation (19,104). CC will further affect water supply nationwide, but most severely in the areas that are already suffering from water scarcity (e.g. densely populated areas of the Rift Valley and eastern lowlands)(18). These factors are especially important for farmers and pastoralists.

There are two studies conducted in Ethiopia that show water scarcity can indeed impact MH. Cooper et al. (46) conducted a qualitative study on the emotions linked to water availability among the pastoralist population in the Afar region studied of Ethiopia, using local idioms of distress. This study demonstrates that emotional distress is significantly impacted by seasonal variation of water security. In the dry season water security is negatively impacted and causes increased pressure on the population, for example through increased travelling for water and concerns of not being able to provide enough water for cattle, resulting in negative emotions. Another small-scale study conducted in Ethiopia also found a connection between water supply and mental wellbeing. In this study the price of water and family size were significantly correlated with increased emotional distress. However, relation to water quantity, reliability and accessibility were not found significant (105).

Economical context

Poor countries with high dependency on agriculture are among the most vulnerable to CC due to the importance of the agricultural sector for livelihood, production, export and employment as well as low adaptive capacity, lack of necessary technology, and limited resources to deal with CC (24).

It is expected that the Ethiopian economy will be significantly impacted by CC, mainly through the vulnerable and large agricultural sector. It is projected that agricultural outputs will decrease while agricultural commodities prices rise (19). Estimated impacts vary from up to 10% of GDP by 2045 (106) up to losses of 40% of GDP by 2050 (19). Aragie (24) estimates that, between 1991 and 2008, a cumulative level of 13% of agricultural output was lost due to rainfall variability alone and predicts losses of more than 6% of yearly agricultural output in the coming years when these climate trends persist. Poverty alleviation is a crucial factor in Ethiopia's development policies and this relies enormously on economic growth (24). Already inadequate MH systems in LMIC are at risk to be further deprived in case of economic adversity due to CC (54).

3.3.3 Social and behavioural factors

Poverty and food security

Extreme climate events are known to be costly to individuals, by destruction or forced sale of assets and through decreased economical consumption (19). Food insecurity is linked to increased levels of psychological distress (107) and impacts on wellbeing (88). Nutritional deficiencies are associated with negative MH impacts like depression and cognitive regression (108). In developing countries, specifically in children, CC is expected to aggravate malnutrition when food security is inadequate (108). Stress linked to increased food prices or reduced food availability can have a negative MH impact especially in combination with a low socio-economic status (96). Another effect of economic adversity is its negative effect on health seeking behaviour due to financial impacts, *especially* for MH and in settings where out-of-pocket payment is required (108) leading to treatment inequality and under-treatment. Furthermore, poverty and hunger are not only impacted *by* CC but are also *influencing* CC vulnerability, as it reduces the resilience and adaptive capacity of individuals (24).

There are strong links between CC, poverty and hunger in Ethiopia. The agricultural sector plays a central role in this topic on both national and community level, firstly as food producer and secondly as source of income and economic development. CC is expected to impact agricultural production in several regions (109). Increasing temperatures, land and water scarcity, drought, flooding and displacement are being exacerbated by CC (110). This has a negative impact on agricultural production and breaks down food systems, leading to malnutrition and food insecurity (104), especially for children and vulnerable groups (110).

Ethiopia is already known to be vulnerable to food insecurity and malnutrition. There has been a structural food deficit for 20 years (109) On top of that, agricultural production is not increasing as fast as the population is growing and plots of farmland is getting smaller (25). Currently there are 8.4 million people in need of humanitarian assistance because of critical physical and MH problems or serious living standards problems. At the same time around 8.5 million people being considered food insecure, of whom 6.5 million are classified in the "crisis" phase (facing high levels of coping distress and the need access to food through livelihood asset stripping) (111,112). In 2019, around 360,000 children with severe acute malnutrition were admitted for treatment every month (111).

Funk et al. (25) state that if current trends continue, per capita cereal production in Ethiopia could reduce by 28% by 2025. Decreased precipitation and sternly increased food prices are severely affecting food security (25). Further deterioration of malnutrition due to CC is projected, as correlations have been found between climate variables and levels of malnutrition (18). An increased frequency of droughts combined with an overall drier climate could produce repeating shocks that increase vulnerability

and fuel a cycle of poverty (25). This cycle can already been seen in the report of the United Nations Office for the Coordination of Humanitarian Affairs (OCHA)(111); there have been exceptionally high numbers (3.2 million) of people who did not recover from their need of relief food assistance and whose needs have become chronic in the period of the last four years. Households are blocked in returning to self-sufficiency by losing their productive assets and insufficient livelihood opportunities. A large part of this aid has been given in areas previously struck by drought. Among those are 403,000 destitute pastoralists that are Internally Displaced Peoples (IDPs), also referred to as Climate-IDPs (111). It demonstrates the vulnerability of this group and shows that there is insufficient time to recover between climate shocks

A study by Gebrekidan Abbay et al. (31) shows that, in an Ethiopian town, financial stress and poverty is reported as one of the major *perceived* causes of mental distress. However, analysis of gross family income and feelings of financial insecurity showed no significant statistical association with mental diseases (31). Nonetheless the current magnitude and the projected impact of CC on poverty, food security and hunger make this an important topic to consider in relation to MH.

Conflict

The causal mechanisms of conflict are complex. They involve many potential pathways and are not yet fully understood. However, CC appears to be one of the causative factors (113). Bowles, Butler and Morisetti describe that CC can induce, intensify or protract conflicts and can be seen as a 'risk multiplier' in this context (114).

It is thought that, when resources reduce through CC (especially arable land and water and reduced livelihood options) the risk of violence and conflict increase. This could happen between ethnic groups or between nations, the latter for example as international conflict over dams or water treaties. These grounds for conflicts are rarely isolated but dependent on pre-existing socio-political instability. However, socio-political stability itself can also be influenced by CC for example through economic recession, increased unemployment and food insecurity (113). Therefore, the risk of conflict stimulated by CC is highest in settings with weak governance and civil institutions (114) and settings that are already highly vulnerable to collective violence (113).

In Africa political and socio-economic instability are influential factors in CC vulnerability and subsequently environmental changes are fuelling further instability (115). CC is known to intensify disparities especially in LIC by increasing poverty and vulnerability in the most disadvantaged groups (113). Through the adverse effects on subsistence farmers in LIC, CC drives migration and urbanisation. This generates further social and political instability and subsequently increases the risk of violence (113). In this way, CC has the capability to increase fragility in states and furthermore to increase violence especially in these fragile states.

An illustration of this is given by Gleick (116), who describes climatic conditions and prolonged drought as one of the root causes for the start of the conflict in Syria in 2011. In a meta-analysis Hsiang, Burke, & Miguel (117) provide strong evidence that deviations from normal climatic conditions significantly influence risk of conflict; the change of 1 standard deviation change in climate variables (both temperature and precipitation) gives a 14% increase in intergroup conflict and a 4% increase in interpersonal violence in a wide range of settings.

Conflict can influence MH through exposure to trauma evoked by conflict. This can result in MH problems like PTSD and depression in both combatants and non-combatants (114). However, conflict affects health and MH through many more

determinants, including degradation of the health care system, social structures, water and sanitation, poor living conditions and malnutrition (113). Additionally, increased temperatures have been linked to increased rates of violence and aggressive behaviour (51).

In Ethiopia, many of the above-mentioned risk factors for conflict due to CC are present. It is a low-income country with a high level of subsistence farmers and increasing population density and migration. OCHA (111) describes a peak in conflict and inter communal violence in 2019 and dedicate this to a mix of factors. These include factors that could be worsened by climate change like disputes over resources, predominantly land and water.

Research from the neighbouring country Somalia reveals that longer periods and increased intensity of drought highly raises the risk of conflict. The economy of livestock markets in Somalia is found to have a central role in the pathway from drought to conflict. One standard deviation variation in drought variables elevate the risk of conflict by 62% (118). This is proportionally higher than the global averages from Hsiang, Burke, & Miguel (117), though it still falls within the range of their findings. There are many similarities in geographic and socio-economic conditions between Somalia and Ethiopia, especially the eastern lowlands where pastoralism and the livestock sector play a central role. This could indicate that also in Ethiopia there is an increased risk of conflict due to drought. OCHA (111) describes how conflict is already affecting various determinants: as conflict interrupts agricultural growing cycles, this results in food insecurity and malnutrition through decreased food availability and increased food prices, especially for the poor. These can again be linked MH through the various determinants as described in this objective.

Migration

Worldwide climate and weather-related disasters caused displacement of 22.5 million people per year between 2008 and 2015 (119) and this is projected to increase (33). Estimates for future numbers vary, however three prominent assessment forecast a total of 150-200 million climate migrants by 2050 and the World Bank projects 86 million in Sub-Saharan Africa alone by the same year (115,120).

Climate driven migration and displacement is linked to MH through several pathways. It can increase conflict and forced migration and can subsequently increase PTSD, anxiety, trauma and susceptibility to stress (9). Forced migration is known for the accumulation of important losses, both material and immaterial and it is commonly paired with exposure to trauma and violence and discrimination (119,120). Torres & Casey (119) describe the MH impact by disruption of social ties as a possible immaterial pathway. Disruption of family and community connections by climate driven migration may lead to social isolation and reduced social and material (e.g., informational, financial) support and can act as a psychological stressor. Being separated from family, community or ethnic networks can decrease the sense of belonging, which could contribute to poorer MH for both migrants and those left behind. However, contrariwise, displacement has also been linked to increased psychosocial resilience (9). A concerning mechanism of migration is the feedback loop described by Vins et al. (98): migration triggered by drought is causing further decline of resources of those left behind, thereby increasing their vulnerability, driving further migration.

Ethiopia is challenged by “one of the most complex human mobility environments in the world” (121), hosting high numbers of both refugees as IDPs. In 2019 it received nearly

100,000 new people from neighbouring countries and accommodated a total of 735,204 refugees (111). This trend is expected to continue (112).

Estimations for internal displacement in 2019 range from over 1,5 million (120) to a peak of 3.2 million (111). Conflict is the primary source of displacement accounting for 29% of IDPs, followed by climatic shocks (drought and flooding) (120). The data on conflict does not uncover underlying causes of the conflict. Therefore, it seems probable that besides the IDPs that are directly linked to climate factors, there also is a significant number of IDPs in Ethiopia that can be linked back to CC through indirect pathways. One important potential pathway is conflict started or intensified by CC.

Population pressure is accumulating by these high numbers of refugees and IDPs as well as the expected increase in climate related migration and the country's rapid population growth. Projections especially show an increase in already densely populated areas. Increased population pressure increases CC vulnerability as it decreases the resources available per person (e.g. land, food and especially water) and can consecutively also increase competition and conflict over resources (18). Providing for refugees reduces the adaptive capacity of the country (19).

Increased levels of MH problems have been reported in refugee and IDP populations in Ethiopia, especially in combination with exposure to violence and conflict. Among Somali refugees in Ethiopia high levels of depression (38.3% (95% CI 34.9-41.9)) are found; risk factors include the experiencing of multiple traumatic events including murder of family or friends but also forceful displacement and lack of shelter (122). Likewise Eritrean refugees in Ethiopia that have been exposed to armed conflict are facing increased levels of mental diseases including PTSD (risk ratio of 4.53 (95% CI 2.48-7.71)), mood disorders (risk ratio of 6.06 (95% CI 1.51-21.90)) and anxiety disorder (risk ratio of 3.16 (95% CI 1.51-6.28)) compared to the group not exposed to armed conflict (123).

In the IDP population, OCHA (111) describes significant levels of psychosocial distress and mental disorders (though no statistics are available in the report), consisting of newly diagnosed disorders as a consequence of physical and mental trauma as well as deterioration of pre-existing disorders due to trauma or disruption of treatment. The collapse of economic, family and social structures and trauma exposure are reportedly linked to increased psychosocial distress. Also increased prevalence of intimate partner violence, suicide attempts and suicides are described (111).

These problems apply to the general IDP population and not exclusively to the climate migrants. It is likely that they are largely shared between IDP groups, though exposure to violence can be expected to be lower between the climate migrants than conflict related refugees.

3.3.4 Physical health effects

The effects of CC on physical health in Ethiopia are well described in the 'National Health Adaptation Plan to Climate Change' and the impact of it is described as "tremendous" in this document (104). Increasing temperatures and changes in rainfall patterns linked to CC are affecting health by worsening and (re-) introducing climate sensitive diseases (73,104). These conditions are favourable to vector-borne diseases like malaria and dengue fever and are likely to result in increased exposure and increase of the endemic areas to the highlands (67,73,104). As discussed earlier in this chapter, CC is threatening food security and can result in malnutrition(104). Increased intensity of precipitation and flooding will increase incidence of waterborne diseases like diarrhoea, cholera and dysentery (67). Contrariwise, increased drought will lead to reduced drinking water and water for hygiene. This is also linked to diarrhoea (and scabies) (104). Increased temperatures are a risk for health-related illness (like heat stroke) and death especially

for children and elderly (104). Respiratory tract infections are likely to increase, as allergens and air pollution are expected to increase in more drought-prone climate (67,104). Furthermore, studies worldwide have linked CC to increased meningitis, heat stroke, heart diseases and lung cancer among others (104).

These physical health effects can influence MH and vice versa, as previously described. Also there are potential (long-term) cognitive and MH effects of climate sensitive diseases that are not yet fully understood (3). An example of this are the effects of infectious and vector borne diseases on the brain as in illustrated in the study of Idro et al. (124) that suggests that cerebral malaria in children may increase the risk of MH problems, potentially due to ischemic damage to the brain.

3.4 Evidence of best practices of climate change strategies influencing mental health

Currently the link between CC and MH is missing in policies globally and 'best-practices' are not yet acknowledged in literature (38). The need to further expand CC adaptation strategies for MH is widely endorsed by auteurs on this topic and many articles offer policy advice or mention policy implications. In an analysis of national adaptation policies for CC in 12 HIC Seidel & Bell (125) state that, although the general concept of MH as a vulnerability factor is widely present in these documents, it is almost never elaborated into more comprehensive adaptation strategies. The American Public Health Organisation (APHA) has integrated current global guidelines in their policy statement and appeals for more a more active, integrated and culturally appropriate approach. All stakeholders are called upon to "actively prioritize, implement, and finance actions that more comprehensively address climate change impacts on MH, well-being, and resilience (both structural and psychosocial) with cultural sensitivity" (38).

Although comprehensive strategies addressing MH effects of CC are missing, there is an abundance of information targeting the MH effects of CC or sub-elements of this topic; regarding what is needed, what should be done and how this should be done, giving multiple potential starting points for action. These include guidelines, guiding principles, various types of interventions and recommendations by international agencies, national health agencies and authors, for example more general health adaptation for CC and MH strategies for migration and emergencies.

There are a few recommendations that are commonly shared in literature on policies and interventions concerning health or MH effects of CC. These recommendations have diverse levels of evidence bases; several derive from implications drawn by the authors after thorough discussion of a certain topic, others advice is based on policy literature.

1. First of all, there is a call for community development initiatives; understanding community needs and context (37) in order to strengthen communities (53,126), increase social capital and increase community preparedness for CC (4), with approaches that are informed by population perspective (115) place-sensitive (102) and culturally relevant (4,38). An example of a promising community development approach for farmers' MH in relation to persistent drought is the "Rural Adversity Mental Health Program" in New South Wales, Australia. This study aimed to raise awareness and address the need of rural populations affected by drought by improving community resilience, improving MH literacy and reduction of stigma. The authors assess this intervention as accepted and effective (53), however the methodology of this study is questionable.
2. Secondly, there is a call for more comprehensive (38), multi-sectoral (71) and trans-disciplinary collaboration (4) with improved coordination (115,127).
3. Thirdly, CC adaptation interventions should be assessed for co-benefits and unintended harm; potential conflicts with health and wellbeing should be avoided, while opportunities for interventions linking CC adaptation or mitigation with positive (mental) health effects should be stimulated (115,128).
4. Preparation of the healthcare system and healthcare workforce for CC impacts by increasing awareness preparedness (38,127).
5. The need to intervene and evaluate on multiple levels of public health: Primary interventions that are pre-disaster, preventive measures, Secondary intervention that are delivered directly post-event and Tertiary interventions that target long-term post-event MH problems. Primary interventions can

- consist of 1) Environmental interventions 2) Equity and social justice-based interventions and 3) MH specific interventions (38).
6. Moreover, there is a call for an equity approach and empowering disadvantaged people (71) and public health prevention strategies identifying (38) and protecting the most vulnerable to MH impacts of CC (9).
 7. Finally, there is a need for the expansion of the evidence base on climate informed MH service planning and MH interventions across settings and cultures (38), the collection of baseline data and impacts of CC on MH (3) and assessment of adaptation (38), the development and validation of culturally appropriate screening tools (129) and the need for the need for better understanding of the complex causal frameworks for the MH effects of CC (130) and finally ecological and multidisciplinary frameworks and research in order limit these negative effects (38).

Besides these policy and intervention recommendations, there are several strategies from international recognized organizations addressing parts of this topic (38) like the ‘Sendai Framework for disaster risk reduction’ (131), the ‘Inter Agency Standing Committee (IASC) Guidelines for mental health and Psychosocial support in Emergency settings’ (132) and the ‘Global Compact on Safe, Orderly and Regular migration’ (133). These underline the importance of MH and psychosocial support related to disasters, emergencies and in refugee populations and offer guidance to governments and other stakeholders regarding the roles, planning and coordination of interventions.

The IASC guidelines (132) are based around six core principles: human rights and equity, participation, do no harm, building on available resources and capacities, integrated support systems and multi-layered supports. This framework is designed for mental health and psychosocial support (MHPSS) in emergencies and is not aimed at sub-acute or indirect effects of CC on MH. The Multi-layered supports system (core principle 6 of IASC) is schematically visualised in the pyramid shown in figure 5. This structure is comparable to the WHO for the “optimal mix of MH services” as depicted in the chapter “Background information” (figure 1) (30).



Figure 5: IASC intervention pyramid for MHPSS. Source IASC, 2007 (132)

The guiding principles of IASC are mainly targeted at local interventions. However, there is a great overlap between the recommendations in literature that are discussed here and the IASC core principles, as shown in table 4. Therefore, they appear to be potential relevant and useful guiding tools for the development and execution of policies and interventions for the MH effects of CC, also those focussing on sub-acute and indirect effects as well as CC adaptation, from community- to government level.

Core principle IASC	Parallels to MH strategies for CC
1. Human rights and equity	Equity approaches
2. Participation	Community development initiatives and community participation
3. Do no harm	Co-benefits and preventing unintended harm
4. Building on available resources and capacities	Using community capacity, strengthen the skills and capacities of individuals, communities and society
5. Integrated support systems	Inter-sectoral collaboration and coordination
6. Multi-layered supports	Community intervention, mhGAP, intervention on multiple levels

Table 4: Parallels between core principles of IASC and MH strategies for CC

3.5 Strategies and policies in Ethiopia with a relation between mental health and climate change that could be improved

There is a wide range of strategic documents and policies in Ethiopia addressing either CC or MH. In these documents Ethiopia formally underlines the importance of CC adaptation and –separately- MH. Ambitious goals for the future are set regarding the reduction of the treatment gap for MH, improving CC adaptation and mitigation and resolving underlying factors like poverty reduction.

The three documents with the closest relation to the topic will be discussed; others are listed in annex 3. However, it is beyond the scope of this thesis to do a full policy gap and needs analysis.

1. Ethiopia's climate resilient green economy – National Adaptation Plan (NAP-ETH) 2019 (21). This is Ethiopia's most up-to-date and comprehensive strategy covering multiple sectors. It builds on preceding national strategies and plans and aims to improve earlier limitations of those plans by addressing trans-regional and multi-sectoral topics in a long-term timeframe, along with efforts to combine adaptation and development action.

Five strategic priorities are identified:

1. Mainstreaming of CC adaptation into development policies, plans and strategies
2. Capacity building of institutions involved in NAP-ETH
3. Effective and sustainable funding
4. CC adaptation research and development
5. Effective knowledge management system for NAP-ETH

In this plan several sectors are reviewed on their CC sensitivity. For the health sector several climate risks are identified. MH is not being mentioned as a climate related concern

2. National Health Adaptation Plan to climate change 2018 (49). This plan shortly touches the combined subject of CC and MH while discussing the gender inequity in CC. It is described that women, through gender roles and responsibilities, face more psychological and emotional distress and adverse MH outcomes but does not offer MH related guidance on this topic. It aims to strengthen the health system by improving its climate resilience with four strategic objectives:

1. Climate resilient health system capacity building
2. Providing of universal health coverage
3. Improve early warning and surveillance for emergencies
4. Implement health adaptation to CC

These are supported by six strategic approaches: mainstreaming CC adaptation into health programmes, strengthening partnership, strengthening existing health delivery system and community mobilization.

3. National Mental Health Strategy 2012/13 - 2015/16 (28). This strategy aims for accessible, effective, sustainable, and affordable MH services by decentralising and integrating MH in PHC. It acknowledges the important interaction between MH and poverty. The strategy is based on the WHO's Optimal Mix of Services that is discussed in objective 4. It identifies several mandates including: integration of MH in PHC, avoid duplication by use existing resources and coordination, definition of MH indicators, create monitoring and evaluation, improve training, development of inter- and intra-sectoral collaboration and coordinated programming and development of legislation in

order to protect the human rights of people with mental illness. The topic of CC is not present in this document.

These three examples show the ambitions and strategic direction for individual topics, as well as large overlap between key priorities and approaches. However, real integrated links are not made between CC and MH and strategic direction for action in MH effects of CC is lacking. Simane et al. (134) argue that this is also the case for the link between health in general and CC policies in Ethiopia. In their analysis of the strategies on health and CC they find a lacking organizational structure, insufficient inter-sectoral collaboration, inadequate stakeholder coordination and communication, lack of reliable policy guidelines and programs for institutions that focus on CC and health and a missing focus on gender and community related impacts of CC. Interestingly these pitfalls can be brought back to absence of the core principles brought up by the IASC and largely resonate with the policy advice given by various authors as discussed in Objective 4.

The lack of attention to and strategic direction for the CC effects on MH in Ethiopia appears not at all surprising, considering firstly the policy gaps for CC and general health, secondly the general lack of attention for MH and the MH treatment gap in countries worldwide (and especially LIC) and finally the general lack of attention for the interaction between CC and MH.

In order to improve current and future policies and actions the IASC core principles can be used. The Ethiopian guidelines therefore could be considered as building blocks to further build on available resources. For further improvement integration and coordination between CC, MH and equity should be central.

4. Discussion

Translating CC to quantitative changes in MH and wellbeing is challenging, as it is difficult to scientifically associate MH outcomes to greenhouse gas emissions and climatological change. These challenges are related to the predictive value of CC forecasts, the complexity of determining burden of MH problems, especially in a cross-cultural context and finally in the scientific robustness of the link between CC to MH.

First of all, there are the uncertainties regarding CC projections. These projections are based on models, which take into account various current and future factors. Most CC projections make use of multiple scenarios based on future emissions and therefore give way to a wide range of outcomes. Furthermore, African CC predictions still have significant systematic errors that are further challenged by determining the interaction between large-scale climate systems with Ethiopia's complex topography (66).

Secondly, there are the challenges related to the complex nature of MH. MH as used in this thesis consists of a wide spectrum of mental diseases in combination with wellbeing. Using the full scope of MH and wellbeing gives the opportunity to study the more nuanced effects and interactions but the more subjective term of wellbeing also makes it harder to quantify and compare outcomes. As is highlighted in objective 1, there are gaps in evidence on MH especially in LIC. There is a knowledge gap on MH across cultural settings and this sets limitation to the generalizability of across contexts (46). Furthermore, baseline MH studies and data for LIC can generally be considered as poor relative to HIC. These limitations underline the importance of smaller scale qualitative studies as done in Ethiopia by Cooper et al (46) in order understand MH in a specific context.

Finally, there is a knowledge gap in the relation between CC and MH. This starts with the limitations in the understanding and scientific consensus of the complex causal pathways and interactions with determinants of health underlying the MH effects of CC (9,10,130). It is very hard to prove causation as almost all research that quantifies interaction between climate and MH is cross-sectional. Due to the inherent complex nature of MH as well as the complexity of these underlying pathways it is very hard to quantitatively attribute changes in MH to CC.

The limitations of this thesis are based on the above general limitations. Furthermore, there are limitations related to the methodology of the thesis. The initial search gave quite an abundance of information. However, for some specific factors information was still limited. The ratio of review articles was very high compared to primary research. Therefore, a significant part of literature was found through snowballing and also in grey literature. This gives room for selection bias. It is also possible that relevant factors are missed because they were not included in the framework and the search. Consequently, further analysis of this topic with a more systematic approach would enhance the quality.

The adapted framework proved useful in order to understand the CC pathways influencing MH in Ethiopia. It showed effective in understanding the various climate drivers in relation to direct and indirect pathways. The replacement of community pathway the contextual factors made way for a somewhat more structured and broader analysis. Still it is clear that many of these factors work through their influence on communities. For a more comprehensive version of the adapted framework, the dimension of vulnerability could be added, as well as illustrating the reverse interaction

between mental health and the indirect exposure pathways. This expanded adapted framework is shown in figure 6.

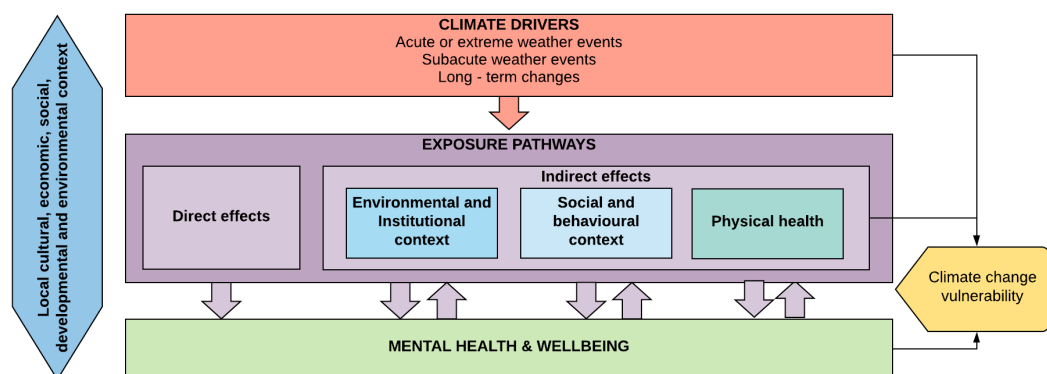


Figure 6: Expanded adapted framework based on the “causal pathway framework” by Berry et al. (8) and “exposure pathway diagram” by USGCRP (3)

Although causation is hard to prove - and attribution of CC on MH is extremely hard to quantify, it is essential to unravel and have knowledge of the underlying pathways. This knowledge is needed in order to notice these effects are present and use as entry points for further research and action that target (elements) of these pathways. This thesis should be seen as a first attempt to do so in a LIC country. Though better understanding of the causal pathways and a more systematic approach is needed in order to better assess the projected impact of each pathway, this thesis has given insight in potentially important pathways specific to Ethiopia. Despite the fact that it is largely based on Western research and this might not be completely transferrable to Ethiopia, the few studies from Ethiopia and LIC indicate that key factors indeed are likely to have relevance in this context.

Using the framework created in objective 1 (describing the interaction between MH, CC vulnerability and health inequities), supported by the multi-level interventions as suggested by APHA and supported by the intervention triangle of WHO, the entry points for interventions are abundant. Future research should indicate what entry points are most effective. Therefore, the inclusion of indicators on equity, CC vulnerability and MH for this kind of research is needed, however academic consensus on these indicators is still to be achieved first (10).

With all of the above limitations and uncertainties, the question is what level of confidence is needed for action. Some authors argue that more data is needed in order to formulate a suitable response (135) and definite policy development (103). Yet the American Public Health Association (38) argues that current scientific evidence reveals such a plausible risk of the negative MH effects of CC that “the well-accepted scientific precautionary principle directs policymakers to fulfil their social responsibility to protect the public from exposure to harm”. I support the standpoint of APHA. It is time to act. In absence of an evidence-based comprehensive strategy for CC and MH, other evidence-based interventions and guiding principles can be used, as is mentioned in objective 4. The separate topics of MH and CC adaptation, *especially* for vulnerable populations, should already be a public health priority. The interaction between CC and MH adds another layer to the urgency and justification of this under-prioritised topic.

5. Conclusion and recommendations

There is an intricate network of influence and exchange between MH, CC and determinants of health. These are closely linked to inequity, both on a global scale as on community level. Ethiopia as a country is highly vulnerable to the effects of CC and therefore also vulnerable to the MH effects of CC. As different pathways can be followed, the accumulation of effects on MH could be extensive; positive effects are rarely described.

In Ethiopia CC impacts on MH can follow direct pathways, with distinct effects through weather disasters. The projected impact of direct gradual effects is less clear. However, especially the indirect pathways appear to be of major significance. This is because most of these pathways can have a profound negative impact on various determinants and many of these determinants are already issues of major importance in Ethiopia; the effects of drought, poverty, food insecurity, physical health effects, conflict and migration are currently major problems on their own. CC is likely to further aggravate these problems and subsequently increase the MH effects of these pathways. Thereafter, the MH effects have the potential to further disrupt these determinants; it can aggravate disparities, drive people further into poverty and increase CC vulnerability. The agricultural sector has an important role in CC vulnerability and can be connected to multiple of the described pathways.

Global policies and strategies on CC and MH exist, but generally they are not linked to each other, which is also the case in Ethiopia. The IASC guidelines for MHPSS share large overlap with policy advice concerning CC and MH and the IASC framework can be used as a basis to strengthen policies regarding MH and CC.

A broad and integrated approach is needed to create communities resilient to adversities - including CC and MH impacts - in a cultural and place sensitive manner. This is not only a task for the health care sector but needs to involve multiple actors including local communities, government agencies and international organisations and importantly would also involve non-health related sectors. Despite the need for further evidence on causal pathways and effective interventions, time should not be wasted as cumulative and cascading effects could have devastating effects on MH, wellbeing, CC vulnerability and equity. In absence of this evidence, current perspectives and an equity- and human rights-based approach could be used as a basis. However, increased awareness of the MH effects of CC is also needed; without the explicit mentioning of the interaction between CC and MH many of these interactions could easily be overseen and would likely go unnoticed.

Recommendations

The first set of recommendations is based on the six core principles of IASC. These recommendations are targeted at all actors involved in MH, CC and development-related domains in Ethiopia, at all levels (policy level, NGO level, health care provision level and community level):

1. Strengthen and prioritize existing MH and CC interventions and equity-based approaches in Ethiopia, for MH it is advised to use the level-based care pyramid and the mhGAP approach.
(IASC principles: Human rights and equity, building on available resources and capacity & multi-layered supports)
2. Increase awareness of the impact of CC on MH including the relation with equity - and incorporate and strengthen the links between CC, MH and equity in relevant strategies and policies in Ethiopia through:
 - a. Increased coordination and multi-sectoral collaboration of all the sectors and organisations involved in these topics (including health and MH, development, equity and poverty approaches, agriculture, migration, food, housing, sectors involved in disaster control and CC adaptation and mitigation)
(IASC principle: Integrated support systems)
 - b. Increased awareness and assessment of both co-benefits and unintended negative effects in strategies and policies targeting CC, MH and equity.
(IASC principle: Do no harm)
 - c. Involve community development initiatives and participation of the community in the above.
(IASC principle: Participation)

Furthermore, there are more general recommendations:

3. For the MOH to improve baseline epidemiological knowledge and local understanding of MH in Ethiopia, including a focus on climate sensitive trends.
4. For global players including scientists and international organisations to improve research on the MH effects of CC, with a specific focus on further exploration of causal relations and identification of relevant climate-sensitive MH indicators.
5. For the MOH to follow up on international evidence regarding CC and MH and asses if this can be implemented in Ethiopia or if this needs adaptation to the local context.

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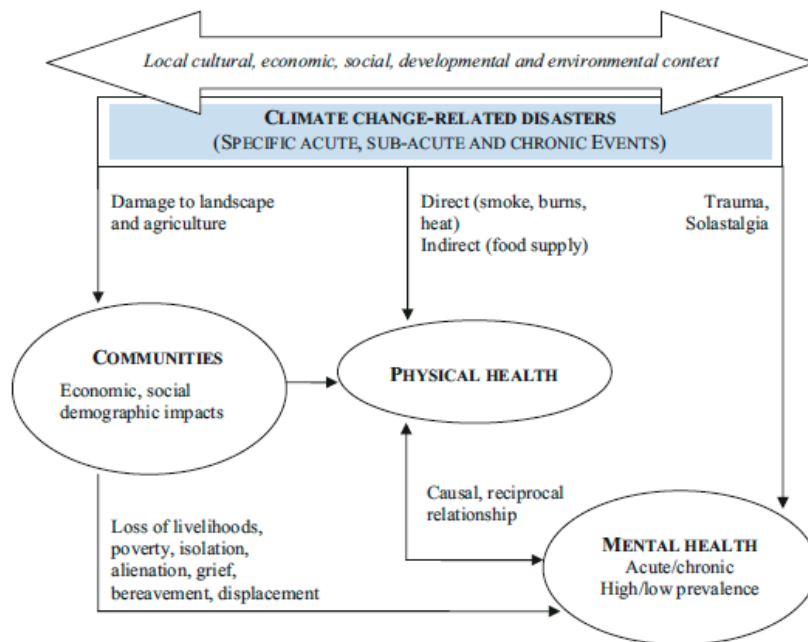
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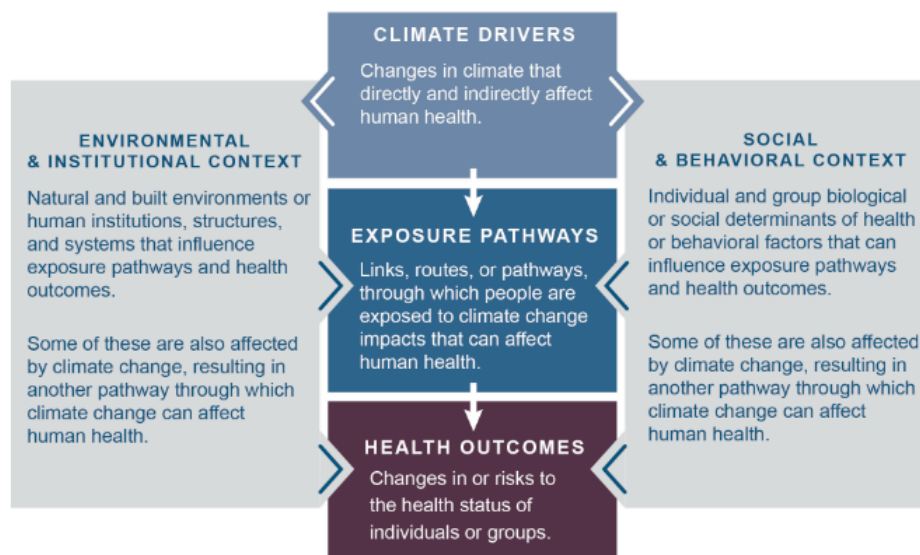
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Annexes



Annex 1: Causal relation framework. Source: Berry et al., 2010 (8)



Annex 2: Exposure pathway diagram. Source: USGCRP, 2016 (3)

Other Ethiopian strategic documents regarding CC or MH

- Growth and transformation plan II (GTP II) 2015/16-2019-20 (136)
- Climate Change National Adaptation Programme of Action (NAPA) of Ethiopia (137)
- National policy and strategy on disaster risk management 2013 (68)
- Intended Nationally Determined Contribution (INDC) 2015 (48)
- Health Sector transformation plan 2015/16 - 2019/20: *climate change seen as health threat, mental health separately discussed* (13)
- Country Environmental Analysis 2017 (138)

Annex 3: Other Ethiopian strategic documents regarding CC or MH.