Climate change and health in Ethiopia: To what extent have the health dimensions of climate change been integrated into the Climate-Resilient Green Economy?

Anand Bhopal1 | Haileselassie Medhin2 | Kristine Bærøe3 | Ole F. Norheim1

1Bergen Centre for Ethics and Priority Setting, Department of Global Public Health and Primary Care, University of Bergen, Bergen, Norway
2Europe Regional Office, World Resources Institute, The Hague, The Netherlands
3Department of Global Public Health and Primary Care, University of Bergen, Bergen, Norway

Correspondence
Anand Bhopal, University of Bergen, Department of Global Public Health and Primary Care, Årstadveien 217804, Bergen, Norway.
Email: anand.bhopal@uib.no

Abstract
Ethiopia is experiencing an increasing frequency and intensity of slow-onset and acute disasters caused by climate change, with significant health impacts. Understanding and addressing these impacts involves trade-offs, which are central to effective priority setting in health and overarching efforts to meet the Sustainable Development Goals. Despite minimal historic greenhouse gas emissions, Ethiopia has been at the forefront of climate action since launching the Climate-Resilient Green Economy (CRGE) in 2011, a low-carbon development strategy. To learn from the Ethiopian approach, this paper examines to what extent health has been integrated into the CRGE. We found that the early years of the CRGE prioritized developing the financial basis of the green economy, while the health impacts of climate change have only been tentatively considered to date and remain detached from broader health strategies. Further analysis of climate adaptation measures, “health co-benefits,” and reducing specific vulnerabilities of the health sector could help improve health and build climate resilience.

Key Points
- Ethiopia has been at the forefront of climate action since launching the Climate Resilient Green Economy (CRGE) in 2011, a low-carbon development strategy.
Early years of CRGE prioritised the economic foundations while the health impacts of climate change have only been tentatively considered to date and remain detached from broader health strategies.

Further analysis integrating adaptation measures, health co-benefits of non-health interventions and ways to reduce specific vulnerabilities of the health sector could help identify synergies and build resilience to climate change in Ethiopia.

The current conflict in the Tigray region presents an ongoing risk of wider destabilisation across the country.

Post-conflict reconstruction and development efforts to follow should seek to better integrate the climate resilience dimension into the health system.

**KEYWORDS**
climate change, Climate-Resilient Green Economy, sustainable development

**BACKGROUND**

Climate change is a present and growing threat to health and wellbeing across the world (Hoegh-Guldberg et al., 2018; Watts et al., 2015). Ethiopia, located in the Horn of Africa, is considered by the Notre Dame Global Adaptation Initiative to be among the most vulnerable countries with a low capacity to adapt to the negative impacts of climate change (Notre Dame Global Adaptation Initiative, n.d.). There are several overlapping reasons for this, including the combination of landlocked geography, drought-prone weather systems, and the socioeconomic dimensions of rural poverty (Climate Security Expert Network, 2019).

Climate change is already exacerbating the risks of acute and chronic food insecurity, internal displacement, poor sanitation, and conflict, undermining broader human, and economic development goals, which could help adapt to these challenges (Ethiopian Panel on Climate Change, 2015b; Federal Ministry of Health, 2018). Despite having had one of the world’s fastest-growing economies and steadily increasing life expectancy—increasing almost 1 year, every year, for the last 20 years—avoidable mortality in Ethiopia remains high (Norheim et al., 2015) and also increasingly precarious in the face of the climate change, the COVID-19 pandemic, and geopolitical unrest, including the conflict in Tigray.

Ethiopia is a home to rapidly growing population of 110 million people, making it the second-most populous country in Africa and one of the youngest in the world, with a median age of only 19.5 years (United Nations, n.d.). The country has a federal government divided into ten regional states and two self-governing city-states. Development policy has been primarily the responsibility of the Federal Government, whereas regional governments have focused on implementation. Small-scale rain-fed farming remains a principal source of employment, which means food security remains intricately entwined with livelihoods, health, and the climate (Climate Security Expert Network, 2019; Robinson et al., 2013). Access to electricity remains a major challenge, especially in rural areas, and there is a continued reliance on biomass fuels for cooking, which has a direct health effect of indoor air pollution as well as a range of other indirect health effects (Medhin & Mekonnen, 2019).
Environmental risks have been increasingly recognized in the policies and laws of the country since the 1990s, not least because of the awareness created by the devastating 1984 drought. The Disaster Prevention and Preparedness Commission launched in 1995 included a comprehensive disease risk management approach, including social, economic, and food security, coordinated by a newly established high-level committee to oversee the implementation. Similarly, Ethiopia's first environmental policy (Federal Democratic Republic of Ethiopia, 1997) launched in 1997 articulated the interdependence of people and the environment, encapsulating the Rio Principles of Sustainable Development and laying the foundation for the country's poverty reduction strategy ever since (Ethiopian Environmental Protection Agency, 2012).

The Climate-Resilient Green Economy (CRGE) strategy, launched in 2011, is a multisectoral approach to developing a climate-resilient, middle-income economy within 15 years. The approach focuses on meeting the twin goals of human and economic development in a warming world through a net-zero growth in carbon emissions, to a large extent based on reversing deforestation and increasing forest cover (Federal Democratic Republic of Ethiopia, 2011).

The CRGE strategy had four key pillars focused on carbon mitigation from high-emission sectors (agriculture, forestry, and transport) together with the expansion of hydropower electricity. It received strong cross-governmental commitment, which has been sustained after a change in government (Federal Democratic Republic of Ethiopia, 2011, p. 20). The strategy mirrored the first 5-year Growth and Transformation Plan (“GTP I”), though it featured heavily in the second GTP (“GTP II”), thereby mainstreaming climate change into central planning. An overarching National Adaptation Plan was released in 2019 (Federal Government of Ethiopia, 2019). Health-specific resilience plans were first released in 2014–2015 (Federal Ministry of Health, 2014), followed by a broader National Adaptation Plan for Health in 2018 (Federal Ministry of Health, 2018).

Over the last 5 years, there has been increasing acknowledgment among Ethiopian policymakers of the need for parity between carbon mitigation and societal adaptation, with growing interest in health (Admasu & Debessa, 2015; Simane et al., 2016; United Nations Development Programme, 2015). To our knowledge, the health dimensions of the CRGE have not been systematically explored. Incorporating the trade-offs of different approaches to tackling climate change is central to effective health priority setting (Johansson et al., 2019) and meeting the overarching Sustainable Development Goals (Norheim et al., 2019). In the face of public health threats, such as undernutrition, food insecurity, and noncommunicable diseases, tackling climate change can have benefits—the 2015 Lancet Commission on Health and Climate Change described these synergies as “the greatest global health opportunity of the 21st century” (Watts et al., 2015). This paper will assess to what extent the health dimensions of climate change have been integrated into the Climate-Resilient Green Economy process, and report on which aspects have been incorporated and identify gaps in the research base.

**METHODS**

We undertook a scoping review exploring the health dimensions of Ethiopia’s CRGE initiative. A scoping review aims to identify research gaps and including different sources and types of evidence are especially valuable in mapping out the key concepts in areas, which have not been comprehensively reviewed (Arksey & O’Malley, 2005). A scoping review is therefore appropriate because the health dimension of climate change policies is in general poorly understood. We followed the five-stage Arksey and O’Malley’s (2005) framework outlined below.
Identifying the research question

To what extent have the health dimensions of climate change been integrated into the CRGE? This study question formed a starting point for the search strategy, which was narrowed as the overview of the field was improved.

Identifying relevant studies

The scoping review aims to identify all relevant literature, regardless of study design or data source (Arksey & O’Malley, 2005). This study draws on government policy documents, published articles, and nongovernmental reports from large published literature databases (PubMed, Embase, Web of Science and Google Scholar), gray literature databases (Gray literature report, Worldcat), and relevant websites, including the United Nations Framework Convention on Climate Change (UNFCCC.int), the Ethiopian government (Ethiopia.gov.et), Prevention Web (preventionweb.net) and the Global Green Growth Institute (gii.org).

The literature search, undertaken in May 2020, combined search terms relating specifically to Ethiopia, climate change, and health impacts:

- (climate change [Title/Abstract] OR (Global warming[Title/Abstract] OR (climate resilient green economy[Title/Abstract] OR (CRGE[Title/Abstract]).
- AND (health[Title/Abstract] OR disease[Title/Abstract] OR nutrition[Title/Abstract]).
- AND (Ethiopia[Title/Abstract]).

Extensive use of “snowballing” (the examination of citation lists) was used to identify additional policy documents and relevant unpublished literature.

Study selection

Establishing the relevance criteria is an iterative process, refined with increasing familiarity with the literature (Arksey & O’Malley, 2005). This review is primarily interested in policy documents from within the Ethiopian CRGE. However, as the CRGE is a broad, multisectoral initiative, not all documents are relevant; conversely, many relevant health documents are aligned to, but not part of the CRGE. We, therefore, included material within the Ethiopian CRGE initiative and Ethiopian government policy documents relevant to the CRGE published since 2010, a year before the formal launch, during which time preparatory documents, such as regional assessments, were being prepared. We included external articles and nongovernmental reviews, which were published after 2011 and directly addressed the CRGE, with no restrictions on study design. The review excluded material that was not available in English. Our reliance on English language searches and databases may be one factor limiting our ability to locate all the regional policy documents.

Charting the data

Using a descriptive-analytic method, data were collected on author, year, document type, stated purpose, and health dimensions in line with our study aims.
Collating, summarizing, and reporting the results

We mapped our findings against the analytic framework used in the 2019 report of the Lancet Countdown on health and climate change (Watts et al., 2019), a leading, international, multidisciplinary research initiative tracking the impact of climate change on health and ways to prevent these harms. “Health threats” correlates with Section 1 of the Lancet Countdown (“Climate change impacts”), which includes health impacts and health sector vulnerability (i.e., infrastructure, electricity supply, transportation). “Health opportunities” correlates with Sections 2 and 3 of the Lancet Countdown (“Adaptation” and “Mitigation and Health Co-benefits”), which include adaptations to improve health and health co-benefits (i.e., health gains from nonhealth interventions). To help understand the relevance for health, the author, title, stated aim, and priority CRGE sector is given for each item included in the results.

RESULTS

Overall profile of documents identified

The literature search identified 25 government policy documents, five published articles, and seven nongovernmental reports, of which 15 government policy documents, one published article, and six reports were included in the review. Out of the 15 included government policy documents, four (27%) were Federal Government documents, three (20%) were regional government documents, five (33%) were from the health ministry, and three (20%) were from other government ministries. We included one (33%) of the published articles and four (57%) of the nongovernmental reports, all of which were released between 2013 and 2016. Regional adaptation plans were all published in 2010, national policies were published throughout the period 2011–2019, and sectoral-specific policies (including health) were published between 2014 and 2018. The key findings are in Tables 1–4.

Policy documents—National Government

As shown in Table 1, seven diverse national policy documents were included in this review: the ‘CRGE Vision’ (Federal Government of Ethiopia, 2011), laying out the ambitions of the CRGE, which was launched at the Conference of Parties climate change summit in 2011; the CRGE Strategy (Federal Democratic Republic of Ethiopia, 2011), a blueprint for implementing the Green Economy (which explicitly does not cover climate resilience); GTP II (National Planning Commission, 2016, p. 93)—an economic strategy, which aimed to mainstream the CRGE strategy, Sustainable Development Goals (SDGs) and Agenda-2063 relevant to health (National Planning Commission, 2016, p. 190); the National Adaptation Plan (NAP) (Federal Government of Ethiopia, 2019), an intersectoral assessment of measures to build climate resilience and reduce vulnerability to climate change; and climate-resilient plans from the agriculture and forestry, water and energy and transport sectors, outlining adaptation and mitigation measures and financing plans.

Health threats

Health impacts of climate change are described in six out of seven documents with a focus on the increased spread of vector and water-borne diseases, flooding incidents, and impacts
| Title/Author | Aim | Stated CRGE priority sectors | Health impacts | Health sector vulnerability | Adaptations to improve health | Health co-benefits of non-health interventions |
|-------------|-----|-----------------------------|---------------|---------------------------|-----------------------------|-----------------------------------------------|
| CRGE Vision, 2011 (Federal Government of Ethiopia, 2011) | “Roadmap for achieving a climate-resilient green economy” | “Vulnerable sectors” Agriculture, Transport, Industry, Energy, Health, Environment | • Vector-borne diseases  
• Non-vector-borne diseases  
• Poorer food and water supply  
• Air pollution  
• Floods and storms  
• Heat-related mortality | Not specified (but mentions close links between rainfall, GDP growth, and wellbeing due to reliance on agriculture) | • Expand health extension program  
• Strengthen health systems  
• Introduce early warning systems | Cleaner energy sources → reduce air pollution |
| CRGE Strategy, 2011 (Federal Democratic Republic of Ethiopia, 2011) | “Protect against the adverse effects of climate change and build a green economy” | “Key pillars” Agriculture, Forestry, Power, Transport | Not specified | Not specified | Not specified | |
| Growth and Transformation Plan II (GTP II), 2016 (National Planning Commission, 2016) | “Spring-board toward the national vision of being a low-to a middle-income country by 2025” | Not specified | • “Spread transmitted diseases in the form of epidemic”  
• “Aggravate food insecurity” | Not specified | • Up to date early warning systems  
• Strengthened safety net programs to improve food security | • Fuel-efficient stoves (indoor air quality)  
• Decreased exhaust fumes → less outdoor air pollution  
• Improved road safety  
• Improved water quality |

TABLE 1  Federal government policy documents
| Title/Author | Aim | Stated CRGE priority sectors | Health threats | Health opportunities | Health co-benefits of non-health interventions |
|-------------|-----|-----------------------------|---------------|----------------------|---------------------------------------------|
| National Adaptation Plan (NAP), 2019 (Federal Government of Ethiopia, 2019) | Strategy to “reduce vulnerability to the impacts of climate change by building adaptive capacity and resilience” | “Vulnerable sectors” Agriculture, Forestry, Health, Transport, Power, Industry, Water, Urban | • Vector-borne diseases | Not specified | • Improved access to potable water → protect health |
| | | | • Water-borne diseases | | • Environmental health surveillance. |
| | | | • Severe malnutrition | | • Developing technologies and research |
| | | | • Increase in flood incidence and displacement | | • Climate-sensitive disease prevention |
| | | | | | • Improved basic health services |
| Climate Resilience Strategy: Agriculture & Forestry, 2015 (Federal Democratic Republic of Ethiopia, 2015a) | Identify challenges related to climate change, adaptations, and financing | “Key pillars” Agriculture, Forestry, Power, Transport | • Droughts and water stress | Not specified | • Enhancing weather warning systems |
| | | | • Floods | | • Social protection for high priority groups, including women and children |
| | | | • Heat stress | | |
| Climate Resilience Strategy: Water and Energy, 2015 (Federal Ministry of Water Irrigation and Energy, 2015) | Identify the economic and social impacts of climate variability and prioritize interventions | Agriculture | • Poor water access | | |
| | | | • Reliance on vulnerable surface water → diarrhea, malnutrition, and neglected tropical diseases | | • Universal access to water, sanitation, and hygiene (WASH) → “saves 946,032 maternal and child deaths” |
| | | | | | • Access to energy and water “could prevent 1.2 m lives” |
| | | | | | • Fuel-efficient stoves (indoor air pollution – “72,400 deaths annually”) |

(Continues)
| Title/Author | Aim | Stated CRGE priority sectors | Health threats | Health opportunities | Health co-benefits of non-health interventions |
|-------------|-----|-----------------------------|---------------|---------------------|---------------------------------------------|
| Ethiopia’s Climate-Resilient Transport Sector Strategy, 2017 (Federal Ministry of Transport of Ethiopia, 2017, 2010) | Explore ‘transport synergies and cost-efficiencies while increasing GHG emission reduction gains’ | Not specified | • Direct temperature mortality  
• Damaged transport infrastructure from adverse weather events \(\rightarrow\) increased road accidents | • Climate resilience of health infrastructure  
• Access points to health facilities are ‘critical road corridors’ | • Enhanced standards for buildings, transport, bridges  
• Health and safety assessments  
• Long-term emergency preparedness, including health infrastructure  
• Reduce air and noise pollution \(\rightarrow\) public health benefits  
• Encourage active transport \(\rightarrow\) improve mental and physical health |

Abbreviation: CRGE, Climate-Resilient Green Economy.
| Title/Author                                                                 | Aim                                                                                                                                                                                                 | Health impacts                                                                 | Health sector vulnerability                                                                 | Adaptations to improve health (indicators)                                           | Health co-benefits of non-health interventions                                      |
|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| **Dire Dawa Program of adaptation to Climate Change, 2011 (Dire Dawa Environmental Protection Agency, 2011)** | Assess climate change vulnerabilities in sectors important for livelihood, the ecosystem, and natural resource of the area                                                                         | • Malnutrition • Malaria at higher altitudes • Water-borne diseases                | • Population growth outstripped expansion of health sector                                 | • Strengthen malaria prevention and control service • Increase community awareness • Communication equipment • Sufficient trained staff in all health centers • Early warning systems | Not specified                                                                         |
| **Oromia Program of Plan on Adaptation to Climate Change, 2011 (Oromia National Regional State Task Force, 2011)** | Identify the major vulnerable sectors to climate change and their adaptive capacity and response measures                                                                                 | • Malnutrition and famine • Malaria at higher altitudes • Water-borne diseases     | • Low availability of social services and schooling for pastoralist communities • Poorly functioning health facilities and low vaccination coverage • Pre-existing food insecurity | • Awareness-raising on health • Mobile health service provisions • Health insurance systems • Strengthen health extension workers • Increase access to household level sanitary services | Not specified                                                                         |
| **Afar National Programme of Plan on Adaptation to Climate Change, 2010 (Afar National Regional State Task Force, 2010)** | Identify the major vulnerable sectors to climate change and their adaptive capacity and response measures                                                                                 | • Malnutrition • Poor child development • Vector-borne diseases • Water-borne diseases • Heat stress | • Inadequate health services, often far from main roads • Low-quality infrastructure. • Rural poverty and lack of alternative incomes • Low health literacy and widely practiced harmful traditional practices | • Malaria protection and prevention campaigns • Improve health facilities • Integrated disaster risk reduction and early warning system systems • Improve water sources (boreholes, springs, wells) • Solar power drilling system → reliable water supply | Switch fuelwood for clean fuels → reduced physical impacts of carrying wood and reduced indoor air pollution |
| Title/Author | Aim | Formal part of CRGE? | Health threats | Health sector vulnerability | Adaptations to improve health (indicators) | Health co-benefits of nonhealth interventions |
|--------------|-----|----------------------|----------------|-----------------------------|-------------------------------------|---------------------------------------------|
| National Framework of Climate-Resilient Health Sector, 2014 (Federal Ministry of Health, 2014) | “Serve as policy guidance and provide roadmap for the realization of Health National Adaptation Plan” | Yes | • Malnutrition  
• Water-borne diseases  
• Vector-borne diseases  
• Meningitis  
• Heat mortality  
• Asthma | • Health facilities ill-equipped (equipment, staff) and lacking water/power/phone to respond to disasters and outbreaks | • Integrated environmental health surveillance  
• Public health capacity building  
• Community-based social security fund for disaster victims  
• Health development army | • Reducing diesel exhaust → decreased asthma |
| Vulnerability and Adaptation Assessment of Health to Climate Change in Ethiopia, 2015 (Federal Ministry of Health, 2015b) | Assess health vulnerabilities to climate change and their interlinkages | Yes | • Malnutrition  
• Water-borne diseases  
• Vector-borne diseases  
• Meningitis  
• Heat stress  
• Extreme weather events  
• Food-borne diseases | • Infrastructure at risk from flooding  
• Limited electricity  
• Basic medical equipment  
• Poor water and sanitation  
• Unsustainable health financing  
• Structural social problems (e.g., widespread poverty) | • Improve public health surveillance systems  
• Strengthen early warning systems  
• Human resource for health development  
• Establish health and climate data system  
• Improve public health services  
• Improve water, sanitation, and hygiene system  
• Advocacy to raise public awareness | Adaptation measures → reduce gender inequities |
| Review of Policy Documents On Climate Change, WASH & Public Health in | Examine sensitivity of WASH policy documents to | Yes | • Vector-borne diseases  
• Nonvector-borne diseases | • Health infrastructure at risk of flood damage | • Integrate climate data and early warning data with WASH/health sectors. | Integration of interventions controlling diseases sharing |
| Title/Author | Aim | Formal part of CRGE? | Health threats | Health opportunities |
|-------------|-----|----------------------|---------------|---------------------|
| Ethiopia, 2015 (Federal Ministry of Health, 2015a) | Climate change and vice versa. | | | |
| Health Sector Transformation Plan, 2015 (Federal Democratic Republic of Ethiopia, 2015b) | Five-year plan to reach Universal Health Coverage | No: In line with GTP II | Extreme events compromising routine health programs and development goals, Heat stress, Drinking water contamination | Capacity building and technical training to mainstream health into climate change adaptation |
| National Health Adaptation Plan to Climate Change (2018–2020), 2018 (Federal Ministry of Health, 2018) | Blueprint for a climate-resilient health system | Yes | Malnutrition, Water-borne diseases, Vector-borne diseases, Heat stress, Respiratory tract infections | Integrated disease surveillance and strengthen early warning systems, Community health insurance scheme, Develop and adopt climate-proof latrine design, Improve access to safe drinking water, Promote family planning, Reduced indoor and outdoor air pollution, Active transport |

Health impacts:
- High deaths from infectious diseases, obesity, diabetes, and heart disease if climate change not mitigated
- Not specified

Health co-benefits of nonhealth interventions:
- Not specified

Abbreviations: CRGE, Climate-Resilient Green Economy; GTP, growth and transformation plan.
## TABLE 4  Scientific articles and non-governmental reports

| Overview | | Health dimensions of CRGE |
|---|---|---|
| **Title** | **Aim** | **Key findings** | **Recommendations** |
| Making Growth Green and Inclusive: The Case of Ethiopia, OECD 2013 (Bass et al., 2013) | Showcase progress and prospects for green growth and clarify the added value of the CRGE strategy | • Health sector adaptation measures will be added in the next phase of CRGE | • Develop a set of inclusive green growth principles, including health |
| Integration of Poverty and Sustainability into National Development Planning: Ethiopia Report, 2015 (United Nations Development Programme, 2015) | Assess integration of development processes and transition to a more inclusive greener economy | Health not included in the analysis | • Institutionalization of CRGE within Ministries at national and regional levels |
| Ethiopian Panel on Climate Change (Health & Settlement), 2015 (Ethiopian Panel on Climate Change, 2015a) | Present known effects of climate change on human health, including population vulnerability and co-benefits | • Systematic review of the evidence | • Strategies to respond to climate change (adaptation, mitigation, finance, capacity-building) should take health impacts into account |
| Ethiopian Panel on Climate Change, summary for policymakers, 2015 (Ethiopian Panel on Climate Change, 2015b) | Summary of the report for the policymakers | • Health impacts are direct, ecosystem-related, and mediated through institutions. Effective short-term solutions are strengthening basic public health services and disaster preparedness and poverty alleviation. | • The Government could make health a priority area in the current climate change activities |
| Review of Climate Change and Health in Ethiopia: Status and Gap Analysis, 2016 (Simane et al., 2016) | Assess environment, climate change, and health and identify research, training, and capacity gaps | • Lack of Ethiopia-based research hinder effective adaptation and mitigation strategies within the CRGE. | • Establish climate and health research centers and update policies. |
| Review of current and planned adaptation action in Ethiopia, International | Outline efforts to increase climate adaptation on | • Limited intersectoral collaboration regionally and nationally | • Specialized training to develop research capacity |

"There are gaps in adaptation action addressing" | • Lack of coordination between academia, NGOs, and policy makers | • Combine health and climate data to monitor climate-sensitive diseases |

Not specified | • Establish multistakeholder fora for climate change and health |
Nonhealth sectoral plans describe some health impacts and identify specific vulnerabilities of the health sector from climate change.

Health opportunities

Adaptations to improve health are outlined in six out of seven documents, focusing on the health system, improving access to health services, and developing early warning systems. The health co-benefits of nonhealth interventions were mentioned in six out of seven documents, though not systematically or as in depth as has been done elsewhere (Haines et al., 2009; Scovronick et al., 2019). Reduced indoor air pollution from the use of fuel-efficient stoves and improved access to clean water were the most frequently described. The NAP noted the historical omission of health from the priority CRGE sectors (Federal Government of Ethiopia, 2019) and mentioned the health dimensions of a range of intersectoral initiatives, including integrated health and environmental surveillance (see Annex 2 in Federal Government of Ethiopia, 2019, for further information).

Policy documents—Regional governments

We included three regional plans on climate change resilience as outlined in Table 2. All identified health as especially vulnerable to climate change and focused primarily on adaptations to improve health. For more details on regional plans see Federal Government of Ethiopia (2019).

Health threats

Health impacts of climate change were discussed in all regional plans and common themes were malnutrition, the spread of malaria at higher altitudes, and water-borne diseases. In contrast to the national policies (Table 1), regional policies discussed some specific vulnerabilities of the health sector to climate change, focusing on poverty, education, and poor access to health services.
Health opportunities

All documents identified several adaptations to improve health. The main themes were the need for increased awareness, early warning systems, and improved basic health services. One document mentioned health co-benefits (reduced indoor air pollution from switching firewood for clean fuels).

Policy documents—Health ministry

Health sector-specific policy documents, shown in Table 3, were first released in 2014, 3 years after the CRGE launch. The National Framework of Climate-Resilient Health Sector (Federal Ministry of Health, 2014) began the process of developing a comprehensive health sectoral response, strengthened a year later in the Health Vulnerability and Adaptation Assessment (Federal Ministry of Health, 2015b). In 2015, the CRGE was mainstreamed into GTP II on which the Health Sector Transformation Plan (HSTP) is based—the HSTP is, therefore, included here.

Health threats

All CRGE-related documents describe a wide range of health impacts from climate change, including malnutrition, water-borne diseases, and vector-borne diseases, and heat mortality. The HSTP states that the risk of higher obesity, diabetes, and heart disease-related deaths if climate change is not mitigated but does not substantiate upon the causes or interventions needed.

Specific vulnerabilities of the health sector identified to focus on equipment and staffing and the physical integrity of buildings limiting sectoral resilience. Structural social problems, such as poverty and access to clean water and sanitation, are included in the vulnerability and adaptation assessment but not substantiated in either the HSTP or the National Health Adaptation Plan. The HSTP does not discuss specific vulnerabilities of the health sector and makes no reference to either the Vulnerability and Adaptation Assessment or the CRGE initiative.

Health opportunities

All documents included in this review identified a range of adaptations to improve health, including investing in public health infrastructure, staffing, and data systems, and developing early warning systems. Other specific adaptations include developing community social security schemes, improving access to clean water and sanitation, and increasing awareness of climate change. The interrelationship between health and the wider social and environmental context was not a clear narrative within these documents. Health co-benefits of public health interventions outside the health sector received scant attention and no detailed analysis to indicate the potential benefits of interventions mentioned, such as promoting active transport or decreasing air pollution.

Reviews—Scientific articles and reports

Outlined in Table 4 are published review articles and nongovernmental reports. The articles (the Ethiopian Panel on Climate Change chapter on health, the accompanying summary for
policymakers, and a “status gap and analysis”) focus on health and climate change in Ethiopia, though not specifically on the CRGE. The nongovernmental reports are not health-focused, although two reports highlight the centrality of health analysis to delivering the aims of the CRGE.

An article (“status gap and analysis”) suggested establishing climate and health research centers to monitor the impacts and build capacity, alignment of climate, and health data to monitor climate-sensitive diseases and increase intersectoral collaboration. The Ethiopian Panel on Climate Change (2015) highlighted the need to incorporate health into broader climate change strategies.

This is echoed in the nongovernmental reports—which highlight gaps in health sector analysis and the importance of health to achieving CRGE goals. Recommendations within the nongovernmental reports include developing a broad set of green growth principles, including health, and greater attention to interlinkages between sectors and initiatives.

**DISCUSSION**

This review investigated to what extent health is integrated into the Ethiopian CRGE. We found that the CRGE identified priority areas (Table 1) on the basis of the economic importance of sectors and the potential for reduced emissions (Federal Democratic Republic of Ethiopia, 2011). Though health and climate resilience were central to the regional adaptation plans (see Table 3) compiled a year before the CRGE launch, the first 5 years of the CRGE were characterized by a focus on building the Green Economy.

Health remains at a less developed stage than other aspects of the strategy. This perhaps reflects delays initiating the health technical subcommittee and undertaking health-specific analysis—it was 3 years before a preliminary analysis was undertaken and 7 years until a comprehensive national health adaptation plan was launched. It may, with sound reasons, not have been a priority. For example, the Ethiopian health Minister in 2015 wrote that the health co-benefits of interventions to tackle climate change “cannot be over-emphasized” but agriculture and energy security are the keys to broader development goals (Admasu & Debessa, 2015).

Another barrier to incorporating health into the CRGE earlier may have been the indirect nature of the relationship between climate change and health (Watts et al., 2019, Section 4). It has traditionally been difficult to directly quantify the health impacts of climate change (McMichael et al., 2003, chap. 7). The World Bank report on the economics of adaptation to climate change in Ethiopia, partly informing the CRGE, explicitly did not consider the health-related implications (World Bank, 2010). Incorporating emerging evidence—for example, the health co-benefits of interventions to improve air quality (Markandya et al., 2018; Vandyck et al., 2018), low-carbon urban transport systems (Shaw et al., 2014), and uptake of a planetary diet (Willett et al., 2019)—through an overarching public health approach could strengthen the CRGE.

The Health Sector Transformation Plan states in the foreword that “Climate change is the greatest global health threat of the 21st century” (Federal Democratic Republic of Ethiopia, 2015b) though does not follow up with coherent actions to mitigate the risks. This mismatch is far from unique to Ethiopia (Ethiopian Panel on Climate Change, 2015b; Watts et al., 2015). However, this challenge may be compounded by a lack of technical expertise (Mitike et al., 2016)—addressing deficits in country-specific, localized data remain a major challenge for designing effective policies across the world.

As indicated by the Ethiopian public health community (Simane et al., 2016), independent reviews (Echeverria & Terton, 2016; Global Green Growth Institute, 2016), and by the government itself (Admasu & Debessa, 2015), health has been somewhat
fragmented within the CRGE. The potential public health benefits of pursuing a green economic development path have been underutilized. Ultimately, many of the health impacts of climate change are dependent on how human systems respond (16); building climate resilience is key to avoid losing hard-won progress in health (Smith et al., 2014). Ethiopia’s 5-year HSTPs present ongoing opportunities to develop synergies between these agendas.

LIMITATIONS

Within this review, we were unable to satisfactorily explore the relationship between national policy making and regional implementation. This paper is intended to form the basis for future in-depth qualitative interviews exploring the implementation of the CRGE. However, given the growing importance of effective integration between health and climate policy across the world (Watts et al., 2015), we believe this study provides useful insights for policymakers engaged in this urgent challenge.

Conclusion and policy implications

Understanding and addressing the health impacts of climate change on health are essential for effective priority setting in health and meeting the overarching SDGs. This study set out to evaluate to what extent the health dimensions of climate change have been integrated into the CRGE of Ethiopia. We found that the early years of the CRGE prioritized developing the financial basis of the green economy, whereas the potential health impacts—and benefits—of climate change mitigation and adaption have only been tentatively considered within the CRGE to date and are not currently coordinated in the health-specific analysis or broader health strategies. Further analysis integrating the necessary adaptation measures, health co-benefits of nonhealth interventions and steps to reduce specific vulnerabilities of the health sector could help identify synergies and build resilience. Updating regional adaptation plans may facilitate this process. Fuller’s integration of the health dimensions of climate change is key to its success.

A key factor we must acknowledge impeding the successful implementation of the CRGE vision is the conflict in the Tigray region with the ongoing risk of wider destabilization across the country. Tigray’s health system has been a major casualty of the violence, with widespread damage and looting of facilities, a lack of remaining health personnel, and occupation by armed soldiers jeopardizing the safe access to health care and compounding the conflict’s human toll (MSF, 2021). Post-conflict reconstruction and development efforts to follow should seek to better integrate the climate resilience dimension into the health system.

The Ethiopian CRGE program remains a leading example of a transformational, low-carbon, climate-resilient economic development agenda, which offers insights for countries across sub-Saharan Africa pursuing a similar path, such as Kenya, Uganda, Ghana, Rwanda, and South Africa (see Green Growth Knowledge Platform, n.d.). The sub-Saharan Africa region faces the dual challenge of improving the health and welfare of citizens through the as yet little tested green developmental path—that is, renewable energy-led socio-economic development, rather than fossil fuels—while contending with, and building resilience to, climate risks, such as extreme weather events. Well-informed, medium- to long-term decision-making is, therefore, essential to prepare for this uncertain future.

As the then Prime Minister of Ethiopia, Meles Zenawi, said at the launch of the CRGE in 2011: “While we did not cause climate change, we must protect ourselves from its impact. We have the opportunity to demonstrate that in the 21st century a new form of green growth
is possible” (United Nations Development Programme, n.d.). One way the research community, both in sub-Saharan Africa and across the world, can support this effort is through undertaking national and cross-country comparative research on health and the green economy agenda to refine policy development, disseminate best practice and fulfill the greater mission of a climate-resilient society for all.

CONFLICT OF INTERESTS
The authors declare that there are no conflict of interests.

ETHICS STATEMENT
Ethical approval was not required for this scoping review. This article is entirely the authors’ own original work, which has not been previously published in any form elsewhere.

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**AUTHOR BIOGRAPHIES**

**Anand Bhopal**, MBChB, MA, is a PhD Research Fellow at the Bergen Centre for Ethics and Priority Setting, Department of Global Health and Primary Care, University of Bergen, Bergen, Norway.

**Haileselassie Medhin**, PhD, is the Director of Strategy and Partnerships, Africa at the World Resources Institute, The Hague, The Netherlands.

**Kristine Bærøe**, PhD, is a Professor of Medical Ethics and Philosophy of Science at the Department of Global Public Health and Primary Care, University of Bergen, Bergen, Norway.
Ole F. Norheim, PhD, is a Professor of Medical Ethics and the Director of the Bergen Centre for Ethics and Priority Setting, Department of Global Health and Primary Care, University of Bergen, Bergen, Norway.

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