Research for Action on Climate Change and Health in the Caribbean:
A Public, Private, People's and Planetary Agenda

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Suggested citation: Allen CF, West RM, Gordon-Strachan G, Hassan S, McFarlane S, Polson-Edwards K, Thomas A, Hospedales CJ, Dubrow R. Research for Action on Climate Change and Health in the Caribbean: A Public, Private, People's and Planetary Agenda. Research for Action on Climate Change and Health in the Caribbean Project, 2024.

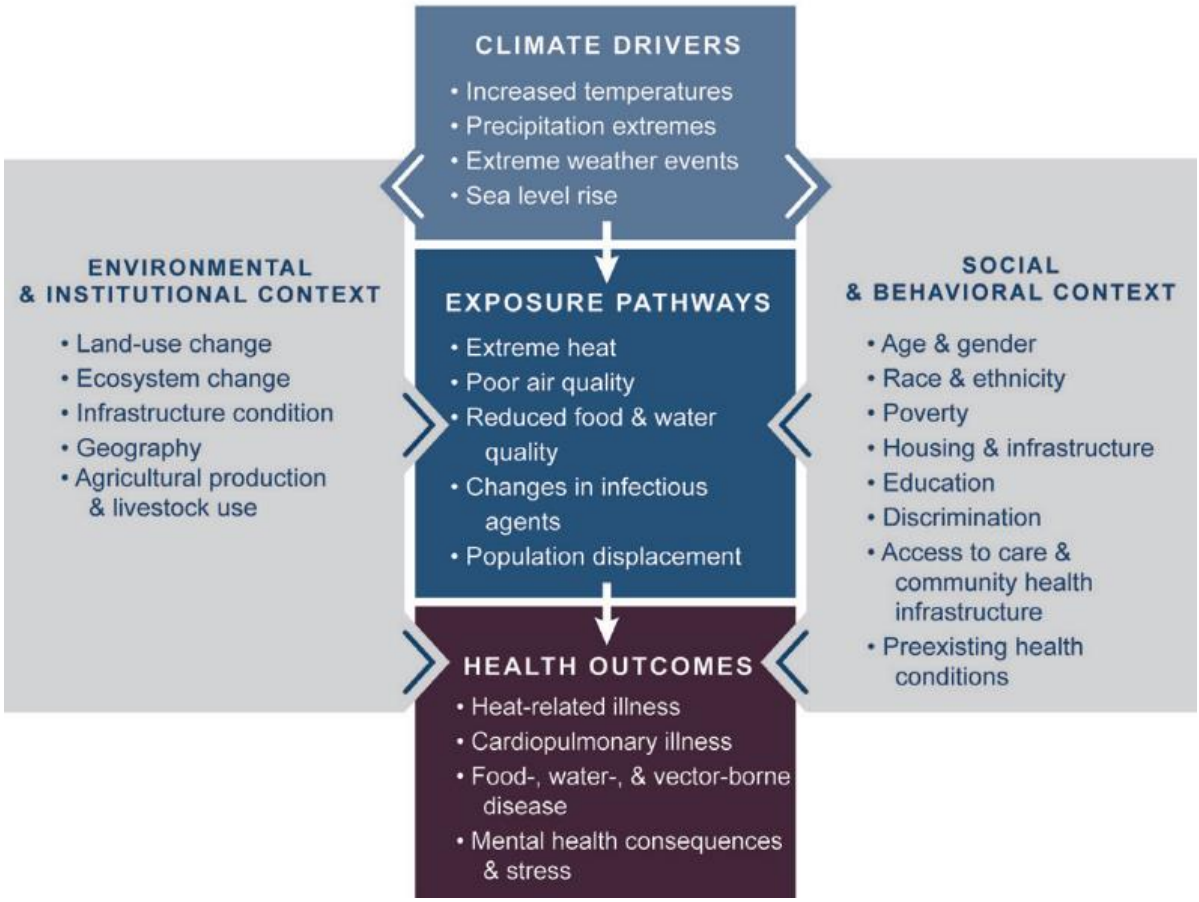
DOMAIN 1: CLIMATE CHANGE HEALTH IMPACTS, EXPOSURES AND VULNERABILITY

9. DISTRIBUTION, EQUITY AND JUSTICE IN CLIMATE CHANGE AND HEALTH

9.1. WHAT IS HAPPENING?

The question of whose health is more affected by climate change is of critical concern. How we manage natural and built resources and the distribution of social and economic resources are determinants of the impacts on health of climate change and their variation among population groups. Variation in preexisting biological and health conditions also determines health outcomes (Allen, 2021; USGCRP, 2016). We consider issues of resource management in Chapters 3, "Water, sanitation and hygiene", 12, "Agriculture, food safety and security", 14, "Marine resources and health", 15, "Climate-friendly health-promoting infrastructure", and 16, "Smart health facilities". Resource management is part of the environmental and institutional context depicted on the left of Figure 1, which influences the exposure pathways of climate drivers, thereby moderating health outcomes. In this chapter we consider the social and behavioural context, depicted on the right of Figure 1. This context affects the distribution of health outcomes among populations and thus raises issues of equity and climate justice.

Figure 1: Primary exposure pathways by which climate change affects health



Source: USGCRP (2016).

Social determinants of health and climate change

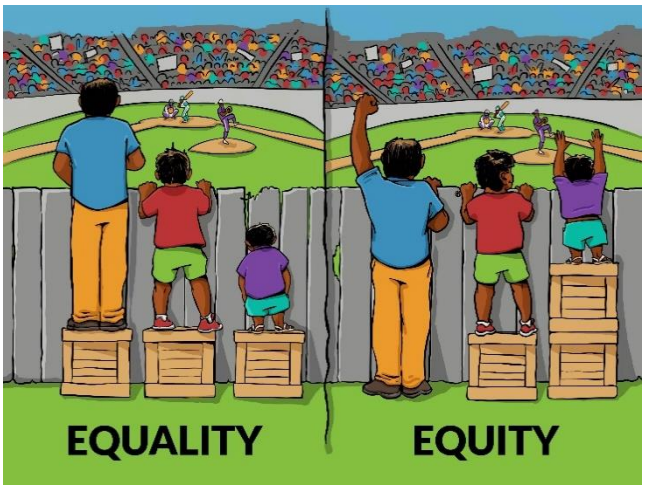
The social determinants of health approach (Marmot, 2005; WHO, 2023a) asserts that the circumstances in which people are born, work, live and age are critical determinants of health. These circumstances are shaped by the distribution of power and resources. To understand health outcomes from a public health perspective, it is important to look beyond immediate symptoms and medical diagnoses to "upstream" factors such as income, education and poverty, which can make a huge difference to an individual's ability to prevent illness and attain health and well-being. People need access to tangible and intangible resources such as energy, gainful employment, health services, education, water and food in order to survive and thrive. All of these affect health and all are affected by climate change (R4ACCHC, 2022a). The impact of climate change on essential resources (described in Chapters 3, "Water, sanitation and hygiene", 12, "Agriculture and food safety and security", 14, "Marine resources and health ", 15, "Climate-friendly health-promoting infrastructure", and 16, "Smart health facilities") compounds existing inequalities, such that approximately half of the population of the world does not have access to an acceptable quality of environmental services such as water and sanitation (Galvão et al., 2009).

Economic policies and systems, development agendas, social norms, social policies and political systems favour some individuals and populations more than others and compound inequalities in access to resources. Some social constructs, such as gender and race, are hierarchical, producing inequalities. Discrimination on the basis of gender or race intersects with other factors of discrimination, such as socioeconomic status, disability, age, migrant status and sexual orientation. This is referred to as intersectionality (World Health Organization, 2023b). These "structural factors" create "social gradients" in health outcomes, with health being positively related to control over resources and higher social status (Marmot, 2005).

Genetic factors and preexisting medical conditions also affect health outcomes. Climate change adds to the number of people in vulnerable populations (Drewry, 2021), given its effects on the incidence of long-term illness, noncommunicable diseases (NCDs) (see Chapters 2, "Vulnerability to vector-borne diseases', 4, "Noncommunicable diseases and risk factors", 5, "Air quality", and 7, "Mental health"), displacement, migration (see Chapter 8, "Population displacement and migration") and access to basic utilities and health care (see Chapters 3, "Water, sanitation and hygiene", 15, "Climate-friendly health-promoting infrastructure", and 16, "Smart health facilities").

Ethical concerns about equality and equity underlie the social determinants of health approach and inform strategies to address them. To achieve equality in outcomes, it is often not enough to treat people equally. This is because preexisting social and economic conditions and hierarchical social norms handicap the abilities of groups to compete on equal terms. Affirmative action may be necessary to achieve equity, which is a key factor in enabling disadvantaged populations to elevate their health status to the level of already advantaged populations. This applies on the global scale, to achieve climate justice among countries, and on the national or local scale, to achieve climate justice among populations. The diagram in Figure 2 is often used to illustrate the difference between equality and equity, showing that redistribution to the person who is in a position of disadvantage is necessary to achieve equal access to opportunities.

Figure 2: Equality vs. equity



Source: Interaction Institute for Social Change (interactioninstitute.org) | Artist: Angus Maguire (madewithangus.com).

Equity and climate justice: health considerations for Caribbean Small Island Developing States

Inequality is a fundamental issue in global, regional and national debates on the impacts of climate change. Caribbean Small Island Developing States (SIDS) and territories emit a minute proportion of global greenhouse gases but suffer some of the most serious consequences of climate change (Gillman and Kersting, 2021; Hamilton, 2021; Lalla, 2021; Nunez-Smith, 2021; Skerrit, 2017). The export by multinational companies to less developed countries of technologies that exacerbate environmental damage and climate change is of further concern (Galvão et al., 2009).

SIDS' geographical vulnerabilities to climate change include geographical remoteness, lack of transport links, small human and natural resource bases and high concentrations of their populations along coastlines. These contribute to climate change-related migration, which, it has been argued, has played a major role in the political transition towards more restrictive border policies in many of the richer countries of the world (Parenti, 2011). In the Caribbean, these inherent vulnerabilities have been exacerbated by the history of colonial exploitation and continued exploitation by former colonial powers. These combined vulnerabilities have been asserted by Caribbean politicians in calls for increased resources for adaptation and mitigation (Skerrit, 2017). For instance, at the 27th Conference of the Parties of the United Nations Framework Convention on Climate Change in 2022, COP27, Barbados's Prime Minister Mia Mottley referred to the history of imperialism while calling for concessional funding to reduce the inequalities between developed and developing countries in access to green energy and other technologies for mitigation and adaptation.

> This world still looks too much like it did when it was part of an imperialistic empire … Our ability to access electric cars, or our ability to access batteries or photovoltaic panels are constrained by those countries that have the dominant presence and can produce for themselves, while the Global South remains at the mercy of the Global North on these issues.
>
> Mia Mottley, Prime Minister of Barbados, at the Opening of the COP27 World Leaders Summit (2022)
>
> *Source*: www.youtube.com/watch?v=5J0egwAfO0w.

Caribbean policymakers are often unaware of the linkages between climate change and health, and thus the health dimensions of the inequalities are not often highlighted (Allen et al., 2021a) and rarely factored into Caribbean advocacy on the global stage. This to some extent reflects a lack of attention being given to the social impacts of and vulnerable populations affected by climate change (Galvão et al., 2009).

However, Caribbean policymakers are giving increasing attention to health issues in their national climate change strategies. For example, a study for the *Lancet* Countdown on Health and Climate Change found that all nine Caribbean SIDS studied mentioned one or more of the following health topics in their first and/or second submissions of nationally determined contributions: mental health, psychosocial health and social well-being; NCDs; heat-related illness; airborne and respiratory illness; vector-borne diseases; malnutrition (food security) and foodborne diseases; infrastructure to withstand extreme weather events; and waterborne diseases, water security and sanitation (Parker et al., 2022). The extent of coverage of equity issues under these headings is unclear.

Vulnerable populations and inequalities: considerations for the Caribbean context

Vulnerability is dependent on the degree of exposure to a threat, the population's sensitivity to the risk and the capacity of the population to cope with the threat – its adaptive capacity (Nurse, 2011; USGCRP, 2016). Globally, the following populations have been identified as especially vulnerable as a result of biological sensitivity, socioeconomic factors and geography: children, pregnant women, older adults, impoverished populations, people with chronic conditions and mobility and cognitive constraints, outdoor workers, and those living in coastal and low-lying riverine zones (Balbus and Malina, 2009; Cissé et al., 2022; USGCRP, 2016). To date, there have been few studies of vulnerable populations or inequalities in the health impacts of climate change in the Caribbean, so some studies from outside the region are cited below to highlight some key issues for consideration.

Low-income populations

Populations with low incomes often live in the areas most affected by climate change and its associated health impacts, such as densely populated urban areas (Diaz-Quijano and Waldman, 2012; Medlock, 2021). For instance, a study in three low-income communities in Jamaica found that 23% of households had no piped water and were more at risk of dengue fever, as storing water was necessary, creating potential mosquito breeding sites (Heslop-Thomas and Bailey, 2006). Outbreaks of cholera, dysentery and diarrhoeal diseases, acute respiratory infections, dengue and malaria are all reported to occur largely in cities with densely populated low-income neighbourhoods following intense and excessive rainfall (Reckien et al., 2017).

Low-income and squatter communities are more likely to live on land subject to environmental hazards such as landslides, torrential flooding and bush fires, which are becoming more frequent because of climate change (Jaramogi, 2021). For instance, in Trinidad and Tobago, low-income and squatter housing is often on riverbanks, in low-lying coastal areas, on steep hills or in floodplains. When extreme weather events occur in these communities, loss of life, health and property accompany them.

People employed in sectors such as street vending and farming are financially dependent on the environment for their livelihoods. Low-income populations have less access to health care than others and are often unable to buy goods and services necessary for their health (e.g. vegetables, potable water, air conditioning) (Hall and Patrinos, 2010; Portier et al., 2010; USGCRP, 2016). In the Caribbean, poverty is more prevalent among female- than male-headed households (Allen, 2018), and thus members of female-headed households are especially susceptible to the impacts of climate change. The large informal sector in the Caribbean is of concern, as most people employed in that sector lack any form of social protection or occupational health services (Galvão et al., 2009).

Rural–urban differences

Rural and urban populations face different sorts of climate-related vulnerabilities, some of which have been described in Chapters 12, "Agriculture, food safety and security", and 15, "Climate-friendly health-promoting infrastructure". In rural areas, access to health facilities and utilities may be lower, and health and livelihoods

may be especially affected by the increasing unpredictability and severity of the weather. For instance, a study in Jamaica showed that farmers were especially concerned about their ability to manage seasonal weather unpredictability (Gamble et al., 2010). In urban centres, health concerns include the urban heat island effect, poor air quality and sanitation, and vulnerability to mosquito-borne diseases; these especially affect people on low incomes, those living in poor housing and outdoor workers (Campbell-Lendrum and Corvalán, 2007; CARPHA, 2018; Medlock, 2021; Mycoo, 2021; Sarjent, 2021).

Gender differences

Women, because of inherent physiological differences, are more intolerant of high air temperatures than men (Druyan et al., 2012). In addition, women generally spend more time than men at home, exposing them to greater risk of vector-borne diseases. This is especially true if they live in poor neighbourhoods with inadequate water supply and sanitation and uncovered water collection containers, and where mosquitoes can easily fly through open, unscreened windows and other openings such as cracks in walls. Women living in the tropics may experience additional heat exposure because of the time they spend in hot, indoor spaces performing tasks traditionally undertaken by women, such as cooking (Reckien et al., 2017).

After disasters, there are usually increases in domestic violence towards and sexual harassment of women and adolescent girls (UNEP, 2014; WHO, 2014). A lack of privacy in hurricane shelters contributes to the increased risk of sexual violence (WHO, 2014).

The gender division of labour can also affect vulnerabilities. Men and boys tend to spend more time working outside, especially in male-dominated sectors such as construction. They also engage in outdoor sports more than women. This exposes them to poor air quality and increased risk of heat stress. However, women are usually primary caregivers in their families and in professions such as nursing. Women may see their care responsibilities increase as climate change increases ill health (CIDA, n.d.; Reckien et al., 2017).

Gender issues have been examined in research on NCDs in the Caribbean (Cunningham-Myrie et al., 2013; Dubois et al., 2011), but the impact of climate change does not appear to have been considered in this body of research.

Children

The most climate-sensitive health impacts on children are diarrhoea, malaria and malnutrition (Cook and Frank, 2008; Michon et al., 2007). The rapid metabolisms and immature organs and nervous systems of young children are not equipped to deal with food and water shortages. Malnutrition and dehydration can have long-term consequences for child development. In the event of heavy rainfall and hurricanes, children are at a higher risk of death and injury than adults. They are more vulnerable to waterborne, foodborne and vector-borne diseases. During times of disaster, there are limited options for children to play and socialise, resulting in a lack of exercise and increased frustration and boredom. Children may be out of school and forced to work to increase the family's income, resulting in long-term risks to their future development. There may also be a higher risk of neglect, as their caregivers are busy, trying to find food and clean water and stabilise infrastructure, for example. As adults worry about the future and become stressed, the risk of them abusing and maltreating their children may increase (Bartlett, 2008).

Young people and adolescents

The importance of young people and adolescents for the future of climate change and health in SIDS is highlighted by the fact that more than 60% of the Caribbean Community (CARICOM) population is under 30 (Barnett, 2021). Young people are at the global forefront of climate activism, and the number of youth organisations and individuals campaigning on climate change is growing. Young Caribbean activists have pointed out that children and young people contribute the least to climate change but suffer the most. While adolescents

and young people tend to have greater physical resilience than other age groups, climate change tends to exacerbate existing diseases, stifles their social and economic prospects and causes mental ill health (Itoewaki, 2021) (see Chapter 7, "Mental health"). Young people and adolescents want the opportunity to fulfil their dreams and contribute meaningfully to the planet. For this to happen, young people recommend developing peer-led organisations, promoting intergenerational cooperation and government accountability, including climate change and health in the school curriculum, public education on climate change and health, strengthening the resilience of health systems, protecting vital oceanic ecosystems and cultural traditions, and making data and science accessible to young people (Lalla, 2021; Lashley, 2021; Nurse-Allen, 2021).

Older people and people with preexisting medical conditions

Older people, who are often less mobile and have preexisting medical conditions such as cardiovascular disease, are also more vulnerable to extreme weather impacts such as injury and heat-related illness. Those with chronic diseases are vulnerable to interruptions in medical supplies and utility outages during extreme weather events. Those with cognitive impairment and mental illness may become further disoriented during such events. This can result in crises such as wandering outdoors and getting lost or forgetting to take their medication (CARPHA, 2019; USGCRP, 2016; WHO, 2009).

Indigenous people

Indigenous populations make up a disproportionate share of the world's poor people (Hall and Patrinos, 2010). The indigenous people of the Caribbean are the earliest known inhabitants, predating colonisation of the territories by Europeans. They are among the poorest in society and tend to live in areas most remote from urban centres where healthcare and other facilities are concentrated. Their vulnerability is often aggravated by lack of recognition of their land rights (Itoewaki, 2021).

Among the Wayana indigenous population, who live in parts of Suriname, Brazil and French Guiana, vulnerabilities result not only from climate change but also from illegal gold mining and logging, mercury poisoning (arising from mining practices affecting the edibility of fish and plants), lack of schools and poor food security arising from lack of land rights. Gold mining and logging cause deforestation, contributing to climate change, floods, droughts and forest fires and damaging the quality of the water available to indigenous people (Itoewaki, 2021).

The indigenous people of the Caribbean and Central America generally rely heavily on natural resources directly for food security and health and also for their livelihood and well-being. For instance, the indigenous Kalinago people of Dominica rely on subsistence farming and fishing as their primary occupations (Tandon, 2012). The cultural institutions, knowledge and practices of indigenous people in the Caribbean and Central America have evolved around the use and conservation of particular natural resources of the region they live in (Kronik and Verner, 2010).

Indigenous people therefore tend to suffer the effects of climate change deeply. The loss of crops, fish, and forest and water resources affects their health more directly than people who rely on the market economy (Vreezdam, 2021). Loss of biodiversity and increased seasonal unpredictability pose threats to traditional knowledge, spirituality and cultural cohesion. These threats, along with the loss of control over land, can contribute to mental health challenges, including suicide in young people. Young indigenous people see very little prospects of good futures for themselves (Itoewaki, 2021; Kronik and Verner, 2010; UN, 2009).

The threat to indigenous people from climate change was recognised in the Paris Agreement at COP21 in 2015. The inclusion of "the rights of Indigenous Peoples" in the preamble of the Agreement, achieved despite the consistent opposition of some states throughout the process, was a significant and unprecedented step forward.

This was the first time this phrase has appeared unqualified in a legally binding United Nations treaty, environmental or otherwise (Caribbean Organization of Indigenous Peoples, 2015).

The vulnerability of indigenous people can be seen in their generally poorer health, and poorer access to health services, compared with people of European descent in Latin America and the Caribbean.

Afro-descendant groups

Afro-descendant groups have poorer-health and poorer access to health services. The health disparities that affect these groups are the result of complex dynamics between social exclusion, poverty and adverse environmental factors, and also cultural and behavioural factors (Giuffrida, 2010).

Descendants of enslaved people from Africa make up the majority of the Caribbean population. Notable exceptions are Trinidad and Tobago and Guyana, where the majority are descended from indentured labourers from India, but where people of African descent also form a large proportion. Differences in health between ethnic groups have been documented in the Caribbean. The focus of much of this Caribbean research has been on ethnicity as a predictor of NCDs, with socioeconomic circumstances increasingly being examined as an additional predictor. This more recent focus on socioeconomic circumstances represents progress from earlier studies that looked mostly at cultural (e.g. diet) and biological differences between ethnic groups as predictors of NCDs (Elia et al., 2021; Ferguson et al., 2015; Giuffrida, 2010; Gopaul et al., 2023; Miller et al., 1989; Nayak et al., 2011; Schutte et al., 2020). However, climate drivers do not appear to have been factored into this body of research.

The history of colonial exploitation continues to affect ethnic relations in the Caribbean, with people with lighter complexions still enjoying higher status and greater control of resources than those with darker complexions (Reddock, 2014). This means that ethnicity is associated with access to resources – an intersection between colonially defined racial categories and other forms of disadvantage, notably low income and lack of access to health care. It is important to bear in mind that racism may be a cause of impoverishment and poor service access – a cause of the causes (Marmot, 2005) of health inequalities arising from climate change. This intersectionality is increasingly being studied in epidemiological research in the Caribbean.

People with disabilities

People with disabilities are especially vulnerable to climate change impacts because infrastructure and interventions have not been adapted to their needs. For example, some of the challenges faced by people with disabilities during disasters such as hurricanes include (Carby, 2021):

- Lack of elevators, ramps, grab bars and space for special equipment in emergency shelters;
- Lack of information in Braille and the only intermittent availability of signing for deaf people;
- Attitudinal barriers, in that people with disabilities tend to be cast in the role of victims and there is little recognition of their potential contribution to disaster risk management planning and operations.

Migrants

Chapter 8, “Population displacement and migration”, presents information on climate-related migration and associated health risks. Migrants tend to have more limited access to health care than people from the countries to which they migrate, and sometimes this discrimination is enshrined in laws (in the Caribbean and elsewhere) that state that only certain sorts of care can be provided to non-nationals. The circumstances of migration may affect migrants’ mental and physical health (Herrán and Biehler, 2021).

Differences by sector of employment

There have been studies on, and activists have expressed concern about, the impact of climate change on economic sectors that make major contributions to national income and employment or that are important to food security, namely tourism, agriculture and fisheries (see Chapters 12, "Agriculture and food safety and security", and 14, "Marine resources and health") (R4ACCHC, 2022b; UN-OHRLLS, 2015). Part of the concern is about the people employed in these sectors and how their livelihoods may be devastated by climate change. For example, the Caribbean Fisheries Early Warning and Emergency Response system has been developed, which includes information for fisherfolk that can be accessed via a mobile phone and is also presented in posters and a documentary video (Headley, 2021). To date, there has not been major focus on the health of people employed in these sectors or on measures to protect their health.

Residents in coastal areas

Caribbean people living the closest to coastlines are especially affected by climate drivers such as sea level rise, heavy precipitation events, hurricanes and storm surges. Changes in wave climate (largely attributable to damage to coral reefs, which provide a buffer) superimposed on sea level rise are predicted to increase coastal flooding and erosion of low-lying coastal areas. The frequency, extent, duration and consequences of coastal flooding are predicted to increase significantly from 2050. However, in the Caribbean, tropical cyclones are predicted to be a more frequent cause of flooding than sea level rise, in contrast to some Pacific atolls, where sea level rise is expected to cause annual wave-driven flooding over their entire surface from around the 2070s (Mycoo et al., 2022).

Climate change also especially affects the infrastructure, water and food security, and economies and culture of coastal settlements, especially through compound events. Many coastal dwellers work in tourism and fisheries, which are highly vulnerable to climate change. Some coastal areas are likely to become less habitable because of a combination of loss of marine and coastal biodiversity and ecosystem services; submergence; destruction of settlements and infrastructure; degradation of health and well-being; economic decline and livelihood failure; and loss of cultural resources and heritage. Enabling people to continue living in these areas is likely to require adaptation, ranging from nature-based solutions, such as growing seagrass and mangroves, to expensive infrastructure projects, such as higher sea walls, elevating the land and adapting buildings. Major government or donor expenditure will be needed to ensure that infrastructural adaptation benefits population groups equitably. Relocation and resettlement may also be needed for some, which again must be managed and funded to ensure equity and that vulnerable populations are not left behind in at-risk coastal areas (Mycoo et al., 2022). See Chapters 14, "Marine resources and health", 15, "Climate-friendly health promoting infrastructure", and 8, "Population displacement and migration".

Limitations of the Caribbean research

There has been little research on mediating social and behavioural factors influencing climate change-related exposure pathways to ill health in the Caribbean region. Questions about distribution of the risks and health co-benefits of climate change have also been little explored in the Caribbean context (Allen, 2021). In addition, a review found that there are few peer-reviewed publications focusing on climate change-related adaptation for health in SIDS compared with "developed" member countries of the Organisation for Economic Cooperation and Development. This limits the scope for using local research to inform policy action locally and to assert Caribbean interests on the global stage (Hamilton, 2021).

The Institute of Gender and Development Studies of the University of the West Indies has worked on mainstreaming gender in a number of climate change-related projects and initiatives in collaboration with other departments of the university and Caribbean agencies, such as the Caribbean Disaster and Emergency

Management Agency. Some of these projects focus on vulnerable communities such as small farmers. However, health has not been a major focus of this work (Allen et al., 2021a,b).

The *Lancet* Countdown on Health and Climate Change conducted a study with climate and health experts in SIDS, including the Caribbean, to identify priority topics for the development of indicators to measure climate change and health impacts and action. Study interviewees called for disaggregated data and measures of difference between populations to enable identification of vulnerabilities and equitable allocation of resources, both within SIDS and at the global level. Measures of gender differences and gender responsiveness were requested, tracking issues such as the impact of climate change on different economic sectors where men or women predominate and responsiveness to domestic violence and other issues predominantly affecting either women or men (Allen et al., 2021a).

9.2. WHAT SHOULD BE DONE?

Individual and community actions and how to support them

Advocate the right to health of populations vulnerable to climate change

Civil society organisations representing vulnerable populations in the Caribbean should increase their involvement in climate and health issues that affect the populations they represent (Gillman and Kersting, 2021; Itoewaki, 2021; Lashley, 2021). They can serve as watchdogs and caretakers of the environment, holding governments and powerful people to account. Civil society organisations are often first responders to emergencies and community needs and can thus play a critical and immediate role in addressing climate-related ill health. Networking with other nongovernmental organisations (NGOs) and state, pan-Caribbean, multilateral, private, academic and education agencies helps NGOs gain support for their communities and meet their resource needs (Jaramogi, 2021).

For civil society action to fulfil its potential, tailored climate and health literacy programmes should be implemented among groups such as people with chronic illnesses and NCDs, people with disabilities, women, children, young people, older people, impoverished people, disadvantaged ethnic groups, migrants, rural populations, urban populations, coastal populations, and lesbian, gay, bisexual, transgender and intersex people. Campaigns for climate justice by the region's politicians on the global stage should also assert the right to health, incorporating messages about health impacts. They should call for interventions and funding to address and prevent ill health in SIDS caused by climate change, especially among those disadvantaged by social determinants of health. Governments should also reduce red tape and improve access to funding to civil society organisations concerned with climate change and health (Jaramogi, 2021).

The inclusion of "the rights of Indigenous Peoples" in the preamble of the Paris Agreement should be used to assert land rights, prevent land grabbing by prospectors and loggers and protect agricultural and other environmental resources essential for indigenous people's health in the context of climate change (Caribbean Organization of Indigenous Peoples, 2015; Itoewaki, 2021; Vreezdam, 2021)

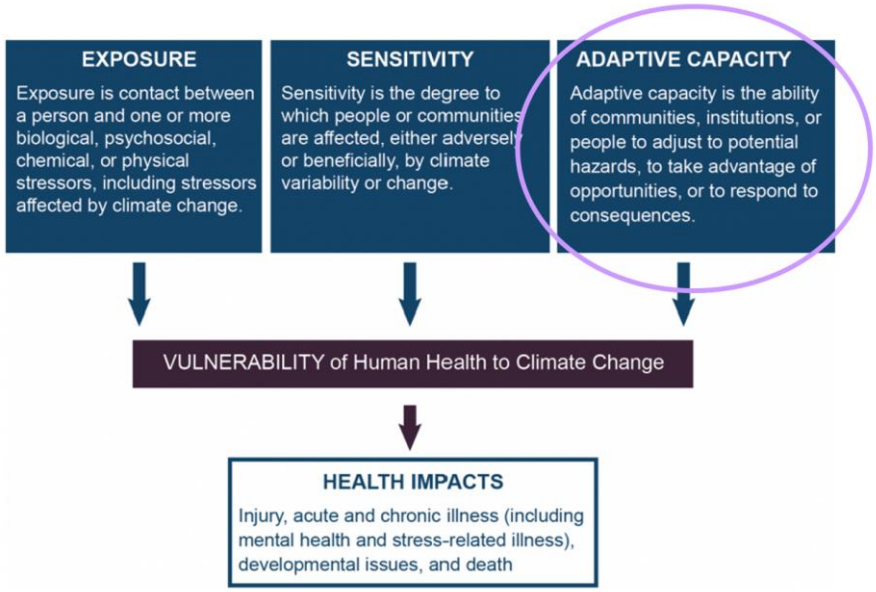
Involve young people in all their diversity in climate change and health action and decision-making

For a sustainable, healthy future, it is especially critical to listen to and involve young people. To support this, climate change and health should be a part of the school curriculum from infant school (Lalla, 2021; Lashley, 2021; Martin, 2021; Nurse-Allen, 2021; Sood, 2021). Climate and health education go hand in hand with health equity and environmental justice (Sood, 2021). Young people should represent populations in all their diversity in advocating equity and justice. A wide range of civil society organisations should be supported, and initiatives such as the Caribbean Community (CARICOM) Youth Ambassadors programme should continue and increase their focus on climate change and health issues (Barnett, 2021).

Build resilience in vulnerable communities and populations

Communities and populations identified as vulnerable to climate change should be the special focus of efforts to build community resilience (Radix, 2021). Six types of community capital have been identified as critical to community resilience: natural, built, financial, human, social and political (National Academies of Sciences, Engineering, and Medicine et al., 2019). Increasing community capital is key to adaptive capacity and thus to reducing vulnerability to health outcomes of climate change, as shown in Figure 3.

Figure 3: Determinants of vulnerability



Source: USGCRP (2016).

Community participation and engagement should take place at the outset of resilience building (Scobie et al., 2021). Representatives of each vulnerable population should be consulted on the existing strengths and weaknesses of each type of capital in their community and asked for recommendations on how each could be strengthened or supplemented by technical advice and donations (National Academies of Sciences, Engineering, and Medicine et al., 2019). Development of tailored approaches is key to agility in the face of threats, which has been defined as a key component of a community's resilience. Agility means being (Radix, 2021):

- Precise – targeting clearly defined issues;
- Comprehensive – being clear about the range of things you want to accomplish;
- Cost-efficient – if the cost of change is too high, it will not be sustainable.

It is critical that the process of consultation is built on a foundation of knowledge in the communities concerned. They should be empowered with education on the climate and health challenges they may be facing and how they can be addressed. Training and tools should be provided. Education on how climate and health challenges can be addressed should include both how communities themselves can be involved (e.g. clearing and minor maintenance of drains and stormwater systems) and how they can engage with institutions at multiple levels, including local and central government, the private sector, and disaster management and technical/development agencies. Networks of support between agencies and communities should be actively built. Demonstrations and simulations should be provided to show how communities can sustain themselves in the face of climate change challenges. Early warning systems should be adapted to facilitate understanding among vulnerable populations, including people with disabilities and low levels of literacy and education (R4ACCHC, 2023).

Structural/governmental and private sector actions

Advocate climate justice for Caribbean Small Island Developing States at the global level

If we are to significantly reduce health vulnerabilities to climate change in Caribbean SIDS, there must be a reduction in greenhouse gas emissions globally. This must be accompanied by robust adaptation measures. Given the historical responsibility of the developed countries and multinational corporations for climate change,

justice will require the developed world to lead and finance global mitigation and adaptation efforts, including massive reallocation of resources to the adaptation and mitigation needs of SIDS. While developed countries should take the lead on this, continued lobbying by Caribbean politicians and civil society will be needed to achieve substantial gains (R4ACCHC, 2023). Corporations, as well as governments, should be the targets of advocacy.

The general diplomatic efforts of Caribbean states in the international arena on trade and other matters should include negotiations on matters pertaining to climate change and health. For example, the impact of climate change on NCDs in the Caribbean should be highlighted as part of negotiations to address the contents and labelling of imported processed foods (Healthy Caribbean Coalition, 2016; R4ACCHC, 2023). See Chapter 18, "Government engagement in health and climate change", for further details on governmental strategies.

Through advocacy from SIDS (Benjamin and Thomas, 2016), some progress has already been made in drawing the attention of the world to the plight of SIDS and their need for access to climate change-related finance. Chapter 17, "Funding streams for climate and health action", provides details of some of the financial resources currently available at global and regional levels.

Conduct and enforce the findings of environmental and social impact assessments in geographically defined communities at risk

Low-income, squatter and indigenous communities without land rights are extremely vulnerable to the environmental determinants of health. These also affect other vulnerable communities as outlined above. Infrastructural projects and unplanned or illegal environmental ventures such as gold mining in Guyana and Suriname can have devastating consequences for these communities (Itoewaki, 2021). Governments are responsible for requiring environmental and social impact assessments that involve local communities in commenting on the consequences of economic projects and ventures. Laws should be strictly enforced.

Integrate equity considerations into health strategies

> We need to ensure that economic and social policy responses to climate changes and other [forms of] environmental degradation take into account health equity.
>
> Galvão et al. (2009)

Significant health disparities among populations support the argument that conventional health policies have failed to improve equity in health and that there is a need for affirmative action to promote equity more effectively (Giuffrida, 2010). Disaggregated data on health outcomes are needed to support interventions and to guide donor support. Since climate change is leading to greater health disparities, it is especially important to integrate equity considerations into health strategies.

For example, two positive discrimination approaches have been proposed to achieve health equity among racial and ethnic groups in Latin America. One applies the principle of vertical equity, allocating more health resources to those populations, such as Afro-descendant and indigenous communities, that have greater health needs. The other focuses on the use of quotas to facilitate the entry of indigenous and Afro-descendant individuals into the health professions, recognising that those who are admitted to the health professions through affirmative action have been found to be more likely than others to address the health needs of those indigenous and Afro-descendant communities (Giuffrida, 2010).

The social determinants of health approach encourages those concerned with public health to address the upstream, structural factors: "the causes of the causes" (Marmot, 2005). It emphasises social justice and redressing the balance of power relations so that no one is left behind. Hierarchical power relations such as racism, sexism and ageism must be addressed and resources redistributed to compensate for disadvantage. Equitable public health policy entails a multisectoral approach that includes development of equal opportunities

legislation that encompasses all forms of vulnerability to discrimination and effective enforcement of this legislation (Hassan, 2021). This will help in dismantling hierarchical normative constructs such as race and gender and thus their power to determine conditions such as poverty that affect health outcomes.

Communicate effectively with vulnerable populations about the climate change and health challenges they face

Government, private sector, philanthropic and advocacy organisations should support the necessary educational and behavioural interventions referred to in the subsection on individual and community action above. They should collaborate with vulnerable populations to design interventions to ensure that they are appropriate, clear and well understood. Scientists should also ensure that their findings are presented accessibly to vulnerable populations and should design education and outreach initiatives accordingly. It is especially important to design communication in ways appropriate for people with various disabilities (Carby, 2021). Key messages should be translated into forms that are easily understood by each affected population, which should be engaged in dialogue to ensure understanding and to foster action (R4ACCHC, 2022c, 2023).

Attending to communication with young people is essential to ensure the sustainability of climate change and health action:

> All the data and science is useless unless it gets into the hands of those who need to act on the information, including the youth.
>
> Lalla (2021)

Address socioeconomic determinants of health such as education, skill accumulation, employment and poverty

Differences between populations in educational achievement and skill accumulation, some of which persist over many generations, should be urgently addressed. Labour market discrimination and market segmentation should be combated so that all are able to thrive economically and be more resilient to climate change (Giuffrida, 2010). Education for vulnerable populations should include information on how to access climate change adaptation resources and build resilience to climate change (R4ACCHC, 2023). When employment and project-related opportunities arise in climate change and health mitigation and adaptation, people from vulnerable populations should be encouraged to apply and workplaces adapted accordingly. Some positive discrimination in employment and higher education enrolment practices is likely to be necessary to address social determinants of health.

Adapt health settings and disaster preparedness and response to the needs of vulnerable communities

This entails the development of strategies according to the needs of specific communities (Hassan, 2021). For instance, the following may be needed: mobile clinics for geographically remote communities; wheelchair ramps and health education materials in Braille or audio format for people with disabilities; and bilingual staff for migrants. The need for such strategies is heightened in the context of disasters, such as hurricanes, that curtail access to services (Carby, 2021). In addition, disaster preparedness must include safe storage and resilient transport systems for the medical supplies, food and water needed by vulnerable populations (Harewood, 2021; Radix, 2021; Riley, 2021).

Adopt gender-responsive approaches

Gender equity considerations should guide interventions to address the health consequences of climate change. Strategies include (Allen et al., 2021a,b; CIDA, n.d.):

- Developing gender-responsive disaster preparedness and response strategies, including protecting women and girls from violence following severe weather events;

- Incorporating women's views on how to improve access to and the quality of resources affecting their domestic labour in the context of climate change, such as water quality, sanitation, food security and housing;
- Incorporating both women and men into the decision-making framework on climate change mitigation and adaptation initiatives (UNDP, 2009);
- Supporting vulnerability reduction measures that target women's needs;
- Making use of technologies that are accessible, beneficial, and acceptable to both male and female stakeholders;
- Providing climate change and health education accessibly and at times and in places appropriate for men and women;
- Supporting the provision of tools, including vulnerability assessments, that build on local and indigenous knowledge, held by women and men, of measures for adapting to, or mitigating the impacts of, climate change.

Research gaps and how to address them

Conduct research to identify populations vulnerable to health impacts of climate change in the Caribbean

To achieve greater equity, it is critical to have information that identifies vulnerable populations geographically and according to socioeconomic, demographic and epidemiological characteristics. This research should be informed by a social determinants of health approach, including indicators of key social determinants that mediate the impact of climate change on health, such as level of education, housing and access to water and other utilities.

Population-level surveys are needed to map climate-sensitive health conditions and environmental factors that can place communities at risk, e.g. housing in flood-prone areas. The information generated through research must be made available to local and central authorities and disaster preparedness agencies.

Produce data disaggregated by key dimensions of social and economic inequality

Data relating to individuals, whether in studies or as part of surveillance, must include key stratification variables such as sex, race, ethnicity, age group, education level and employment status. Some of these pose challenges of definition, given that self-identified gender and ethnic status may not conform to conventional categories (Nazroo, 2003). Personal income is sensitive data, so education, employment and other proxy measures are often used to assess differences in access to resources. Some flexibility in definitions is needed, which may be informed by consultation with the vulnerable populations themselves.

Disaggregated data are a fundamental need for informing equity-oriented climate change and health action (Allen, 2021). Once adequately collected, datasets on climate-sensitive health conditions should be analysed to identify significant differences in prevalence, incidence and risk factors among populations. To be able to use data effectively, it is also important that data sharing agreements are developed between countries and regional organisations (Allen et al., 2021a).

More research is needed to develop adequate measures of socioeconomic status at various points in the life course, so that interventions can be targeted to areas of greater need and be responsive to age group differences (Nazroo, 2003; Patterson-Waterston, 2021).

In interviews with Caribbean stakeholders for an assessment of climate change and health in SIDS by the *Lancet* Countdown on Health and Climate Change, participants called for measures of difference between populations to enable identification of vulnerabilities and equitable allocation of resources. Measures of gender differences

and gender responsiveness were specifically requested, tracking issues such as the impact of climate change on various economic sectors where men or women predominate and the gender responsiveness of strategies on domestic violence and other issues predominantly affecting women or men (Allen et al., 2021a).

The advent of new data technologies involving geographic information systems and artificial intelligence offer new possibilities for pinpointing vulnerable geographical areas/populations and offering assistance. Ethical considerations must precede any use of personal data generated from mobile phone and internet use to prevent further abuse of vulnerable populations.

Study relationships between social determinants of health, climate change and health inequities

Much more analysis of the relationship between the social determinants of health, climate change and health inequities is needed to inform policy and practice (Galvão et al., 2009; R4ACCHC, 2023). Retrospective studies should examine differences in immediate health outcomes and access to health care among populations following a severe weather event, with a focus on hierarchical social stratifiers and commitment to taking action to redress any inequities in access found. Elements of community resilience – natural, built, financial, human, social and political – should be measured and compared between geographically defined communities selected on the basis of stratifiers such as mean levels of education and employment. Tools to measure community resilience should be adapted to the local context through community consultation and used in action research (National Academies of Sciences, Engineering, and Medicine et al., 2019).

The impact of climate change on poor people in urban and rural areas should receive special attention, along with the survival and economic strategies they have developed, which may have positive and negative environmental consequences. The geographical distribution of vulnerable populations in areas of risk such as coastal and flood plains, and the quality and climate resilience of their housing and basic utilities should also be studied (Richards, 2008).

Conduct longitudinal studies of the impact of climate drivers on health of people with preexisting genetic and medical conditions in the Caribbean

The Caribbean relies mainly on international research on genetic or medical predisposition to climate change exposure pathways such as extreme heat and poor air quality. More research with Caribbean populations is needed to tailor solutions to local characteristics. For instance, does sensitivity to heat stress differ between men and women, and between ethnic groups, in the Caribbean context? How are older Caribbean people affected by heat stress? What are the adaptive measures adopted by these populations to avoid heat stress and how effective are they?

Longitudinal research with people with conditions predisposing them to NCDs should also be conducted, monitoring their health status alongside climate information. The impact of severe weather events on their health, access to care and other social determinants of health, such as education and level of income, should be studied.

For example, researchers at the University of Puerto Rico were monitoring the incidence of NCDs in a cohort of overweight and obese people when Hurricanes Irma and Maria struck in 2017. Study participants were aged 40–65 years and free of diabetes at baseline. Among the participants, 6.5% developed diabetes in the pre-hurricane period compared with 12.9% post hurricane. After adjusting for age and body mass index, diabetes incidence was significantly higher after the hurricanes than before (incidence rate ratio = 2.1; 95% confidence interval 1.4–3.1). Blood glucose levels were also significantly higher at the post-hurricane visit compared with those recorded during pre-hurricane monitoring. Participants (15.2%) reported having trouble getting medical care for diabetes or related complications, and 12.8% reported encountering problems getting or storing insulin (Joshipura, 2021; Martinez-Lozano et al.,2021).

Involve vulnerable populations in research on and development of adaptation and mitigation solutions suitable for their needs

People in positions of disadvantage are very aware of the challenges they face and may have good ideas for overcoming them, with technical and financial assistance. With adequate support and investment in research, they can develop innovative solutions to adapt their environments and adopt sustainable energy and technology solutions. Traditional knowledge can supplement that of conventional science in developing locally appropriate technologies (Carby, 2021).

Conduct qualitative research with vulnerable populations to identify the climate change and health challenges they face and develop solutions

Exploratory qualitative research with vulnerable populations can enable them to speak about the forms of discrimination and obstacles they face in protecting their health from the impacts of climate change. Participants should be encouraged to identify cultural, physical and other barriers that limit access to health and health services. This type of information is key to developing the most effective policies to reduce health inequalities (Giuffrida, 2010; Nazroo, 2003; R4ACCHC, 2023).

Qualitative and quantitative research should also be conducted in geographically defined communities and specific communities of interest (e.g. people with disabilities, people with low levels of education) so that members can identify their own vulnerabilities and needs. Special efforts should be made to facilitate the inclusion of people with disabilities in this research, such as by employing researchers who can use sign language and through outreach programmes for people with mobility challenges (R4ACCHC, 2023).

Conduct research on the vulnerabilities and adaptation strategies of specific populations

Examples of suitable research questions include:

- What is the understanding and capacity for adoption of emergency management procedures among people with disabilities? What measures can be taken to enhance their understanding and capacity? What are the attitudes to people with disabilities among government officials concerned with emergency management? (Carby, 2021).
- What are the impacts of coastal erosion, coral bleaching and ocean acidification on food security in impoverished populations and on livelihoods and health in key sectors (fisheries and tourism)? (Nurse-Allen, 2021).
- What are the sanitation and waste management conditions and practices in impoverished communities and their gender dimensions?
- What are the health vulnerabilities to climate change of the indigenous people of the Caribbean? (Kronik and Verner, 2010).
- What are the roles of women and men in the management of food- and waterborne diseases? The management of such diseases should be examined by considering the differences in the culturally defined responsibilities of men and women for food preparation and hygiene in domestic and professional settings (Allen, 2021).
- What is the exposure to and control of insect and other animal vectors in impoverished communities? (Medlock, 2021).
- In what ways do exposure pathways (e.g. heat, sea level rise) affect women and men according to their occupational and mobility patterns?

Surveillance gaps and how to address them

Include disaggregated data in routine administrative and surveillance data collection

As emphasised above, disaggregated data are essential in assessing the impacts of climate change on health in various populations. Routine administrative data collected by service providers and health surveillance data must include social stratification variables and geographical indicators to help pinpoint needs and monitor progress in reaching equity goals.

Environmental monitoring should focus on communities at risk because of their geographical location and inadequate level of adaptation, such as communities living in floodplains with low drainage capacity. Health data should be collected from sentinel sites in these communities.

Include gender indicators in monitoring and evaluation of projects

Data disaggregated by sex would be necessary to develop gender indicators, such as the proportions of male- and female-headed households storing water in uncovered containers and thus vulnerable to mosquito-borne diseases. Integrating gender analysis and gender indicators into programmes and projects can identify where specific vulnerabilities to climate change lie and where opportunities for behavioural interventions and for mitigating and adapting to climate change can be found (Allen et al., 2021a).

Develop and use approaches to measure social and health impacts and inequities

To enable climate policy to respond appropriately to social and health impacts and inequities, these inequities must be measured in a way that policymakers can use. For instance, if a renewable energy project causes the loss of some jobs in fossil fuel production, this must be compared with the new jobs to be created by the renewable energy project. The impacts on health of the old and new energy production methods should be factored in, including the mental health impacts of possible job losses. This highlights the need for strengthening public health surveillance.

The various costs and benefits, some of which will be external to the project itself, should be compared. Evidence-based economic models can be used to build tools to project the costs and benefits of specific projects. For example, the Greenkeeper software developed in the United Kingdom calculates location-specific economic values for health and the social and environmental benefits of urban green infrastructure (Patterson-Waterston, 2021). In addition to cost–benefit analysis, other approaches used to assess the social and health impacts and equity of projects include econometrics, natural capital accounting, cross-sectional data analysis, and geographic information systems.

Research and surveillance capacity-strengthening needs

Strengthen research skills in vulnerable populations

To achieve the research and surveillance objectives above, peer research capacities among the vulnerable populations themselves must be strengthened. This will help to ensure that the research is efficiently targeted at the community's needs and at the building of appropriate adaptation and mitigation strategies (R4ACCHC, 2023). Deficits in basic education in some of these populations should be addressed, and grants and scholarships provided for specialised education. Equipment such as computers and statistical software should be provided.

Strengthen statistical and epidemiological skills

More people, especially in vulnerable populations, should be skilled in the conduct of basic and advanced epidemiological analysis of the differences between populations. This is critical in order to identify and measure inequalities in health outcomes. Skills in the measurement of association are also needed to identify

environmental risk factors. Multivariate analysis will be necessary to investigate the contribution of climate change-related exposure relative to other factors in determining health outcomes.

Strengthen skills in environmental and social assessment and mapping

Skills and equipment to conduct environmental and social assessments and map them geographically are needed, such as for spatial epidemiology and geographic information systems (Nayak et al., 2021).

Train healthcare workers to record and analyse sociodemographic data

Health information systems should be strengthened to enable the recording of sociodemographic data on patients, and healthcare workers should be trained and supported to use these systems. This should be accompanied by human rights training to ensure that all people are treated equitably. Issues of climate justice and equity should be included in health students' curricula (Sood, 2021).

Disciplines needed

A wide range of different disciplines is needed to conduct research that will serve to address inequities in health.

Lawyers are needed to investigate the rights of various populations that determine access to key resources, including land, property, education and health care. The local and regional frameworks of anti-discriminatory and equal opportunities legislation should be examined with a view to achieving equity between all people.

Other disciplines and skills needed include biomedicine, communications studies, disaster needs assessment, sociology, economics, engineering, environmental health, ethnic studies, gender studies and geography.

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