The Social and Economic Inequalities of Climate Change Events on the Elderly, Disabled and Homeless Societies in the Caribbean

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Abstract: The are several vulnerable populations experiencing climate change events around the world that continue to threaten the health and well-being of some of the most susceptible populations in our society, such as, the elderly, the disabled, and the homeless. Although there are 100 million homeless people globally, overall, 1.6 billion people live without proper housing. Such hardship implies that this population group might be unable to effectively prepare, respond, and recover from climate change events. In the Caribbean, this group of people is at risk because of the volatile nature of climate change, such as, changing temperatures and catastrophic weather events, which may not be included in the design of mitigation plans. This presents a significant gap, as there is limited information in the literature that highlights the impact that climate change may have on these vulnerable groups existing in the Caribbean. This chapter seeks to fill this gap by discussing the social and economic inequalities that climate change events pose to elderly, disabled, and homeless individuals. By implementing a secondary research methodology, this study finds that in the Caribbean, these groups tend to lack financial and physical resources to respond and recover from climate change events due to their low income and the inequitable and inefficient dissemination of information on climate change adaptation and mitigation strategies.

1. Introduction

According to Rhiney and Baptiste (2019), climate change and its accompanying threats in the Caribbean can be seen as developmental in nature. Presently, it deepens existing vulnerabilities that can prove debilitating and impact issues such as poverty and inequality. Vulnerable groups such as the homeless, elderly, and disabled could be negatively affected by climate change, especially if elderly individuals are both disabled, and homeless. Layers of inequalities can create a heavy burden for these three categories of individuals. Awareness of the consequences can lead to effective interventions to help alleviate such a burden. All human life is essential. Worth and dignity coupled with a propensity to grow should be values that are adhered to with the utmost standards. EPA (2021) states that one of the populations that are adversely affected and socially vulnerable to climate change is the elderly: a group aged 65 years and over. Bryant et al. (2022) add that people 65 and older are particularly vulnerable to the effects of climate change because of special needs and

advancing age. They reiterate that, despite their vulnerability, older people are often omitted from climate change discussions and don't have a seat at that table. Bryant et al. (2022) state that first responders, health care providers, and society, in general, tend to overlook older adults until after an extreme event or post-disaster. They add that few initiatives have focused on studying the long-term consequences of these events for the older population, preparing at-risk older adults and their families for such events, or helping this population and their families better comprehend, prevent, and mitigate the long-term debilitating effects of climate change. The issues and challenges that impact the elderly, disabled and homeless are discussed in this chapter from a physical, health, and psychological point of view. Furthermore, this chapter also strives to discuss the economic implication of climate change events on this population segment in the Caribbean. Emphasis is placed on the social and economic inequalities of climate change events on these vulnerable groups. Within the climate change literature, although there is much that has been conducted on the Caribbean's extreme vulnerability to climate change, there has been very little consideration made regarding how these events (natural or man-made disasters) impact the elderly, disabled, and homeless in Caribbean society. As a result, the needs and inequalities experienced by these groups are often inadequately captured and addressed in climate change resilience plans in the Caribbean. This presents a significant research gap in the literature, which this study seeks to fill, and in doing so, this study from a Caribbean perspective makes two important contributions.

The first is it examines in detail the social inequalities that the elderly, disabled, and homeless groups in the Caribbean are likely to experience during climate change events from the perspective of the aging process, cognitive impairment, social isolation, and other issues. Secondly, it examines the economic implications that climate change events are likely to have on the elderly, disabled, and homeless in Caribbean societies from the perspective of having limited household incomes, precarious housing and public infrastructure, health and safety, and climate change adaptation measures that are designed with these vulnerable groups in mind.

A summary of the review findings highlights that from the social perspective, the elderly, disabled, and homeless populations face a myriad of challenges because of climate change events such as storms and hurricanes. Their vulnerability increases as a consequence of these events. Each member of the population highlighted has its own set of issues that can overlap with each other. Strategies need to be put in place by those in charge to help alleviate these challenges, especially in times of crisis. Everyone is important, and no one should be left behind. This also speaks to the promotion of human rights for all.

Additionally, a review of the economic implications that climate change is likely to have on elderly, disabled, and homeless groups in the Caribbean reveals several interesting findings. Firstly, elderly women who might also be homeless and people who are rendered homeless during and after climate change events might not have sufficient household income to access basic needs. This problem

may be exacerbated during climate change events, as they may be allocated fewer resources. Second, during climate change events, the movement of both the elderly and the disabled is severely hampered by different modes of transportation, which can become inaccessible to those affected. The lack of inclusion of different modes of public transportation creates an even greater risk during these events as the elderly and disabled might use these services less. Third, it is expected that during periods of excessive rainfall, the overall health of the homeless would be lowest during this time because they may be more susceptible to foodborne, waterborne, and vector-borne diseases, with little access to secure and safe forms of housing and clean drinking water. Fourth, the destruction of green spaces during climate change events may negatively impact the health outcomes of older people, leading to a rise in chronic health conditions. Fifth, since elderly, homeless, and destitute people in the Caribbean are also known to suffer from the negative effects of extreme temperatures and, in some instances, heat waves, there is a need for risk assessment and communication studies to be undertaken to consider how climate change impacts them, and how they can respond to these events.

This chapter is organized as follows. Following the introduction in Section 1, a brief discussion in Section 2 is provided on the material and methods implemented in this study. This is followed by Section 3, which examines the social inequalities of climate change events in elderly, disabled, and homeless societies in the Caribbean, and then Section 4 explores the economic implications of climate change on the elderly, disabled, and homeless in the Caribbean. Finally, the study is concluded in Section 5.

2. Research Methodology

Given that this study is conceptual in nature, it focuses heavily on analyzing the existing literature and how climate change events impact elderly, disabled, and homeless societies in the Caribbean. Such a conceptual framework is necessary as it is built upon the existing literature, which is appropriate when discussing the social and economic implications of climate change on these specific vulnerable groups.

To build this framework, first, the topic for research, i.e., the social and economic inequalities of climate change events on elderly, disabled, and homeless societies in the Caribbean, was decided upon. Second, using a secondary research perspective, several pieces of literature which are relevant to the topic were collected. These collected works were obtained from many reliable sources such as relevant books, scientific journals, and reports from climate change and environmental institutions such as the National Oceanography Centre (NOC), the Environmental Protection Agency (EPA), and the United Nations (UN).

Third, when using the literature, emphasis was placed on the social and economic implications that elderly, disabled, and homeless groups are likely to experience resulting from climate change events. Emphasis was placed on social and economic factors as together they influence the ability of these vulnerable populations

to achieve long, healthy lives, as well as reduce long-term inequalities in society. Fourth and finally, using the relevant literature available, a research framework was developed. To this effect, in this study, two frameworks were developed. The first examined the social inequalities of climate change on the elderly, disabled, and homeless in the Caribbean. To perform this, the physiological and psychological reasons why these vulnerable segments are more susceptible to the effects of climate change were examined. The second framework examined the economic implications of climate change on the elderly, disabled, and homeless in the Caribbean. To conduct this, economic factors, which included but were not limited to household income and public sector provisions, were examined in the context of climate change events in the Caribbean.

In the case of this study, a conceptual research methodology was appropriate because it was cost-effective, used fewer resources, it was likely to assist in generating new research ideas, as this study can be a foundation upon which climate change data are collected based on the experiences of these vulnerable groups. Using this study can help identify patterns in the literature and can improve the overall analysis of the topic.

Using this approach, the literature map used to inform a discussion on the economic implications of climate change on the elderly, homeless, and the disabled in the Caribbean in Section 4 is shown in Figure 1 below. This figure identifies the 5 major themes to be discussed, i.e., limited household funding, housing and public infrastructure, health and safety, climate change adaptation, and research and development.

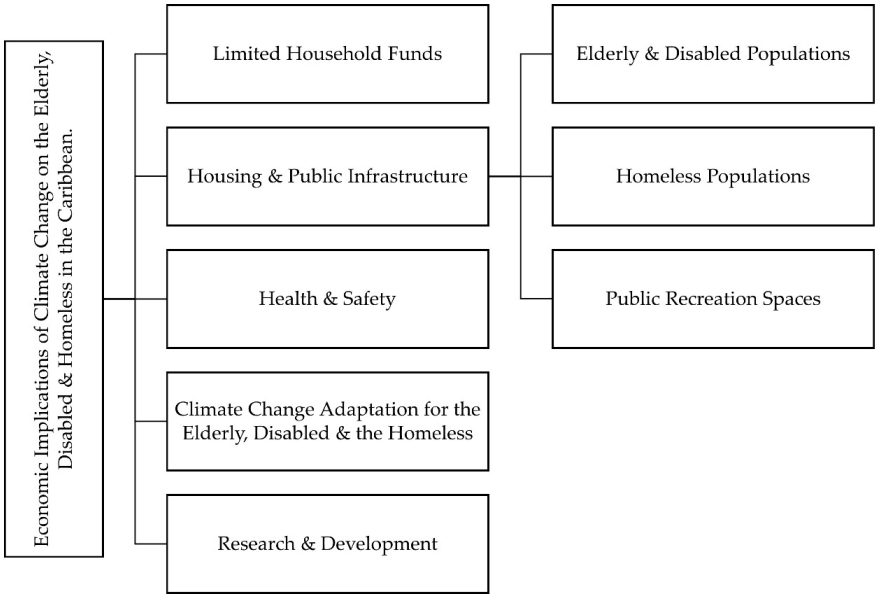

Figure 1. Literature map of the economic implications of climate change on the elderly, homeless, and disabled in the Caribbean. Source: Figure by authors.

3. Social Inequalities of Climate Change Events on Elderly, Disabled and Homeless Societies in the Caribbean

The seven major themes discussed for social aspect in this paper can be seen in the concept map in Figure 2.

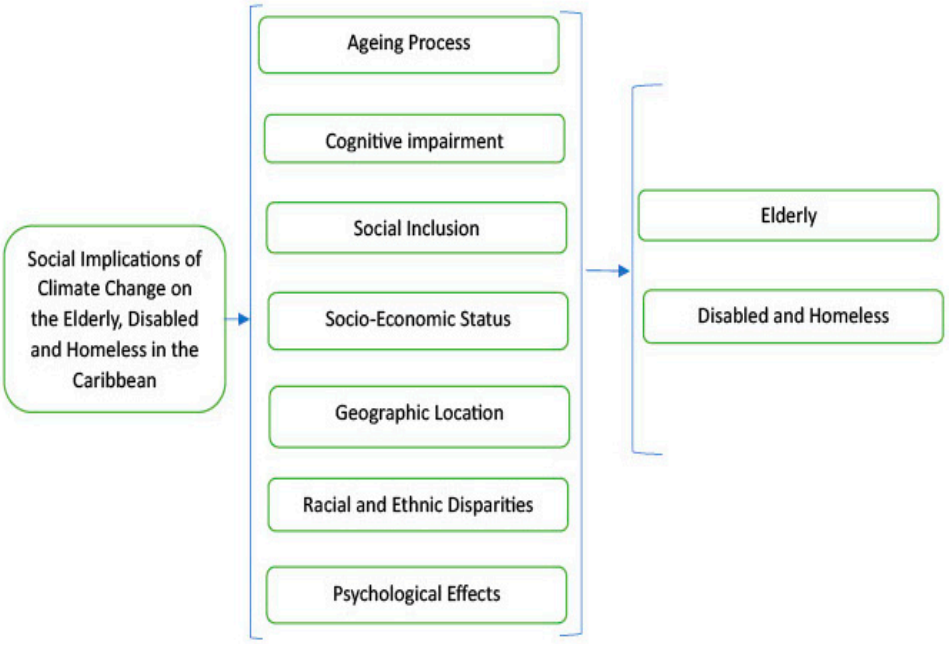

Figure 2. Literature map of the social implications of climate change on the elderly, homeless, and disabled in the Caribbean. Source: Figure by authors.

3.1. The Elderly

Bryant et al. (2022) share the physiological and psychological reasons why elderly persons are more susceptible to the effects of climate change. These included the aging process, cognitive impairment, social isolation, socio-economic status, geographic location, and racial and ethnic disparities.

3.1.1. Aging Process

Aging can increase risk factors for mobility, chronic conditions, and susceptibility to dehydration and can diminish sensory awareness (ACL 2018). These conditions can reduce the ability of these seniors to respond to climate events. Climate change events can exacerbate chronic illnesses in adults, especially when there is a lack of food or water, extreme heat or cold, stress, exposure to infections, and interruptions to access much-needed medications. Additionally, the elderly that are reliant on physical support and medical equipment may encounter disruptions in a climate change event such as a storm, hurricane, earthquake, or volcanic eruption (Balbus et al. 2016). Gamble et al. (2013) report that the most foreboding climate stressors

facing the elderly are heat waves, hurricanes, flooding, droughts, poor air quality, and infectious diseases. They might also be experiencing factors associated with advancing age, such as diabetes, cardiovascular impairments, and heat sensitivity. Bunker et al. (2016) find that a 1-degree Celsius rise in temperature can affect the mortality and morbidity of the elderly.

3.1.2. Cognitive Impairment

A study of evacuations during Hurricane Gustav in 2008 finds that nursing home residents with severe dementia had an increased mortality risk between 30 and 90 days after the evacuation (Brown et al. 2012). During a climate crisis or event, the elderly with cognitive impairments can have a limited grasp on communications, weather warnings, disaster bulletins, and offers of assistance. They might also have difficulty taking preventative measures before the event or being able to help themselves after the event. These seniors can become agitated during the crisis. Brown et al. (2012) report that, during Hurricane Gustav in 2008, residents in nursing homes had an increased mortality risk 30 to 90 days after evacuation. According to USA Today (2019), suffocating heat resulted in 12 patients dying after the passing of Hurricane Irma in September 2017. Irma caused a power outage to the nursing home's air conditioning system, and, as such, the residents experienced temperatures of nearly 100-degree temperatures for days. The workers at the facility, it was said, failed to evacuate despite the terrible heating situation at the Rehabilitation Center.

3.1.3. Social Isolation

Social isolation can create feelings of loneliness, helplessness, and hopeless feelings in the elderly. It can reduce an individual's capacity to cope with climate events. Seniors who are ill and housebound are unable to flee from harm during an emergency. They might not be able to ask for help or receive emergency information (Bryant et al. 2022). Banks (2013) adds that rescuers might not be aware of these individuals during search, rescue, and recovery efforts. This also points to the competence of emergency managers who do not recognize the specific vulnerabilities of the elderly and their inability to address these needs effectively.

3.1.4. Socio-Economic Status

Poverty tends to increase as individuals age (Li and Dalaker 2019). Elderly persons who live in sub-standard housing might be unduly affected (Gamble et al. 2013). Some elderly individuals living on fixed incomes may postpone much-needed repairs to their homes, which can be inadvertently affected by severe weather events. These weather events can expose this population to increased harm and danger with the inability to leave their homes quickly and safely.

3.1.5. Geographic Location

The Caribbean Islands are referred to as Small Island Developing States (SIDS). They might be the least responsible of all nations for climate change; however, they are the most likely to experience the worst effects of the same. In the long term, some islands may become inhabitable, and, as such, this makes them even more vulnerable. According to UNFCCC (2005), 90% of SIDS are located in the tropics and are seasonally affected by extreme weather events such as storms, hurricanes, and cyclones. These events produce flooding in coastal erosion, which affects the livelihoods of many. El Nino Southern Oscillation events also produce dramatic weather changes in rainfall, rising sea levels, and other events.

Mycoo et al.'s (2022) report states that the main areas of living are located along the coast and with their current infrastructure concerning urban development and are exposed to climate change hazards. They state that the population of many SIDSs are concentrated in the low-elevation coastal zone (LECZ), which is defined as coastal areas below a 10 m elevation. Approximately 22 million people in the Caribbean live below a 6 m elevation (Cashman and Nagdee 2017). Mycoo et al. (2022) posit that sustainable development challenges include insufficient land use planning and competition, which contributes to the vulnerability of settlements to climate change. Category 4 and 5 hurricanes severely impact settlements; for example, Hurricane Maria in 2017 destroyed nearly all of Dominica's infrastructure, and losses per unit of GDP amounted to more than 225% of the annual Gross Domestic Product (GDP) (Eckstein et al. 2018). Therefore, with respect to climate change incidences, SIDSs face several health risks that pertain to temperature change, including rainfall, climate variability, and extremes (Mycoo et al. 2022). Climate change is increasing the present burden of climate-related health risks. Health risks can arise from exposure to extreme weather events such as heatwaves, changing weather patterns, the compromised safety and security of food and water, and the creation of disruptions to health systems (Schnitter et al. 2019).

The homeless, as one of the groups most vulnerable to climate change, are exposed to especially concerning health impacts. These individuals are most exposed to weather conditions and a myriad of social and economic issues. Gamble et al. (2013) report that older adults and higher numbers of older adults with low incomes live in high-risk locations affected by global warming. These areas include coastal zones, which have experienced more frequent and severe tropical storms. Urban locations are considered a risk factor for vulnerability to climate stressors because of the 'urban heat island effect', present because of the dense concentration of pavements, buildings, and other surfaces that absorb heat. This heat effect can lead to heat-related illnesses and mortality.

3.1.6. Racial and Ethnic Disparities

Members of minority groups are susceptible to the effects of climate change as they may most likely experience situations that increase climate-related risks, such

as poverty. Poverty limits access to healthcare and proper housing for the elderly (Gamble et al. 2013).

3.1.7. Extreme Weather Events

Older adults are at risk of the impact of hurricanes; people 65 and older had the greatest mortality rate after Hurricane Maria, which descended on Puerto Rico in 2017 (Cruz-Cano and Mead 2019). The above discussion on the specifics of climate change that affect older adults can also be said about the homeless and the disabled. All three categories of vulnerable populations can be affected by social isolation, socio-economic status, geographic location, and extreme events such as hurricanes and flooding. This points to mobility issues for the elderly, disabled, and homeless. Where can they go to when such events occur? Who helps them? Additionally, are their immediate needs prioritized?

3.1.8. Psychological Effects

Older adults, according to Adeola and Picou (2014), experience higher stress levels three years after Hurricane Katrina compared to those under the age of 65. The psychological effects of experiencing a storm or hurricane had an impact on this vulnerable group. Levinson (2012) notes that while most homes for the elderly provide mental health services normally, these services are interrupted and not prioritized during disasters.

3.2. The Disabled

For the disabled, reduced adaptive capacity, according to Rhoades et al. (2016), is an issue, as traveling to a shelter in a storm can be extremely difficult for those confined to a wheelchair. These challenges can be worsened by crises. The morbidity risk is high for those with mental illnesses, disabilities, alcoholism, cognitive impairment, and other substance abuse and social isolation, increasing the risk of death (Ramin and Svoboda 2009).

3.3. The Homeless

It must be noted that homeless populations face unique vulnerabilities, and these vulnerabilities can lead to critical mental and physical health consequences, adding to which the prevalence of homelessness worldwide could be increasing due to climate change. Consequently, Kidd et al. (2021a) developed a hypothetical model that captures the risk factors and the vulnerabilities of the homeless to climate change. They looked at the types of risks in two categories: both primary and secondary. At the primary level, the risks were associated with cold, humidity, water level, rapid change, and disasters. At the secondary level, food, water, insecurity, vector-borne diseases. illness, mortality, morbidity, emergency service use, infrastructure burden, and homelessness prevalence were included.

Both levels of risk can be impacted by the following: dwelling vulnerability, chronic illness, malnourishment, mobility, education, social inequity, social service infrastructure, and response. As a consequence, the following outcomes can materialize, for example, illnesses that can lead to increased mortality and rising morbidity, exposure to violence, and emergency service use and infrastructure burden. This can have a cyclic effect and further increase the primary and secondary risks without proper interventions to mitigate these circumstances. Kidd et al. (2021b) add that there is a need for outreach and education, service adaptations, and disaster planning to assist with disaster responses. Homeless people may experience vulnerability to conditions such as heat stroke, dehydration, and respiratory illness (Osborn et al. 2019). Malnutrition is a huge issue that reduces their ability to tolerate temperature extremes (Walters and Gaillard 2014). It must also be noted that the homeless are a highly stigmatized group, and historic inequities can be exacerbated during adverse climate change events.

4. Exploring the Economic Implications of Climate Change on the Elderly, Disabled and Homeless in the Caribbean

By the year 2022, it is estimated that the population of the Latin American and Caribbean region will be 658 million (UN 2022). Even though the rate of fertility in the region has slowed by two births per female, those of the adolescent age have a rate of 53 births per thousand. This, together with the rising life expectancy of Caribbean nationals to 80.6 years by 2050, implies that by 2056, the region's population is expected to peak at 752 million (UN 2022). Such a transformation in the size of the population could undoubtedly cause significant changes in the demographic structure of the region. This implies that the vulnerable segment of these populations, such as the elderly and weaker social groups, not unlike the homeless and the disabled, are all likely to grow. According to the ECLAC-UN (2022), it is expected that by the year 2030, the proportion of people 60 years and older in the Latin American and Caribbean region will be 16.5%.

As the Caribbean region continues to grapple with the effects of climate change such as the negative fallout from natural disaster events, i.e., hydrological hazards, such as flooding, geophysical hazards such as earthquakes and landslides, and meteorological hazards such as hurricanes and tropical storms, it is expected that the number of people affected by such events will also grow. Among the wide range of areas in which these vulnerable segments could be impacted as discussed below, the one which stands out the most is housing, which could either be compromised or unavailable. Because of the immediate threats that climate change poses to the housing of the elderly, disabled and the homeless, this unavoidably creates a domino effect, with a myriad of challenges ranging from changes in household spending to individual healthcare, which these groups now face.

4.1. Limited Household Funds

Paying special attention to the economic implications that these events are likely to have on the elderly, homeless, and disabled in the Caribbean reveals that the elderly living in squalid and overcrowded conditions are susceptible to climate change events. Like elderly migrant women living in the slum areas of Dhaka City, India, and Kenya, elderly women in rural areas in the Caribbean might be one of the most vulnerable groups to climate change events because they are the poorest in their communities. It is possible that these elderly women, who may also be homeless and those who are rendered homeless due to climate change events, do not have sufficient household income to access basic needs such as food, shelter, and healthcare services (Amjad 2020).

This is an important issue because, during rising levels of inflation and cost of living in the Caribbean and given that the spending habits of the elderly and homeless people tend to yield short-term benefits, they are often allocated fewer public resources as their experience of climate risks is either ignored or oversimplified (Omolo and Mafongoya 2019). As a result, what may transpire is a reduced quality of life and standard of living, as climate change events might increase the risk of undernutrition as well as water insecurity experienced by the elderly, disabled, and homeless population; existing inequalities continue to persist because government assistance in the form of senior citizen's pensions, public assistance grants, and food cards are limited and insufficient to meet the medical and dietary requirements of such people as the cost of living continues to rise (Stein and Stein 2021). For these reasons, the elderly, homeless, and disabled in the Caribbean might not fully support climate change policies because of the lack of inclusion of their needs and experiences in climate change mitigation and adaptation plans (Andor et al. 2018).

4.2. Housing and Public Infrastructure

4.2.1. The Elderly and Disabled Population

The prevalence and intensity of climate change events often cause a significant and negative impact on household and living conditions, as well as the public infrastructure of victims around the world. In Brazil, Azevedo et al. (2021) explain that during climate change events, the movement of both the elderly and the disabled is severely hampered by different modes of transportation, which become inaccessible to them. This lack of inclusion by different modes of public transportation, such as public buses and taxis, creates an even greater risk during rainy weather, storms, and flooding events, as the elderly and disabled might use these services less, especially when residing in urban and rural areas in the Caribbean.

The lack of inclusion and social capital regarding disaster response for these groups often serves to exacerbate their current circumstances and makes them even more marginalized than before (Benevolenza and DeRigne 2018). This is especially the case, as disabled and weaker social groups in the Caribbean tend to be more

prone to impoverished conditions. As a result, they are less likely to be given priority during evacuation exercises and offered insurance to protect their assets and homes during adverse weather events. One example of such a situation occurred during the passage of Hurricane Katrina in 2005 when it was estimated that 155,000 people with visual and physical impairments were adversely affected during evacuation exercises (Kosanic et al. 2019). This is because people with disabilities as well as the elderly who are disabled, might not have access to safe housing and shelters during adverse weather conditions due to infrastructural issues such as walkways, bathrooms, and beds not being designed to meet their needs. Thus, some disabled people may be rendered homeless during and after severe weather events.

4.2.2. The Homeless Population

People who experience homelessness are generally exposed to extreme weather events because they lack the financial know-how to adapt to conditions by having their own homes. Often, these people may also be elderly and disabled and can have very little access to supportive social networks and secure supplies of food, shelter/housing, medical facilities, and medication (Anderson et al. 2021). In the Caribbean, it is expected that during the annual dry and rainy seasons, extreme temperatures and rainfall, which in the latter case lasts from June-November, means that the overall health of the homeless is lowest during this time. This is mainly because, during the rainy season, the increase in rainfall and the risk of flooding and landslides make them more susceptible to foodborne, waterborne, and vector-borne diseases, as they may have little access to secure and safe forms of housing and clean drinking water (Kidd et al. 2021a). Living in such conditions, unfortunately, contributes to the homeless in the Caribbean experiencing instances of lower emotional well-being, as well as the continued erosion of both their physical and mental health (Bezgrebelna et al. 2021).

Regrettably, in the design of climate change policies, the subject of climate change and the homeless population is often treated as two separate issues rather than looking at how they interact with one another (Greif 2021). Such a disconnect in the climate change discussion in the Caribbean implies that the vulnerability of the homeless to climate change events is not effectively addressed. This leads to the greater stigma associated with homelessness and more occurrences of environmental injustice toward the homeless (Gibson 2019). In such a situation, what is needed to combat the issue of climate change and homelessness in the Caribbean is a Human Rights-Based Approach, which addresses the housing precarity that the homeless face, providing better means of housing and urban planning with the homeless population as the main stakeholder.

One good example of a climate change response that is sensitive to the needs of the homeless, which the Caribbean region can learn from, is the measures implemented by the government of Bangladesh to deal with climate change-induced displacement. This plan, as explained by Kisinger and Matsui (2021), resettles

displaced homeless people into cluster villages on public land, providing life skills and training to help them better reintegrate into society and the workforce, as well as support through social safety nets, and financial support from all non-governmental organizations.

4.2.3. Public Recreational Spaces

Further to this, as the world's population continues to age, in most cities and communities where the elderly live, public spaces such as community gardens, parks, cafes, and barbershops are being created to encourage them to lead a more active, sociable, and healthier lifestyle. Unfortunately, as Higueras et al. (2021) explained, climate change events such as typhoons, hurricanes, and earthquakes can not only destroy these public spaces but also have a marked effect on the health outcomes of older people. Where there is a lack of green spaces, it is expected that health issues such as obesity, cardiovascular diseases, respiratory diseases, heat/cold shocks, accidents, and mental health issues, may pose an even greater risk when the elderly reside in high-density and rural areas.

In the Caribbean, even though there are many private and public sector enterprises which contribute to a thriving social atmosphere, such as waterparks, boardwalks, and parks, it is unknown whether these activities are designed for the needs of the elderly and the fluctuating climate change conditions in mind. For this reason, what is needed in the Caribbean is the design of inclusive, comfortable, and healthy green spaces, as well as communities that consider the safety, location, and health/mobility of the older population.

4.3. Health and Safety

Given that climate change influences the mortality of the elderly through elevated temperatures and air pollution, there is a need for age-specific temperatures and air pollution projection studies to be undertaken in the Caribbean to determine the predicted mortality burden of these changes within a heating climate (Chen et al. 2020). Studies have shown that in countries such as San Paulo, Brazil, as well as China and Crete, the prevalence of heat waves pose a significant threat to some of the most sensitive populations, such as the elderly, with the estimated heat-wave elderly-related mortality rate rising to 587 deaths per 100,000 residents per year in Brazil with exponential growth in the years of life lost to the elderly in China, and a strong correlation between the mortality of the elderly with both ambient temperature and humidity in Crete, Greece (Diniz et al. 2020; Huang et al. 2018; Tsekeri et al. 2020).

Notwithstanding the outcomes experienced by the elderly and other vulnerable groups in these countries, in the Caribbean, at the intuitional level, there is a need for municipalities within each town or district within their own local government office or regional cooperation office to design strategies that manage how the elderly in their respective communities' experience and manage heat-related

risks through enhancing their adaptation work. Such adaptation measures, like those implemented in Baden-Wurttemberg, Germany, could also target general practitioners and nurses who tend to the medical needs of elderly clients by providing supplementary emergency medical training to treat heat-related conditions (Herrmann and Sauerborn 2018). Such training would allow general practitioners in the Caribbean to better check for cardiovascular (ischemic heart disease) and respiratory ailments (heat stroke, exhaustion, and asthma) while monitoring how the use of certain drugs such as blood pressure medications, antihistamines, and decongestants, used to treat hypertension, asthma and allergies and changes in extreme temperatures, can cause heat intolerance.

Like the elderly, homeless and destitute people in the Caribbean are also known to suffer from the negative effects of extreme temperatures and, in some instances, heat waves. However, there remains very little empirical research, as well as adaptation and mitigation plans, documenting their experiences with climate change events such as extreme temperature, flooding, droughts, pollution, and vector-borne diseases.

Often the homeless, such as those in Australia and India, and like the Caribbean, may be more vulnerable to heat stress and other conditions resulting from changes in their living environment. For this reason, these groups are more likely to suffer from dehydration and heat stress symptoms and may even die from hunger (Every et al. 2021; Islam 2022). For this reason, what is needed in the Caribbean, in such a case, is for the state and non-governmental organizations to make available safe and clean forms of drinking water for the homeless alongside safe forms of housing, information on heat stress symptoms through outreach programs, and to provide greater access to housing units, and shelters which are aimed at the homeless population.

4.4. Climate Change Adaptation for the Elderly, Disabled and Homeless

Given that many countries may not have specific climate change adaptation and mitigation plans which are focused on the needs of the elderly, the disabled, and the homeless in society, what is needed in the Caribbean are risk assessment and communication studies which concentrate on vulnerable groups such as the elderly, disabled and the homeless, to determine how they perceive the impact that climate change is likely to have on their health and response to extreme weather conditions (Bi et al. 2020).

In this way, Caribbean environmental agencies can learn from and follow in the footsteps of countries like China and Japan, who are already ahead of most countries in ensuring that, even with the occurrence of climate change events, the most vulnerable in society can continue to lead a healthy lifestyle which is both sustainable and productive, while designing effective communication strategies to meet the needs of these groups.

For example, in the case of Tokyo, Japan, Park et al. (2021) explained that the use of more advanced mapping techniques, such as fine-scale heat mapping, is an essential component in the design of adaptation strategies when it comes to dealing with the intensity of heat exposure experienced by the elderly residing in urban areas. The use of spatial patterns of heating, if adapted to the Caribbean, would allow for not only greater comparisons to be made but help environmentalists and policymakers in the Caribbean identify where the hotspots of heat exposure by the elderly occur and how large they are expected to grow in the future.

Further to this, given that climate change impacts the livelihoods of elderly, disabled, and the homeless in a significant way, it is expected that during and after climate change events, the ability of some economically actively elderly and disabled people may be constrained either through the loss of jobs, or their reduced ability to undertake tasks at work due to financial and personal constraints. Further to this, continued joblessness, together with the loss of income and housing, are also contributing factors to people becoming homeless. Thus, it is important to develop employment programs that are targeted toward retired and unemployed elders, as well as persons who are disabled, to strengthen their earning capacity.

4.5. Research and Development

Additionally, besides the individual and institutional economic costs associated with the impacts of climate change on the elderly, disabled, and the homeless, it is noted that within the environmental research literature, there is a significant lack of country-specific studies that examine the impact of climate change events on these vulnerable groups, particularly for the Caribbean (Kwon 2020; Kinay et al. 2018). For this reason, it is not likely that the direct effects of climate change diseases and the negative outcomes caused by climate change events, such as extreme temperatures, are recorded in the Caribbean. This hinders the implementation of policy measures promoting the adaptation of vulnerable groups such as the elderly, homeless, and disabled to climate change events since few studies produced in the Caribbean empirically examine the impact that climate change has on these communities (Kosanic et al. 2022).

Such insufficient research is likely to have a negative influence on the design, practice, and implementation of climate change policies concerning this segment of vulnerable people, as the research undertaken may not be either supportive or inclusive of the needs of these people. Furthermore, the exclusion of these vulnerable persons in the design of climate change policies could create an unstable policy environment, reducing the dissemination and uptake of research. This issue, together with issues of limited grant funding and limited engagement with policymakers, practitioners, and intermediaries, could, unfortunately, discourage researchers from undertaking good quality climate change research focusing on vulnerable populations that are robust and ethical and can inform policymaking. For this reason, there is a dearth of case studies that examine these issues in the Caribbean.

What is needed, in this instance, is greater investment in conducting empirical research studies and a case study approach, which examines the health effects of climate change on the homeless, elderly, and disabled in the Caribbean. The findings of such studies could be integrated and used in the policy implementation process of adaptation and mitigation plans. The collection of relevant data, and the production of empirical research studies, are imperative to the successful implementation of these policies because their lack of evidence is often highlighted as the main barrier to undertaking such studies. Should greater data be collected and analyses be undertaken, it would illustrate how climate change events influence the ability of the elderly to adapt to such situations with the need for more social safety nets (Rhoades et al. 2016).

Further to this, within the literature, there is a great need for climate change research to be more compassionate in terms of its conceptualization of human vulnerability (Eriksen 2022). Instead of describing the disabled, elderly, and homeless as victims of climate change, they could be viewed as the experts on adaptation and mitigation strategies that are geared toward their specific vulnerable group. Such a reimagining of the roles and insights of the disabled and the vulnerable concerning climate change events could reduce their exclusion and promote greater inclusion in the design of environmental and climate change policies (Larrington-Spencer et al. 2021).

Moreover, the experiences and needs of vulnerable communities in response to climate change events are often clumped together and generalized within the literature. Strambo et al. (2021) explained that such a practice should be stopped in each vulnerable group, such as the disabled, homeless, and elderly, who all have multiple identities with different needs that all intersect with each other. As the systematic scoping review method implemented by Kidd et al. (2021b) revealed, in the case of the impact that climate change has on homelessness, this topic is severely under-developed, and is insufficient in its current form to adequately address or even inform mitigation and adaptation plans.

5. Conclusions

Small Island Developing States (SIDS) are vulnerable to climate change events because of their nature and geographical location. Many dwelling places are located along the coast in the direct path of adverse weather events, such as storms and hurricanes, which wreak havoc on landfall. The vulnerable populations of the elderly, homeless, and disabled are inappropriately affected because of already present health issues, social isolation, mobility, limited access to services, and psychological issues. Stakeholders and the Government of the day must recognize the social and economic implications of these vulnerable populations and seek to address these as soon as possible. Mitigation and adaptation plans are necessary and must be prioritized to ensure that the risks to these groups are minimized and that an element of safety and security ensues. The fundamental human rights of these groups are in question

concerning climate change and its events. Awareness and education are integral as a means of support and recognition of these groups. There must be action and intervention undertaken to protect the lives of these vulnerable populations.

Some of the most important economic implications that climate change is likely to have on the elderly, disabled, and homeless groups in the Caribbean include (1) the elderly and the homeless might not have a sufficient household income to put in place mitigation measures in cases of severe weather conditions, (2) the movement of the elderly and the disabled could be severely impacted by severe weather conditions as different modes of transportation become limited and inaccessible during extreme flooding and rainfall, (3) the health of the homeless population is likely to worsen during periods of excessive rainfall, as they may have limited access to safe housing and clean drinking water, (4) the destruction of green spaces during climate change events can negatively impact the health outcomes of older people, leading to a rise in chronic health conditions.

The findings from this study show that not only do climate change events have a significant and often irreversible impact on the elderly, disabled, and homeless groups in the Caribbean, but their exclusion from climate change policies, and empirical research studies, can mask greater societal problems in the Caribbean like unequal opportunities, discrimination, ableism, gentrification, and ageism. The findings of this study provide several avenues for several unique pieces of future research to be undertaken, such as examining the link between gentrification and climate change in the Caribbean, as well as looking at the role which ageism plays in climate change discussions in the aging Caribbean region.

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