CLIMATE CHANGE AND MENTAL HEALTH- PAST AND FUTURE SOCIAL JUSTICE CONSIDERATIONS

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ABSTRACT

Evidence continues to mount regarding the impact of climate change on the ecosystems of the world with increasingly dire predictions about the need for global action to slow warming and its downstream effects. Human beings are not immune to changes in their environment. Growing research demonstrates the impact of climate change on cardiovascular, pulmonary, psychiatric, neurologic and renal diseases, as well as its disruption of overall health through malnutrition, infectious disease, and pregnancy and developmental complications. Stress is known to precipitate, worsen, and maintain chronic disease. Social and community factors are known to impact individual and community mental health. The psychological stress of loss of goods, identity, and social support through weather events brought about by climate change has the potential to worsen the health and wellbeing of populations.

Climate change does not impact communities equally. Populations historically and currently disadvantaged by inequitable policies may live in environments more at-risk to natural disaster, and have access to fewer financial, governmental, social, and healthcare resources to respond to climate events. Limitation of individual and community ability to respond to stressors reduces resilience and perpetuates chronic stress.

The aim of this thesis is to examine the intersection of mental health and climate change with a particular focus on how social injustice has shaped the capability of populations, particularly those in urban settings, to respond to environmental changes with Philadelphia as a particular example.

DEDICATION

Dedicated to all of the teachers throughout my life.

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Thank you to Dr. Nora Jones for supervising this thesis and widening my perspective throughout the last three years.

This thesis would not have been possible without the hard work of many before me to raise the importance of climate injustice and who continue to advocate tirelessly for correction of these injustices.

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CHAPTER 1: INTRODUCTION

Climate change has become an increasingly well recognized issue across the world in scientific, political, and social realms. While the media in the U.S. continues to write of doubt among some citizens, scientific data shows clear changes in global temperature, extreme weather events, and decades-long biodiversity loss (IPCC, 2021). In 1990, a report by the Intergovernmental Panel on Climate Change (IPCC)-an organization established between the UN and World Meteorological Association to study climate change- was the first to acknowledge on a worldwide scale the phenomenon of global warming and need for intergovernmental intervention to slow its impacts. Four subsequent reports by the IPCC have highlighted an increasingly acute need for world action to limit the warming of the Earth by 1.5^{o} Celsius by 2100. For this to happen, global emissions need to be limited to around 45% of the current rate by 2030 . In November 2021 the UN Climate Change Conference (COP 26) concluded with few enforceable commitments to slowing the rate of climate destruction by the world's greatest contributors to pollution historically, the United States and China, (Sommer 2021).

With an increase in high profile hurricanes, heatwaves, and fires across the world, health scientists have begun to question the impact of climate change on human health and have found robust linkages to disease burden and decreased quality of life. Associations between climate change and mental health specifically have begun to emerge as clinicians have noted the psychological effects of a changing environment on their patients and communities. The COVID-19 pandemic demonstrated the inadequacies

of the public health system in the United States to respond to widespread health emergencies and highlighted inequities between communities. The aim of this thesis is to examine the intersection of mental health and climate change with a particular focus on how social injustice has shaped the capability of populations, particularly those in urban settings, to respond to environmental changes. Philadelphia will be used as a particular example of these ideas given my interest in this work being directly applicable to Temple's patient population. Of note, the scope of this thesis is to focus on urban environments in the United States and as such, takes a limited, Western view of the climate crisis while humbly acknowledging the impacts of the United States' actions on other nations.

CHAPTER 2: HEALTH IMPACTS OF A CHANGING ENVIRONMENT

Health and Climate Change in Medical Sciences Literature

Concern about the health impacts of climate change has steadily increased within the medical literature as climate change research has become more prominent across scientific fields and in the public consciousness. The Lancet has published a multidisciplinary Countdown Report on health and climate change since 2016, with the 2021 title describing "code red for a healthy future." In Fall 2021 an editorial titled Call for Emergency Action to Limit Global Temperature was published simultaneously in over 230 medical journals (Romanello et al. 2021; Atwoli et al. 2021, 939). Studies have demonstrated climate change repercussions on health with both direct and indirect associations with infectious, pulmonary, cardiac, neurologic and renal diseases, malnutrition, and pregnancy complications (Rocque et al. 2021, 6-8). An analysis of systematic reviews on health and climate change published in 2020 by Rocque et al. found 94 systematic reviews on the subject. Most were published after 2015, showing a particularly rapid increase in interest on the subject recently (Rocque et al. 2021,4). Primary themes in the literature were the association of heat and humidity across health concerns and the impact of extreme weather events. Heat related deaths, especially in the elderly, have increased over 50% in 20 years and specific heat- related exacerbation of illness has been found for infectious, respiratory, sleep, mental health, and cardiovascular disorders (Rocque et al. 2021, 6-9; Atwoli et al. 2021, 939).

Another particular area of interest emerging for mental health professionals in the health literature is the neurologic effects of air pollution (Xu, Ha, and Basnet 2016, 157).

A review of 40 hazardous air pollutants found that neurological effects were second in health impact second only to pulmonary effects (Fox et al., 2004, 305-6). Insults to brain structure and function have significant impact on mood and behavior. Air pollution has been found to increase neuro-inflammation in areas central to cognition and has associations with changes seen in diseases of dementia and neuro-degeneration (Lu 2019, 54-7). Studies have also shown air pollution can potentially impact brain development in utero and impair attention in children and adults. It is important to note that more research is needed to strengthen these preliminary findings as most studies have been small and unable to completely control for all potential cofounders (UPHE, 2021). Despite this, the growing number of studies finding potential neurologic impacts of air pollution suggest important linkages between human produced climate change and population development and health that warrants further investigation.

Mental Health and Climate Change in Medical Sciences Literature

Potential mental health impacts are broadly acknowledged in the health literature related to climate change, however detailed data and assessment related to psychiatric diseases lags compared to other health focuses. The lack of focus on mental health within the medical literature related to climate change leaves a substantial gap in the overall picture of healthcare in the time of climate change and serves as a potential confounder to comprehensive, implementable mitigation and planning strategies. It is projected that even without climate change, mental illness and disorders will be the second greatest burden of non-fatal disease by 2030, a statistic that has only accelerated due to the COVID-19 pandemic (Berry 2009, 453). For the sake of this review, mental health refers to both mental illness and disorders as well as states of psychological wellbeing (Hayes et

al. 2018, 1). Mental health has been shown to interact with climate change in both direct and indirect ways- via exacerbation of pre-existing mental health conditions following extreme weather events, higher rates of new onset mental health diagnoses in populations directly and indirectly experiencing climate stressors, and increased potential for physical illness and therefore vulnerability to climate change (Cianconi, Betrò, and Janiri 2020, 1-11), (Berry et al 2010, 126), (Panu 2020, 2,10). Just as in the health literature at large, heat increases seem to be a particular point of concern.

First, there is a direct link between extreme climate events (ex: heatwaves, floods, fires) and exacerbation of existing mental health disease. It is well known that persons who have a pre-existing mental illness are more likely to relapse when external social and environmental stressors are present. Those with PTSD, anxiety disorders, or depressive disorders are at increased risk of exacerbation of symptoms following extreme weather events through exposure to known risk factors for those conditions such as threat to life or wellbeing, lack of control over threatening situation, and loss of individual and community supports. Interruption of existing healthcare supports also increases the risk of relapse in mood and substance use disorders. Additionally, extreme weather events have been associated with increase in violence in communities, which raises a community-wide risk of exacerbation and new onset mental health disorders secondary to trauma (Morganstein 2019).

Heat has particular implications for exacerbation of pre-existing disorders. Sleep is critically important to remission of mood disorders. It has been shown that atypical nighttime temperature is associated with insufficient sleep, which has implications for worsening mental illness as the number of abnormally warm nights increases

(Obradovich et al. 2017, 1). Research also shows increased risk of completed suicide with temperature rise (Gao et al. 2019, 1027), tripling of all-cause mortality during a heatwave if a person has a pre-existing mental illness, and increase in hospital ER visits and admissions for mental illness in the days following heatwaves (Cianconi, Betrò, and Janiri 2020, 5, 8). Persons with schizophrenia spectrum disorders are at even further increased risk of harm during high temperatures via changes in serotonin and dopamine as a result of heat stress, impact of certain psychiatric medications on thermoregulation, and potential for prolonged exposure due to disorganized thought process (Chan et al. 2018, 11.; Cusack, Crespigny, and Athanasos 2011, 915-917). Heat has also been shown to increase risk of hyperthermia and death for individuals with alcohol, opioid, and sympathomimetic (cocaine, MDMA, amphetamine) dependence (Cusack, Crespigny, and Athanasos 2011, 915-917).

Climate change and associated extreme weather events also have the potential to cause new mental illnesses in populations. Reactions to extreme events can range from acute symptoms of distress immediately following the event to lasting psychiatric disorders. Most notably there have been observed increases in diagnosis of Post-Traumatic Stress Disorder (PTSD), generalized anxiety, panic disorder, substance use disorders, and major depression which have been seen to develop and be sustained following events (Cianconi, Betrò, and Janiri 2020, 8). The psychological impacts of displacement including loss of employment, community, and sense of identity can perpetuate mental illness for years due to loss of protective social and support factors known to be critical in reducing onset and exacerbation of mental illness. These social supports can be particularly important in communities historically less able to access

healthcare and government resources. A study on flooding for example found that psychological impacts persisted at four year follow-up and the risk was 1.7 times for those who had been flooded and displaced versus not displaced (Berry et al. 2018, 283).

There are emerging terms for the psychological distress experienced with climate change not captured by current psychiatric disorders. While anxiety as a concept and symptom underlies much of the feelings persons have in reaction to climate change, current definitions for generalized anxiety or panic disorder do not capture the more chronic, existential experiences of climate change and climate worry. Terms such as eco-anxiety, solastalgia, eco-grief, and eco-trauma have begun to enter the psychological literature to describe what clinicians have begun to see in patients experiencing psychological impacts of climate change (Panu 2020, 10). In 2017 the American Psychological association presented a working definition of eco- anxiety as "a chronic fear of environmental doom" (Clayton et al., 2017, 29). Solastalgia has been used to describe a more nebulous existential loss of place or roots as a result of climate change. Defense reactions of denial, disavowal, and avoidance may come into play by both clinicians and patients experiencing climate stress and impact the ways one does or does not take action on climate issues, which can further impact senses of self-efficacy and anxiety. The emergence of discussion of these new terms highlights the increasing presence of ecological factors within our collective consciousness and the mental health system.

Impacts on the Healthcare System

With all of the data pointing to the health impacts, both physical and psychological, of climate change, the literature has begun to consider what impacts this

may have on the healthcare system in the United States. The health impacts of climate change often lead to chronic conditions that do not cease even if the climate stressor ceases. This will lead to a population that overall has a higher physical and mental disease burden and requires a system that can adequately address these needs. In disaster response, it is estimated that the emotional impacts of a disaster may persist up to 3 years after even a one-time event, which could have immeasurable impact on one's lack of care for physical conditions during those years as well (U.S. Department of Health and Human Services 2000). As the current coronavirus pandemic shows, our social and medical systems are not adequately prepared for a simultaneous, sustained rise in acute and chronic needs of the population. Much of the psychological literature calls for increased mental health workforce, training in climate change, operational changes to reduce climate impact from health systems, and education by healthcare providers to vulnerable populations (Hwong et al. 2021, 1-3). While these things are important, they likely will not be able to proactively keep pace with need, leaving at-risk populations increasingly less likely to receive resources and widening opportunity gaps in society.

What Remains Unsaid

Responding to climate change impacts on the U.S. health system solely through action that remains within the current bounds of the system cannot be successful as it ignores the root cause of the growing mental health and climate crises: social inequity. In both the climate change literature and mental health literature there is repeated acknowledgement that lower-resourced populations are more at-risk to both climate change and mental health conditions, but there is often little discussion as to the systemic inequity that created and continues to drive this vulnerability. Inequity is at the core of

increased rates of mental illness in certain populations due to higher exposure to stress and trauma and reduced access to prevention and treatment. Additionally those with serious mental illness have shorter life expectancies (up to 20 years less) largely due to under- diagnosed and under-treated physical illnesses. Proposed prevention and response strategies to both climate change and many mental health problems in the U.S. are still centered largely on individual level action within current systems and policies, demonstrating a failure to acknowledge the decades of purposeful inequity in access to resources within the country's social systems. Steps must be taken by medical and societal leaders to move beyond documenting discrepancies in health and environment and starting to examine instead how these discrepancies arise in order to take meaningful action.

CHAPTER 3: IMPACT OF UNREMEDIED PAST INEQUITIES ON THE FUTURE OF MENTAL HEALTH DURING CLIMATE CHANGE

Social Determinants of Mental Health

In recent years the mental health field has shifted back to a bio-psycho-social model of disease, acknowledging that social determinants of health (SDH) have significant impacts on development and continuation of mental illness along with more classically considered biologic and psychological factors. Social determinants of health can be defined as "the driving forces behind social, environmental, and behavioral risk factors for poor physical and mental health, as well as disease and morbidity" and include discrimination, poverty- with poor access to food, housing, and healthcare resources- job insecurity, "adverse features of built environments", and income inequality, though there are many other familial and cultural factors that influence SDH (Compton and Shim 2015, 420-1). Health literature has roundly established the importance of SDH in a person's disease risk and process and social determinants are often acknowledged within medical literature. Even factors such as genetics previously thought to be strictly biological have been shown to be mediated by social factors such as stress.

In present practice clinicians often incorporate social factors into their assessments of patients and even electronic medical records have shifted to display prominently potential socially limiting factors of a patient's health. These shifts reflect a movement within medicine seeking to identify reasons textbook medical practice often underperforms in real world practice. The hope is that in finding groups more vulnerable to get or continue to have certain conditions, interventions can be more precisely

delivered. In reality, medicine has done a good job identifying and categorizing at-risk groups without equal results in the ability to intervene and reduce health gaps in those with more SDH. The reason for this being identifying patients as vulnerable implies some need for action, however there is not current consensus as to who is responsible for such protections. As such current healthcare and socio-political systems are discordant with what is known in the literature to be required to support the health of certain groups. A recent small but vocal group in the mental health community argues that healthcare cannot be justly delivered to all without policy changes at federal and state levels to meaningfully begin to address social injustices exposing certain populations to mental health risk factors. Before such large scale changes can be integrated into health and social policy, however, what even constitutes vulnerability must be critically evaluated as it is an oft used concept but one that does not have widespread agreement in meaning within different spheres of discussion.

A Note About Vulnerability

Throughout the literature about the impact of the changing climate on the world environment and health, researchers often note that certain populations of people will be more vulnerable than others. Widely agreed upon vulnerable groups to the effects of climate change include children and persons who are elderly, physically sick, disabled, mentally ill, or impoverished (Ingle and Mikulewicz 2020, e128-130). Though the term vulnerability is often used in health literature, it is not often defined. Vulnerability is usually assumed by the reader to mean a predisposition to risk, often risk of harm, through either exposure or ability to respond (Rogers, Mackenzie, and Dodds 2012, 12). In the medical literature and especially mental health literature, vulnerability often carries

an additional connotation that this risk of harm implies an ethical imperative to protect a group, drawing from a bioethical tradition influenced by past abuses on human subjects in medical research. However, "many vulnerabilities are context dependent and demand responses because of their significance within a particular setting" (Rogers, Mackenzie, and Dodds 2012, 12). When the term is used to broadly categorize an at-risk group without consideration of the setting or source of such risk, there is potential for an overgeneralized, paternalistic response that may in fact exert harm itself rather than address the source of vulnerability. For example, those with mental health disorders have historically been classified as vulnerable populations in research which has had the unintended effect of exclusion from studies and a dearth of literature on medical treatment in those with mental illness. A more nuanced approach could instead be to consider in studies when person's mental illness puts them at elevated risk of harm in research and what might be done to reduce this risk or adequately warn, thereby addressing context specific factors and preserving personal agency.

By considering social determinants in health literature, researchers are essentially naming contexts in which a risk of harm from illness may be increased, either by exposure or ability to respond. Climate change with large climate events and insidious reshaping of environments acts as an additional potential source of vulnerability that becomes more prescient considered among a person's other social, biological, and psychological contexts. It is therefore important to consider the intersection of sources that increase risk of harm and the contexts in which they may emerge in order to understand potential duties and means of responding. A person with schizophrenia is not necessarily at all times vulnerable to climate change if they are appropriately housed in

temperature controlled housing with access to medical care. Their vulnerability -and arguably societal duty to protect- changes if a person with schizophrenia does not have these resources during a heatwave, is more likely to be impacted by the effects of heat due to their medication regimen, and stops appropriate medical care as a result, with downstream impacts of relapse of mental illness and further inability to care for self, heightening risk of harm and agency to respond to stressors. This thesis therefore aims to move beyond categorizing those with mental illness as a single vulnerable group and instead explore how social factors have shaped risk from mental illness during a time of changing environment and how this may carry forward this risk.

Social Inequity and Climate Change

On a global scale, the groups expected to be most impacted by climate change have historically been least responsible and least likely to benefit from the human contributions to global warming and habitat destruction (Atwoli et al. 2021, 939). The United States and China are the biggest polluters in the world and benefit from profits of companies headquartered on their soil while using the resources and habitats of other nations, thereby elevating the risk of climate events in populations other than those profiting. This can be applied on a local scale as well. Those who are most at risk of climate change in our community are the groups who have benefitted least from the policies and systems that profit from climate and community exploitation. Groups more at-risk to climate change such as those with physical and mental illness, those who have insecure access to financial means, and those living in unsafe spaces (both the physical location of home and housing) have been disproportionately socially excluded and disadvantaged at the benefit of others. This historical disadvantage then predisposes these

populations to magnified future impediment through exacerbation of pre-existing conditions and decreased capability to respond to stressors due to climate change [1].

Decreased Capability and Mental Health in Urban Communities

Social determinants of mental health and climate change overlap greatly and become a multiplicative process when interacting. Racist policies prevent equal housing and job security, which impact the location and safety of housing. Through these policies, even if they were in place generations ago, people may end up living in housing that lacks heat and air conditioning or contains environmental toxins such as lead. Housing may also be located in less desirable areas more likely to be impacted by natural disasters and near sources of environmental toxins and waste which increase lifetime risk of chronic conditions like cancer and asthma. Neighborhoods may be unsafe for exercise, be excluded from public transit options to access healthy food and medical resources, and contain schools tied to property taxes which lag behind higher income areas, thereby limiting early intervention on childhood chronic conditions like intellectual disability due to toxin exposure and asthma due to pollution. Chronic health conditions exacerbated by the physical environment, in conjunction with ongoing chronic stressors of racism, income inequality, and unequal educational and health supports can lead to development of depression, anxiety, and substance use disorders due to heightened stress. These conditions can be passed to future generations through genetic, epigenetic, and gene by environment interactions.

[1] Capability is used in this paper as defined in capability approach, or that what one can achieve if choosing to (capability) and what one does achieve (functionings) are limited by personal and sociopolitical means (The Capability Approach (Robeyns and Byskov, 2011,2020)

As climate events disproportionately begin to impact those in inadequate housing and divested neighborhoods, stress increases through inconsistent and more difficult access to basic needs, and repeated evacuations can interrupt learning, social support structures, health visits, job security, and sense of safety. Chronic health conditions worsen due increased stress, social capital by way of resources gets reduced, and the cycle widens the gap between those who have capability to rebound from climate stressors and those whose capability is reduced each time. In fact, it has been demonstrated in the literature that as local environmental hazard events increase, so does wealth inequality. This is continued through Federal Aid being disproportionately granted to the wealthy and protections for low income workers being more quickly dispatched with in order to "get the economy going again" at the expense of their own recovery (Howell and Elliott 2019, 451-2). This is just one case of how social and political factors of law, policy, racism, classism, and access to resources are deeply enmeshed with personal and community health and wellness.

Indigenous persons have noted for decades the damage that racist, inequitable environmental policy has on their communities. While these policies have been uniquely harmful and at times specifically targeted to indigenous communities, they shed light on potential broader implications of inequity in environmental policy throughout the United States. Racist attempts at erasure of indigenous culture through lack of Federal recognition, forced assimilation, incarceration, family separation, and seizure of land have limited community cohesion and cultural identity. Climate change has added increased stress on the health and identity of indigenous persons through continued destruction of resources essential for livelihood and identity (Liddell, McKinley, and

Lilly 2021, 2,4). Psychologically, loss-especially when chronic and tied to loss of place or cultural identity- can manifest in grief, confusion, and trauma.

Similar themes of loss and fear of unpredictability with climate change and environmental policy are present in urban populations despite different historical and cultural ties to land than indigenous or rural communities. For example, one study looking at understanding of climate change in a low income community on the East Coast found themes of powerlessness and concern for the future coupled with a desire to be more included in community policy decisions and education (Singer, Hasemann, and Raynor 2016, 457-460). Climate change has the potential to impact community social cohesion through forced migration via destruction of place or livelihood and disruption of community infrastructure and routine. In groups historically less able to access government or healthcare services, this loss of social and community support may be particularly damaging.

Impact of Agency Within Reduced Capability

The mental health impacts of climate change interaction with historical inequity can be seen in the Philadelphia area as well. The following few cases highlight that within communities with reduced capability due to sociopolitical factors, personal and community ability to negotiate and make choices can have significant impact in future capability. Eastwick is a low-lying area with homes built on silt of wetlands following displacement for urban development in the 1950's. A predominantly Black neighborhood to this day, residents have begun to see repeated climate consequences of being relocated to at-risk housing in the past for the sake of improved infrastructure for other parts of the city. The area has undergone repeated flooding with hurricanes and is

home to an EPA Superfund site, Clearview Landfill. Current residents continue to disproportionately pay a price for development that primarily benefits those outside of their community.

While the federal government has been involved with proposed interventions, new city plans are attempting to take into account results of a survey showing Eastwick residents' desire to stay in their town and community (Phillips 2021). The new plan would involve a land swap within Eastwick, where residents would transfer their current land rights to the city in exchange for homes built on city land at higher elevation. Land in wetlands would go to the John Heinz Conservation area which is already an established source of nature in the community. A member of the community working on the development project, Carolyn Moseley, spoke to the sense of loss felt in a community during climate migration and the power of agency in the process, "'Relocation does not make you whole,' she said. 'It gets you out, but where are you going to go?'…'[With this plan] we can dictate our own terms, because now the land is owned by the community'" (Phillips 2021). Mental health is bolstered by resilience, or the positive belief in one's own ability to overcome sources of stress (Clayton et al. 2017, 40). Allowing for agency in communities experiencing threats of climate mitigation through both emphasizing community member's voices throughout the process and providing financial and other resources bolsters resilience through hope and self-efficacy. This also reduces the potential for harm (both purposeful or unintended) that may come from following traditional, top-down community planning.

Alternatively, the success of programs to mitigate climate change is limited if not centered on community agency. Another significant climate threat is heat. Tree cover is

known to significantly impact ground temperature especially in cities where heat gets trapped by pavement and buildings. Philadelphia has the lowest rate of urban tree cover of any Northeastern city and there are significant discrepancies in tree cover based on income- only 1/3rd of trees in the city are in areas with the poorest half of residents. Philadelphia has had a program to plant free street trees since 2012, however it has notably been utilized more in higher income areas. The current rate of tree planting will not make up for gaps in the lowest income areas. For example, Hunting Park currently has 3% tree cover and the program aims to get to 30% city-wide by 2025 (Briggs and Jarmillo 2019). The program is free and open to any resident, however it requires property owner permission. Some concern has been raised that property owners lack education on the program or benefits of the trees, however community leaders in low income areas advocating for tree usage find this explanation lacking, " 'We do the education, we do the outreach,' Ortiz said. '[But] there's not a whole lot of folks who actually go through the entire process or may even apply [to get a tree planted]' " (Briggs and Jarmillo 2019).

Blaming resident lack of education shifts responsibility to individuals in a community without seeking the underlying cause. The TreePhilly application is online, in English, and requires multiple clicks and choices to apply for a tree. Alongside the free tree option, there are other listed possibilities like hiring your own arborist (Philadelphia Parks and Rec 2021). This, combined with lower rates of owner inhabited properties in poorer neighborhoods (again, due to systemic inequity) and owner responsibility of property and tree maintenance, it is no wonder that the TreePhilly program is not meeting its intended aim. Making a program that puts the onus of education, time, and navigation

of policy on a group that has already been asked to do so in multiple other facets of life in order to receive services (education, healthcare, housing, etc) limits a group's agency to improve their environment.

The impact of reduced agency in the face of climate change has been seen in other ways in Philadelphia as well. In an article about recent Philadelphia flooding from Tropical Storm Isaias, the author states, "In the midst of multiple intersecting crises of a global pandemic, economic recession, structural racial inequality, and gun violence, Philadelphia is faced with another crisis: climate change" (Richardson and Smith 2021). This thesis would argue that climate change is not another crisis alone, but a stressor highlighting the already pre-existing economic, racial, and structural crises set up by generations of inequity that have led to health catastrophes such as pandemic deaths in marginalized communities and escalating violence in the city. Philadelphia has been experiencing higher rates of violent crime over the past year as the pandemic has continued (Macgillis, 2021). While the reasons behind this cannot be clearly distilled, it has become clear that a combination of social and economic stress and fear from the ongoing pandemic along with coinciding reduction of available social services, community supports, and healthcare services have increased tensions and violence in communities already with reduced capability to respond to stressors. Certain communities such as those in North and West Philadelphia did not have the options more historically advantaged populations did during the pandemic- money and savings, flexible work schedules, technology, access to multiple housing and transportation options to flee to safety, and various healthcare options.

Violence can be seen as a result of added environmental stress interacting with interpersonal stress in areas already with reduced capability for self-efficacy through years of inequitable social action and structural policy. Increasing violence has been correlated with heat increases, both due to the combination of stress and increased interpersonal contact when seeking cooling places in areas without infrastructure like air conditioning and shade (Cianconi, Betrò, and Janiri 2020, 8-9). This can be particularly pronounced in urban areas where pavement without tree cover can create "heat islands" increasing ambient temperature; temperatures can increase up to 22 degrees more in areas of North Philadelphia compared to wealthier parts of the city (Briggs and Jarmillo 2019; Singer, Hasemann, and Raynor 2016, 453). It follows then that urban areas, already densely populated, at risk of higher experienced heat due to lack of environmental infrastructure, become at risk for violence and its mental health impacts even without added climate stressors of pandemics, droughts, or floods -disasters which have also been correlated with subsequent rises in domestic violence and interpersonal aggression (Clayton et al. 2021, 4.6 .

The above examples are just a sampling of the mental health repercussions of neighborhoods set up to be unhealthy through active racist policies and passive downstream impacts of disinvestment. There are already significant divides in Philadelphia related to poverty, health, and environment and these inequities matter in response to climate change.

CHAPTER 4: A CRITICAL REVIEW OF SELECT CLIMATE POLICY AND RESPONSE

Ongoing inequity fuels the perpetuation of disparities in society from the negative impacts of climate change, health, and mental health. In their paper on social determinants of mental health, Compton and Shim argue "The greatest population-based impact for improving mental health and reducing risk of mental illnesses and substance use disorders will be achieved by optimizing public policies to make them more health promoting, and by altering social norms so that the health of all members of society is a priority" (Compton and Shim 2015, 419). The environmental justice movement was similarly developed by indigenous communities calling for equity in development, implementation, and enforcement of policy related to land and environment (Liddell, McKinley, and Lilly 2021, 2). Taken together, it can be said that the impacts of historical inequity on mental illness and susceptibility to climate events have been well-documented, and now it is ethically imperative to move towards mitigating these inequities as a matter of public health and social justice. However, despite overwhelming evidence to this effect, many local, state, and federal institutions emphasize individual responsibility in policies and education circulated to the public.

Philadelphia exhibits drastic disparities in health (life expectancies differing up to 20 years in adjacent neighborhoods), racial segregation (one race or ethnic group representing the majority in 84 percent of the city's 381 census tracts), and poverty (the second highest rate of U.S. cities with rates in non-whites significantly higher), all of which are considered social determinants of mental health(Philadelphia Office of

Sustainability 2021, 5-6). In his opening statement in the Philadelphia Climate Action Playbook, Mayor Kenney acknowledges the interplay between inequity and climate change "If left unaddressed, the hotter and wetter climate will multiply existing risks like poverty, poor health, and economic inequity" (Philadelphia Office of Sustainability 2021, 3). A positive step to address this in Philadelphia's climate response is the establishment of a Philadelphia Environmental Justice Advisory Commission which is currently accepting applications. Notably, the advisory commission does invite residents or workers specifically in areas highly vulnerable to climate change, though the monthly requirement of 10-15 hours at a reimbursement rate of $1-2 per hour all but excludes those who are caregivers or have to work significant hours to support themselves and seems a negligible amount of compensation (Rudoff, 2021). The acknowledgement of inequity is a vital first step towards action, but as social determinant research in mental health demonstrates, further action must be taken to make meaningful impact in populations.

The updated Action Plan released in January 2021 was reviewed by the Office of Sustainability and assessed along 4 categories- health, equity, environment, and economy and a readable chart is included to visually depict each action point's impact on these categories. This is an important step in focusing limited resources in the most equitable and impactful way, and if used, could be a guidepost for repeated re-centering of goals of equitable health of certain populations and environments. However, it is unclear how many if any of these policies were developed with community input or any sort of ongoing community partnership with actual ability for decision over plans and implementation. For example, much of the public transit category highlights increasing

bike share programs and reducing the high rate of motor vehicle and bike accidents. Though positive, it seems a less equitable focus for public transit as it is exclusionary to those who are not able physically to bike or walk, does not allow for helmets, and requires payment each time a bike is used. The city has also been criticized for repeated lack of protected, safe bike lanes and road infrastructure is noticeably worse in low income areas, potentially increasing health risks most for those who already live areas devalued historically by policy.

Other individual proposals such as expansion of recycling programs and the establishment of composting could be incredibly important in downstream impact, but will require large shifts in current social norms in the city in addition to current policy in order to be successful. Currently, composting is only available through paid subscription services. These programs could benefit greatly as well from community input on feasibility and usefulness prior to initiation so that, when available, residents are able to use and benefit from them directly without additional perceived onus like the TreePhilly program discussed previously. Additionally, though the recycle-compost plan does include business and industrial waste, large institutions should be held to earlier, higher standards to establish and support waste reduction as they inherently use more resources and benefit more from those resources than individual citizens, particularly those in historically disadvantaged areas. Using proposed global policy as a template, those historically benefitting now should have the greatest duty (enforced through policy) to combat the problem.

A positive example of a city program to aid in climate resiliency with a focus on equity is the Beat the Heat program piloted in Hunting Park. Started in 2018, the project

was borne out of earlier city-wide resident feedback about lack of equity related to climate resources being enacted. The Office of Sustainability focused on inclusivity when planning for the initiative and relied on community stakeholder involvement from planning to implementation. In the public report published online as an example to other cities, they acknowledge that racist policies in the past have led to higher concentration of industrial sites and lack of designed green spaces in neighborhoods like Hunting Park with more people of color(Philadelphia City Government 2019, 1). By starting with an acknowledgment of past inequity then focusing plans from conception on community-driven needs, the power of the process is moved back to the community. Given the extensive research on the effect of heat on mental health and what is known about the impacts of past injustices on mental health, it is imperative that more climate resiliency programs are approached in this way as a form of improved, lasting public health versus simply increasing capacity at hospitals or provider numbers. What is important in this plan, and will be important with continued equitable climate plans, is the responsibility of funding and manpower to implement changes lies with the city and profiting organizations. In the Beat the Heat plan, they list the city responsibility of identifying funding and implementing greening of spaces through public works. Community stakeholders should be involved at every point of the process, but too often that means asking them to secure grants, volunteer time, and navigate implementation -disguising shifted responsibility as community-focused work. The bottom line in any just policy or program focused on climate action is that resources be not *equally* distributed by need or loss, but that they be *equitably* provided in context of past injustices and disadvantages accumulated as a result. This program is a good example of identifying communities at

risk specifically because of past actions of the government and using government resources for improvement based on community priorities.

There is not yet integration between the city of Philadelphia and major mental health organizations in the city regarding climate change action. It is likely that as climate change continues to highlight risk factors for decreased physical and mental health in the community this will have to change. Philadelphia in particular has close ties between mental health and public resources with Community Behavioral Health (CBH), a managed care organization launched by the city for behavioral health needs of all Medicaid recipients in the county. The unique ties between healthcare for its poorest residents and the city incentivizes the city to examine ways to improve policy to improve health. This has already begun to happen with substance use and housing and has become a renewed effort during the pandemic. Though arguably approaches to substance use by the city have not been equitable or just in many ways, which is beyond the scope of this discussion, the interdependent nature of health and social justice are becoming undeniable in places like Philadelphia. Health organizations, including mental health providers, will have increasing roles in the discussion of policy, resource distribution, and patient care as climate change continues to exacerbate mental illness.

Mental Health Organization Responses

The American Psychiatric Association, the largest professional association in the U.S. for psychiatrists, published a position statement and 4 page resource document in 2017 related to mental health and climate change. The position statement is a 3 sentence acknowledgement that climate change poses a risk to mental health and a general pledge of support in collaboration with healthcare groups and patients to mitigate its effects

(Morganstein, 2019). While they do acknowledge generally how at-risk groups are more likely to experience amplified response to climate change, there is woefully little guidance beyond a page titled "Resilience and Individual Actions Before and After a Disaster" which focuses primarily on individual's role in responding to climate anxiety through action. Individual resilience should not be discounted, but as argued before, is limited by more than an individual's desire to act. Some of the listed interventions like buying a backup generator, having an emergency kit, replacing old appliances, planting trees, increasing home efficiency, driving less, and increasing one's sense of social support in their community all assume a starting place of housing, transit, and financial options many the APA deems most at risk do not have (Morganstein 2019). While these are evidence based individual actions, they are the very things impacted by inequity and therefore limiting individual capability- persons with few resources may not have the luxury of storing supplies or accessing nature, and disinvested communities may have been systematically stripped of cultural resources and infrastructure for generations. Some of the best advice on the page concerns how to discuss with children the impacts of climate change, but is advice that could be applied to all ages. They recommend to talk openly about fears, focus on one's ability to respond to stress, and anticipate a wide range of emotions and behaviors after climate events. If the APA is to use their platform to disseminate information to individuals about mental health and climate change, more focus should be put on this anticipatory guidance as a way to bolster patient's psychological coping skills instead of linking resilience with action limited by financial capability.

Reports put forth by the American Psychological Association in 2017 and 2021 regarding mental health and climate change provide a much more comprehensive guide to how large organizations and clinicians within the mental health field can give voice to the need for action of mental health professionals beyond individual support. While they do also include resources on individual resilience and provide some similar suggestions that served as the basis of the American Psychiatric Association's recommendations, they go on to acknowledge these are not accessible for all and not an adequate response by the mental health field (Whitemore-Williams al. 2017, 31). In fact, the most recent report in 2021 is titled "Impacts, Inequities, Responses" and specifically seeks to highlight sources of climate stress in communities (Clayton et al., 2021, 49-62). The reports emphasize the importance of investing in community resilience and encourage mental health professionals to be vocal leaders within the communities they live and work in. Social inequities are acknowledged in the guidelines for mental health professionals, stating, "A community with large resource disparities is not resilient. To broaden resilience community-wide, Baussan and Kelly (2016) suggested that communities do what they can to reduce disparity by investing in affordable housing, expanding employment opportunities, and improving public transportation." Later points also highlight the importance of community engagement at all stages in climate and disaster planning in order for it to be successful. It is promising to see a large mental health organization in the United States begin to highlight the need to correct past injustices as a part of mental wellness in communities with actionable guidelines centered on the populations in question.

Large healthcare professional organizations can play a critical role in research and policy efforts through collective calls for action on climate change as a matter of public health. Knowing the health implications of climate change, healthcare institutions have a duty to do less harm to the patients they serve by reducing emissions (the healthcare industry is responsible for an outsized percentage of emissions) and divesting in non-sustainable sources of goods (Eckelman et al. 2020, 2071). The healthcare industry is undeniably a massive sector of the economy in this country and though it ostensibly follows similar ethics as healthcare professionals, in reality motivations of profits influence policy. Even so, climate change already costs up to $820 *billion* a year in healthcare spending(Thompson and Heyd, 2021). Healthcare institutions often benefit greatly from the communities around them through their populations and land and in return should do more than pollute the surrounding area to profit off of non-sustainable investments. Healthcare institutions, insurance companies, and professional organizations of clinicians all have massive power through politics and financial position. If profits continue to be prioritized over equitable use of resources and power is not used to promote health through climate action, the healthcare system is again showing it is not operating from a place of beneficence or non-maleficence.

CHAPTER 5: CONCLUSION

There is now overwhelming data showing that the Earth is warming and we see this evident through ever increasing extreme weather events such as floods, droughts, wildfires, and destroyed landscapes. Extreme climate events have been shown to exacerbate pre-existing physical and mental health disparities, worsen income inequality, and trigger grief and trauma responses. It is likely that the mental health implications of climate change will continue to become more evident as climate events become more severe and frequent as the result of accelerated global warming. These traumatic events and experiences have the potential to impact generations beyond those who experienced them. Intergenerational trauma transmission is thought to occur due to parental behavior and mood symptoms impacting family dynamics and epigenetic (changes in expression of genes) effects on progeny living with caregivers who experienced trauma. It is likely that it is a combination of these factors that result in a parent-to-offspring trauma response and perpetuate parental stress to future generations. Groundbreaking studies in Holocaust survivors found trauma experienced by the survivors prior to conception of their children was associated with changes in DNA response in both the survivors and their offspring, and their offspring were more likely to have biologic stress responses like PTSD even in the absence of their own trauma (Yehuda and Lehrner 2018, 243-252; Howie, Rijal, and Ressler 2019, 418,421). While there is still much to be known about the complex relationship of trauma to intergenerational susceptibility to stress, this research should be considered in a discussion of how extreme weather events resulting in famine and displacement have the potential to have lasting mental health consequences in

generations beyond those directly impacted. Taken together with the already known outsized effect of climate change on populations with reduced capability to respond to stress, it can be seen how one generational event could amplify mental and physical health disparities in generations to come, widening the gap in equity within communities over time.

Mental health literature regarding climate change has been at the forefront of noting the relationship of climate change to pre-existing health disparities in community and individual health. Mental health clinicians are at a unique advantage to advocate for climate action in their institutions and communities due to their understanding of the complex interactions of socio-economic factors on health and can expand on programs and policies that work in their communities combating social inequity in mental health to include climate action. Given the growing body of literature warning clinicians of the health repercussions of climate change, there is an ethical imperative as a clinician to reduce pain and suffering (non-maleficence) by acting in a manner within ones patient relationships, institution, and community that acknowledges the impact of climate change through support of socially just, equitable approaches to climate change that enhance capability.

Traditional approaches to medical non-maleficence are paternalistic in nature and focus on how to protect a patient from a harm. It has been seen that paternalistic approaches to protection often do not work when discussing such a complex threat of climate change, as they lack a fundamental consideration of what is needed in a community and reduce a person or community's capability to protect themselves from future threats on an ongoing basis. Rather than consider how the mental health field can

protect patients from climate change, the work should be focused on how to increase capability in populations to protect themselves from climate-health impacts. This requires action beyond the individual physician-patient relationship and can only be achieved through work to repair damage from past injustices and prevent widening of disparities in society. As has been discussed in this paper, an individual's health is not the result of only individual action. Equity in response to climate change will be crucial at all levels of society to make meaningful impacts on overall health of our population, particularly those in communities like North Philadelphia living with the manifestations of systemic disadvantage.

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