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Climate change and COVID-19: Assessing the vulnerability and resilience of U.S. Indigenous communities to syndemic crises

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1. Introduction

The COVID-19 pandemic highlights the scale and urgency of climate change, the greatest public health crisis of our generation [1]. Climate-related impacts are felt disproportionately among vulnerable populations including Indigenous Peoples in the United States (US). However, Indigenous Peoples have simultaneously been on the forefront of the most innovative and sustainable public health solutions [2]. The scale and reach of the pandemic—caused by COVID-19’s virulence, high rate of transmission and the resultant stress on social systems—threw into sharp relief the health disparities and unique climate-related challenges that already exist for US Indigenous Peoples [3]. Threatened water resources, aging and poorly-maintained infrastructure, degraded land resources, threatened Indigenous food systems, and forced displacement, fundamentally caused by ongoing colonization, racism, and structural and non-structural discrimination, represent public health crises facing Indigenous communities in the US, that preceded the pandemic and have exacerbated the impact of COVID-19 [4−7]. In the face of the COVID-19 pandemic, which has multiplied climate-driven health disparities, Indigenous-led sustainable and enduring strategies have emerged, which address not only climate and health impacts, but multifaceted emerging public health threats.

We examine the ways in which climate change and COVID-19 have had the potential to amplify health disparities among Indigenous Peoples in the US and how effective public health strategies, developed by US Indigenous Peoples, instead increased resilience to current and future compounding public health crises. Specifically, we present case examples of how US Indigenous Peoples have responded to address the root causes of climate-related health impacts in their communities during the pandemic. These case studies serve as strategic examples of how all communities can improve resilience in the face of a changing climate.

1.1. COVID-19 and Indigenous peoples

COVID-19 has challenged communities and health systems universally, and lead to high rates of morbidity and mortality, including among Indigenous Peoples. However, Indigenous knowledge systems that promote contextual, community-based, and collective health determinist framing prompted a response to the pandemic that resulted in these communities having the highest first-dose and full vaccination rates of any racial or ethnic group in the US [8,9]. Still, COVID-19 case incidence among US Indigenous Peoples rose to
3.5 times that among White persons and Indigenous Peoples were nearly twice as likely to die from COVID-19 compared to non-Hispanic Whites [10].

The reasons that Indigenous populations are at especially high risk from COVID-19 are fundamentally due to ongoing colonization, racism and structural discrimination at all levels, which are magnified in the face of climate-related exposures. Displacement, forced labor, removal of children, relocation, ecological destruction, massacres, genocide, slavery, (un)intentional spread of deadly diseases, banning of Indigenous languages, regulation of marriage, assimilation and eradication of social, cultural and spiritual practices have resulted in reverberating mental and physical challenges[11]. As a result, Indigenous Peoples in the U.S. currently have the lowest life expectancy of any US ethnic group, and suffer higher rates of numerous modern diseases [12]. For example, American Indigenous Peoples have a disproportionately higher prevalence of obesity, diabetes mellitus, and cardiovascular disease than the general US population, known risk factors for higher COVID-19-related morbidity and mortality [https://www.zotero.org/google-docs/?uxsXxl13]. This can be traced to forced relocation from homelands to reservations (food deserts) which severely restrict access to traditional foods and create reliance on federal food programs and processed, highly-refined foods [14]. Furthermore, long-standing inequities in public health funding, infrastructure, and access to health care, education, stable housing, healthy foods, and insurance coverage continue to create challenges in addressing chronic disease burdens [14].

1.2. Climate change a risk-multiplier for COVID-19 affected US Indigenous communities

In this section we will evaluate the adverse interplay of climate change and COVID-19 on systems critical to the health of Indigenous Peoples, and how these systemic health threats exacerbate the existing disparities in water resources, food systems, housing, mental and spiritual health, resulting from historic and ongoing colonialism and systemic racism [15–18] Fig. 1.

1.2.1. Water resources

The existing disparity in the availability of safe water sources for Indigenous Peoples is growing more severe due to climate change and may adversely impact COVID-19 outcomes, especially on tribal lands. Access to clean water is critical for the health and wellbeing of all communities [19]. However, early colonial practices excluded Indigenous Peoples from making claims to surface water and ongoing modern colonialist and racist practices persist when it comes to meaningful Indigenous water sovereignty [20,21].

Climate-driven drought, heavy rainfalls and resultant water contamination further exacerbates the effect of pre-existing water insecurity on tribal lands [22]. Over the past 200 years, a significant number of Indigenous Peoples have been forced to relocate to remote reservations which lack indoor plumbing and rely on unregulated water supplies that are vulnerable to aforementioned climatic factors [23]. For Indigenous Peoples, water insecurity manifests as diminished access for agricultural pursuits and lack of access to safe water for drinking and hygiene. Climate change exacerbates both of these existing challenges by increasing environmental pollutants and contributing to ecosystem and waterway deterioration [5].

Lack of access to safe water contributes to the disproportionate burden of COVID-19 among Indigenous Peoples [24]. When indoor plumbing and running water are lacking, communities are unable to maintain recommended hygienic standards [23]. Research has suggested that a lack of indoor plumbing, a problem that American Indian households face at a rate 3.7 times the national average, is strongly correlated with COVID-19 cases [25]. In the absence of clean water infrastructure, compliance with transmission mitigation efforts, like hand-washing, are compromised [26]. Therefore, in Indigenous communities where fundamental human rights like access to clean and sanitary water are strained by underlying structural racism and colonization and climate-related impacts on water systems, COVID-19 deepens the health disparities between Indigenous Peoples and the broader population.

1.2.2. Food systems

The effects of climate change and COVID-19 also undermine already tenuous Indigenous food systems. There is a long history of Indigenous agricultural systems being intentionally disrupted through forced relocation and restriction of land rights. These factors are further eroded by the effects of climate change. Indeed, “Indigenous agriculture is already being adversely affected by changing patterns of flooding, drought, dust storms, and rising temperatures, with
future projections varying by region, but indicating increased soil erosion and irrigation water demand, and decreased crop quality and animal herd sizes” [27].

Climate change is known to disrupt traditional Indigenous food systems insofar as many Indigenous communities rely on natural ecosystems for nutrition. This is particularly appreciable among Alaska Native populations where access to grocery stores is limited and many Indigenous communities depend on wild sources for food security [28]. For the Confederated Tribes of the Umatilla Reservation in Oregon, salmon, elk, deer, roots, and huckleberry habitat have all been identified as threatened by the effects of climate change [29].

Efforts to curtail the transmission of COVID-19, including lockdown measures, have exacerbated the disruption in Indigenous food systems in places like the American Southwest and elsewhere in the US where many Indigenous lands are classified as food deserts [30]. The combination of infection control restrictions impacting modern food supply chains, together with climate induced drought and flooding impacting traditional Indigenous subsistence agriculture, leads to greatly magnified food insecurity. For many Indigenous Peoples, fractured food supply networks contribute to undernutrition in populations where food systems have already been compromised by forced relocation, lack of land rights, eradication of cultural practices and climatic extremes [31–33].

1.2.3. Housing insecurity and displacement

As with water and food, housing resources for Indigenous Peoples are also aggravated by COVID-19 and by ongoing climate effects. Many Indigenous Peoples have been forced to relocate to remote and geographically isolated regions with aging and degraded housing infrastructure which is further threatened by climate change [34]. Furthermore, climate related displacement of certain Indigenous Peoples, due to sea-level rise and extreme weather, further pushes this situation into crisis [32]. The U.S. Commission on Civil Rights has identified displacement due to the effects of climate change as a contributor to negative health outcomes for Indigenous Peoples [35]. The Alaska Native villages of Newtok, Shishmaref, and Kivalina are examples of Indigenous communities that require relocation due to rising sea levels, ultimately contributing to adverse health outcomes [36]. Such displacements predispose communities to negative health outcomes in general, and to COVID-19 in particular. Displacement from historical homelands often leads to condensed, overcrowded and multi-generational households making social distancing challenging and placing vulnerable family members at increased risk of contracting COVID-19 [37]. Thus, Indigenous Peoples already subject to insecure housing face an even more amplified burden from climate change and COVID-19.

1.2.4. Mental and spiritual health

Although traditional ways of life continue to exist among Indigenous Peoples, intentional attempts at the eradication of the spiritual, cultural, social and linguistic practices, mass repeated trauma and other atrocities continue to contribute to high rates of mental illness [38]. Climate change, through its threats to ancestral homelands, rapid and unabated ecosystem changes, and extreme weather disasters further threaten the spiritual, social and cultural health of Indigenous Peoples. The trauma of entire communities losing their homeland to sea level rise is only one example of climate impacts on Indigenous mental health. Furthermore [37], Indigenous Peoples face severely limited and disproportionate access to mental health professionals although [38,39] it is estimated that Indigenous Peoples experience psychological distress at 2.5 times the rate of the general population [40,41].

The 2016 Climate and Health Assessment identified numerous direct pathways for how climate change can lead to exacerbation of underlying psychiatric illness and development of new disorders among otherwise healthy people. For Indigenous communities, a significant driver of mental health distress is tied to the way in which mental health and spiritual health are intimately linked [32,38]. Indeed, many Indigenous communities embrace a worldview where connectedness, family bonds, and community traditions are essential protective factors when it comes to mental health [42].

Both climate change and COVID-19 threaten traditional Indigenous community structures, and such indirect pathways also play a role in how the climate and COVID-19 adversely affect mental health. When identity is closely related to place and environment and these are both threatened by climate change, the spiritual health of Indigenous Peoples suffers [43]. Additionally, the public health response to COVID-19 directly exacerbates the mental health crisis in Indigenous communities. While limited information exists for Indigenous communities in the US, data from Indigenous Peoples in Canada demonstrates that COVID-19 has exacerbated the mental health crisis among Indigenous populations. In this study 60% of Indigenous Peoples reported that their mental health worsened with COVID-19 related physical distancing [44].

2. Building resilience toward compounding public health threats

US Indigenous Peoples are subject to ongoing colonization, racism and structural discrimination which compromises water and food security, energy and social infrastructure, air quality and has created wide-reaching mental health impacts. These existing impacts are further escalated by climate change and have increased vulnerability to COVID-19. Vulnerability to climate hazards represents the susceptibility of a population to the negative effects of climate change and is defined by that population’s exposure, sensitivity, and adaptive capacity. In the face of such challenges, many Indigenous Peoples have shown exemplary resilience through employing traditional knowledge and cultural practices. We discuss resilience as the ability to anticipate, prepare for, and respond to hazardous events, trends, or disturbances related to climate change.

The following case studies from the Indigenous and Indigenous-serving co-authors of this paper exemplify novel initiatives taken to adapt to and confront current challenges to Indigenous health posed by the synergetic crises of climate change and COVID-19. The excerpts represent a convenience sampling of Indigenous and Indigenous-serving contributors, who were virtually convened in 2020 due to their already published work on increasing resilience to climate change within Indigenous communities. Authors limited the sampling to three excerpts to allow for in-depth reflection. Each excerpt section concludes with a summative discussion by the author team.

2.1. Navajo Nation - Building food security through regenerative farming

Contributor: James Skeet, Member of the Navajo Nation and Founder of Spirit Farm, New Mexico.

Spirit Farm, a demonstration farm located in Vanderwagen, New Mexico, has established a novel approach to food security and climate change dubbed “Indigenous Regenerative Intelligence” [45]. In an interview with James Skeet in March, 2021 at Spirit Farm, traditional Navajo farming and spiritual practices are utilized to, according to James Skeet, “heal the high desert southwestern soil” and to be a living example of “how we can recover and reclaim food sovereignty and reduce dependence on the food system that is harming us.”

“The Navajo people have always been close to the earth and closely attuned to listen and hear nature’s patterns. Their survival depended on the connection they had with their environment, the patterns of Mother Nature, and the honoring of all things as sacred,” says Mr. Skeet. “There is an inextricable link between the impacts of food colonization across the Navajo Nation and poor (physical, mental and spiritual) health outcomes,” says Mr. Skeet. Better nutrition can also reduce the risk of poor outcomes from pandemics such as
COVID-19. Finally, Mr. Skeet reflects that “COVID-19 has exposed inequities in our world and has prematurely ended many Indigenous Peoples’ lives. A lack of healthy food in these communities makes it difficult for our bodies to fight the virus.”

The philosophy of Spirit Farm is simple: heal the land and soil to heal the people. To achieve this, the farm utilizes regenerative agriculture whereby natural nutrient cycling is restored and the soil is brought back to life by encouraging microbial populations to multiply and flourish, exactly the kind of agricultural practice by which the soil can sequester large amounts of carbon. This practice leaves the soil in much better condition and protects against climate-induced soil compaction and erosion, the common effects of modern agriculture, practices which also make farming a source of net greenhouse gas emissions.

According to Mr. Skeet, “Engaging people in the production of their own food supply and connecting it to their cultural traditions and Mother Earth elevates farming to a spiritual/cultural practice.” This form of spiritual and traditional practice has the added benefit of ameliorating the stress associated with the necessary measures to prevent the spread of Covid-19, according to Mr. Skeet.

The primary expected outcome at Spirit Farms is to have Native families begin growing their own food again. By doing so Spirit Farms is demonstrating the kind of agricultural practice which could be one of the most cost effective forms of carbon sequestration, while helping to prevent soil erosion, improving the nutritional value of the food grown and spiritual resilience to climate change and Covid-19.”

Spirit Farm draws from Indigenous knowledge systems to inform the Navajo approach to food security and the healing of the land. This knowledge intimately links the health of Navajo people with the health of the soil they farm and the food that is produced and consumed. The combined effects of climate change and soil degradation are expected to adversely impact the four pillars of food security (availability, access, utilization, and stability), contributing to the threat of food insecurity [46]. Modern industrial agriculture practices cause soil erosion, carbon and nutrient loss from the soil and can lead over time to crop failure [47]. However, Indigenous knowledge that prioritizes regenerative soil practices may serve as a protection against the further land and soil degradation and resulting food insecurity, thereby serving to bolster local resilience to climate change [48].

2.2. Pala Tribe - a framework for mental health resilience

Contributor: Shasta Gaughen, Tribal Historic Preservation Officer, Pala Band of Mission Indians, California.

The spiritual healing from connecting to Mother Earth at Spirit Farms is mirrored by the Pala Band of Mission Indians, which includes people of Kuupangawichum (Cupeño) and Payómkawichum (Luiseño) descent. With the arrival of Spanish missionaries in 1769 in what is now called San Diego, life for many of California’s Indigenous Peoples changed forever. Over 250 years later, the trauma of colonialism, federal extermination and assimilation policies, and loss of cultural heritage has been layered with a new threat: that of climate change. For Pala, the physical effects of climate change include increased heat and drought stress, greater risk of catastrophic wildfire, and more exposure to extreme weather events.

COVID-19 has brought the existing mental health and cultural impacts of climate change into sharper relief. The effects of climate change already cause stress and anxiety; coupling that with mandatory quarantines, an inability to gather for cultural events, and physical distancing requirements makes those stressors worse. Climate change laid the groundwork for psychosocial stress; COVID-19 added insult to injury.

“Chemshuion Pe’ícháachuqeli (When our Hearts are Happy): A Tribal Psychosocial Climate Resilience Framework” is a guide for Indigenous Peoples for developing their own strategies for managing the mental and emotional effects of climate change [49]. This framework provides a model that can be adapted to a variety of specific cultures and communities. It begins with a broad base of self- and community care that offers support and resilience to mitigate the impact of mental health issues. Because COVID-19 has created similar mental health stresses as those caused by climate change, the general tools in the framework can also be applied to the psychosocial effects of the pandemic.

The Pala Tribal Psychosocial Climate Resilience Framework illustrates how the tools developed by Indigenous Peoples to address these stressors brought about by one crisis can be applied to new insults. COVID-19 has created novel psychosocial stress on Indigenous Peoples but the framework for resilience built by Pala’s Tribal Climate Health Project to address climate change serves as a buffer to adverse mental health outcomes from COVID-19 as well. Moreover, the Tribal Psychosocial Climate Resilience Framework can be adapted to serve a wide range of communities and the unique challenges they face as a result of climate change and compounding public health crises.

2.3. Swinomish - first foods and Indigenous health indicators

Contributor: Larry Campbell (wanaseah) and Jamie Donatuto, Community Environmental Health Program, Swinomish Indian Tribal Community, Washington State.

The Swinomish are fishing, hunting, and gathering people. Harvesting, preparing, and using Swinomish foods and medicines are integral to the sociocultural community fabric. Akin to many other Indigenous communities, the Swinomish characterize a healthy community by referencing countless generations of knowledge and practices developed via connections to the lands and waters. “Health” is shaped by the many interrelated relationships among humans, non-human beings, and nature.

First Foods, also referred to as traditional foods (or “our foods” by Indigenous Peoples), comprise regionally specific foods, medicines, and technologies that Indigenous Peoples have relied on since time immemorial. The impacts of climate change “place pressure” on First Foods systems by limiting both access to the land and the availability of the First Foods. Every Indigenous community across the U.S. feels the impacts of climate change on their regionally specific First Foods.

First foods are central to the Swinomish cultural resilience to climate change and Covid-19, and measurement of such resilience is facilitated by a Centers for Disease Control framework called BRACE, but modified by incorporating Indigenous concepts of health. I-BRACE represents an “indigenized” adaptation of the CDC’s Building Resilience Against Climate Effects (BRACE) framework [2]. I-BRACE also enhances the framework’s applicability and attention to equity by incorporating a model of Indigenous values-based data collection, analysis, and decision making. For the Swinomish, health values are embodied in the Indigenous Health Indicators, which are not represented in conventional public health assessments. These indicators are community connection, natural resources security, cultural use and practices, education (the Swinomish teachings), self-determination, and resilience. The Swinomish Indigenous Health Indicators identify natural resource security, exemplified by First Foods, as a principle health value, thus acting to discount the false dichotomy between human and environmental health. Adaptive strategies built from an understanding of the integral connections between humans, other living relatives, the environment, and the spiritual realms increases resilience in the face of climate change as well as other impacts such as COVID-19.

The Swinomish Indigenous Health Indicators highlighted in the I-BRACE framework includes the measurement tools needed to evaluate potential public health interventions in a culturally relevant context. Climate change will exacerbate food insecurity for vulnerable populations, and eventually for larger swaths of the population [46].
Both climate change and COVID-19 point to the critical intersection of human and environmental health, and it will be beneficial to have culturally relevant measurement tools such as the Swinomish version of I-BRACE to guide the implementation of public health measures.

3. Discussion

3.1. Towards a sustainable recovery

For US Indigenous Peoples where access to clean water, healthy food and safe housing are strained by ongoing structural racism and ecosystem deterioration, COVID-19 has intensified health threats. The federally-based responses to climate change and the COVID-19 pandemic have been insufficient, and have resulted in profound impacts on Indigenous Peoples. In the face of these multifaceted crises, Indigenous solutions have emerged which sustainably and effectively manage these crises while simultaneously address root causes. These solutions, which support long-term community resilience and work to restore sustainable health and livelihood practices, serve as a model for public health efforts throughout the US.

Indigenous perspectives are increasingly being recognized as critical to the response to climate change and are gradually being incorporated into established policy objectives set out by the Paris Agreement and the Intergovernmental Panel on Climate Change. Analysis of specific examples of adaptation interventions offered by Indigenous Peoples reveal that Indigenous-specific approaches not only address acute threats to health, but simultaneously can improve environmental health and natural resources while improving long-term mental and physical health [50–52]. Such perspectives illustrate how Indigenous Peoples are both experiencing the effects of climate change and COVID-19 disproportionately, but also how they are responding to these existential stressors in highly adaptive ways which go beyond addressing acute health threats. Far from passively experiencing the adverse health effects of climate change and COVID-19, Indigenous Peoples are paving the way for unique strategies to address syndemic threats [50].

The lessons gleaned from the excerpts provided by Indigenous scholars, knowledge-holders, and tribal-serving professionals support the call for the epistemological-pluralism (an approach that “recognizes that, in any given research context, there may be several valuable ways of knowing, and that accommodating this plurality can lead to more successful integrated study”) [9,53]. The examples from the Pala, Navajo, and Swinomish Peoples demonstrate that Indigenous knowledge and ways of knowing offer important lessons rooted in a close relationship and interconnectedness with the land. Further, these context-specific examples of Indigenous knowledge applied to public health threats in the form of COVID-19 and climate change point to a need for an assets-based approach that aims to mobilize and harness the skills, resources, and talents of individuals and communities [54].

4. Conclusions

US Indigenous Peoples’ health is disproportionately affected by the climate crisis and compounded by public health emergencies such as the COVID-19 pandemic. Recognizing this vulnerability is essential in order to deliver health justice. However, an appreciation of the resilience of Indigenous communities in the face of compounding health crises will be essential for the development of context-specific approaches to the challenges posed by the climate crisis. Embracing these diverse sets of knowledge and adopting an assets-framing approach to Indigenous perspectives may help to inform adaptations seeking a more sustainable future for all humanity in the face of existential threats.

Author agreement statement

We declare that this manuscript is original, has not been published before and is not currently being considered for publication elsewhere.

We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us.

We understand that the Corresponding Author is the sole contact for the Editorial process. He/she is responsible for communicating with the other authors about progress, submissions of revisions and final approval of proofs.

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The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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