**Climate and Weather-Related Mental Health Impacts: Measures and Policies for US Health Departments**

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# **Abstract**

Objective:

Develop a list of feasible metrics and policies that will help state and local health departments measure and address the mental health impacts of climate change.

Methods:

Scoping Literature review

Results:

Few existing metrics, many developed in academic/research contexts which are often resource intensive. Utility in using medical health records, to indicate mental illness as well as any acute weather-related impacts in these records. Identifying chronic or vicarious impacts is more challenging and would require more regular behavior monitoring. But there are many commonly used approaches by small health departments, capacity for data storage, and local organizations support for analysis or collection. These relationships are not uncommon with about 55% working with academic institutions. (Erwin et al., 2015)

Conclusions:

# **Introduction**

“When you’ve studied one health department you’ve studied one health department.”

Our paper aims to identify measures and policies used by health departments in the United States to assess and address the mental health impacts of climate change. We reviewed academic and gray literature to identify federal, state, and local policy interventions that if not already being implemented by health departments, would be feasible and useful to adopt. The indicators of climate-related health impacts utilized by state and local health departments are few and varied, and mostly pertain to acute severe climate events, like wildfires or hurricanes. Natural and manmade disasters have many components that impact health that researchers investigate with complex models, cross agency data, and retrospective cohort studies. The intricacy of these impacts is often beyond the capabilities of health departments to implement but these types of studies make up most of the research found in this review. This paper aims to take these more complex and resource intensive metrics and use the suggestions of these papers identified for developing effective, equitable and affordable adaptation and mitigation approaches, to synthesize measures suitable to implementation in state and local health departments across the United States.

Climate and Weather-Related Events are annually responsible for many mental health impacts through long-term chronic exposures, severe acute traumas, or even anticipatory or vicarious exposure. Public Health Professionals have many approaches to measuring and identifying the relationships between different environmental exposures and mental health disorders and symptoms. To understand how significantly and specifically an exposure will impact the mental health of a population, it can be helpful to explore risk and protective factors through a framework. For example, often use the Social-ecological model to examine the possible avenues through which these types of events can be indirect and direct causes of Mental illness. (Brofenbrenner, 1979) Particularly useful is the idea that these different systems interact with each other. For example, an environment level event such as a Hurricane can influence community level infrastructure and supports that influence personal and interpersonal issues such as substance abuse. Natural disasters and reoccurring stressors like heat or can create high risk circumstances even beyond the affect area, especially in vulnerable populations like those with low socioeconomic status or persecuted groups.

This review follows the Center for Disease Controls’ Building Resilience Against Climate Effects (BRACE) framework, which consist of 5 steps, from forecasting impacts to evaluating adaptation and mitigation plans. The steps in the framework are reliant on the collection and synthesis of health data and weather-related data. Commonly studies in the review would use Electronic Medical Records to assess the mental health impacts following a disaster like a hurricane. But these methods are limited in their sensitivity as they tend to skew towards more severe cases and miss psychosocial measures of psychological distress.

Attribution is a particularly challenging aspect of measuring the mental health impacts of climate events. Environmental data and mental health data is generally combined to develop these findings which requires levels of data analysis not typically employed by health departments especially those in climate vulnerable communities who may have been historically disadvantaged.

United States Health Departments can improve the efficacy and equity of their policy or program interventions by using the appropriate measures to capture the complex network of factors that influence mental health. This review examines research papers, systematic reviews, government papers, and policy recommendations across the United States, to identify which measures are useful for specific mental health disorders, event-specific traumas, and general population attitudes. Additionally, this paper explores how these measures are implemented to assess the mental health problem in relation to the climate and weather-related events. For simplicity, the review uses the social-ecological model to sort out which mental health measures health departments would benefit from using in specific contexts, like disaster situations, or reoccurring long-term dangerous environmental conditions.

A scoping review by Charlson et al., in 2021 examining the impact of climate change on mental health shows a large portion of qualitative studies, which may be difficult for L/SHD to analyze and This paper suggests approaches for L/SHD to utilize in data collection in disaster contexts and understanding anticipatory, or chronic exposure. These diseases are soften connected to personal experience and perspectives identifying interpersonal protective factors like social cohesion weakening the impact of extreme seasonal weather across income levels. (Mason et al., 2018) Ultimately, this review allows researchers, practitioners and organizations to identify the “Sectors and Resources of Concern” and extent to which groups are engaging in “Adaptation and Mitigation Responses.” Outlined in the conceptual model for the National Climate Indicators System.

# Methods:

This review documented **metrics and frameworks** that can be or are used by state health department to measure the climate impacts on health. The review also examined papers on **policy approaches** to addressing the impact of climate on health. Ultimately, data extracted from the review informs a general surveillance framework for US Health Departments to guide their deployment of measures to better capture climate-related mental health impacts.

## Search Terms

To gather the data for this review we conducted a systematic search through Embase, MEDLINE, Scopus, and PubMed. A list of search terms was created from **climate keywords** (I.e., heat, flood...), **health effect keywords**, and **metric and policy Terms.** The initial search yielded around 10,000 results and to ensure a focused analysis the health effect terms were adjusted to focus on cardiovascular disease, mental health, and pulmonary health problems. This review focuses on a subset of these impacts, emphasizing indicators and policies relevant to mental health impacts, but does not exclude articles that discuss comorbid conditions or health impacts more generally.

Table 1. Search Term Groups and Keywords

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## Inclusion Criteria

Using Covidence, a team conducted a consensus-based screening, including, or excluding the articles based on their publication date, type language, and relevance to the research topic. Due to the rapidly changing policy and research landscape, studies were restricted to the past five years to ensure relevance. While primarily focused on studies from the United States, some studies at the international level were included to gain insights from similar countries or conduct comparative analyses. Exploring types of publications allowed us to analyze which sectors, private, government or academic, were developing and implementing indicators and policies. Additionally, several papers, published more than five years prior to 2024, were included as they were deemed seminal works that guided the framework for developing our research questions.

Table 2. Inclusion Criteria Details



## Data Extraction

After screening we began data extraction on the remaining 250 studies. Collecting data on the study characteristics allowed us to examine, the climate hazards and mental health impacts where that were being monitored, the types of metrics being used, the level of policy interventions analyzed. we can understand what research is needed to develop more appropriate and feasible, indicators, policies, interventions and adaptation approaches, for specific disasters, conditions and local economic, cultural and political contexts.

Table 3. Data Extraction Details

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# Results:

## Overview of Studies

The 250 papers included in the review ranged from academic research, government papers to opinion pieces. The 89 research studies used a variety of data sources and data gathering approaches involving qualitative and quantitative survey data, as well as environmental surveillance gathered from temperature or precipitation monitoring systems. Except for 3 studies about air quality and 12 about heat, these studies focus on acute disaster-related mental health impacts in the short-term and long-term. Comparatively there were a total of 5 government papers or tools included in the review, 3 of which (Kenney, 2016),(USGCRP, 2016),(Hess, 2017) were part of the special snowball sample we collected focusing on seminal papers. These seminal papers provided more general guidelines for indicator development and for

The Florida Department of Health utilized a community assessment(CASPER) with on the ground interviews, resource intensive metrics, to assess prevalence, risks, and need for services. (Torres-Mendoza 2021) This approach may not work in all communities, such as rural areas or in tribal health systems which may have smaller workforces and limited resources.

Table 4. Federal and State Level Policy intervention Studies

Often studies tied these data to medical records. Particularly of interest was attention to how and when surveys were conducted as often the weather events disrupted infrastructure and had far reaching impacts, as well as long lasting effects. The mental health impacts could be missed without proper attention to the evolving social and physical contexts of communities experiencing weather-related disasters.

Mental health changes in the context of climate change are also connected to social climate changes. Indicators of climate change impacts cannot be narrowly tied to acute disaster events, but also must assess how people respond to global issues and larger cultural dynamics. Existing social forces like economics and differential-advantages can improve area’s ability to respond and change how the mental health impacts may present themselves or their prevalence. Attributing the emergence of mental health illnesses to climate change requires understanding the relationship between frequency of climate hazards and global carbon emissions and the etiology of different mental disorders. Because climate hazards also impact social infrastructure, the type of climate hazard may change the course of mental (Lecture 2, Climate change and Health, Jura Agustivista)

## Study Findings by Regionality:

**Southern (Texas, Louisiana, Mississippi, North Carolina)**

46 studies total were grouped into the Region of the Southern United States. Most of these studies focused on flooding and hurricane related exposures, though 3 investigated extreme heat and 1 study focused on extreme cold.

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**Territories (Puerto Rico)**

Table 5: Measures used to assess, mitigate, and adapt to Hurricane Impacts on Puerto Rico



Western (California, Washington, Oregon, Alaska)

Northeastern (New York), Mid-Atlantic, and Midwestern

The more regular collection of general mental health indicators and social and climate exposures will be useful to assess causality of climate change, as well as give local and state health departments better means to develop targeted and context-appropriate mental health interventions, prevention programs, and identify the systems that may prove to be vulnerable in a climate disaster such as public schools, housing access, and health care responses. This review reveals a large wealth of academic research that can be used to develop efficient and valid measures of climate associated mental health and psychosocial outcomes.

## Key Findings

Federal policy interventions and metrics are the most used in post disaster findings. the local and state health departments, very few studies mentioned explicit measures used by health departments, though a search of websites revealing only 1 state and 1 city health department to have mental health measures related to climate change. There were several useful papers providing policy recommendations and frameworks that would aid health systems in preparing for extreme weather events, managing existing inequities to improve resilience, and incorporating mitigation efforts into programing and operations. (Ebi 2021,Zavala 2024)

Several papers focused on developing new measures to better capture the broader psychosocial outcomes like in Le’s 2024 research study in California focused particularly on adolescent and others assessing climate emotions (KÄ±rÄ±mer-AydÄ±nlÄ± 2024) As well as psychosocial dynamics during disaster events like Tolupe’s 2021 study on water safety attitudes, during the 2018 camp fire. Additionally studies examined means to model the longer term impact of trauma exposures during disasters like hurricane Katrina(Lowe, 2020),(Blackburn, 2021) This contrasts with only 1 or 2 studies examining psychological exposures and conditions in communities prior to disaster exposure, or in a state of anticipatory exposure, data which is necessary if researchers and policymakers wish to be able to attribute the mental health impacts to climate change, to ultimately identify and act on these social determinants of health.

Hurricane disasters make up a significant portion of the studies, with Puerto Rico studies may reveal unique relationships between the lack of resources as a result of being a us territory. Measures specific to each disaster are important, repeated exposures, structural resilience, (Garfin, 2022) Other social and personal factors, such as racism, violence, substance abuse or commorbidities, cultural specific resilience influence outcomes and are important for health systems to engage with to prevent more harm from increasingly frequent disasters and chronic climate stressors. (Gilmore 2021),Dicket 2023,Baggerly, 2019), (Zhang, 2020)

The review also aided in identifying possible prevention and intervention programs, such as telehealth networks, mobile apps, therapies, community (Ezeonu, 2024) Balderas 2023), Gonzalez-conty,2020, Pavlacic, 2024) Some suggestions involve collaboration across health departments to share lessons from adaptation and mitigation efforts. (Fears, 2023)

A couple studies even revealed there are positive mental health outcomes amongst disaster aftermath (appel 2021), Similarly studies explored complex family dynamics and social capital,

Certain hazards are better studied and measured than others, depending on the area of the US. Hurricanes, floods, fire, air pollution, and heat made up most of the studies, with very few examining drought conditions, extreme cold, tornados, or general anthropogenic environmental degradation. While a good portion were focused on disaster response several explored longer term policy changes, and climate mitigation, (levy, 2024

Limitations

These results were limited however because our pursuit was to examine the existing measures and policies specifically related to climate and health utilized by Local and State Health departments, we were not able to examine suggestions more generally related to improving health department data collection and policy development. This review instead provides a glimpse of the limits of academic research in describing the structural landscape of united states health department operations. Improving the assessment of health departments and providing tailored recommendations, tools and resources for monitoring mental health indicators, climate hazards, would be a significant step forward building supportive networks and buffering local responses to acute and ongoing climate threats.

Additionally, climate change is a global and systemic issue, facing many areas of the world much more severely than the United States, and with some countries having more advanced green transitions, so using literature restricted to the United States geographically may not fully capture the lessons learned from countries on the frontline of climate change, and those with more progressive climate policies. However, this does mean that the suggestions we developed for state and local health departments is regionally specific, and challenges specific to the United States, such as racist housing policies, or private insurance failings in the aftermath of disasters, can be highlighted and addressed.

# References

A screenshot of a diagram

Description automatically generated

Survey methods:

A large portion of the papers conducted assessments of psychological wellbeing and tested for the presence of mental disorders through the use of interviewer-conducted and self-report surveys. Many of these were standard surveys like the PHQ-9 for monitoring depresson or the ADP for examining Anxiety symptoms, though some were more specific such as the Impact of Event Revised( IES-r) scale to assess Post Traumatic Stress Symptoms (PTSS)

* PHQ-9
  + Found that in partnership with the ADP more effective, looked at in extreme weather events
* ADP
* Life Events Checklist(LEC)
  + Assesses pre- and postdisaster exposure to Potentially Traumatic Experiences
* Disaster-Related Potential Traumatic Experiences(PTEs)
  + 8-item scale specific to disaster experiences, developed in Lowe et al., 2020
* Impact of Event Revised (IES-R)
  + “22-item scale that assesses distress related to a specific traumatic event” <https://doi.org/10.15195/v3.a9>
* K6
  + 6-item scale, focused on the past 30 days assessing feelings related to Psychological Distress
* Combination of Measures:
* -Self-report surveys
* -Hospital Records
* -Community level assessment
* -modeling

Medical Records:

Disaster Specific Considerations:

Flooding/Storms/Hurricanes

Flooding experience significant predictor of mental health status

El-Mousawi 2023- flood victims across country’s had health outcomes influenced by policy decisions of government.

Impact of adaptation and mitigation plans

Mental Health

96 of the papers examined mental health alone, 55 looked at mental health and accompanied by other conditions like pulmonary(8), cardiovascular(24), and others like physical health(13) for a total of 141 papers in total.

Of these 141 papers 33 were systematic reviews, 83 were research papers, 3 were policy recommendation articles, 4 were government papers or tools, 11 were editorial columns, and the remaining

88 of the studies we reviewed were mainly conducted in US alone.

* Event-related Impacts
  + Natural Disasters (and repeated exposures?)
  + Overlapping exposure categories with
    - Flooding/Storm(90)/Wildfires(16)/Drought
    - Trauma
    - Burnout
    - Stress
  + Heat
    - Violence
  + Air Quality
    - 36 of the papers were related
* General Impacts
  + - Attitudes and public opinion
    - Adaptive behaviors
    - Maladaptive behaviors
    - Suicide and suicidal ideation
    - Climate Anxiety

Policy interventions

52 papers in the review outlined policy interventions, with 26 focused on a combination like

- Adaptation and Mitigation

-Emergency Preparedness

Vulnerable populations

53 of the 250 papers didn’t focus on vulnerable populations, but this seems to illuminate that a majority of studies including those from more academic research.

(Are state health departments looking?)

-Children and Adolescents

-Indigenous Peoples

-Older Adults/Elderly

-Pregnant women and Infants

-Socioeconomic Status/Occupational

-What makes populations more resilient?

-Pre-existing conditions

Table with appendix, classify studies according to types, measures assessment of use to Government departments at the end. Environmental measures easier, versus health impacts,, but needed for early warning systems.

## Table of measures