

## CalBRACE Step Two: Project Disease Burden

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Based on the findings of the previous step, you can assess, estimate or quantify the additional burden of health outcomes due to the most likely climate change impacts. Reviewing existing literature addressing likely climate impacts in similar local conditions can help to select public health interventions. Below are several examples of documents that can support your work in projecting disease burden.

### CDC and Environmental Health Guidance

- [\*\*Projecting Climate-Related Disease Burden: A Guide for Health Departments\*\*](#)  
This guide presents a starting point for health departments interested in developing climate change health impact projections and lays out a general map of the process of establishing exposure-response relationships and developing scenario-based projections.
- [\*\*Projecting Climate-Related Disease Burden: A Case Study on Methods for Projecting Respiratory Health Impacts\*\*](#)  
The example in this document provides one approach to estimate the excess current and future public health burden related to respiratory hospitalizations attributable to extreme heat in summer in New York State (NYS).
- [\*\*Technical Documentation on Exposure-Response Functions for Climate-Sensitive Health Outcomes\*\*](#)  
The purpose of this report is to provide resources to public health practitioners and agencies interested in applying the BRACE framework, including (1) examples of relevant health, weather, and climate data that can be used in health-effects studies, (2) provide resources on study designs commonly used to assess the relationships between climate hazards and health effects, and (3) provide case studies for quantifying the future disease burden due to climate change.
- [\*\*Environmental Health Indicators: Climate Change\*\*](#)  
Council of State and Territorial Epidemiologists catalogues indicators to measure environmental variables that either directly or indirectly can affect human health, such as maximum and minimum temperature extremes. Other indicators can be used to project future health impacts based on changes in exposure, assuming exposure-response relationships remain constant over temporal and spatial scales.
- [\*\*Developing Climate Change Environmental Public Health Indicators: Guidance for Local Health Departments\*\*](#)

This guidance document outlines a three-tiered approach to establishing a local climate change environmental public health tracking (EPHT) program — placing emphasis on opportunities to partner with external resources at the local, state, and federal levels. It also explains how climate and health tracking programs can support LHDs' efforts to provide the 10 Essential Services of Public Health and to achieve accreditation.

## Literature for Climate Exposures:

### Heat

- [\*\*The 2006 California Heat Wave: Impacts on Hospitalizations and Emergency Department Visits\*\*](#)  
This study investigated whether any age or race/ethnicity groups experienced increased hospitalizations and emergency department (ED) visits overall or for selected illnesses during the 2006 California heat wave.
- [\*\*Future heat vulnerability in California Part I: Projecting future weather types and heat events\*\*](#)  
Changes in oppressive weather days and consecutive-day events are projected for future years by a synoptic climatological method.
- [\*\*Future heat vulnerability in California Part II: Projecting future heat related mortality\*\*](#)  
To assess impacts, future heat-related mortality estimates are derived for nine metropolitan areas in the state for the remainder of the century. Heat-related mortality is first assessed by initially determining historical weather-type mortality relationships for each metropolitan area.
- [\*\*Vulnerability to Heat-related Mortality\*\*](#)  
This paper aims to provide a systematic assessment of the epidemiologic evidence regarding vulnerability to heat-related mortality.
- [\*\*Mortality risk attributable to high and low ambient temperature: a multi-country observational study\*\*](#)  
This paper aims to quantify the total mortality burden attributable to non-optimum ambient temperature, and the relative contributions from heat and cold and from moderate and extreme temperatures.
- [\*\*Projecting Future Heat-Related Mortality under Climate Change Scenarios: A Systematic Review\*\*](#)  
Systematic review of research and methods for projecting future heat related mortality under climate change scenario
- [\*\*Diabetes incidence and glucose intolerance prevalence increase with higher outdoor temperature\*\*](#)

Rising global temperatures might contribute to the current worldwide diabetes epidemic, as higher ambient temperature can negatively impact glucose metabolism via a reduction in brown adipose tissue activity. Therefore, we examined the association between outdoor temperature and diabetes incidence in the USA as well as the prevalence of glucose intolerance worldwide.

- [Variability in Temperature-Related Mortality Projections under Climate Change](#) (Method)  
Assesses the variability of temperature projections and dependent future mortality distributions, using a large panel of temperature simulations based on different climate models and emission scenarios.

## Air Pollution

- [Climate Change, Tropospheric Ozone and Particulate Matter, and Health Impacts](#)  
Reviews how climate change could affect future concentrations of tropospheric ozone and particulate matter (PM), and what changing concentrations could mean for population health.
- [Estimation of future PM2.5- and ozone-related mortality over the continental United States in a changing climate](#)  
This paper evaluates the PM2.5- and ozone-related mortality at present (2000s) and in the future (2050s) over the continental United States by using the Environmental Benefits Mapping and Analysis Program (BenMAP-CE).

## Wildfire and Wildfire Smoke

- [Differential respiratory health effects from the 2008 northern California wildfires: A spatiotemporal approach](#)  
Health effects associated with fine particulate matter during a long-lived, large wildfire complex in northern California in the summer of 2008.
- [Critical Review of Health Impacts of Wildfire Smoke Exposure](#)  
This study assesses the evidence of health effects from exposure to wildfire smoke and to identify susceptible populations and reviews the scientific literature for studies of wildfire smoke exposure on mortality and on respiratory, cardiovascular, mental, and perinatal health.
- [Modeling acute respiratory illness during the 2007 San Diego wildland fires using a coupled emissions-transport system and generalized additive modeling](#)  
This study analyses the impacts on respiratory health of the 2007 wildland fires in and around San Diego County, California is presented. This study helps to address the impact of fire emissions on human health by modeling the exposure potential of proximate populations to atmospheric particulate matter (PM) from

vegetation fires. The model captured the variability in emergency department visits due to several factors by including nine ancillary variables in addition to wildfire PM concentration.

- [\*\*A systematic review of the physical health impacts from non-occupational exposure to wildfire smoke\*\*](#)

A systematic search to identify peer-reviewed scientific studies published since 1986 regarding impacts of wildfire smoke on health in exposed communities, this study reviewed and synthesized the state of science of this issue including methods to estimate exposure, and identified limitations in current research. Review of 61 epidemiological studies linking wildfire and human health in communities.

## Drought

- [\*\*Physical, Mental, and Financial Impacts From Drought in Two California Counties, 2015.\*\*](#)

Drought-impacted households might perceive physical and mental health effects and might experience financial or property impacts related to the drought. Public Health Implications. Local jurisdictions should consider implementing drought assistance programs, including behavioral health, and consider rapid assessments to inform public health action.

- [\*\*Drought and the risk of hospital admissions and mortality in older adults in western USA from 2000 to 2013: a retrospective study\*\*](#)

Occurrence, severity and geographic extent of droughts are anticipated to increase under climate change, but the health consequences of drought conditions are unknown. This study estimates risks of cardiovascular and respiratory-related hospitalization and mortality associated with drought conditions for the western U.S. elderly population.

- [\*\*Impact of drought on crime in California: A synthetic control approach.\*\*](#)

California suffered severe drought since 2011, resulting in intensely dry winters and several of the hottest days on record. It is likely that the drought increased economic stress and shifted routine activities of the population, potentially increasing the likelihood of crime. This study used a synthetic control method to estimate the impact of California's drought on both property and violent crimes.

- [\*\*Assessment of Vulnerability to Coccidioidomycosis in Arizona and California.\*\*](#)

This research adds to the body of knowledge that could be used to target interventions to vulnerable counties and provides support for the hypothesis that population vulnerability to coccidioidomycosis is associated with climate variability.

- [\*\*Drought and immunity determine the intensity of West Nile virus epidemics and climate change impacts\*\*](#)

Local-scale data from one region suggested drought increased epidemics via

changes in mosquito infection prevalence rather than mosquito abundance. In addition, human acquired immunity following regional epidemics limited subsequent transmission in many states. We show that over the next 30 years, increased drought severity from climate change could triple West Nile virus cases, but only in regions with low human immunity. These results illustrate how changes in drought severity can alter the transmission dynamics of vector-borne diseases.

## **Inland Flooding**

## **Sea Level Rise**

## **Other Resources**

Contact project staff at [CalBRACE@cdph.ca.gov](mailto:CalBRACE@cdph.ca.gov)