CalHeatScore Methods Documentation Version 2.0

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Summary of Updates

The Office of Environmental Health Hazard Assessment (OEHHA) oversees the development and maintenance of CalHeatScore, a web tool that ranks daily weather conditions by their expected heat-related impacts on human health. OEHHA released an update to the CalHeatScore ranking methods on January 31, 2026. The following document provides information on the current data and methods used to develop the CalHeatScore tool. Changes to the methods include updates to the climate and health data and how the impact of heat on health is represented. Most notably, the number of years of health data included in the underlying model informing CalHeatScore ranks have increased and now span 2008 through 2018. Weather and climate conditions are now being drawn from refined locations for each zip code based on the population center. Additionally, the underlying model has been updated with revised factors to improve estimates of the historical heat-health relationships. Within the model, a threshold "floor" of 80 degrees Fahrenheit is now being used as the minimum requirement to trigger an increase from a CalHeatScore rank 0 to 1 for all zip codes. These updates have resulted in adjustments to the feels-like temperature thresholds used for each CalHeatScore rank for each zip code. To review the previous methods for the December 30, 2024 CalHeatScore release, please reference the corresponding Methods document accompanying that release.

Introduction

California, like most regions across the globe, is experiencing an increase in the frequency, duration, and intensity of extreme heat events compared with historical climate conditions (IPCC, 2021; USGCRP, 2023). Heat waves put people at risk of adverse health effects, including serious heat-related illnesses and even death (Ebi et al., 2021). However, many heat-related illnesses and deaths can be prevented with heat mitigation resources and public awareness of oncoming heat (Vaidyanathan, Malilay, Schramm, & Saha, 2020).

To support California's efforts to increase awareness and prepare Californians for upcoming heat events, the Office of Environmental Health Hazard Assessment (OEHHA), on behalf of the California Environmental Protection Agency, oversees the development of CalHeatScore. CalHeatScore is a web tool that uses a heat-health ranking system to provide information on local and regional extreme heat events in California. The purpose of CalHeatScore is to reduce heat-related illness and save lives by translating complex meteorological, weather and health data into easy-to-understand public heat risk alerts. This tool raises awareness of extreme heat events and empowers parents, seniors, caregivers, and communities to plan for, mitigate, and survive extreme heat events. CalHeatScore is committed to prioritizing the most vulnerable populations and ensuring that everyone has the information they need to stay safe during extreme heat.

CalHeatScore translates weather information into easy-to-understand scores ranging from 0 to 4 to indicate levels of human health risk due to heat ranging from low to severe. These scores are displayed on the web tool along with historical climate and demographic information. CalHeatScore is updated daily, incorporating current temperature forecasts to indicate the severity of upcoming extreme heat events based on historical health responses to heat. The current version of the web tool can be accessed here: CalHeatScore Tool.

The development of CalHeatScore is conducted in collaboration with state agencies: California's Office of Emergency Services, the Department of Insurance, the Department of Public Health, and the Governor's Office of Land Use and Climate Innovation. Under contract with OEHHA, the University of California Los Angeles (UCLA) Center for Healthy Climate Solutions developed the underlying statistical model used in CalHeatScore with collaborators from Oregon State University and Applied Climatologists, Inc. More information associated with the CalHeatScore program can be found on the CalHeatScore website.

This document provides descriptions of the methods used in the current version of CalHeatScore, released on January 1, 2026, that inform the ranking approach and supplementary information on the tool's dashboard. The following sections include descriptions of the climate and health data sources used, the underlying statistical model used to quantify heat-health impacts to inform the ranking scheme, and detailed information regarding supplementary community and demographic data sources, such as the location of cool centers, incorporated into the tool.

Methods

The CalHeatScore ranking system is based on estimated historical relationships between climate conditions and human health across California. The climate and health datasets described below are used to quantify these relationships at the zip code level. Temperature thresholds based on these relationships are then used to establish rankings that describe different levels of heat-related health risks. These ranks are denoted as scores from 0 to 4, with 4 describing the highest level of risk. The thresholds are developed at the zip code level, the same level of geography that the historical health data are reported.

The following changes have been made to the methodology underlying the current version of CalHeatScore, released January 1, 2026:

- For each zip code, weather and climate conditions are now all drawn from refined population-weighted centroid locations, revised from the previous approach of using a mixture of population and geometric centroids. This approach helps better align estimations of community-level heat to population centers.

- The historical health response data and corresponding climate data used to inform the CalHeatScore ranking methodology was previously drawn from May through October 2016 to 2018 and now spans May through October 2008 to 2018.
- The underlying heat-health statistical model has been updated with revised covariates. Baseline temperature conditions now possess a standard minimum of 80 degrees Fahrenheit (˚F) for all zip codes, which has been reported as the minimum temperature associated with increases in heat-health risk in past literature.

Climate

Data Inputs

The climate datasets used for the development and operations of the CalHeatScore ranking system include historical climate data and weather forecasts. Below are more details on the datasets used.

Historical Climate

To represent historical climate conditions in locations across California, CalHeatScore uses gridMET, which is a daily 1/24th degree resolution (~4 kilometer) gridded surface meteorological dataset that provides data from 1979 to near-present day (Abatzoglou, 2013). Daily near-surface air temperature and relative humidity are used in the calculation of historical daily maximum heat index. More information on gridMET can be found at the gridMET dataset provider website.

Weather Forecasts

CalHeatScore is based on gridded forecasts from the National Weather Service (NWS) National Digital Forecast Database (NDFD). The NWS NDFD provides 2.5-kilometer (km) resolution digital gridded forecasts from local NWS weather forecast offices in collaboration with a national blend of forecast models (Glahn & Ruth, 2003). Hourly air temperature and relative humidity are used in the calculation of forecasted daily maximum heat index. These heat index values are used for the CalHeatScore forecasts, updated daily. More information about NDFD data can be accessed at the National Oceanic and Atmospheric Administration (NOAA) NDFD webpage.

Zip Code Heat Calculations

Zip code-level historical climate conditions and weather forecasts are retrieved from the population-weighted centroid of each zip code. Population-weighted centroids used in this model were developed by the UCLA Center for Healthy Climate Solutions. The EnviroAtlas dasymetric population density dataset, developed by the US Environmental Protection Agency (EPA), was used to estimate the population-weighted centroids

(Baynes, Neale, & Hultgren, 2022). This dataset consists of 30 meter resolution gridded estimates of population density derived from a combination of 2020 Census block data and land cover classifications and can be accessed at the EPA's Environmental Dataset Gateway (last accessed November 17, 2025). The population data grid cells were assigned to corresponding zip codes with the greatest spatial overlap. To calculate the population-weighted centroid for each zip code, the population grid was converted into points using the geometric center of each grid cell, and the population-weighted average of all points in a zip code was computed using population count as the weight. This revised approach replaces the previous method of using a combination of population-weighted and geometric centroids with a uniform population-weighted approach. This approach allows for all climate and weather measurements to be drawn from zip code level population centroids in lieu of a mixed approach.

Maximum heat index is used to define daily heat conditions at the zip code level. The heat index quantifies how warm temperatures feel to the human body using weather variables such as air temperature and relative humidity. Depending on these variables, the heat index temperature can be higher or lower than air temperature. The current implementation of CalHeatScore uses the NOAA NWS formula of the heat index to calculate the heat index from historical climate data and present-day weather forecasts.

Human Health

Data Inputs

Emergency Department (ED) Visits

The California Department of Health Care Access and Information (HCAI) maintains a dataset of ED encounters from hospitals licensed to provide emergency medical services across the state. This dataset includes patients' medical records along with other personal health information, such as demographic information and health insurance details, and is therefore bound by the provisions of the Health Insurance Portability and Accountability Act (HIPAA).

ED visits were obtained from HCAI's Emergency Department dataset using records from 2008-2018. It is important to note that when an ED encounter leads to an admission to the same hospital, that record is maintained as a hospital inpatient record and is not included in the ED visits dataset. Thus, only encounters that began and ended in the ED are included. This dataset is used to calculate the daily number of ED visits in California due to heat-related illnesses (HRI), by zip code. HRI are defined with the following International Classification of Diseases (ICD) 9 and 10 diagnostic codes, respectively: dehydration (276.51, E86.0); acute and chronic kidney failure (584-586, N17-N19); and heat illness and heat stroke (992, T67) (Basu, Pearson, Malig, Broadwin, & Green, 2012). The definition of HRI may expand in future updates to

CalHeatScore. For each California zip code, the residential zip code of each ED patient and zip code-specific population estimates are used to calculate the daily heat-related illness rate per 10,000 people. Data on ED visits was available for 1,678 zip codes using the patient zip code. For more detail on the ED visit data, refer to **Table A1** in the Appendix.

Heat-Health Model

To inform the CalHeatScore zip code-level temperature thresholds, the current CalHeatScore approach employs a spatiotemporal hierarchical Poisson regression model to estimate historical daily ED visits in relation to daily climate conditions and quantify the relative impact of heat on health at each zip code.[1] This model was developed as part of an OEHHA contract with the UCLA Center for Healthy Climate Solutions and collaborators from Oregon State University and Applied Climatologists, Inc. with input from OEHHA. The model relies on historical climate and health data, as well as other variables including climate zones[2] and temporal variables such as year, day of the year, and day of the week. This model is updated from the original CalHeatScore model (released December 30, 2024). To review the details of the previous model, please reference the CalHeatScore Prototype Methods document accompanying that release.

For zip code z, the ED visit rate for day d, defined as $\lambda_{z,d}$, is modeled as:

$$\lambda_{z,d} \sim Poisson\left(\frac{\theta_{z,d}}{n_z}\right)$$

where:

$\theta_{z,d}$ is the expected ED count for zip code z on day d;

n_z is the population size in zip code z.

The equation for the log visit rate is defined as:

$$\log\left(\frac{\theta_{z,d}}{n_z}\right) = a_z + b_z H_{z,d} + \beta_1 \overline{H_z} + \beta_2 H_{z,d} + \gamma_{Year(d)} + \delta_{DOW(d)} + f(DOY_d)$$

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[1] Poisson regression is used when the outcome variable is a count, such as the expected number of ED visits. This regression model assumes that the number of daily ED visits has a Poisson distribution.

[2] Thirty climate zones across California were constructed based on daily mean apparent temperature from May-October 2021-2022 data from the European Center for Medium-Range Weather Forecasts (ECMWF) Reanalysis v5 dataset (ERA5) (Hersbach et al., 2020). See **Figure A1** in the Appendix for more detail.

where:

a_z is the spatial random intercept for zip code z modeled with a Besag-York Mollié 2 (BYM2) model to capture spatial random effects for spatial smoothing[3];

b_z is the spatially varying heat slope for zip code z modeled with a Besag model for spatial smoothing;

$\overline{H_z}$ is zip code z's average scaled heat intensity[4] across all years;

$H_{z,d}$ is the difference between zip code z's daily scaled heat intensity on day d and its average scaled heat intensity across all years ($\overline{H_z}$);

$\gamma_{Year(d)}$ is a fixed effect for the year to account for long-term trends;

$\delta_{DOW(d)}$ is a categorical fixed effect[5] to account for variations due to the day of the week;

$f(DOY_d)$ is a second-order random walk[6] on the day of the year to capture seasonal trends throughout the year independent of temperature changes.

This heat-health model directly estimates the relationship between daily maximum heat index and the number of daily ED visits using climate and health data from a historical period of May through October 2008-2018. Using the model output, the relative risk (RR) can be calculated to describe the relative change in the ED visit rate for a given day d at zip code z compared to baseline conditions.

To calculate the RR for any given zip code and day, the modeled ED visit rate for that day $\lambda_{z,d}$ (i.e., “observed rate”) is divided by the modeled baseline or counterfactual ED visit rate $\lambda_{z,b}$ (i.e., “expected rate”). The modeled counterfactual ED visit rate is calculated with the average temperature of the associated climate zone using all days in the historical period used (May through October 2008-2018, see **Table A2** in the Appendix for more detail). The average temperatures used to calculate the modeled counterfactual rates are restricted by a heat index temperature floor of at least 80˚F, which has previously been reported as the minimum temperature associated with increases in heat-health risk (Levy, Broccoli, Cole, Jenkins, & Klein, 2015).

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[3] Spatial smoothing is an approach that uses neighboring values to smooth values to reduce noise due to small population size or low data availability.
[4] Heat intensity is calculated as the mean-centered daily maximum heat index.
[5] Fixed effects are used to treat specific factors as constants in statistical models.
[6] Random walks are stochastic processes that can describe factors with gradual changes (e.g., ED visits).

The formula for calculating the RR is:

$$Relative\ Risk = \frac{\lambda_{z,d}}{\lambda_{z,b}}$$

If there is no difference between the modeled daily and counterfactual ED visit rates, then RR = 1. RR values above 1 indicate an increased relative risk of heat-related ED visits, while RR values below 1 indicate a reduced relative risk of ED visits. RRs below 1 can occur when observed ED visits fall below the expected number of visits for any given day.

In summary, each zip code has a time series of RR values and corresponding maximum heat index values within the time frame of the analysis.

Temperature Thresholds

Using the historical RR values described above, zip code-level relationships were developed between daily RRs and maximum heat index values. For all zip codes, the relationship between maximum heat index and RR values was modeled with a fitted quartic polynomial equation. Then, heat index values corresponding to specific RR values from the fitted equation were used to delineate the different CalHeatScore ranks for each zip code. Days where there were mismatches between heat index and RR values, such as where RR > 1 and heat index < 80˚F, were excluded. Additionally, due to the temperature floor of 80˚F used, observations at or below 80˚F were also excluded. Below, **Figure 1** shows an example of the RR and heat index values for an individual zip code from the analysis period.

CalHeatScore uses 25% (RR = 1.25), 50% (RR = 1.5), and 75% (RR = 1.75) relative increases in ED visit rates to break daily heat-health conditions into different ranks. Below, **Table 1** lists the RR values, lower bound temperature thresholds, and percentage of heat days (RR > 1) that correspond to each CalHeatScore rank. Due to broad changes to the model, the RR range associated with each CalHeatScore ranking has been adjusted to better categorize each level of heat-health risk. The previous RR ranges are listed in Appendix **Table A3**.

Figure 1. Relationship between heat index temperature and relative risk for an example zip code. Values for the period of May through October 2008-2018 are shown as blue points and the fitted polynomial equation is shown in red. Values below 80°F are not shown. The horizontal blue lines denote RRs at 1, 1.25, 1.5,

and 1.75. The vertical green lines denote the corresponding maximum heat index temperatures at the RR values based on the fitted polynomial.

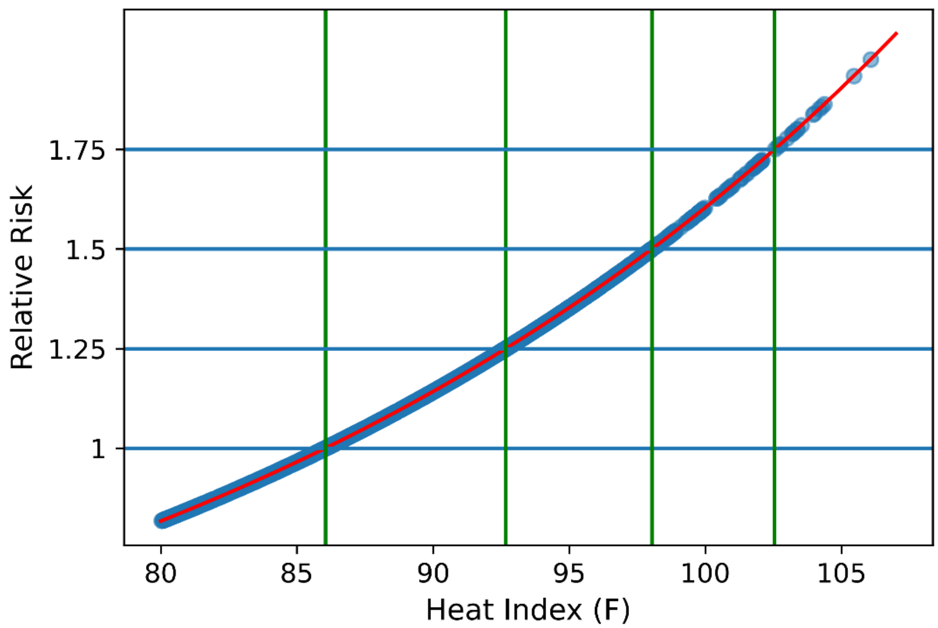

Table 1. CalHeatScore ranks. CalHeatScore ranks are listed with corresponding relative risk (RR) range and lower bound heat index temperature thresholds across all California zip codes. The percentage of heat days (RR > 1) for each rank across all zip codes with available ED data from the study period of May through Oct 2008-2018 are also included for reference.

CalHeatScore (CHS) Rank	RR Range	Lower Bound Heat Index Threshold (˚F) (Mean ± SD)	Percent (%) of Heat Days from May-Oct 2008-2018
CHS 0	0 < RR ≤ 1	-	-
CHS 1	1 < RR ≤ 1.25	82.75 ± 3.60	64.81%
CHS 2	1.25 < RR ≤ 1.50	89.46 ± 3.53	25.22%
CHS 3	1.50 < RR ≤ 1.75	94.92 ± 3.64	7.31%
CHS 4	1.75 < RR	99.51 ± 3.83	2.66%

With zip code-specific heat index temperature thresholds, CalHeatScore translates daily forecasted zip code-specific maximum heat index temperatures into its corresponding rank. Each zip code has unique temperature thresholds that reflect the local heat-health relationship.

For zip codes with little to no ED data where the model cannot estimate the full set of thresholds, CalHeatScore uses inverse distance weighting to interpolate temperature thresholds based on the nearest neighboring zip codes. Inverse distance weighting is a form of spatial estimation where available values are weighted by distance from the point of interest. For zip codes with incomplete observations for the range of the RR values (1-1.75), CalHeatScore uses the modeled RR = 1 threshold for Rank 1 and interpolates the differences between the remaining ranks (Ranks 2-4) with the nearest neighbors.

As described in the Climate section, the CalHeatScore ranking system is updated daily using gridded forecast data from NWS. The forecast is accessed from the NWS NDFD forecast webpage. CalHeatScore is updated automatically at 5:00AM and 8:00AM each morning based on the most recently issued forecast from NWS, with the 8:00AM forecast serving as the definitive rankings for the current day. Using the heat index value from the grid cell containing each zip code's population-weighted centroid, the zip code is assigned a CalHeatScore rank from 0-4.

All CalHeatScore values are displayed using 2019 zip code polygons accessed from the California state geoportal in September 2024 (CA Department of Education, 2021).

Supplementary Data

In addition to the daily CalHeatScore rankings, the CalHeatScore webtool also provides locally relevant information and resources that can help Californians prepare for and adapt to upcoming extreme heat events.

Cool Centers

The CalHeatScore mapping tool includes locally available feature layers of cool centers located throughout California. These feature layers are created and published by external entities (typically California counties) on ArcGIS Online, and they are not maintained by OEHHA. The map includes layers that are publicly available and have been updated in the past 24 months. Each feature layer is accessed by the CalHeatScore tool by using the layer’s published URL, which ensures that any updates to the hosted feature layers are automatically updated on the map. These feature layers are not exhaustive and may have inconsistencies with regard to the currently available information.

Cool centers are important community resources that provide a cool environment where the public can gather during an extreme heat event. Counties designate their own cool centers, which may include libraries, community and senior centers, government facilities, public swimming pools and splash pads, or any other location determined by county officials. Some cool centers may only be open or have extended hours during extreme heat events. Therefore, it is important to contact the facility directly to determine its current operating status. Additional cool center details such as facility name, address, and hours of operation may be available depending on the feature layer source.

Forecasted Weather and Historical Climate

When a user of the CalHeatScore tool clicks on a specific zip code shown on the map, the forecasted weather for that day and historical climate information is displayed in a side panel. This data comes from the NWS weather forecast and the gridMET historical climate dataset described in the Climate section.

The data shown include:

- Daily maximum temperature forecast: The forecasted daily maximum air temperature for the current or forecasted date.
- Daily "feels like" temperature forecast: The forecasted daily maximum heat index temperature for the current or forecasted date.
- Historical maximum temperature: The highest maximum air temperature of the current calendar day from 1979 to near-present day.
- Historical average temperature: The average daily maximum air temperature of the current calendar day from 1979 to near-present day.

Population Demographics

Zip code-level population estimates are displayed when a user clicks on the "Temperature", "Profiles (1/2)", and "Profiles (2/2)" tabs. Demographic estimates are derived using data from the 2022 American Community Survey (ACS) (US Census Bureau, 2024), available on the US Census website, and a census tract-to-zip code US Postal Service (USPS) crosswalk dataset (HUD Office of Policy Development and Research, 2023)[7] to obtain estimates at the zip code level. Population estimates are initially calculated at the census tract level using the 2022 ACS data and then estimated at the zip code level utilizing the proportions from the crosswalk dataset.

When a user of the CalHeatScore tool clicks on a specific zip code shown on the map, local population demographic information populates on a side panel. This demographic information is presented visually with infographics, depicting the estimated count and rate of these subgroups relative to the total population (or another denominator as defined in the Appendix). Information on the following demographic variables can be found below. This list of demographic variables is not exhaustive and will be expanded over time.

[7] We utilize the "TRACT_ZIP_122023" table in the December 2023 US Department of Housing and Urban Development (HUD)-USPS ZIP Code Crosswalk. This table provides estimates of proportion of the specified census tract population that overlaps with the zip code boundaries at time of HUD-USPS crosswalk publication.

Total Population

Data from the ACS DP05 table was utilized to calculate an estimate of the total population associated with all types of addresses, including residential, business, and other address types.

Age

Younger and older age groups are identified as being more vulnerable to extreme heat events (Basu et al., 2012; Benmarhnia, Deguen, Kaufman, & Smargiassi, 2015; Forsyth & Solan, 2022; Knowlton et al., 2009; Meade et al., 2020; Ou, Wang, Zhao, & Deng, 2023; Schapiro, McShane, Marwah, Callaghan, & Neudecker, 2024). Therefore, utilizing data from the ACS DP05 table, estimates of the total population were calculated, broken down by relevant age groups: under 5 years old, 5-17 years old, 18-64 years old, and 65 years and older.

Race and Ethnicity

The impact of extreme heat on health varies by racial and ethnic groups (Basu, Chen, Li, & Avalos, 2017; Dialesandro, Brazil, Wheeler, & Abunnasr, 2021). This can be due to many factors including, but not limited to natural and built environmental variations, such as tree canopy coverage, the heat island effect, and access to air-conditioned spaces. These factors are influenced by systemic drivers such as historical redlining and economic disparities (Wilson, 2020). Utilizing data from the ACS DP05 table, estimates of total population were calculated, broken down by the following mutually exclusive race and ethnicity groups: Hispanic or Latino, White, Black, Asian, American Indian/Alaskan Native (AIAN), and Other/Multiple. For these analyses, all individuals who identified as ethnically Hispanic or Latino were grouped together, regardless of race, and were not included in any other race groups. See the Appendix for more details about these groupings.

Linguistic Isolation

A linguistically isolated household is defined as any household without a member at least 14 years old who can speak English well. This can impact a household's understanding and adherence to public health warnings, leaving them vulnerable to preparing and responding to extreme heat events (CalBRACE, 2016; Uejio et al., 2010). Data from the ACS S1602 table was utilized to calculate the proportion of households in each zip code that are linguistically isolated.

Outdoor Workers

Prolonged exposure to extreme heat, such as that which may be experienced by individuals who work outdoors, can cause occupational heat stress, resulting in illness, injury, and even death (Abokhashabah, Jamoussi, Summan, Abdelfattah, & I., 2021;

Kjellström, Maître, Saget, Otto, & Karimova, 2019). Data from the ACS S2401 table was utilized to calculate the proportion of workers in each zip code who work outdoors.

Uninsured

When experiencing a heat-related illness or injury, it may be necessary to seek medical treatment. Individuals without health insurance may be reluctant to seek medical care during earlier stages of heat illness, when treatment is more effective and less expensive (Abokhashabah et al., 2021; Schmeltz, Petkova, & Gamble, 2016). If there is a delay in medical care, health symptoms may be severe and emergency medical care may be needed, which could lead to worse health outcomes. Data from the ACS S2701 table was utilized to calculate the proportion of individuals in each zip code who do not have health insurance.

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Appendix

Data Dictionary for Supplementary Data

All population estimates for supplemental data are derived using the December 2023 HUD-USPS ZIP Code Crosswalk (TRACT_ZIP_122023) which provides estimates of the proportion of the specified census tract population that overlaps with the zip code boundaries at time of HUD-USPS crosswalk publication. Each field and census tract population estimate are initially identified in the associated 2022 ACS 5-year estimates tables, then estimated at the zip code level with the proportions from the HUD-USPS ZIP Code Crosswalk. The data dictionary table with detailed information on each supplemental data variable and associated data source can be accessed here: Data Dictionary for Supplementary Data.

Supplementary Analyses Methods

Zip Code Identification

The USPS periodically updates zip codes by adjusting existing zip code boundaries, and by adding new or decommissioning zip codes as the population changes and the needs for postal services change. Because of the dynamic nature of zip codes over time, not all boundary maps cover the same geographic regions and populations. CalHeatScore derives zip code boundaries from a range of sources. As previously described, population estimates are derived from applying the HUD-USPS December 2023 tract to zip code HUD-USPS crosswalk ratio to the 2022 ACS census tract population estimates. The completeness and discrepancy of identified zip codes and population estimates is detailed below.

A total of 2,425 California zip codes were identified using the HUD-USPS crosswalk to estimate total population at the zip code level from the 2022 ACS census tract data from the US Census data website. The zip code polygons used for CalHeatScore contain 1,721 zip codes (CA Department of Education, 2021). Of these, 32 zip codes have no population, according to 2019 estimates, and begin with three leading zeros (i.e., “000”).

Of the remaining 1,689 populated zip codes, 1,662 zip codes matched the December 2023 HUD-USPS crosswalk used for the population estimates. 763 zip codes were identified by the HUD-USPS crosswalk but were not in the CA state geoportal. One zip code, 93519, was identified by the CA State geoportal but was not in the HUD-USPS crosswalk.

Zero Values and Associated Average Population Size

CalHeatScore presents population estimates for a variety of relevant demographic groups, including age, race/ethnicity, outdoor workers, linguistically isolated households, and individuals without health insurance. Because of the variation in total population estimates and sub-group population distributions, there can be zip codes that do not have an estimated population size for one of the sub-groups. In these cases, the estimated sub-group population is zero. To provide a clearer picture of the relevance of these zero values, **Table A4** in the Appendix presents both the number of zip codes with zero values for the given group, as well as the average total population estimates of the associated zip codes. For most of the demographic groupings, the missing values are associated with sparsely populated zip codes. There are some exceptions where the average total population size is > 1,000 people, such as within certain race/ethnic groups, as well as families with linguistic isolation.

Appendix Tables

Table A1. Number and percent of heat-related emergency department visits by diagnosis from May to October 2008-2018.

Diagnosis	ICD-9	ICD-10	Number of Visits	Percent of Visits
Dehydration	276.51	E86.0	443,043	80%
Renal failure	584-586	N17-19	74,436	13%
Heat illness and stroke	992	T67	35,937	7%

Table A2. Daily maximum apparent temperature averaged by climate zones. Climate zone averages were calculated by averaging zip code-level daily maximum apparent temperature from May to October 2008-2018.

Climate Zone	Apparent Temperature (°F)
1	67.71
2	78.97
3	70.67
4	76.44
5	71.45
6	76.48
7	85.81
8	79.41
9	86.46
10	85.14
11	82.09
12	84.44
13	76.57
14	71.22
15	82.39
16	87.09
17	80.28
18	88.25
19	71.97
20	81.73
21	69.63
22	85.89
23	78.05
24	89.75
25	93.99
26	97.58
27	85.76

Climate Zone	Apparent Temperature (°F)
28	84.04
29	77.96
30	81.09

Table A3. Relative risk (RR) ranges by CalHeatScore ranks and release date.

CalHeatScore (CHS) Rank	Original RR Ranges: Released December 30, 2024	Updated RR Ranges: Released January 1, 2026
CHS 0	0 < RR ≤ 1	0 < RR ≤ 1
CHS 1	1 < RR ≤ 1.333	1 < RR ≤ 1.25
CHS 2	1.333 < RR ≤ 1.667	1.25 < RR ≤ 1.5
CHS 3	1.667 < RR ≤ 2	1.5 < RR ≤ 1.75
CHS 4	2 < RR	1.75 < RR

Table A4. Number of zip codes with zero value reported, and average total population size, by subgroups of interest.

Demographic Category	Demographic Variable	Average Population Size[8]	Number of Zip Codes with `0` Value
Age	< 5 years old	420.2	56
	5-7 years old	2.7	14
	18-64 years old	0.4	1
	65+ years old	552.1	22
Race and Ethnicity	AIAN	5,482.3	264
	Asian	575.4	83
	Black	1,021.4	149
	Latino	3.5	10
	White	4.4	2
	Other / Multiple	1,204.4	45
Outdoor Worker	Total Workers	0.8	2
	Outdoor Workers	614.1	53
	Non-Outdoor Workers	4.4	3
Linguistic Isolation	All Households	0.8	2
	Not Linguistically Isolated Households	95.4	3
	Linguistically Isolated Households	1,146.8	184
Health Insurance	Civilian Noninstitutionalized[9]	0.4	1
	Has Health Insurance	0.4	1
	Does Not Have Health Insurance	301.5	34

[8] Average population size is measured by the number of people.
[9] People over 15 years old, living in US States or the District of Columbia, and who are not active-duty military or in an institution (such as homes for aged, mental health facilities, or penal institutions).

Appendix Figures

Figure A1. Climate zones across California. Climate zones were defined based on daily average apparent temperature from May to October 2021-2022 through principal component analysis and k-means cluster analysis. Each individual zip code in California is assigned to a climate zone based on where the zip code's population-weighted centroid is located. These climate zones were developed by Applied Climatologists Inc.