California Building Resilience Against Climate Effects (CalBRACE) Project

Short Title: Air Conditioning
Full Title: Percent of households with air conditioning

CalBRACE Domain: Adaptive Capacity

Why is this important to health?

Increasing temperatures and the risk of heat waves pose a serious public health concern. Air conditioning (AC) is an important protective factor against heat-related morbidity and mortality. Communities of color have both higher heat-related morbidity and mortality, and lower access to AC. The cost of AC can be a barrier to low-income households. Even in households that have AC, use may be limited by financial considerations.[1] Houses, schools, workplaces, and older buildings (e.g., in older urban neighborhoods and rural areas) generally do not have insulation or air conditioning.[2] In addition to low-income and communities of color, populations that will be most impacted, include the elderly, children, and areas currently unaccustomed to heat waves (such as coastal communities, northern latitudes, and higher elevations).[2]

Summary of Evidence for Climate Change and Health?

Studies have shown that having working home air conditioning (AC) was the strongest protective factor against death during a heat wave, followed by access to an air-conditioned place for some time.[3] Research specific to California found that a 10 percent increase in AC ownership would reduce heat-related mortality by 1.4 percent per 10°C change in temperature.[4] A similar protective effect was found for the excess risk of hospitalizations.[3] Air conditioning varies greatly by income, the age of the house, and geographic location. A study found heat-associated mortality to be two times higher in Blacks than in Whites, and 64 percent of this disparity is attributable to central AC prevalence.[5] Another study found that more than one third of elderly people in the United States restrict use of AC during hot weather due to financial burden.

Key References:

1. Reid CE, O'Neill MS, Gronlund CJ, et al. Mapping community determinants of heat vulnerability. *Environ Health Perpect.* 2009; 117(11): 1730-1736.
2. Climate Action Team Public Health Workgroup. Preparing California for Extreme Heat: Guidance and Recommendations. Sacramento, CA: California Environmental Protection Agency and California Department of Public Health; 2013.
3. Ostro B, Rauch S, Green R, et al. The effects of temperature and use of air conditioning on hospitalizations. *American Journal of Epidemiology.* 2010; 172: 1053-1061.
4. Ostro B, Rauch S, Green S. Quantifying the heatlh impacts of future changes in temperature in California. *Environmental Research.* 2011; 111: 1258-1264.
5. O'Neill MS, Zanobetti A, Schwartz J. Disparities by race in heat-related mortality in four US cities: the role of air conditioning prevalence. *Journal of Urban Health.* 2005; 2: 191-197.

What is the Indicator?

Detailed Definition

- Indicator (percent)= % Households with air conditioning × population weight
- Stratification: income level and race of head of household
- Interpretation: Climate resilient communities will have higher percentage of homes with air conditioning

Data Source and Methodology

- Air conditioning ownership data from California Energy Commission's 2009 Residential Appliance Saturation Study (RASS). (https://websafe.kemainc.com/RASS2009/Default.aspx)
  - Years available: 2003, 2009
  - Geographies available: California statewide survey data
- 2010 U.S. Census blocks, U.S. Census Bureau Redistricting File for California (*http://www2.census.gov/census_2010/01-Redistricting_File--PL_94-171/California/*).
  - Years available: 2010
  - Geographies available: county (derived), region (derived), state (derived)

The 2009 Residential Appliance Saturation Study (RASS) was implemented as a two-stage mail survey, with an option for respondents to complete it online, to a representative sample of Californian households. Non-response follow up was implemented. Energy consumption estimates were obtained using a conditional demand analysis which calculates average annual consumption estimates per appliance from survey data, household energy consumption data, and weather information. The survey yielded estimates for 24,464 individually metered and 1,257 master-metered households. Survey and conditional demand analysis results were weighted to provide population level estimates representative of the participating utilities that allow comparison across utility service territories, forecast climate zones, and other variables of interest (such as dwelling type, dwelling age group, and income).

Limitations

Survey was implemented in service areas of five participating utilities. Potential bias may be introduced from survey non-response and incomplete or missing survey data. Data may be unstable due to low sample size and model uncertainty introduced by conditional demand modeling method. Zip code level data was suppressed due to high relative standard error and small sample sizes.

Acknowledgement and Disclaimer

This publication was supported by Cooperative Agreement 5UEE1EH001052 from the Centers for Disease Control and Prevention. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the Centers for Disease Control and Prevention.

Examples of Maps, Figures, and Tables:

Figure 1. Statewide Percent of Households Without Air Conditioning, by Race/Ethnicity Groups, California, 2009

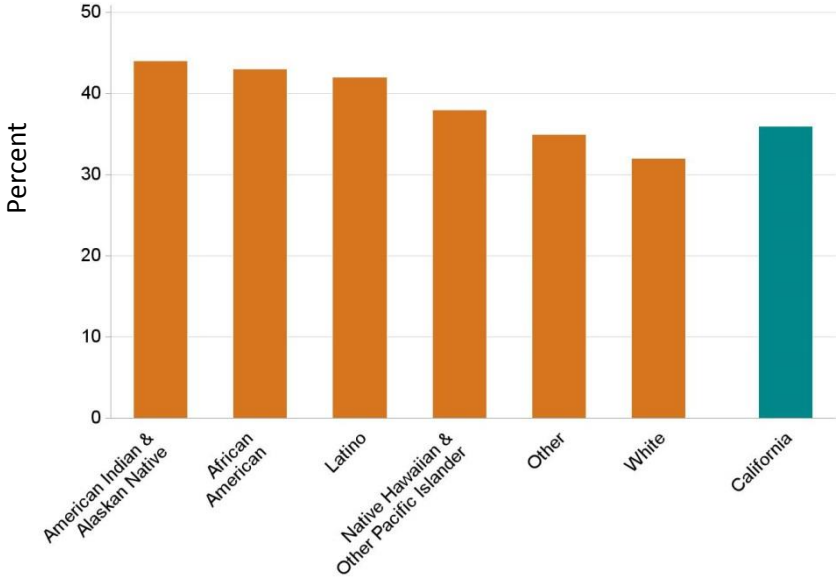


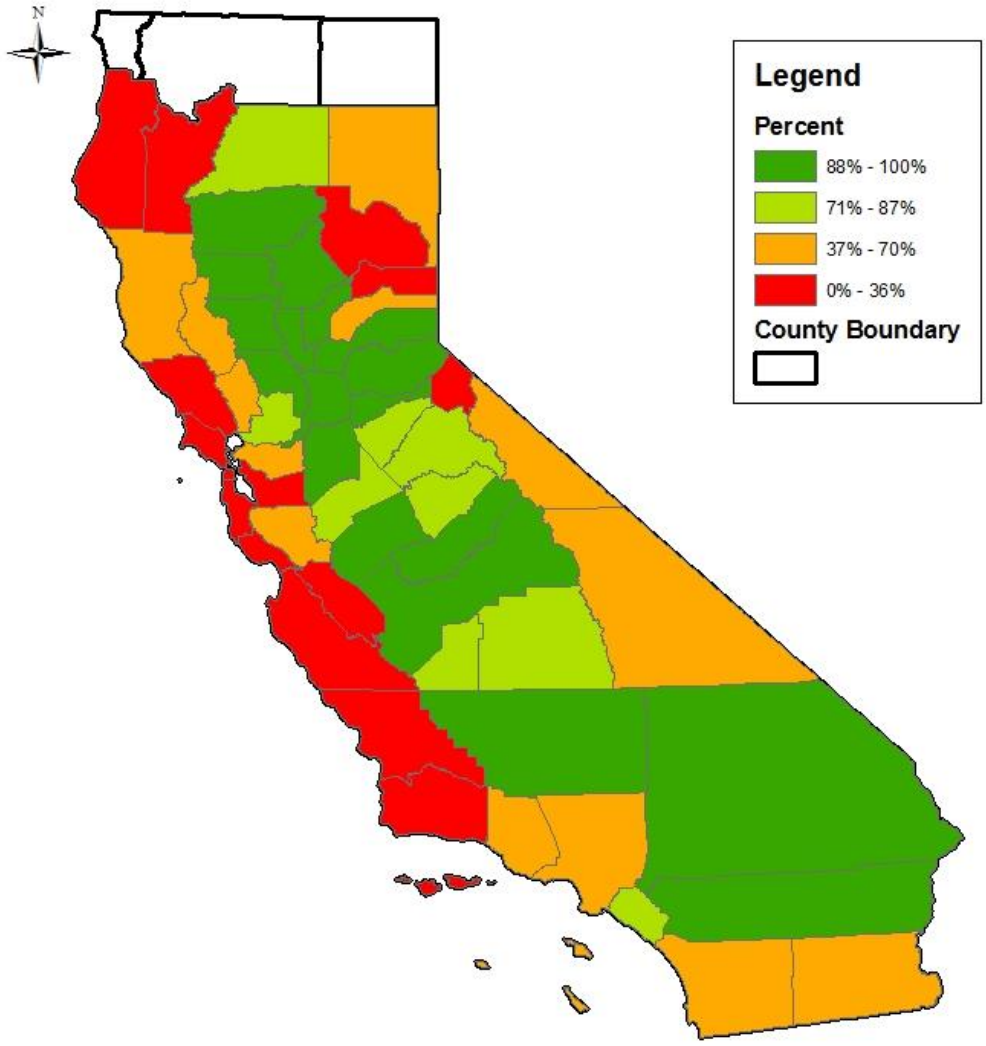
Table 1. Percent of Households Without Air Conditioning, San Diego County, California, 2009

Location	Percent	Total Population
San Diego County	47%	1,100,403
California	36%	11,523,719

Data represents households in service areas of five participating utilities and may be unstable in areas with small populations.

Source: Residential Appliance Saturation Study (RASS), 2009; U.S. Census Bureau, 2010. Analysis done by UC Davis and CDPH.

Percentage of Households with Air Conditioning Ownership by County, RASS, 2009



Data Source: Residential Appliance Saturation Study, 2009
Analysis by CDPH and UC Davis