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│                        EXHIBIT A                            │
│                      SCOPE OF WORK                          │
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☒ Contract ☐

Does this project include Research (as defined in the UTC)?　☒ Yes　☐ No

PI Name: Sandie Ha and Manali I. Patel

Project Title: HEAT--Health Equity and Adaptation to Extreme Temperature

Project Summary/Abstract

Increasing temperatures and extreme heat pose major health risks in Kern County, particularly for individuals with low-income, racial and ethnic minorities, outdoor workers, older adults, children, and student athletes. Understanding and mitigating risks is critical for this region.

The primary objective of this study is to assess the health-related impacts of a community-agreed upon heat adaptation strategy among disparate populations at greatest risk from health disparities, including low-income, older adults, and racial and ethnic minorities in Kern County. This study is expected to provide an understanding of the impact of the implementation of a local strategy to mitigate heat-related health risks and reduce heat-related health disparities. This contract will highlight the health benefits, economic impact, and community perspective of the impact of the strategy and its implementation. The findings will better inform the California Air Resources Board (CARB) climate programs and implementation of heat adaptation strategies that aim to protect populations most at-risk for health effects of extreme heat and improve community resilience to heat exposure.

If Third-Party Confidential Information is to be provided by the State:

☐ Performance of the Scope of Work is anticipated to involve use of third-party
　Confidential Information and is subject to the terms of this Agreement; *OR*

☐ A separate CNDA between the University and third-party is required by the third-party
　and is incorporated in this Agreement as Exhibit A7.

Scope of Work

Increased temperatures manifested as heat days and sustained high heat days (i.e., heat waves) directly impact human health and exacerbate pre-existing health conditions including respiratory and cardiovascular diseases. On top of that, groups including persons with disabilities, older adults, developing fetuses, children, outdoor workers, athletes, and individuals with precarious socioeconomic status (e.g., unhoused people) and social isolation are disproportionately and adversely affected by heat.[6-10]

Kern County is a priority area for extreme heat exposure. In 2005-2010, there were 2.4 times the state-based age-adjusted emergency room visits.[5] The county also has a high proportion of people most at risk of heat-

related health impacts including racial and ethnic minority residents, people with one or more chronic medical conditions, people with incomes below the Federal Poverty Level, people with social vulnerabilities, unhoused people and outdoor workers. Baseline rates of death and health disparities among these at-risk populations are higher than state-based averages. According to Bakersfield's recent Priority Climate Action Plan[6], of all climate-related impacts, Kern County is most susceptible to rising temperature and extreme heat.[6] In prior work, the University of California Merced (UCM or Contractor) created a Community Advisory Board (CAB) to address impacts of climate change, specifically wildfires and poor air quality on the health of people living and working in the San Joaquin Valley. Over the past 2 years, the Contractor conducted interviews with people living and working in the region and met with our 15-member CAB. In the CAB meetings over the past 2 years, Kern County residents noted that over 15% of people at most risk for heat-related impacts lack air conditioning, and 35% have poorly functioning air conditioners. Although cooling centers, sheltered transit stops, heat alerts, and tree canopy initiatives are being implemented, it is not clear that the community is aware of these strategies and how effective the implementation of these strategies are, to date, in reducing heat-related adverse health outcomes and associated heat-related health disparities. While this project will use a community-based participatory approach to identify an intervention for evaluation, the Contractor chose to use the example of the cooling center initiative, which meets the minimum criteria for evaluation (see Task 1 for details), to illustrate the methodology presented.

The overarching goal of the project is to evaluate current adaptations and local strategies for addressing increasing temperatures and extreme heat, and the associated health risks among those most vulnerable to adverse health outcomes and health disparities. Our proposed work in collaboration with the MLKCommUNITY Initiative, American Cancer Society, Central California Public Health Consortium, and AgSafe is comprised of the six tasks described below and summarized at the end of this section in Table 2, "Activities and Deliverables by Task".

Climate change is expected to increase the frequency, intensity, duration, and spatial distribution of many extreme weather events, including extreme heat[1,2]. Moreover, research also consistently show significant health disparities on health impacts of heat, where groups including persons with disabilities, older adults, pregnant people, developing fetuses, children, outdoor workers, athletes, and individuals with precarious socioeconomic status (e.g. unhoused people) and social isolation are significantly more disproportionately and adversely affected[3,4]. In California, heat effects vary widely across regions and communities and several state agencies and programs provide funding to support heat adaptation strategies aiming to reduce heat effects and promote community resilience in the changing climate. Kern County is a priority area for extreme heat exposure. In 2005-2010, there were 2.4 times the state-based age-adjusted emergency room visits.[5] The county also has a high proportion of people most at risk of heat-related health impacts including racial and ethnic minority residents, people with one or more chronic medical conditions, people with incomes below the Federal Poverty Level, people with social vulnerabilities, unhoused people and outdoor workers. Baseline rates of death and health disparities among these at-risk populations are higher than state-based averages. According to Bakersfield's recent Priority Climate Action Plan[6], of all climate-related impacts, Kern County is most susceptible to rising temperature and extreme heat.[6] In our recent work in Kern County, residents noted that over 15% of people at most risk for heat-related impacts lack air conditioning, and 35% have poorly functioning air conditioner. Due to these deleterious health effects of heat, interventions like cooling centers have been implemented in the region. However, their health benefits are unclear and have not been evaluated. In this mixed approach study, our interdisciplinary team proposes to leverage (i.e., cooling center).

Findings from our study will help CARB and the state better understand the full impacts of a heat intervention. The project will also provide insights for the state in its efforts to prioritize local heat adaptation strategies that maximize health benefits while addressing community needs, especially for vulnerable and priority communities around the state.

Project Tasks

Task 1. Co-Develop the Overall Research Project Plan and Specific Case Studies by Investigators and Community Partners

Subtask 1.1. Project Start-up
Prior to project launch, the CAB established for previous heat- and climate-related research in the San Joaquin Valley will be convened virtually or consulted via email by the Contractor to identify missing and under-represented groups or community members and recruit additional partners, if necessary, with a goal of onboarding new members in month 2. In month 3, an initial in-person or virtual meeting will be held with the Contractor, and Stanford University, the CAB, and CARB representatives to review goals, processes, and roles and revise plans if needed.

Subtask 1.2. Trust and Capacity Building Workshops
Building on the Contractor and Stanford University previous experience, a series of in-person and/or virtual CAB meetings (months 2-6) will focus on trust building and development of equity-based collaboration principles related to issues such as transparency, accountability, communication, decision-making, conflict resolution, and power dynamics. The Contractor, Stanford University, and CAB members will engage in capacity building and mutual learning on agreed-upon topics, such as:
- Identifying and accessing heat adaptation resources in the county and the state, for example, using the California Climate Investments Project Map
- Democratizing data: how and where to find relevant data and information on heat, air quality, health and relevant socio-demographic information
- Basics of participatory research and evaluation and ground-truthing methods

Subtask 1.3. Intervention Selection
Concurrent with trust and capacity building, an iterative, participatory process will be used by the Contractor to identify and assess heat adaptation strategies for potential evaluation. The Contractor, and Stanford University will present the CAB with a short list of interventions that meet the following minimum criteria for evaluation:
- Intervention has been in place in Kern County since at least 2021 (long enough to evaluate effectiveness and potential lag effects)
- Sufficient pre-and post-intervention data are available for health-related outcomes to be measured statistically
- Ground-truthing is feasible
  Intervention evaluation is relevant to CARB or state climate programs (e.g., the intervention is applicable to other communities in the state; future use of this intervention is planned or being considered)
- No sufficient evaluation of this type has been conducted or planned for the intervention to understand impact
- State-led or state-sponsored interventions
- Relevant for informing work in other regions of the state

The CAB will determine whether further criteria are needed for selecting interventions for evaluation, for example:
- Intervention was designed to benefit disproportionately impacted community members
- Intervention was intended to provide additional health or social benefits

- Intervention can be evaluated in terms of health equity
- Intervention is located in an Environmental Justice community (e.g., AB 617 Community Air Protection Program communities)
- Ground-truthing process and results will be meaningful to the community

Criteria will be applied to eligible interventions and basic profiles of interventions will be developed to outline the characteristics such as the following:

- What is the intervention?
- Where is the intervention located?
- Who are the intended beneficiaries?
- What are the intended benefits?
- What health and additional benefits (i.e. co-benefits) might the intervention have
- What possible negative consequences might the intervention have?
- How might the intervention be evaluated?
- What are the other advantages and disadvantages to selecting the intervention?
- What impact might the intervention have on health disparities?

The CAB will then select one intervention for evaluation using a modified Delphi Process called the RAND/ University of California at Los Angeles Appropriateness Method which our team has utilized in several other community-based projects. The method was developed in the 1980s and has been widely used in healthcare settings. It is a structured approach that merges scientific evidence with expert judgment to create guidelines or consensus recommendations on specific issues. It begins with selecting a panel of experts recognized for their knowledge in the relevant field, followed by a comprehensive review of existing research. Utilizing the Delphi method, experts independently rate a series of statements in multiple rounds, refining their responses based on collective feedback. This is often followed by face-to-face (or live virtual) meetings to discuss findings, resolve disagreements, and finalize recommendations. Through this iterative process, the panel strives to reach a consensus that integrates both empirical evidence and expert insights. The final recommendations will be carefully documented and published.

While consensus is the goal, this process provides input on various items from group-based discussions in the chance that consensus may not always be reached. This process has always, in our experience, resulted in group agreement on particular discussion items, in this case the intervention strategy to evaluate. Specifically, the CAB will brainstorm, discuss, and propose potential interventions as per above and will consider acceptability, feasibility, and the above criteria to select and organize potential interventions. The CAB members will begin by independently rating and ordering potential interventions and together the CAB will discuss the ratings, potential discordance across members, and re-rate potential interventions after discussion. The Contractor, Stanford University and the CAB will present the highest rated intervention to the group to obtain agreement for intervention selection for this project.

Subtask 1.4. Co-Designing Evaluation Plan
The Contractor and Stanford University will lead the CAB in developing an evaluation plan. The Contractor and Stanford University will present the CAB with a list of population-level indicators that are relevant to the intervention and for which data are available (e.g., preterm births; emergency room visits and hospitalizations related to asthma, stroke, heart attack and mental health during heat waves), as detailed in Task 2. The Contractor and Stanford University will also present the CAB with a draft proposal for ground-truthing methods to assess community members' experiences and perceptions of the intervention (see Task 3). The evaluation plan will be adapted based on CAB feedback. The CAB will discuss and define project roles, responsibilities, processes, timelines, milestones, risks and assumptions in further detail. At the end of Task 1, the basic profile and evaluation plan will be used to create a case study and project work plan for the selected intervention, which will detail the research questions, rationale, methods, roles, and timeline.

Subtask 1.5. Community Engagement Plan
Community members will be engaged throughout all project tasks. The CAB will be comprised of 15-20 members, 10 of whom are already established, including representatives of local community-based organizations, researchers, public and occupational health professionals and advocates, employers, and policy makers who will guide the project. The CAB will initially be composed of CAB members working on related studies in the San Joaquin Valley using group model building methods.[11,12] The CAB's process and membership will be expanded as needed to enhance diversity and representation. This process will begin prior to the launch of the funded project to ensure efficiency in project tasks. The CAB will meet six times per year, with in-person meetings held at the beginning, mid-point and end of the project along with in-between communication through email and phone calls. In-person capacity-building workshops and trainings will be held in conjunction with Tasks 1 and 3. CAB members will recruit lay community scientists and participants for ground-truthing and project-related events. The draft engagement plan is informed by principles of community-centered research and emphasizes genuine, bi-directional partnership. In Task 1, the Contractor, Stanford University, and CAB, including liaisons from CARB, will collectively develop equity-based collaboration principles and engage in trust-building activities to ensure authentic, respectful, equitable, inclusive processes and practices and that recognize histories and legacies of power imbalances between institutions and communities along lines of race, ethnicity, gender, age, class, sexuality, and gender expression and identity. This contract will be optimized to ensure congruency with community values, cultural values, gender, acculturation, country of origin, income status, educational attainment, race, and ethnicity. Given the confidential nature of the data collected for this work, UCM will not be able to disseminate raw data. Instead, all findings will be aggregated and deidentified before publicly disseminated as agreed upon by CARB and the CAB, including through dissemination of content across CAB members' networks using communication channels and formats that engage priority audiences and the broader public according to their needs and preferences. The CAB will host a public kick-off meeting to share project information, gather insights and gauge interest among community members in Kern County.

Subtask 1.6. Task 1 Closeout
At the end of Task 1, a team check-in will be conducted to review progress, identify what is working well, determine areas for improvement and finalize all Task 1 deliverables.

Task 1 deliverables: The Contractor will provide equity-based collaboration principles, finalize the selected intervention for the case study, and deliver a revised community engagement plan, a comprehensive project work plan, an evaluation plan, and a communications plan, as well as summaries from the CAB meetings and public kick-off meeting. The collaboration principles will take the format of a written word document approved by the research team and the CAB that goes over expectations for respectful collaboration and authorship. The community engagement plan will outline anticipated events and outreach. CAB meeting notes and/or recordings will be maintained.

Task 2. Estimate the Health Benefits of the Heat Adaptation Strategies

Based on the outcomes from Task 1, the Contractor will select the most appropriate intervention to quantitatively evaluate for health impacts. Depending on the selected intervention, the Contractor will also select other relevant indicators to evaluate. For example, for cooling surface/roof strategies, the Contractor will also evaluate energy cost and indoor temperatures. Based on community inputs and depending on feasibility (i.e. data availability), the Contractor will also explore unintended benefits and/or consequences as well as co-benefits where appropriate. For this contract, the Contractor will recommend a methodology for an intervention that the Contractor believes will be likely selected based on existing knowledge: local cooling centers. Figure 1 illustrates available cooling centers in Kern County in 2021. We note that even if the final intervention is different, the proposed approach can still be applied.

Figure 1. Cooling centers in Kern County, 2021
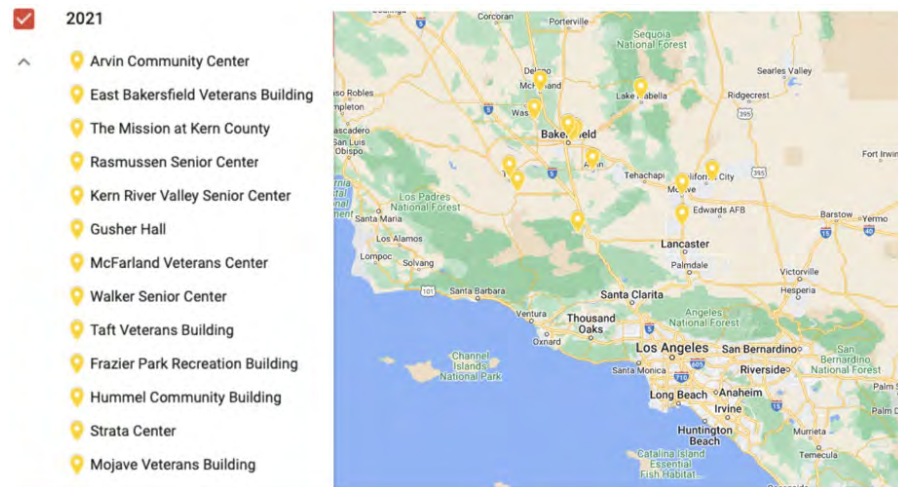
Subtask 2.1. Study Design.

The quantitative evaluation will employ an interrupted times series design, where rates of various health outcomes will be compared before and after the selected intervention. The Contractor will focus on health outcomes across the lifespan, including preterm birth (birth), ED visits and hospitalization related to asthma (children and adults), cardiovascular diseases (i.e. stroke, heart attack, adults), psychiatric outcomes (adults), and heat-related illnesses (children and adults). Specific strategies to identify these health outcomes are described in Subtask 2.3. Methods section below. The Contractor will compare general rates of specific health outcomes during the warm season (April-October) and during heat events, including heat day and heatwave before and after the intervention. The Contractor will use zip-code specific temperature distributions here to account for heat acclimatation by capturing the usually hot temperature for a specific area. Multiple metrics and cut-offs for heat day and heatwave definitions can also be explored to inform policies (e.g. heat warning). Time frame and data resolution are described in Subtask 2.2 (Data collection) and Subtask 2.3 (Data management and measure construction), respectively.

Subtask 2.2. Data Collection.

To ascertain the health outcomes mentioned above, we will obtain population-based health data from multiple sources, including 1) California Office of Vital Statistics and 2) California Office of Health Care Access and Information (HCAI)[13]. HCAI captures individual data from all ED and hospitalization patient discharge data (PDD) from all medical encounters in licensed hospitals and healthcare facilities in California (except the Veteran Administration). Vital statistics captures individual data on births occurring in California. Drs. Ha and Chan-Golston have extensive prior experience managing and analyzing these datasets. For this contract, data for the years 2019 through 2023 will be obtained. If newer data are available at the time of expected receipt of data, we will obtain those as well. The Contractor will restrict our analysis to participants with a Kern County zip codes (n~44 non- Post Office box zip codes)[14]. The final study timeframe will depend on the selected intervention, but the Contractor will ensure sufficient pre- and post-intervention data for meaningful analyses and statistical power (see power analysis below). To identify heat events (e.g., heat days and heatwave) and assess potential confounders (e.g., air pollution), the Contractor will obtain outdoor temperatures from regional regulatory monitors supplemented with Purple Air Citizen Science monitor network in Kern County[15].

Subtask 2.3 Data Management and Measure Construction

Heat season and heatwave definition. Heat season will be defined as April through October of each year based on existing literature[16]. In addition, the Contractor will also evaluate heat events including heat days and heat waves. The Contractor will use several ways to define heat days. First, heat day will be defined as any day with temperatures exceeding the 90th, 95th, or 98th percentile of the zip-code specific daily average temperature distribution during the study period. This approach captures the effects of usually hot temperatures in the area for the same time of year. Second, the Contractor will also incorporate night temperature in the definition, where heat day will be defined as, a day with day and night temperature exceeding the 90th, 95th, or 98th percentile of the day and nighttime temperature distribution during the study period. This approach allows the Contractor to consider night temperature given studies suggesting its critical role. Third, the Contractor will also simply define heat day as a day with temperatures exceeding the temperature threshold that cooling center uses to operate: 105 degrees Fahrenheit. Lastly, where data are sufficiently available for pre- and post-intervention periods, the Contractor will use the National Weather Service's Heat Risk data to define heat day. This tool captures heat risk using a few different considerations[17]:

- How unusual the heat is for the time of the year?
- The duration of the heat including both daytime and nighttime temperatures.
- If those temperatures pose an elevated risk of heat-related impacts based on data from the CDC.
- Humidity indicators.

Heat risk score output ranges from 0-4 as described in Figure 2 below. The Contractor will define a heat day as a day with risk score exceeding three (3) or four (4). Other cut-offs will also be explored as appropriated.

Figure 2. The National Weather Service's Heat Risks Scores

Category	Risk of Heat-Related Impacts
Green 0	Little to no risk from expected heat.
Yellow 1	Minor - This level of heat affects primarily those individuals extremely sensitive to heat, especially when outdoors without effective cooling and/or adequate hydration.
Orange 2	Moderate - This level of heat affects most individuals sensitive to heat, especially those without effective cooling and/or adequate hydration. Impacts possible in some health systems and in heat-sensitive industries.
Red 3	Major - This level of heat affects anyone without effective cooling and/or adequate hydration. Impacts likely in some health systems, heat-sensitive industries and infrastructure.
Magenta 4	Extreme - This level of rare and/or long-duration extreme heat with little to no overnight relief affects anyone without effective cooling and/or adequate hydration. Impacts likely in most health systems, heat-sensitive industries and infrastructure.

Heatwave will be defined as two, three, or four consecutive heat days. Additionally, the Contractor will follow the California's Extreme Heat Action Plan's definition and define heat event as two or more days and nights of temperatures exceeding the different heat day thresholds described above.[18] In addition to temperature, the Contractor will also explore apparent temperature and consider minimum as well as maximum temperatures for the heat event definition. Apparent temperature is a measure that captures how a heat environment feels like to the human body. It has been increasingly used in study of heat impacts and is a measure of heat index and incorporates the effects of humidity.[19-23]

Health outcome measures. Preterm birth will be defined as any delivery before 37 completed weeks of gestation, which will be ascertained from birth certificate from California Vital Statistics. The Contractor will also assess outcomes related to asthma, cardiovascular diseases, psychiatric outcomes, and heat-related events using patient discharge data and ED visits data from HCAI. These outcomes will be identified using primary International Classification of Disease (ICD) diagnosis codes (i.e. where these outcomes were the main reason for ED visit or hospitalization). For data before October 2015 (the Contractor proposed to use data for 2019 and later, but this is for if UCM end up needing with an old intervention and need them), we will use ICD version 9; otherwise, version 10, will be used. For the purpose of this proposal, we will be using the primary diagnosis ICD codes specified in Table 1 below.

Table 1. Health outcomes evaluated in the study						
Outcome Categories	Specific Diagnoses of Interest	ICD-9 Codes	ICD-10 Codes	Spatial Resolution	Temporal Resolution[b]	Time Frame[c]

Birth outcomes	Preterm birth (<37 weeks gestation)	NA, will be assessed using birth certificate	NA, will be assessed using birth certificate	Zip-code	Daily or monthly	2019-2023
Respiratory outcome	Overall diseases of the respiratory system	460-519	J00-J99	Zip-code	Daily or monthly	2019-2023
	Asthma	493	J45	Zip-code	Daily or monthly	2019-2023
Cardiovascular outcomes	Overall	390-459	I00-I99	Zip-code	Daily or monthly	2019-2023
	Acute myocardial infarction (heart attack)	410	I21, I22	Zip-code	Daily or monthly	2019-2023
	Cardiac arrest	427.5	I46	Zip-code	Daily or monthly	2019-2023
	Heart failure	428	I50	Zip-code	Daily or monthly	2019-2023
	Hemorrhagic stroke	430,431,432	I60, I61, I62	Zip-code	Daily or monthly	2019-2023
	Ischemic stroke – transient ischemic attack	433,434,435, 436	I63, G45.9	Zip-code	Daily or monthly	2019-2023
Psychiatric outcomes	All psychiatric conditions	290-316	F01-F69, F90-F98	Zip-code	Daily or monthly	2019-2023
	Depression	296.2-296.3, 311	F32-F33	Zip-code	Daily or monthly	2019-2023
	Anxiety	300.0	F40-F41	Zip-code	Daily or monthly	2019-2023
Heat-related outcomes	All	E900, 992	X30, T67	Zip-code	Daily or monthly	2019-2023
Homelessness [a]	Homelessness (to identify unhoused population	V60.0	Z59.0	NA	Daily or monthly	2019-2023

[a]This is not a health outcome of interest but is an indicator to identify whether someone is coded as unhoused.
[b]This measure will either be daily or monthly depending on how the data will look after preliminary analyses.
[c]This timeframe is finalized when we know exactly what intervention is selected to be evaluated.

These health outcomes will be identified from the data sources and aggregated at the weekly or monthly level for each zip code for analysis. The Contractor will also aggregate data by individual characteristics including age, race/ethnicity, sex, primary language, and insurance status (as a proxy for socioeconomic position).

These individual characteristics will be assessed using birth certificate for birth outcomes and HCAI data for the rest of the health outcomes.

Covariates. Given air pollutants may be potential confounders of the relationship between the intervention and health impacts, the Contractor will also be obtaining data on particulate matter <2.5 microns and ozone from the San Joaquin Valley Air Control District.[24] These data were interpolated by the Air District using a regression-based approach that incorporates outputs from the Community Multi-scale Air Quality models, local observed pollution data, as well as emission. The data is publicly available at https://apps.valleyair.org/waaqs/.

Subtask 2.4. Statistical Analysis

The Contractor will use Poisson regression models to evaluate pre- and post-intervention differences in the various health and environmental indicators as previously described. To inform optimal spatial distribution of cooling center and to account for potential spatial dependence in terms of usage (i.e. people are more likely to benefit if they live closer to the cooling center), we will also analyze data hyper-locally. In other words, we will be analyzing data for zip codes with cooling centers while considering k-th neighbor effects on the first, second, and third order (the first, second, and third adjacent zip codes). Where appropriate, the Contractor will also incorporate information regarding hours of operation to evaluate its contribution to health benefits. Other accessibility measures will be explored in Task 3. Given the potential lag effects of cooling centers are likely limited (i.e. within a week), the Contractor will explore potentially delayed health benefits of the intervention by considering a lag structure for two weeks (or 1 month if the Contractor ends up having to use month as the temporal resolution). The Contractor can also explore longer lags based on preliminary analyses. The Contractor will adjust analyses for important confounders such as co-pollutants such as humidity, fine particles, and ozone. The Contractor will use the statistical model below.

$$log(\lambda_{ijk}) = log(pop_i) + \beta_0 + \beta_1 t_{jk} + \beta_2 month_j + \beta_3 year_k + \beta_4 humidity_{ijk} + \beta_5 PM2.5_{ijk} + \beta_6 O_{3\,ijk} + \beta_7 neighbor_i + \beta_8 neighbor_i \times t_{jk} + \delta_{ijk} ;$$
$$Y_{ijk}|\lambda_{ijk} \sim Pois(\lambda_{ijk})$$

Here Y_{ijk} reflects the outcome observed at the ith zip code, in the jth month and k^{th} year, where i = 1, …, 44; j = 1, …, 6 (the six warm months); and k = 1, …, 4. We include an offset to account for different zip code population sizes. The covariate will count the number of months that have occurred after the intervention occurred (or be set to 0 if the intervention had not occurred yet). Humidity, $PM_{2.5}$, and ozone will be measured at each zip code at each time point. The neighbor covariate is defined as 0 if the intervention was performed in a zip code, 1 if the zip code is directly adjacent to the intervention zip code, 2 if the zip code is not adjacent to the intervention zip code but is adjacent to one that is, etc. The intervention of the neighbor covariate and the time from intervention will be used to determine if effects seen in the health outcome varied by distance to the intervention zip code. The Contractor will also conduct sensitivity analyses to adjust for duration of heat events (# of days). If found significant, this variable will be added to the main model. Important information from Task 3 will also be incorporated into our final model as appropriate (e.g., the number of people using the cooling centers, etc.).

To explore susceptible populations (i.e. those who may have benefited more/less), the Contractor will also perform analyses by various socioeconomic indicators at the individual and contextual level identified through CalEnviroScreen 4.0[25] and the California Healthy Places Index (HPI).[26] More specifically, for the contextual characteristics obtained from CalEnviroScreen, the Contractor will define disadvantaged neighborhood using the provided environmental burden scores. A neighborhood is considered disadvantaged if it scores in

the top 25th percentile. For those obtained from the California HPI, we will define a disadvantage neighborhood as those with the lowest 25th of the scores. The Contractor will also explore outcomes specifically among the unhoused population as indicated in their ED and hospitalization data.

Where data are available, the Contractor will explore joint effects of interventions by comparing observed joint effects to their expected independent effects. More specifically, the Contractor will be evaluating the independent effects of one intervention in areas that only had that intervention implemented using the methods described approached. The Contractor will then evaluate the independent effects of the other intervention. These analyses will allow us to estimate the independent effects of these two interventions separately. The Contractor then finds an area where both interventions were implemented and estimates their joint effects. By comparing the independent effects and the joint effects, the Contractor can explore the potential synergism of the two interventions.

Lastly, using the health reduction estimates, the Contractor will estimate counterfactual outcomes hadn't the intervention(s) been implemented. More specifically, using pre-intervention data together with known information regarding temporal fluctuation, the Contractor will project future rates of health outcomes in the study area. This would represent the counterfactual hadn't the intervention been implemented. The Contractor will then estimate the number of outcome cases that were prevented by the intervention post-intervention and will also project this benefit into the future.

Power analysis. A power analysis with a Type I error of 0.05 was performed using selected health outcomes including preterm birth and cardiovascular ED and PDD rates (Figure 2). There will be 1,056 (44 zip codes x 6 months x 4 years) of observations. Preliminary data suggests approximately 100 preterm birth events per 1000 birth events per month. Dividing this by 44 zip codes, we expect 2.27 preterm birth events per zip code per month. Power was calculated detectable relative risks ranging from 0.85 (medium effect) to 0.99 (very small effect). The study achieves power of 80% when the relative risk is 0.94 or lower. While birth events may be assumed to be independent, a sensitivity analysis penalized the sample size by 25% to account for information loss due to spatial and longitudinal associations and similar findings were found. As preliminary data for cardiac emergency department visits and hospitalizations had higher rates (~134 and ~289 per month, respectively), the minimum detectable relative risk was at least as large. For 80% power, it was 0.94 or lower for ED visits and 0.98 or lower for hospitalizations. Where power is limited, the Contractor will aggregate data over several zip codes to increase counts and may also consider a larger temporal window and/or resolution.

Figure 2. Power analysis
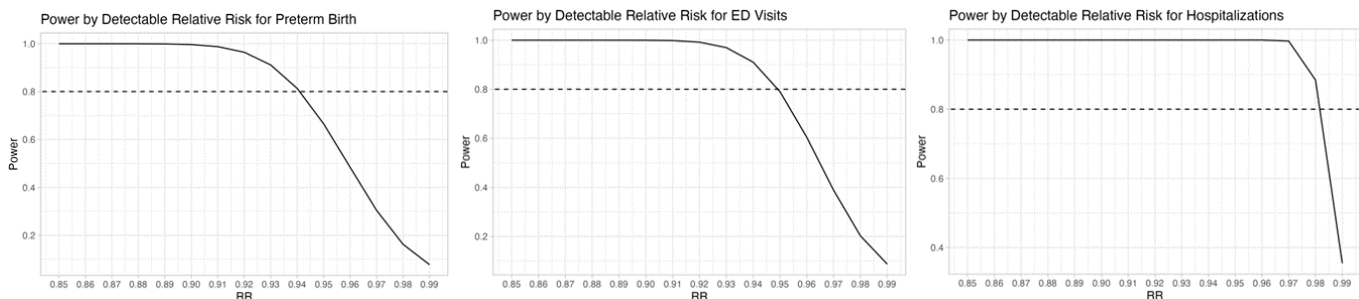
Subtask 2.5. Ongoing Engagement.

Community partners will be informed all the analysis in Task 2 (as in Task 1). The Contractor will hold regular team meetings to review data, plan further analyses and share interim findings. A plan of our engagement efforts is presented below.

- Months 1-3: Share data analysis plan with CAB for feedback and revise.
- Months 8-9: Share draft findings with CAB for feedback/insights.
- Months 9-10: Run any additional analyses based on CAB feedback.
- Month 3-12: Report development.
- Month 12: Progress check-in to close Task 2.

Task 2 deliverable: The Contractor will generate a report with documentation of the approach and study findings related to the estimated health benefits and co-benefits (if applicable) of the selected heat adaptation strategy(ies).

Task 3. Ground-truth the Health Benefits of the Heat Adaptation Strategies and Assess Community Perspectives

In the context of this evaluation, ground-truthing refers to the use of a range of qualitative and quantitative research methods to a) determine the degree to which the intervention is operating as planned and meeting identified objectives (i.e., fidelity to the model), b) assess community members' knowledge, behaviors and attitudes related to the program, and 3) identify and measure health benefits, co-benefits and unintended consequences and impact on health disparities. Ground-truthing priorities and methods will be co-determined by the research team and the CAB and will be tailored to the intervention selected. The Contractor will use qualitative and quantitative methods such as key informant interviews, focus groups, and a community survey. Data will be analyzed using content analysis in which the objective is to systematically transform text into highly organized and concise summaries of key results. The Contractor will analyze raw data from verbatim transcribed interviews to form categories or themes and identify and condense meaning units, coding, and categories, returning to the raw data to reflect on our initial analysis and iterating until meaning units can capture a core meaning. The analysis is a flexible adaptive and reflective process of working and re-working the data to reveal connections and relationships. The analysis involves familiarizing with the data, dividing up the transcripts and texts into meaning units and subsequently condensing these meaning units, formulating codes, and developing categories and themes.

Subtask 3.1. Methods and Tool Refinement.
Based on the findings of Task 2, the research team and CAB will revisit the ground-truthing plan and adjust as needed. The research team will design data collection instruments and share them with the CAB for feedback before finalizing for submission to the IRB for approval for use. This process is expected to take place between months 11 and 13.

Subtask 3.2. In-depth Interviews and Focus Groups.
Key informant interviews with cooling center and county staff members who deploy, manage, and communicate with the public about these interventions. Specific data points that will be collected will be: circumstances regarding the cooling centers such as where they are deployed, if they are in dedicated centers versus ad hoc areas such as at local libraries, the hours and operations and rules they have for visitors, and if any transportation option is offered. Compensation for interviewees who are able to accept compensation will be $50 per interview with an anticipation of conducting at least 10-15 interviews. Interviews will also be conducted with local healthcare providers to explore their perceptions and experiences related to heat-related health impacts, trends, and heat adaptation interventions.

If needed, in-depth interviews and/or focus groups will be conducted to gather further information on program benefits and needs for improvement, particularly with representatives of or those working with harder-to-reach populations such as outdoor workers and unhoused people. CAB and community partners will identify interviewees using snowball and convenience sampling. Interviews and focus groups will be conducted around months 11-12, and then in conjunction with community science (approximately months 16-19).

Subtask 3.3. Community Science.
CAB members will recruit community members who will be trained in data collection and will be guided by members of the research team and/or colleagues from their academic institutions. Recruitment is expected to take place in months 12-13, with data collector trainings taking place in months 14-15 and field research conducted in months 16-19. In the cooling center example, data collectors would visit a sub-set of cooling centers throughout the county on days meeting the program's criteria for being open (e.g., outdoor temperature is at or above 105 degrees F) to document conditions and utilization. A random time of the operating hour will be selected to ensure representation. A paper/electronic form will be used to document characteristics including: whether the center was open under the conditions specified by the program (e.g. outdoor air temperature threshold met), presence of outdoor signage and languages in which signage was available, number of people utilizing the facility during a 180 minute period (3 hours), number of people waiting to enter facility if over capacity; compliance with Americans with Disabilities Act Accessibility requirements; availability of drinking water at cooling center; amenities offered to people and whether there are places for privacy and for people to work (e.g., internet access, etc.). Air temperatures outside and inside of the cooling center will be measured using two air thermometers. Data collectors will also observe who is using the facilities (e.g., children, adults, older adults, etc.) and how they are using them.

Subtask 3.4. Community Survey.
An electronic survey will be co-developed with the CAB and deployed broadly throughout the county in English and Spanish to ascertain community members' reported knowledge of cooling centers (and how they learned about them); use of centers; attitudes about centers (e.g., safety, accessibility, comfort); perceived benefits, barriers and facilitators of use, and preferred channels for receiving information. Other aspects such as what could be improved will also be ascertained in the survey. If available, data collected by cooling center programs will be analyzed. The survey instrument and data collection protocol will be refined based on pilot and interview findings. The expected timeframe for the community survey is months 16-20.

Subtask 3.5 Data Analysis and Sharing.
Quantitative data will be analyzed using a series of regressions where the form of the data determines what models are constructed. Qualitative data will be analyzed through content analysis. The Research Team will share findings with the CAB for feedback and further inquiry, and revise and summarize findings. If our quantitative and qualitative data do not agree, the Contractor will work with the CAB to take this as an opportunity to explore potential explanations and identify areas for further work.

Task 3 Deliverables: The Contractor will provide results and analysis of ground-truthing activities, including survey data results in aggregate and overall themes that emerge from the qualitative data.

Task 4: Perform Cost-Effectiveness Analysis of the Heat Adaptation Strategies

Based on the heat adaptation strategies identified in Task 1, the intervention effect estimates from Task 2, and insights gained from the ground-truth process in Task 3, a microsimulation model will be used to (1) estimate the long-term impact of different interventions and (2) estimate the cost effectiveness of these interventions. Microsimulation models allow researchers to simulate individual behaviors, preferences, and health outcomes over time, and are commonly used in public health to quantify the population-level health impact (e.g., in disability adjusted life years) of an intervention under a wide range of plausible scenarios. While other simulation approaches, such as Markov cohort models, are computationally less demanding, they focus on population averages and are unable to easily simulate important population heterogeneity — a crucial aspect when evaluating the racial/ethnic equity of interventions. For the purposes of this project, it will be assumed that the intervention of interest is the rollout of local cooling centers and that the impact of this intervention has been quantified in Task 2. Additionally, it will be assumed that important community-based insights from the ground-truthing process in Task 3 were acquired, such as higher likelihood of going to

cooling centers located at senior centers among the older population but non-senior centers among younger population. The Contractor notes that the microsimulation approach could be used for any intervention.

Subtask 4.1. Creation of Baseline Scenario for Microsimulation.
In the microsimulation model, a baseline scenario (i.e., status quo) will be created using tract-level age-, sex-, and race/ethnicity-specific population estimates from the US Census Bureau covering the same period as the final analysis conducted in Task 2. Prevalence estimates for the health outcomes outlined in Table 1 will be used to calculate the total disability-adjusted life years (DALYs) accumulated over a ten-year period with no interventions (in this case local cooling enters), assuming these prevalence estimates remain stable on their estimated secular trends and the US Census population projection estimates are accurate.

Subtask 4.2. Integration of Intervention Scenarios.
The baseline scenario will be modified by incorporating the effect estimates calculated for each health outcome in Task 2, and the discounted DALYs accumulated over a ten-year period attributable to the intervention of interest will be calculated. Where enough data are available, heterogeneous treatment effects by race/ethnicity, age, and sex will be incorporated. Estimate uncertainty will be incorporated by drawing effect estimates from a uniform probability bounded by the 95% confidence interval of the estimates. While local cooling centers are generally low-cost interventions, the number of DALYs saved per dollar under a range of reasonable economic scenarios that incorporate the cost of running local cooling centers (e.g., extra staffing hours, providing water, increased electricity) will be estimated.

Subtask 4.3. Full Microsimulation to Assess Cost Effectiveness.
Incorporating insights from the community. Based on the insights from Task 3, different behavioral responses to intervention effectiveness will be simulated. In this example, it will be assumed that insights from Task 3 indicate older populations prefer local cooling centers located at senior centers while younger populations prefer to avoid senior centers. The impact of increasing the number of senior-center based cooling centers in a simulation can be evaluated. For example, in a scenario where resources are limited such that the opening of a new local cooling center requires the closing of an existing one, the population level impact (in DALYs) of replacing a cooling center with one based at a senior center can be evaluated.

Effectiveness of outreach programs. Again, based on insights from Task 3, the impact of increasing outreach programs among community members who are both vulnerable and have low cooling center utilization can be simulated. Simulations can include a range of plausible effectiveness of different outreach campaigns and account for a range of plausible costs for each campaign to identify interventions that may be particularly high yield.

Throughout all scenarios, uncertainty in the population estimates and effect sizes will be incorporated by drawing from an appropriate distribution for each simulation and repeating simulations 100,000 times, reporting the median and middle 95%ile. Community partners will inform this analysis (as in previous tasks). In Task 4, the Contractor will hold regular team meetings to review data, plan further analyses and share interim findings.

Task 4 Deliverable: The Contractor will provide a written summary of simulation and findings including extensive sensitivity analyses of important assumptions/parameters based on CAB feedback

Task 5. Recommend Heat Adaptation Strategies in Response to Health Benefits and Community Perspectives

The CAB will develop community-specific and state-based recommendations including the results from Tasks 1, 2, 3, and 4 and the implications of the strategy from the perspectives of the community to inform future directions and investment in heat adaptation strategies specifically as it relates to the intervention studied.

This may include, for example, recommendations to increase the number of cooling centers or the hours of operation or to consider changing locations of cooling centers based on use by the community and will incorporate not only the cost-effectiveness findings (Task 4) but also the ground-truthing findings (Task 3) and health benefits findings (Task 2). Additional recommendations could include that adaptations may not address the root cause of the heat-related health disparities and should be layered with other interventions that can address the root cause of climate-related health impacts. The Contractor will also recommend possible approaches for ongoing, systemized, and sustainable ground truthing (such as employing community members to conduct specific activities such as monitoring use of the cooling centers or the hours of operation) to ensure interventions are being monitored consistently over time.

Task 5 deliverables: The Contractor will provide an overview of the benefits of the selected intervention and recommendations for informing, prioritizing, and implementing heat adaptation strategies to maximize health benefits and address the community's needs or local context.

Task 6. Disseminate and Translate Research Findings

Subtask 6.1. Community Dissemination Plan.
The Contractor will disseminate results in a multimodal format amongst various interested group networks, collaborators, organizations, and the broader public. The Contractor will work closely with the CAB and community partners to disseminate findings jointly to participants and local community members, health care and public health practitioners, payers, and policymakers upon completion of Task 3 and, if time permits, upon completion of Task 4. We will share information on websites and through social media in collaboration with our universities and community partners. All information will be available in plain language in English and Spanish. The Contractor will also share information through existing forums, channels, public awareness/safety campaigns – including statewide campaigns like Listos CA, Heat Ready CA, and via channels/partners that work with heat-vulnerable populations (e.g., CBOs, groups serving ag workers who may be undocumented, not be proficient in English, etc.) The Contractor, along with the CAB, will create one-page infographics and flyers regarding the project and results and host at least one virtual town hall meeting inviting participants, community members, and other interested parties to attend to learn about project findings and recommendations upon completion of the overall project. This will also serve as a re-engagement opportunity in providing us with additional feedback regarding the evaluation findings and recommendations.

Subtask 6.2. Project Reporting and Other Deliverables.
The Contractor will meet with CARB staff quarterly and submit quarterly progress reports (and progress meetings as needed) using the CARB-designated template, and in invoice for the same period will accompany each progress report.

Nine months prior to the end of the study, the Contractor will submit a draft final report (DFR), which will include the results of the project, and the additional deliverables identified in Exhibit A1, Deliverables. The DFR will be submitted in accordance with the Final Report format and will be reviewed by CARB staff. CARB's comments will be sent to the Contractor and after receiving the reviewer's comments, the Contractor shall modify and resubmit the modified DFR to the CARB Project Manager. The modified DFR will be subject to formal review by the Research Screening Committee (RSC). Once accepted by the RSC, the Contractor will revise the modified draft final report addressing the RSC comments and any remaining concerns from CARB staff and will submit the revised final report to CARB. If CARB has additional comments on the report, the Contractor will be notified so appropriate changes can be made; otherwise, CARB will accept the revised final report as the final. The Contractor will submit the final report in an Americans with Disabilities compliant format. A notation in the Final Report task should denote that the University will incorporate a one-page Public Outreach Document into the Final Report, that will be widely used to communicate, in clear and direct

terms, the key research findings from the study to the public. The format for the Public Outreach Document is outlined in Exhibit A1 Public Outreach, Section 2.

At the contract start, the Contractor will develop a 1-page plain-language project summary in consultation with CARB staff. The Contractor and CARB will hold a public seminar at the contract close to communicate project results. All manuscripts developed in the project will be sent to CARB for review before submission to the scientific journals for peer review.

Task 6 Deliverables: The Contractor will generate dissemination materials and products in various formats based on audiences' needs and preferred communication channels, in English and Spanish, and deliver quarterly progress reports, a final report, a public seminar and other deliverables outlined in Exhibit A1 to CARB.

Conclusion

This project, co-developed with perspectives and experiences of disproportionately impacted community members, will robustly assess heat adaptation strategy on health and health disparities in Kern County. The project aims to evaluate the health benefits of a specific heat adaptation strategy and the impact on health disparities.[27] The Contractor will provide recommendations incorporating the associated benefits from a health perspective and potential social benefits as well as potential economic benefits for adaptation and investments that are translatable to other parts of the state. This project will provide recommendations regarding how to conduct low-cost, routine monitoring and evaluation using ground-truthing methodology with a focus on continuous improvement.

Table 2. Activities and Deliverables by Task (Research Team & CAB)

Task #	Subtask Label	Activities	Estimated Timeframe (month #)
Task 1. Co-Develop the Overall Research Project Plan and Specific Case Studies by Investigators and Community Partners			
	IRB Approval	Research Team will lead process of obtaining IRB approval from UC Merced, Stanford and California Committee on the Protection of Human Subjects.	**Pre-award period**
1.1	**Project Start-up**	**Initial meeting with CARB** • PIs, key personnel and CARB staff will meet to discuss overall plan, project schedule, personnel/changes in personnel, and any issues that need to be resolved before work can begin. **CAB Membership** • Research Team will virtually convene or consult existing CAB members to identify missing/under-represented groups. • Research Team and CAB member(s) will recruit new members.	**Month 1**

		Onboarding and Logistics • Research Team and CAB member(s) will onboard new members. • Research Team will schedule CAB meetings. • Research Team will schedule monthly research team check-in meetings to review progress. • Research Team will identify 3-5 interventions that meet minimum criteria in preparation for CAB selection process.	Month 2

		CAB+CARB Meeting 1 (in person or virtual)
		• Research Team, CAB and CARB will jointly develop agenda, emphasizing community dialogue and likely including the following items:
		  • Introductions (Research Team, CAB members, CARB representatives).
		  • Overview of the project purpose and aims.
		  • Development of equity-based collaboration principles, including reviewing/revising statement of cultural humility and best practices included therein.
		  • Review and revision of ground rules for respectful meetings (Appendix C & D).
		  • Setting expectations for attendance and participation.
		  • Defining roles, responsibilities, and processes.
		  • Identifying topics for capacity building/mutual learning.
		• Research Team will disseminate post-meeting temperature check survey (Appendix E & F).
		• Research Team and CAB will summarize meeting proceedings and outcomes.
			Month 3-4

1.2	Trust and Capacity Building Workshops	CAB Meetings (in person or virtual):
		• Research Team and CAB engage in trust-building exercises such as a discussion of hopes and fears, a project premortem, and visioning.
		• Research Team and CAB engage in capacity building and mutual learning on agreed-upon topics, for example:
		  • Identifying state-supported heat adaptation strategies
		  • Accessing public health data
		  • Ground truthing methodology
		• Discuss the necessary data and assess gaps.
		• Disseminate post-meeting temperature check survey (Appendix E & F).
		Racial Equity/Implicit Bias training to be completed by investigators and key personnel by end of month 3.
			Month 2-6

1.3	Intervention Selection	• Research Team presents minimum criteria, basic profiles of possible interventions with the CAB, and draft additional criteria for consideration. • CAB members and Research Team refine criteria. • CAB members engage in selecting an intervention and will also be able to propose interventions not included on the list.	Month 4-6

1.4	Co-Designing Evaluation Plan	• Research Team and CAB discuss and co-design review and ground-truthing methods. • Research Team drafts case study and project work plan; CAB reviews; items finalized.	Month 5-7
1.5	Community Engagement Plan	**Planning** • Research team and CAB develop a community engagement plan. • With the MLK CommUNITY Initiative and other partners, create a partnership agreement form (Appendix I). • Research Team and CAB identify communication channels and formats for priority audiences; draft communications plan.	Month 1-5
		Public Kick-off Meeting Preparations • CAB will identify location and time for event in Kern County. • Research Team, CAB and CARB advertise meeting to English and Spanish-speaking community members. A sample town hall flyer from a past project is included as a model (Appendix G & H). • All other logistical and planning tasks identified, assigned and conducted.	Month 4-6
		Public Kick-off Meeting Held (in person) • Attendees have opportunity to provide input on project and feedback on meeting and can sign up to stay informed.	Month 7-8
1.6	Task 1 Closeout	• CAB check-in on process and progress; identify and address necessary changes. • Research Team will lead finalization of all Task 1 deliverables.	Month 9

Task 1 Deliverables:
- Document outlining equity-based collaboration principles
- Detailed project workplan indicating all activities and responsible parties
- Summary of meeting proceedings or meeting notes
- Case study for selected intervention
- Revised community engagement plan
- Communications plan
- Town hall flyer/promotional materials
- Summary of Town Hall
- List of Town Hall attendees wishing to stay engaged

Task 2. Estimate the Health Benefits of the Heat Adaptation Strategies (all subtasks to be led by the Research Team)

2.1	Study Design	• Adjust proposed study design based on selected intervention, i.e. health outcomes and data sources. • Ensure sufficient pre- and post-intervention data. • Continue monthly research team check in meeting to review progress. • Start IRB and data requests from relevant state agencies (HCAI and Vital Statistics). • Start report writing for Task 2.	Month 1-5

2.2	Data Collection	• Obtain health data from relevant sources (can be a couple months wait). • Obtain relevant temperature from San Joaquin Valley Air District and other publicly available sources.	Month 6
2.3	Data Management and Measure Constructions	• Employ interrupted time series design. • Conduct data cleaning and management. • Construct heat measures and identify outcomes.	Months 6-8
2.4	Statistical Analysis	• Use Poisson regression to evaluate intervention benefit. • Stratify analyses by socioeconomic indicators. • Adjust for confounders. • Estimate counterfactual outcomes. • Prepare tables/figures for report. • Finalize report for Task 2.	Months 8-10
2.5	Ongoing Engagement	• Process and progress check-in, and task closeout.	Months 11-12

Task 2 Deliverables:
- A report outlining the approach and findings related to the estimated health benefits and co-benefits (if applicable) of the selected heat adaptation strategy(ies).

Task 3. Ground-truth the Health Benefits of the Heat Adaptation Strategies and Assess Community Perspectives

3.1	Methods and Tool Refinement	• Research Team and CAB will review ground-truthing process and revise if needed. • Research Team will design data collection instruments with CAB input and submit to IRB as amendments.	Months 11-13
3.2	In-depth Interviews and Focus Groups	Research Team and CAB will conduct interviews and focus groups to underserved and/or hard-to-reach populations.	Months 11-12 16-19
3.3	Community Science	**Recruitment and training** • CAB will assist with recruiting community members to serve as data collectors. • Research Team will train data collectors to conduct ground truthing per protocol through a series of workshops. • Engage them in collecting data and analyzing results.	Months 12-13 (recruitment) 14-15 (training)
		Field Research • Data collectors will conduct field research, with support from Research Team, per protocol. • Data collectors and Research Team will debrief, adjust plans as needed after initial visits.	Months 16-19

3.4	Community Survey	Research Team and CAB will deploy survey broadly throughout the county in English and Spanish to assess knowledge, beliefs, attitudes and behaviors related to intervention.	Months 16-20
3.5	Data Analysis and Sharing	Research Team analyzes data using qualitative and quantitative methods; presents findings to the CAB and receives feedback; documents results.	Month 19-23

Task 3 Deliverables:
- Results and analysis of ground-truthing activities, including survey data results in aggregate and overall themes that emerge from the qualitative data.

Task 4: Perform Cost-Effectiveness Analysis of the Heat Adaptation Strategies

4.1	Creation of Baseline Scenario for Microsimulation	Research Team will begin gathering data (e.g., US Census data) and other information necessary to begin the creation of the baseline scenario that will provide the foundation of the microsimulation.	Month 9-10
4.2	Integrate Intervention Scenario	Research Team will then integrate the findings from Task 2 into the microsimulation to create an intervention scenario.	Months 13-15
4.3	Full Microsimulation to Assess Cost Effectiveness	With feedback from the CAB, Research Team will begin incorporating the community insights from Task 3 into the simulation.	Month23-24

Task 4 Deliverables:
- Written summary of simulation and findings including extensive sensitivity analyses of important assumptions/parameters based on CAB feedback
-

Task 5. Recommend Heat Adaptation Strategies in Response to Health Benefits and Community Perspectives

	Case Study and Recommendations	Research Team and CAB develop recommendations based on analyses and community feedback. Prepare findings for dissemination in multimodal and plain language formats.	Months 25-26
Task 5 Deliverables: • Written summary of the recommendations.			
Task 6. Disseminate and Translate Research Findings			
6.1	**Community Dissemination Plan**	Research Team, CAB, CARB liaisons, and community share findings and re-engage community through multimodal formats including: • One-page infographics and flyers • Virtual town hall meeting • Plain language materials in English and Spanish	**Months 27-28**
6.2	**Project Reporting and Other Deliverables**	Research Team prepares and submits the following deliverables to CARB: • Quarterly progress reports (and meetings as needed) • A draft final report and a final report • A 1-page plain-language project summary • A public seminar	**Months 1-36**
Task 6 Deliverables: • Copies of all infographics and flyers. • Recording of town hall meeting(s). • Final report and all deliverables outlined in Exhibit A1.			

DATA MANAGEMENT PLAN

The Contractor will use appropriate data management and storage standards to manage and store all data generated by the proposed project. Data will be spot checked and compared during regular meetings among the Contractor to ensure data quality and timeliness. Any data anomalies will be discussed at regular meetings, and when necessary, we will discuss with data collectors and/or data providers such as HCAI or Vital Statistics with questions. When appropriate, metadata will be added to the data to reproduce basic analyses and will be well structured and commented. Interim datasets will be accessible to all approved project personnel via password-protected servers at UC Merced and Stanford during the lifetime of the project and the generation of publications that extend beyond the end of the project. The project has protected health information and IRB approvals will be obtained from all involved institutions before the study begins. The original data collected from the study will not be shared with anyone outside of the study team. The team will not use the data beyond the intended research purposes. All data will be stored appropriately within REDCap or secure, PHI-safe folders as approved by IRB. Transcripts will be de-identified, and recordings will then be destroyed. Aggregated results of the study will be published open access and available to all interested stakeholders without additional permissions or fees. Any errors noted after publication of the data, by our research team or by others, will be communicated immediately to the archive and will follow their guidance for updating the data and metadata.

PROJECT SCHEDULE

Task 1: Co-Develop the Overall Research Project Plan and Specific Case Studies by Investigators and Community Partners
Task 2: Estimate the Health Benefits of the Heat Adaptation Strategies
Task 3: Ground-truth the Health Benefits of the Heat Adaptation Strategies and Assess Community Perspectives
Task 4: Assess Economic Impacts of the Heat Adaptation Strategies
Task 5: Recommend Heat Adaptation Strategies
Task 6: Disseminate and Translate Research Findings

TASK	MONTHS 1-18																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	■	■	■	■	■	■	■	■	■									
2	■	■	■	■	■	■	■	■	■	■	■	■						
3											■	■	■	■	■	■	■	■
4								■	■			■	■	■	■			
5																		
6																		
	m		pm			pm			pm			pm			pm			pm

TASK	MONTHS 19-36																	
	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	■	■	■	■	■	■												
2	■	■	■	■	■	■	■	■	■	■	■	■						
3	■	■	■	■	■													
4					■	■												
5							■	■										
6									■	■	■	■	■	■	■	■	■	■
	m		pm			pm			pm			dm			pm			fm

p = Quarterly progress report
d = Deliver draft final report (to be submitted six months prior to contract expiration)
f = Deliver final report
m = Meeting with CARB staff

PROJECT MANAGEMENT PLAN

The Contractor brings together a transdisciplinary team of researchers and community members with a diverse range of qualifications and experience necessary for the successful completion of this proposal. Each member has profound expertise on the subject matter, relevant expertise in their respected field, and proven ability to work across discipline on applied research problems. The Contractor has a track record of successful collaboration on complex projects including several past and current projects that can be

leveraged in the proposed work plan. Dr. Ha has conducted extensive research on how various climate change indicators (including heat) impact health across the lifespan. She has collaborated extensively with Dr. Chan-Golston, who is a biostatistician with significant expertise and experience in biostatistical methods and spatial analyses relevant for this proposal. Ha has also previously collaborated with Dr. Patel and her team from Stanford in a project aiming to address wildfire-related health concerns in vulnerable populations in the San Joaquin Valley. Dr. Ha will be responsible for overseeing overall project coordination, administration, and will lead Task 2 involving the use of large population-based data to a) assess the health benefits of heat adaptation strategies (e.g., cooling centers), and b) explore of potential disparities and co-benefits. Dr. Ha will also co-lead Tasks 1 and, 3-6 with Stanford University.

Co-PI Dr. Manali I. Patel, MD MPH MS FASCO is an Associate Professor at Stanford University in the Division of Oncology and will serve as a co-PI and specifically responsible for the community engagement aspects of the entire proposal. Dr. Patel will be responsible for developing and maintaining community partnerships, including leading the HEAT Community Advisory Boards, conducting all the ground-truthing analyses and community engagement-related tasks in this project (Tasks 1, 3, and 4), and co-lead Tasks 5 and 6 with UCM. Dr. Patel will be responsible for project milestones, data collection, management, and analysis related to the ground-truthing aspects of the proposed research.

Dr. Kiang is a Co-Investigator who is an expert in computational social science and social epidemiology as it relates to climate change. Dr. Kiang will participate in all aspects of the study with specific focus on development of an economic simulation model of the projected impact of adaptations and interventions defined by the community.

Dr. Wong-Parodi is a social climate change scientist with expertise using multiple convergent methods -- interviews, surveys, experiments, prospective longitudinal designs, ecological momentary assessments, and remote and personal sensing. She has much expertise in engaging in community-based research and research among vulnerable populations as it relates to behavior and adoptions to climate change. Dr. Wong-Parodi will participate in all aspects of the study, including participating and providing expertise in the ground-truthing components of the proposed research. She will participate in meetings to disseminate findings from the proposed project.

Dr. Patel is also responsible for engaging community partners who will participate as well on this project and are active members of the research team and will serve as consultants for this award. These include Dr. Arleana Waller of the MLK CommUNITY Initiative, Amber Shavers of the Central California Public Health Consortium, Theresa Kiehn, President and CEO of AgSafe, and representatives from the San Joaquin Valley regional office of the American Cancer Society.

Dr. Arleana Waller is the founder of the MLK CommUNITY Initiative and "SheEO" of the ShePower Leadership Academy and the Circle of Life Development Foundation in Bakersfield, California. She has over three decades of experience bridging barriers and providing mentorship to young women facing adversity. Through community-engaged efforts, she has built partnerships between city and community stakeholders to overcome social vulnerability in San Joaquin Valley. She has mobilized grassroots efforts in the San Joaquin Valley to address food insecurity, homelessness, gang violence, and education. She currently lives in the San Joaquin Valley. In collaboration with the research team, the MLK CommUNITY Initiative under the leadership of Dr. Waller will assist with the ground-truthing aspects of the proposed research, specifically hiring 2 community ambassadors to recruit participants for the HEAT Study and facilitating the community advisory board meetings.

Ms. Shavers is a Data Scientist at the Central California Public Health Consortium with experience in data-informed and community-based participatory research to improve equity in San Joaquin Valley and has

extensive networks throughout the region focused on public health. AgSafe is an organization with a primary goal of ensuring the safety of farmworkers and expressed their desire to ensure compliance with risk reduction policies in the county for farmworkers. AgSafe will provide agriculture industry representation on the community advisory board and may assist with dissemination efforts. The regional American Cancer Society advocated for a policy statement from the American Society of Clinical Oncology (ASCO) regarding recommendations to reduce cancer risks due to climate change which is drafted by the ASCO Board Members and will be published soon. ACS is interested in reducing climate-related impacts on community health, including the effects of extreme heat on vulnerable populations such as cancer patients, and will help to connect us with local resources, community groups, and provide representation on the Community Advisory Board.

All personnel will contribute to various research related discussion and papers/report resulting from the work.

The team values open and respectful communication. Given prior successful partnership, we do not expect conflicts, but if they occur, Drs. Ha and Patel will bring them up in an open but respectful manner during team meetings to resolve. With the team's prior experience with community-based research, we will prioritize efforts to make community partners feel heard and valued in all steps of the study. Although unlikely, if a conflict cannot be resolved internally, the team will consult external resources as appropriate. Our organizational chart is presented in Figure 3 below.

Figure 3. Organizational chart
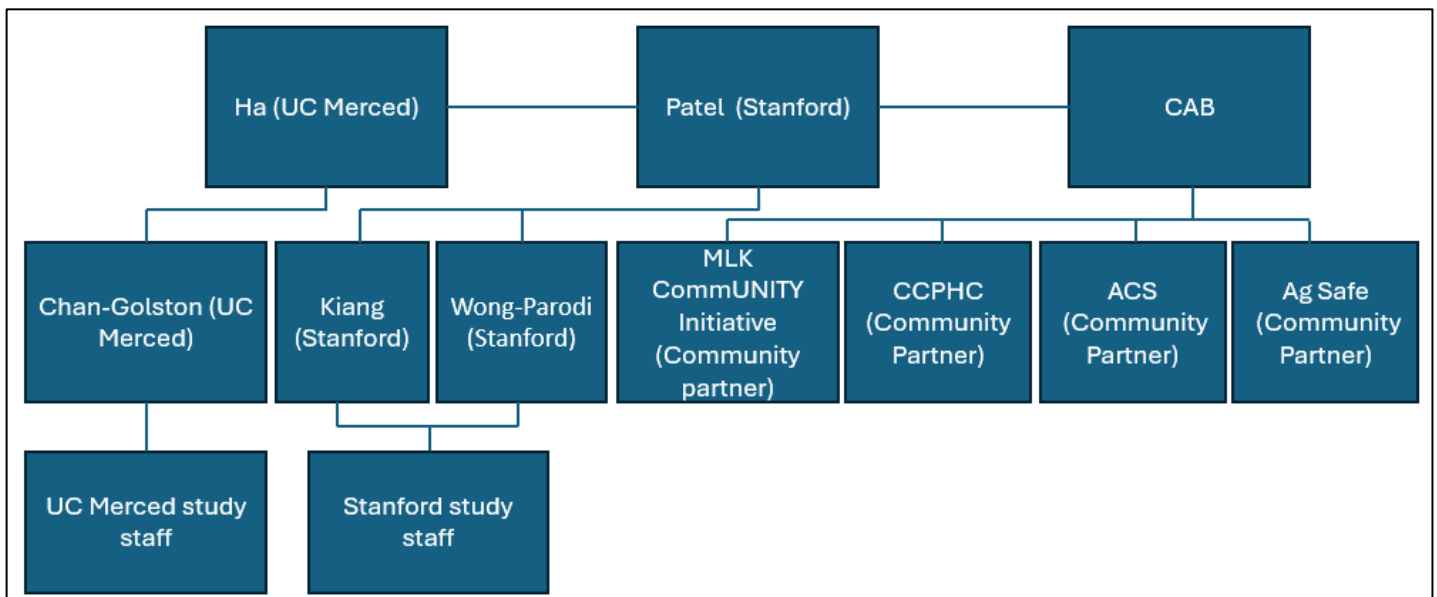
FACILITIES

1. **UC Merced**

The **Environmental and Perinatal Epidemiology Lab**, which Dr. Ha directs, at UC Merced, has a fully-equipped a secured computer lab with multiple workstations connected to a secured server certified for the storage and management of protected health information data. All computers are up-to-date with all security requirements specified by data providers, IRB, and IT standards. Drs. Ha and Chan-Golston all have private and secured office space. Dr. Chan-Golston also has a secured computer lab certified for human subject data. All campus offices are supplied with telephones, LAN line and all buildings on campus are equipped with wired as well as wireless internet access. Additional office space for graduate students is available in graduate student suites in close proximity to faculty mentors. All involved personnel, including students, will have access to all the necessary tools for the successful completion of the proposed research.

Below we briefly describe some relevant resources for this proposed research. More details can be provided if necessary.

Computer. UNIX and Windows desktop and/or laptop PCs are available for all faculty members for research use in their assigned office areas, as well as in laboratories. Faculty, staff and students may access custom built and designed systems utilizing School provided Windows and Linux based laptop and desktop computers using common web browsers. Laptop and desktop computers may access printers via network for easy production of materials. Laptop and desktop computers are loaded with statistical and graphical manipulation software to facilitate data analyses and production of presentation materials. Both wired and wireless networks are supported as well as remote access for seamless communications and Internet use.

Kolligian Library is a 4-story, 215,961 gross square-foot building that houses the campus library and meeting rooms in the four-story east wing, and administrative offices and student services space in the three-story west wing. Additionally, executive campus leadership and administration, a large public gathering space and common dining area, and the campus bookstore are located within the building. The library has 17 group meeting rooms, and dedicated study space as well as library instructional space. As part of the University of California, UC Merced Library shares resources with other campuses and has developed much of its electronic collection in conjunction with the California Digital Library (CDL). The library offers 48 laptops for instruction, 10 public workstations that visitors can use to access library information online, and two high resolution book scanners.

The MERCED Cluster (Multi-Environment Research Computer for Exploration and Discovery Cluster) is available for all faculty projects at no cost. It is a Linux cluster composed of - 100+ nodes with between 20 and 42 cores, from 8G to 256G per machine for a total of 2000+ core and 18T of RAM. - 6 GPU Nodes with 12 NVIDIA Tesla P100- 5 storage nodes for a total of 350TB. All above nodes are interconnected via infiniband w/ RDMA for fast (25Gbits/s) and for low latency (sub ms) data transfer. The network has also been extended over existing infrastructure so that individual labs hosting specialized scientific instrumentation, such as microscopes and imagers, are also connected to provide 10-40Gbps when required. This allows researchers to share their data with centralized computational resources, such as MERCED, or with external collaborators.

Spatial Analysis Research Center. The goal of the Spatial Analysis Research Center (SpARC) Centralized Research Center is to add value and capabilities to UC Merced's existing and planned research, teaching, administrative, and community outreach efforts in the area of spatial analysis and spatial science. Many UC Merced faculty are engaged in spatial sciences including historians and archaeologists, social and cognitive scientists, engineers, computer scientists, environmental scientists, and biologists. SpARC's mission extends across all three academic Schools and has connections with the Sierra Nevada Research Institute, the Great Valley Center, Yosemite National Park, the Center for the Study of Health Disparities, and the Division of Administration. SpARC aims to foster new intellectual collaboration, stimulate new sources of funding, further

innovative and original research, supply research techniques and services to faculty groups, perform services and outreach to the public and support student learning.

Biostatistics and Data Support Consulting Services (currently directed by Dr. Chan-Golston)

The HSRI Biostatistics and Data Support Core provides the following services to UC Merced faculty, students, and other researchers, as well as non-UC community partners conducting research:
- Comprehensive statistical and data analysis support
- Study design and proposal writing assistance
- Primary and secondary data collection
- Database design, security, and maintenance
- Publishing and communication

The BDS Core works on a recharge basis per hour of support and provides support at all research phases. They encourage investigators to collaborate with biostatisticians beginning in the early stages of their project.

Analyzing complex data. They provide statistical expertise for epidemiological, biomedical, and behavioral research projects. The consultants can guide researchers through analyses or conduct them for researchers. Written reports, including methodology and results sections, can be provided as well. Areas of expertise include:
- Complex survey designs
- Longitudinal data
- "Big" data
- Statistical software support, particularly for Stata, R and SAS
- Fitting of statistical models
- Interpreting, visualizing, and summarizing results

Preparing research grants. They can provide the data support for research grant applications. They can assist with:
- Specifying and refining the research hypotheses
- Choosing the specific aims, study outcomes, and appropriate statistical methods
- Reviewing the literature regarding relevant statistical methods
- Performing sample size and power calculations
- Writing statistical analysis plans for grants and IRB submissions
- Providing letters of support to be submitted with the application
- Responding to reviewer comments

Study design planning.
- Determining the appropriate sampling techniques
- Deciding whether an observational vs. experimental design is right for your project
- Identifying the best data collection methods
- Planning proper statistical analyses

Acquiring data. They can help identify and navigate appropriate data sources, including local, state, and national databases.

Cleaning and handling data. They have experience in working with many different types of datasets and can guide clients in managing their data, including:
- Cleaning of current datasets and the creation of new variables
- Designing efficient databases
- Advising for data entry, such as format and structure of data records, variable coding, and treatment of missing data

The Health Sciences Research Institute (HSRI) was established in June 2012 as UC Merced's second Organized Research Unit, with the aim of fostering world-renowned research with student involvement and community engagement.

San Joaquin Valley regional health issues include asthma, obesity, diabetes, cancer, hypertension, heart disease, risky teen behaviors, teen tobacco use, sexually transmitted diseases, hepatitis, and many others.

HSRI has more than one hundred affiliated faculty members across UC Merced's three schools (Engineering, Natural Sciences, and Social Sciences, Humanities & Arts) covering a range of health and medical research. HSRI also allows Graduate Student Members, Clinical Affiliate Members and Community Affiliate Members as part of its commitment to diversity and inclusiveness. The opportunities to address the growing and complex health issues of the San Joaquin Valley and beyond require inter- and multidisciplinary team and, as such, HSRI members are organized by primary research interest:

Health Disparities:
- Environmental Health;
- Biomolecular Research;
- Biosimulation and Modeling;
- Cancer Control and Prevention;
- Immunity and Infectious Diseases;
- Basic & Behavioral Neuroscience, Learning and Development; and
- Health Decision Making

HSRI members are also engaged in research on evaluation and effectiveness research, and public health systems and services research.

HSRI's collaborative multidisciplinary research clusters and community emphasis provide an opportunity to rapidly develop, test, and disseminate new ways of improving health and delivering healthcare. This will help establish UC Merced as a world-renowned research university while improving the health of the people in the San Joaquin Valley.

HSRI faculty support services include:
- Facilitation of interdisciplinary research, from intra- and inter-cluster, topic-specific research meetings, to identifying extramural funding opportunities to develop research ideas;
- Assistance in applying for extramural funding;
- Post-award management; and
- Junior faculty mentoring
- Shared project coordination personnel
- Graphic design and communications services

HSRI facilities are available to all members and include:
- Flexible meeting space with conference-style seating for up to 16 people, informal meeting area and hotel desk space. The meeting room is equipped with a large screen (70") wall-mounted LCD monitor with desktop microphone and web cam for video conferencing and presentations, conference speakerphone and DVD/Blu-ray player.
- Small item lending library for studies and presentations, such as voice recorders, MacBook Pro, desktop LCD projector and portable pop-up 60x80" screen, digital still and video cameras with tripod.

2. **Stanford University**

Stanford University is recognized as one of the world's leading universities with a remarkable range of academic and medical research opportunities. The institution has a strong, well-established didactic and research program that crosscuts the interests represented in this proposal, specifically in oncology and health services research. The Division of Oncology, which is where this research is focused, is renowned for its groundbreaking basic and clinical research. The physicians and researchers in the Division of Oncology at Stanford collaborate closely and use the most current findings to offer sophisticated, quality and innovative care. The Stanford University Department of Health Policy of which Dr. Patel is a member, focuses on health services research and provides full access to both physical and intellectual resources at Stanford University, including quantitative data science research, community-based participatory research, and guideline adherence and creation research. The Department of Health Policy is a multidisciplinary department that conducts rigorous research that lays the foundation for better domestic and international health policy and healthcare. The Department engage faculty, staff, and students from across Stanford University campuses including medicine, economics, statistics, business, law, engineering, and psychology to engage in research on health policy and clinical practice. CHP/PCOR has a long history of hosting conferences, workshops, and seminars. The Department holds a weekly Health Policy/Health Services Research in Progress seminar and invites junior faculty speakers to present their research or present on specific methodological issues. Dr. Patel will present at these seminars throughout the study duration. Dr. Patel also has financial support from the Stanford University School of Medicine with protected time for research with salary support and additional funding to support infrastructure costs for her growing research group. She has dedicated space for her research staff. As a member of the Stanford Cancer Institute, Dr. Patel has access to a patient and family advisory board that provides ongoing feedback and engagement for faculty members' research interests and proposals.

The Stanford Center for Clinical and Translational Research and Education (SPECTRUM) Spectrum is an independent, interdisciplinary center that facilitates clinical and translational research across the university. The mission of Spectrum, Stanford's Clinical and Translational Science Award (CTSA)-supported research hub, is to transform clinical and translational research and education at Stanford to make it more effective at discovering and implementing data-driven strategies to serve the health needs of individuals and the population. Spectrum's programs extend from the earliest stages of the translational pipeline to the "final mile" of implementation science at the patient and population levels. Spectrum leverages local achievements, institutional strengths and resources, and advancements in the focus of the CTSA consortium to nurture an innovative and collaborative workforce that can transfer health discoveries from the University to patients and the community. The CTSA has dedicated resources such as clinical trial assistance, statistical consultants, and grant writing workshops that Dr. Patel will have access to throughout this award. Additionally, the CTSA has a community engagement component that sponsors the Office of Community Health (OCH). The OCH has didactic workshops and activities to help engage researchers in community based participatory research activities.

Meeting and workspace. Dr. Manali Patel's lab is housed at Stanford Research Park at 3180 Porter Drive, Palo Alto, CA 94304. Dr. Patel maintains an office as well as cubicle space for staff. The building is secured by a digital card reader. Dr. Patel's office will provide a secure, locked, IRB-compliant space for data analysis and storage. Additionally, conference rooms, meeting rooms, and call booths are available for faculty and staff use in the building. The office is equipped with desks, chairs, bookshelves, high-speed wired and wireless Internet, filing cabinets, whiteboards, and tables/chairs for group tasks.

Computer: All Stanford investigators and research support staff have Stanford-provided personal computers to support their role in the proposed research. Research data/information is on a centralized server and abides by Stanford's computer and network usage policy and information security. All servers are behind a firewall with restricted access to stakeholders only; no unauthorized remote access is allowed. Intrusion monitoring software is handled through the central university network office and locally as a backup. Stanford

University provides access to HIPAA-compliant Research Electronic Data Capture (REDCap), a web-based application to capture data for clinical research and create databases, surveys, and projects. Stanford provides PHI-safe Zoom video conferencing services free to staff, with Zoom unlimited cloud-based storage of recorded video conferences. Stanford also provides access to several computing resources including NVivo and other qualitative software that will be used.

Quantitative Sciences Unit–The Quantitative Sciences Unit (QSU) is a biostatistics unit in the Biomedical Informatics Research (BMIR) Division in the Department of Medicine (DOM). The QSU provides expertise in missing data, prediction modeling, statistical computing, database creation, security, software development, and dissemination from highly trained statisticians. The QSU currently collaborates on more than 30 large-scale scientific projects.

Office of Information Resources & Technology (IRT)–IRT provides information technology, informatics and knowledge management services in support of the School of Medicine's clinical, research and educational missions. The Privacy and Data Security Office ensures compliance with HIPAA and other privacy mandates.

Lane Medical Library & Stanford University Libraries (SUL): The Lane Medical Library is a modern full-service library providing access to print and digital resources for the biomedical sciences and clinical medicine, including databases. SUL maintains university print collections and multimedia resources and provides a wide array of digital information resources, including access via university-wide licenses to essentially all on-line journals (except clinical medicine journals, for which access is managed by Lane Medical Library). Lane Medical Library accelerates scientific discovery, clinical care, medical education and humanities through teaching, collaboration, and delivery of biomedical and historical resources. Lane Library has 30 full-time staff of which 20 are librarians or technology professionals, and each department is assigned a liaison. The library offers support and services with literature searches, data services, and publishing and research impact services.

HUMAN SUBJECTS

This proposal does not involve animal subjects, but we will have human subjects for Tasks 1, 3, 4, and 5. The project presents minimal risks for research participants and there will be no invasive intervention. All data will be observational and for Task 2, it is entirely secondary data analysis with no participant contact. We will be obtaining IRB approval at UC Merced, Stanford University, and from the California Committee for the Protection of Human Subjects (CPHS).

RISKS TO HUMAN SUBJECTS
Human Subjects Involvement, Characteristics, and Design.
This study involves human subjects in order to solicit community impressions and experiences with heat adaptation interventions in Kern County. The involvement of human subjects will occur primarily through community engaged activities such as surveys, interviews, and town hall and CAB meetings. Participants will include local residents, community leaders, health professionals, outdoor workers, and other interested parties who are concerned about heat exposure and health. In Task 1 we will form a Community Advisory Board 15-20 participants representing diverse backgrounds. These individuals will continue to be engaged for Tasks 3-5. During Task 1 these individuals will work with the research team to co-develop the project plan and determine the specific intervention for evaluation. In Task 3, they will engage in ground truthing out in the community to verify other sources of data and reporting. Additional participants may be engaged in interviews, focus groups, or surveys during Task 3. In Task 4, participants will engage in Expert Panel

methods to help generate recommendations about heat adaptation strategies based on the ground truthing and Task 2 findings. In Task 5 participants will assist with disseminating findings within their networks.

Inclusion Criteria: Eligible participants will be Kern County residents with lived or occupational/professional experience related to heat impacts on health and with an interest in engaging in community-driven evaluation efforts for Kern County heat adaptation efforts. Participants of any racial and ethnic background or socioeconomic status can participate. Participants must be 18 years or older and able to consent.

Exclusion Criteria: Reasons for exclusion include inability to provide informed consent, being younger than 18 years, or being unable to participate in English or Spanish.

For task 2, given the secondary nature of the analysis and the minimal risk, we plan to include all ED visits and hospitalizations to maximize the representativeness of the data as well as statistical power. Such comprehensive analysis will also allow the opportunity to explore subgroups who may be more vulnerable.

Study Procedures, Materials, and Potential Risks.

Study procedures have been previously described under the specific tasks above. The study involves minimal risks as previously stated. Materials will include data collection instruments such as surveys and interview guides

The overall risks for this study are minimal. Risks include feeling uncomfortable when considering or learning about possible impacts of heat on health or on the Kern County community. Participation is voluntary and participants can end their participation at any time with no negative consequences. Participants may also simply decline to share or skip specific interview or survey questions. While unlikely, there is always a risk of loss of confidentiality for survey or interview responses, however IRB approved responsible data management practices make this risk very low.

ADEQUACY OF PROTECTION AGAINST RISKS

Informed Consent and Assent
This study team has a record of successfully recruiting and retaining study participants in several prior studies involving participants diverse community members, including in collaboration with the proposed partner organization, the MLK CommUNITY Initiative. All research staff have undergone CITI human subjects' training and are skilled at leading informed consent conversations. All consent and assent forms will be developed using appropriate templates from Stanford's Institutional Review Board. We will work closely with our Community Advisory Board and the MLK CommUNITY initiative to identify potential participants in the community who may choose to (1) request to be contacted by the research team, or (2) reach out to the research team. The study may also be advertised through flyers, social media, virtual events such as a town hall, and on investigator websites (www.paccresearch.org, https://sites.ucmerced.edu/sandieha, and https://healthyair.ucmerced.edu/ . Interested participants will be asked to sign a consent form (available in English and Spanish) that describes the goals, risks, and benefits of the study. If allowed by IRB, an oral-only consent process may be used, whereby no signature is necessary, but participants still retain a copy of the consent document. Additionally, all participants will have access to research staff contact information so that they can easily ask questions about the study at any time.

Protection Against Risk.
The overall risks for this study are minimal. All research will be reviewed by the Institutional Review Boards from Stanford University UC MERCED as well as the California Committee for the Projection of Human Subjects. Prior to study start. All study staff will comply with the Stanford University School of Medicine requirement for training in the protection of human subjects. We will avoid coercion of participants by

emphasizing the voluntary nature of the study at enrollment and consent and offering a modest token of appreciation for enrollment and completion of the surveys, as approved by IRB.

Prior to beginning ground truthing, all participants will receive training by the PIs and research team. Training will also include specific safety protocols to ensure the safety of all participants during work in the community. This may include a check-in system, buddy system, paired with a research team member, remaining within their designated ground truthing area (e.g. a specified block radius or specified cooling center location), and maintaining proper hydration and extended rest periods which will be provided by the research team to each participant.

We will ensure confidentiality of participant data gathered during ground-truthing, in surveys, or by interviews or focus group by using REDCap for survey data collection, using non-identifying subject numbers instead of identifying information for the survey files, password protection for all data files on a hard drive, locking file cabinets for hard copy documents, and deleting all links between subject numbers and identifiers at the end of the study period. Recordings of interviews or focus groups will be maintained in PHI-safe folders on Stanford Medicine Box with restricted access. Transcripts will be de-identified. All final data will be anonymous and untraceable.

While we do not expect any adverse events during this study, it is possible that participants may divulge sensitive information. In the event of disclosure, staff will inform Dr. Patel (Principal Investigator) who will speak privately with the participant to clarify the comment or will designate another member of the research team to do so. In the rare instance that a participant is in immediate danger, the Principal Investigator or another member of the research team will contact authorities (e.g., police, emergency medical services) and request assistance. If there is a report of abuse or neglect that is non-emergency in nature, the Principal Investigator and other members of the research team will review what is known about the situation and assess the legal and ethical issues, with appropriate consultation with the Stanford University Research Compliance Office. If they determine that the study has an ethical or legal obligation to report the incident to authorities, the Principal Investigator or another member of the research team will report it to the police department in the appropriate jurisdiction, or other appropriate authorities. In all instances of adverse events, an Adverse Events incident report will be written and submitted to the Stanford University Office for Protection of Human Subjects for review.

Vulnerable Subjects

This work will engage populations from low-income households and racial and ethnic minority adults as part of the CAB and ground truthing. Children and prisoners are not eligible to participate. It is possible that pregnant women may choose to participate in the CAB or ground truthing activities, but there are no special risks anticipated for this population. We will follow all IRB guidance related to the participation of pregnant women in this study. Individuals with physical disabilities may participate and virtual options, closed captioning, and other accessibility accommodations will be provided whenever possible. Individuals with mental disabilities or cognitive impairments may participate if they are able to provide consent and have capacity as determined by their primary physician, if applicable.

For task 2, given the secondary nature of the analysis and the minimal risk, we plan to include all ED visits and hospitalizations (including unhoused persons, children and pregnant people) to maximize the representativeness of the data as well as statistical power. Such comprehensive analysis will also allow the opportunity to explore subgroups who may be more vulnerable.

POTENTIAL BENEFITS OF THE PROPOSED RESEARCH TO THE RESEARCH PARTICIPANTS AND OTHERS.

There are no direct benefits anticipated for participants in this study. Participants may learn more about their community and available heat adaptation strategies in place that may improve their experience on high heat days. Participants may feel a sense of pride in contributing on the evaluation of heat adaptation strategies in their community and may feel an increased sense of agency by engaging in ground truthing to ensure that community priorities are addressed by the research. Longer-term, this work may lead to the funding or expansion of programs in the community to address heat.

IMPORTANCE OF THE KNOWLEDGE GAINED.
Various heat mitigation strategies have been implemented in Kern County, but no formal evaluation has been conducted to understand their impact and efficacy. This work will facilitate a comprehensive, community-engage evaluation that can direct further efforts, expansions, or modifications to heat adaptation strategies. This work will directly inform policymakers, urban planners, health services agencies, and others with decision-making powers relevant to addressing heat in the community.

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Meetings

A. <u>Initial meeting.</u> Before work on the contract begins, the Principal Investigator and key personnel will meet with the CARB Contract Project Manager and other staff to discuss the overall plan, details of performing the tasks, the project schedule, items related to personnel or changes in personnel, and any issues that may need to be resolved before work can begin.

B. <u>Progress review meetings.</u> The Principal Investigator and appropriate members of his or her staff will meet with CARB's Contract Project Manager at quarterly intervals to discuss the progress of the project. This meeting may be conducted by phone.

C. <u>Community Engagement and/or Technical Advisory Committee Meetings</u> (If Applicable). For community engagement efforts, including meetings with a Technical Advisory Committee (TAC), the Contractor must co-create meeting materials, including presentation slides, flyers, and speaking notes with CARB staff. The Contractor will work with CARB to understand policies and agree to accurately represent those policies or defer for follow-up. CARB will participate in community meetings and TAC meetings, unless mutually agreed upon with CARB and the PI, in cases where it could impact community engagement efforts negatively.

D. <u>Technical Seminar.</u> The Contractor will present the results of the project to CARB staff and a possible webcast at a seminar at CARB facilities in Sacramento or El Monte.

CONFIDENTIAL HEALTH DATA AND PERSONAL INFORMATION

CARB will not be provided access to and will not receive any confidential health data or other confidential personal information under this contract. Further, CARB will have no ownership of confidential health data or other confidential personal information used in connection with this contract. The entities conducting the research in this contract will follow all applicable rules and regulations regarding access to and the use of confidential health data and personal information, including the Health Insurance Portability and Accountability Act (HIPAA) and requirements related to the Institutional Review Board (IRB) process. CARB will not be a listed entity with authorized access to confidential information pursuant to the IRB process for this contract.

HEALTH AND SAFETY

Contractors are required to, at their own expense, comply with all applicable health and safety laws and regulations. Upon notice, Contractors are also required to comply with the state agency's specific health and safety requirements and policies. Contractors agree to include in any subcontract related to performance of this Agreement, a requirement that the subcontractor comply with all applicable health and safety laws and regulations, and upon notice, the state agency's specific health and safety requirements and policies.

GENERATIVE ARTIFICIAL INTELLIGENCE (GENAI) TECHNOLOGY USE & REPORTING

During the term of the contract, Contractor must notify the State in writing if their services or any work under this contract includes, or makes available, any previously unreported GenAI technology, including GenAI from third parties or subcontractors. Contractor shall immediately complete the GenAI Reporting and Factsheet (STD 1000) to notify the State of any new or previously unreported GenAI technology. At the direction of the State, Contractor shall discontinue the use of any new or previously undisclosed GenAI technology that materially impacts functionality, risk or contract performance, until use of such GenAI technology has been approved by the State.

Failure to disclose GenAI use to the State and submit the GenAI Reporting and Factsheet (STD 1000) may be considered a breach of the contract by the State at its sole discretion and the State may consider such failure to disclose GenAI and/or failure to submit the GenAI Reporting and Factsheet (STD 1000) as grounds for the immediate termination of the contract. The State is entitled to seek any and all relief it may be entitled to as a result of such non-disclosure.

The State reserves the right to amend the contract, without additional cost, to incorporate GenAI Special Provisions into the contract at its sole discretion and/or terminate any contract that presents an unacceptable level of risk to the State.

Deliverable	Description	Due Date
Racial equity/implicit bias training	The Principal Investigator and key personnel must demonstrate that they have taken, or will take, cultural competency training, implicit bias training, or racial equity training, whichever is administered at their institution. Training certificates or certificates of completion completed within one (1) year prior to the agreement start date will be accepted. If the training has not been completed within one (1) year prior to the agreement start date, then the Principal Investigator and key personnel must demonstrate that they have scheduled the training within 30 days of the agreement start date and shall complete the training within 90 days of the agreement start date.	Within 90 days of the agreement start date.
Initial Meeting	Principal Investigator and key personnel will meet with CARB Contract Project Manager and other staff to discuss the overall plan, details of performing the tasks, project schedule, items related to personnel or changes in personnel, and any issues that may need to be resolved before work can begin.	Month 1
Task 1: Co-Develop Research Plan & Case Studies	• This will include outlining equity-based collaboration principles, detailed project workplan indicating all activities, and responsible parties. Summary of meeting proceedings or meeting notes, case study for selected intervention, along with a revised community engagement, and communications plan. Town hall flyer/promotional materials, summary of Town Hall, list of Town Hall attendees wishing to stay engaged.	
Task 2: Estimate the Health Benefits of the Heat Adaptation Strategies	A report outlining the approach and findings related to the estimated health benefits and co-benefits (if applicable) of the selected heat adaptation strategy(ies)	
Task 3: Ground-truth the Health Benefits of the Heat Adaptation Strategies and Assess Community Perspectives	Results and analysis of ground-truthing activities, including survey data results in aggregate and overall themes that emerge from the qualitative data.	
Task 4: Perform Cost-Effectiveness Analysis of the Heat Adaptation Strategies	Written summary of simulation and findings including extensive sensitivity analyses of important assumptions/parameters based on CAB feedback	

Task 5: Recommend Heat Adaptation Strategies in Response to Health Benefits and Community Perspectives	Written summary of the recommendations	
Task 6: Disseminate and Translate Research Findings	Deliverables will include copies of all infographics and flyers, recording of town hall meeting(s). and Final Report •	
Progress Reports & Meetings	Quarterly progress reports and meetings throughout the agreement term, to coincide with work completed in quarterly invoices.	Quarterly
Draft Final Report	Draft version of the Final Report detailing the purpose and scope of the work undertaken, the work performed, the results obtained and conclusions, and a Public Outreach Document and an Equity Implications Section. The Draft Final Report shall be copy-edited before being sent to CARB for review and the Principal Investigator shall attest that the Final Report has been reviewed and approved. The Draft Final Report shall be submitted in an Americans with Disabilities Act compliant format. CARB's standard for ADA compliance requires that the submitted document adhere to the Web Content Accessibility Guidelines (WCAG) 2.1 AA (https://www.w3.org/TR/WCAG21/) and Federal Section 508 (https://www.section508.gov/).	Nine (9) months prior to agreement end date.
Data	Data compilations first produced in the performance of this Agreement by the Principal investigator or the University's project personnel.	Two (2) weeks prior to agreement end date.
Public Seminar	Presentation of the results of the project to CARB staff and a possible webcast at a seminar at CARB facilities in Sacramento or El Monte. The Public Seminar slides shall be submitted in an Americans with Disabilities Act compliant format.	On or before agreement end date.
The following Deliverables are subject to paragraph 19. Copyrights, paragraph B of Exhibit C		
Final Report	Written record of the project and its results. The Final Report shall be submitted in an ADA compliant format. CARB's standard for ADA compliance requires that the submitted document adhere to WCAG 2.1 AA (https://www.w3.org/TR/WCAG21/) and Federal Section 508 (https://www.section508.gov/). The Public Outreach Document and Equity Implications Section, as described in Exhibit A1, Section 2, shall be incorporated into the Final Report. All comments and edits to the from CARB on the draft final report should be addressed and/or resolved prior to submission of the final report.	Two (2) weeks prior to agreement end date.

1. **Reports and Data Compilations**

   A. With respect to each invoice period University shall submit, to the CARB Contract Project Manager, one (1) electronic copy of the progress report. When emailing the progress report, the "subject line" should state the contract number and the billing period. Each progress report must accompany a related invoice covering the same billing period. Each progress report will begin with the following disclaimer:

   > *The statements and conclusions in this report are those of the University and not necessarily those of the California Air Resources Board. The mention of commercial products, their source, or their use in connection with material reported herein is not to be construed as actual or implied endorsement of such products.*

   B. Each progress report will also include:

      1. A brief summary of the status of the project, including whether the project is on schedule. If the project is behind schedule, the progress report must contain an explanation of reasons and how the University plans to resume the schedule.

      2. A brief narrative account of project tasks completed or partially completed since the last progress report.

      3. A brief discussion of problems encountered during the reporting period and how they were or are proposed to be resolved.

      4. A brief discussion of work planned, by project task, before the next progress report. and

      5. A graph or table showing percent of work completion for each task.

   C. Nine (9) months prior to Agreement expiration date, University will deliver to CARB an electronic copy of the draft final report in both PDF and Microsoft Word formats. The draft final report will conform to Exhibit A1, Section 2 – Research Final Report Format.

   D. Within forty-five (45) days of receipt of CARB's comments, University will deliver to CARB's Contract Project Manager an electronic copy of the final report incorporating all reasonable alterations and additions. Within two (2) weeks of receipt of the revised report, CARB will verify that all CARB comments have been addressed. Upon acceptance of the amended final report approved by CARB in accordance to Exhibit A1, Section 2 – Research Final Report Format, University will within two (2) weeks, deliver to CARB an electronic copy of the final report in both PDF and Microsoft Word formats.

   E. As specified in Exhibit A1, Section 2, Final Report will be submitted in an Americans with Disabilities Act compliant Format.

   F. Together with the final report, University will deliver a set of all data compilations as specified in Exhibit A1 – Schedule of Deliverables.

   G. University's obligation under this Agreement shall be deemed discharged only upon submittal to CARB of an acceptable final report in accordance to Exhibit A1, Section 2 – Research Final Report Format, all required data compilations, and any other project

deliverables.

2. Research Final Report Format

The research contract Final Report (Report) is as important to the contract as the research itself. The Report is a record of the project and its results and is used in several ways. Therefore, the Report must be well organized and contain certain specific information. The CARB's Research Screening Committee (RSC) reviews all draft final reports, paying special attention to the Abstract and Executive Summary. If the RSC finds that the Report does not fulfill the requirements stated in this Exhibit, the RSC may not recommend release, and final payment for the work completed may be withheld. This Exhibit outlines the requirements that must be met when producing the Report.

Note: In partial fulfillment of the Final Report requirements, the Contractor shall submit a copy of the Report in PDF format <u>and</u> in a word-processing format, preferably in Word – Version 6.0 or later. The electronic copy file name shall contain the CARB contract number, the words "Final Report", and the date the report was submitted.

Accessibility. To maintain compliance with California Government Code Sections 7405 and 11135, and Web Content Accessibility Guidelines, Assembly Bill No. 434, the final Report must be submitted in an Americans with Disabilities Act compliant format. The Final Report will be posted on the CARB website and therefore must be in an accessible format so that all members of the public can access it.

Watermark. Each page of the draft Report must include a watermark stating "DRAFT." The revised report should not include any watermarks.

Title. The title of the Report should exactly duplicate the title of the contract. However, minor changes to the title may be approved provided the new title does not deviate from the old title. These minor changes must be approved in writing by the contract manager. Significant changes to the title would require a formal amendment.

Page size. All pages should be of standard size (8 ½" x 11") to allow for photo-reproduction.

Corporate identification. Do not include corporate identification on any page of the Final Report, except the title page.

Unit notation. Measurements in the Reports should be expressed in metric units. However, for the convenience of engineers and other scientists accustomed to using the British system, values may be given in British units as well in parentheses after the value in metric units. The expression of measurements in both systems is especially encouraged for engineering reports.

Section order. The Report should contain the following sections, in the order listed below:

Title page
Disclaimer
Acknowledgment (1)
Acknowledgment (2)
Table of Contents
List of Figures
List of Tables
Abstract

Public Outreach Document
Executive Summary
Equity Implications Section
Body of Report
References
List of inventions reported and copyrighted materials produced
Glossary of Terms, Abbreviations, and Symbols
Appendices

Page numbering. Beginning with the body of the Report, pages shall be numbered consecutively beginning with "1", including all appendices and attachments. Pages preceding the body of the Report shall be numbered consecutively, in ascending order, with small Roman numerals.

Title page. The title page should include, at a minimum, the contract number, contract title, name of the principal investigator, contractor organization, date, and this statement:
"Prepared for the California Air Resources Board and the California Environmental Protection Agency"

Disclaimer. A page dedicated to this statement must follow the Title Page:

> The statements and conclusions in this Report are those of the contractor and not necessarily those of the California Air Resources Board. The mention of commercial products, their source, or their use in connection with material reported herein is not to be construed as actual or implied endorsement of such products.

Acknowledgment (1). Only this section should contain acknowledgments of key personnel and organizations who were associated with the project. The last paragraph of the acknowledgments must read as follows:

> This Report was submitted in fulfillment of [CARB contract number and project title] by [contractor organization] under the [partial] sponsorship of the California Air Resources Board. Work was completed as of [date].

Acknowledgment (2). Health reports should include an acknowledgment to the late Dr. Friedman. Reports should include the following paragraph:

> This project is funded under the CARB's Dr. William F. Friedman Health Research Program. During Dr. Friedman's tenure on the Board, he played a major role in guiding CARB's health research program. His commitment to the citizens of California was evident through his personal and professional interest in the Board's health research, especially in studies related to children's health. The Board is sincerely grateful for all of Dr. Friedman's personal and professional contributions to the State of California.

Attestation. A page dedicated to this attestation statement must follow the Acknowledgement(s). The Principal Investigator (PI) must digitally sign below the following statement:

> The Final Report for CARB Agreement No. [contract number] titled "[Enter project title]" has been copy-edited for grammar, style, and format and is reviewed and approved by the Principal Investigator (PI), [title and name of PI] of [Contractor Name]. The signature below attests that the PI has completed a thorough review of this Final Report and approves it for submission to the California Air Resources Board.

PI Signature
Date

Table of Contents. This should list all the sections, chapters, and appendices, together with their page numbers. Check for completeness and correct reference to pages in the Report.

List of Figures. This list is optional if there are fewer than five illustrations.

List of Tables. This list is optional if there are fewer than five tables.

Abstract. The abstract should tell the reader, in nontechnical terms, the purpose and scope of the work undertaken, describe the work performed, and present the results obtained and conclusions. The purpose of the abstract is to provide the reader with useful information and a means of determining whether the complete document should be obtained for study. The length of the abstract should be no more than about 200 words. Only those concepts that are addressed in the executive summary should be included in the abstract.

Example of an abstract:

A recently developed ground-based instrument, employing light detecting and ranging (lidar) technology, was evaluated, and found to accurately measure ozone concentrations at altitudes of up to 3,000 meters. The novel approach used in this study provides true vertical distributions of ozone concentrations aloft and better temporal coverage of these distributions than other, more common methods, such as those using aircraft and ozonesonde (balloon) techniques. The ozone and aerosol measurements from this study, in conjunction with temperature and wind measurements, will provide a better characterization of atmospheric conditions aloft and the processes involved in the formation of unhealthful ozone concentrations than can be achieved with traditional ground-based monitors.

Public Outreach Document. The public outreach document is a one-page document that will be widely used to communicate, in clear and direct terms, the key research findings from the study to the public. CARB will be translating the document into other languages. This document must adhere to the following guidelines:

- Single space, limited to one-page or about 500 words.
- Use narrative form and active voice.
- Incorporate a graphic that it is easy to interpret and captures the results' central message.
- Avoid jargon and technical terms. Use a style and vocabulary level comparable to that of sixth grade reading level.
- The document should contain a title and the following five sections: Issue/s, Main Question, Key Research Findings, Conclusion/s, and More Information. Guidance on how to write these sections is described below.

  TITLE: Adopt a short, non-technical title to make the topic clear and concise. The title will likely differ from the original title of the contract.

  ISSUE/S: In one to two paragraphs, describe why the project was needed. In this section, identify the problem leading to this study and what the study was set to

accomplish to help address the problem. Reference any history that is relevant such as a regulation, legislation, program, law, or other. Without going into detail and disclosing the research findings, mention the methods used in the study and how it informed the results.

MAIN QUESTION: Present a concise central research question driving this project.

KEY RESEARCH FINDING/S: This section covers the key research findings. List key points and or findings.

CONCLUSION/S: In one to two paragraphs, discuss how the results could be used. Mention its relevance to policies, rules, regulations, legislations, or CARB programs. Include suggestions for next steps, additional research, or other actions.

MORE INFORMATION: In two to three short sentences provide specifics about the study. This section should include the full title of the study, sponsor, authors, and where the full report can be found (the final report will be posted on the CARB website). In addition to a direct contact to gain more information (author and CARB contract manager).

Executive Summary. The function of the executive summary is to inform the reader about the important aspects of the work that was done, permitting the reader to understand the research without reading the entire Report. It should state the objectives of the research and briefly describe the experimental methodology[ies] used, results, conclusions, and recommendations for further study. All of the concepts brought out in the abstract should be expanded upon in the Executive Summary. Conversely, the Executive Summary should not contain concepts that are not expanded upon in the body of the Report.

The Executive Summary will be used in several applications as written; therefore, please observe the style considerations discussed below.

Limit the Executive Summary to two pages, single spaced.

Use narrative form. Use a style and vocabulary level accessible to the general audience. Assume the audience is being exposed the subject for the first time.

Do not list contract tasks in lieu of discussing the methodology. Discuss the results rather than listing them.

Avoid jargon.

Define technical terms.

Use passive voice if active voice is awkward.

Avoid the temptation to lump separate topics together in one sentence to cut down on length.

The Executive Summary should contain four sections: Background, Objectives and Methods, Results, and Conclusions, described below.

THE BACKGROUND SECTION. For the Background, provide a one-paragraph discussion

of the reasons the research was needed. Relate the research to the Board's regulatory functions, such as establishing ambient air quality standards for the protection of human health, crops, and ecosystems; the improvement and updating of emissions inventories; and the development of air pollution control strategies.

THE OBJECTIVES AND METHODS SECTION. At the beginning of the Objectives and Methods section, state the research objectives as described in the contract. Include a short, one or two sentences, overview of what was done in general for this research.

The methodology should be described in general, nontechnical terms, unless the purpose of the research was to develop a new methodology or demonstrate a new apparatus or technique. Even in those cases, technical aspects of the methodology should be kept to the minimum necessary for understanding the project. Use terminology with which the reader is likely to be familiar. If it is necessary to use technical terms, define them. Details, such as names of manufacturers and statistical analysis techniques, should be omitted.

Specify when and where the study was performed if it is important in interpreting the results. The findings should not be mentioned in the Objectives and Methods section.

THE RESULTS SECTION. The Results section should be a single paragraph in which the main findings are cited, and their significance briefly discussed. The results should be presented as a narrative, not a list. This section must include a discussion of the implications of the work for the Board's relevant regulatory programs.

THE CONCLUSIONS SECTION. The Conclusions section should be a single short paragraph in which the results are related to the background, objectives, and methods. Again, this should be presented as a narrative rather than a list. Include a short discussion of recommendations for further study, adhering to the guidelines for the Recommendations section in the body of the Report.

Equity Implication Section. The equity implications section should summarize how the research results inform disparate impacts of policies, regulations, or programs on priority communities. [1] This section should summarize how sociodemographic factors were examined in this research. Given the data used or collected, which populations are excluded or overrepresented? How were relevant communities engaged in the research effort and/or how were existing data gaps identified and ground-truthed during the research project? If ground-truthed data were found to not accurately reflect the lived experiences of community members, what future research projects could address this disconnect. The research results should inform existing or future CARB programs and the equity implications section should discuss how the research results may inform programs to close disparities in

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[1] Priority communities here encompasses various terms CARB uses such as priority populations[2], communities of concern[3], protected classes[4], or disadvantaged communities[5].
[2] Priority Populations — California Climate Investments
[3] Referenced from the California Public Utilities Commission Environmental and Social Justice Plan an effort resulting from California's Capitol Collaborative on Race & Equity.
[4] Protected Classes | California State Senate
[5] SB-535-Designation-Final.pdf (ca.gov) ; California Climate Investments to Benefit Disadvantaged Communities | CalEPA; CalEnviroScreen 4.0 | OEHHA

health outcomes, pollutant exposure or climate adaptation, etc., for priority communities. This section should be limited to a maximum of two (2) pages, single spaced and shall include the following sections.

HISTORICAL ANALYSIS. Provide an overview of the inequities and disparities observed in the existing data or data gathered during the research and how it ties to historic policies. For example, what is the root-cause of the disparity being experienced by the community or population central to this research?

MATERIALS AND METHODS. Describe how this research project examines racial equity. Some methods can include but are not limited to: examining the potential for existing data to address racial inequalities, ground-truthing existing data, engaging priority communities, assessments for racial and ethnic subgroups in the development of data and approaches, identifying data gaps and filling those gaps.

RESULTS AND DISCUSSION. Describe how the results improve our understanding of the equity issues identified or interventions to address those inequalities .

Body of Report. The body of the Report should contain the details of the research, divided into the following sections:[6]

INTRODUCTION. Clearly identify the scope and purpose of the project. Provide a general background of the project. Explicitly state the assumptions of the study.

Clearly describe the hypothesis or problem the research was designed to address. Discuss previous related work and provide a brief review of the relevant literature on the topic.

MATERIALS AND METHODS. Describe the various phases of the project, the theoretical approach to the solution of the problem being addressed, and limitations to the work. Describe the design and construction phases of the project, materials, equipment, instrumentation, and methodology.
Describe quality assurance and quality control procedures used. Describe the experimental or evaluation phase of the project.

RESULTS. Present the results in an orderly and coherent sequence. Describe statistical procedures used and their assumptions. Discuss information presented in tables, figures, and graphs. The titles and heading of tables, graphs, and figures, should be understandable without reference to the text. Include all necessary explanatory footnotes. Clearly indicate the measurement units used.

DISCUSSION. Interpret the data in the context of the original hypothesis or problem. Does the data support the hypothesis or provide solutions to the research problem? If appropriate, discuss how the results compare to data from similar or related studies. What are the implications of the findings?
Identify innovations or development of new techniques or processes. If appropriate, discuss cost projections and economic analyses.

SUMMARY AND CONCLUSIONS. This is the most important part of the Report because it is the section that will probably be read most frequently. This section should begin with a clear, concise statement of what, why, and how the project was done. Major results and conclusions of the study should then be presented, using clear, concise statements. Make sure the conclusions reached are fully supported by the results of the study. Do not overstate or overinterpret the results. It may be useful to itemize primary results and conclusions. A simple table or graph may be used to illustrate.

RECOMMENDATIONS. Use clear, concise statements to recommend (if appropriate) future research that is a reasonable progression of the study and can be supported by the results and discussion.

References. Use a consistent style to fully cite work referenced throughout the Report and references to closely related work, background material, and publications that offer additional information on aspects of the work. Please list these together in a separate section, following the body of the Report. If the Report is lengthy, you may list the references at the end of each chapter.

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[6] Note that if the research employs multiple distinct methods, analyses, etc., the final report can include separate materials/methods, results, and discussion sections to allow for coherent discussion of each set of analyses and findings. However, the executive summary and conclusions sections should synthesize the collective findings of the entire study.

List of inventions reported and publications produced. If any inventions have been reported, or publications or pending publications have been produced as a result of the project, the titles, authors, journals or magazines, and identifying numbers that will assist in locating such information should be included in this section.

Glossary of terms, abbreviations, and symbols. When more than five of these items are used in the text of the Report, prepare a complete listing with explanations and definitions. It is expected that every abbreviation and symbol will be written out at its first appearance in the Report, with the abbreviation or symbol following in parentheses [i.e., carbon dioxide (CO2)]. Symbols listed in table and figure legends need not be listed in the Glossary.

Appendices. Related or additional material that is too bulky or detailed to include within the discussion portion of the Report shall be placed in appendices. If a Report has only one appendix, it should be entitled "APPENDIX". If a Report has more than one appendix, each should be designated with a capital letter (APPENDIX A, APPENDIX B). If the appendices are too large for inclusion in the Report, they should be collated, following the binding requirements for the Report, as a separate document.

The contract manager will determine whether appendices are to be included in the Report or treated separately. Page numbers of appendices included in the Report should continue the page numbering of the Report body. Pages of separated appendices should be numbered consecutively, beginning at "1".

3. **Other Deliverables**

   A. Any other deliverables shall be provided in a mutually agreed upon format unless the deliverable format is already specified in Exhibit A.

EXHIBIT A2

KEY PERSONNEL

Last Name, First Name	Institutional Affiliation	Role on Project
Principal Investigator (PI):		
Sandie Ha	UC Merced	Principal investigator
Co-PI(s) – if applicable:		
Manali Patel	Stanford	Co-Principal investigator
Other Key Personnel:		
Alec Chan-Golston	UC Merced	Co-Investigator
Matthew Kiang	Stanford	Co-Investigator
Gabrielle Wong-Parodi	Stanford	Co-investigator

EXHIBIT A3

AUTHORIZED REPRESENTATIVES

The following individuals are the authorized representatives for the State and the University under this Agreement. Any official Notices issued under the terms of this Agreement shall be addressed to the Authorized Official identified below, unless otherwise identified in the Agreement.

State Agency Contacts	University Contacts
Agency Name: **CARB**	University Name: University of California Merced
Contract Project Manager (Technical) Name: Feng-Chiao Su Address: Research Division	*Principal Investigator (PI)* Name: Sandie Ha Address: 5200 North Lake Road Merced, CA 95343 Designees to certify invoices under Section 14 of

Authorized Official (contract officer) Name: Alice Kindarara, Branch Chief Address: Acquisitions Branch **Send notices to (if different):** Name: Mariah Figueroa Address: Research Division	**Authorized Official** Name: Jue Sun Address: 5200 N. Lake Rd Merced, CA 95373-5705
Administrative Contact Name: Mariah Figueroa Research Division	**Administrative Contact** Name: Bryan O'Neill Address: 5200 N. Lake Rd Merced, CA 95373-5705
Financial Contact/Accounting Name: Accounts Payable Address: P.O. Box 1436 Sacramento, CA 95814	**Authorized Financial Contact/Invoicing** Name: Devan Hinojosa Address: 5200 N. Lake Rd Merced, CA 95373-5705

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EXHIBIT A4

USE OF INTELLECTUAL PROPERTY & DATA

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A. State: Preexisting Intellectual Property (IP)/Data to be provided to the University from the State or a third party for use in the performance in the Scope of Work.

☒ None or ☐ List:

Owner (State Agency or 3rd Party)	Description	Nature of restriction:

B. University: Restrictions in Preexisting IP/Data included in Deliverables identified in Exhibit A1, Deliverables.

☒ None or ☐ List:

Owner (University or 3rd Party)	Description	Nature of restriction:

C. Anticipated restrictions on use of Project Data.
If the University PI anticipates that any of the Project Data generated during the performance of the Scope of Work will have a restriction on use (such as subject identifying information in a data set), then list all such anticipated restrictions below. If there are no restrictions anticipated in the Project Data, then check "none" in this section.

☐ None or ☒ List:

Owner (State Agency or 3rd Party)	Description	Nature of restriction:
Office of Vital Statistics	Birth certificate data will be used to identify preterm births in Task 2	We will only be reporting aggregate data. no identifiable information will be reported.
Office of Health Care Access and	Emergency department visits and hospitalization data will be obtained from HCAI to identify health outcomes in Task 2	We will only be reporting aggregate data. no identifiable

Information (HCAI)		information will be reported.
Participants	Data from ground-truthing including interviews and focus groups.	We will only report this data in aggregate results with representative quotes that cannot be attributable to any individual participant.

EXHIBIT A5

RÉSUMÉ / BIOSKETCH

Attach 2-3 page Résumé/Biosketch for Key Personnel listed in Exhibit A2.

Sandie U. Ha, PhD, MPH
Environmental and Perinatal Epidemiologist

EDUCATION AND TRAINING

May 2008	**Bachelor of Science (BS)** in Biology/Physiology, University of Washington, Seattle, WA
May 2011	**Master in Public Health (MPH)** in Epidemiology, University of Florida, Gainesville, FL
Aug 2015	**Doctor of Philosophy (PhD)** in Epidemiology, University of Florida, Gainesville, FL

RELEVANT PROFESSIONAL EXPERIENCE

2024 –	**Associate Professor**, Department of Public Health, University of California, Merced, CA
2017 – 2024	**Assistant Professor**, Department of Public Health, University of California, Merced, CA
2015 – 2017	**Postdoctoral Fellow**, *Eunice Kennedy Shriver* National Institute of Child Health and Human Development, Bethesda, MD.
2011 – 2015	**Pre-Doctoral Award Fellow**, University of Florida, Gainesville, FL
2010 – 2011	**Public Health Intern**, University of Florida Family Data Center, Gainesville, FL
2010 – 2011	**Research Assistant**, College of Medicine, University of Florida, Gainesville, FL

SELECTED FUNDED PROJECTS (pending projects are described in the current/pending research file)

2024 – 2027	**Unlocking Health Benefits for Californians by escalating management efforts of Natural and Working Lands**; Role: Co-PI; amount: $553,827; Funder: California Air Resources Board
2024 – 2027	**Stanislaus County Climate, Health, and Environmental Justice Project**; Role: Co-PI; amount (subcontract): $130,094; Funder: USEPA
2023 – 2025	**Adaptation pathways for agricultural land repurposing in the San Joaquin Valley and their impacts on heat and air quality extremes on vulnerable communities**. Role: Co-PI; amount: $298,224; funder: UC Merced Climate Action Research Seed Fund Competition
2022 – 2023	**A Health Impact Assessment in Fresno AB617 Communities: Concerns in the Changing Climate (2023).** Role: PI; amount: $99,000; funder: UC Merced Community and Labor Center
2022 – 2024	**Fresno Air Pollution Health Impact Assessment (2022-2023).** Role: PI; amount: $303,473; funder: City of Fresno, CA
2021 – 2023	**San Joaquin Valley Center for Community Air Assessment and Injustice Reduction (SJV CC-AIR) (2022-2023).** Role: Co-PI; Amount: $1,222,460; Funder: California Attorney General Office
2020 – 2024	**California Policy Lab: Data-Driven Solutions to California's Most Complex Issues (2021-2024).** Role: Co-I, Amount: $3,233,696; Funder: UC Office of the President's Multicampus Research Programs and Initiatives
2020 – 2022	**Farmworker Health Study.** Role: Collaborator; Amount: $1,350,000; Funder: California Department of Public Health
2017 – 2025	**Environmental determinants of adverse birth outcomes** (2017-present). Role: PI; Amount: $160,000; Funder: University of California, Merced; UCOP
2019 – 2021	**The Impact of Extreme Temperature Exposure on the Risk of Preterm Birth and Preterm Labor.** Role: Co-PI, amount: $5,000, funder: Central California Faulty Medical Group.
2018 – 2019	**Early and prenatal exposures to air pollution and childhood development.** Role: PI, amount: $5,000, funder: UC Merced Academic Senate Faculty Research Grants Program.

SELECTED RELEVANT PUBLICATIONS (*graduate students, **undergrad students)

For a more complete list of publication, please visit: https://orcid.org/0000-0002-2975-8232

IP Valle K*, DeMarsh K*, Herrera E, Chan-Golston AM, Tyner T, Payton D, Reece J, Peterson J, **Ha S**, Goldman-Mellor S, Espinosa A, Rosas GBF, Hirst T, Bradman A. The San Joaquin Valley Center for Air Injustice Reduction (SJV-CAIR): a community based low-cost air quality monitoring network. Environmental Health Perspectives. Submitted 6/26/2024

IP DeMarsh K*, Valle K*, Tyner T, Payton D, Reece J, Herrera E, **Ha S**, Goldman-Mellor S, Hirst T, Bradman A, Chan-Golston, AM. The San Joaquin Valley Center for Air Injustice Reduction (SJV-CAIR): Evaluation of a community monitoring

network for improved characterization of PM2.5 exposure in Fresno County, California, USA. ACS ES&T Air. Submitted 6/21/2024

IP LaPointe S, Nie J, Stevens DR, Gleason JL, **Ha S**, Seeni I, Grantz KL, Mendola P. Acute ambient temperature extremes and NICU admissions: A time-stratified case-crossover study. Science of the Total Environment, Submitted 5/9/2024

1 **Ha S**, Abatzoglou J, Adebiyi A, Ghimire S*, Martinez V*, Wang M, Basu R. The effects of heat waves and wildfires on risk of preterm births in California. Environmental Research. In press

2 Ping J; Li Y; Tong M; **Ha S**; Gaw E; Nie J; Mendola P; Wang M. Wildfire particulate exposure and risks of preterm birth and low birth weight in the Southwestern US. Public Health 2024; 230:81-88. PMID: 38518428.

3 Balascio P*, Moore M*, Gongalla M*, Regan A, **Ha S**, Taylor BD, Hill AV. Measures of Racism and Discrimination in Preterm Birth Studies: A Narrative Synthesis. Obstetrics & Gynecology 2022; 141(1): 69-83.

4 **Ha S**, Ghimire S*, Martinez V*. Outdoor air pollution and pregnancy loss: a narrative review. Current Epidemiology Reports 2022; 9: 387-405 [invited]

5 Mendola P, **Ha S**. Beyond the baby in your arms - climate effects last for generations. Fertility and Sterility 2022; 118(2): 224-229. [invited]

6 **Ha S**. The changing climate and pregnancy health. *Current Environmental Health Reports* 2022;9:263-275. [invited]

7 **Ha S**, Martinez V*, Chan-Golston, MA. Air pollution and preterm birth: a time-stratified case-crossover analysis in the San Joaquin Valley of California. *Perinatal and Pediatric Epidemiology* 2021; 36(1): 80-89.

8 Kanner J**, Stevens D, Nobles C, Rohn M, **Ha S**, Mannisto T, Ouidir M, Mendola P. Risk of cardiovascular events during labor and delivery associated with acute ambient temperature changes. *The Journal of Climate Change and Health* 2022; 3: 100060

9 **Ha S**. Air pollution and neurological development in children. *Developmental Medicine & Child Neurology 2020*; 63(4): p. 374-381. [invited]

10 **Ha S**, Martinez V*. Associations between disability and infertility among US reproductive-aged women. *International Journal of Environmental Research and Public Health*, 2021; 18, 3202.

11 Kanner J**, Williams A, Nobles C, **Ha S**, Ouidir M, Sherman S, Mendola P. Ambient temperature and stillbirth: Risks associated with chronic extreme temperature and acute temperature change. *Environmental Research* 2020;189:109958.

12 **Ha S**, Nobles C, Kanner J, Sherman S, Cho SH, Perkins N, Williams A, Grobman W, Biggio J, Subramaniam A, Ouidir M, Chen Z, Mendola P. Air pollution exposure monitoring among pregnant women with and without asthma. *International Journal of Environmental Research and Public Health* 2020; 17(13), 4888.

13 Williams AD, Messer L, Kanner J, **Ha S**, Mendola P. Ethnic enclaves and obstetric outcomes among Asian/Pacific Islanders in the United States. *Journal of Racial and Ethnic Health Disparities* 2019.

14 Entwistle MR*, Gharibi H, Tavallali P, Cisneros R, Schweizer D, Brown P, **Ha S**. Air pollution and asthma emergency department visits in Fresno, California, USA, during the warm season 2005-2015: a time-stratified case crossover analysis. *Air Quality, Atmosphere and Health* 2019; 12(6): 661–672.

15 **Ha S**. Yeung E, Bell E, Insaf T, Ghassabian A, Bell G, Muscatiello N, Mendola P. Prenatal and early-life exposures to air pollution and neurodevelopment. *Environmental Research* 2019; 174:170-175.

16 **Ha S**, Mendola P. Are we ready to establish a causal relationship between air pollution and pregnancy loss? *The Lancet Planetary Health* 2019; 3(5):e198-e199 [invited]

17 **Ha S,** Mendola P. Opportunities and challenges to investigate the effects of air pollution on pregnancy loss. *Fertility and Sterility*, 2019;111(2):256-257 [invited]

18 Gharibi H*, Entwistle MR, **Ha S**, Gonzalez M, Brown P, Schweizer D, Cisneros R. Ozone pollution and asthma emergency department visits in the Central Valley, California, USA, during June to September of 2015: a time-stratified case-crossover analysis. *Journal of Asthma* 2018; 9:1-12.

19 Seeni I**, **Ha S**, Nobles C, Liu D, Sherman S, Grantz KL, Mendola P. Air pollution exposure during pregnancy: maternal asthma and neonatal respiratory outcomes. *Annals of Epidemiology* 2018; 28(9):612-618.e4.

20 Nobles C, Schisterman E, **Ha S**, Kim K, Mumford S, Buck Louis G, Chen Z, Liu D, Sherman S, Mendola P. Ambient air pollution and semen quality. *Environmental Research* 2018; 163:228-236.

21 Nobles C, Schisterman EF, **Ha S**, Sundaram R, Buck Louis G, Sherman S, Mendola P. Time-varying cycle average and daily variation in ambient air pollution and fecundability. *Human Reproduction* 2018; 33(1):166-176.

22 **Ha S**, Sundaram R, Buck Louis G, Nobles C, Seeni I, Sherman S, Mendola P. Ambient air pollution and the risk of pregnancy loss: a prospective cohort study. *Fertility and Sterility* 2018; 109(1):148-153

23 **Ha S**, Liu D, Zhu Y, Sherman S, Mendola P. Ambient temperature and preterm rupture of membranes. *Epidemiology* 2018; 29(2):175-182. PMID: 29087988.

24 **Ha S**, Nguyen MK**, Liu D, Männistö T, Nobles C, Sherman S, Mendola P. Ambient temperature and risk of cardiovascular event at labor and delivery: A case-crossover study. *Environmental Research* 2017; 159:622-628.

25 Mendola P, **Ha S**, Pollack A, Zhu Y, Seeni I, Kim SS, Sherman S, Liu D. Chronic and acute ozone exposure in the week prior to delivery is associated with the risk of stillbirth. *International Journal of Environmental Research and Public Health* 2017;

14(7). pii: E731.

26 **Ha S**, Männistö T, Liu D, Sherman S, Ying Q, Mendola P. Air pollution and risk of cardiovascular event at labor and delivery: a case-crossover analysis. *Annals of Epidemiology* 2017; S1047-2797(16)30351-9.

27 Zhu Y, Zhang C, Liu D, **Ha S**, Kim SS, Pollack A, Mendola P. Ambient air pollution and risk of gestational hypertension. *American Journal of Epidemiology* 2017; 186(3):334-343.

28 **Ha S**, Liu D, Zhu Y, Kim SS, Sherman S, Grantz KL, Mendola P. Ambient temperature and stillbirth: a multi-center retrospective cohort study. *Environmental Health Perspectives* 2017; 125(6):067011.

29 **Ha S**, Zhu Y, Liu D, Sherman S, Mendola P. Ambient temperature and air quality in relation to small for gestational age and term low birthweight. *Environmental Research* 2017; 185(4):259-261.

30 **Ha S**, Liu D, Zhu Y, Kim SS, Sherman S, Mendola P. Ambient temperature and early delivery of singleton pregnancies. *Environmental Health Perspectives* 2017; 25(3):453-459.

31 **[Editor's Choice] Ha S**, Mendola P. Invited Commentary: Ambient environment and risk of preterm delivery. *American Journal of Epidemiology* 2017; 185(4):259-261 [invited]

32 Hu H, **Ha S**, Xu X. Ozone and Hypertensive Disorders of Pregnancy in Florida: Identifying Critical Windows of Exposure. *Environmental Research* 2017; 153:120-125.

33 Xu X, **Ha S**, Basnet R. A Review of Epidemiological Research on Adverse Neurological Effects of Exposure to Ambient Air Pollution. *Frontiers in Public Health* 2016; 4(suppl4).

34 Cai J, Meng X, Wang C, Chen R, Zhou J, Xu X, **Ha S**, Zhao Z, Kan H. The cold effects on circulatory inflammation, thrombosis and vasoconstriction in type 2 diabetic patients. *Science of the Total Environment* 2016; 568:271-277.

35 Yang Y, Chen R, Xu J, Li Q, Xu X, **Ha S**, Song W, Tan J, Xu F, Kan H. The effects of ambient temperature on outpatient visits for varicella and herpes zoster in Shanghai, China: A time-series study. *Journal of the American Academy of Dermatology* 2015; S0190-9622(15) 01929-5.

36 Hu H, **Ha S**, Warner TD, Roth J, Kan H, Xu X. Association of Atmospheric Particulate Matter and Ozone with Gestational Diabetes Mellitus. *Environmental Health Perspectives* 2015; 123(9):853-9.

37 Chen R, Zhao A, Chen H, Zhao Z, Cai J, Wang C, Yang C, Li H, Xu X, **Ha S**, Li T, Kan H. Cardiopulmonary benefits of reducing indoor particles of outdoor origin: a randomized double-blind crossover trial of air purifiers. *Journal of the American College of Cardiology* 2015; 65(21):2279-87.

38 Wang C, Chen R, Zhao Z, Cai J, Lu J, **Ha S**, Xu X, Chen X, Kan H. Particulate air pollution and circulating biomarkers among type 2 diabetic mellitus patients: the roles of particle size and time windows of exposure. *Environmental Research* 2015; 140:112-118.

39 **[Editor's choice] Ha S**, Hu H, Roth J, Kan H, Xu X. Association between proximity to power plants and adverse birth outcomes. *American Journal of Epidemiology* 2015; 182(3):215-24.

40 Cai J, Chen R, Wang W, Xu X, **Ha S**, Kan H. Does CO ambient have protective effect on COPD patients? *Environmental Research* 2015; 136, 21-26.

41 **Ha S**, Hu H, Roussos-Ross D, Kearney G, Kan H, Roth J, Xu X. The effects of air pollution on adverse birth outcomes. *Environmental Research* 2014; 134C:198-204.

42 Cai J, Zhao A, Zhao J, Chen R, Wang W, **Ha S**, Xu X, Kan H. Acute effects of air pollution on asthma hospitalization in Shanghai, China. *Environmental Pollution* 2014;191C:139-144.

43 Xu X, Hu H, **Ha S**, Roth J. Ambient Air Pollution and Hypertensive Disorder of Pregnancy. *Journal of Epidemiology and Community Health* 2014; 68(1):13-20.

44 **Ha S**, Talbott E, Kan H, Prins C, Xu X. Effects of heat stress and its effect modifiers on stroke hospitalizations in Allegheny County, Pennsylvania. *International Archives of Environmental Epidemiology* 2014; 87(5):557-65.

45 Xu X, **Ha S**, Kan H, Hu H, Curbow B, Lissaker C. Health Effects of Air Pollution on Length of Respiratory Cancer Survival. *BMC Public Health* 2013; 13: 800.

46 Xu X, Sun Y, **Ha S**, Lissaker C. Association between Ozone Exposure and Onset of Stroke in Allegheny County, Pennsylvania 1994-2004. *Neuroepidemiology* 2013;41(1):2-6.

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: Alec M. Chan-Golston

eRA COMMONS USER NAME (credential, e.g., agency login): aleccg

POSITION TITLE: Assistant Professor

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
University of California, Los Angeles	B.S.	06/2013	Applied Mathematics, Statistics
University of California, Los Angeles	M.S.	06/2015	Biostatistics
University of California, Los Angeles	Ph.D.	09/2020	Biostatistics

A. Personal Statement

I am an assistant Professor of Public Health whose research focuses on the applications of spatial statistics to Public Health. As I have expertise in analyzing hierarchical intervention data and accounting for complex sampling designs and patterns of missingness, as well as experience in analyzing health outcomes related to social and environmental exposures, I am well-suited to be a collaborator on this project. My dissertation involved estimation of health seeking behaviors during an intervention to modify the health environment, given spatially associated data with complex patterns of missing. This intervention was a community-engaged, multisite study. I have experience in implementing, collecting, and modeling multisite interventions, particularly in the context of community-engaged research.

Two current projects I would like to highlight are:

State of California, Department of Justice Automobile Emissions Research and Energy Fund
Bradman (PI), Role: co-investigator
9/1/21-8/31/23
San Joaquin Valley Center for Community Air Assessment and Injustice Reduction

UC Tobacco-Related Disease Research Program: New Investigator Award
Payán (PI), Role: co-investigator
7/01/22–6/30/25
Policy Surveillance and Implementation of Local Flavored Tobacco Product Sales Bans in California

1. Gill, M., Roth, S. E., **Chan-Golston, A. M.**, Rice, L. N., Crespi, C. M., Koniak-Griffin, D., Cole, B. L., & Prelip, M. L. (2019) Evaluation of an Intervention to Increase Physical Activity in Low-Income, Urban

Middle Schools. *Journal of School Health, 89(9),* 705-714. doi: 10.1111/josh.12808.

2. Ortega, A. N., Albert, S. L., **Chan-Golston, A. M.**, Langellier, B. A., Glik, G. C., Belin, T. R., Garcia, R. E., Brookmeyer, R., Sharif, M. Z., & Prelip, M. L.(2016). Substantial improvements not seen in health behaviors following corner store conversions in two Latino food swamps. *BMC Public Health*, *16*(1), 1. doi: 10.1186/s12889-016-3074-1

B.   Positions and Honors

Positions and Employment
2020 -   Assistant Professor, Department of Public Health, University of California, Merced
2018 - 2019   Part-Time Lecturer, Department of Public Health, California State University, Los Angeles

Professional Memberships
2018 -   Member, American Statistical Association
2016 -   Member, American Public Health Association

Honors
2019   Graduate Division Dissertation Year Fellowship, University of California, Los Angeles
2017   Celia G. and Joseph G. Blann Fellowship, University of California, Los Angeles
2016   Judith Blake Memorial Fellowship, University of California, Los Angeles
2015   Abdelmonem A. Afifi Fellowship, University of California, Los Angeles

C.   Contributions to Science

1. My primary research focuses on Bayesian spatial statistics and its applications to Public Health. Specifically, this methodological work examines the estimation of finite population quantities, accounting for both complex sampling designs and spatial associations. This field of study combines work in Bayesian statistics, spatial statistics, finite population estimation, and the analysis of missing data, whose literatures have previously not been linked. My most recent work, which describes estimation of finite population quantities under preferential sampling, is currently in submission and is described in my dissertation.

   3. **Chan-Golston, A. M.**, Banerjee, S., & Handcock, M. S. (2019) Bayesian Finite Population Modeling for Spatial Process Settings. *Environmetrics.* doi: 10.1002/env.2606.

2. With a group of researchers at the University of California, Los Angeles, I have also been an active collaborator in the analysis of two interventions in Los Angeles, which both aimed to modify the health environment, accounting for social exposures. The first was corner store intervention which found that despite implementing changes at the store-level, no community level change was seen in the food environment (#2 above). The second implemented a physical activity intervention in middle school students and found no treatment effect (#1 above). However, social support and perceived benefits of exercise were found to be associated with physical activity levels.

   4. Roth, S. E., Gill, M., **Chan-Golston, A. M.**, Rice, L. N., Crespi, C. M., Koniak-Griffin, D., Cole, B. & Prelip, M. L. (2019) Physical activity correlates in middle school adolescents: Perceived benefits and barriers and their determinants. *Journal of School Nursing, 35(5),* 348-358. doi: 10.1177/1059840518780300.

5. Albert, S. L., Langellier, B. A., Sharif, M. Z., **Chan-Golston, A. M.**, Prelip, M. L., Garcia, R. E., Glik, G. C., Belin, T. R., Brookmeyer, R., & Ortega, A. N. (2017) A Corner Store Intervention to Improve Access to Fruits and Vegetables in Two Latino Communities. *Public Health Nutrition, 20(12),* 2249-2259. doi: 10.1017/S1368980017001008

Manali Indravadan Patel, M.D., M.S.P.H, M.S., F.A.S.C.O.

Colleges and Universities Attended:

1997-2001	Bachelor of Arts (Double) in Chemistry and Anthropology
	Summa cum laude
	University of North Carolina, Chapel Hill, North Carolina
2001-2006	Doctor of Medicine (M.D.)
	University of North Carolina, Chapel Hill, North Carolina
2004-2005	Masters in Science in Public Health (M.S.P.H)
	University of North Carolina, Chapel Hill, North Carolina
2013-2015	Masters in Health Services Research (M.S.)
	Stanford University School of Medicine, Stanford, California

Academic Appointments:

5/1/2023-present	Associate Professor, Division of Oncology
	Stanford University School of Medicine, Stanford, California

Peer-Reviewed Original Research (90 total; 88 published, 2 in press):

1. **Patel MI,** Schupp C, Chang, E, Gomez, S, Wakelee, H. How do social factors explain outcomes from non-small cell lung cancer among Hispanics in California: Explaining the Hispanic Paradox. *Journal of Clinical Oncology,* October 2013; 31(28):3572-8. PubMedID: 23960183

2. **Patel MI,** Wang A, Kapphahn K, Kubo J, Desai M, Chlebowski R, Simon M, Cote M, Adams Campbell L, Gomez S, Bird C, Corbie-Smith G, Stefanick M, Wakelee H. Racial and Ethnic Variations in Lung Cancer Incidence and Mortality: Results from the Women's Health Initiative. *Journal of Clinical Oncology,* February 2016: 34(4):360-8. PubMedID: 26700122

3. **Patel MI**; McKinley M; Cheng I; Haile R; Wakelee H; Gomez S. Lung Cancer Incidence Trends in California by Race/Ethnicity, Histology, Sex, and Neighborhood Socioeconomic Status: An Analysis Spanning 28 years. *Lung Cancer,* June 2017: 140-149. PubMedID: 28625626

4. **Patel MI**,** Sundaram V, Desai M, Periyakoil VJ, Kahn J, Bhattacharya J. Asch S, Milstein A, Bundorf K. The effect of a Lay Health Worker Intervention on End of Life Care for Patients with Cancer. *JAMA Oncology*, July 2018. PubMedID: 30054634.
   **Paper was noted top 5 practice changing research by the American Academy of Hospice and Palliative Medicine.

5. **Patel MI**, Nevedal A, Bhattacharya J, Coker T. A community-partnered evidence-based approach to improving cancer care delivery for low-income and minority patients with cancer. *Journal of Community Health,* March 2019. PubMedID: 30825097

6. **Patel MI,** Ramirez D, Agajanian R, Agajanian H, Coker TR. Enhancing community capacity to improve cancer care delivery: The effect of a lay health worker intervention on patient-reported symptoms, healthcare use, total costs of care and end-of-life care delivery. *Journal of American Medical Association Network Open*, March 2020. PMID: 32176306.

7. **Patel MI,** Khateeb S, Coker TR. A randomized trial of a multi-level intervention to improve advance care planning and symptom management among low-income and minority employees diagnosed with cancer in outpatient settings. *Contemporary Clinical Trials,* April 2020. PMID: 32145441.

8. Yabroff R, Reeder-Hayes K, Zhao J, Halpern M, Lopez AM, Bernal-Mizrachi L, Collier A, Neuner J, Phillips J, Blackstock W, **Patel MI.** Health Insurance Coverage Disruptions and Cancer Care and Outcomes: Systematic Review of Published Research. *Journal of the National Cancer Institute*, July 2020. PMID: 32337585.

9. Dickerson J, Ragavan M, Parikh D, **Patel MI.** Health Care Delivery Interventions to Reduce Cancer Disparities Worldwide. *World Journal Clinical Oncology*, September 2020. PMID: 33033693
10. **Patel MI,** Lopez AM, Blackstock W, Reeder-Hayes K, Moushey A, Phillips J, Tap W. Cancer Disparities and Health Equity: A Policy Statement from the American Society of Clinical Oncology. *Journal of Clinical Oncology*, October 2020. PMID: 32783672
11. Parikh D, Ragavan M, Dutta R, Garnet J, Dickerson J, Maitra D, Lee F, **Patel MI.** Financial toxicity of cancer care; an analysis of financial burden in three distinct healthcare delivery systems. *Journal of Clinical Oncology Oncology Practice*, April 2021. PMID: 33826366
12. **Patel MI,** Khateeb S, Coker TR. Association of a Lay Health Worker-led Intervention on Goals of Care, Quality of Life, and Clinical Trial Participation among Low-Income and Minority Adults with Cancer. *Journal of Clinical Oncology Oncology Practice,* May 2021. PMID: 33999691
13. Gladys R, Ferguson J, Kurian A, Bondy M, **Patel MI.** The impact of COVID19 on cancer: A qualitative study. *American Journal of Clinical Oncology*, November 2021. PMID: 34519677.
14. **Patel MI**, Banks L, Das M. Improving Supportive Cancer Care for Patients with Thoracic Malignancies: A Randomized Controlled Trial. *Contemporary Clinical Trials Communications*, May 2022. PubMedID: 35669484
15. Wood E, Leach M, Villicana G, Rosas L, Duron Y, Obrian D, Koontz Z, **Patel MI**. A Community Engaged Process for Adapting a Proven Community Health Worker Model to Integrate Precision Cancer Care Delivery for Low-Income Latinx Adults with Cancer. *Health Promotion Practice*, Online ahead of print, June 2022. PubMedID: 35658733
16. **Patel MI**, Ferguson J, Castro E, Pereira-Estremera C, Armaiz-Pena G, Duron Y, Hlubocky F, Infantado A, Nuqui B, Julian D, Nortey N, Steck A, Bondy M, Maingi S. Racial and Ethnic Disparities in Cancer Care During the COVID-19 Pandemic. *JAMA Network Open*, July 2022. PubMedID: 35834248
17. **Patel MI**, Murillo A, Duron Y, Obrian D, Koontz Z. Perspectives of Low Income and Minority Populations with Lung Cancer: An Evaluation of Unmet Needs. *Journal of Clinical Oncology Oncology Practice*, June 2022. PubMedID: 35696628
18. **Patel MI**, Kapphahn K, Dewland M, Aguilar V, Sanchez B, Sisay E, Murillo A, Smith K, Park D. The Effect of a Community Health Worker Intervention on Acute Care Use, Advance Care Planning, and Patient-reported Outcomes among Adults with Cancer –A Randomized Controlled Trial. *JAMA Oncology*, August 2022. PubMedID: 35771552
19. Rodriguez G, Wood E, Duron Y, Obrian D, Koontz Z, **Patel MI.** Community Health Workers and Precision Medicine: A Randomized Controlled Trial. *Contemporary Clinical Trials*, October 2022. PubMedID: 36084898
20. Rodriguez G, Leach M, Osorio J, Wood E, Duron Y, Obrian D, Koontz Z, Rosas L, **Patel MI**. Exploring Cancer Care Needs for Latinx Adults: A Qualitative Evaluation. *Supportive Cancer Care*, December 2022. PubMedID: 36544063
21. **Patel MI**, Hinyard L, Hlubocky F, Merrill J, Smith K, Kamaraju S, Carrizosa D, Kalawar T, Fashoyin-Aje L, Gomez S, Jeames S, Florez N, Kircher S, Tap W. Assessing the Needs of Those Who Serve the Underserved: A Qualitative Study Among US Oncology Clinicians. *Cancers,* June 2023. PMID: 37444421.
22. Rodriguez G, Kumar D, **Patel MI**. "I have constant fear." A national qualitative study on the impact of COVID-19 on cancer care and potential solutions to improve the cancer care experience during the pandemic. *Journal of Clinical Oncology Oncology Practice*, August 2023. PMID: 37382970.
23. Manz CR, Rocque GB, **Patel MI.** "Leveraging Goals of Care Interventions to Deliver Personalized Care Near the End of Life." *JAMA Oncology*, August 2023. PMID: 37382970.

24. **Patel MI,** Kapphahn K, Wood EH, Coker TR, Salava D, Riley A, Krajcinovic I. "The effect of a community health worker-led intervention among low-income and minority patients with cancer: A Randomized Clinical Trial." *Journal of Clinical Oncology*, August 2023. PMID: 37625110.

25. Akimoto K, Taparra K, Brown T, **Patel MI.** Diversity in Cancer Care: Current Challenges and Potential Solutions to Achieving Equity in Clinical Trial Participation. *Cancer Journal.* December 2023. PMID: 37963364.

26. **Patel MI**, Hinyard L, Hlubocky F, Merrill J, Smith K, Kamaraju S, Carrizosa D, Kalawar T, Fashoyin-Aje L, Gomez S, Jeames S, Florez N, Kircher S, Tap W. Assessment of Challenges and Solutions to Support Oncology Professionals serving underserved populations with cancer in the United States: Results from the American Society of Clinical Oncology Serving the Underserved Task Force. *Journal of Clinical Oncology Oncology Practice*, February 2024. PMID: 38354324.

27. Rodriguez G, Popat R, Goldman R, **Patel MI**. Racial and Ethnic Disparities in Intensity of Care at the End-of-Life for Patients with Lung Cancer: A 13-year Population-based Study. *Journal of Clinical Oncology*, March 2024. PMID: 3878794.

28. **Patel MI**, Agrawal M, Blayney D, Bundorf K, Milstein A. Long-term Effects of the Engagement of Patients with Advanced Cancer Randomized Clinical Trial. *JAMA Oncology*, July 2024.

RESEARCH GRANTS

Present:

8/2019-7/2024	Funder:	Lung Cancer Research Foundation
	Title:	Reducing Disparities in Lung Cancer Through Community Partnerships
	Role:	Principal Investigator

2/2022-1/2028	Funder:	Patient Centered Outcomes Research Institute
	Title:	Comparative Effectiveness of Two Supportive Care Delivery Models for Adults with Cancer
	Role:	Principal Investigator

10/2022-9/2024	Funder:	American Cancer Society
	Title:	ALCANCE-Plus Navigation Program
	Role:	Principal Investigator

1/2023-6/2024	Funder:	California Breast Cancer Research Program
	Title:	Achieving Equity in Genomic Testing Through Stakeholder-Led Policies
	Role:	Principal Investigator

3/2023-2/2025	Funder:	Stanford Population Health
	Title:	Wildfires and Cancer Control: A Community-engaged approach for practices that can achieve Equity
	Role:	Principal Investigator

11/2023-10/2024	Funder:	National Institutes of Health
	Title:	CC-CURES Pilot Award
	Role:	Principal Investigator

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. DO NOT EXCEED FIVE PAGES.

NAME: Kiang, Mathew

eRA COMMONS USER NAME (credential, e.g., agency login): mathewkiang

POSITION TITLE: Assistant Professor

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE (if applicable)	END DATE MM/YYYY	FIELD OF STUDY
San Diego State University, Sociology, San Diego, CA	BA	2007	Sociology
New York University, International Community Health, New York, NY	MPH	2010	Public Health
Harvard T.H. Chan School of Public Health, Social and Behavioral Sciences, Boston, MA	SCD	2018	Quantitative Methods

A. Personal Statement

I am a computational and social epidemiologist with substantial training in sociology, statistics, and epidemiologic methods, and an Assistant Professor in the Department of Epidemiology and Population Health at Stanford University School of Medicine. My work focuses on racial/ethnic disparities in health and leverages both novel data, such as data from smartphones or mobile phones, and traditional health data by using a variety of causal, spatial, machine learning, and Bayesian modeling techniques. For example, my K99/R00-funded project looks at ways to improve initiation and retention in treatment for opioid use disorder among racialized groups using machine learning and nontraditional data. I am also a Co-I on a NIDA-funded R21 that seeks to use nontraditional data from Twitter and Reddit to inform local responses to the opioid epidemic.

My work is multidisciplinary and includes unique collaborations with community partners, governmental organizations, and industry partners. For example, using "big data" from a telecom company, I incorporated large, scale human mobility data into traditional epidemiologic modeling to help the Thailand Ministry of Health improve their dengue forecasting models [a]. During the time of COVID-19, we assisted other industry partners such as Facebook, Google, and Apple, in providing epidemiologically-meaningful yet privacy-preserving data to inform the COVID-19 response of local departments of public health [b]. Both of these examples show the promise of big data from industry partners and we show that incorporating this data in a way that preserves user anonymity can still be useful for informing public health interventions and preparedness. While data from mobile phones have shown great promise, we have discussed ways in which these types of data also require thoughtful considerations of replicability, ethical and legal issues, and transparency [b, c]. In another example of interdisciplinary and collaborative projects, I worked with the American Medical Association to investigate the impact of COVID-19 on the physician workforce in the US [d].

a. Kiang MV, Santillana M, Chen JT, Onnela JP, Krieger N, Engø-Monsen K, Ekapirat N, Areechokchai D, Prempree P, Maude RJ, Buckee CO. Incorporating human mobility data improves forecasts of Dengue fever in Thailand. Sci Rep. 2021 Jan 13;11(1):923. PubMed Central PMCID: PMC7806770.

b. Kishore N, Kiang MV, Engø-Monsen K, Vembar N, Schroeder A, Balsari S, Buckee CO. Measuring mobility to monitor travel and physical distancing interventions: a common framework for mobile phone data analysis. Lancet Digit Health. 2020 Nov;2(11):e622-e628. PubMed Central PMCID: PMC7462565.

c. Balsari S, Kiang MV, Buckee CO. Data in Crisis – Rethinking Disaster Preparedness in the United States. New England Journal of Medicine. 2021 Oct 14;385(16):1526-1530. doi: 10.1056/NEJMms2104654. Epub 2021 Sep 1. PubMed PMID: 34469643; PubMed Central PMCID: PMC8622661.

d. Kiang MV, Carlasare LE, Israni ST, Norcini J, Zaman JAB, Bibbins-Domingo K, Excess mortality among US physicians during the COVID-19 pandemic. JAMA Internal Medicine. 2023 Feb 6;. doi: 10.1001/jamainternmed.2022.6308. [Epub ahead of print] PubMed PMID: 36745424.

B. Positions, Scientific Appointments and Honors

Positions and Scientific Appointments

2022 -	Assistant Professor, Stanford University School of Medicine, Department of Epidemiology and Population Health, Stanford, CA
2020 - 2021	Instructor, Stanford University School of Medicine, Department of Epidemiology and Population Health, Stanford, CA
2018 - 2020	Postdoctoral Research Fellow, Stanford University School of Medicine, Center for Population Health Sciences, Stanford, CA

Honors

2012 - 2016	Department of Social and Behavioral Sciences Scholarship, Harvard School of Public Health
2008 - 2009	Steinhardt Graduate Student Scholarship, New York University
2018	Department of Social and Behavioral Sciences Travel Award, Harvard School of Public Health
2017	Department of Social and Behavioral Sciences Travel Award, Harvard School of Public Health
2017	Department of Epidemiology Teaching Assistant Award, Harvard School of Public Health
2010	E. George Payne Memorial Award, New York University

C. Contribution to Science

1. <u>Historical and current racism in the US continue to have lasting health effects</u>. As the primary data analyst, I co-authored several papers showing the need to understand black-white differences in health in a broader context that includes geography, history, and socioeconomic contexts. While the outcomes and methods in each of these papers varied widely, the social justice-centered questions around racial/ethnic health inequalities remained constant. A broader understanding of the health effects of both current-day racism and historical racism, are necessary in order to address health inequalities effectively. This is an underlying theme in my research today. For example, using a novel Bayesian modeling strategy, I show how racial/ethnic inequalities in health can be decomposed into race-specific and shared-risk factors and how two counties can have the same level of inequality through different mathematical mechanisms [a].

   a. Kiang MV, Krieger N, Buckee C, Onnela J, Chen J. Decomposition of the US black/white inequality in premature mortality, 2010–2015: an observational study. BMJ Open. 2019 November 19; 9(11):e029373-. DOI: 10.1136/bmjopen-2019-029373

   b. Krieger N, Gruskin S, Singh N, Kiang MV, Chen JT, Waterman PD, Beckfield J, Coull BA. Reproductive justice & preventable deaths: state funding, family planning, abortion, and infant mortality, US 1980-2010. SSM Popul Health. 2016 Dec;2:277-293. PubMed Central PMCID: PMC4950871.

   c. Krieger N, Kiang MV, Kosheleva A, Waterman PD, Chen JT, Beckfield J. Age at menarche: 50-year socioeconomic trends among US-born black and white women. Am J Public Health. 2015 Feb;105(2):388-97. PubMed Central PMCID: PMC4318288.

   d. Krieger N, Kosheleva A, Waterman PD, Chen JT, Beckfield J, Kiang MV. 50-year trends in US socioeconomic inequalities in health: US-born Black and White Americans, 1959-2008. Int J Epidemiol. 2014 Aug;43(4):1294-313. PubMed Central PMCID: PMC4121555.

2. <u>The opioid epidemic is not a "white only" or "rural poor" problem</u>. Despite a common narrative in academic journals and the media, the opioid epidemic not a problem restricted to the US non-Hispanic white population or rural, Appalachian states. Through a series of papers, I show that racially-differential prescribing patterns of physicians in the 1990s elevated the opioid mortality rate in the non-Hispanic white population to a level much higher than the non-Hispanic black population. However, both historically (i.e., before 1990) and since 2010, the opioid mortality rate is increasing at least as rapidly in the non-Hispanic Black population as it is in the non-Hispanic white population and in many instances, the rate is increasing even more rapidly. Recently, we also show that as the opioid epidemic shifted to illicit opioids (specifically, fentanyl), it spread geographically, and the epidemic is currently driven by these potent synthetic opioids. In addition, I have work estimating the indirect impact of drug-related mortality in the US through parental deaths of youth — we estimate over 750,000 youth (those under 18 years of age) have experienced the death of at least one parent due to drugs. Results from this collective work suggests

policies and interventions to curb the opioid epidemic need to be tailored and take into account different pathways to opioid initiation and addiction and different target populations, some of which may be indirectly impacted.

a. Kiang MV, Humphreys K, Cullen M, Basu S. Opioid prescribing patterns among medical providers in the United States, 2003-17: retrospective, observational study. BMJ. 2020 January 29; :l6968-. DOI: 10.1136/bmj.l6968

b. Kiang MV, Basu S, Chen J, Alexander MJ. Assessment of Changes in the Geographical Distribution of Opioid-Related Mortality Across the United States by Opioid Type, 1999-2016. JAMA Netw Open. 2019 Feb 1;2(2):e190040. PubMed Central PMCID: PMC6484620.

c. Kiang MV, Tsai AC, Alexander MJ, Rehkopf DH, Basu S. Racial/Ethnic Disparities in Opioid-Related Mortality in the USA, 1999-2019: the Extreme Case of Washington DC. J Urban Health. 2021 Oct;98(5):589-595. PubMed Central ID: PMC8566633.

d. Schlüter B-S, Alburez-Gutierrez A, Bibbins-Domingo K, Alexander MJ‡, Kiang MV‡. Youth experiencing parental death due to drug poisoning and firearm violence in the United States, 1999 – 2020, JAMA. 2024 May 4, doi: 10.1001/jama.2024.8391. [Epub ahead of print] PubMed PMID: 38703404; PubMed Central PMCID: PMC11070062. ‡Senior authors contributed equally.

3. <u>Leveraging mobile phones for health research</u>. Many important epidemiological questions require both individual-level behavior and data on collective human behavior. I was the analyst on a team that introduced the field of "digital phenotyping" to collect, analyze, and understand individual-level human behavior, at scale, within the natural context of everyday life [a]. In this project, we developed smartphone applications that collected high-density individual behavioral data, for example GPS or accelerometer, to create a more nuanced behavioral profile of research participants. While still nascent, pilot work in this field is promising with papers indicating this technique can be used to predict depressive symptomology and schizophrenic relapse. In addition, several pilots show this approach is feasible in a broad range of participants (e.g., college students, mental health patients, late-stage cancer patients) and, because it relies on participants' own smartphone with no additional cost to the researcher, it is highly scalable while remaining low burden. While digital phenotyping is less susceptible to bias than traditional forms of data collection, important foundational questions about how digital phenotyping data collection may vary by race/ethnicity or other demographic factors has not been clear. To address this issue, I performed a meta-study showing that digital phenotyping is feasible across a wide range of sociodemographic characteristics with limited levels of data missingness by age, gender, education, and race/ethnicity [b]. I have used telecommunication provider data to capture collective human behavior [c]. By quantifying human mobility between locations, we have been able to show the impact of mobility on epidemic dynamics and better inform public health interventions [d].

a. Torous J, Kiang MV, Lorme J, Onnela JP. New Tools for New Research in Psychiatry: A Scalable and Customizable Platform to Empower Data Driven Smartphone Research. JMIR Ment Health. 2016 May 5;3(2):e16. PubMed Central PMCID: PMC4873624.

b. Kiang MV, Chen JT, Krieger N, Buckee CO, Alexander MJ, Baker JT, Buckner RL, Coombs G 3rd, Rich-Edwards JW, Carlson KW, Onnela JP. Sociodemographic characteristics of missing data in digital phenotyping. Sci Rep. 2021 Jul 29;11(1):15408. PubMed Central ID: PMC8322366.

c. Brown T, Engø-Monsen K, Kiang MV, Mahmud A, Maude R, Buckee C. The impact of mobility network properties on predicted epidemic dynamics in Dhaka and Bangkok. Epidemics. 2021 June; 35:100441-. Available from: DOI: 10.1016/j.epidem.2021.100441

d. Salje H, Wesolowski A, Brown T, Kiang MV, Berry I, Lefrancq N, Fernandez S, Jarman R, Ruchusatsawat K, Iamsirithaworn S, Vandepitte W, Suntarattiwong P, Read J, Klungthong C, Thaisomboonsuk B, Engø-Monsen K, Buckee C, Cauchemez S, Cummings D. Reconstructing unseen transmission events to infer dengue dynamics from viral sequences. Nature Communications. 2021 March 22; 12(1):-. DOI: 10.1038/s41467-021-21888-9

IDENTIFYING INFORMATION:

NAME: Wong-Parodi, Gabrielle

ORCID iD: https://orcid.org/0000-0001-5207-7489

POSITION TITLE: Assistant Professor

PRIMARY ORGANIZATION AND LOCATION: Stanford University, Department of Earth System Science, Department of Environmental Social Sciences, Woods Institute for the Environment, Stanford, California, United States

Professional Preparation:

ORGANIZATION AND LOCATION	DEGREE (if applicable)	RECEIPT DATE	FIELD OF STUDY
University of California, Berkeley, Berkeley, CA, United States	PHD	12/2011	Social and Behavioral Sciences (ERG)
University of California, Berkeley, Berkeley, CA, United States	MA	05/2007	Social and Behavioral Sciences (ERG)
University of California, Berkeley, Berkeley, CA, United States	BA	05/2003	Psychology (High Honors)

Appointments and Positions

2019 - present   Assistant Professor, Stanford University, Department of Earth System Science, Department of Environmental Social Sciences, Woods Institute for the Environment, Stanford, California, United States

2015 - 2019   Assistant Research Professor of Behavioral Decision Sciences, Carnegie Mellon University, Pittsburgh, PA, United States

2013 - 2015   Research Scientist, Carnegie Mellon University, Pittsburgh, PA, United States

2011 - 2013   Postdoctoral Researcher, Carnegie Mellon University, Pittsburgh, PA, United States

2004 - 2011   Principal Research Associate in Residential Standards Group, Lawrence Berkeley National Laboratory, Berkeley, CA, United States

Products

Products Most Closely Related to the Proposed Project

1. Herbert N, Beckman C, Cannedy C, Cao J, Cho S, Fischer S, Huang S, Kramer S, Lopez O, Lopez S, Ouyang D, Suckale J, Wulf-Saena V, Zhang Z, Wong-Parodi G. Improving adaptation to wildfire smoke and extreme heat in frontline communities: evidence from a community-engaged pilot study in the San Francisco Bay Area. Environmental Research Letters. 2023 June 26; 18(7):074026-. Available from: https://iopscience.iop.org/article/10.1088/1748-9326/acddf9 DOI: 10.1088/1748-9326/acddf9

2. Wong-Parodi G. Community-engaged research is stronger and more impactful. Nat Hum Behav. 2022 Dec;6(12):1601-1602. PubMed PMID: 36443502.

3. Treves R, Liu E, Fischer S, Rodriguez E, Wong-Parodi G. Wildfire Smoke Clean Air Centers: Identifying Barriers and Opportunities for Improvement from California Practitioner and Community Perspectives. Society & Natural Resources. 2022 August 30; 36(9):1078-1097. Available from: https://www.tandfonline.com/doi/full/10.1080/08941920.2022.2113487 DOI:

10.1080/08941920.2022.2113487

1. Wong-Parodi G. Support for public safety power shutoffs in California: Wildfire-related perceived exposure and negative outcomes, prior and current health, risk appraisal and worry. Energy Research & Social Science. 2022 June; 88:102495-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S2214629622000032 DOI: 10.1016/j.erss.2022.102495

2. Santana F, Herbert N, Wong-Parodi G. Descriptive social norms, social support, and behavioral response to climate-related and co-occurring health hazards. Journal of Risk Research. 2024 April; 27(1):138-165. Available from: https://www.tandfonline.com/doi/full/10.1080/13669877.2024.2315997 DOI: 10.1080/13669877.2024.2315997

Other Significant Products, Whether or Not Related to the Proposed Project

1. Wong-Parodi G, Relihan DP, Garfin DR. A longitudinal investigation of risk perceptions and adaptation behavior in the US Gulf Coast. PNAS Nexus. 2024 Apr;3(4):pgae099. PubMed Central PMCID: PMC11003376.

2. Wong-Parodi G, Garfin DR. Priming close social contact protective behaviors enhances protective social norms perceptions, protection views, and self-protective behaviors during disasters. Int J Disaster Risk Reduct. 2022 Oct 1;80:103135. PubMed Central PMCID: PMC9233988.

3. Berrang-Ford L, Siders A, Lesnikowski A, Fischer A, Callaghan M, Haddaway N, Mach K, Araos M, Shah M, Wannewitz M, Doshi D, Leiter T, Matavel C, Musah-Surugu J, Wong-Parodi G, Antwi-Agyei P, Ajibade I, Chauhan N, Kakenmaster W, Grady C, Chalastani V, Jagannathan K, Galappaththi E, Sitati A, Scarpa G, Totin E, Davis K, Hamilton N, Kirchhoff C, Kumar P, Pentz B, Simpson N, Theokritoff E, Deryng D, Reckien D, Zavaleta-Cortijo C, Ulibarri N, Segnon A, Khavhagali V, Shang Y, Zvobgo L, Zommers Z, Xu J, Williams P, Canosa I, van Maanen N, van Bavel B, van Aalst M, Turek-Hankins L, Trivedi H, Trisos C, Thomas A, Thakur S, Templeman S, Stringer L, Sotnik G, Sjostrom K, Singh C, Siña M, Shukla R, Sardans J, Salubi E, Safaee Chalkasra L, Ruiz-Díaz R, Richards C, Pokharel P, Petzold J, Penuelas J, Pelaez Avila J, Murillo J, Ouni S, Niemann J, Nielsen M, New M, Nayna Schwerdtle P, Nagle Alverio G, Mullin C, Mullenite J, Mosurska A, Morecroft M, Minx J, Maskell G, Nunbogu A, Magnan A, Lwasa S, Lukas-Sithole M, Lissner T, Lilford O, Koller S, Jurjonas M, Joe E, Huynh L, Hill A, Hernandez R, Hegde G, Hawxwell T, Harper S, Harden A, Haasnoot M, Gilmore E, Gichuki L, Gatt A, Garschagen M, Ford J, Forbes A, Farrell A, Enquist C, Elliott S, Duncan E, Coughlan de Perez E, Coggins S, Chen T, Campbell D, Browne K, Bowen K, Biesbroek R, Bhatt I, Bezner Kerr R, Barr S, Baker E, Austin S, Arotoma-Rojas I, Anderson C, Ajaz W, Agrawal T, Abu T. A systematic global stocktake of evidence on human adaptation to climate change. Nature Climate Change. 2021 October 28; 11(11):989-1000. Available from: https://www.nature.com/articles/s41558-021-01170-y DOI: 10.1038/s41558-021-01170-y

4. Santana F, Gonzalez D, Wong-Parodi G. Psychological factors and social processes influencing wildfire smoke protective behavior: Insights from a case study in Northern California. Climate Risk Management. 2021; 34:100351-. Available from: https://linkinghub.elsevier.com/retrieve/pii/S2212096321000802 DOI:

10.1016/j.crm.2021.100351

1. Davis A, Wong-Parodi G, Krishnamurti T. Neither a borrower nor a lender be: Beyond cost in energy efficiency decision-making among office buildings in the United States. Energy Research & Social Science. 2019 January; 47:37-45. Available from: https://linkinghub.elsevier.com/retrieve/pii/S2214629618308685 DOI: 10.1016/j.erss.2018.08.008

Certification:

I certify that the information provided is current, accurate, and complete. This includes but is not limited to current, pending, and other support (both foreign and domestic) as defined in 42 U.S.C. § 6605.

I also certify that, at the time of submission, I am not a party to a malign foreign talent recruitment program.

Misrepresentations and/or omissions may be subject to prosecution and liability pursuant to, but not limited to, 18 U.S.C. §§ 287, 1001, 1031 and 31 U.S.C. §§ 3729-3733 and 3802.

Certified by Wong-Parodi, Gabrielle in SciENcv on 2024-05-29 13:25:30

EXHIBIT A6

CURRENT & PENDING SUPPORT

PI: Sandie Ha

Status	Award #	Source	Project Title	Start Date	End Date
Active	23RD004	California Air Resources Board	Unlocking Health Benefits for Californians by escalating management efforts of Natural and Working Lands	4/01/2024	3/31/2027
Active	NA	University of California Office of the President	Adaptation pathways for agricultural land repurposing in the San Joaquin Valley and their impacts on heat and air quality extremes on vulnerable communities	07/01/2023	6/30/2025
Active	NA	California Department of Justice	San Joaquin Valley Center for Community Air Assessment and Injustice Reduction (SJV CC-AIR)	01/01/2022	12/31/2025
Active	NA	EPA	Stanislaus County Climate, Health, and Environmental Justice Project	6/01/2024	5/31/2027
Pending	NA	EPA	Environmental Strategies and Tools Utilizing Data Integrations and Outreach in Underserved Communities (ESTUDIO)	NA	NA
Pending	NA	California Air Resources Board	HEAT--Health Equity and Adaptation to Extreme Temperature	04/01/2025	03/31/2027

PI: Alec Chan-Golston

Status	Award #	Source	Project Title	Start Date	End Date
Active	NA	EPA (subcontract with Stanislaus County, CA)	Stanislaus County Climate, Health, and Environmental Justice Project	6/1/2024	5/31/2027
Active	2022-1723	UC Tobacco-related Disease Research Program	Policy surveillance and implementation of local flavored tobacco product sales bans in California	9/1/2022	8/31/2025
Active	5R01MD018058-02	NIH	The Impact of Multiple Levels of Immigrant Policy on Rural Latino Mental Health and Health Care Access	7/21/2023	1/31/2028

Active	NA	CA Department of Justice	San Joaquin Valley Center for Community Air Assessment and Injustice Reduction (SJV CC-AIR)	1/1/2022	12/31/2025
Active	NA	UC Office of the President	Bioaerosols in the San Joaquin Valley: Characterization, transmission, and climate resilience	1/1/2024	6/30/2025
Pending	NA	California Air Resources Board	HEAT--Health Equity and Adaptation to Extreme Temperature	04/01/2025	03/31/2027
Pending	NA	EPA	Environmental Strategies and Tools Utilizing Data Integrations and Outreach in Underserved Communities (ESTUDIO)	NA	NA

PI: Manali Patel					
Status	**Award #**	**Source**	**Project Title**	**Start Date**	**End Date**
Managed/Administered by Stanford University:					
Active	SPO-147081	Lung Cancer Research Foundation	Reducing Disparities in Lung Cancer Through Community Partnerships	08/2019	07/2024
Active	2021-09, SPO-226286	LUNGevity Foundation	Ensuring Precision-Medicine Delivery for Veterans with Lung Cancer	11/2021	10/2024
Active	IHS-2020C3-20916; SPO-158643	Patient Centered Outcomes Research Institute	Comparative Effectiveness of Two Models for Supportive Cancer Care Delivery for Adults with Cancer	02/2022	05/2029
Active	87359, SPO-264938	American Cancer Society, Inc	Addressing Latinx CANcer Care Equity - Program for Long-term United Skills building	10/2022	12/2024
Active	2023-24-SCI-CIA-Patel (Womens), SPO-288135	Stanford Cancer Institute	The impact of Multiraciality, Comorbidity, and Geography on Cancer Disparities Among the Native Hawaiian and Other Pacific Islander Population in the United States	03/2023	08/2024
Active	2023-25-SCI-CHE-Patel, SPO-289361	Stanford Cancer Institute	The Community Impact of Wildfires and Cancer: A Community-Engaged Approach to Understanding and Addressing the Burden of Climate Change on Vulnerable Populations	03/2023	02/2025
Active	5U54CA28081102, SPO-270971	National Institute of Health	Central California Communities addressing UPSTREAM Cancer Risks and Equity (CC-CURES)	11/2023	10/2024

Status	Award #	Source	Project Title	Start Date	End Date
Pending	TBD	University of Pennsylvania/National Institutes of Health	Algorithm enabled - PACT (Patients Activated in Cancer Care by Teams)	12/2024	11/2029
Pending	TBD	University of California Merced/California Air Resource Board	Health Equity and Adaptation to extreme Temperature	03/2025	02/2027
Managed/Administered by PAVIR & VAPAHCS:					
Active Please note this grant is also listed under the Stanford section as there is a subcontract to PAVIR under the main award at Stanford. Effort listed is for the overall project (and should not be double-counted)	IHS-2020C3-20916; SPO-158643	Patient Centered Outcomes Research Institute / Stanford University	Comparative Effectiveness of Two Models for Supportive Cancer Care Delivery for Adults with Cancer	02/2022	05/2029
Pending	TBD	VA Palo Alto Health Care System	Algorithm-enabled Engagement of Patients with Advanced Cancer	01/2025	12/2028

PI: Matthew Kang					
Status	**Award #**	**Source**	**Project Title**	**Start Date**	**End Date**
Active	R00 DA051534	National Institutes of Health	Reducing racial disparities in the treatment of opioid use disorder using machine learning-based causal analysis	02/01/2022	01/31/2025
Active	FORD0087-30387	Fordham University/National Institutes of Health	The 3E study: Economic and Educational Contributions to Emerging Adult Cardiometabolic Health	01/01/2023	12/31/2027
Active	R21DA057598	National Institutes of Health	Tracking the opioid epidemic with social media: an early warning system	09/30/2022	09/29/2024
Active	Stanford Cancer Institute	2023-25-SCI-CHE-Patel	The Community Impact of Wildfires and Cancer: A Community-Engaged Approach to Understanding and Addressing the Burden of Climate Change on Vulnerable Populations	03/01/2023	02/28/2025
Active	Stanford Institute for Human-Centered Artificial Intelligence	298330	Leveraging Smartphone Data Collection to Improve Data Quality and Sample Generalizability in Epidemiologic Studies	02/01/2023	01/31/2025
Pending	University of Kentucky Research Foundation/National Institutes of		Administrative Supplement: Rapid Actionable Data for Opioid Response in Kentucky (RADOR-KY)	09/30/2024	09/29/2025

	Health				
Pending	ARPA-H	ARPA-H-SOL-24-106	The American Family Cohort: Enhancing Primary Care EHR Data for Improving Urban and Rural Population Health	09/01/2024	08/31/2029
Pending	University of California, Merced/State of California	TBD	HEAT: Health Equity and Adaptation to Temperature	03/2025	02/2027

PI: Gabrielle Wong-Parodi					
Status	**Award #**	**Source**	**Project Title**	**Start Date**	**End Date**
Active	1 [327892]	Strategic Energy Research Consortium	Shifting the Gold-Standard in Building Cooling: From Mechanical to Natural	01/2024	12/2026
Active	2023-331874 [326879]	Silicon Valley Community Foundation	Implementing Just Transitions in Fossil Fuel Communities through Emerging Climate Infrastructure Industries	09/2023	08/2024
Active	00011582 [297205]	University of California Office of the President	Improving social-Ecological Resilience of California Dryland Forest Agroecosystems to Climate Change	08/2023	07/2025
Active	2024-27 [304084]	NOAA / Univ. of Oklahoma	BIL: Integrating Social and Meteorological Data to Assess the Dynamics of Flood Hazards and Impact: An Interdisciplinary approach Leveraging AI, Risk Communication, and Data Sciences	08/2023	07/2025
Active	2302650	National Science Foundation	EAGER: Advanced Digital Twin Capabilities for NSF NHERI Wind Tunnel Facilities	07/203	06/2025
Active	2023-25-SCI-CHE-Patel [289361]	Stanford Cancer Institute	The Community Impact of Wildfires and Cancer: A Community-Engaged Approach to Understanding and Addressing the Burden of Climate Change on Vulnerable Populations	03/2023	02/2025
Active	HPHP 2022 [280952]	Stanford Woods Institute for the Environment	Establishing Data-Driven Community Mitigation Strategies for Climate Change and Air Quality on the Tule River Reservation	10/2022	09/2024
Active	2021 EVP [243429]	Stanford Woods Institute for the Environment	Digital Platforms Empowering Small-Scale Fishers	10/2021	09/2024
Active	84024001 [211633]	U.S. Environmental Protection Agency	Evaluating the Effectiveness of Reducing Wildfire Smoke Exposure and Health Risks in Low-Income Hard-to-Reach Communities in California	09/2021	08/2026
Active	2045129 [199612]	National Science Foundation	CAREER: Understanding the Drivers and Consequences of Personal Adaptation Behavior to Environmental Extremes	04/2021	03/2027
Pending	2024-0468 [342780]	NOAA / NCAR	Messaging for a Moving Target: Advancing Longitudinal Social Science Observations to	09/2025	08/2026

			Improve Hazardous Weather Risk Communication		
Pending	[343161]	National Science Foundation / Purdue University	RAISE CHIRRP: Adapt Policy Pathways to Equitably Manage Hydrologic Threats to Coastal Infrastructure Serviceabilty	07/2025	06/2028
Pending	TBD [342930]	State of California	HEAT: Health Equity and Adaptation to Temperature	03/2025	02/2027
Pending	TBD	CARB	Collaborating with Communities to Find Ways to Cope with Heat and Reduce Health Impacts	03/2025	02/2027
Pending	[343890]	US EPA / UC San Francisco	Healthy Homes through Every Door	01/2025	12/2027
Pending		Woods Institute for the Environment	Human Mobility and Critical Infrastructure	10/2024	09/2026
Pending	GRANT 14101653 [335489]	National Oceanic and Atmospheric Administration	Increasing the Actionability of Co-Produced Decision Support Tools (DSTs) in Support of Climate Adaptation	09/2024	08/2026
Pending	GRANT: 14211563 [343797]	US Geological Survey	Characterizing the Human State in the Coupled Human-Costal System	08/2024	08/2026
Pending	[258801]	EPA / Tule River Tribe	Establishing Data-Driven Community Mitigation Strategies for Air Quality on the River Indian Reservation	08/2023	07/2026