UCSF Health

Climate Resilience Emergency Management Integration Toolkit

Climate Action Innovation and Entrepreneurship: Transforming UC Health Systems to Reduce the Impact of Climate on Vulnerable Populations

Parnassus Heights Campus. *By Matt Beardsley.*

INTRODUCTION

The impact of climate change in California is intensifying. Persistent droughts and extreme heat events have been fueling wildfires. Exposure to heat, poor air quality from wildfire smoke, and flooding from storms exacerbate existing health disparities. Although climate change affects all communities, those with pre-existing conditions and systemic vulnerabilities will be disproportionally impacted. The University of California has committed to monitoring its environmental impact, as outlined in The UC Sustainable Practices Policy. To complement this effort, the UC Health system has developed the *Transforming UC Health Systems to Reduce the Impact of Climate on Vulnerable Populations* project. The project has three objectives: 1) Reduce greenhouse gas emissions by transitioning to a portable system for nitrous oxide 2) Create dynamic sustainability reporting for UC Health, and 3) Develop health system resilience plans and best practice toolkits. Acknowledging that UCSF Health's operations are underprepared for climate disaster events, the UCSF Health climate resilience toolkit aims to align established emergency preparedness plans with climate resilience strategies to increase the adaptive capacity of UCSF Health. The University of California has developed a Justice, Equity, Diversity, and Inclusion (J.E.D.I.)-centered Climate Resilience Framework, which focuses on marginalized and at-risk groups throughout the climate resilience planning process. The UCSF Health climate resilience toolkit will use the J.E.D.I. lens by outlining how to foster accessible and equitable care during climatic hazards through the integration of climate resilience with established emergency management protocols. This toolkit can serve as a framework for other health systems to align climate resilience with emergency management.

2. ACKNOWLEDGMENTS

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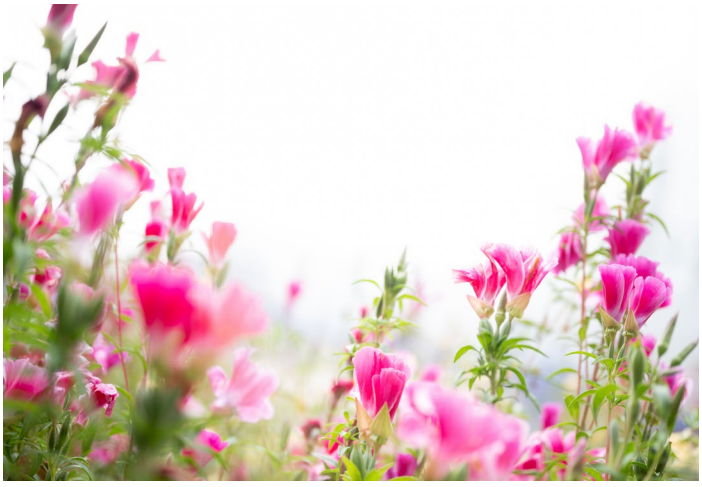
3. BACKGROUND



Pink Clarkia, a native flower, blooms on the most western of the four rooftop gardens of the Ray and Dagmar Dolby Regeneration Medicine Building, at the Parnassus Heights campus. *By Susan Merrell.*

3.1. Climate Models

The Intergovernmental Panel on Climate Change (IPCC) released its Climate Change 2023 report, which includes risks associated with various greenhouse gas emission pathways. The 2023 IPCC report highlights that rapid changes in the atmosphere, ocean, cryosphere, and biosphere have already occurred, with many adverse impacts disproportionately affecting vulnerable communities (IPCC). "Risks and projected adverse impacts and related losses and damages from climate change escalate with every increment of global warming (very high confidence). Climatic and non-climatic risks will increasingly interact, creating compound and cascading risks that are more complex and difficult to manage (high confidence)"

(IPCC). Even the lowest emission pathways are expected to result in moderate to high potential for adverse consequences. The findings of the 2023 IPCC report indicate that preparing for climate emergencies is a necessity, as these events are already occurring and will worsen in the future.

In California, an increase in the frequency and intensity of climate hazard events has been observed. Wildfires, heat events, and flooding from extreme storms and sea level rise are impacting the safety and health of communities across the state. Over a third of the most destructive and deadly wildfires in California have occurred between 2020 to 2021 (Rosenthal, A., Stover, E., & Haar, R. J). Regions in California have been found to have the worst air quality in the nation due to ozone pollution and high levels of small particulate matter (Gharibi et al.). Exposure to wildfires and poor air quality, extreme heat and weather events, flooding, and vector-borne diseases intersect with other health issues, multiplying risk factors. In addition to physical impacts, all climate risk events can impact mental health outcomes. The 2023 report of the Lancet Countdown on Health and Climate Change states that addressing climate change is potentially the largest health intervention that can be made this century. “With climate change claiming millions of lives annually and its threats rapidly growing, seizing the opportunity to secure a healthier future has never been more vital” (The Lancent Countdown on Health and Climate Change). Not only do climate hazard events directly impact health outcomes, but there are also many indirect impacts. The loss of health-supporting physical infrastructure and fewer safe hours to work or exercise outdoors increases the exposure to health risks (The Lancent Countdown on Health and Climate Change). Addressing both the direct and indirect impacts of climate change on health will be critical in the upcoming years.

Sutro Tower seen from the Mission Bay parking garage, on the day the sun was obscured by orange and yellow smoke from the West Coast fires. *By Susan Merrell.*

UCSF Health is a health center that is part of the University of California, with many medical centers and clinics across the San Francisco Bay Area. UCSF Health is working on numerous decarbonization projects to limit its impact on climate change. Along with the other University of California Health centers, UCSF Health signed onto the White House Health Sector Climate Pledge, committing to reduce emissions by 50% of 2009 baseline year levels by 2030, and to reach net zero by 2050. UCSF Health's goal is to become fossil-free for Scope 1 and 2 emissions by 2025, and for Scope 3 emissions by 2050. However, since the impacts of climate change are already being felt, mitigation projects alone will not be enough; adaptation efforts are needed. As a health center, UCSF Health is responsible for ensuring that equitable care can be provided during climate hazard events.

At UCSF Health, as well as at most other health centers, emergency management practices already incorporate some climate resilience work. For example, planning for near-term climate emergencies is common practice for emergency management. Integrating climate resilience planning with emergency management will create a streamlined process to ensure that resilience planning aligns with the work already being completed at the health system.

3.2. UCSF Health Sustainability

The Sustainability department at UCSF Health focuses on helping the organization achieve sustainability by managing sustainability programs and projects in collaboration with other departments. Sustainability projects include reducing waste and greenhouse gas emissions, improving energy and water efficiency, increasing environmentally preferred purchasing, and climate resilience planning. The department is responsible for data tracking, reporting, identifying opportunities for improvement, and educating members of the UCSF Health community about sustainability initiatives. Many other departments work closely with Sustainability to achieve UCSF Health's environmental goals. The Energy, Utilities, and Infrastructure department is responsible for various sustainability projects, such as decarbonization efforts, energy efficiency, and reducing water usage. The Environmental Health and Safety department manages waste streams at the medical centers and helps Sustainability with waste diversion efforts. The Facilities department supports decarbonization efforts and provides space and support for waste diversion projects. Hospitality finances waste-related sustainability efforts, such as waste sorters, auditing tools, and bin placements. The Medical Director of Sustainability works with clinical staff and Sustainability to reduce greenhouse gas emissions from medical procedures and reduce waste by increasing the reuse and recycling of medical supplies. Nutrition and Food Services collaborate on decreasing greenhouse gas emissions and food waste through a robust composting and donations program. The Procurement and Materials department focuses on sustainable procurement, vendor diversity, and environmentally preferred purchasing. In addition to working with UCSF Health departments, Sustainability also collaborates with counterparts across the UCSF Campus.

3.3. UCSF Climate Resilience Core Team

The UCSF Climate Resilience Core Team leads efforts to create an enterprise-wide response to climate change with a focus on J.E.D.I.-centered planning. The Core Team is made up of representatives from 10 departments across UCSF Campus and Health, meeting monthly to develop climate resilience planning strategies and ensure cross-departmental collaboration.

3.4. UCSF Health Emergency Management

The UCSF Health Office of Emergency Management is responsible for managing emergency preparedness, mitigation, response, recovery, and business continuity. There is significant overlap between Emergency Management's responsibilities and climate resilience. The established Hazard Vulnerability Analysis tool, Disaster Plans, Hospital Incident Command Center structure, and Business Continuity program have the potential to incorporate climate resilience planning strategies.

3.4.1. Hazard Vulnerability Analysis

A Hazard Vulnerability Analysis (HVA) identifies potential emergencies at locations within the organization that could affect the demand for or the ability to provide services. The HVAs allow for a systematic assessment of hazards, ranking them based on risk, and are used to align the organization's efforts (see Figure 1). They take into account the likelihood an event will occur and the severity of the event, which is determined by comparing the expected impact to the preparedness and response. All elements are ranked on a scale of 0-3 to generate the overall risk rating. HVAs are reviewed annually. UCSF Health has five locations that complete HVAs: Parnassus, Mount Zion, Mission Bay, Oakland, and Langley Porter Psychiatric Hospital. Current UCSF Health HVAs consider 60 different hazards, including some climate-related issues. HVA hazards relating to climate include high winds, wildland fire, power failure, flood, landslide/mudslide, water supply disruption, and coastal tsunami. As of the 2022 HVA, climate risks and impacts that are in the top 10 at UCSF Health locations include work stoppage, air quality issues, temperature extremes, electrical disruption, and floods.

Figure 1. The current UCSF Health HVA tool.

UCSF Health - Sample HVA

Hazards - UCSF Health
Hazard Vulnerability Assessment Tool

Alert Type	PROBABILITY	ALERTS	ACTIVATIONS	SEVERITY = (MAGNITUDE - MITGATION)						RISK
				HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur			Possibility of death or injury	Physical losses and damages	Interuption of services	Preplanning	Time, effectiveness, resources	Community/Mutual Aid staff and supplies	* Relative threat
SCORE	0 = N/A 1 = Low 2 = Moderate 3 = High	Number of Alerts	Number of Activations	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = High 2 = Moderate 3 = Low	0 = N/A 1 = High 2 = Moderate 3 = Low	0 = N/A 1 =High 2 = Moderate 3 = Low	0 - 100%
Drought	1	0	0	1	0	0	1	1	1	4%

3.4.2. Disaster Plans

The UCSF Health Emergency Management department has disaster-specific response plans that establish proactive measures before disruption events occur. The plans include university policy, definitions of the hazards, and emergency operations plans. Algorithms to trigger the initiation of the disaster plans have also been established. Disaster plans that correspond with climate resilience include the Code Red Response Plan, Flood Response Plan, Interim Excessive Heat Contingency Plan, Operation Exit Total Evacuation Response Plan, Partial Evacuation/Relocation Response Plan, Sever Weather Response Plan, Surge Plans, and Utility System Failure Response Plan.

3.4.3. Hospital Incident Command Center

UCSF Health uses the Hospital Incident Command Center (HICC), a monitoring system for emergency events. HICC is deployed during an emergency and allows for a review of the response after the disruption ends. During emergencies, HICC establishes a centralized and uniform response system, allowing assets and resources to be allocated effectively. The organization has the authority to assume control of owned spaces, such as conference rooms, during emergencies to accommodate the HICC team. The HICC team is comprised of command staff and general staff. Command staff include the Public Information Officer, Liaison Officer, Safety Officer, and Medical/Technical Officer. General staff include operations, planning, logistics, and finance chiefs. After hazard events, a debrief is hosted among various involved departments to gather input on emergency response and guide improvements in the future.

3.4.4. Business Continuity

The Business Continuity Program provides a process to ensure UCSF Health continues to operate during emergencies. The business continuity process involves the steps of Management, Initiation, Requirements & Strategy, Implementation, Ongoing Operation, Implementation, and Process Involvement. The management process performs risk assessments and identifies organizational frameworks. Initiation requires senior leadership support and funding. Requirements and Strategy prioritizes UCSF's functions and identifies gaps in fulfilling needs. Implementation documents continuity plans, establishes response procedures and communication frameworks, and provides awareness and training. Ongoing Operation involves maintaining all business continuity processes. Process Involvement assesses the process and identifies improvements. During emergencies, all UCSF control points that directly report to the Chancellor "shall assure all units with mission essential services or functions are capable to be restored within the agreed upon essential function's RTO (Return To Operations) standard after closure or disruption due to an emergency" (Emergency Management Policy).

3.5. Healthcare Guidelines

There are various guidelines that health systems are required to follow for emergency management. UCSF Health is accredited by The Joint Commission, a not-for-profit accrediting body that sets standards for health care. Since UCSF Health operates in the state of California, it is also subject to special regulations from the California Code of Regulations. Both The Joint Commission and the California Code of Regulations provide regulations for emergency management in health systems.

3.5.1. The Joint Commission

The Joint Commission has specific accreditation and certification standards for emergency management. A written Emergency Management program is required to use an "all-hazard" approach to prepare for a full spectrum of emergencies. A multidisciplinary committee must oversee and evaluate the emergency management program, with updates conducted every two years. Facility-based hazard vulnerability assessments of natural, human, information technology (IT), hazmat, and infectious disease emergencies are required, and the findings must be prioritized and addressed. A detailed Emergency Operations Plan must be created and tested twice annually. A written Continuing of Operation Plan, disaster recovery strategies, and staff education and training are also required.

3.5.2. California Title 22

Title 22 is the social security title of the California Code of Regulations. Division 5 of Title 22 ("Licensing and Certification of health facilities, home health agencies, clinics, and referral agencies") includes regulations related to emergency preparedness that all licensed hospitals must follow. A separate license is required for hospitals that are on separate premises. To maintain the license, a representative appointed by the California Department of Social Services must conduct an assessment "to assure quality care is being provided" at least once every two years. Compliance with California Title 22 is assessed by the California Department of Public Health.

4. METHODS: UCSF HEALTH CLIMATE RISKS AND VULNERABILITIES

4.1. Climate Risks

To identify relevant climate risks, the UCSF Climate Resilience Core Team forecasted climate vulnerabilities in collaboration with an external consultant. A prospective Climate Change Hazard Overview was completed for the UCSF Health West Bay Medical Centers located in San Francisco, including Parnassus, Mission Bay, and Mount Zion. A Climate Change Hazard Overview identifies relevant priority climate hazards on a long-term scale. The UCSF Climate Change Hazard Overview looked at 2050 and 2080 timelines for each of the three UCSF locations in the San Francisco region. Data was pulled from county and city mitigation plans, the HVAs, FEMA flood plains and National Risk Index, state-wide assessments and national reports, and climate change projection tools. Hazards assessed included extreme heat, wildfire and wildfire smoke, drought, and flooding. All hazards were identified as priorities at UCSF Health.

The 4th Street Park in front of the Benioff Children's Hospital and Medical Center at Mission Bay. *By Susan Merrell.*

The Climate Change Hazard Overview identified that wildfire is not a relevant threat, both now and in the future, for the UCSF Health West Bay Medical Centers. However, wildfire smoke is a relevant screening threat in both the present and future. The number of days classified as having extreme fire danger is projected to increase through the 2050s. Temperature measurements, including a gradual increase in temperature and extreme heat days, are projected to rise through the 2050s and continue increasing

through the 2080s. Drought is also a relevant screening threat for both the present and future. The number of dry days and the maximum number of consecutive dry days are projected to increase through the 2080s. Total annual precipitation is projected to increase in the 2050s and persist in the 2080s. Total precipitation in the fall and winter are also projected to rise through the 2050s and 2080s, while total spring precipitation is expected to decrease. Windstorms are a relevant screening threat; however, low confidence in future projections prevents establishing clear trends for windstorms. The global average frequency and intensity of cyclones are likely to increase in the future. Coastal flooding is already being experienced in the Mission Bay area and is projected to worsen in the future.

4.2. Vulnerable Assets/Populations/Services

To identify vulnerabilities associated with the relevant climate risks to UCSF Health, three strategies were used along with the J.E.D.I. framework. First, an initial vulnerability assessment was completed by the climate resilience consultant as part of the Climate Change Hazard Overview to provide high-level considerations as a starting point. Stakeholder workshops were then held to gather internal input from a wide range of UCSF stakeholders. This input formed the basis of a detailed vulnerability assessment matrix called the Climate Impact Assessment (CIA). The UCSF Climate Resilience Core Team, with participation from subject matter experts, ranked vulnerabilities on a numeric scale. Each vulnerability assessment tool categorizes vulnerabilities into three groups: assets (including cultural, natural, and physical), populations (such as patients, visitors, staff, and neighboring communities), and services (e.g., research, education, transportation, recreation, and events).

4.2.1. Climate Change Hazard Overview Initial Vulnerability Assessment

The initial vulnerabilities identified in the Climate Change Hazard Overview cover potential impacts from climate risks of temperature, precipitation, wind, drought and water supply, wildfire and wildfire smoke, stormwater flooding, coastal flooding, sea level rise, groundwater and saltwater intrusion, landslide, and insect infestation and micro-organisms. Overall, impacts on UCSF populations include both direct and indirect impacts to human physical and mental health, discomfort and reduced productivity, and increased stress and impacts at home. Impacts to UCSF assets include direct permanent damage to assets resulting in a need to repair or replace, increased maintenance and operating costs due to changing trends, reduced durability of the indoor environment, and damages associated with natural assets. Top impacts to services include disruptions due to the reprioritization of staff, staff shortages resulting in disruptions of operations, cancellation of outdoor programming, and surges for medical and other support services.

4.2.2. Stakeholder Workshops

Stakeholder engagement workshops were hosted to ensure diverse and equitable participation, and increase internal buy-in and cross-departmental coordination. Stakeholders from 25 departments participated, from both UCSF Health and Campus. Multiple workshops were conducted to ensure scheduling constraints would not prevent participation. The workshops focused on the climate risks of wildfire and wildfire smoke, drought and heat, and rainstorm and coastal flooding. Impacts and key affected assets were discussed across the categories of buildings, utilities and infrastructure, research assets, open space and natural assets, transportation and fleet, people, and services – both clinical and non-clinical. The workshops allowed stakeholders to share their perspective on climate vulnerabilities based on lived experiences, thus centering J.E.D.I. and ensuring a meaningful planning process.

In addition to identifying vulnerabilities, the social and environmental determinants of health, necessary outreach to at-risk populations, and potential partnerships to build upon were discussed. Partnerships that could be strengthened include the City, County, and Port of San Francisco, other Bay Area medical centers, and external community-based resilience hubs. UCSF Health has worked closely with the City of San Francisco for many years to collaborate on shared challenges, including conducting drills for threat events. Collaboration has also been established with many other Bay Area medical centers to share resources, such as bed spaces during large influxes of patients.

4.2.3. Climate Impact Assessment

The Climate Impact Assessment (CIA) reviewed the climate impacts of wildfire and smoke, drought and heat, and rain and flood. Climate change impacts were assessed based on exposure, sensitivity, and adaptive capacity, with each category being ranked on a scale of 1 to 5 to generate an overall score. The Climate Resilience Core Team was responsible for gathering responses. Subject matter experts, along with UCSF Community Benefit and the UCSF Anchor Institution Mission were consulted to identify climate risk mitigation strategies that already exist at UCSF. The CIA expanded upon the initial vulnerability assessment work completed by the external consultant in the Climate Change Hazard Overview by incorporating internal input from UCSF members.

4.3. Gap Analysis

Analysis of the Climate Change Hazard Overview, stakeholder workshops, and the CIA, along with the current emergency management system, allowed for the identification of gaps in UCSF Health's climate risk preparedness. The HVAs are updated annually and focus on the probability of a risk occurring in the next year. However, climate hazards may not be identified as top priorities until they are already occurring, leaving little time to prepare and make the necessary systematic investments to prevent the most negative impacts. To expand UCSF Health's capacity to face climate hazards, a framework that merges the risk timelines identified in the CIA into emergency management protocol is needed. Additionally, while the Climate Change Hazard Overview and the CIA identify risks and preparedness, they do not establish procedures for how to mitigate the risks. UCSF Health will need to develop a management system for climate resilience along with climate action planning.

5. UCSF HEALTH CLIMATE RESILIENCE EMERGENCY MANAGEMENT INTEGRATION TOOLS

UCSF Medical Center at Mount Zion at sunset. *By Susan Merrell.*

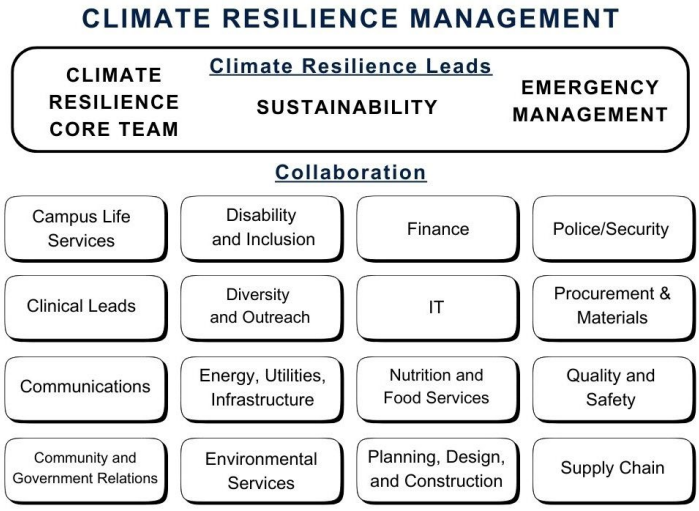
The goal of the UCSF Health Climate Resilience Toolkit is to integrate the established emergency management system with the climate resilience work being done at UCSF. A framework for climate planning will be developed to establish responsibilities and procedures related to climate hazards. The following tools are recommendations for achieving implementation and ongoing support of the climate resilience framework.

5.1. Tools

5.1.1. Climate Resilience Management Organization Chart

The climate resilience management organization chart outlines who is responsible during climate hazard events, as well as who maintains ongoing climate resilience planning efforts (see Figure 2). Emergency Management, Sustainability, and Climate Resilience Core Teams should make up the Climate Resilience Leads and are responsible for organizing and managing climate resilience integration efforts. The Climate Resilience Leads will collaborate with other departments such as Campus Life Services (which is comprised of Facilities, Transportation, etc.), Clinical Leads, Communications, Community and Government Relations, Disability and Inclusion, Diversity and Outreach, Energy, Utilities, and Infrastructure, Environmental Services, Finance, IT, Nutrition and Food Services, Planning, Design, and Construction, Police/Security, Procurement and Materials, Quality and Safety, and Supply Chain to gain input and support climate resilience planning and responses.

Figure 2. The Climate Resilience Management Organization Chart.



5.1.2. CIA HVA Integration

The Climate Impact Assessment (CIA) Hazard Vulnerability Analysis (HVA) integration tool harmonizes the CIA findings with emergency response and business continuity planning (see Figure 3). The tool provides a clear overview of the probability that a risk will occur currently, in the 2050s, and in the 2080s. The severity of the risk is calculated by subtracting the mitigation – which comprises preparedness, internal response, and external response -- from the magnitude of the risk, which includes human impact, property impact, and business impact. This format helps to prioritize mitigation and adaptation planning strategies for climate resilience.

The key difference between the current HVA format and the CIA HVA integration tool is the timeline of the risk assessment. By assessing risk in the 2050s and 2080s, future hazards can be planned for rather than solely prioritizing the threats expected on a one-year time frame. This tool should be completed by the Climate Resilience Management team with input from various subject matter experts. The CIA HVA integration tool will stand separately from the established HVAs to avoid detracting from the current emergency management planning strategy.

Figure 3. The CIA HVA Integration Tool.

UCSF Health - Sample CIA HVA Integration Tool

Hazards - UCSF Health
Climate Impact and Hazard Vulnerability Assessment Tool

Alert Type	PROBABILITY	PROBABILITY (2050)	PROBABILITY (2080)	ALERTS	ACTIVATIONS	SEVERITY = (MAGNITUDE - MITGATION)						RISK
						HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	INTERNAL RESPONSE	EXTERNAL RESPONSE	
	Likelihood this will occur	Likelihood this will occur in 2050	Likelihood this will occur in 2080			Possibility of death or injury	Physical losses and damages	Interuption of services	Preplanning	Time, effectiveness, resources	Community/Mutual Aid staff and supplies	* Relative threat
SCORE	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	Number of Alerts	Number of Activations	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = Low 2 = Moderate 3 = High	0 = N/A 1 = High 2 = Moderate 3 = Low	0 = N/A 1 = High 2 = Moderate 3 = Low	0 = N/A 1 =High 2 = Moderate 3 = Low	0 - 100%

5.1.3. Climate Resilience Planning Checklist

The Climate Resilience Planning Checklist establishes procedures for before, during, and after a climate hazard event (see Figure 4).

Before Disruption

Before climate hazard events occur, a Climate Resilience Management Core Team and Climate Resilience Leads should be established. Leaders from various departments should be engaged, including but not limited to the departments highlighted in Figure 2.

An accountability matrix should be developed to list tasks and assign them to a responsible person or department.

External stakeholders should be engaged to gain input throughout all stages of the planning process, using various outreach strategies to ensure equitable participation. Key external groups engaged should include the city and county, other local healthcare institutions, and community resilience hubs. Dedicated funding for external outreach will need to be established to ensure that outreach is consistent and transparent.

A Climate Change Hazard Overview and CIA should be completed every five years to update risks and vulnerability levels, allowing for informed decision-making. Trends from the Climate Change Hazard Overview should be tracked to inform the prioritization of mitigation strategies. The CIA HVA Integration tool should be completed annually.

To establish priorities based on vulnerabilities, an impact effort analysis timeline should be created. This timeline should account for the costs associated with the anticipated climate risks, as well as the resources needed for mitigation strategies, allowing for a full analysis to prioritize actions. It should also track the current and historical spending on climate-related emergencies from the emergency budget. A financial analysis method should be established, particularly for climate risk mitigation strategies that do not have clearly defined returns on investment. Target goals for all anticipated risks should be set, and progress toward the goals should be tracked. Funding to achieve these targets should be allocated to support both infrastructure and operational improvements.

Procedures for what to do during a climate emergency event can be developed if they do not already exist within emergency management's disaster plans. Algorithms to initiate the disaster plans will also need to be created. Response procedures should be developed in collaboration with external stakeholders to share best practices and align response protocols. These external stakeholders may be equipped with certain resilience assets, such as cooling centers, that could be used in collaboration with UCSF Health resources during climate hazard events. Additionally, the climate emergency response procedures should be aligned with the local government's public plans.

A knowledge campaign should be implemented to produce a "common-knowledge" approach to climate resilience. All internal departments should be aware of the climate resilience planning process and how they can contribute. As part of the knowledge campaign, notifications will be developed for distribution before, during, and after climate emergencies. Shared resources should include educational material and asset maps of external resources. Notification types should include inpatient, outpatient, clinicians, and facilities teams. A system to identify at-risk patients will need to be established to enable targeted notifications. Factors to determine at-risk patients include vulnerabilities such as medical conditions, medical history, and food and home security. Notifications should also be sent to skilled nursing facilities and other external outpatient facilities to inform them about how to prepare for climate hazard events, to prevent UCSF Health emergency rooms from being overwhelmed with patients.

All materials and procedures developed during the planning process need to be included in any other relevant health system policies and plans, such as the Long-Range Development Plan and the Climate Action Plan.

During Disruption

During a climate hazard events, the pre-established procedures will be followed. Emergency notifications should be sent out to patients and providers simultaneously.

Recovery

After the climate hazard disruption, recovery procedures will begin. A debrief session with the Climate Resilience Management Core Team should be conducted to evaluate the strengths and weaknesses of the emergency response. An After-Action Report should be created to document the impacts of the climate hazard event, the financial, time, and physical resources used, and improvement areas for future responses. Based on the lessons learned, planning materials should be updated to reflect the identified strengths, weaknesses, and areas for improvement.

Figure 4. The Climate Resilience Planning Checklist.

Before Disruption

- ☐ Establish a Climate Resilience Management Core Team.
- ☐ Create an Accountability Matrix.
- ☐ Update the Climate Change Hazard Overview and CIA every five years.
- ☐ Complete the CIA HVA Integration tool annually.
- ☐ Develop an Impact Effort Analysis Timeline.
- ☐ Create target goals for the anticipated risks.
- ☐ Establish funding for ongoing development.
- ☐ Develop procedures for climate emergency events.
- ☐ Align response protocols with external stakeholder groups.
- ☐ Develop a system to identify at-risk patients.
- ☐ Create a knowledge campaign.
- ☐ Develop climate emergency notification materials.
- ☐ Integrate climate resilience work with other health system policies and plans.

During Disruption

- ☐ Deploy climate emergency procedures.
- ☐ Send out climate emergency notifications.

Recovery

- ☐ Host a debrief with the Climate Resilience Management Core Team.
- ☐ Create an After-Action Report.
- ☐ Update the Before Disruption materials as appropriate.

6. NEXT STEPS

6.1. Develop the Proposed Climate Resilience Tools

To expand the climate resilience work described in this toolkit, UCSF Health will need to put the proposed climate resilience integration strategies into action. The Climate Resilience Management team should be identified and meet regularly. The CIA HVA integration tool should be completed by the Climate Resilience Leads with input from other departments and subject matter experts for all climate risks identified in the Climate Change Hazard Overview. All tasks in the Climate Resilience Planning Checklist should be completed with guidance from the Climate Resilience Leads. Additionally, these tools should be aligned with other climate action planning techniques being implemented by the Climate Resilience Core Team and at the UCSF Campus.

6.2. Expand the Location Scope

Climate Change Hazard Overviews, stakeholder workshops, and CIAs have only been completed for the UCSF Health medical centers located in the San Francisco region. To ensure the climate resilience plan encompasses the entire UCSF operation, the range of in-scope locations will need to be expanded. There are many other UCSF clinics, medical office buildings, and business operations located in San Francisco and across California that need to assess their climate risks and vulnerabilities. Any newly acquired locations, such as the St. Mary's and St. Francis medical centers in San Francisco, will also need to be assessed. Climate risks and vulnerabilities should also be reviewed in Washington State where the UCSF data center is located. Regardless of where climate risk and vulnerability assessments have been completed, this toolkit can function as a framework to integrate climate resilience into emergency management.

6.3. Revision of the HVA Framework

While developing this toolkit, the Emergency Management department at UCSF Health expressed that HVAs for all types of emergencies would benefit from a long-term perspective. Ideally, there would be one HVA tool that ranks threats based on current and future risk, encompassing both

traditional and climate hazards. Budget allocation for all emergencies will be streamlined, and funding for climate hazards will not need to be separate. The HVA format is standard for many medical centers and would require operational support across the industry to change. Adopting a long-term perspective would increase the adaptive capacity of medical centers when preparing for any type of emergency and should be pursued.

7. CONCLUSION

Climate resilience planning is an essential component of ensuring safe and equitable patient care in the future. UCSF Health already has many aspects of climate resilience embedded within its established emergency management framework. Aligning emergency management with climate resilience planning allows health systems to prepare for climate risks in a way that integrates with existing systems. The Climate Resilience Management Organization Chart indicates which departments are responsible for managing climate resilience efforts and which departments should be consulted. The CIA HVA Integration tool will allow for the HVA format to extend into the future in a way that is meaningful for addressing climate risks. The Climate Resilience Planning checklist establishes target procedures to prepare for all phases of climate hazard events. By implementing these climate resilience emergency management integration tools, UCSF Health and other health centers can reduce the impact that climate hazards have on the health and wellness of their communities.

8. APPENDIX

8.1. Definitions

Adaptation

"In *human systems*, the process of adjustment to actual or expected *climate* and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects" (IPCC)

Adaptive Capacity

"The ability of systems, *institutions*, humans and other organisms to adjust to potential damage, to take advantage of opportunities or to respond to consequences" (IPCC)

Climate Change

"A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings such as modulations of the solar cycles, volcanic eruptions and persistent anthropogenic changes in the composition of the atmosphere or in land use" (IPCC)

Emissions Pathway

"Modelled trajectories of global anthropogenic emissions over the 21st century" (IPCC).

Exposure

"The presence of people; livelihoods; species or ecosystems; environmental functions, services, and resources; infrastructure; or economic, social, or cultural assets in places and settings that could be adversely affected" (IPCC).

Mitigation

"A human intervention to reduce emissions or enhance the sinks of greenhouse gases" (IPCC).

Resilience

"The capacity of interconnected social, economic and ecological systems to cope with a hazardous event, trend or disturbance, responding or reorganising in ways that maintain their essential function, identity and structure" (IPCC).

Resilience Hubs

"Resilience Hubs are community-serving facilities augmented to: 1.support residents and 2. coordinate resource distribution and services before, during, or after a natural hazard event" (Urban Sustainability Directors Network).

Risk

"The potential for adverse consequences for human or ecological systems, recognising the diversity of values and objectives associated with such systems. In the context of *climate change*, risks can arise from potential *impacts* of climate change as well as human responses to climate change. Relevant adverse consequences include those on lives, *livelihoods*, health and *well-being*, economic, social and cultural assets and investments, infrastructure, services (including *ecosystem services*), *ecosystems* and species.

In the context of climate change impacts, risks result from dynamic interactions between climate-related *hazards* with the exposure and *vulnerability* of the affected human or ecological system to the hazards. Hazards, exposure and vulnerability may each be subject to uncertainty in terms of magnitude and *likelihood* of occurrence, and each may change over time and space due to socio-economic changes and human decision-making (see also *risk management*, *adaptation* and *mitigation*).

In the context of climate change responses, risks result from the potential for such responses not achieving the intended objective(s), or from potential trade-offs with, or negative side-effects on, other societal objectives, such as the *Sustainable Development Goals (SDGs)* (see also *risk trade-off*). Risks can arise, for example, from uncertainty in implementation, effectiveness or outcomes of *climate policy*, climate-related investments, technology development or adoption, and system transitions" (IPCC).

Sensitivity

"The degree to which a system or species is affected, either adversely or beneficially, by climate variability or change. The effect may be direct (e.g., a change in crop yield in response to a change in the mean, range, or variability of temperature) or indirect (e.g., damages caused by an increase in the frequency of coastal flooding due to sea level rise)" (IPCC).

Social and Environmental Determinants of Health

"The social determinants of health (SDH) are the non-medical factors that influence health outcomes. They are the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life. These forces and systems include economic policies and systems, development agendas, social norms, social policies and political systems" (WHO)

"Environmental factors can influence human health, including physical, chemical, and biological factors that are external to a person, and all related behaviors. Collectively, these are referred to as environmental determinants of health" (NIH).

Vulnerability

"The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements, including sensitivity or susceptibility to harm and lack of capacity to cope and adapt" (IPCC).

8.2 REFERENCES

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