A Health Impact Assessment of San Francisco's Shelter-in-Place Policy

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Summer 2015

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This report was in part made possible through funding from cooperative agreement from the Centers for Disease Control and Prevention (CDC).

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APPENDICES

ACRONYMS

ABAG	Association of Bay Area Governments
ATC	Applied Technology Council
CAPSS	Community Action Plan for Seismic Safety
CCSF	City and County of San Francisco
CDC	Centers for Disease Control
DBI	Department of Building Inspection
DEM	San Francisco Department of Emergency Management
DPH	Department of Public Health
DPW	Department of Public Works
EOC	Emergency Operations Center
ESF	Emergency Support Function
ESIP	Earthquake Safety Implementation Program
HSA	Human Services Agency
HMP	Hazard Mitigation Plan
IHSS	In-Home Supportive Services
NEN	Neighborhood Empowerment Network
NERT	Neighborhood Emergency Response Teams
PHEPR	Public Health Emergency Preparedness and Response Branch
POD	Point of Distribution
PUC	Public Utilities Commission
SFFD	San Francisco Fire Department
SSIP	Sewer System Improvement Program
SPUR	San Francisco Planning & Urban Research Association
USGS	U.S. Geological Survey

EXECUTIVE SUMMARY

Recovery after a large scale earthquake in San Francisco will be slow and long, and the complex changes in living conditions will result in a variety of potentially hazardous exposures that could result in negative health outcomes for residents. In order to expedite recovery the City's current goal is to reduce the number of evacuees and to keep residents living in their homes post-disaster. This health impact assessment measures the City and County of San Francisco's (CCSF) capacity to support its shelter-in-place policy, and highlights areas that warrant further attention to better protect its citizens.

METHODS

Environmental exposures, health outcomes, and vulnerable populations were identified in disaster and health literature. CCSF activities were gathered from agency websites and reports. The San Francisco Community Resilience Indicator System was used to assess current conditions, while ten key informant interviews evaluated the potential effectiveness of San Francisco's Shelter-in-Place policy and health impacts. Through this process, we identified vulnerable populations and gaps to inform our recommendations. This HIA was driven by three research questions:

01. What are the delayed health risks residents could experience if they shelter-in-place?

- *Structural Damage:* malnutrition, dehydration, food and waterborne illnesses, transmission of disease, shock and fume exposure
- *Non-Structural Damage:* cuts and bruises, wound infections, eye and respiratory infections, hypo/hyperthermia
- *Delays in Health & Human Services:* exacerbation of health conditions, hypertension, anxiety, depresion, and malnutrition

02. What City polices, plans, programs, or activities could prevent or respond to these risks?

The most mentioned activities cited in key informant interviews included: The Soft Story Retrofit Program, Department of Emergency Management's (DEM) Points of Distribution (PODs), NERT's Community Response Training, The Lifeline's Council, PHEPR's Communication Strategy with Medical Service Providers, and Community Resilience effort of the City Administrator's Office.

03. What gaps exist within the City's efforts to support residents as they shelter-in-place?

- Lack of diverse distribution strategies from PODs to vulnerable populations
- Absence of a waste collection plan to collect garbage and human waste from households
- Lack of a holistic physiological first aid plan
- Need for communication strategy to ensure resident trust
- Need targeted planning facilitated by geospatial maps and data analytics
- Lack of coordination around shelter-in-place efforts
- Lack of public education on health risks of shelter-in-place and strategies for staying healthy
- Need for culturally competent emergency planning

RECCOMENDATIONS

01. Support the development of additional resource distribution sites and distribution strategies for vulnerable populations to help individuals who have access and functional needs shelter-in-place.

02. Allocate a portion of Federal emergency funds to family and children services, including domestic violence services and child protective services.

03. Design an alternative collection strategy for human waste and increase public education about personal hygiene, sanitation and personal waste management for post-disaster situations.

04. Design liquefaction removal plans to reduce silt and dust post-earthquake.

05. Develop a comprehensive City wide Psychological First Aid Strategy.

06. Develop additional public outreach material and public education on how to live in a post-disaster area, and ways to avoid long-term health hazards. Material should be culturally sensitive and translated depending on target population.

07. Advance the phased Shelter-in-Place Alternative Habitability Standards, and support related programs, plans, and strategies.

08. Develop a health and emergency management data collection framework to be administered following an earthquake.

09. Incorporate geospatial and data analytics to target resources and repairs.

10. Establish interagency coordination around publishing both pre-event and post-event plans, program, and polices efforts within San Francisco City agencies.

01. INTRODUCTION & PURPOSE

San Francisco is extremely vulnerable to a catastrophic earthquake because of its location between the San Andreas and Hayward Faults (Figure 1), its population density and diversity, and the condition of its infrastructure. The U.S. Geological Survey (USGS) predicts a 62% chance that a magnitude 6.7 or greater earthquake will hit the Bay Area before 2038.[1] Recovery after such a large scale disaster will be slow and long. The City's public education campaign advances individual preparedness and self-reliance for 72 hours post-disaster and the earthquake emergency response plan anticipates 7-15 days to restore electricity, 2-3 months to fully restore water systems, and several years for a full recovery.[2]

The San Francisco Planning and Urban Research Association (SPUR), anticipates only 75% of San Francisco's housing stock will provide adequate shelter after a major earthquake and that 85,000 households could need interim housing for several months.[3] This estimate exceeds the City's top shelter capacity of 60,000 people and does not account for long term housing needs. Due to San Francisco's limited available land space and the insufficient number of emergency shelters, most residents will be forced to remain in their homes or "shelter-in-place" after an earthquake. In San Francisco shelter-in-place is defined as "a resident's ability to remain in his or her home while it is being repaired after an earthquake, typically for days or months after the main shock."[4] For the purpose of this report, shelter-in-place is distinguished from relocation to an emergency shelter.

The impact of a major earthquake will be compounded by the City's aging building stock and infrastructural lifelines (e.g. water, sewage, communication systems, and streets). These complex changes in living conditions will result in a variety of potentially hazardous exposures which could result in delayed negative health outcomes for residents. In the aftermath of a catastrophic earthquake, San Francisco residents and policymakers will face one daunting question—should people shelter-in-place or go elsewhere? In order to facilitate and expedite recovery and restoration, the City's current goal is to reduce the number of evacuees and to keep residents living in their homes post-disaster.

This Health Impact Assessment (HIA) reviews public health and disaster literature to assess the delayed health impacts residents could experience while they shelter-in-place. It identifies linkages to potentially environmental exposures that resident may encounter from structural, non-structural damage, and delays in health and human services. Following the literature review is a summary of CCSF's current programs, policies, strategies, and plans that could prevent or respond to the environmental exposures identified from the literature. Baseline conditions and neighborhood vulnerability and resiliency were evaluated using the San Francisco Community Resilience Indicator System (CRIS) and input from local city agency stakeholders. Collectively this report identifies gaps within CCSF's ability to keep residents healthy during a post-disaster shelter-in-place scenario and provides recommendation on San Francisco's shelter-in-place policy.

FIGURE 1

02. BACKGROUND

Within the United States, there is limited literature on how local public health department's support residents during long term recovery post-earthquake. Internationally, more examples were found including New Zealand's Ministry of Health's 2011-2014 Statement of Intent, and Christchurch's City Health Profile for drinking water, food security, and housing overcrowding. Recent literature has documented the need for long-term epidemiological studies post-earthquake, and suggests the need for surveillance systems to be put in place pre-disaster.[5] [6] From the literature review, environmental exposures were grouped into three categories: Structural, Non-Structural, and delays in Health & Human Services. The following table summarizes the working definitions of each category.

Vulnerable Populations

As with any emergency event, vulnerabilities and injuries are the result of a complex relationship between the type of emergency, the characteristics of the built environment (place vulnerability), and the social demographic and economic factors (social vulnerability).[7] Disasters have the largest impact on populations with pre-event low social capital and political representation, and a lack of access to resources including both materials and information. Examples of these populations include low income individuals and families, racial and ethnic minorities, limited English speaking populations, women, children, and the elderly.[8] In addition, individuals who have mental health challenges, chronic health conditions, and mobility challenges will also be at increased risk because of disruption in health and human services and nutrition programs. Individuals and families living in dense urban areas and overcrowded conditions are also more likely to be at risk to impacts from a disaster as available living space is reduced, and hygiene may be compromised, resulting in increased risk for disease transmission.

CATEGORY	WORKING DEFINITIONS
Structural	• Building systems or utilities • Ingress and egress
Non-Structural	• Household objects and debris • Internal and external hazardous material • Weather tightness • Air quality • Secondary natural disasters like landslides, heatwaves, and flooding • Amount of adequate living space
Delays in Health & Human Services	• Access to medical, behavioral health, and nutrition services • Mental health and well-being

III. LITERATURE REVIEW: BUILDING & HEALTH IN DISASTERS

The following section summarizes literature on the relationship between housing, health, and disasters. Each section identifies environmental exposures, correlated health risks, and vulnerable populations.

STRUCTURAL DAMAGE

Infrastructure Failure & Delayed Entrapment

The immediate safety concern after an earthquake is building damage and collapse. Severe building damage does not allow for safe sheltering-in-place. San Francisco has many buildings that would be vulnerable to severe damage and collapse, including concrete buildings built before 1980, unreinforced masonry buildings, single family houses over garages, single-family homes with un-braced crawl space, and soft-story wood frame buildings that are characterized by large openings on the first floor, typically for parking or commercial space.[9] The health and safety concerns from structural failure include injuries from falling elements, and further damage from aftershocks. Secondary health and safety concerns include entrapment which could lead to malnutrition, dehydration, delays in social services and an exacerbation of stress, mental health challenges, and pre-existing health conditions.

Safe Water and Food Systems

With a decrease in safe water access, residents may consume non-potable water, which could lead to an increased risk of contracting communicable diseases (e.g. Escherichia coli (E. coli), Giardia, and Cryptosporidium), and dehydration.[10] As access and availability to food and proper preparation facilities decrease, the risk of consuming contaminated or spoiled food, malnutrition, and food insecurity will also increase. The proximity of distribution sites will be an issue for individuals with mobility challenges and other vulnerable populations, which include pregnant or lactating women, children, and elderly, the chronically ill, and individuals who are injured.[11]

Sanitation

Secondary public health issues have the potential to arise from damaged sewage systems and interruption to garbage collection. Inadequate hygiene and sanitation increase incidences of diarrhea from various pathogens and infections.[12] Drinking water may become contaminated from damaged pipes, and there is a low risk that sewage water could contaminate dust particles and liquefaction silt, become air borne and create a respiratory hazard.[13] Waste Management will also become more complex based on building typology. Single family or low unit households can potentially remain in their homes by removing waste from living quarters, but it will be more difficult for high density multi-unit apartment dwellers to live without an operating sewage system.[14] Early response efforts may be as simple as designating an area for defecation away from water or food supplies or an advance coordination plan with private emergency waste collection companies.

Overcrowding

Damage to one's residence can force relocation and prompt residents to seek shelter with neighbors, friends, and family, which can lead to overcrowding.[15] The close proximity of living space can increase disease transmission including diarrheal disease, tuberculosis, influenza, pneumonia, and other respiratory and skin infections.[16] [17] [18] Overcrowding and a decrease in ventilation can lead to an increase in interior moisture, providing a nurturing environment for mold and vectors.[19] Populations who pre-disaster live in neighborhoods or structures naturally prone to overcrowding, including apartment complexes and single room occupancy hotels, are at greater risk for overcrowding and related health outcomes post-event.[20] After the 2011 Christchurch earthquake, overcrowding was estimated to have increased to 29%, and the number of people living in cars, caravans, and garages increased to 34%.[21] [22]

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Electricity

Following a power outage, individuals in their home are at risk for food and water contamination due to interruption of refrigeration and electric water pumps forcing them to resort to potentially unsafe sources. Unsafe food preparation includes the use of charcoal grills indoors, which increases the risk of carbon monoxide (CO) poisoning. Furthermore, CO exposure is also related to improper placement of generators. CO poisoning has been reported as a leading cause of mortality and morbidity in post-disaster situations.[23] Without electricity and temperature regulating equipment like heaters and fans, exposure to extreme temperatures may increase.[24] During power outages, individuals' risks increase for trips and falls as their natural movement is compromised. Fire risks also increase as residents substitute lighting with open flamed candles. The need for power also extends to the service sector, particularly the health sector, which is dependent upon electricity to administer treatment.[25] Power outages will also lead to the interruption of in home medical equipment for special-needs populations.

Physical Utility Exposure

Broken and exposed utility pipes and electrical equipment could pose a variety of risks to health and safety both inside and outside the home.[26] Broken gas pipes could create an explosion, fire, or fume hazards causing burns and smoke inhalation. Broken electrical equipment and wet electrical outlets could cause shock.[27] Use of equipment with broken exhaust pipes can result in fire or carbon monoxide poisoning.[28]

NON-STRUCTURAL DAMAGE

Non-Structural Building Elements

The most common type of injuries reported from recent earthquakes, were caused by non-structural building elements including pictures, light fixtures, glass, mirrors.[29] Other hazards include building contents like glass, furniture, fixtures, appliances, and chemical substances can also cause injury.[30] An elevator, which is commonly referred to as a nonstructural element may cause endanger to building occupants by leaving them trapped and unable to access essential resources like food and water. Most vulnerable populations include people with access and functional needs. Damage to non-structural elements like windows and door-ways can also increase exposure to extreme weather and environmental elements. Residents may be more at risk for hypothermia and hyperthermia, as well as exposures to vector-borne disease from mosquitoes, flies, rats, and fleas due to long term disruption in control efforts.[31]

Dust

Dust generated by building damage or collapse can clog breathing passages causing respiratory challenges. Fulminant pulmonary edema or the rapid accumulation of fluid in the lungs from dust inhalation may also be a delayed cause of death.[32] Another source of dust is from liquefaction silt. Liquefaction occurs when solid soil loses its stiffness and becomes "a liquid-like matrix," which then settles on the soil surface in the form of silt deposits.[33] (Appendix B) These deposits can become airborne after being disturbed and settle in homes and public spaces. Silt, smaller than 10m, poses the greatest concern for health as it is easily inhaled and absorbed into the lungs. [34]

Health effects from silt and dust exposure include an exacerbation of pre-existing respiratory injury and infections, chronic coughs, new allergies, and eye irritations.[35] [36] [37] Vulnerable populations include people with pre-existing respiratory conditions, the very young and old.[38] Also in regards to respiratory issues, damage to buildings could also disturb asbestos fibers and put demolition and construction workers at risk of exposure.

Secondary Environmental Emergencies

Secondary environmental emergencies could occur simultaneously or as a result of an earthquake and become an added risk during recovery. Current climate trends indicate that weather events are becoming more severe for both wet and dry years, including more extreme heat days, cold snaps, and a decrease in air quality, and increase in flooding. As the atmosphere warms, both the melting ice caps and the thermal expansion of oceans will cause global sea-levels to rise. Secondary emergencies caused by an earthquake could include landslides and debris flow, which can contribute to injury and death. Flooding has been directly linked to the spread of water borne disease, the movement of hazardous materials, and long term mold and bacteria growth. Following the 1989 Loma Prieta earthquake, 20% of post-earthquakes injuries were caused by toxic materials.[39] The risk of exposure to toxic substance is especially high in industrial areas.[40]

Tsunamis affecting the Bay Area can result from off-shore earthquakes within the Bay Area, or from very distant events. Although it is possible for a tsunami to originate along the central California Coast only one in history has been recorded, this was after the 1906 earthquake and was only a four-inch wave. It is more likely that an earthquake originating in Alaska or Japan would cause a tsunami large enough to cause damage.[41]

Following the 1989 Loma Prieta Earthquake, 20% of post-earthquakes injuries were caused by toxic materials.

HEALTH & HUMAN SERVICES

Public Health Services

Medical and public health impacts of a severe earthquake may be compounded by significant damage to medical facilities, hospitals, clinics, and supply stores.[42] A majority of injuries will result from the mechanical movement of the earthquake. This surge, along with damage to buildings and impacts on staff could create long term delays. Delay and failure to maintain or restore normal medical service can exacerbate chronic diseases such as diabetes or hypertension, anxiety and other mental health problems such as depression.[43] Early medical treatment could lessen complications of primary injuries, including wound complications, and neurological disabilities.[44]

Human and Social Service

Similar to potential medical facility damage, a City's human service facilities could also be impacted causing delays for vulnerable populations reliant on financial and social services. In addition, City contracted community based organizations that provide services could be severely impacts. Food banks, food pantries, and nonprofits that deliver food to the chronically ill will be strained as they may have to provide for more individuals than their original clients, putting these pre-disaster vulnerable populations at an even more risk for inadequate nutrition. These include populations that are already food and housing insecure and individuals with chronic diseases or infections including cancer, HIV and AIDS.

Psychological & Mental Health

The interconnection between disasters and mental health can create a variety of complex challenges to psychological well-being. According to the US Department of Health and Human Services, an individual can experience physical, behavioral, and emotional responses to emergency situations, including sleep problems, social withdrawal, headaches, nausea, grief, shock, depression, anxiety, despair, and mood swings.[45] Stress and anxiety can exacerbate hypertension and lead to an increase in heart attacks, and the number of abortions, and premature births can rise and continue days after, as reported with the 1985 Mexico City earthquake.[46]

Stress, frustration, and post-earthquake challenges also can strain family and relationship bonds. Following the Loma Prieta Earthquake, the director of the Santa Cruz battered women's shelter reported an increase of 50% in requests for temporary restraining orders.[47] Following Hurricane Sandy in 2012, the state of New Jersey allocated $4.8 million in federal funds to augment some of the state's domestic violence programs. The money awarded was from two funding streams, including the Social Service Block Grant (SSBG) and the Family Violence Prevention Service Act (FVPSA) grant.[48] [49]

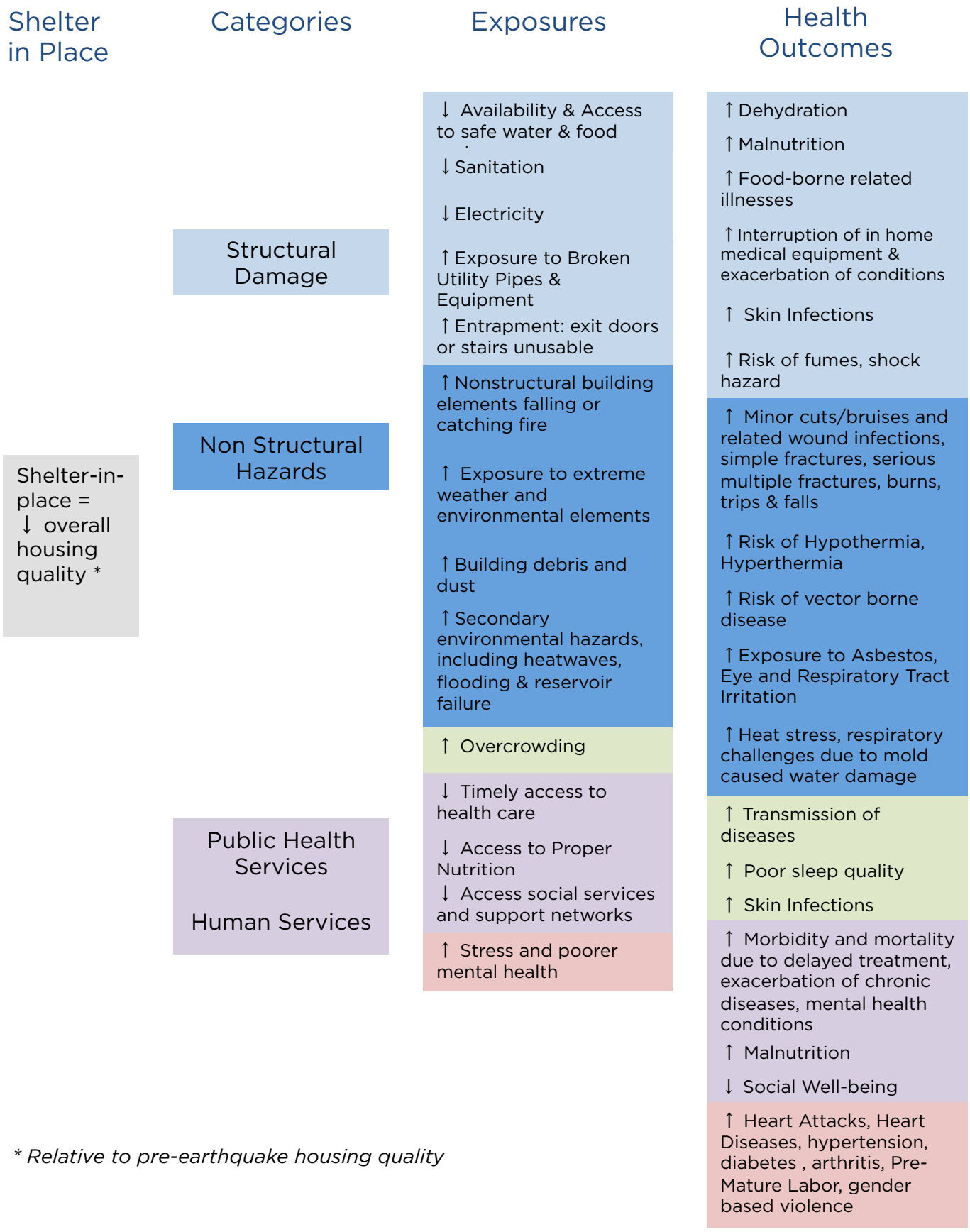
Following the Loma Prieta Earthquake, the director of the Santa Cruz battered women's shelter reported an increase of 50% in requests for temporary restraining orders.

Recent research on the relationship between the strengths of social networks and resilience, has led many scholars to assess the impacts of earthquakes and disasters in terms of its medium and long term effects on community security, mental health, and the speed of recovery. The weakening of social networks has been cited as particularly impactful on the aging community. Studies conducted after earthquakes in Asia concluded that older populations were disproportionally effected by a number of secondary consequences including the break down in family and neighborhood structures as connections expired or relocated for economic opportunities.[50]

04. METHOD & SCOPE

Following the review of the literature, a scoping diagram was created to depict the general causal pathway of the potential health outcomes (Figure 2). The next step was an assessment of CCSF's capacity to reduce human health effects for residents that shelter-in-place. Information was gathered from City agency websites and through key informant interviews. A description of the interview process and findings is discussed in section five. Relevant material was categorized using the same themes as the literature review (e.g. Structural, Non-Structural, and Health & Human Services). Each materials were analyzed on how well it addressed at least one of the five different criteria; 1) public education and outreach, 2) education within City government, 3) plans and strategies, 4) existing codes and policies, and 5) the existence of supporting data analytics. A discussion of the City's existing population conditions used the SFDPH's Community Resilience Indicator System and informant interviews.

FIGURE 2- SHELTER-IN-PLACE HEALTH OUTCOME PATHWAY DIAGRAM



** Relative to pre-earthquake housing quality*

05. ASSESSMENT

EXISTING CONDITIONS

To assess existing conditions, the San Francisco Community Resiliency Indicator System (CRIS) was used to describe environmental, health, and socio-economic factors that indicate the degree of pre-event resilience for City neighborhoods

FIGURE 3– KEY FINDINGS

ENVIRONMENTAL CHARACTERISTICS

- 26.9% of SF considered 'high' or 'very high' for heat vulnerability, with Chinatown, Civic Center, and South of Market neighborhoods most at risk.
- Neighborhoods with the highest PM 2.5 are Civic Center, Financial District, and Chinatown.
- Neighborhoods with a high percentage of land within a quarter mile from contamination sites include Treasure Island with 97.8%, Bayview with 27.0% and Potrero Hill with 22.7%

GEOGRAPHY & DENSITY

- 22.8% of the land is prone to liquefaction or landslide. Neighborhoods with the largest square footage of liquefaction include Bayview, South of Market, and Mission Bay.
- SF is home to approximately 830,000 people, which increases about 20% during daytime hours. Day time population is 1.4 million people.
- Daytime population densities per square mile are highest for Chinatown with 278,476, the Financial District with 113,954, and South of Market with 107,755 individuals per square mile.

SOCIAL CHARACTERISTICS

- 25% of the population lives 200% below the poverty line.
- Neighborhoods with the largest populations of residents over 65 are Chinatown, Seacliff, and North Beach.
- Neighborhoods with a high percentage of people with disabilities include Financial District, Civic Center and Chinatown
- Individuals living alone over the age of 65 are highest in Chinatown with 24.8% of the population.

CITY AND COUNTY OF SAN FRANCISCO EMERGENCY & RESILIENCE EFFORTS

This section identifies existing City materials in relationship to known environmental conditions identified in the literature review. Information collected through key informant interviews offer additional information to existing conditions as well as insight into forecasted outcomes. Each subsection highlights the most relevant pre-event and post-event efforts that could directly influence the shelter-in-place experience for residents. Appendix D shows a complete and detailed gap analysis using filled circles as symbols for degree of sufficiency, and Appendix E is a complete list of the material reviewed.

STRUCTURAL DAMAGE

Infrastructure Failure & Delayed Entrapment

The City currently advances several efforts focused on both pre-event infrastructure integrity, and post-event infrastructure evaluation. The following efforts are considered relevant to increasing the likelihood that residents could shelter-in-place and prevent extreme infrastructure damage that could result in injury, compromised mobility, and entrapment.

- The Soft Story Ordinance, a 2013 Building Code modification, which requires mandatory retrofit for wood-frame buildings of three or more stories or two stories over a basement or underfloor area that has any portion extending above grade.[51]

- Infrastructure Branch of the Emergency Operations Center (EOC), the City's overarching post-event coordination effort will be coordinating safety evaluations of buildings in coordination with DBI using ATC-20, a structural and non-structural evaluation procedure.

Safe Water

For the past ten years the City has taken an active role in implementing both larger pre-event mitigation efforts to improve water system resilience, advancing public education around safe water, and planning efforts to establish coordination protocols for water dissemination post-event. The list below summarizes those efforts.

- San Francisco Public Utilities Commission's (PUC) Water System Improvement Project to be completed by 2015 will help to reduce water shortages to residents after an earthquake.

- PUC public education on safe water treatment using their website and through direct outreach

- The City and County of San Francisco's (CCSF) Earthquake Annex (EQA) stipulates a variety of goals to establish 1-2 points of distribution (POD) within each district for resources. Recently, new curriculum for was added to the San Francisco Fire Department's (SFFD) Neighborhood Emergency Response Team (NERT) to train local neighbors to assist the setting up of the water truck distribution sites.

Safe Food

The City's effort to support food access begins with pre-event public education campaigns around personal preparedness. Pre-event efforts around cross sector partnerships to aid in both acquiring food and distributing are also being advanced by several agencies and nonprofits listed below.

- DEM's SF72, recommends residents have resources for 72 hours, while NERT curriculum advances 5-7 days.

- Food will also be supplied through PODs and through pre-established agreements with food banks, Glide, and the Salvation Army.

- The Neighborhood Empowerment Network (NEN) is presently partnering with community based organizations to build coordination plans for further sites of distribution or 'Neighborhood Support Center,' (NSC) and efforts to support vulnerable residents after an emergency event.

Utility Damage & Physical Utility Exposure

The issue of utility damage currently is concentrated on pre-event coordination of departments and public education for personal preparedness. Post–event, lifeline restoration will largely be implemented based on extent of damage and partnerships with private companies. The initiatives below represent the City's efforts to prepare residents for utility damage.

- The City Lifelines Council was established to improve public and private collaboration.[52]
- CCSF's Emergency Response Plan: ESF #12 Water and Utilities Annex, and the Emergency Response Plan: ESF #3 Public Works and Engineering Annex. Both annexes guide assessment of utility shortfalls, and coordinate private and public sector response.
- The SFFD conducts a multi-day NERT training, which encompasses when and how to shut off utilities for natural gas and water and electrical controls, and how to respond to a down power line.
- The Public Health & Emergency Preparedness & Response Branch (PHEPR) of SFDPH currently is advancing medical providers to develop lists of patients who are electricity reliant.
- DBI will be conducting ATC-20 evaluations, which includes identifying potential broken gas lines and fallen power lines which triggers an "Unsafe" criterion.

Sanitation

The City has taken an active role in mitigation efforts to improve the sewer system and there is some basic education about personal waste management.

- PUC's $7 billion Sewer System Improvement Program (SSIP) will make upgrades to two major treatment facilities and improve performance of the City's sewer system, although effort will not be completed until 2035.
- NERT's educates on basic ways residents can manage human waste if or when infrastructure damage has occurred. Although DEM's Earthquake Annex identifies establishing portable toilets, and sanitation stations for hand washing and showering, it is unclear whether this message is being shared with residents, or if there will be enough.[53]

Overcrowding

Indirectly several City efforts could reduce the likelihood of overcrowding. Additionally planning for interim housing was completed in 2011.

- The Soft Story Retrofit Program to bring both public and private buildings to seismic compliance[54] will directly and indirectly influence the number of residents who will be displaced.
- 2011 *Summary Report of CCSF Interim Housing Policy Planning Workshop* articulates the goal to use existing housing resources including rentals, hotels, and dormitories, and using open spaces for temporary units.

NON-STRUCTURAL DAMAGE

Non-Structural Building Elements

Public education has taken the dominant role in CCSF advanced activities to prevent non-structural building damage, although several activities more related to policy and exist, as well as future efforts still in the planning phase.

- NERT advances public education on securing internal non-structural elements to reduce falling hazards, including glass items, heavy furniture, and household hazardous or flammable materials.
- DBI's ATC-20 evaluation primarily focuses on structural damage, some non-structural hazards like gas and water breaks, and hazardous material are included.
- The City Administrator's Office and DEM are considering a Rapid Repair Program that would facilitate the movement of resources to residents to make minor home repairs in order to meet the Alternative Habitability Standards. Collectively these two activities could help keep residents in their homes and could prevent exposure to environmental exposures hazards.

Dust and Debris

Presently, there exist both non-emergency and emergency related efforts to control dust and debris in the City. Non-emergency dust codes offer a baseline understanding of what is healthy, while emergency coordination plans help to prioritize areas of the City for debris removal. Both of these resources, listed below, may benefit from expanding the scope of debris removal to consider liquefaction silt removal and silt dust control.

- *Emergency Response Plan: ESF #3 Public Works and Engineering Annex.*
- *City of San Francisco Health Code Article 22B and CCSF Ordinance Number 176-08.*

Secondary Environmental Emergencies

In regards to secondary environmental emergencies that could result due to an earthquake or occur simultaneously, the City's efforts include plans and some public education listed below.

- NERT includes basic education about potential secondary environmental hazards, including fires, blackouts, flooding, tsunamis, and hazardous materials spills. NERT currently does not include a discussion of extreme heat in their training.
- CCSF's 2014 *Hazard Mitigation Plan* (HMP) identifies reservoir failure although the probability of failure is unknown. Currently reservoir inundation maps are outdated.[55]

HEALTH & HUMAN SERVICES

The San Francisco Department of Public Health (SFDPH) has a variety of policies and plans that exist for emergency times. SFDPH's emergency plans highlight the efforts to continue medical health services and environmental health inspection programs and reduce delays in accessing needed services. Additionally, in an effort to prevent delays in human and social services, the City has taken both an infrastructural and administrative approach to prepare both City and community based organizations (CBOs).

The following material is a summary of disaster related activities.

Medical

- SF Medical Surge Plan outlines efforts to continue adequate care during events that exceed normal trends.

- All medical contracts have emergency plans, but not continuity of operation plans (COOP). PHEPR is currently addressing COOP for the City's Mental Health & Substance Abuse Clinics.
- PHEPR will act as a communication hub with clinics and hospitals post-disaster

Environmental Health Services

- Environmental Health Branch approval and inspection of shelters for sanitation, food, and garbage.
- Water Safety will be monitored in coordination with the SFPUC and public notification will be activated accordingly using the State Water Resource Control Board Guidelines.[56]
- Air Quality monitoring for demolition areas will be subject to the current SF Building and Health Code regulations, and according to key informant interviews the Hazardous Material surveillance will mostly rely on reactive investigation from public reports. SFDPH's internal Emergency Planning and continuity of operations for disease surveillance are established, but are reliant on available resources.

Human & Social Service

- CAPSS recommends that that the ESIP assist community service organizations to reach earthquake infrastructure resilience.
- San Francisco Human Services Agency (HSA) programs have a continuity of operations plan (COOP) and case workers will continue client visits, although this will be a slow process.
- HSA contracts state that CBOs "will make a good faith effort to continue to provide services."
- DEM's Earthquake Response Annex: ESF #16- Non-Governemntal Organization Response and Coordination completed by summer of 2015.
- The Neighborhood Empowerment Network works to strengthen community leadership and coordination between service providers through neighborhood emergency and resilience planning.

Psychological & Mental Health

- CCSF's *Earthquake Annex's* post-disaster public communication protocol.
- San Francisco Health Department Behavioral Health Branch stations at shelters.
- Current in-progress efforts include PHEPER's efforts to establish a continuity of operations plan with San Francisco's Mental Health and Substance Abuse Clinic.

OTHER

The following activities refer to overarching resilience efforts that did not readily fit in the previously stated categories.

- The Department of Emergency Management's "Policy Playbook" is decision making tree that inventories regulations and permits that could impact response, and offer insight if policies are waved or temporarily suspended.
- Efforts to advance an 'Alternative Habitably Standards.' The City Administrator's Office and SPUR's goal is to develop housing standards that fit the complexity of the housing environment post-disaster.

IMPACT ANALYSIS

Key Informant Interviews

The key informant interviews served as a means to evaluate the potential effectiveness of the City's disaster planning efforts and to analyze the health impacts of the City's shelter-in-place policy. Based on the findings, data regarding neighborhood resiliency and the existing empirical literature, gaps were assessed and conclusions were drawn to make recommendations that would improve health outcomes in sheltering-in-place. Key informant interviews were conducted in person with City officials who are involved within the emergency management planning, and who have capacity to address exposure prevention or response. The objectives of the interviews were, 1) to collect information on potential environmental conditions and health outcomes most likely to impact San Francisco residents, 2) to inventory existing CCSF activities, 3) identify gaps to solidify recommendations, and 4) increase an understanding of the role stakeholders feel the Department of Public Health should take within the shelter-in-place dialogue. In total ten (10) semi-structured interviews were conducted using five standard questions (Appendix F) and approximately eight additional questions specific for each stakeholder, agency, or program. Interviews lasted approximately 45 to 60 minutes.

1. SF City Administrator's Office (2)
2. SF Human Services Agency
3. SF Department of Emergency Management
4. SF Public Health & Emergency Preparedness Response Branch
5. SF Public Health Department, Environmental Health
6. SF Public Utilities Commission
7. SF Department of Building Inspection (3)

Overview

Interview participants were asked what they anticipate being the biggest health threats for residents who shelter-in-place after a major earthquake.

Below is an overview and list of responses based on most frequently mentioned exposures and outcomes. For a complete list see the Key Informant Interview: Frequency of Exposures and Gaps (Appendix G).

After an earthquake, residents most likely will be occupying their home for days or weeks without professional knowledge of the extent of damage. Private dwellings will be a low priority for structural evaluations, and although the evaluation will site a gas or fuel line break, hazardous material spills, and damage to water systems, this evaluation should not be considered an inspection for healthy housing or habitability elements like electricity needs, food and water needs, debris, dust and/ or air quality, and sanitation needs. Although the City advances self-sufficiency for 72 hours, many residents may not have the needed resources. Additionally residents will need resources past 72 hours and may have transportation challenges to distribution sites established by the City. Ensuring that residents get the resources they need while the City is repairing larger conveyance systems is largely a logistics and coordination challenge, but vulnerable residents, especially people with mobility issues, people with disabilities, language and cultural barriers, and pre-existing health challenges will have the most challenges for sheltering-in-place and accessing needed resources. Finally, although many agencies are involved in the shelter-in-place dialogue, there is not one single location to access information, updates to activities, or established avenues for collaboration. The list below is a summary of the top seven environmental exposures and health risks mentioned by interviewees.

1. Decrease in sewage systems may lead to material collecting in and around people's homes, and could contaminate drinking water.

2. Non-structural damage will compromise the living environment and lead to trips and falls, and exposure to environmental elements (ex. temperature and moisture) could lead to challenges of thermal regulation.

3. Decrease in safe water systems can increase likelihood of health risks, including the risk of consuming unsafe water, sanitation issues, and dehydration.

4. Failure in safe food systems, including lack of safe food preparation, decreased access to food, and risk of consuming unsafe food could increase the risk of malnutrition, and food borne illness.

5. Secondary emergencies will occur including fires caused by the use of candles and unsafe cooking methods including the use of BBQ and open flames indoors.

6. Availability and delays in health services and interruption of social networks or relationships will be mentally and emotionally impactful. Shock, psychological impairment, and mental health challenges will affect most people, while some will experience more extreme reactions.

7. Old buildings will fare the most damage. These buildings are often the homes of owners and residents with little means to retrofit their building pre-event, and who will have the most difficulty accessing resources and support post-event.

Identified Gaps

Although the high risk for earthquakes has made San Francisco's disaster planning systems strong there are still areas of improvement. This section summarizes the gaps identified in the CCSF Gap Analysis, and key informant interviews. Information from the Community Resilience Indicator System (CRIS) and the literature review also help to inform the identification of the gaps. Below is a list of the gaps most identified by key informants. For a complete list please refer to Appendix G.

1. The gap identified by most interviewees is the lack of diverse resource distribution strategies from PODs to individuals with limited mobility or individuals with health challenges. As cited by five interviewees, mobility challenges may prevent residents from getting needed resources from City established distribution sites. Based on current conditions from the CRIS, 10.5% of San Francisco's population reports having a disability, while 13.7% are over the age of 65 and 2.20% are over the age of 85. Across the City, 10.10% of residents over 65 live alone, adding an additional risk for isolation. By 2030 populations over 75 are expected to increase.[57] This implies that as time passes and the risk for an earthquake increases diverse distribution strategies will become more necessary.

2. An additional gap identified by five interviewees, is that presently there is not an established collection strategy for human waste, nor a consistent dialogue with residents on what is expected from them and what they can expect from the City. San Francisco Fire Department's NERT curriculum advances that residents should bag waste and that the City will collect this waste even though there is neither a plan, nor an agreement as to the agency responsibility. Neighborhoods with the highest population density and overcrowding will have the most challenge when managing waste and ensuring that it is placed away from living quarters, food, and water. Within San Francisco, average residential population density per square mile is 17,179. Average daytime population is 23,280 people. Neighborhoods with the highest residential and daytime population density per square mile include Chinatown, Financial District, and South of Market, Civic Center, and Nob Hill. In addition, within San Francisco, 6% of the population lives in households with 1 or more people per room, a definition of overcrowding. Neighborhoods with the highest percentages of overcrowding include Chinatown (25%), Crocker Amazon (15%), and Civic Center (13.8%).

3. Currently the City does not have a holistic plan or strategy for physiological first aid education and services. Following an event

it is likely that residents will turn to family members, friends, and community members for support. Public education about how to identify mental stress in others, knowledge of how to protect themselves, and how to coordinate with the City resources and lead partners like Red Cross to create coordinated network through which referrals can be made when needed. Although most residents will feel to some degree emotional and behavioral impacts, populations to consider are the elderly and youth. Presently, the neighborhoods with the highest percentage of individuals under 18 include Bayview (26.0%), Visitacion Valley (22.7%) and West of Twin Peaks (19.1%). Neighborhoods with the highest percentage of individuals over 65 include Chinatown (28.1%), North Beach (19.6%), and Twin Peaks (18.9%).

4. Targeted planning could be facilitated by the further development and utilization of geospatial maps and data analytics that would help identify pre-event trends that could become exacerbated post-disaster, as well as locations where vulnerable buildings and populations reside. Planning should be targeted toward areas currently prone to overcrowding for sanitation issues (Chinatown, Crocker Amazon, Civic Center), high elderly populations for medical and food distribution (Chinatown, North Beach, Twin Peaks, Parkside), and poor air quality for environmental air quality monitoring (Civic Center, Financial District, Chinatown), and liquefaction silt and earth removal in liquefaction and landslide zones (Mission Bay, Financial District, Treasure Island, Bayview, South of Market). Both the Community Resilience Indicator System (Appendix G) and the San Francisco Indicator Project (sfindicatorproject.org) are valuable sources for maps and data related to community, environment, and economy that can facilitate more equitable and culturally sensitive emergency management policies.

5. There is a lack of City-wide coordination around shelter-in-place efforts. Many departments have their own plans and resources including geospatial mapping and data, but there is not a cohesive movement, nor enough interagency sharing of information, data, and programmatic progress. This was also evident while researching the activities of departments and the challenge of completing a comprehensive inventory of activities for this report. Several agencies have issued reports and plans including the Lifelines Council's Interdependency Study, SF Planning Department's Community Safety Element, and NERT's training manuals.

6. Gaps exist with educating the general population on how to live in a post-disaster landscape successfully and ways to avoid long-term health outcomes and an exacerbation of pre-existing health conditions, strategies to manage sanitation, risks of food and water borne illness, and identifying structural and non-structural failure, which could facilitate an individual's decision to relocate. Neighborhoods with the highest percentage of preventable hospitalizations include Bayview, Civic Center, Treasure Island, Mission, and Western Addition. Preventable hospitalizations include diabetes, hypertension, heart failure, dehydration, bacterial pneumonia, and asthma.

7. The role of cultural competency in emergency planning is more than language translation, but includes a sensitivity and awareness of different cultural practices and an ability to adapt services to fit group needs.

In 2001 the Language Access Ordinance was passed to advance equal access to services including those who with limited proficiency in English. Neighborhoods that would benefit most from culturally competent and equitable emergency management planning include those that are the most diverse. Across San Francisco, 50% of the population is non-white, while Chinatown (87.9%), Visitacion Valley (85.1%), and Bayview (79.7%) have the highest neighborhood percentage.

07. RECOMMENDATIONS

A first draft of the recommendations was developed from the literature review and the assessment. In an effort to incorporate stakeholder feedback, the draft recommendations were presented to 27 San Francisco emergency management coordinators and community leaders at a Shelter in Place Symposium. Common overarching themes from participants included; 1) the role of the community and the need for capacity building at the neighborhood level, including strengthening nonprofits and community based organizations that are contracted with the city and that provide vital services to residents, 2) the importance of inter-agency collaboration and how competition between agencies can prevent sharing of information, and 3) that key partners collaborate across the recommendations. These include: Department of Emergency Management, Human Services Agency, Department of Public Works, Public Utilities Commission, City Administrator's Office and its community engagement program the Neighborhood Empowerment Network, the Department of Public Health, and the nonprofit San Francisco City Agencies Responding to Disaster (SF CARD). Lastly, participants not familiar with the City's emergency response structure and processes had a challenging time understanding how the recommendations fit within the City's larger emergency preparedness context. Future presentations of this HIA may need to provide an overview context. The recommendations incorporate participant feedback where applicable.

Recommendation 1: Support the development of additional resource distribution sites and distribution strategies for individuals that have access and functional needs sheltering in place.

The City should seek to improve its current efforts and increase the number of resource distribution sites within vulnerable neighborhoods. This would entail developing further dissemination strategies from the City's Points of Distribution to households and additional planning and coordination with City agencies and community based organizations. Material and goods distributed would include food, water, and clothing. Planning for additional and diverse resources distribution strategies should be targeted to the City's least resilient neighborhoods. Using the Community Resilience Indicator System, the neighborhoods with the lowest cumulative resilience score are Bayview and Hunter's Point, Visitacion Valley, Crocker Amazon, Financial District (Tenderloin), Downtown/Civic Center, Chinatown, and Treasure Island.

Recommendation 2: Develop a plan to support woman, children, and elderly residents post disaster, as well as designate a portion of emergency funds to help supplement abuse prevention programs.

As stress, frustration, and post-earthquake challenges strain family and relationship bonds, the City should not overlook women, children, and the elderly in violent circumstances. Efforts to address this challenge could include a pre-disaster agreement with family and children services as well as aging and adult services to develop and/ or expand existing emergency plans in exchange for a portion of emergency funds that would be earmarked and distributed following the earthquake. These plans could include continuity of operation plans for both department programs and contracted community based organizations, a communication plan between service providers, shelters, and clinics, and developing a strategies for supporting clients to access supportive services. A component of this plan would also focus on the long-term recovery needs of these populations.

Recommendation 3: Design a City level alternative collection strategy for human waste and increase public education about personal hygiene, sanitation and personal waste management for post-disaster situations.

This recommendation will help mitigate serious health risks that would further impact a community already traumatized by the disaster. Personal hygiene, sanitation, and managing human waste

should be a standard conversation part of every community emergency preparedness effort. Residents living in high density neighborhoods with high rates of overcrowding and/or dense apartment buildings will have the largest challenges to establishing collection sites away from living environments. Planning and designing a strategy for waste collection should be focused on neighborhoods and structural buildings with these characteristics. Current neighborhoods with the highest overcrowding rates include Chinatown, Civic Center, Financial District, South of Market, and Nob Hill. At risk structural buildings include high rises, apartment complexes, and single room occupancy hotels.

Recommendation 4: Design liquefaction removal plans to reduce silt and dust post-earthquake.

Following an earthquake liquefaction deposit sites can become a nuisance and dust from dried liquefaction can contribute to respiratory issues. Removal of liquefaction debris should be targeted to neighborhoods with the highest risk to large areas of liquefaction sites. This recommendation would coincide with the San Francisco Health Code Article 22B and CCSF Ordinance Number 176-08 which stipulates dust sites larger than half acre within 1,000 feet of open public spaces are to be controlled by watering, sheltering, or removing. Neighborhoods with large areas of liquefaction include Bayview, South of Market, and Mission Bay. Neighborhoods with high rates of preventable asthma hospitalizations, such as Bayview, should be prioritized for debris removal, as well as other sensitive receivers around homes, playgrounds, and schools. Other safety precautions could include public health announcement, dampening of dust, and/ or sheltering liquefaction silt deposits and debris to reduce the spread of the dust into living environments. City agencies, such as DPH, DBI, and DPW should consider amending existing legislation to include liquefaction silt deposits and incorporate high risk neighborhoods into their plans.

Recommendation 5: Develop a comprehensive City wide Psychological First Aid Strategy.

The Psychological First Aid Strategy should span pre-event and post-event efforts, and should heavily emphasize education for the general public, service providers, and City staff. A primary target population should be community service providers who will play a large role post-disaster, such as NERT, SF ALERT, faith-based institutions, in home support service providers, and other relevant non-profits. The education would include basic information about disaster psychology and mental health, including how to identify and offer support to other individuals experiencing mental stress, and how and when to refer individuals to clinical care. A similar approach could be implemented for the general public emphasizing basic information on how to support themselves, friends, family, and peers. The second target population includes training for City employees, including social workers and community behavioral health care organizations. Both types of trainings given should include a component on cultural sensitivity or social diversity to advance cultural competency. The City wide strategy should be a comprehensive disaster plan emphasizing behavioral health service capacity for before, during, and following an earthquake. Both education approaches should also address how each could interface to optimize coordination and implementation.

Recommendation 6: Develop additional public outreach material and public education on how to live in a post-disaster area, and ways to avoid long-term health hazards. Material should be culturally sensitive and translated depending on target population.

Although public outreach is conducted by several City agencies and non-profits, an opportunity exists to emphasize and address the delayed and long-term health challenges within public education. This would include the creation of public outreach material to compliment NERT, DEM's SF72 and NEN meeting materials. Additional education could include safe and unsafe ways to

prepare food indoors and outdoors, identifying non-structural hazards pre and post-event, the risks around dust and debris reducing poor air quality in liquefaction zones, how to maintain mental health post-disaster, and how to participate in the City's waste collection strategies. Health should take a dominant role in the curriculum. Neighborhoods that have high rates of preventable hospitalization should be prioritized. Materials should be translated into appropriate languages and distributed by trusted partners in neighborhoods with a high percentage of households that do not speak English "very well", which include neighborhoods such as Chinatown, Crocker Amazon, and Visitacion Valley.

Recommendation 7: Advance the phased Shelter-in-Place Alternative Habitability Standards, and support related programs, plans, and strategies.

During times of emergencies the "regular" health and housing standards considered "unsafe" would contribute to a large number of residents forced to evacuate. In an effort to develop housing standards that fit the complexity of the environment, alternative standards should be advanced for different phases following the disaster. These alternative standards would supersede regular code requirements only during a declared "housing emergencies," offer a vocabulary and expectation for habitability, and facilitate decision making for City agencies and residents. The standards would be applied to residential one and two-unit dwellings and in multi-unit buildings and be implemented in phased periods following an earthquake.

In order to successfully implement the alternative standards, education and training will need to be conducted for City employees and the public, along with supporting check lists and manuals. This outreach material should be translated and disseminated through trusted community partners. A complementary Rapid Repair Program that partners and utilized CBOs will need to be established. This would assist residents in meeting the requirements set forth by the new standards and reduce the possibility of exposures to unsafe conditions including broken windows, exposed utilities, safe exits, and life line repairs.

Recommendation 8: Develop a health and emergency management data collection framework to be administered in the following months after the earthquake.

Designing pre-event a multi-part research project to be implemented post-event would offer a framework to collect valuable information that could inform future preparedness efforts not only for San Francisco, but other cities as well. This multi-part after actions framework would include 1) a performance evaluation of key City agencies including DEM, PUC, DPW, DPH, and City Administrator's Office, 2) interviews with residents about their experience sheltering-in-place and interacting with the City's programs, and 3) an analysis of medical records for health trends. This research project would require establishing performance metrics for agencies, the design of a survey to be administered door-to-door or through phone calls, and coordination with hospitals and clinics for medical records. An example of this process could be the City's efforts to establish points of distribution, interviews with residents about benefits or challenges accessing the sites, and any medical attention that may have been sought for malnutrition or dehydration. Conclusions drawn from the data could illustrate the relationship between the City's performance and residential health.

Following the 2014 Napa and Vallejo earthquake the Napa Department of Health sampled resident with a door-to-door survey, reflecting against their after action reports could offer an example for San Francisco. Further modification may need to be made to fit San Francisco's urban context.

Recommendation 9: Incorporate geospatial and data analytics to target resources and repairs

Develop or utilize geospatial maps to identify areas to target pre-event public education efforts, or post-event resources distribution and health surveillance. One of the benefits of using maps pre-event is to support planning efforts in vulnerable neighborhoods and assess resource gaps. An example would be mapping the approximately 22,000 in home support clients of HSA to facilitate where emergency medical shelters should be established. Upholding individual confidentiality and population migration may present barriers. Geospatial data could also facilitate planning for deploying post-event limited City resources. As City departments return to operation, surveillance measures around hazardous material exposure and air quality monitoring should be targeted to districts and neighborhoods with histories of environmental health challenges and health disparities. Examples include neighborhoods with poor air quality in the Civic Center District, Financial District, and Chinatown or neighborhoods with past environmental contamination, such as Treasure Island or Bayview. Other examples include water surveillance for water contamination, and mold and mildew in the flood inundation zones of surrounding neighborhoods.

Recommendation 10: Establish interagency coordination around publishing both pre-event and post-event plans, program, and polices efforts within San Francisco City agencies.

A platform or database system in the interest of standardization of programs, projects, plans and data will help facilitate interagency collaboration and sharing of knowledge. Currently, there are numerous City departments with plans, reports, and recommendations but not a standard way to monitor cross agency similarities or progress. The City's preparedness efforts and disaster response plans are fragmented and decentralized. In addition, many departments and offices have created their own internal maps of information and these should be housed on one platform to support city and community planning. Establishing a policy and sharing platform would reduce redundancy and support collaboration. Examples of an interagency collaboration and data sharing platform can be found with the City's Vision Zero initiative.

VII. CONCLUSION

In order to facilitate and expedite recovery and restoration following a large scale earthquake, the City's current goal is to reduce the number of evacuees and to keep residents living in their homes post-disaster or to shelter-in-place. Post-disaster changes in living conditions could result in a variety of potential hazards which could result in delayed or long-term negative health outcomes for residents, particularly for vulnerable residents. This health impact assessment (HIA) evaluated San Francisco's capacity to support residents while they shelter-in-place and while resource distribution and social service networks are being repaired. Findings from this HIA suggest that the City's current plans, strategies and policies could be improved to help residents avoid negative health outcomes in a shelter-in-place scenario. Interventions suggested in the recommendation section could help support significant health benefits, especially for vulnerable populations.

Next steps include working with policy makers on implementation feasibility and how to strengthen coordination between the many organizations, community members and city agencies that need to be involved to help resident's safely shelter-in-place and remain healthy. Community members and organization will play a vital role to ensure neighborhoods unique culture and perspective is incorporated into the City's efforts, as well as create buy in from residents when the recommendations are implemented.

Appendix A: San Francisco Liquefaction

Appendix B: CCSF Gap Analysis Matrix (1 of 9)

Description: This matrix organizes and rates the sufficiency of City activities in relation to potential environmental exposures and health needs for residents who shelter-in-place. Categories for types of material include: Public Education & Outreach, City Agency Education, Plans & Strategies, Policies & Codes, and Strategic Data Analytics & Mapping. Filled circles symbols indicate the amount of material found for each of the five categories. City agency websites and key informant interviews served as the primary source to find the information, and for a complete list of CCSF material referenced please refer to Appendix C. This matrix facilitated the identification of gaps within City efforts, and informed the recommendations on page 24.

Ledged:	
X	Material was not specifically researched
○	Material was specifically researched but was not found
◔	A small amount of material was found
◐	Some material was found
●	Considerable material was found

	Exposure	Health Outcome	PRE	POST	Public Edu. &Outreach	City Agency Edu.	Plans & Strategies	Policies & Codes	Strategic Data Analytics & Mapping	Possible Recommendations & Notes
Structural Damage (Building Systems)	↑Infrastructure Failure & Entrapment: exit doors or stairs unusable	↑ Injuries ↑ Malnutrition, ↑ Dehydration ↑ Isolation	INFRASTRUCTURE •Earthquake Safety Implementation Program (ESIP) • Mandatory Seismic Retrofit Program •CAPSS Rec #2d: Public Edu •CAPSS Rec #4: Requires all buildings upon sale to be evaluated for seismic risk by a certain deadline, if no sale then by a deadline (9/15/2014) • ESIP's Earthquake Safety Working Group •Mandatory Soft Story Ordinance No. 66-13 •Unreinforced Masonry Building (UMB) Ordinance •Disproportionate Damage Trigger Legislation, 2013 •Cali Health & Safety Code 19161- 19162 grants local government authority to inspect and require a retrofit mandate •Building Occupancy Resumption Program (BORP) •There are 250 certified evaluators in CCSF. ENTRAPMENT •HCSMP: Guideline 3.3.2: Working in collaboration with DAAS to support in home supportive services. GENERAL •Community Safety Element: An Element of the General Plan of the City and County of San Francisco, published by the San Francisco Planning Department in 2012	INFRASTRUCTURE •Infrastructure Branch of EOC will be coordinating safety evaluations of buildings only deemed essential-DBI has about 250 certified evaluators who will use ACT-20 to evaluate private buildings. If CCSF needs more then they will use a Mutual Aid Call Out. •Dwellings will be last on the list and could take days for inspectors to get to. •Resource Distribution sites in each district- house bound populations are only mentioned with under the responsibility of IHSS •Building inspectors, housing recovery team, interim housing strategy- EQA pg. 65 ENTRAPMENT •IHSS & Children's Services will conduct individual assessments of clients	◔	◔	●	◐	X	•Consider public education around identifying basic infrastructure failure that would facilitate decision making around sheltering in place or evacuating •Support increasing the number of large residential apartment building participation in BORP •Develop a 'resource directive' to direct residents to available resources, or quick 'to-do' steps to prevent health risks this could be attached to the STEP program (or Rapid Repair Program) DEM is considering and distributed at PODs or Neighborhood Support Centers

Appendix B: CCSF Gap Analysis Matrix (2 of 9)

	Exposure	Health Outcome	PRE	POST	Public Edu. &Outreach	City Agency Edu.	Plans & Strategies	Policies & Codes	Strategic Data Analytics & Mapping	Possible Recommendations & Notes
Structural Damage (Building Systems)	↓ Access to safe water ↓ food & cooking systems,	↑Dehydration ↑ Transmission of communicable diseases ↑Malnutrition, ↑Food-borne related illnesses	WATER • PUC's Water System Improvement Project (WSIP)- end date 2015 •Water Safety public education on PUC website & Water Treatment Public Education Campaign distributing small bleach droppers and instruction to treat water •PUC Emergency Operation Plan (EOP) is tested on a regular bases by conducting emergency exercises •SFPUC employees have emergency training requirements & - educational meetings are help with PUC's Whole Sale Customers FOOD • SF72 public campaign to have food & water for 72 hours •NERT Training advanced 5-7 days of supplies, and water purification techniques, as well as ways to communicate with residents •Partnerships with food banks, Salvation Army, NGOs (ESF #6)	WATER •Alternative Water Supply System (AWSS): 67 designated fire hydrants, four 5,000 gal water trucks, twelve 2,000 gal bladders •DPH to coordinate with PUC to assist with the regulation of potable water (DEM Water & Utilities Annex pg.10) •DPH's Boil Water Notice FOOD • DPH Environmental Health's Food Safety Program's priority will be to inspect food distribution sites at Emergency Shelters and PODs •There is no evidence of Food Safety public education and messaging for post-disaster safety DISTRIBUTION • "Points of Distribution" (POD) Annex of the "ESF #6": The goal is to have 1-2 sites per district, the plan is in draft stages •NEN & Neighborhood Support Center Development: The goal of the Neighborhood Support Center is to connect into HSA's distribution plans, but NSC plans are still being constructed and only 3 neighborhoods are active under NEN •Pre-existing distribution sites, programs, and networks: food banks, Glide, Salvation Army •HSA Bulk Distribution Program & Mobile Supply Distribution by trucks, including Mobil Feeding (ESF #6)	◑	◑	◑	◑	X	•Develop a strategy of distributing resources from Points of Distribution (PODs) to vulnerable populations with limited mobility through the coordination of HSA, DPH, City Administrator's Office, and community organizations •Use maps and data analytics to supplement outreach strategy plan and target efforts to support vulnerable populations, and buildings that are considered high risk either due to age, of structure or not having gone through retrofit •Could not find anything about safety precautions around food & risk of food borne illnesses.

Appendix B: CCSF Gap Analysis Matrix (3 of 9)

	Exposure	Health Outcome	PRE	POST	Public Edu. &Outreach	City Agency Edu.	Plans & Strategies	Policies & Codes	Strategic Data Analytics & Mapping	Possible Recommendations & Notes
Structural Damage (Building Systems)	sanitation	↑ Transmission of communicable diseases ↑ Skin Infections	• PUC's Sewer System Improvement Project (SSIP) •DPH's Emergency Shelter Employee Training Presentation-Module 8: Solid Waste & Hazard Training by CDC address the need to collect solid and hazardous waste after a disaster •NERT- public education around building a temporary toilet and designating a collection cite in agreement with neighbors.	•Public Sanitation Teams- Portable toilet, sanitation stations- hand washing stations, showers (ESP # 3) •Utility Restoration Strategy (EQ Annex, pg. 66)-utility providers will restore services in accordance with their pre-established restoration priorities •Long-term post Disaster Assistance Program (EQ Annex, pg. 67) •DPW to make repairs to damaged sewer lines through the Bureau of Street and Sewer Repair (DEM Water & Utilities Annex pg.10)	◔	◔	◐	X	◯	•Establish a strategy or a policy for a waste collection system that collaborates with private waste companies. Use data projections around overcrowding, apartment, buildings, and pre-existing housing violations as hot spots for sanitation risks.
	↓ electricity/ power, and gas	↑Interruption of in home medical equipment and exacerbation of conditions	• GSA's Lifelines Council- what is expected by performance •CCSF Interim Housing Policy- utilizing existing housing, using temporary trailers or manufactured homes, and relocation •DEM's Water and Utility Annex (ESF#6)	•Interruption for power & gas is expected to be 7-15 days. PUC will be coordinating with Energy Industry, assessing damages, and making repairs. Consult DEM Water and Utility Annex for more info	◯	◔	◐	X	X	•Recommend a required generator registration for the city and a strategy to disseminate them to needed areas including, senior centers, day care centers, churches, community centers, and other informal buildings that may act as impromptu shelters. •Public Education around the risk of carbon monoxide poisoning as people use alternative power sources. •Public Education on strategies or actions to take during power outages and supporting electricity reliant residents.
	↑ Exposure to Broken Utility Pipes	↑Risk of Fume Exposure, Shock Hazard	•NERT training encompasses utility safety, including when, where, and how to shut off supplies for natural gas, water and electricity within the home. Education also includes the potential hazard of fallen electrical lines, and the shock hazard of fallen lines in flooding and standing water	•ATC- 20 Rapid Evaluation Criteria assesses broken gas lines, fallen power lines	◐	◯	●	◐	◔	

Appendix B: CCSF Gap Analysis Matrix (4 of 9)

	Exposure	Health Outcome	PRE	POST	Public Edu. &Outreach	City Agency Edu.	Plans & Strategies	Policies & Codes	Strategic Data Analytics & Mapping	Possible Recommendations & Notes
Structural Damage (Building Systems)	↑ Exposure to extreme weather and environmental elements	↑Risk of Hypothermia, Hyperthermia ↑Exposure to disease vector	• Rapid Repair Program/ STEP Program (status: in consideration) FEMA Program- was specifically designed for water damage after Sandy- to fund minor repairs for houses to support residents as they shelter in place. DEM is exploring whether a program like this would have applicability in an earthquake scenario.	•HSA Bulk Distribution Program to distribute tarps and blankets	X	X	◔	X	X	•Support DEM in considering a Rapid Repair Program/ STEP program. This program could be done in partnership with community repair nonprofits like Rebuilding Together, and could act as an avenue to small scale resources to make minor home repairs to improve shelter in place.
	↑Structure Fires due to gas leaks & as power is restored	↑Fire related injuries, burns, lesions	•NERT training includes removing or identifying household flammable hazards, the types of fire, and how to use an extinguisher. •CAPSS Rec # 10: Require gas shut off valves on vulnerable buildings located in high fire hazard areas •Post Earthquake High Fire Hazard Areas developed by SFFD & DBI •PUC Emergency Firefighting Water System Projects- improves the reliability of water system post EQ	•SFFD & Search and Rescue activities within geographical fire divisions (EQ Annex, pg. 31 & 77) •Post- EQ Public Notification message around fire risks with candles (EQA) •ATC-20, inspections of nonstructural hazards including potential fire hazards like unanchored boilers (pg. 95)	◐	X	◐	◐	◐	•Fires are most likely to occur where high-density wood frame houses built over soft soil- North Beach, Mission, South of Market, Downtown, Civic-Are these residents aware of the increased risk? Could something be required in their lease or ownership to increase public awareness?

Appendix B: CCSF Gap Analysis Matrix (5 of 9)

	Exposure	Health Outcome	PRE	POST	Public Edu. &Outreach	City Agency Edu.	Plans & Strategies	Policies & Codes	Strategic Data Analytics & Mapping	Possible Recommendations & Notes
Non Structural Hazards	↑Nonstructural building elements (bricks, lights, chemical & flammable materials) falling	↑ Minor cuts/bruises and related wound infections, simple fractures, serious multiple fractures, burns	• Building Code: Façade Ordinance (status: pending) •NERT's public education curriculum includes securing non-structural elements within the home, including glass, heavy furniture, and household hazardous materials and flammable hazards •SF Planning Dept. "Community Safety Element" Objective 1 •Inspection program to assess parapets, decorative building elements? •#16 CAPSS Addressing Hazards from damage to building systems (cited as fallen ceilings and fixtures, broken pipes, and overturned equipment)	• Post- EQ Public Notification message around non-structural hazards • ACT-20- Structural Assessment includes non-structural hazards, and even some basic health hazards like hazardous material (pg. 95)	◑	◑	◑	●	✕	
	↑↑More likely to be exposed to building debris and dust	↑Exposure to Asbestos , Eye and Respiratory Tract Irritation ↑Exposure to Silt & Dust contaminated with sewage around broken pipes	•Building and Health Code regulations around size and location of dust sites in relation to construction. These regulations may be applied during emergency times as well. •City Debris Removal Plan •NERT-Recommends including in personal emergency kits dust masks and eye protection	• Debris removal is focused more on the goal to clear transportation routes and spark rebuilding • ACT-20 Rapid Evaluation looks for asbestos contamination	◔	✕	◑	◑	✕	•Consider extending Building and Health Code regulations and strategies of control to liquefaction sites post disaster, if silt becomes a nuisance.
	↑Risk of Flooding for housing downhill from reservoirs & Secondary Environmental Hazards	↑Disease transmission, spreading of waste, or hazardous material, land slides, long term mold, or vector infestations	•NERT- relevant secondary emergencies- flooding, blackouts, and tsunamis, as well as hazardous waste exposure and spills •SFDEM's 2014 Hazard Mitigation Plan identifies Reservoir Failure pg. 52-54. Identifies locations of reservoirs, cites that the probability of failure is unknown, but Cali law requires inundation maps, but maps are outdated, and exact risk is unknown. Some parts of the SFPUC-owned system > 75yrs old. Potential health risks associated with flooding (mold, etc.)	• ATC- 20 inspections by geotechnical evaluators, not a primary inspection, but it is included in manual	◑	✕	●	◔	◑	Update reservoir failure inundation maps and consider any short and long term health risks for flooding that compound with earthquake sheltering in place health risks. •Update maps, according to SFDEM Hazard Mitigation Plan, inundation areas are likely outdated, maps from 1970s.

Appendix B: CCSF Gap Analysis Matrix (6 of 9)

	Exposure	Health Outcome	PRE	POST	Public Edu. &Outreach	City Agency Edu.	Plans & Strategies	Policies & Codes	Strategic Data Analytics & Mapping	Possible Recommendations & Notes
Health Services	↓ More likely to have a decrease in timely access to health care	↑ Morbidity and mortality due to delayed treatment ↑Exacerbation of chronic diseases, ↑Psychological & mental health conditions	PLANS •San Francisco Community Health Improvement Plan San Francisco Health Care Master Plan, Recommendations 3.1-3.4 address increasing access to appropriate care for SF's vulnerable populations •PHEPR's Communication Strategy: "A List of Lists" with key intermediary partners who have extensive contact lists with clients, vulnerable populations or additional service providers. •Communication with Hospitals and Clinics: to support patients who are reliant on electricity and dialysis •All medical contracts have emergency plans, but not all have individual continuity plans POLICIES •CA State Law: Senate Bill 1953 requires owners of acute care hospitals to evaluate their facilities DATA & MAPPING •Mapping out Durable Medical Equipment •Mapping out private and public high rise buildings that house elderly, older adults, and people with disabilities. PUBLIC EDU. •Various public education efforts that often address personal preparedness and possibility of delays in services.	•PHEPER will primarily act as a communication and coordination hub • Medical Surge Plan- outlines to continue care during events that exceed normal trends. •Structural Integrity Inspection using ATC-20, will be prioritized by EOC, and will include clinics, hospitals, and care centers. •Clinics and Hospitals have priority to have their buildings inspected. •Master DPH Response Plan stipulates that Disaster Service Workers & Police will go door to door. DPH-health needs; HAS- food, water, resources •Vial of Life Programs helps first responders gain information on the medical needs of seniors & people with disabilities before issuing help. Part of SFFD and SFSU Community Involvement	◒	◯	●	●	◒	

Appendix B: CCSF Gap Analysis Matrix (7 of 9)

	Exposure	Health Outcome	PRE	POST	Public Edu. &Outreach	City Agency Edu.	Plans & Strategies	Policies & Codes	Strategic Data Analytics & Mapping	Possible Recommendations & Notes
Human Services	↓ More likely to have a decrease in timely access		•HSA employee training for Disaster Service Workers & Personal Preparedness •HSA programs have COOP planning •HSA contracts with NGOs stipulate continuing services • Community Based Organization Financial Recovery Piece/ Policy (status: in progress): Reimbursing contractors and nonprofits who apply for compensation for aid given "above and beyond normal service provisions." •CAPSS Recommendation #6: Assist community service organizations to reach earthquake infrastructure resilience • Policy Playbook: (status: in progress):facilitate decision makers if regulations need to be waved or temporarily suspended.	•HSA a lead agency for Points of Distribution •IHSS & Children's Services will conduct individual assessments of clients	✗	◒	◒	◔	✗	Recommendation: •IHSS Client Education for SIP •Further contract language for COOP of contracted services, or further effort to support contracted CBOs through COOP development

Appendix B: CCSF Gap Analysis Matrix (8 of 9)

	Exposure	Health Outcome	PRE	POST	Public Edu. &Outreach	City Agency Edu.	Plans & Strategies	Policies & Codes	Strategic Data Analytics & Mapping	Possible Recommendations & Notes
Applies to All	↑ Stress and poorer mental health	↑ Heart Attacks, Heart Diseases, hypertension, diabetes , arthritis, Pre-Mature Labor, gender based violence	PUBLIC EDU: Neighborhood Empowerment Network Disaster resilience the development of social capital on mitigating stress and mental health issues •SF Fire Dept. & NERT class session on disaster psychology (in progress) SF HEALTH CARE SERVICE MASTER PLAN • Guideline 1.1.5: Advance the efforts of the Mayor's Office of Violence Prevention Services including recommendations of SF's current and future Violence Prevention Plan • Guideline 3.2.3: Increase availability of behavioral health and trauma-related services in high rate violence neighborhoods •Guidelines 2.1.1-2.1.2: which support expansion of open space, recreation facilities, and urban planning that facilitates future health care needs and service connectivity for seniors and people with chronic conditions or limited mobility- supports social cohesion, physical and transportation access to service •Emphasis on culturally competent community clinics •Recommendation 2.1: Support "healthy" urban growth EMERGENCY PLANS: COOP planning for City's Mental Health & Substance Abuse Clinics (in progress) •PHEPR internal department training for psychological first aid	•DPH's DOC (Dept. of Operation's Center) for Behavioral Health Coordination Team will help to coordinate resources to support to ensure continuity of care to the larger behavioral system •To maintain public calmness, DEM has a 24 hour goal to make regular news briefings to inform residents on CCSF operations & services (EQA p.27) •Mental health support more concentrated at shelters- EQ Annex's SIP strategy is to use alert and notification through the public info officer (p.56-57) •SF72 communication platform offers a way for people to communicate, and access information, although it is difficult to know who will have access to internet, and often the people who do are not the most vulnerable	◐	◔	◐	◐	✕	•Develop a comprehensive City wide Psychological First Aid Strategy. •Continue to support pre-disaster community resilience engagement work that supports nurturing social connectivity or social capital to help mitigate stress and mental health challenges.
	↑Overcrowding	↑ Transmission of diseases ↓ Sleep quality ↑ Skin Infections	•Multiple programs to retrofit and bring both public and private buildings to seismic compliance- this will directly influence the number of residents who will be displaced or forced to live in crowded areas •July 2001, Policy Planning Workshop for Post Disaster Interim Housing- couldn't find literature	•City's Interim Housing Strategy: as articulated in the 2011 Summary Report of CCSF Interim Housing Policy Planning Workshop 1. Making Use of Existing Housing Resources, 2. Developing New Interim Housing Resources 3. Ensuring Effective Governance/Management	✕	✕	◐	◐	◯	•Use existing data and maps that describe neighborhoods with overcrowding to facilitate target resource planning. •Post event, use maps to target resources to overcrowded areas, as well as buildings like SROs and smaller multi unit apartment complexes were issues of sanitation, respiratory disease, and vector infestation will be most prevalent.

Appendix B: CCSF Gap Analysis Matrix (9 of 9)

	Exposure	Health Outcome	PRE	POST	Public Edu. &Outreach	City Agency Edu.	Plans & Strategies	Policies & Codes	Strategic Data Analytics & Mapping	Possible Recommendations & Notes
Acronyms: •CAPSS-Community Action Plan for Seismic Safety •CDC-Centers for Disease Control •DBI-Department of Buildings •DSW-Disaster Service Worker •DOC-Department Operation Center maintain internal dept. operations and contribute to the citywide response in coordination with EOC •DPH-Department of Public Health •EOC-Emergency Operations Center- the central point for multi-agency emergency management coordination •EQA-Earthquake Annex •ESF #6- Emergency Support Function, 6th Annex •ESF #12- Water and Utilities Annex •FAST- Functional Assessment Service Team •GSA-General Services Agency •HSA-Human Services Agency •IHSS-In Home Supportive Services •NEN-Neighborhood Empowerment Network •NERT-Neighborhood Emergency Response Team •NSC-Neighborhood Support Center •HCSMP- Health Care Service Master Plan •POD-Point of Distribution •PHEPR-Public Health, Emergency Preparedness & Response Branch •SF-San Francisco •SFFD-San Francisco Fire Department										

Appendix C: City and County of San Francisco Material

The following is a list of CCSF material reviewed to summarize current effort to support the shelter-in-place policy. City agency websites and key informant interviews served as the primary research method.method.

ATC-20-Applied Technology Council: *Procedures for Post-earthquake Safety Evaluation of Buildings*, Department of Building Inspections
California State Water Resource Control Board, Unsafe Water Notice Guidance & Boil Water Notice http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Notices.shtml
CCSF Emergency Response Plan ESF #3: Public Works & Engineering Annex CCSF Emergency Response Plan ESF #6: Mass Care, Housing, & Human Services Annex CCSF Emergency Response Plan ESF #12: Water and Utilities Annex CCSF Emergency Response Plan: Earthquake Annex CCSF Emergency Response Plan: Tsunami Annex CCSF Hazard Mitigation Plan Executive Summary http://sfdem.org/index.aspx?page=413
Community Action Plan for Seismic Safety (CAPSS) http://www.sfgsa.org/index.aspx-?page=6046
DBI Soft Story Retrofit Program & Building Code Ordinance Legislation http://sfdbi.org/mandatory-soft-story-program http://www.sfbos.org/ftp/uploadedfiles/bdsupvrs/ordinances13/o0066-13.pdf
Disproportionate Damage Trigger Legislation, SF Building Code Amendment http://sfdbi.org/sites/sfdbi.org/files/migrated/FileCenter/Documents/Administrative_Bulletins/2013_AB/AB_098_updated_010114.pdf
DOE "Toxics & Health: In home hazardous material" http://www.sfenvironment.org/toxics-health
DPH Community Health Improvement Plan https://www.sfdph.org/dph/comupg/knowlcol/chip/default.asp
DPH Emergency Operations Plan: Environmental Health Branch & Behavioral Health Coordination Team http://dphnet.in.sfdph.net/EOP
DPH Employee Training- Shelters (PowerPoint)
DPH Employee Training Solid Waste and Hazardous Materials (PowerPoint)
DPH Environmental Health Assessment Form for Shelters
DPH Health Care Service Master Plan https://www.sfdph.org/dph/files/HCSMP/Final/FINAL-HCSMP-October2013.pdf
DPH Medical Surge Assessment Findings Report & Gap Analysis: Hospital & Long Term Care Facilities
Emergency Operations Center (EOC): Infrastructure Branch

Appendix C: City and County of San Francisco Material (continued)

SF Interim Housing Policy Planning Workshop (2011) Summary Report
Lifelines Council, Lifelines Interdependency Study http://www.sfgsa.org/modules/showdocument.aspx?documentid=12025
Neighborhood Emergency Response Team (NERT): curriculum http://www.sf-fire.org/modules/showdocument.aspx?documentid=3077
Neighborhood Empowerment Network http://empowersf.org/
PHEPR Being Prepared and over 60 (PowerPoint)
SF72-Department of Emergency Management http://www.sf72.org/home
SF Planning Department Community Safety Element http://www.sf-planning.org/ftp/general_plan/community_safety_element_2012.pdf
PUC 2010 Urban Water Management Plan http://sfwater.org/modules/showdocument.aspx-?documentid=1055
PUC "2005 City Wide Upgrade, Ten Year Effort"
PUC Water Safety & Treatment http://www.sfwater.org/index.aspx?page=539
PUC Sewer System Improvement Program (SSIP) http://www.sfwater.org/index.aspx?page=116

Appendix D: San Francisco Community Resiliency Indicators, 2014 (1 of 3)

The Community Resiliency Indicator System was determined through a review of national best practices and interactions with City and community stakeholders. Data was collected from the 2013 United States Census, the 2008-2012 American Community Survey, and San Francisco City agencies.

		San Francisco	Most Resilient	Least Resilient
Hazard	Percent of the neighborhood in the 100 year storm flood plain	2.10%	26 Neighborhoods have 0%	Treasure Island 26.3% Mission Bay 13.3% Bayview 6.8%
	Percent of the neighborhood in 'high' or 'very high' heat vulnerability areas	26.90%	12 Neighborhoods have 0%	Chinatown Civic Center South of Market 100%
	Percent of the neighborhood in a liquefaction or landslide zone	22.80%	Presidio Heights 0.0% Inner Richmond 0.7% Pacific Heights 1.6%	Mission Bay 95.6% Financial District 80.3% Treasure Island 79.3%
	Square footage of liquefaction only	251,229,610	Inner Richmond Inner Sunset Presidio Heights West of Twin Peaks 0.0%	Bayview 71,410,442 South of Market 28,723,914 Mission Bay 19,392,980
Environment	Percent impervious surface	63.5	Presidio 20.1% Seacliff 22.9 % Twin Peaks 35.8%	South of Market 88.8% Nob Hill 87.3% Civic Center 86.8%
	Percent tree cover	13.80%	Presidio 32.8% Seacliff 29.3% Inner Sunset 20.5%	Mission Bay 3.1% Civic Center 4.1% South of Market 4.7%
	PM2.5 concentration	8.5	Seacliff 8.1 Outer Richmond 8.2 Outer Sunset 8.2	Civic Center 9.2 Financial District 9.2 Chinatown 8.8
	Percent of the neighborhood within .25 miles of a contamination risk	6.90%	Haight Ashbury Nob Hill Noe Valley Outer Richmond Outer Sunset Pacific Heights Twin Peaks West of Twin Peaks 0%	Treasure Island 97.8% Bayview 27.0% Potrero Hill 22.7%
Transportation	Average minutes of active transportation (walk+bike) per day	48.00	Treasure Island 43:27 South of Market 43:01 Financial District 42:14	Ocean View 14:14 Crocker Amazon 14:14 Lakeshore 14:78
	Public Transit Score	Data Not Available	Chinatown 89.9 Nob Hill 89.4 Civic Center 83.3	Treasure Island 0.9 Lakeshore 8.0 Presidio 9.2
Community	Violent crimes, per 1000 people	53.1	Presidio 0.7 Noe Valley 13.2 Inner Sunset 13.3	Civic Center 177.5 South of Market 174.9
	Voting rates in the 2012 Presidential Election	72.50%	Diamond Heights 84.0% Noe Valley 82.5% West of Twin Peaks 82.3%	Visitacion Valley 50.8% Treasure Island 56.4% Chinatown 57.9%
	Percent of the population that moved to San Francisco within the last year	7.60%	West of Twin Peaks 2.3% Outer Mission 2.3% Parkside 2.9%	Lakeshore 23.3% Russian Hill 13.8% North Beach 13.6%
	Percent of the population without United States citizenship	18.00%	Presidio Heights 7.3% Marina 8.4% Castro 8.5%	Chinatown 38.0% Mission Bay 35.6% Treasure Island 27.6%
	Percent of population living in households without English spoken "Very Well"	23.30%	Castro 3.3% Haight Ashbury 3.8% Marina 3.8%	Chinatown 68.0% Crocker Amazon 43.1% Visitacion Valley 42.9%

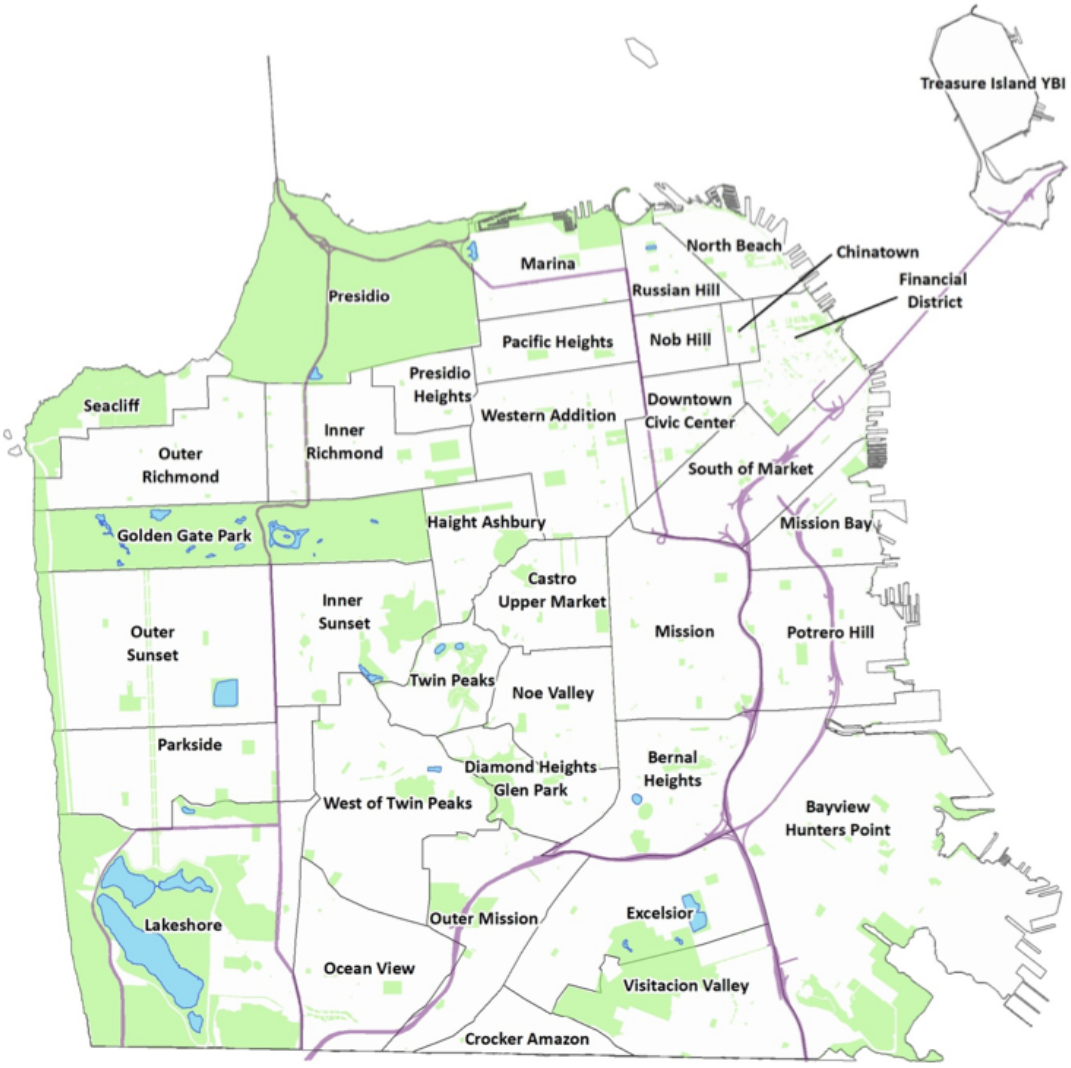
Appendix D: San Francisco Community Resiliency Indicators, 2014 (2 of 3)

Public Realm	Healthy Food Score	Data Not Available	Civic Center 93.3 Nob Hill 91.4 Chinatown 90.8	Treasure Island 0.0 Visitacion Valley 24.8 Lakeshore 28.8
	Percent of the population over 25 with a high school degree	85.90%	Pacific Heights 98.7% Presidio 97.8% Castro 97.3%	Chinatown 44.7% Visitacion Valley 69.5% Excelsior 70.9%
	Percent of the land area within .25 miles of a pharmacy	32.50%	Chinatown 100% Civic Center 99.7% Financial District 93.1%	Presidio 0.0% Treasure Island 0.0% Potrero Hill 6.6%
Housing	Percent of households with a resident living alone	39.40%	Crocker Amazon 17.4% Excelsior 17.7% Vicitacion Valley 18.6%	Financial District 70.5% Civic Center 67.6% South of Market 55.2%
	Percent of households with a resident over 65 and living alone	10.10%	Potrero Hill 4.2% Haight Ashbury 6.2% Crocker Amazon 6.4%	Chinatown 24.8% Western Addition 15.9% Lake Shore 14.7%
	Percent of households with 1 or more people per room	6.00%	Presidio Heights 0.6% Haight Ashbury 0.6% Castro 0.7%	Chinatown 25.0% Crocker Amazon 15.0% Civic Center 13.8%
	Residential housing violations, per 1000 people	3.14	Treasure Island 0.1 Mission Bay 0.5 Presidio 0.5	Financial District 12.7 Chinatown 10.6 Russian Hill 9.6
	Percent of buildings with air conditioning	Data not Available	Mission Bay 65.0%Financial District 51.0%South of Market 22.7%	Diamond HeightsHaight AshburyInner SunsetPresidio HeightsWest of Twin Peaks0.0%
	Percent of renter households whose gross rent is 50% or more of their household income	22.10%	West of Twin Peaks 3.7% Outer Mission 7.0% Potrero Hill 7.5%	Civic Center 29.6% Financial District 29.4% Lakeshore 27.7%
Economy	Percent of the population over 16 that are employed	92.00%	Presidio 98.1% Seacliff 96.8% Pacific Heights 96.6%	Bayview 83.8% Chinatown 84.3% Visitacion Valley 84.4%
Health	Shelters and cooling centers within .25 miles, per 1000 people	105 total citywide	Noe Valley 0.46 Chinatown 0.42 Presidio Heights 0.37	Twin Peaks 0.00 Mission Bay 0.11 Russian Hill 0.12
	Shelters and cooling centers within .25 miles, per 1000 people (daytime population)	105 total citywide	Noe Valley 0.58 Bernal Heights 0.48 Diamond Heights 0.43	Twin Peaks 0.00 Financial District 0.02 South of Market 0.04
	Percent of the population within 30 minutes commute of a hospital or clinic	Data Not Available	Data Not Available	Data Not Available
	Percent of the population reporting a disability	10.50%	Inner Sunset 6.1% Mission Bay 6.2% Pacific Heights 6.3%	Financial District 30.2% Civic Center 21.1% Chinatown 19.6%
	Preventable hospitalizations, per 100,000 people	894	Presidio 6 Financial District 469 Mission Bay 487	Bayview 1893 Civic Center 1549 Treasure Island 1350
Demographics	Percent of the population over 85	2.20%	Presidio 6 Financial District 469 Mission Bay 487	Chinatown 4.9% Twin Peaks 4.5% Parkside 3.7%
	Percent of the population over 65	13.70%	Bernal Heights 0.6% Bayview 1.6% Castro 1.4%	Chinatown 28.1% North Beach 19.6% Twin Peaks 18.9%
	Percent of the population under 18	13.40%	Nob Hill 6.9% Castro 7.2% Russian Hill 7.4%	Bayview 26.0% Visitacion Valley 22.7% West of Twin Peaks 19.1%
	Percent of the population under 5	4.40%	Chinatown 1.6% North Beach 2.1% Civic Center 2.5%	Bayview 8.8% Diamond Heights 7.1% Outer Mission 6.9
	Percent of the population non-white	50.00%	Marina 16.5% Castro 19.0% Pacific Heights 20.8%	Chinatown 87.9% Visitacion Vallley 85.1% Bayview 79.7%

Appendix D: San Francisco Community Resiliency Indicators, 2014 (3 of 3)

	Percent of the population Latino	5.80%	Outer Sunset 5.4% Pacific Heights 5.5% Inner Sunset 5.8%	Mission 33.6% Bernal Heights 30.7% Excelsior 30.0%
	Percent of the population Black / African American	33.30%	Inner Sunset 1.1% Outer Richmond 1.2% West of Twin Peaks 1.9%	Bayview 34.2% Western Addition 16.1% Visitacion Valley 14.4%
	Percent of the population Asian	14.70%	Haight Ashbury 8.6% Castro 9.3% Marina 11.8%	Chinatown 83.0% Crocker Amazon 58.2% Outer Sunset 58.0%
	Percent of households below 200% of the poverty rate	28.00%	Marina 11.2% Pacific Heights 12.8% Noe Valley 13.9%	Chinatown 65.7% Treasure Island 56.8% Civic Center 56.1%
	Population density, people per square mile	17,179	Presidio 1,255 Treasure Island 3,241 Seacliff 3,552	Chinatown 70,416 Civic Center 65,411 Nob Hill 60,138
	Daytime density, people per square mile	23,280	Presidio 2,497 Seacliff 6,658 Lakeshore 6,686	Chinatown 278,476 Financial District 113,954 South of Market 107,755

Appendix E: Map of San Francisco Neighborhoods



Appendix F: Key Informant Interview Guide

Objective: to gather information on existing mitigation or response activities, programs, or plans implemented by CCSF, and to gain additional more in-depth information that could help solidify recommendations

Standard Questions:

1. What do you think will be the biggest health threats for residents who shelter-in-place after a major earthquake?
2. What programs or policies exist within your department that would help residents that shelter-in-place after an earthquake?
3. Are there additional programs or polices that exist outside of your department or cross sector collaborations which could help residents shelter-in-place?
4. What gaps do you think exist within the City's efforts to support residents as they shelter-in-place?
5. How can the public health department can inform or affect these activities?

Appendix G: Key Informant Interview: Frequency of Exposures and Gaps (1 of 3)

Exposures	Frequency
Infrastructure Failure	
Lack of knowledge about the structural integrity and risk of collapse	3
Aftershocks and risk of further injury, damage, and entrapment	3
Total	**6**
Failure in Safe Food System	
Lack of safe food preparation	4
Decrease access to food	3
Risk of consuming unsafe food	3
Lack of gas	1
Total	**11**
Failure in water system	
Risk of consuming unsafe water	6
Failure in water system	5
Lack of water for fire suppression	1
Total	**12**
Electricity Failure	
Increase use of candles and risk of fire	4
Miscellaneous electricity failure	3
Decrease in security	1
Increase trips and falls	1
Improper use of generators- indoor hazard	1
Total	**10**
Physical Utility Exposure	
Gas main break-fire and explosion hazard	2
Miscellaneous physical utility exposure	1
Shock hazard	1
Total	**5**
Sanitation	
Failure in home sewage systems	7
Miscellaneous sanitation risk	3
Decrease in personal hygiene	2
Disease transmission	2
Delays in garbage collection	1
Total	**15**

Appendix G: Key Informant Interview: Frequency of Exposures and Gaps (2 of 3)

Non-Structural Elements	
Compromised living environment leading to trips and falls	4
Exposure to environmental elements (ex. temperature)	4
Window and glass	2
Un-useable egress-stairs & elevator failure	2
Household hazardous materials like gasoline, paint, pesticides	1
Total	**13**
Air Quality	
Asbestos	3
Increase in dust from building collapse and demolition	1
Smoke from fires	1
Decrease in internal air quality due to damage	1
Total	**6**
Secondary Environmental Risks	
Risk of fire (duplicative of Electricity Failure, see above)	4
Rain storm filling waste water holding tanks	1
Ground displacement	1
Hazardous material facilities in neighborhoods (ex. ammonia facilities)	1
Underground storage tanks for heating	1
Total	**8**
Delay in Human Services	
General delay in human services	2
Failure in food delivery services	1
Total	**3**
Delay in Health Services	
General delay in health services	4
Decrease mental health services	3
Challenges accessing medication	2
Total	**9**
Delay in Safety Service	
General delay in safety service	1
Reduced chance of getting fire and police	1
Total	**2**

Appendix G: Key Informant Interview: Frequency of Exposures and Gaps (3 of 3)

Decrease in Social Connectivity	
Isolation	4
Failure in telecommunication	2
General decrease in social connectivity	1
Total	**7**
Overcrowding	
General overcrowding	1
Total	**1**

CCSF Gaps	Frequency
Distribution Strategy from PODs	5
Waste Collection Plan	5
Communication Strategy to Ensure Resident Trust	4
City Strategy for Response and Support to Mental Health Needs	3
Culturally Competent Communication	2
Alternative Habitability Standard	2
Substance Abuse Clinic COOPs	2
Lack of City Wide Pre-Event Planning Coordination	2
Interim Supply of Lifeline Utilities	1
Transportation System for Residents and Resources	1
Emergency Preparedness and Shelter-in-Place Education with IHSS clients	1
Prioritization List of DBI Infrastructure Inspections	1
Private School Inspection Strategy	1

ENDNOTES

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