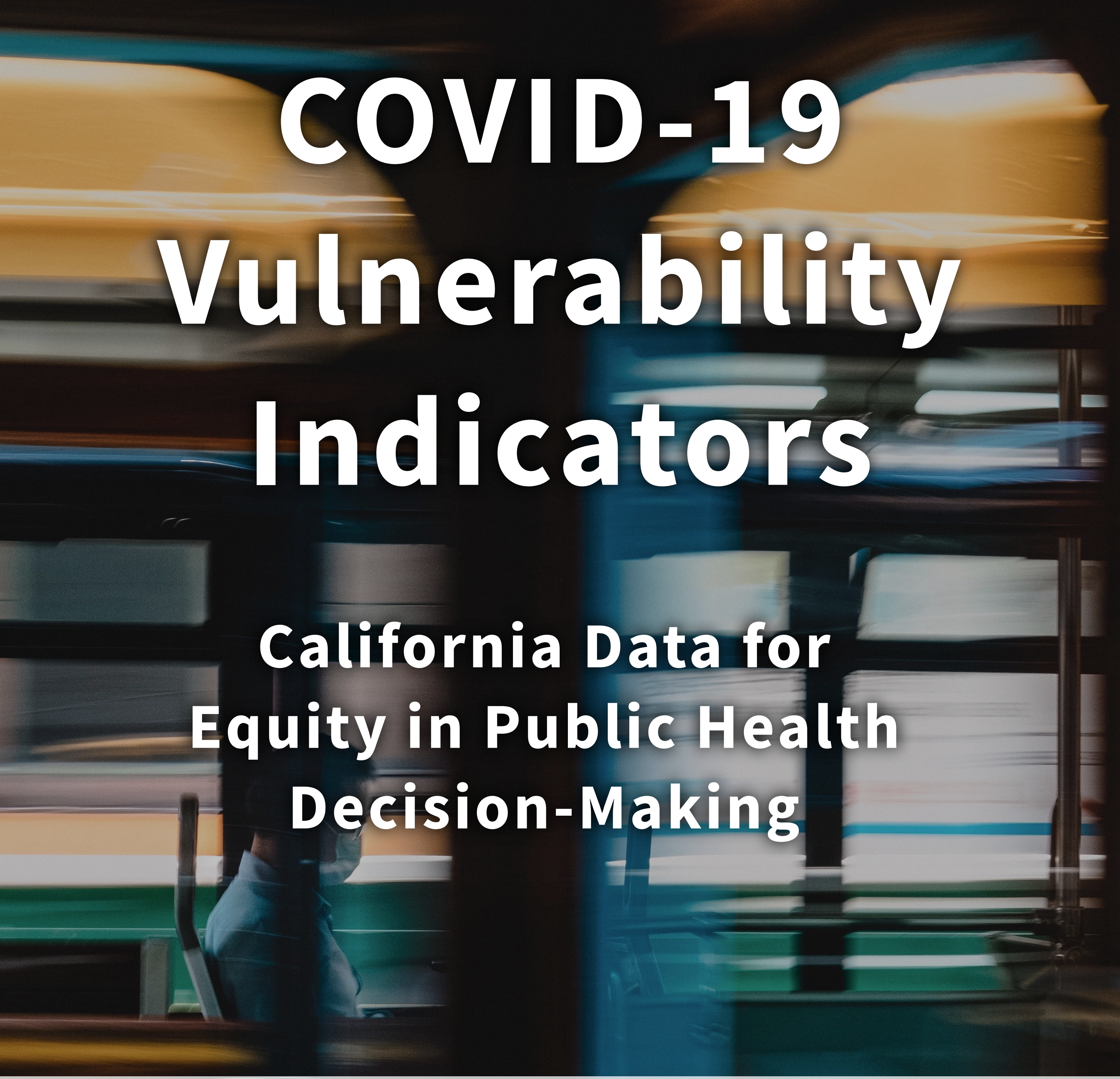

COVID-19 Vulnerability Indicators

California Data for Equity in Public Health Decision-Making

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UCLA Center for Neighborhood Knowledge

BRITE CENTER for Science, Research & Policy

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ACKNOWLEDGEMENTS

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As a land grant institution, the authors acknowledge the Gabrielino and Tongva peoples as the traditional land caretakers of Tovaangar (Los Angeles basin, Southern Channel Islands), and recognize that their displacement has enabled the flourishing of UCLA.

AUTHORS

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DISCLAIMER

CITATION

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INTRODUCTION

This brief describes the development of four statewide vulnerability indicators aimed at identifying which neighborhoods in California are at most risk of becoming impacted by COVID-19 infections. This project is an extension of a similar effort for Los Angeles County. A full description of that initial work can be found at https://knowledge.luskin.ucla.edu/covid-19-medical-vulnerability/. We have upscaled the indicators to cover most of California. The available statewide data covers over 96% of the population.

The four indicators in this brief are: 1) Pre-Existing Health Conditions; 2) Barriers to Accessing Services; 3) Built Environment Risk; and 4) CDC's (Centers for Disease Control and Prevention) Social Vulnerability Index (SVI). Each indicator is a composite of several input variables. Reporting geographies are zip code tabulation areas (ZCTAs).

To understand and assess the indicators, the brief includes four analyses: the distribution of socioeconomic groups (five ethnoracial populations, persons in poverty, and households with limited English proficiency) by the four neighborhood vulnerability categories (defined by pre-existing health conditions, barriers to assistance, SVI and built environment). The major finding is that disadvantaged groups are more likely to be disproportionately concentrated in the most vulnerable places, which are also low-income areas related to negative social determinants of health.

DATA SOURCES

The four California COVID-19 Vulnerability Indicators and COVID-19 statistics use information from the following data sources:

AskCHIS Neighborhood Edition	Contains data on pre-existing COVID-19 health conditions for California at the ZCTA level. The data come from the California Health Survey (CHIS), and the project uses information for 2015 and 2016.
American Community Survey (ACS)	Contains data on neighborhoods' demographic, social, and economic characteristics. The study uses ZCTA-level data from the 2014-18 5-year ACS estimate.
California Department of Parks and Recreation	Contains data on the availability of parks and open space in California at the Census tract level. A geographic crosswalk was utilized to allocate census tract data into ZCTAs.
Worldometer	A reference website that provides up-to-date counts on COVID-19 case rate, deaths and recovery rates. https://www.worldometers.info/coronavirus/usa/california/
California Department of Finance	"E-1 Population Estimates for Cities, Counties, and the State — January 1, 2019 and 2020," http://www.dof.ca.gov/Forecasting/Demographics/Estimates/e-1/

GEOGRAPHIC SCALE

The geographic unit of analysis is the Zip Code Tabulation Area. The ZCTA is defined by the U.S. Census Bureau as polygons roughly equivalent to United States Postal Service zip-code service areas. In this brief, the terms "ZCTAs", "neighborhoods" and "communities" are used interchangeably.

INDICATORS

Pre-Existing Health Vulnerability	The Pre-Existing Health Vulnerability (PHV) indicator was developed to capture risks of COVID-19 infection and death due to pre-existing health conditions identified in academic journals and through input from health experts consulted for this project. The PHV consists of six variables: (1) diabetes, (2) obesity, (3) heart disease, (4) fair or poor health status, (5) mental health and (6) food insecurity.
Built Environment Risk	The Built Environment Risk indicator is meant to identify areas at higher risk of COVID-19 infection due to lack of adequate space available to adhere to shelter-in-place mandates and other precautions that aim to limit the spread of COVID-19. The indicator is composed of five variables: (1) population density, (2) building structure density, (3) in-unit housing crowding, (4) availability of nearby parks and open space, and (5) average household size.
Barriers to Assistance Indicator	The indicator on Barriers to Accessing Services is meant to capture barriers that increase difficulty in accessing COVID-19 and other general health care services. This indicator is composed of five different variables: (1) Non–U.S. citizen population, (2) English language barrier, (3) lack of broadband internet, (4) lack of health insurance, and (5) availability of vehicles per person.
Social Vulnerability Index	The Social Vulnerability Index was created by the Centers for Disease Control and Prevention (CDC) to identify vulnerable areas in need of preparation and response to hazardous events or natural disasters. The SVI indicator classifies the level to which a community experiences different socioeconomic conditions, such as unemployment, and that might affect its ability to prepare and respond to hazardous events, such as natural disasters. CDC uses 15 ACS variables. The variables are organized into four dimensions: (1) socioeconomic status; (2) household composition; (3) minority status and language; and (4) housing type and transportation.
COVID-19 Case Rates	Cumulative case rates per 100,000 persons: total cases as reported by county health departments divided by estimated 2020 population from the state of California. Reported cases are likely to be systematically biased because disadvantaged populations and neighborhoods have less access to testing, particularly during the early months of the pandemic. Despite a lack of precision and accuracy, the rates are, nonetheless, useful in capturing relative differences across populations and communities.

METHODS

For each composite indicator, we first rank each of the input variables using the ranking procedure in SAS, a statistical software. These rankings are then summed, and the composite value is then re-ranked as percentiles. For mapping, we divide the ZCTAs into quintiles, from lowest to highest vulnerability. Each quintile group contains roughly 20 percent of all ZCTAs within California and the rankings of each ZCTA are relative to all ZCTAs in the State. The quintiles do not necessarily have equal numbers of persons because ZCTAs can vary in the population size (and geographic areas). We also use these quintiles to investigate the distribution of ethnoracial and socioeconomic subpopulation groups across all the vulnerability indicators. We present the results using bar graphs. Each bar represents a given group, and segments denote the percent population within a given vulnerability quintile for each indicator. For both the maps and bar graphs, the orange areas represent neighborhoods that are vulnerable, with darker orange areas denoting the greatest vulnerability. The green areas represent neighborhoods that are less vulnerable, with darker green denoting the lowest vulnerability.

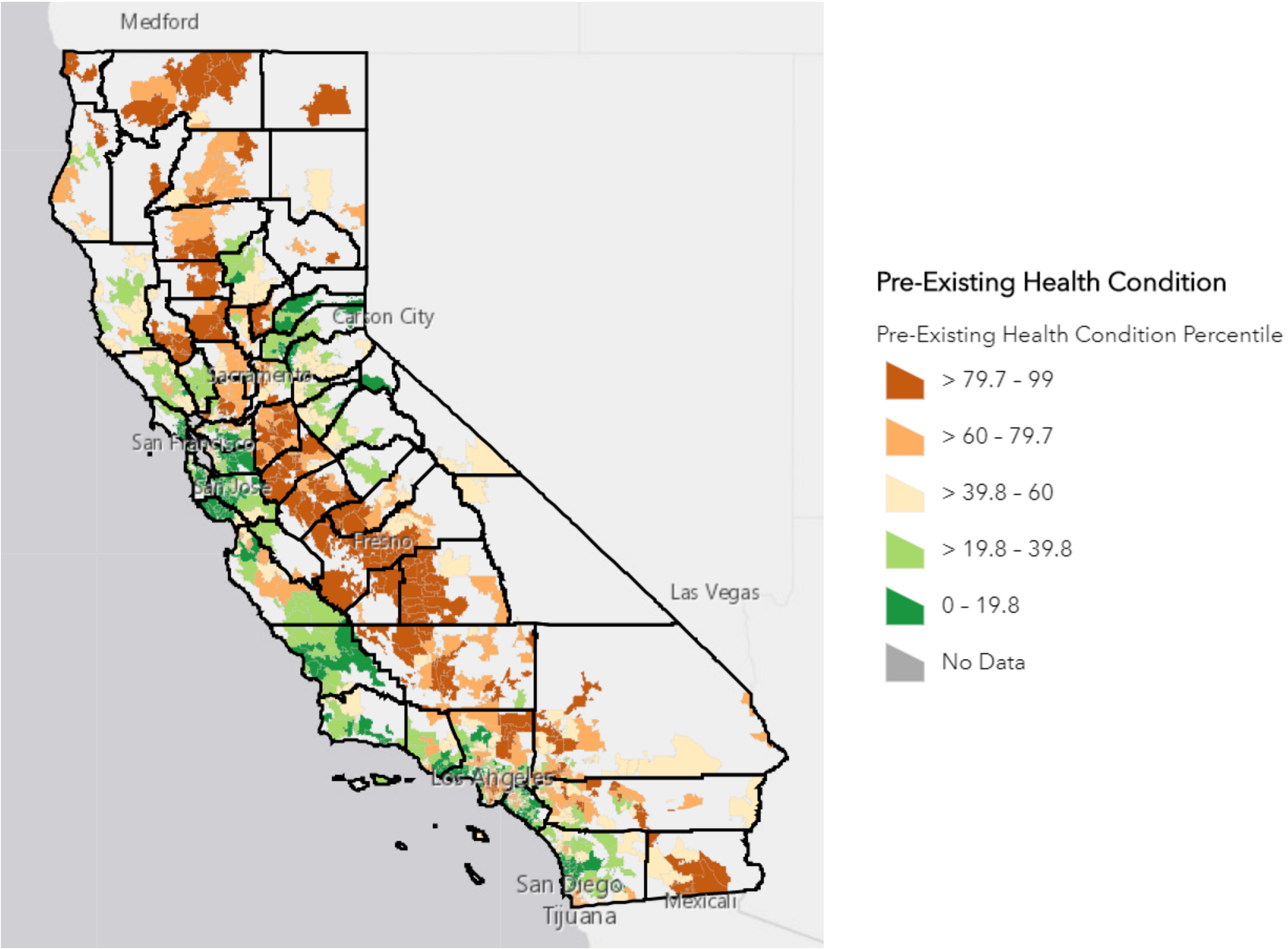
GEOGRAPHIC PATTERNS

The following maps display California's neighborhoods by level of vulnerability for each of the four indicators. The orange areas on the map represent neighborhoods that are vulnerable, with darker orange denoting the greatest vulnerability. The green areas represent neighborhoods that are less vulnerable, with the darker green denoting the lowest risk.

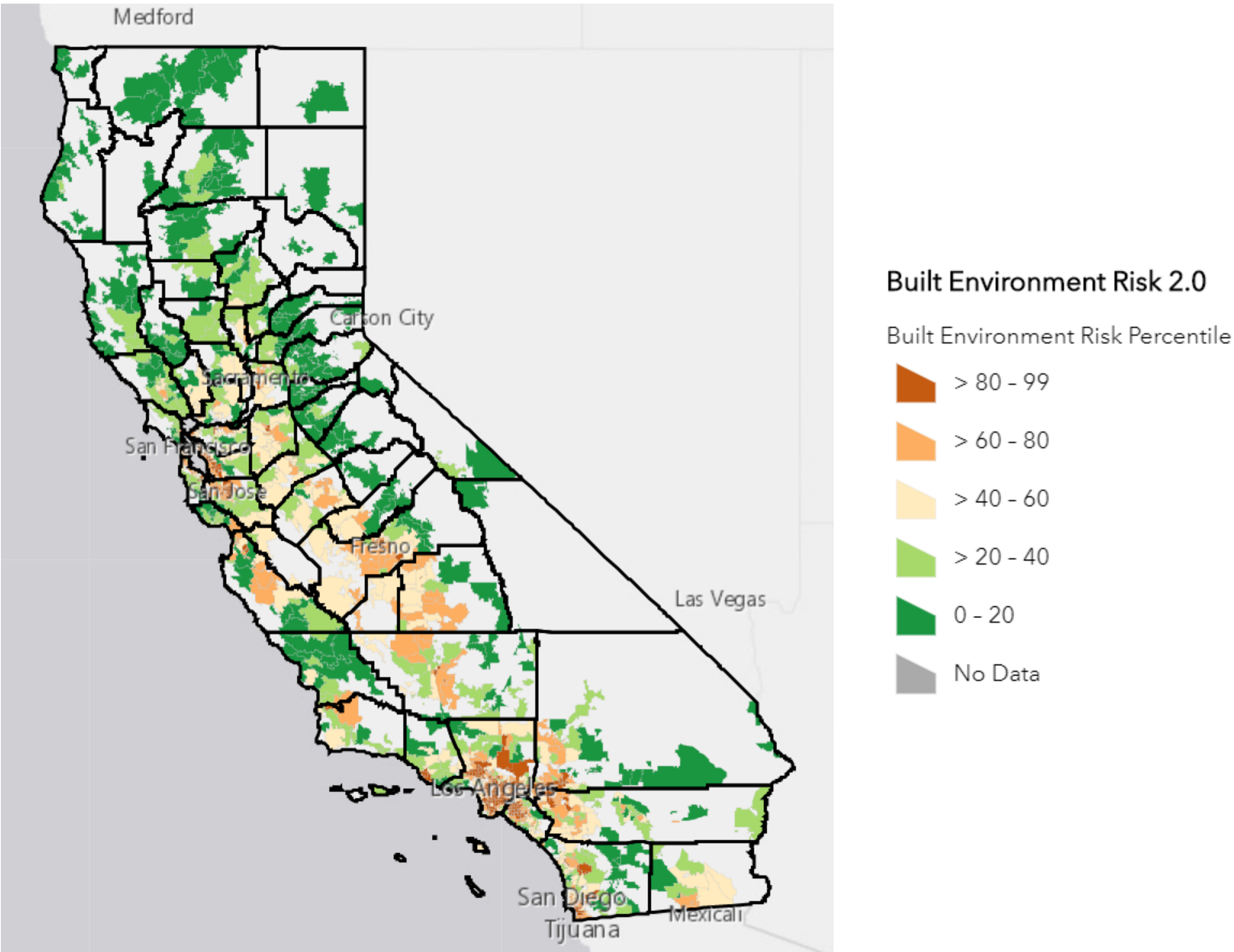
The maps reveal distinct geographic patterns across regions. The Central Valley tends to be more vulnerable in terms of pre-existing health conditions, barriers to services and general social vulnerability. The less dense parts of the state (the far north and along the eastern edge) tend to have mixed outcomes: some areas with high levels of pre-existing health conditions, most have fewer barriers to services, and mixed results for general vulnerability. On the whole, non-urban coastal places fare better than the rest of the state. Among the large metropolitan areas, the San Francisco Bay Area fares better than Los Angeles, although there are Bay Area neighborhoods that have high vulnerability.

Finally, it appears to be a rough spatial correspondence between the level of vulnerability and COVID-19 outcomes. Places that have high composite vulnerability scores tend to be located in counties with high COVID-19 case rates. This can be seen in the differences between the Bay Area (lower overall vulnerability and lower case rates) and Los Angeles (higher overall vulnerability and higher case rates), and in the high rates of the agriculture-based counties in the Central Valley (high vulnerability and high case rates). The regional differences, however, hide significant variations in vulnerability and infection rates across subpopulations and neighborhoods within each region.

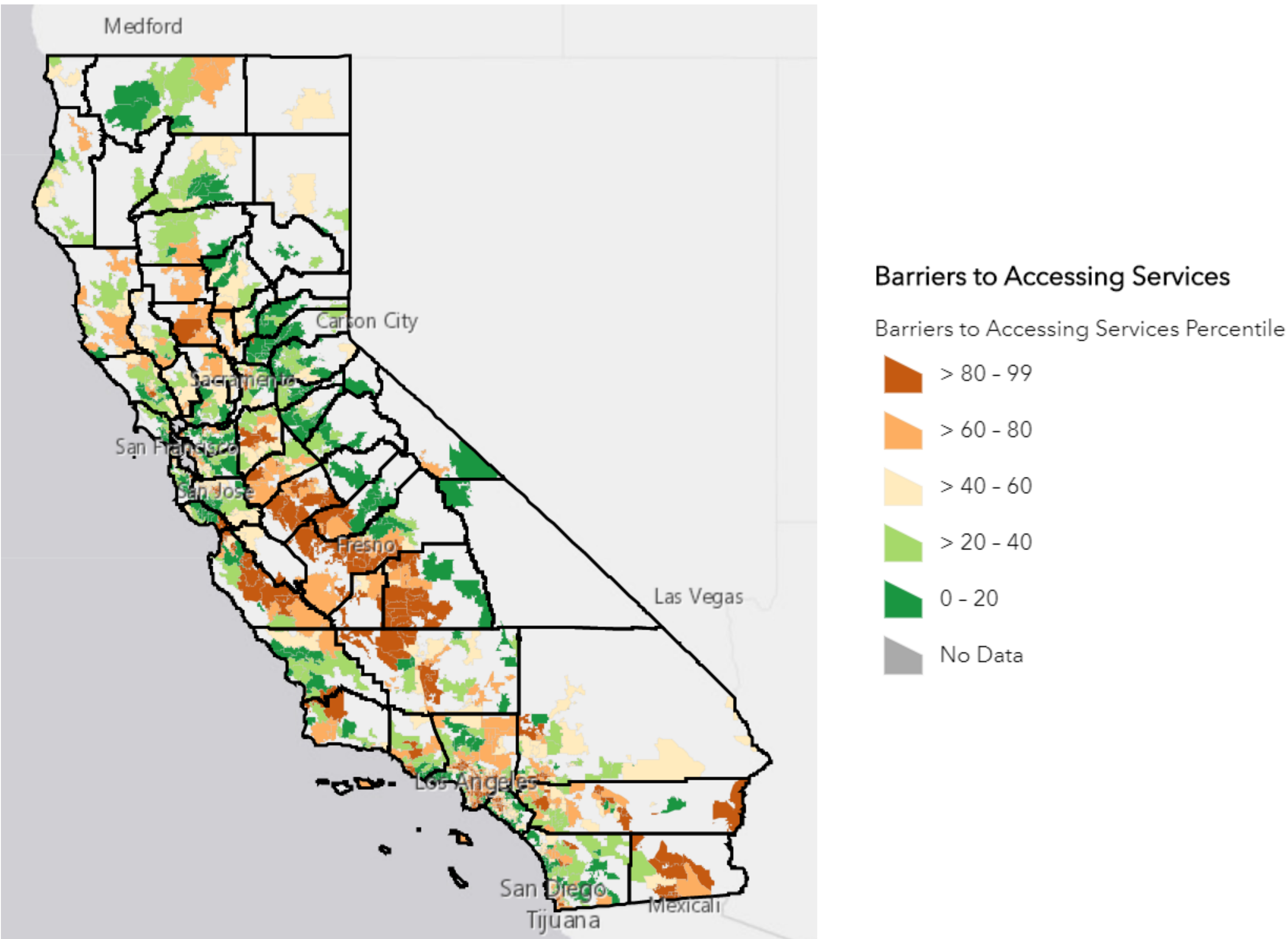
Map 1: Pre-Existing Health Condition



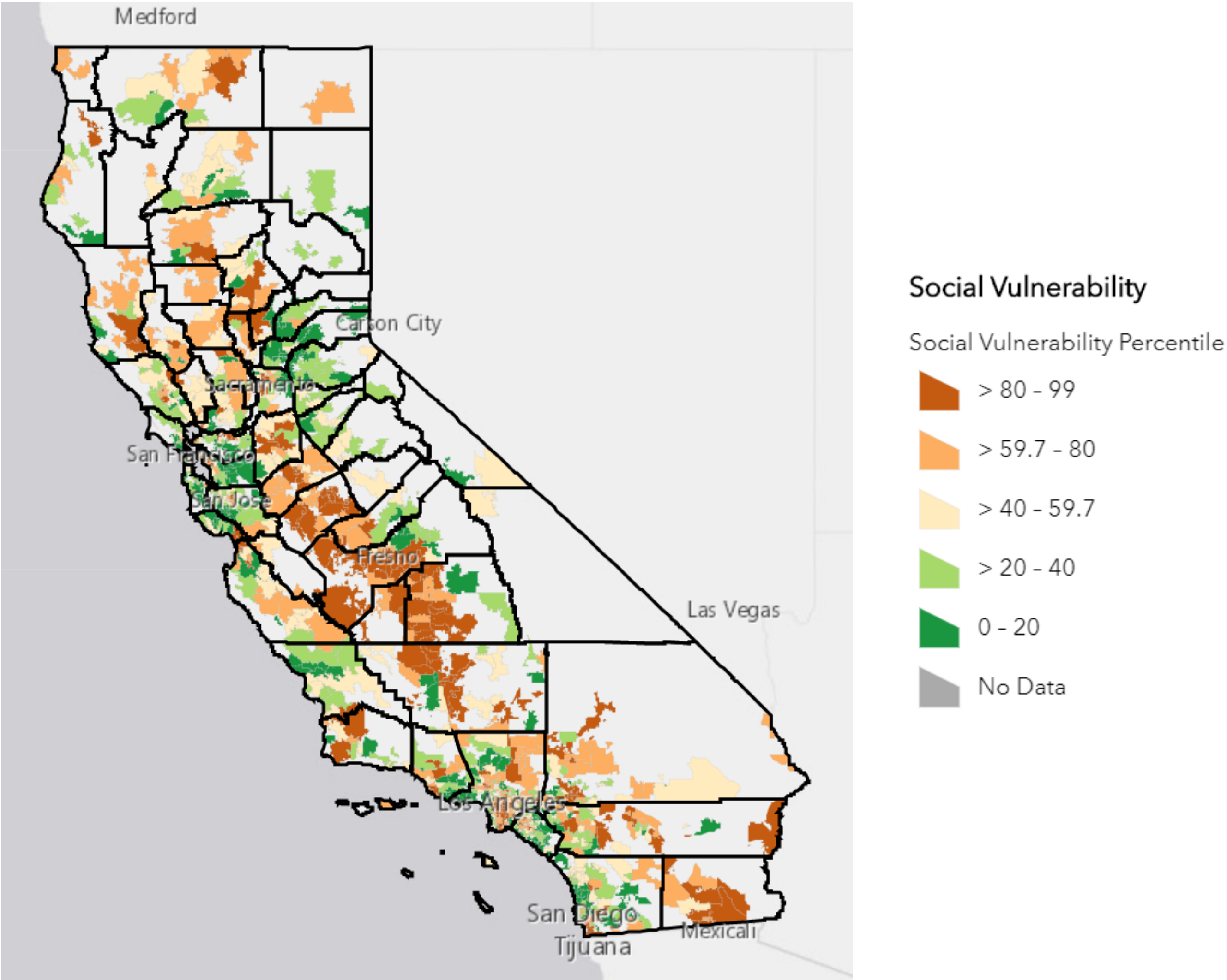
Map 2: Built Environment Indicator



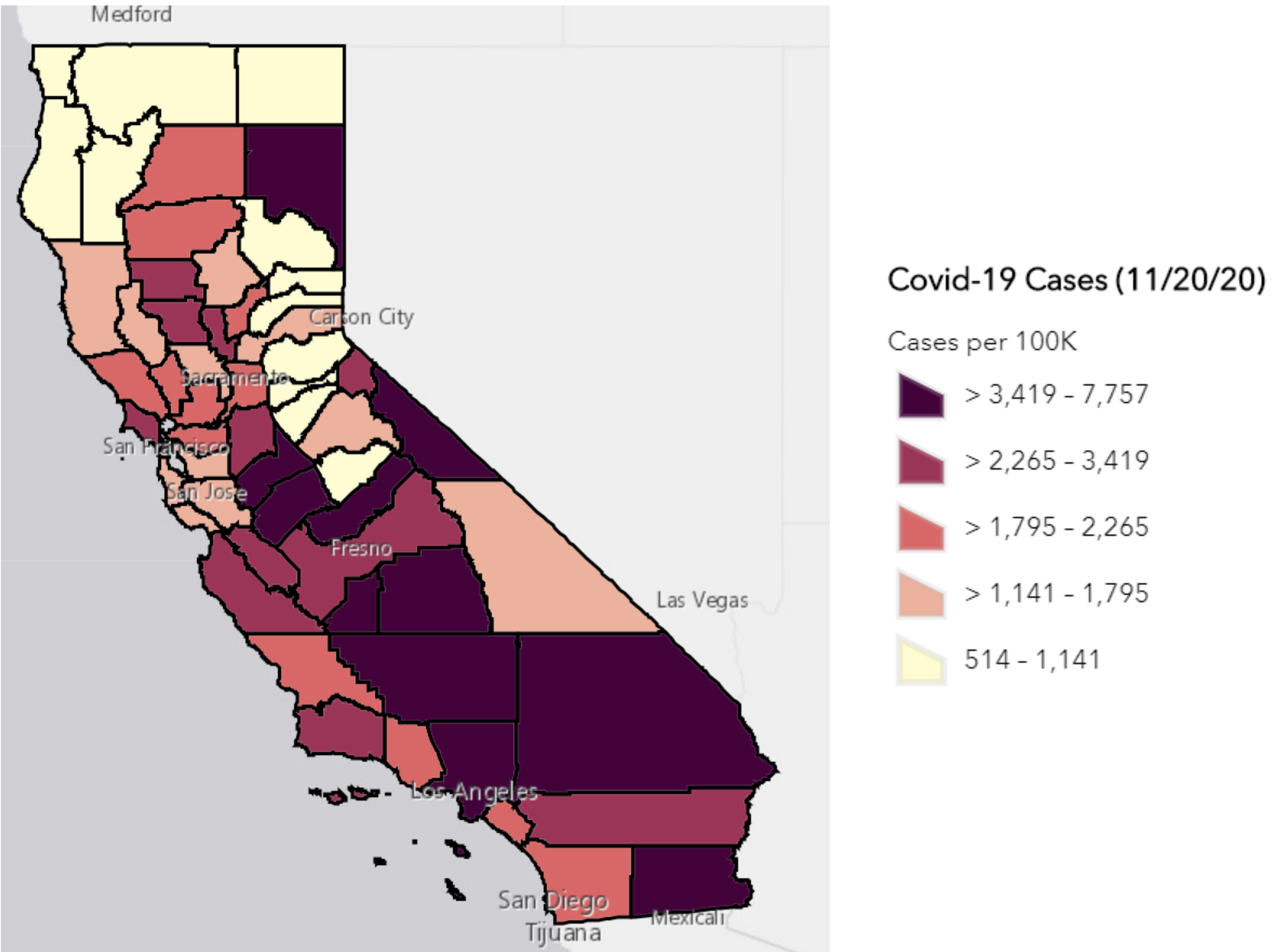
Map 3: Barriers to Accessing Services



Map 4: Social Vulnerability Index



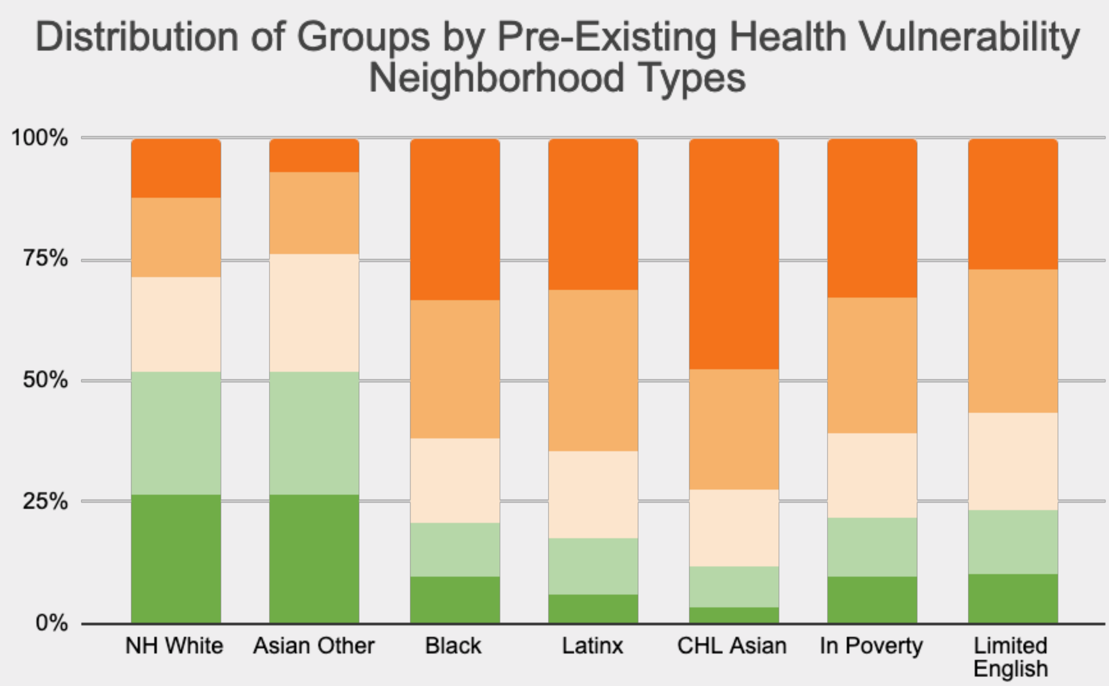
Map 5: COVID-19 Case Rates



ETHNORACIAL AND SOCIOECONOMIC PATTERNS

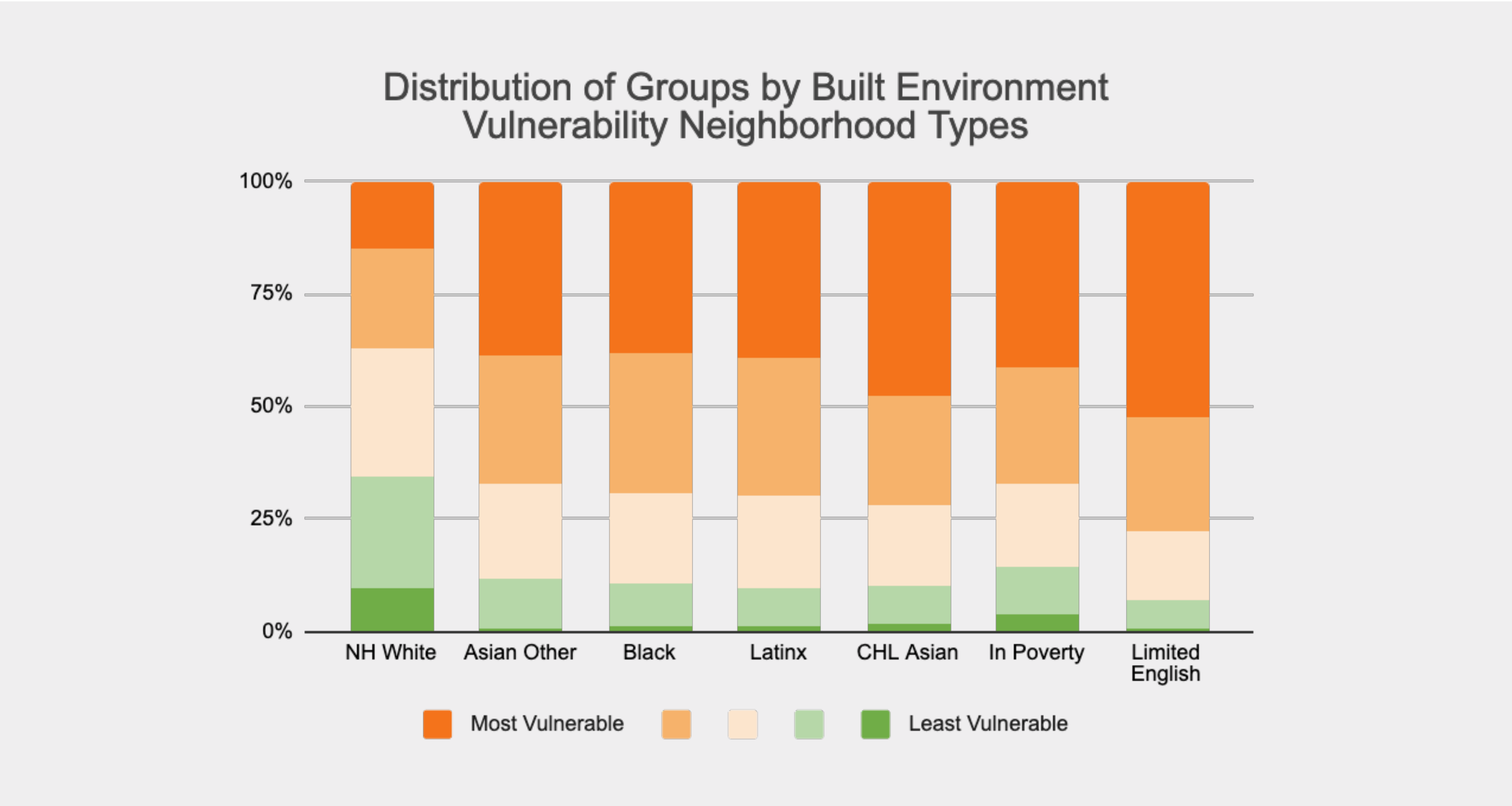
Graph 1 illustrates the uneven distribution of ethnoracial and socioeconomic groups by five categories of Pre-Existing Health Vulnerability, from the most to least vulnerable. Nearly three quarters (73%) of the state's Cambodian, Hmong, and Laotians population reside in neighborhoods with the high or highest rates of pre-existing health conditions. This was followed by 64% of Latinos and 62% of Blacks. Conversely, 28% of white residents live in areas with low or the lowest vulnerability. Populations living in poverty and with limited English proficiency disproportionately reside in neighborhoods with either the highest or high levels of vulnerability (61% and 57% respectively).

Graph 1: Distribution of Groups by Pre-Existing Health Vulnerability Neighborhood Types



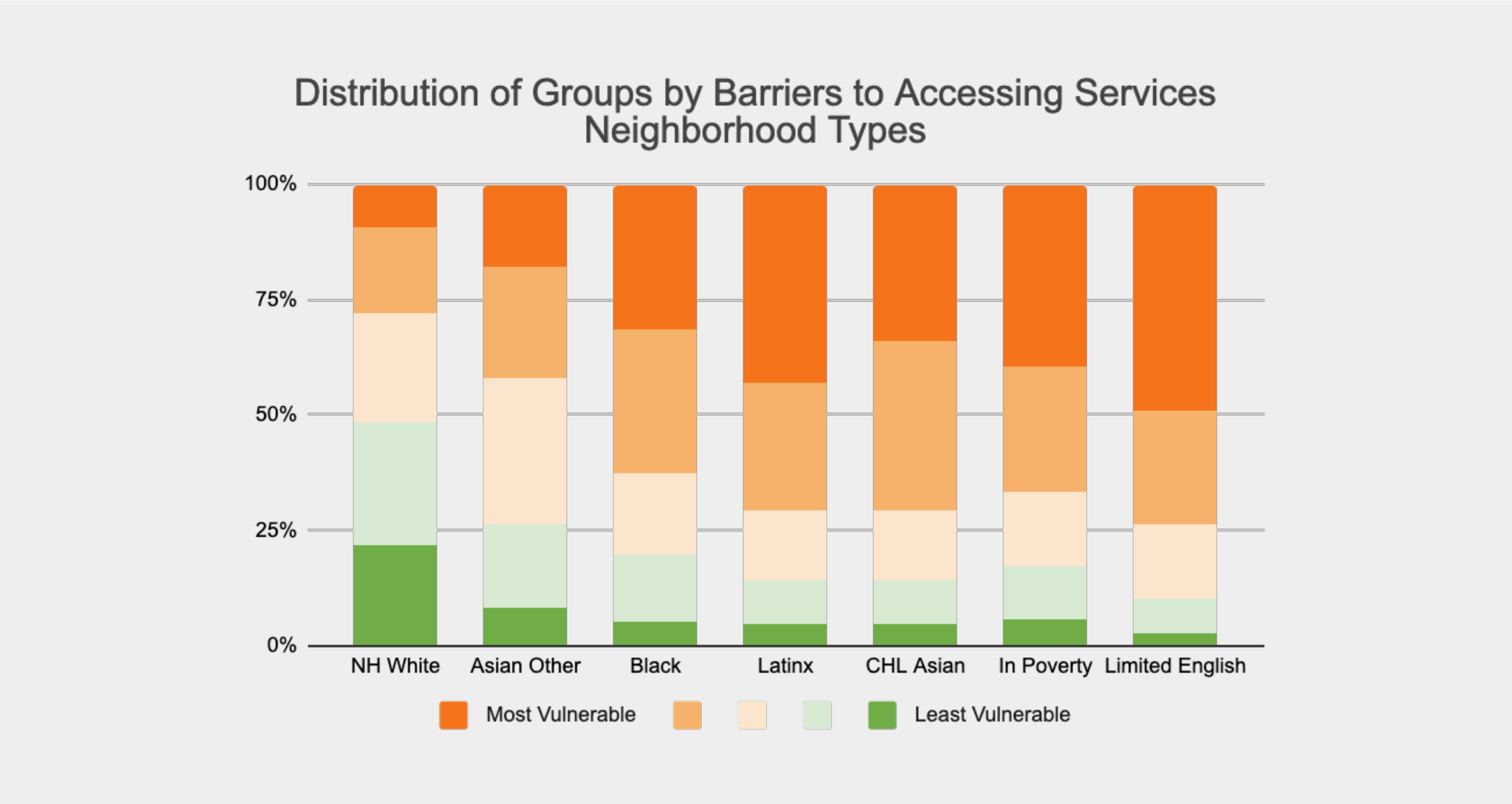
Graph 2 shows that in the Built-Environment Risk indicator, Latinx, Black, and CHL Asian populations are heavily concentrated in neighborhoods designated as either high or highest levels of vulnerability (72%, 70%, 69%, respectively). In contrast, over one-third (37%) of the state's NH (non-Hispanic) White population reside in high or highest vulnerability neighborhoods as it relates to the built environment. Furthermore, populations with limited English proficiency and living in poverty are disproportionately likely to reside in neighborhoods with either the highest or high level of Built Environment Vulnerability (77% and 67% respectively).

Graph 2: Distribution of Groups by Built Environment Vulnerability Neighborhood Types



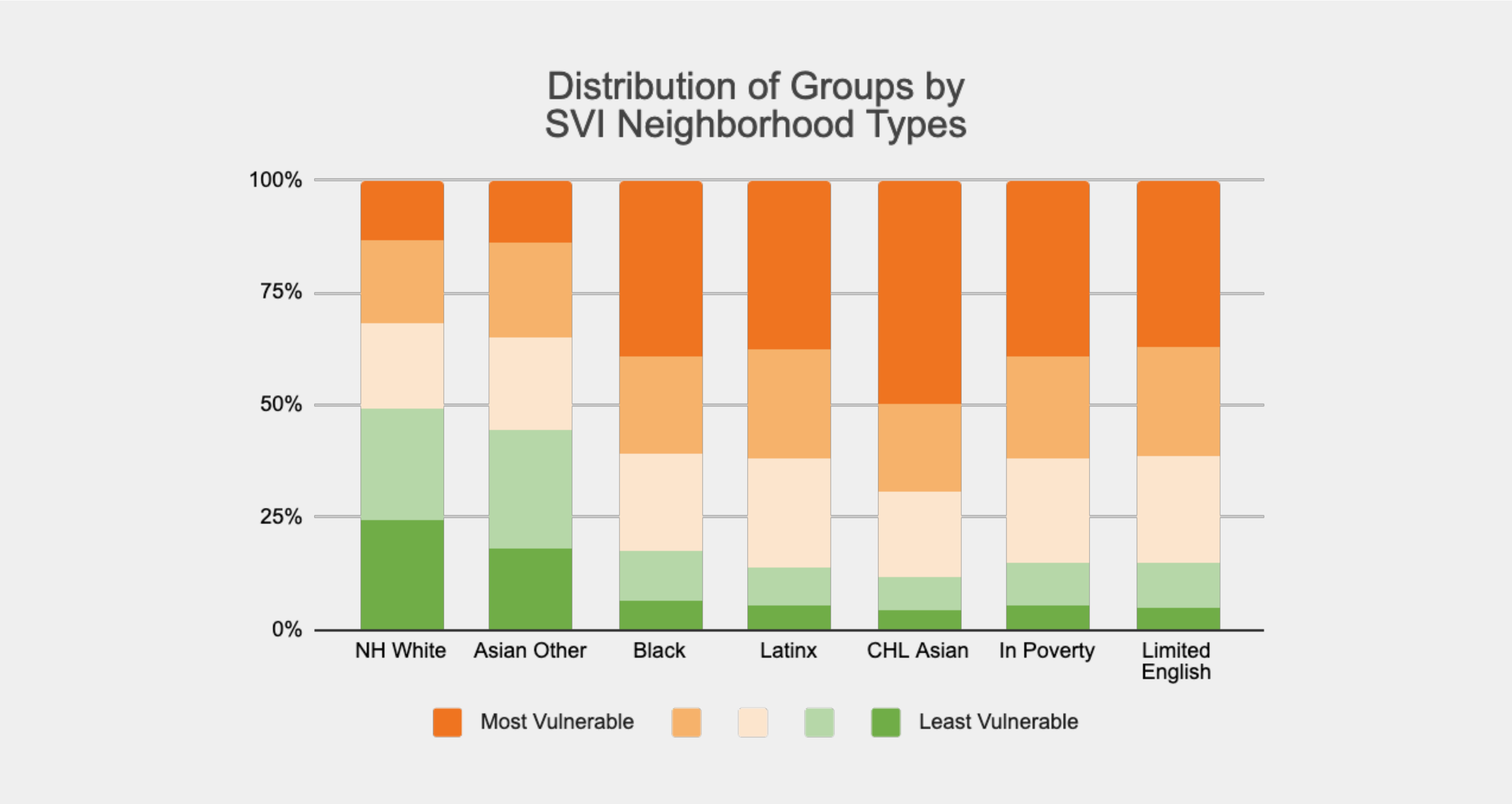
Graph 3, depicts disparities among ethnoracial groups by five categories of level of barriers to accessing services. Latinx, CHL Asian, and Black populations disproportionately reside within neighborhoods with the highest or high levels of vulnerability (71%, 71% and 63% respectively). In contrast, over a quarter (28%) of the NH White population is concentrated in neighborhoods with the highest or high levels of barriers to accessing services. Again, populations with limited English proficiency (74%), followed by populations living in poverty (64%), disproportionately reside in neighborhoods with the highest or high levels of vulnerability to accessing assistance.

Graph 3: Distribution of Groups by Barriers to Accessing Services Neighborhood Types



Lastly, Graph 4 displays ethnoracial, poverty, and limited English proficiency by the neighborhoods' SVI. Three fourths (75%) of the CHL population reside in neighborhoods with either the highest or high levels of SVI vulnerability. Latinx and Black populations also disproportionately reside within these same types of neighborhoods (67% and 64% respectively). In contrast, 30% of the NH White population resides in neighborhoods with the highest or high levels of SVI vulnerability. Additionally, populations in poverty and with limited English proficiency are also disproportionately residing in neighborhoods with either the highest or high levels of SVI vulnerability (67% and 68% respectively).

Graph 4: Distribution of Groups by SVI Neighborhood Types



CONCLUSION

This project developed indicators capturing four dimensions of COVID-19 vulnerabilities: pre-existing health conditions, barriers to accessing services, built environment risk, and social vulnerability. The analysis quantifies what many already suspect. For instance, the most vulnerable neighborhoods across all indicators tend to be concentrated in urban centers in Southern California and the Bay Area, and agricultural communities in the Central Valley. Most of these places are characterized by low-income ethnoracial neighborhoods. They are home to a disproportionately large number of Blacks, Latinx, CHL Asians (Cambodians, Hmong, and Laotian), people in poverty, and those with limited English proficiency. These individuals are over-concentrated in areas where social determinants and social risk factors increase their vulnerability to COVID-19 infection and often experience the worst morbidity and mortality.

The goal of this project is to serve the needs of communities most impacted by COVID-19 in the hopes of providing data for community level decision-making, empowerment in advocacy activities designed to push for equity and to gauge the seriousness of protective public health efforts needed to mitigate against the surge of new infections. Our results provide state planners, public health officials, social service and volunteer organizations charged with state planning an evidenced-base model in which resources such as testing and vaccine distribution can take into account vulnerability for infection based not just on pre-existing conditions but social risk and social determinants of inequity.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APPENDIX A: UCLA CENTER FOR NEIGHBORHOOD KNOWLEDGE BRIEFS ON COVID-19

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APPENDIX B: UCLA BRITE CENTER AND COVID-19 MATERIALS

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