

WHY ARE DEATH RATES RISING AMONG WHITES IN CALIFORNIA?

The Role of Stress-Related Conditions



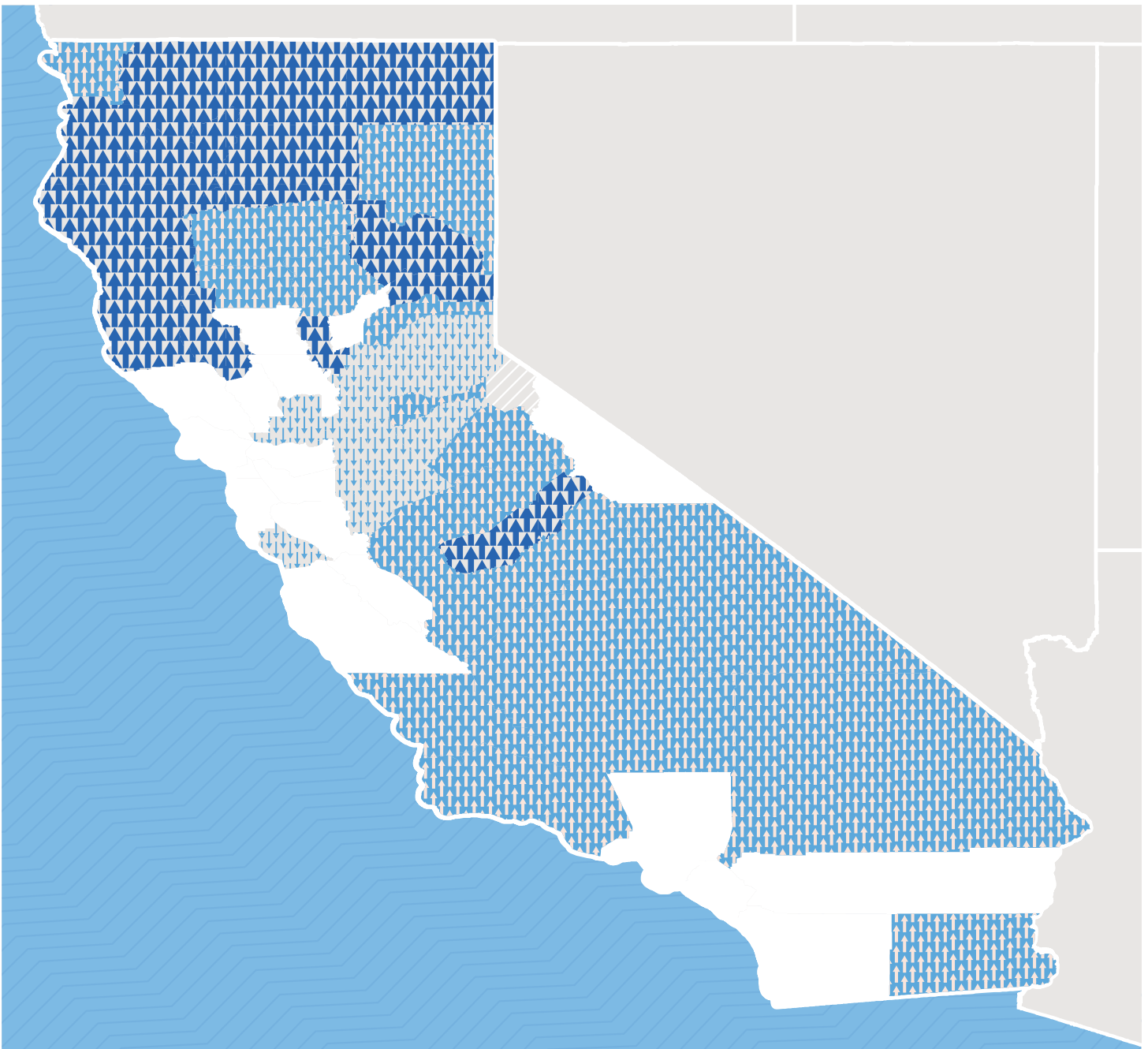
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Technical Supplement

INTRODUCTION

Life expectancy is generally improving in the United States. Mortality rates are decreasing among most racial and ethnic groups, and the black-white mortality gap has narrowed.¹ A potential explanation for the narrowing black-white mortality gap carries ominous implications: recent studies suggest that the pace of improvement in life expectancy may be slowing among non-Hispanic (NH) whites. Mortality rates for some conditions appear to be increasing dramatically in this population. Studies to date suggest that the increase in mortality among NH whites is occurring primarily among middle-aged whites, those with less education, and women.²⁻¹⁰ Substance abuse, suicide, and liver disease are among the suspected causes, but research to date has been limited. Most studies report national data, but health varies significantly by state, county, or even census tract.¹¹⁻¹⁷

Even the elevated rates among NH whites are still lower, on average, than those of blacks; continued efforts to reduce the excessive mortality rates experienced by people of color remain vital. However, researchers must also investigate whether and why mortality patterns are reversing themselves among NH whites. Understanding this phenomenon could be relevant to all racial and ethnic groups.

Changing socioeconomic conditions, and how people respond to them, could be shaping mortality patterns.^{18,19} For many years, working class whites, especially those in rural areas, have endured weak job markets, wage stagnation, high poverty rates, and limited economic opportunity and social mobility for their children.²⁰⁻²⁶ Chronic stress, and unhealthy coping mechanisms for dealing with it, could lead to fatal injuries and disease complications, causing what some have called “deaths of despair.”²⁶ These stress-related conditions could include depression, suicide, drug and alcohol abuse, and the accidents and diseases they produce.

Testing this hypothesis with mortality data is problematic. More relevant outcomes are behaviors and the prevalence and morbidity of illnesses—not deaths—and mortality data yield limited inferences given the imprecision of death certificates.²⁸⁻³⁴ But no outcome is more alarming than increased deaths, especially those involving young people. At the request of the California Endowment, we examined vital statistics in California over two decades, using methods designed to address the above limitations. All potential causes of death were examined in detail, including mortality from stress-related conditions. Our topline findings are reported elsewhere.³⁵ This report provides documentation of the scientific methods used in the study and greater detail about our results, along with data tables and figures that could not be included in the issue brief.

METHODS

Deaths in California were examined in aggregate (all-cause mortality) and for specific causes from 1995 to 2014. Individual-level death data for California were obtained under special arrangements with the National Center for Health Statistics (NCHS) and the approval of the National Association for Public Health Statistics and Information Systems. The death data, including county of residence, were abstracted from the Mortality Multiple Cause Micro-data Files. Rates based on fewer than 10 deaths were suppressed per NCHS regulations. Population counts for calculating mortality rates were obtained from the National Cancer Institute's Surveillance, Epidemiology, and End Results Program.³⁷ The study was exempted by the institutional review board of Virginia Commonwealth University.

Death counts were aggregated into 5-year periods (1995-1999, 2000-2004, 2005-2009, and 2010-2014) to increase stability and reduce suppression. Mortality rates were stratified by age, sex, race, and ethnicity. Sample size considerations required the population to be classified into five, broad racial-ethnic groups: Hispanics/Latinos and NH whites, NH blacks, NH Asians and Pacific Islanders, and NH American Indians and Alaskan Natives.

Causes of death were coded to the International Classification of Diseases (ICD) revision in effect at the time of death. Causes of death were grouped into 116 categories in 11 broad domains (Table 1). Deaths from 1995-1998 and 1999-2014 were coded to ICD-9 and ICD-10, respectively (Table 2). Because the transition from ICD-9 to ICD-10 in 1999 could potentially introduce artifactual changes in cause-specific rates and because some mortality patterns changed distinctly after 2000-2004, the percentage increase in mortality rates was measured from both 1995-1999 and 2000-2004. Mortality data are not shown for 1995-1999 if the specific cause of death did not have corresponding codes in the 9th and 10th revisions; mortality rates for these causes of death are shown only from 2000-2004 to 2010-2014. Data are also not reported for conditions that caused no more than 30 deaths in any 5-year time period among those below age 40 years; the cutoff was 100 deaths for those age 40 years and older. County-level smoking rates were obtained from the California Department of Public Health.³⁸

Table 1.
HIERARCHICAL STRUCTURE FOR ANALYSIS OF CAUSES OF DEATH, BY DOMAIN AND PROJECT CODES

CAUSE OF DEATH	PROJECT CODES (N = 111)	ICD-10 CODES
ALL CAUSES	001	A00-Z99
Domain 1. Infectious and parasitic diseases	002	A00-B99
Tuberculosis	003	A16-A19
Septicemia	004	A40-A41
Viral disease	005	A80-B34
Viral hepatitis	006	B15-B19
HIV disease	007	B20-B24
Domain 2. Cancer	008	C00-C97, D00-D48
Cancer of oral cavity and pharynx	009	C00-C14.8
Cancer of digestive organs	010	C15-C26, C48
Cancer of esophagus	011	C15
Cancer of stomach	012	C16
Cancer of other and ill-defined digestive	013	C17, C21, C23, C24, C26
Cancer of colon and rectum	014	C18-C20, C26.0
Cancer of liver and intrahepatic bile ducts	015	C22
Cancer of pancreas	016	C25
Cancer of the respiratory system	017	C30-C39
Cancer of larynx	018	C32
Cancer of lung and bronchus	019	C34
Cancer, melanoma of skin	020	C43
Cancer of breast	021	C50
Cancer of cervix uteri	022	C53
Cancer of corpus/uterus, NOS	023	C54-C55
Cancer of ovary	024	C56
Cancer of prostate	025	C61
Cancer of the testis	026	C62
Cancer of kidney and renal pelvis	027	C64-C65
Cancer of urinary bladder	028	C67
Cancer of brain/other nervous system	029	C70-C72
Cancer of thyroid	030	C73
Cancer, Hodgkin lymphoma	031	C81
Cancer, non-Hodgkin lymphoma	032	C82-C85
Cancer, myeloma	033	C88.7-C88.9, C90.0, C90.2
Cancer, leukemia	034	C90.1, C91-C95
In situ, benign and uncertain neoplasms	035	D00-D48
Domain 3. Diseases of the endocrine system	038	E00-E88
Diabetes mellitus	039	E10-E14
Nutritional deficiencies	040	E40-E64
Malnutrition	041	E40-E46
Obesity	042	E65-E68
Metabolic disorders	043	E70-E88
Domain 4. Diseases of the nervous system	045	G00-G98
Meningitis	046	G00, G03
Parkinson's disease	047	G20-G21
Alzheimer's disease	048	G30
Multiple sclerosis	049	G35
Epilepsy	050	G40-G41

Table 1. (continued)
HIERARCHICAL STRUCTURE FOR ANALYSIS OF CAUSES OF DEATH, BY DOMAIN AND PROJECT CODES

CAUSE OF DEATH	PROJECT CODES (N = 111)	ICD-10 CODES
Domain 5. Diseases of the circulatory system	114	I00-I99
Heart disease	052	I00-I09, I11, I13, I20-I51
Rheumatic fever (acute) and chronic rheumatic heart diseases	053	I00-I09
Coronary heart disease	054	I11, I20-I25, I51.6
Hypertensive heart disease	055	I11
Ischemic heart diseases	056	I20-I25
Acute myocardial infarction	057	I21-I22
Atherosclerotic cardiovascular disease	058	I25.0
Hypertensive heart and renal disease	059	I13
Heart failure	060	I50
Hypertension (essential/primary) and hypertensive renal disease	061	I10, I12
Cerebrovascular diseases	062	I60-I69
Atherosclerosis	063	I70
Phlebitis, thrombophlebitis, venous embolism and thrombosis	064	I80-I82
Domain 6. Diseases of the respiratory system	065	J00-J98
Influenza and pneumonia	066	J10-J18
Influenza	067	J10-J11
Pneumonia	068	J12-J18
Chronic lower respiratory diseases	069	J40-J47
Bronchitis, chronic and unspecified	070	J40-J42
Emphysema	071	J43
Asthma	072	J45-J46
Pneumoconiosis	073	J60-J66
Pneumonitis due to solids and liquids	074	J69
Domain 7. Diseases of the digestive system	075	K00-K92
Peptic ulcer	076	K25-K28
Liver disease, chronic and cirrhosis	077	K70, K73-K74
Liver, alcoholic liver disease	078	K70
Cholelithiasis and other disorders of gallbladder	079	K80-K82
Pancreas and biliary tract disorders	080	K83-K86
Domain 8. Genitourinary system	084	N00-N98
Nephritis, nephrotic syndrome and nephrosis	085	N00-N07, N17-N19, N25-N27
Renal failure	086	N17-N19
Domain 9. Congenital malformations, deformations, chromosomal abnormalities	089	Q00-Q99
Domain 10. External cause of death, injury and accidents	091	U01-U03, V01-Y89
Homicide (assault)	095	U01-U02, X85-Y09, Y87.1
Homicide (assault), by discharge of firearm	096	U01.4, X93-X95
Suicide (intentional self-harm)	097	U03, X60-X84, Y87.0
Suicide (intentional self-harm), not firearm, other or unknown	098	U03, X60-X71, X75-X84, Y87.0
Suicide (intentional self-harm), by firearm	099	X72-X74
Accidents	100	V01-X59, Y85-Y86
Accidents, transport	101	V01-V99, Y85
Accidents, other transport, not motor vehicles	102	V01, V05-V06, V09.1, V09.3-V09.9, V10-V11, V15-V18, V19.3, V19.8-V19.9, V80.0-V80.2, V80.6-V80.9, V81.2-V81.9, V82.2-V82.9, V87.9, V88.9, V89.1, V89.3, V89.9, V90-V99, Y85

Table 1. (continued)
HIERARCHICAL STRUCTURE FOR ANALYSIS OF CAUSES OF DEATH, BY DOMAIN AND PROJECT CODES

CAUSE OF DEATH	PROJECT CODES (N = 111)	ICD-10 CODES
Accidents, motor vehicle	103	V02-V04, V09.0, V09.2, V12-V14, V19.0-V19.2, V19.4-V19.6, V20-V79, V80.3-V80.5, V81.0-V81.1, V82.0-V82.1, V83-V86, V87.0-V87.8, V88.0-V88.8, V89.0, V89.2
Accidents, nontransport	104	W00-X59, Y86
Accidents, nontransport excluding poisoning	105	W00-X39, X50-X59, Y86
Falls	106	W00-W19
Accidental discharge of firearms	107	W32-W34
Drowning and submersion (accidental)	108	V90, V92, W65-W74
Fire, smoke, and flames (accidental)	109	X00-X09
Accidental poisoning and exposure to noxious substances	110	X40-X49
Accidental drug poisoning	111	X40-X44
Accidental alcohol poisoning	112	X45
Complications of medical and surgical care	113	Y40-Y84, Y88
Domain 11. Other causes of death		
Diseases of the blood and blood forming organs	036	D50-D89
Mental and behavioral disorders	044	F01-F99
Skin and subcutaneous tissue	081	L00-L98
Diseases of the musculoskeletal system & connective tissue	082	M00-M99
Rheumatoid arthritis and related inflammatory polyarthropathies	083	M05-M08
Pregnancy, childbirth, and the puerperium	087	O00-O99
Perinatal conditions	088	P00-P96
Symptoms, signs not otherwise classified	090	R00-R99
Diseases of the eye, adnexa, ear and mastoid	115	H00-H57, H60-H93

Table 2.
TRANSLATION BETWEEN CORRESPONDING ICD-9 AND ICD-10 CODES

PROJECT CODE	CAUSE OF DEATH	ICD-10 CODE	ICD-9 CODE
1	All causes of death	A00-Z99	000-799, E800-E999
2	Infectious and parasitic diseases	A00-B99	000-139
3	Tuberculosis	A16-A19	010-018
4	Septicemia	A40-A41	038
5	Viral disease	A80-B34	042-079
6	Viral hepatitis	B15-B19	070
7	Human immunodeficiency virus (HIV) disease	B20-B24	042-044
8	Cancer	C00-C97	140-208
9	Cancer of oral cavity and pharynx	C00-C14.8	140-149
10	Cancer of digestive organs	C15-C26, C48	150-159
11	Cancer of esophagus	C15	150
12	Cancer of stomach	C16	151
13	Cancer of other and ill-defined digestive	C17, C21, C23, C24, C26	152, 154.2, 154.3, 154.8, 156, 159.1, 159.8, 159.9
14	Cancer of colon and rectum	C18-C20, C26.0	153.0-154.1, 159.0
15	Cancer of liver and intrahepatic bile ducts	C22	155

Table 2. (continued)
TRANSLATION BETWEEN CORRESPONDING ICD-9 AND ICD-10 CODES

PROJECT CODE	CAUSE OF DEATH	ICD-10 CODE	ICD-9 CODE
16	Cancer of pancreas	C25	157
17	Cancer of the respiratory system	C30-C39	160-165
18	Cancer of larynx	C32	161
19	Cancer of lung and bronchus	C34	162.2-162.9
20	Cancer, melanoma of skin	C43	172
21	Cancer of breast	C50	174-175
22	Cancer of cervix uteri	C53	180
23	Cancer of corpus/uterus, NOS	C54-C55	179, 182.0-182.8
24	Cancer of ovary	C56	183.0
25	Cancer of prostate	C61	185
26	Cancer of the testis	C62	186
27	Cancer of kidney and renal pelvis	C64-C65	189.0, 189.1
28	Cancer of urinary bladder	C67	188
29	Cancer of brain/other nervous system	C70-C72	191-192
30	Cancer of thyroid	C73	193
31	Cancer, Hodgkin lymphoma	C81	201
32	Cancer, non-Hodgkin lymphoma	C82-C85	200.0-200.8, 202.0-202.2, 202.8-202.9
33	Cancer, myeloma	C88.7-C88.9, C90.0, C90.2	203.0, 203.2-203.8
34	Cancer, leukemia	C90.1, C91-C95	202.4, 203.1, 204-208
35	In situ, benign and uncertain neoplasms	D00-D48	210-239
36	Diseases of the blood and blood forming organs	D50-D89	280-289
37	Drug-induced deaths	D52.1, D59.0, D59.2, D61.1, D64.2, E06.4, E16.0, E23.1, E24.2, E27.3, E66.1, F11.0-F11.5, F11.7-F12.5, F12.7-F13.5, F13.7-F14.5, F14.7-F15.5, F15.7-F16.5, F16.7-F17.0, F17.3-F17.5, F17.7-F18.5, F18.7-F19.5, F19.7-F19.9, G21.1, G24.0, G25.1, G25.4, G25.6, G44.4, G62.0, G72.0, I95.2, J70.2-J70.4, L10.5, L27.0-L27.1, M10.2, M32.0, M80.4, M81.4, M83.5, M87.1, R78.1-R78.5, U01.6, X40-X44, X60-X64, X85, Y10-Y14	292, 304, 305.2-305.9, E850-E858, E950.0-E950.5, E962.0, E980.0-E980.5
38	Diseases of the endocrine system	E00-E88	240-279
39	Diabetes mellitus	E10-E14	250
40	Nutritional deficiencies	E40-E64	260-269
41	Malnutrition	E40-E46	260-263
42	Obesity	E65-E68	278
43	Metabolic disorders	E70-E88	270-277
44	Mental and behavioral disorders	F01-F99	290-319
45	Diseases of the nervous system	G00-G98	320-359
46	Meningitis	G00, G03	320-322
47	Parkinson's disease	G20-G21	332
48	Alzheimer's disease	G30	331.0
49	Multiple sclerosis	G35	340
50	Epilepsy	G40-G41	345
51	Cardiovascular diseases (major)	I00-I78	390-448
52	Heart disease	I00-I09, I11, I13, I20-I51	390-398, 402, 404-429
53	Rheumatic fever (acute) and chronic rheumatic heart diseases	I00-I09	390-398
54	Coronary heart disease	I11, I20-I25, I51.6	402, 410-414, 429.2
55	Hypertensive heart disease	I11	402

Table 2. (continued)
TRANSLATION BETWEEN CORRESPONDING ICD-9 AND ICD-10 CODES

PROJECT CODE	CAUSE OF DEATH	ICD-10 CODE	ICD-9 CODE
56	Ischemic heart diseases	I20-I25	410-414
57	Acute myocardial infarction	I21-I22	410
58	Atherosclerotic cardiovascular disease	I25.0	429.2
59	Hypertensive heart and renal disease	I13	404
60	Heart failure	I50	428
61	Hypertension (essential/primary) and hypertensive renal disease	I10, I12	401, 403
62	Cerebrovascular diseases	I60-I69	430-438
63	Atherosclerosis	I70	440
64	Phlebitis, thrombophlebitis, venous embolism and thrombosis	I80-I82	451-453
65	Diseases of the respiratory system	J00-J98	460-519
66	Influenza and pneumonia	J10-J18	480-487
67	Influenza	J10-J11	487
68	Pneumonia	J12-J18	480-486
69	Chronic lower respiratory diseases	J40-J47	490-496
70	Bronchitis, chronic and unspecified	J40-J42	490-491
71	Emphysema	J43	492
72	Asthma	J45-J46	493
73	Pneumoconiosis	J60-J66	500-505
74	Pneumonitis due to solids and liquids	J69	507
75	Diseases of the digestive system	K00-K92	520-579
76	Peptic ulcer	K25-K28	531-534
77	Liver disease, chronic and cirrhosis	K70, K73-K74	571
78	Liver, alcoholic liver disease	K70	571.0-571.3
79	Cholelithiasis and other disorders of gallbladder	K80-K82	574-575
80	Pancreas and biliary tract disorders	K83-K86	576-577
81	Skin and subcutaneous tissue	L00-L98	680-709
82	Diseases of the musculoskeletal system & connective tissue	M00-M99	710-739
83	Rheumatoid arthritis and related inflammatory polyarthropathies	M05-M08	714
84	Genitourinary system	N00-N98	580-629
85	Nephritis, nephrotic syndrome and nephrosis	N00-N07, N17-N19, N25-N27	580-589
86	Renal failure	N17-N19	584-586
87	Pregnancy, childbirth, and the puerperium	O00-O99	630-676
88	Perinatal conditions	P00-P96	760-779
89	Congenital malformations, deformations, chromosomal abnormalities	Q00-Q99	740-759
90	Symptoms, signs not otherwise classified	R00-R99	780-799
91	External cause of death, injury and accidents	U01-U03, V01-Y89	E800-E999
92	Firearm related injuries (accidental, suicide, homicide, undetermined, legal interv.)	U01.4, W32-W34, X72-X74, X93-X95, Y22-Y24, Y35.0	E922, E955.0-E955.4, E965.0-E965.4, E970, E985.0-E985.4
93	Poisoning (accidental, suicide, homicide, undetermined, legal interv.)	U01.6, U01.7, X40-X49, X60-X69, X85-X90, Y10-Y19, Y35.2	E850-E869, E950-E952, E962, E972, E980-E982
94	Suffocation and strangulation (accidental, suicide, homicide, undetermined)	W75-W84, X70, X91, Y20	E911-E913, E953, E963, E983
95	Homicide (assault)	U01-U02, X85-Y09, Y87.1	E960-E969
96	Homicide (assault), by discharge of firearm	U01.4, X93-X95	E965.0-E965.4
97	Suicide (intentional self-harm)	U03, X60-X84, Y87.0	E950-E959
98	Suicide (intentional self-harm), not firearm, other or unknown	U03, X60-X71, X75-X84, Y87.0	E950-E954, E955.5-E959.9
99	Suicide (intentional self-harm), by firearm	X72-X74	E955.0-E955.4
100	Accidents	V01-X59, Y85-Y86	E800-E869, E880-E929
101	Accidents, transport	V01-V99, Y85	E800-E848, E929.0, E929.1

Table 2. (continued)
TRANSLATION BETWEEN CORRESPONDING ICD-9 AND ICD-10 CODES

PROJECT CODE	CAUSE OF DEATH	ICD-10 CODE	ICD-9 CODE
102	Accidents, other transport, not motor vehicles	V01, V05-V06, V09.1, V09.3-V09.9, V10-V11, V15-V18, V19.3, V19.8-V19.9, V80.0-V80.2, V80.6-V80.9, V81.2-V81.9, V82.2-V82.9, V87.9, V88.9, V89.1, V89.3, V89.9, V90-V99, Y85	E800-E807, E820-E848, E929.0, E929.1
103	Accidents, motor vehicle	V02-V04, V09.0, V09.2, V12-V14, V19.0-V19.2, V19.4-V19.6, V20-V79, V80.3-V80.5, V81.0-V81.1, V82.0-V82.1, V83-V86, V87.0-V87.8, V88.0-V88.8, V89.0, V89.2	E810-E819
104	Accidents, nontransport	W00-X59, Y86	E850-E869, E880-E928, E929.2-E929.9
105	Accidents, nontransport excluding poisoning	W00-X39, X50-X59, Y86	E880-E924.0, E924.8-E928, E929.2-E929.9
106	Falls	W00-W19	E880-E886, E888
107	Accidental discharge of firearms	W32-W34	E922
108	Drowning and submersion (accidental)	V90, V92, W65-W74	E830, E832, E910
109	Fire, smoke, and flames (accidental)	X00-X09	E890-E899
110	Accidental poisoning and exposure to noxious substances	X40-X49	E850-E869, E924.1
111	Accidental drug poisoning	X40-X44	E850-E858
112	Accidental alcohol poisoning	X45	E860
113	Complications of medical and surgical care	Y40-Y84, Y88	E870-E879, E930-E949
114	Diseases of the circulatory system	I00-I99	390-459
115	H codes	H00-H57, H60-H93	360-389
116	R and Y codes	R00-R99, Y10-Y39, Y89	780-799, E970-E999

The study focused on identifying causes of death responsible for shifting death rates in the population. This was accomplished by systematically examining and reporting all-cause mortality trends by race and ethnicity and then conducting a more detailed analysis of mortality trends among NH whites. Using an interactive data tool developed for this project, aggregate deaths were combined across age groups to pinpoint the span in age groups that experienced a distinct trend of increasing mortality rates. As reported below, we identified whites ages 25–34 years and 40–64 years as the group of interest and identified 42 affected counties—located primarily in northern rural California and the Central Valley—where mortality increased among at least one of the two age groups studied.

Although the analysis focused on age-specific mortality rates, age adjustment was performed to account for changes in age distributions within the age groups. Weights calculated from the 2000 US standard million population were applied to age-specific rates and summed across age groups to produce the final age-adjusted rates. Trends in death rates reported in the issue brief generally refer to age-adjusted rates; crude rates are reported in selected tables to provide the reader with complete information on actual death rates.

The statistical significance of differences in mortality rates was determined using the standard error of the difference³⁹ (for crude rates) and by checking for overlap between 95% confidence intervals, which were computed using Fay and Feuer's method using the gamma distribution⁴⁰ (for age-adjusted rates). Calculations were performed in SAS (version 9.4, Cary, NC).

Excess and averted deaths were calculated using the following procedure: The expected number of deaths for each time period (assuming no mortality increase) was computed by applying the prior time period's crude mortality rate to the subsequent time period's population. Specifically, crude mortality rates for 1995-1999 were applied to the population of 2000-2004, 2000-2004 mortality rates to the 2005-2009 population, and 2005-2009 rates to the 2010-2014 population. Actual deaths were subtracted from the expected deaths to determine the number of averted deaths (decrease in cause-specific mortality) or excess (increase in cause-specific mortality) for each time period. The number of averted/excess deaths was summed over the three time periods to arrive at a total number of averted/excess deaths by cause.

We grouped the counties into three categories based on observed mortality trends: (1) the 24 counties in the four largest Metropolitan and Micropolitan Statistical Areas (MMSAs) in California—Los Angeles-Long Beach-Riverside; San Jose-San Francisco-Oakland; San Diego-Carlsbad-San Marcos; and Sacramento-Arden—and the “impacted counties” in which mortality increases were observed, including (2) the 14 largely rural counties with the greatest increases in death rates (increases greater than 50 deaths per 100,000) and (3) the 19 other counties with more modest increases (50 deaths or fewer per 100,000).^a We compared characteristics of the two groups of impacted counties, using data from the U.S. Census Bureau to examine geographic and demographic characteristics, socioeconomic conditions, the physical environment, housing, transportation, and access to health care (definitions and data sources in Table 3).

Finally, we examined temporal trends in socioeconomic data to see how the three groups of counties fared over time in terms of median household income, poverty, and unemployment. We obtained data from the U.S. Census Bureau, using its Small Area Income and Poverty Estimates (SAIPE) Program for recent decades (1999 forward)⁴¹ and its Historical Income Tables⁴² to examine whether the patterns observed predated the observation period of this study.

^a Alpine County had too few deaths to calculate the mortality rate and was excluded from the analysis.

Table 3.
PLACE-BASED INDICATORS EXAMINED IN CALIFORNIA COUNTIES

PLACE-BASED INDICATOR	DEFINITION	DATA SOURCE
Geographic Characteristics		
Rural (%)	Percentage of the county population living in rural areas	U.S. Census, 2010 Census Urban and Rural Classification
Urban (%)	Percentage of the county population living in urban areas	U.S. Census, 2010 Census Urban and Rural Classification
Demographic Characteristics		
Single parent households (%)	Percentage of children who live in single-parent households	2016 County Health Rankings
Diversity Index	Probability that two individuals chosen at random would be of different races or ethnicities	PolicyMap, 2010-2014
Foreign born population (%)	Percentage of the population who is foreign-born	U.S. Census, ACS 2014 5-year estimates, Table B05012
Socioeconomic Conditions		
Limited English proficiency (%)	Percentage of households where no one age 14 and over speaks English only or speaks English "very well"	2016 County Health Rankings
Bachelor's degree or more education (%)	Percentage of persons 25 years or older with a Bachelor's degree or higher	U.S. Census, ACS 2014 5-year estimates, Table S1505
Unemployment (%)	Percentage of civilian labor force (ages 16 and older) that is unemployed but seeking work	2016 County Health Rankings
Median household income (\$)	Median annual household income	2016 County Health Rankings
Poverty (%)	Percentage of population living below poverty level	U.S. Census, ACS 2015 5-year estimates, Table S1701
Poverty (adult only, %)	Percentage of population ages 18-64 years living below poverty level	U.S. Census, ACS 2015 5-year estimates, Table S1701
Child poverty (%)	Percentage of children (under age 18 years) living in poverty	2016 County Health Rankings
Gini Index	Statistical dispersion measure (zero to 1.0) representing the distribution of income	U.S. Census, ACS 2014 5-year estimates, Table B19083
Physical Environment		
Close proximity to highways (%)	Percent of population living within 150 meters of a highway	CDC Environmental Public Health Tracking Network, 2010
Ozone days (per year)	Number of ozone days per year above regulatory standard	CDC Environmental Public Health Tracking Network, 2012
Access to parks (%)	Percentage of population living within a half mile of a park	CDC Environmental Public Health Tracking Network, 2010
Low food access (%)	Percentage of population living more than 1 mile from a grocery store in an urban area or more than 10 miles in a rural area	2015 USDA ERS Food Environment Atlas
Violent crime rate (per 100,000)	Number of reported violent crime offenses per 100,000 population	2016 County Health Rankings
Housing		
Overcrowding (%)	Percentage of households with more than one occupant per room	U.S. Census, ACS 2014 5-year estimates, Table DP04
Cost burden (homeowners, %)	Percentage of owner-occupied households paying more than 30% of income on housing	U.S. Census, ACS 2014 5-year estimates, Table B25093
Cost burden (renters, %)	Percentage of renter-occupied households paying more than 30% of income on housing	U.S. Census, ACS 2014 5-year estimates, Table B25070
Severe housing disrepair (%)	Percentage of households with at least 1 of 4 housing problems: overcrowding, high housing costs, or lack of kitchen or plumbing facilities	2016 County Health Rankings
Housing built before 1950 (%)	Proportion of housing units built 1950 or earlier	U.S. Census, ACS 2014 5-year estimates, Table B25034
Transportation		
No vehicle access (%)	Percentage of workers age 16 years and over in households without a vehicle available	U.S. Census, ACS 2014 5-year estimates, Table B08141
Commuting to work by motor vehicle (%)	Percentage who commute by car, truck, van, taxi, motorcycle, or other means	U.S. Census, ACS 2014 5-year estimates, Table S0801
Commuting to work by public transit (%)	Percentage of workers age 16 years and over who commute to work by bus, train, or subway	U.S. Census, ACS 2014 5-year estimates, Table S0801

Table 3. (continued)
PLACE-BASED INDICATORS EXAMINED IN CALIFORNIA COUNTIES

Transportation		
Commuting to work by walking/cycling (%)	Percentage of workers age 16 years and over who commute to work by walking or cycling	U.S. Census, ACS 2014 5-year estimates, Table S0801
Access to Health Care		
Primary care physician ratio	Ratio of population to primary care physicians	2016 County Health Rankings
Mental health provider ratio	Ratio of population to mental health providers	2016 County Health Rankings
Dentist ratio	Ratio of population to dentists	2016 County Health Rankings
Uninsured (%)	Percentage of population without any health insurance	U.S. Census, ACS 2014 5-year estimates, Table S2701
Public insurance (%)	Percentage with public health insurance (e.g., Medicare, Medicaid)	U.S. Census, ACS 2014 5-year estimates, Table S2701
Private insurance (%)	Percent with private insurance	U.S. Census, ACS 2014 5-year estimates, Table S2701
<i>ACS=American Community Survey, CDC=Centers for Disease Control and Prevention</i>		

RESULTS

All-Cause Mortality

Between 1995 and 2014, overall age-adjusted, all-cause mortality rates decreased by 20.0% among NH whites in California (from 860.9 to 688.4 per 100,000). The age-adjusted mortality rate among NH blacks decreased by 25.3% (from 1,159.9 to 866.7 deaths per 100,000) during the same years, but remained 1.3 times that of NH whites; notably, despite recent gains, all-cause mortality among blacks in 2010-2014 was still higher than that of NH whites 15 years earlier. Age-adjusted mortality rates among Hispanics and NH Asians and Pacific Islanders were lower than those of NH whites and decreased by 20.5% and 26.7%, respectively. However, the age-adjusted mortality rate among NH American Indians and Alaskan Natives increased by 27.3% after 1995 (from 577.6 to 735.3 deaths per 100,000). A full investigation of this trend, including concerns about relatively small death counts and population accuracy, was beyond the scope of this project.

Among NH whites, age-specific mortality rates declined among children, adolescents, and older adults, but after 2000 the decline in all-cause mortality ceased in two age groups: Young NH whites (ages 25-34 years) experienced no statistically significant change in all-cause mortality between 2000 and 2014 (Table 4). Among middle-aged NH whites (ages 40-64 years), the unadjusted mortality rate increased by 1.1% between 2000 and 2014 ($p < 0.05$). The age-adjusted rate decreased by 10.9%, suggesting that the increase in unadjusted rates in this age group was caused by conditions associated with age (Table 5).

Table 4.
INCREASING MORTALITY RATES AMONG NON-HISPANIC WHITES AGES 25-34 YEARS, CALIFORNIA, 1995-2014

CAUSE OF DEATH (ICD-10 CODE*)	DEATHS AND MORTALITY RATES BY CAUSE AMONG NON-HISPANIC WHITES AGES 25-34 YEARS, 1995-2014								RELATIVE INCREASE IN AGE-ADJUSTED (CRUDE) MORTALITY RATE (%) [§]	
	1995-1999		2000-2004		2005-2009		2010-2014		FROM 1995-99	FROM 2000-04
	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)		
ALL CAUSES (A00-Z99)	12,783	105.7 (106.6)	8,847	86.9 (87.3)	8,002	86.3 (85.6)	8,663	88.4 (87.9)	-16.4 (-17.5)	1.8 (NS) (0.8) (NS)
STRESS-RELATED CONDITIONS										
CONDITIONS RELATED TO DRUG USE										
Accidental drug poisoning (X40-X44)	1,004	8.3 (8.4)	813	8.0 (8.0)	1,249	13.4 (13.4)	1,775	18.1 (18.0)	117.8 (115.2)	126.6 (124.6)
Narcotics and hallucinogens (X42)	NC	NC	338	3.3 (3.3)	501	5.4 (5.4)	693	7.0 (7.0)	—	111.9 (111.0)
Sedative-hypnotic, psychotropic, antiepileptic, and antiparkinsonian drugs (X41)	NC	NC	124	1.2 (1.2)	127	1.4 (1.4)	156	1.6 (1.6)	—	31.1 (NS) (29.4)
Other drugs, medicaments and biological substances (X44)	NC	NC	338	3.3 (3.3)	603	6.5 (6.4)	921	9.4 (9.3)	—	183.7 (180.4)
CONDITIONS RELATED TO ALCOHOL USE										
Alcoholic liver disease (K70)	173	1.4 (1.4)	96	0.9 (1.4)	104	1.1 (1.1)	191	2.0 (1.9)	42.5 (NS) (34.4)	116.9 (NS) (104.6)
Accidental alcohol poisoning (X45.0)	16	NA (0.1)	12	NA (0.1)	40	NA (0.4)	62	0.6 (0.6)	NA (371.7)	NA (431.6)
SUICIDE (SEE NOTES)	1,909	15.9 (15.9)	1,414	13.9 (13.9)	1,237	13.3 (13.2)	1,460	14.8 (14.8)	-6.8 (NS) (-6.9)	6.7 (NS) (6.2) (NS)
Suicide not involving firearm (see notes)	1,064	8.9 (8.9)	870	8.6 (8.6)	820	8.8 (8.8)	966	9.8 (9.8)	10.7 (NS) (10.5)	14.6 (NS) (14.3)
Hanging, strangulation, or suffocation (X70)	490	4.1 (4.1)	434	4.3 (4.3)	391	4.2 (4.2)	480	4.9 (4.9)	18.7 (NS) (19.2)	13.8 (NS) (13.8)
Narcotics and hallucinogens (X62)	NC	NC	37	NA (0.4)	22	NA (0.2)	37	NA (0.4)	—	NA (2.9) (NS)
Other drugs, medicaments and biological substances (X64)	NC	NC	110	1.1 (1.1)	145	1.6 (1.6)	164	1.7 (1.7)	—	54.9 (NS) (53.4)
Jumping from a high place (X80)	80	0.7 (0.7)	72	0.7 (0.7)	74	0.8 (0.8)	98	1.0 (1.0)	48.8 (NS) (49.1)	39.8 (NS) (40.0) (NS)
Suicide by firearm (X72-74)	845	7.1 (7.0)	544	5.4 (5.4)	417	4.5 (4.5)	494	5.0 (5.0)	-28.7 (NS) (-28.8)	-6.0 (NS) (-6.6) (NS)

Table 4. (continued)

INCREASING MORTALITY RATES AMONG NON-HISPANIC WHITES AGES 25-34 YEARS, CALIFORNIA, 1995-2014

CAUSE OF DEATH (ICD-10 CODE*)	DEATHS AND MORTALITY RATES BY CAUSE AMONG NON-HISPANIC WHITES AGES 25-34 YEARS, 1995-2014								RELATIVE INCREASE IN AGE-ADJUSTED (CRUDE) MORTALITY RATE (%) [§]	
	1995-1999		2000-2004		2005-2009		2010-2014		FROM 1995-99	FROM 2000-04
	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)		
STRESS-RELATED CONDITIONS										
ACCIDENTS POTENTIALLY RELATED TO INTOXICATION										
Accidents, motor vehicle (see notes)	1,543	12.9 (12.9)	1,301	12.9 (12.8)	1,221	12.9 (13.1)	1,107	11.2 (11.2)	-13.5 (NS) (-12.7)	-13.4 (NS) (-12.4)
Pedestrian injury (V09) [‡]	11	NA (0.1)	61	0.6 (0.6)	68	0.7 (0.7)	88	0.9 (0.9)	NA (873.8)	47.7 (NS) (48.4)
Motorcyclist injured in collision with fixed or stationary object (V27)	14	NA (0.1)	48	NA (0.5)	59	0.6 (0.6)	60	0.6 (0.6)	NA (421.7)	NA (28.6) (NS)
Motorcyclist injured in other transport accidents (V29)	NA	NA	40	NA (0.4)	78	0.8 (0.8)	77	0.8 (0.8)	NA	NA (98.1)
Occupant of special all-terrain or other off-road vehicle (V86)	16	NA (0.1)	14	NA (0.1)	23	NA (0.2)	30	NA (0.3)	NA (128.2)	NA (120.5)
OTHER CONDITIONS										
Hypertensive heart disease (I11)	42	NA (0.4)	55	0.5 (0.5)	55	0.6 (0.6)	61	0.6 (0.6)	NA (76.8)	18.2 (NS) (14.1) (NS)
Cardiomegaly (I51.7)	21	NA (0.2)	27	NA (0.3)	58	0.6 (0.6)	57	0.6 (0.6)	NA (230.4)	NA (117.2)
Infantile cerebral palsy (G80)	39	NA (0.3)	43	NA (0.4)	71	0.8 (0.8)	72	0.7 (0.7)	NA (124.7)	NA (72.3)

* ICD-10 codes refer to deaths from 1999 forward. Deaths in 1995-1998 were classified under ICD-9 codes using the conversion dictionary provided in the online supplement, Table 2-S.

§ All mortality rate increases were statistically significant ($p < 0.05$) unless otherwise noted as non-significant (NS).

¶ Includes agents primarily acting on smooth and skeletal muscles and the respiratory system anesthetics (general)(local) drugs affecting the: cardiovascular system, gastrointestinal system, hormones and synthetic substitutes, systemic and hematological agents, systemic antibiotics and other anti-infectives therapeutic gases, topical preparations, vaccines, water-balance agents, and drugs affecting mineral and uric acid metabolism.

‡ Data refer to pedestrian injuries in unspecified transport accidents, which account for one-third to one-half of pedestrian fatalities. The unadjusted mortality rates for all pedestrian injuries (ICD 10 codes V01-V09) in 2000-2004 and 2010-2014 (1.7 vs 1.8 deaths per 100,000, respectively) did not differ significantly.

NA=Not available: Crude mortality rates are not provided if there were fewer than 10 deaths over the five-year period. According to suppression rules, age-adjusted rates are not provided if the average number of deaths per year during the five-year period was less than 10.

NC=No conversion: deaths not reported because deaths during this period (1995-1999) were classified under ICD-9 codes that were not comparable to those in ICD-10.

Notes: Causes of death responsible for no more than 30 deaths in any time period are excluded. Population counts for calculating crude rates were 11,993,797 (1995-1999), 10,138,553 (2000-2004), 9,352,424 (2005-2009), and 9,853,526 (2010-2014). ICD-10 codes for suicide included U03, X60-84, and Y87.0; those for suicides not involving firearms included U03, X60-X71, X75-X84, and Y87.0. ICD-10 codes for motor vehicle accidents included V02-V04, V09.0, V09.2, V12-V14, V19.0-V19.2, V19.4-V19.6, V20-V79, V80.3-V80.5, V81.0-V81.1, V82.0-V82.1, V83-V86, V87.0-V87.8, V88.0-V88.8, V89.0, and V89.2.

Table 5.
MORTALITY FROM STRESS-RELATED CONDITIONS AMONG NON-HISPANIC WHITES AGES 40-64 YEARS,
CALIFORNIA, 1995-2014

CAUSE OF DEATH (ICD-10 CODE*)	DEATHS AND MORTALITY RATES BY CAUSE AMONG NON-HISPANIC WHITES AGES 40-64 YEARS, 1995-2014								RELATIVE INCREASE IN AGE-ADJUSTED (CRUDE) MORTALITY RATE (%) [§]	
	1995-1999		2000-2004		2005-2009		2010-2014		FROM 1995-99	FROM 2000-04
	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)		
ALL CAUSES (A00-Z99)	141,092	536.7 (538.5)	147,184	490.8 (506.2)	152,141	468.1 (513.9)	147,424	437.2 (511.9)	-18.6 (-4.9)	-10.9 (1.1)
STRESS-RELATED CONDITIONS										
Conditions related to drug use										
Accidental drug poisoning (X40-X44)	3,154	12.1 (12.0)	4,019	14.0 (13.8)	6,591	22.8 (22.3)	7,534	26.2 (26.2)	116.9 (117.3)	86.3 (89.3)
Sedative-hypnotic, psychotropic, anti-epileptic, and antiparkinsonian drugs (X41)	NC	NC	616	2.2 (2.1)	1,132	3.9 (3.8)	1,661	5.8 (5.8)	—	165.5 (172.3)
Narcotics and hallucinogens (X42)	NC	NC	1,587	5.5 (5.5)	2,232	7.7 (7.5)	1,929	6.7 (6.7)	—	21.5 (NS) (22.7)
Other drugs, medicaments and biological substances (X44)¶	NC	NC	1,765	6.2 (6.1)	3,171	10.9 (10.7)	3,898	13.5 (13.5)	—	119.4 (123.0)
Conditions related to alcohol use										
Alcoholic liver disease (K70)	4,531	17.3 (17.3)	4,943	16.6 (17.0)	5,768	18.3 (19.5)	6,423	20.2 (22.3)	17.0 (29.0)	21.3 (31.2)
Alcoholic cirrhosis of liver (K70.3)	2,939	11.2 (11.2)	3,153	10.6 (10.8)	3,687	11.7 (12.5)	4,386	13.6 (15.2)	21.6 (35.8)	28.5 (40.5)
Alcoholic hepatitis (K70.1)	213	0.8 (0.8)	234	0.8 (0.8)	310	1.0 (1.0)	304	1.0 (1.1)	23.5 (NS) (29.8)	26.2 (NS) (31.2)
Alcoholic fatty liver (K70.0)	206	0.8 (0.8)	105	0.4 (0.4)	176	0.6 (0.6)	206	0.7 (0.7)	-13.3 (NS) (-9.0) (NS)	89.1 (NS) (98.1)
Accidental alcohol poisoning (X45.0)	47	NA (2.2)	67	0.2 (0.2)	368	1.3 (1.2)	641	2.3 (2.2)	1,162.8 (1,141.4)	861.9 (867.8)
Suicide (see notes)	5,238	20.0 (20.0)	5,338	18.4 (18.4)	6,817	22.8 (23.0)	7,376	25.1 (25.6)	25.5 (28.1)	36.7 (39.5)
Suicide not involving firearm (see notes)	2,703	10.3 (10.3)	2,884	10.0 (9.9)	4,127	14.1 (13.9)	4,528	15.8 (15.7)	52.9 (52.4)	58.2 (58.5)
Hanging, strangulation, or suffocation (X70)	812	3.1 (3.1)	960	3.4 (3.3)	1,414	4.9 (4.8)	1,757	6.3 (6.1)	102.9 (96.9)	87.7 (84.8)
Sedative-hypnotic, psychotropic, anti-epileptic, and antiparkinsonian drugs (X61)	NC	NC	225	0.8 (0.8)	293	1.0 (1.0)	268	0.9 (0.9)	—	17.9 (NS) (20.3)

Table 5. (continued)

MORTALITY FROM STRESS-RELATED CONDITIONS AMONG NON-HISPANIC WHITES AGES 40-64 YEARS, CALIFORNIA, 1995-2014

CAUSE OF DEATH (ICD-10 CODE*)	DEATHS AND MORTALITY RATES BY CAUSE AMONG NON-HISPANIC WHITES AGES 40-64 YEARS, 1995-2014								RELATIVE INCREASE IN AGE-ADJUSTED (CRUDE) MORTALITY RATE (%) [§]	
	1995-1999		2000-2004		2005-2009		2010-2014		FROM 1995-99	FROM 2000-04
	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)		
STRESS-RELATED CONDITIONS										
Conditions related to drug use										
Narcotics and hallucinogens (X62)	NC	NC	140	0.5 (0.5)	229	0.7 (0.8)	222	0.7 (0.8)	—	46.9 (NS) (60.1)
Other drugs, medicaments and biological substances (X64)	NC	NC	645	2.2 (2.2)	1,016	3.4 (3.4)	1,131	3.9 (3.9)	—	76.1 (77.0)
Sharp object (e.g., stabbing) (X78)	NC	NC	1,587	0.5 (0.5)	201	0.7 (0.7)	206	0.7 (0.7)	—	31.3 (NS) (36.8)
Jumping from a high place (X80)	152	NC	152	0.7 (0.6)	239	0.8 (0.8)	303	1.1 (1.1)	85.9 (NS) (81.4)	65.3 (NS) (63.6)
Jumping or lying before moving object (X81)	164	0.6 (0.6)	84	0.3 (0.3)	98	0.3 (0.3)	133	0.5 (0.5)	-24.5 (NS) (-26.2)	63.3 (NS) (59.9)
Suicide by firearm (X72-74)	2,535	9.7 (9.7)	2,454	8.4 (8.4)	2,690	8.8 (9.1)	2,848	9.3 (9.9)	-3.8 (NS) (2.2) (NS)	11.1 (NS) (17.2)
Accidents potentially related to intoxication										
Accidents, motor vehicle (see notes)	3,030	11.6 (11.6)	3,584	12.3 (12.3)	3,618	12.3 (12.2)	2,931	10.0 (10.2)	-13.1 (NS) (-12.0)	-18.6 (-17.4)
Pedestrian injury (V09)‡	33	NA (0.1)	194	0.7 (0.7)	277	0.9 (0.9)	349	1.2 (1.2)	NA (862.2)	76.7 (NS) (81.6)
Motorcyclist injured in collision with car, pickup truck, or van (V23.4)	16	NA (0.1)	127	0.4 (0.4)	183	0.6 (0.6)	164	0.6 (0.6)	NA (832.5)	26.0 (NS) (30.4)
Motorcyclist injured in non- collision transport accident (V28)	26	NA	(0.1) 109	0.4 (0.4)	158	0.5 (0.5)	130	0.5 (0.5)	NA (354.9)	22.3 (NS) (20.4) (NS)
Motorcyclist injured in other transport accidents (V29)	34	NA (0.1)	153	0.5 (0.5)	265	0.9 (0.9)	230	0.8 (0.8)	NA (515.4)	48.0 (NS) (51.8)
Non-transport accidents (excluding poisoning) (see notes)	2,020	7.7 (7.7)	2,293	7.8 (7.9)	2,792	9.1 (9.4)	2,601	8.2 (9.0)	6.7 (NS) (17.1)	5.1 (NS) (14.5)

Table 5. (continued)

MORTALITY FROM STRESS-RELATED CONDITIONS AMONG NON-HISPANIC WHITES AGES 40-64 YEARS, CALIFORNIA, 1995-2014

CAUSE OF DEATH (ICD-10 CODE*)	DEATHS AND MORTALITY RATES BY CAUSE AMONG NON-HISPANIC WHITES AGES 40-64 YEARS, 1995-2014								RELATIVE INCREASE IN AGE-ADJUSTED (CRUDE) MORTALITY RATE (%) [§]	
	1995-1999		2000-2004		2005-2009		2010-2014		FROM 1995-99	FROM 2000-04
	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)		
STRESS-RELATED CONDITIONS										
Accidents potentially related to intoxication										
Falls (W00-19)	636	2.4 (2.4)	801	2.7 (2.8)	1,000	3.1 (3.4)	1,039	3.1 (3.6)	29.2 (NS) (48.7)	15.6 (NS) (31.0)
Inhalation and ingestion of food (W79)	85	0.3 (0.3)	95	0.3 (0.3)	136	0.4 (0.5)	123	0.4 (0.4)	19.5 (NS) (31.7)	21.8 (NS) (30.7)

* ICD-10 codes refer to deaths from 1999 forward. Deaths in 1995-1998 were classified under ICD-9 codes using the conversion dictionary provided in the online supplement, Table 2-S.

§ All mortality rate increases were statistically significant (p < 0.05) unless otherwise noted as non-significant (NS).

¶ Includes agents primarily acting on smooth and skeletal muscles and the respiratory system anesthetics (general)(local) drugs affecting the: cardiovascular system, gastrointestinal system, hormones and synthetic substitutes, systemic and hematological agents, systemic antibiotics and other anti-infectives therapeutic gases, topical preparations, vaccines, water-balance agents, and drugs affecting mineral and uric acid metabolism.

‡ Data refer to pedestrian injuries in unspecified transport accidents, which account for one-third to one-half of pedestrian fatalities. The unadjusted mortality rate for all pedestrian injuries (ICD 10 codes V01-V09) increased from 2.2 to 2.6 deaths per 100,000 after 2000-2004 (p < 0.05).

NA=Not available: Crude mortality rates are not provided if there were fewer than 10 deaths over the five-year period. According to suppression rules, age-adjusted rates are not provided if the average number of deaths per year during the five-year period was less than 10.

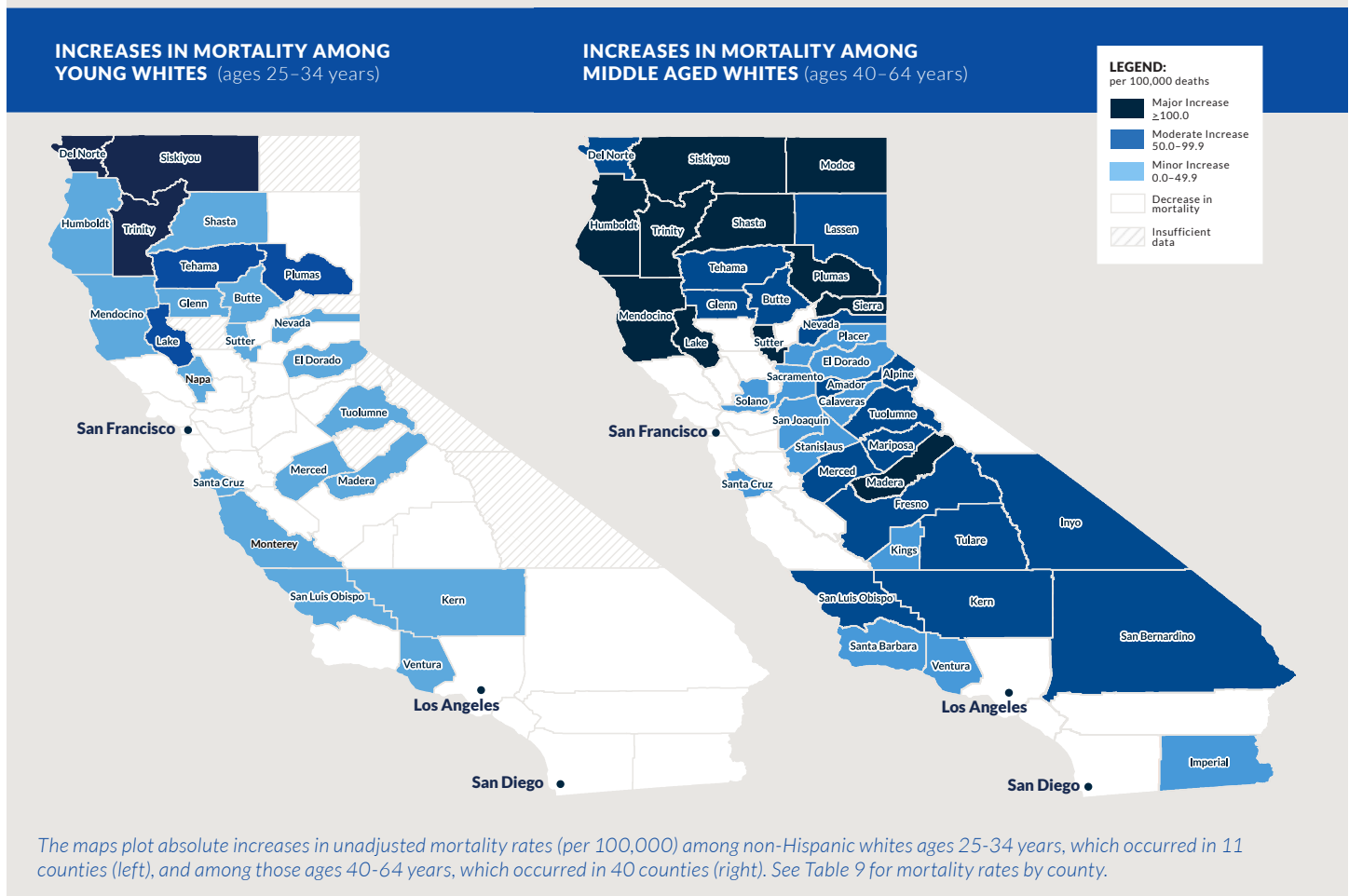
NC=No conversion: deaths not reported because deaths during this period (1995-1999) were classified under ICD-9 codes that were not comparable to those in ICD-10.

Notes: Causes of death responsible for no more than 100 deaths in any time period are excluded. Population counts for calculating crude rates were 26,199,818 (1995-1999), 29,077,191 (2000-2004), 29,607,180 (2005-2009), and 28,798,410 (2010-2014). ICD-10 codes for suicide included U03, X60-84, and Y87.0; those for suicides not involving firearms included U03, X60-X71, X75-X84, and Y87.0. ICD-10 codes for motor vehicle accidents included V02-V04, V09.0, V09.2, V12-V14, V19.0-V19.2, V19.4-V19.6, V20-V79, V80.3-V80.5, V81.0-V81.1, V82.0-V82.1, V83-V86, V87.0-V87.8, V88.0-V88.8, V89.0, and V89.2. ICD-10 codes for non-transport accidents included W00-X39, X50-59, and Y86.

Geographic Distribution

The mortality increases among young and middle-aged NH whites occurred primarily in rural northern California and the Central Valley, where increases in all-cause mortality exceeded statewide trends. After 1995-1999, unadjusted all-cause mortality rates among those ages 25-34 years rose in 23 of the state's 58 counties (with rate increases by county ranging from 2.4% to 138.9%); all-cause mortality in three of these counties increased more than 100.0 deaths per 100,000. Unadjusted all-cause mortality rates at ages 40-64 years rose in 40 counties (rate increases ranging from 0.05% to 77.0%). Increases of more than 100.0 deaths per 100,000 occurred in 11 of these counties, all but one located in rural northern California (Figure 1).

Figure 1. Counties with an increase in mortality rates between 1995-1999 and 2010-2014



Cause-Specific Mortality

Deaths from Substance Abuse, Accidents, and Suicides

The failure of mortality rates to decrease statewide among NH whites ages 25-34 years and 40-64 years and to increase in rural northern and central California reflects an upsurge in deaths from specific causes. Statewide, these mortality rate increases caused an estimated 21,350 excess deaths among NH whites in these two age groups between 1995 and 2014.

Increased mortality from external causes (e.g., drug or alcohol overdoses, suicides, accidents) accounted for 80.3% of the excess deaths at ages 25-34 years (Figure 2) and 33.9% of the excess deaths at ages 40-64 years (Figure 3). The source data for Figures 2-3 are provided in Tables 6-7.

Figure 2. Averted and excess deaths among non-Hispanic whites ages 25-34 years, 1995-2014

Table 6 provides a detailed list of averted and excess deaths.

CVD = cerebrovascular disease, HIV = human immunodeficiency virus infection, MVA = motor vehicle accidents.

LEGEND

👤 = 1%

TOTAL AVERTED DEATHS
(No. = 3,205)



TOTAL EXCESS DEATHS
(No. = 1,320)

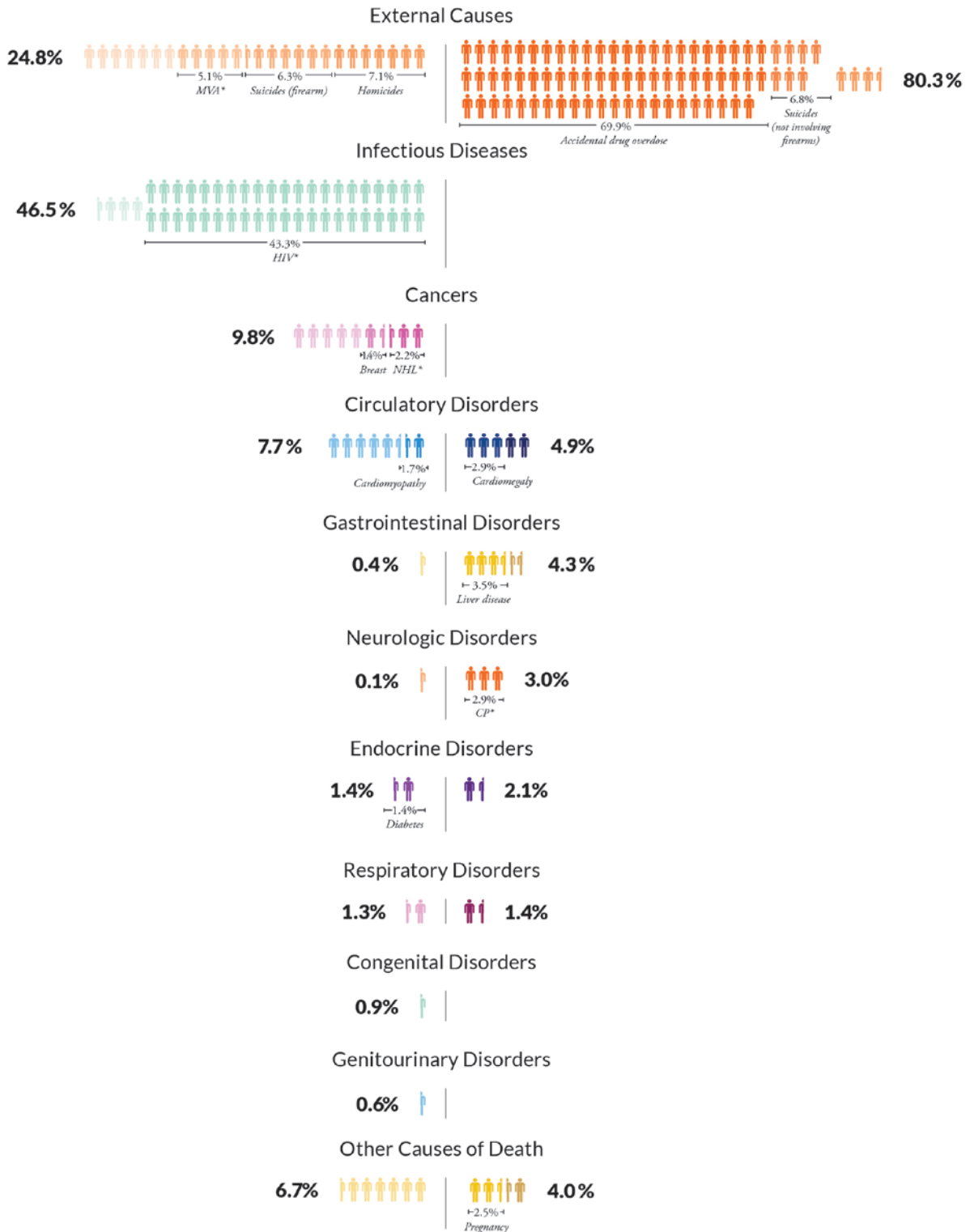
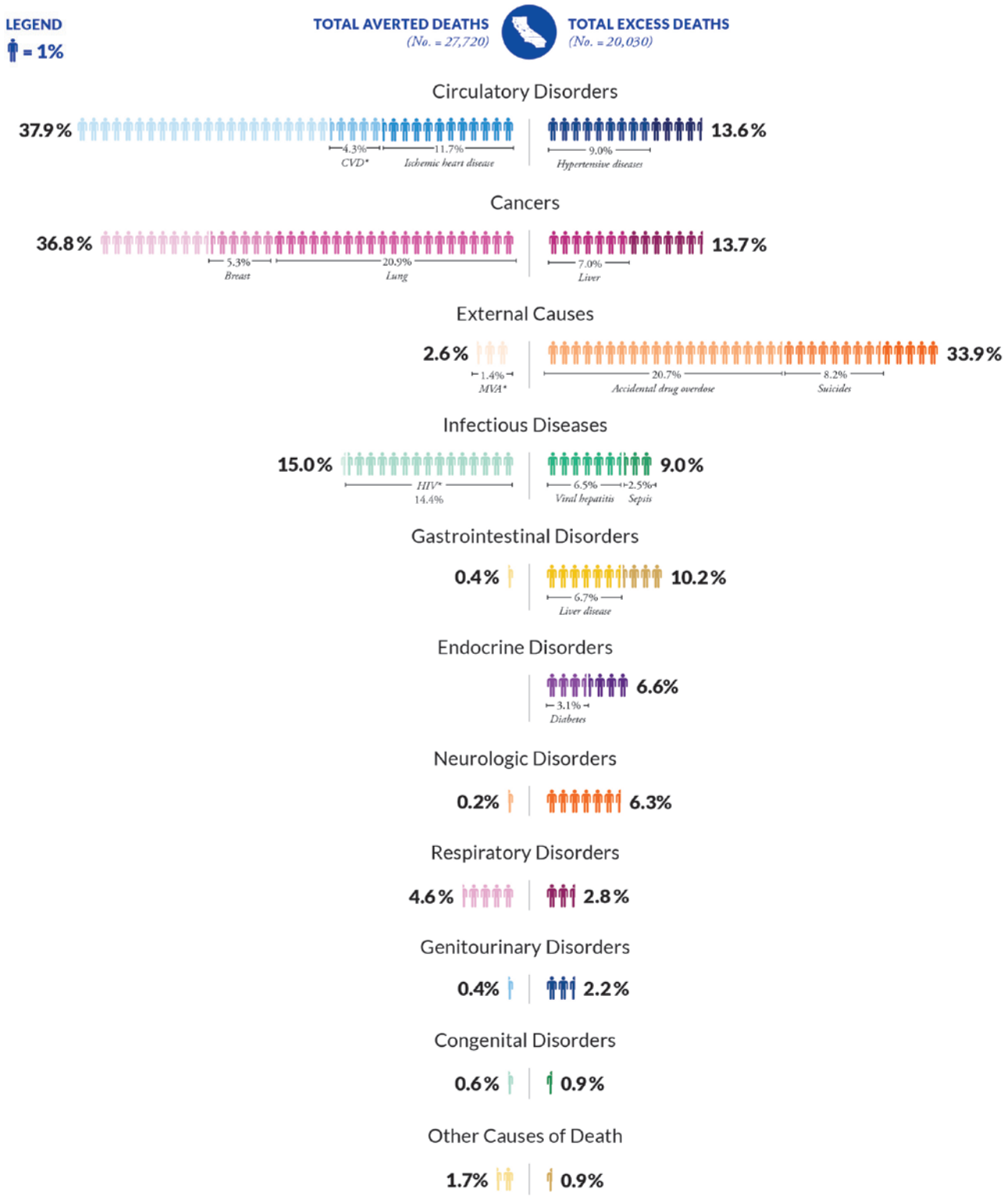


Figure 3. Averted and excess deaths among non-Hispanic whites ages 40-64 years, 1995-2014

Table 7 provides a detailed list of averted and excess deaths.
 CVD = cerebrovascular disease, HIV = human immunodeficiency virus infection, MVA = motor vehicle accidents.



Accidental drug overdoses (poisoning) caused 33,735 deaths among NH whites of all ages in California between 1995 and 2014, doubling in frequency among young and middle-aged whites (Tables 4-5). The rate increase in these two age groups resulted in 5,063 excess deaths between 1995 and 2014, accounting for 69.9% of the excess deaths among young adult whites (Table 6) and 20.7% of excess deaths in midlife (Table 7).

Alcohol poisoning (e.g., from binge drinking) caused fewer deaths among NH whites than did drugs, but the unadjusted mortality rate increases after 1995-1999 were more stunning: 371.7% among those ages 25-34 years and 1,140.9% among those ages 40-64 years (Tables 4-5). Across all age groups, alcoholic liver disease caused 31,883 deaths in California among NH whites between 1995 and 2014, 70.0% of them at ages 40-64 years. Chronic liver disease accounted for 6.7% of the excess deaths in this age group (Table 7). Death rates from alcoholic liver disease doubled among younger adults after 2000-2004, although death counts were too low for the increases to reach statistical significance (Table 4).

Unadjusted death rates from injuries potentially associated with intoxication increased after 1995-1999, notably pedestrian and motorcycle fatalities involving both young and middle-aged NH whites, and falls and choking (on food) among middle-aged NH whites (Tables 4-5).

Between 1995 and 2014, 50,755 NH whites of all ages committed suicide. The suicide rate increased distinctly among those age 40-64 years, claiming 24,769 lives and accounting for 8.2% of excess deaths in this age group; all forms of suicide increased, notably those involving hanging, strangulation, or suffocation (Table 5).

Table 6.
ESTIMATED AVERTED/EXCESS DEATHS AMONG NON-HISPANIC WHITES AGES 25-34 YEARS,
CALIFORNIA, 1995-2014

CAUSE OF DEATH	ICD-10 CODES	AVERTED DEATHS (N, %)	EXCESS DEATHS (N, %)	NET EXCESS DEATHS
ALL CAUSES	A00-Z99	-3,205 (100.0)	1320 (100.0)	-1,885
Domain 1. Infectious and parasitic diseases	A00-B99	-1,490 (46.5)		-1,490
Septicemia	A16-A19	-3 (0.1)		
Viral hepatitis	A40-A41	-24 (0.8)		
HIV	B20-24	-1,389 (43.3)		
Other infectious diseases		-73 (2.3)		
Domain 2. Cancer	C00-C97, D00-D48	315 (9.8)	19 (1.4)	-296
Oral cavity and pharynx	C00-C14.8	-5 (0.1)		
Digestive organs	C15-C26, C48		1 (0.1)	
Respiratory system	C30-C39	-28 (0.9)		
Melanoma	C43	-44 (1.4)		
Breast	C50	-46 (1.4)		
Uterine cervix	C53	-15 (0.5)		
Corpus uterus	C54-C55		1 (0.1)	
Ovaries	C56	-18 (0.5)		
Prostate	C61	-1 (0.0)		
Testes	C62	-3 (0.1)		
Kidney and renal pelvis	C64-C65		4 (0.3)	
Urinary bladder	C67		2 (0.1)	
Brain cancer/other nervous system	C70-C72	-30 (0.9)		
Thyroid	C73		1 (0.0)	
Hodgkin's lymphoma	C81	-22 (0.7)		
non-Hodgkin's lymphoma	C82-C85	-71 (2.2)		
Myeloma	C88.7-C88.9, C90.0, C90.2	-5 (0.2)		
Leukemia	C90.1, C91-C95	-30 (0.9)		
In situ, benign and uncertain neoplasms	D00-D48	-9 (0.3)		-9
Other cancers			11 (0.8)	
Domain 3. Diseases of the endocrine system	E00-E88	-45 (1.4)	27 (2.1)	-18
Diabetes mellitus	E10-E14	E10-E14	-45 (1.4)	
Obesity	E40-E64	E65-E68		20 (1.5)
Cystic fibrosis	E40-E46	E84		6 (0.4)
Other diseases of the endocrine system	E65-E68			2 (0.1)
Domain 4. Diseases of the nervous system	G00-G98	-4 (0.1)	39 (3.0)	35
Infantile cerebral palsy	G80		39 (2.9)	
Other diseases of the nervous system		-4 (0.1)		
Domain 5. Diseases of the circulatory system	I00-I99	-246 (7.7)	65 (4.9)	-180
Hypertensive heart disease	I11		27 (2.0)	
Cardiomyopathy	I42	-53 (1.7)		
Cardiomegaly	I51.7		38 (2.9)	
Other diseases of the circulatory system		-192 (6.0)		
Domain 6. Diseases of the respiratory system	J00-J98	-41 (1.3)		-41
Domain 7. Diseases of the digestive system	K00-K92		57 (4.3)	57
Alcoholic liver disease	K70		47 (3.5)	
Other digestive diseases			10 (0.8)	
Domain 8. Genitourinary system	N00-N98	-19 (0.6)		-19
Domain 9. Congenital malformations, deformations, chromosomal abnormalities	Q00-Q99	-27 (0.9)		-27

Table 6. (continued)
ESTIMATED AVERTED/EXCESS DEATHS AMONG NON-HISPANIC WHITES AGES 25-34 YEARS,
CALIFORNIA, 1995-2014

CAUSE OF DEATH	ICD-10 CODES	AVERTED DEATHS (N, %)	EXCESS DEATHS (N, %)	NET EXCESS DEATHS
Domain 10. External cause of death, injury and accidents	U01-U03, V01-Y89	-795 (24.8)	1,060 (80.3)	265
Homicide	U01-U02, X85-Y09, Y87.1	-226 (7.1)		
Suicide, not involving firearm	U03, X60-X71, X75-X84, Y87.0		90 (6.8)	
Suicide, involving firearm	X72-X74	-200 (6.3)		
Motor vehicle accidents	V02-V04, V09.0, V09.2, V12-V14, V19.0-V19.2, V19.4-V19.6, V20-V79, V80.3-V80.5, V81.0-V81.1, V82.0-V82.1, V83-V86, V87.0-V87.8, V88.0-V88.8, V89.0, V89.2	-162 (5.1)		
Other non-transport, non-poisoning accidents		-140 (4.4)		
Accidental drug overdose	X40-X44		922 (69.9)	
Accidental alcohol overdose	X45		47 (3.6)	
Other external cause of death, injury, accidents		-67 (2.1)		
Domain 11. Other causes of death		-215 (6.7)	53 (4.0)	-161
Diseases of the blood and blood forming organs	D50-D89		15 (1.2)	15
Mental and behavioral disorders	F01-F99	-88 (2.7)		-88
Skin and subcutaneous tissue	L00-L98		5 (0.4)	5
Diseases of the musculoskeletal system and connective tissue	M00-M99	-10 (0.3)		-10
Pregnancy, childbirth, and the puerperium	O00-O99		33 (2.5)	33
Perinatal conditions	P00-P96	-1 (0.0)		
Signs, symptoms, not otherwise specified	R00-R99	-113 (3.5)		-113
Diseases of the eye, adnexa, ear and mastoid	H00-H57, H60-H93	-4 (0.1)		-4

See preceding text for methods used to calculate averted and excess deaths. Percentages do not total 100.0 due to rounding errors.

Table 7.
ESTIMATED AVERTED/EXCESS DEATHS AMONG NON-HISPANIC WHITES AGES 40-64 YEARS,
CALIFORNIA, 1995-2014

CAUSE OF DEATH	ICD-10 CODES	AVERTED DEATHS (N, %)	EXCESS DEATHS (N, %)	NET EXCESS DEATHS
ALL CAUSES	A00-Z99	-27,720 (100.0)	20,030 (100.0)	-7,690
Domain 1. Infectious and parasitic diseases	A00-B99	-4,160 (15.0)	1,803 (9.0)	-2,356
Septicemia	A16-A19		495 (2.5)	
Viral hepatitis	A40-A41		1,308 (6.5)	
HIV	B20-24	-3,984 (14.4)		
Other infectious diseases		-176 (0.6)		
Domain 2. Cancer	C00-C97, D00-D48	-10,187 (36.8)	2,743 (13.7)	-7,487
Oral cavity and pharynx	C00-C14.8		21 (0.1)	
Digestive organs	C15-C26, C48		1 (0.1)	
Esophagus	C15		147 (0.7)	
Stomach	C16	-191 (0.7)		
Other and ill-defined	C17, C21, C23, C24, C26		126 (0.6)	
Colon and rectum	C18-20, C26.0	-189 (0.7)		

Table 7. (continued)
ESTIMATED AVERTED/EXCESS DEATHS AMONG NON-HISPANIC WHITES AGES 40-64 YEARS,
CALIFORNIA, 1995-2014

CAUSE OF DEATH	ICD-10 CODES	AVERTED DEATHS (N, %)	EXCESS DEATHS (N, %)	NET EXCESS DEATHS
Liver and intrahepatic bile ducts	C22		1,408 (7.0)	
Pancreas	C25		493 (2.5)	
Other cancers of digestive organs		-20 (0.1)		
Respiratory system	C30-C39			
Lung and bronchus	C34	-5,772 (20.9)		
Larynx	C32	-116 (0.4)		
Other respiratory cancers		-67 (0.2)		
Melanoma	C43	-119 (0.4)		
Breast	C50	-1,474 (5.3)		
Uterine cervix	C53	-86 (0.3)		
Corpus uterus	C54-C55		346 (1.7)	
Ovaries	C56	-239 (0.9)		
Prostate	C61	-24 (0.1)		
Testicles	C62		17 (0.1)	
Kidney and renal pelvis	C64-C65	-138 (0.5)		
Urinary bladder	C67		111 (0.6)	
Brain cancer/other nervous system	C70-C72	-36 (0.1)		
Thyroid	C73		30 (0.1)	
Hodgkin's lymphoma	C81	-70 (0.3)		
non-Hodgkin's lymphoma	C82-C85	-1,021 (3.7)		
Myeloma	C88.7-C88.9, C90.0, C90.2	-114 (0.4)		
Leukemia	C90.1, C91-C95	-299 (1.1)		
Other cancers		-210 (0.8)		
In situ, benign and uncertain neoplasms	D00-D48		43 (0.2)	43
Domain 3. Diseases of the endocrine system	E00-E88		1,324 (6.6)	1,324
Diabetes mellitus	E10-E14		625 (3.1)	
Obesity	E65-E68		449 (2.2)	
Metabolic disorders	E70-E88		209 (1.0)	
Other diseases of the endocrine system			41 (0.2)	
Domain 4. Diseases of the nervous system	G00-G98	-53 (0.2)	1,255 (6.3)	1,202
Parkinson's disease	G20-G21		85 (0.4)	
Alzheimer's disease	G30		232 (1.2)	
Multiple sclerosis	G35	-53 (0.2)		
Epilepsy	G40-G41		78 (0.4)	
Motor neuron disease	G12.2		204 (1.0)	
Infantile cerebral palsy	G80		140 (0.7)	
Anoxic brain damage, not elsewhere classified	G93.1		104 (0.5)	
Other diseases of the nervous system			412 (2.0)	
Domain 5. Diseases of the circulatory system	I00-I99	-10,465 (37.9)	2,724 (13.6)	-7,741
Rheumatic heart disease	I00-09	-178 (0.6)		
Essential (primary) hypertension	I10		641 (3.2)	
Hypertensive heart disease	I11		1,167 (5.8)	
Ischemic heart disease	I20-25	-3,241 (11.7)		
Atrial flutter/fibrillation	I48.0		240 (1.2)	
Other cardiac arrhythmias	I49		167 (0.8)	
Heart failure	I50		330 (1.6)	
Cardiomegaly	I51.7		180 (0.9)	

Table 7. (continued)
ESTIMATED AVERTED/EXCESS DEATHS AMONG NON-HISPANIC WHITES AGES 40-64 YEARS,
CALIFORNIA, 1995-2014

CAUSE OF DEATH	ICD-10 CODES	AVERTED DEATHS (N, %)	EXCESS DEATHS (N, %)	NET EXCESS DEATHS
Cerebrovascular disease	I60-69	-1,188 (4.3)		
Other diseases of the circulatory system		-5,857 (21.2)		
Domain 6. Diseases of the respiratory system	J00-J98	-1,258 (4.6)	556 (2.8)	-702
Influenza	J10-11		96 (0.5)	
Pneumonia	J12-18	-697 (2.5)		
Chronic lower respiratory diseases	J40-47	-561 (2.0)		
Pneumonitis due to solids and liquids	J69		320 (1.6)	
Other respiratory diseases			140 (0.7)	
Domain 7. Diseases of the digestive system	K00-K92	-120 (0.4)	2,051 (10.2)	1,931
Peptic ulcer disease	K25-28	-120 (0.4)		
Paralytic ileus	K56		111 (0.6)	
Peritonitis	K65		29 (0.1)	
Chronic liver disease and cirrhosis	K70, K73-74		1,341 (6.7)	
Acute pancreatitis	K85		99 (0.5)	
Other digestive diseases			471 (2.4)	
Domain 8. Genitourinary system	N00-N98	-121 (0.4)	441 (2.2)	320
Renal failure	N17-N19		441 (2.2)	
Other genitourinary conditions		-121 (0.4)		
Domain 9. Congenital malformations, deformations, chromosomal abnormalities	Q00-Q99	-173 (0.6)	171 (0.9)	-2
Down's syndrome	Q90		171 (0.9)	
Other congenital disorders		-173 (0.6)		
Domain 10. External cause of death, injury and accidents	U01-U03, V01-Y89	-720 (2.6)	6,783 (33.9)	6,063
Homicide	U01-U02, X85-Y09, Y87.1	-260 (0.9)		
Suicide	U03, X60-X84, Y87.0		1,652 (8.2)	
Motor vehicle accidents	V02-V04, V09.0, V09.2, V12-V14, V19.0-V19.2, V19.4-V19.6, V20-V79, V80.3-V80.5, V81.0-V81.1, V82.0-V82.1, V83-V86, V87.0-V87.8, V88.0-V88.8, V89.0, V89.2	-398 (1.4)		
Other non-transport, non-poisoning accidents			394 (2.0)	
Accidental drug overdose	X40-X44		4,140 (20.7)	
Accidental alcohol overdose	X45		598 (3.0)	
Other external cause of death, injury, accidents		-62 (0.2)		
Domain 11. Other causes of death		-464 (1.7)	179 (0.9)	285
Diseases of the blood and blood forming organs	D50-D89		9 (0.0)	9
Mental and behavioral disorders	F01-F99		60 (0.3)	60
Skin and subcutaneous tissue	L00-L98		80 (0.4)	80
Diseases of the musculoskeletal system and connective tissue	M00-M99	-21 (0.1)		-21
Pregnancy, childbirth, and the puerperium	O00-O99		23 (0.1)	23
Perinatal conditions	P00-P96		3 (0.0)	3
Signs, symptoms, not otherwise specified	R00-R99	-443 (1.6)		-443
Diseases of the eye, adnexa, ear and mastoid	H00-H57, H60-H93		4 (0.0)	4

See preceding text for methods used to calculate averted and excess deaths. Percentages do not total 100.0 due to rounding errors.

Deaths From Other Causes

In addition to overdoses, alcoholic liver disease, and suicides, organ diseases accounted for a large proportion of excess deaths among middle-aged NH whites (Table 8). Many of these diseases could have had potential links to substance abuse and stress, among other risk factors. For example, age-adjusted death rates at ages 40-64 years from hepatitis C increased by 993.0% after 2000-2004; the unadjusted rate increased by 1,223.6%. Mortality from liver cancer also increased in this age group. These two liver diseases accounted for 13.6% of the excess deaths that occurred among middle-aged NH whites between 1995 and 2014. Death rates increased for other conditions with potential links to alcohol, chronic stress, overdoses, and suicide attempts. For example, 16.5% of excess deaths in middle-aged NH whites involved hypertensive heart disease, essential hypertension, atrial fibrillation and flutter, pneumonitis from solids or liquids, sepsis, and renal failure (Table 7). Unadjusted death rates at ages 40-64 years from atrial fibrillation and flutter and from pneumonitis increased by 655.4% and 245.8%, respectively, after 1995-1999 (Table 8). Deaths from obesity-related disorders also increased. The age-adjusted death rate from type 2 diabetes increased by 188.5% after 2000-2004) (Table 8).

Despite these increases in cause-specific deaths, the all-cause mortality rate did not increase in either age group because these excess deaths were offset by averted deaths: 3,205 among young adults and 27,720 among middle-aged adults. These deaths were averted due to declines in mortality from other causes after 1995-1999, notably from HIV infection (accounting for 43.3% of averted deaths among young NH whites), ischemic heart disease, lung and breast cancer, cerebrovascular disease, non-Hodgkin's lymphoma, leukemia, and pneumonia (Table 7).

Table 8.
INCREASED MORTALITY FROM ORGAN DISEASES AMONG NON-HISPANIC WHITES AGES 40-64 YEARS,
CALIFORNIA, 1995-2014

CAUSE OF DEATH (ICD-10 CODE*)	DEATHS AND MORTALITY RATES BY CAUSE AMONG NON-HISPANIC WHITES AGES 40-64 YEARS, 1995-2014								RELATIVE INCREASE IN AGE-ADJUSTED (CRUDE) MORTALITY RATE (%) [§]	
	1995-1999		2000-2004		2005-2009		2010-2014		FROM 1995-99	FROM 2000-04
	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)		
ALL CAUSES (A00-Z99)	141,092	536.7 (538.5)	147,184	490.8 (506.2)	152,141	468.1 (513.9)	147,424	437.2 (511.9)	-18.6 (-4.9)	-10.9 (1.1)
GASTROINTESTINAL DISEASE										
Viral hepatitis (B15-19)	1,121	4.3 (4.3)	1,446	4.9 (5.0)	2,299	7.0 (7.8)	2,516	7.1 (8.7)	66.0 (104.2)	45.6 (75.7)
Chronic viral hepatitis C (B18.2)	NC	NC	184	0.6 (0.6)	2,161	6.6 (7.3)	2,412	6.8 (8.4)	—	993.0 (1223.6)
Malignant neoplasm of liver and intrahe- patic bile ducts (C22)	1,067	4.1 (4.1)	1,452	4.8 (5.0)	2,015	5.9 (6.8)	2,564	6.8 (8.9)	68.4 (118.6)	42.5 (78.3)
Liver cell carcinoma (C22.0)	583	2.2 (2.2)	774	2.6 (2.7)	1,103	3.2 (3.7)	1,287	3.4 (4.5)	52.0 (100.8)	31.9 (67.9)
Intrahepatic bile duct carcinoma (C22.1)	207	0.8 (0.8)	253	0.8 (0.9)	353	1.0 (1.2)	448	1.2 (1.6)	58.4 (96.9)	49.7 (78.8)
Malignant neoplasm of liver, unspecified (C22.9)	277	1.1 (1.1)	421	1.4 (1.4)	554	1.6 (1.9)	828	2.2 (2.9)	110.2 (171.9)	58.7 (98.6)
Other diseases of liver (K76)	NC	NC	567	1.9 (2.0)	858	2.7 (2.9)	791	2.4 (2.7)	—	26.0 (NS) (40.9)
Acute pancreatitis (K85)	199	0.8 (0.8)	215	0.7 (0.7)	309	1.0 (1.0)	315	1.0 (1.1)	31.5 (NS) (44.0)	37.5 (NS) (47.9)
Paralytic ileus and intestinal obstruc- tion without hernia (K56)	35	NA (0.1)	124	0.4 (0.4)	157	0.5 (0.5)	148	0.4 (0.5)	NA (284.7)	6.5 (NS) (20.5) (NS)
Peritonitis (K65)	74	0.3 (0.3)	69	0.2 (0.2)	89	0.3 (0.3)	110	0.3 (0.4)	15.0 (NS) (35.2)	39.9 (NS) (61.0)
Pneumonitis due to solids and liquids (J69)	118	0.4 (0.5)	252	0.8 (0.9)	293	0.9 (1.0)	448	1.3 (1.6)	192.4 (245.8)	58.6 (NS) (79.5)
Interstitial pulmonary disease, unspecified (J84.9)	NC	NC	120	0.4 (0.4)	171	0.5 (0.6)	207	0.6 (0.7)	—	42.7 (NS) (74.2)
GASTROINTESTINAL DISEASE										
Diabetes mellitus (E10-14)	3,245	12.3 (12.4)	3,806	12.6 (13.1)	4,198	12.6 (14.2)	4,181	11.9 (14.5)	-3.3 (NS) (17.2)	-5.3 (NS) (10.9)
Non-insulin- dependent diabetes mellitus (E11)	NC	NC	466	1.5 (1.6)	1,075	3.2 (3.6)	1,603	4.4 (5.6)	—	188.5 (247.3)

Table 8. (continued)

INCREASED MORTALITY FROM ORGAN DISEASES AMONG NON-HISPANIC WHITES AGES 40-64 YEARS, CALIFORNIA, 1995-2014

CAUSE OF DEATH (ICD-10 CODE*)	DEATHS AND MORTALITY RATES BY CAUSE AMONG NON-HISPANIC WHITES AGES 40-64 YEARS, 1995-2014								RELATIVE INCREASE IN AGE-ADJUSTED (CRUDE) MORTALITY RATE (%) [§]	
	1995-1999		2000-2004		2005-2009		2010-2014		FROM 1995-99	FROM 2000-04
	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)		
Unspecified diabetes mellitus with renal complications (E14.2)	24	NA (0.1)	87	0.3 (0.3)	105	0.3 (0.4)	373	1.0 (1.3)	NA (1313.9)	248.7 (332.9)
Obesity (E66)	433	1.6 (1.7)	781	2.6 (2.7)	981	3.1 (3.3)	939	3.0 (3.3)	81.6 (97.3)	13.5 (NS) (21.4)
Metabolic disorders (e.g., lipidemias) (E70-88)	607	2.3 (2.3)	650	2.2 (2.2)	815	2.5 (2.8)	872	2.5 (3.0)	7.5 (NS) (30.7)	15.3 (NS) (35.5)
CIRCULATORY DISEASES										
Hypertensive heart disease (I11)	1,749	6.7 (6.7)	2,730	9.1 (9.4)	2,953	9.1 (10.0)	3,077	9.3 (10.7)	39.2 (60.1)	2.0 (NS) (13.8)
Essential (primary) hypertension (I10.0)	271	1.0 (1.0)	441	1.5 (1.5)	681	2.0 (2.3)	931	2.6 (3.2)	150.9 (212.5)	78.3 (113.2)
Heart failure (I50)	435	1.7 (1.7)	656	2.2 (2.3)	793	2.3 (2.7)	803	2.2 (2.8)	33.8 (NS) (68.0)	2.7 (NS) (23.6)
Secondary pulmonary hypertension (I27.2)¶	NC	NC	105	0.4 (0.4)	275	0.9 (0.9)	321	1.0 (1.1)	—	185.1 (208.7)
Atrial fibrillation and flutter (I48)	33	NA (0.1)	58	0.2 (0.2)	139	0.4 (0.5)	274	0.7 (1.0)	NA (655.4)	288.9 (377.0)
Other cardiac arrhythmias (I49)	29	NA (0.1)	140	0.5 (0.5)	156	0.5 (0.5)	197	0.6 (0.7)	NA (518.0)	22.7 (NS) (42.1)
Cardiomegaly (I51.7)	210	0.8 (0.8)	286	1.0 (1.0)	518	1.7 (1.8)	404	1.4 (1.4)	73.9 (75.0)	41.1 (42.6)
RENAL CONDITIONS										
Renal failure (N17-19)	3,245	12.3 (12.4)	3,806	12.6 (13.1)	4,198	12.6 (14.2)	4,181	11.9 (14.5)	-3.3 (NS) (17.2)	-5.3 (NS) (10.9)
Chronic renal failure (N18)	NC	NC	466	1.5 (1.6)	1,075	3.2 (3.6)	1,603	4.4 (5.6)	—	188.5 (247.3)
Acute renal failure (N17)	29	NA (0.1)	43	NA (0.1)	100	0.3 (0.3)	107	0.3 (0.4)	NA (235.7)	NA (151.3)
Hypertensive renal disease (I12)	137	0.5 (0.5)	235	0.8 (0.8)	260	0.8 (0.9)	312	0.9 (1.1)	72.5 (NS) (107.2)	14.9 (NS) (34.1)
RENAL CONDITIONS										
Septicemia (A40-41)	301	1.1 (1.1)	557	1.9 (1.9)	700	2.1 (2.4)	820	2.4 (2.8)	105.1 (147.8)	26.9 (48.6)
Enterocolitis due to <i>Clostridium difficile</i> (A04.7)	NC	NC	66	0.2 (0.2)	173	0.5 (0.6)	249	0.7 (0.9)	—	207.5 (280.9)

Table 8. (continued)
INCREASED MORTALITY FROM ORGAN DISEASES AMONG NON-HISPANIC WHITES AGES 40-64 YEARS,
CALIFORNIA, 1995-2014

CAUSE OF DEATH (ICD-10 CODE*)	DEATHS AND MORTALITY RATES BY CAUSE AMONG NON-HISPANIC WHITES AGES 40-64 YEARS, 1995-2014								RELATIVE INCREASE IN AGE-ADJUSTED (CRUDE) MORTALITY RATE (%) [§]	
	1995-1999		2000-2004		2005-2009		2010-2014		FROM 1995-99	FROM 2000-04
	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE- ADJUSTED MORTALITY RATE (CRUDE)		
CANCER										
Uterine cancer (C54-55)	454	1.7 (1.7)	594	2.0 (2.0)	690	2.0 (2.3)	842	2.3 (2.9)	32.4 (NS) (68.7)	17.1 (NS) (43.1)
Malignant neoplasm of rectosigmoid junction (C19)	148	0.6 (0.6)	207	0.7 (0.7)	228	0.7 (0.8)	322	1.0 (1.1)	72.2 (NS) (97.9)	41.4 (NS) (57.1)
Malignant neoplasm of anus and anal canal (C21)	33	NA (0.1)	132	0.4 (0.5)	144	0.4 (0.5)	171	0.5 (0.6)	NA (371.4)	9.2 (NS) (30.8)
Diffuse non- Hodgkin's lymphoma (C83)	NC	NC	212	0.7 (0.7)	204	0.6 (0.7)	274	0.8 (1.0)	—	14.3 (NS) (30.5)
Oropharyngeal cancer (C10)	156	0.6 (0.6)	69	0.2 (0.2)	91	0.3 (0.3)	132	0.4 (0.5)	-36.7 (NS) (-23.0)	66.8 (NS) (93.2)
Cancer of ill-defined digestive organs (C26)	73	0.3 (0.3)	78	0.3 (0.3)	77	0.2 (0.3)	127	0.4 (0.4)	31.3 (NS) (58.3)	41.1 (NS) (64.4)
Secondary malignant neoplasm of other specified sites (C79.8)	24	NA (0.1)	223	0.7 (0.8)	343	1.0 (1.2)	327	0.9 (1.1)	NA (1139.6)	26.3 (NS) (48.1)
NEUROLOGIC DISEASES										
All neurologic diseases (G00-98)	2,340	8.9 (8.9)	3,009	10.0 (10.3)	3,538	10.8 (12.0)	3,755	10.9 (13.0)	22.9 (46.0)	9.1 (NS) (26.0)
Motor neuron disease (G12.2)	536	2.0 (2.0)	684	2.3 (2.4)	737	2.2 (2.5)	791	2.3 (2.7)	10.8 (NS) (34.3)	0.3 (NS) (16.8)
Alzheimer's disease (G30)	115	0.4 (0.4)	184	0.6 (0.6)	295	0.8 (1.0)	355	0.9 (1.2)	106.5 (180.9)	48.8 (NS) (94.8)
Unspecified dementia (F03.0)	NC	NC	75	0.2 (0.3)	143	0.4 (0.5)	208	0.5 (0.7)	—	114.7 (NS) (180.0)
Infantile cerebral palsy (G80)	68	0.3 (0.3)	112	0.4 (0.4)	190	0.6 (0.6)	212	0.7 (0.7)	174.5 (183.6)	86.7 (NS) (91.1)
Parkinson's disease (G20-21)	110	0.4 (0.4)	152	0.5 (0.5)	194	0.5 (0.7)	205	0.5 (0.7)	24.2 (NS) (69.5)	4.4 (NS) (36.1)
Epilepsy (G40.9)	83	0.3 (0.3)	131	0.5 (0.5)	129	0.4 (0.4)	165	0.6 (0.6)	74.6 (NS) (80.9)	21.3 (NS) (27.2)
Anoxic brain damage, not elsewhere classified (G93.1)	75	0.3 (0.3)	114	0.4 (0.4)	176	0.5 (0.6)	185	0.6 (0.6)	96.6 (NS) (124.4)	45.9 (NS) (63.9)

Table 8. (continued)

INCREASED MORTALITY FROM ORGAN DISEASES AMONG NON-HISPANIC WHITES AGES 40-64 YEARS, CALIFORNIA, 1995-2014

CAUSE OF DEATH (ICD-10 CODE*)	DEATHS AND MORTALITY RATES BY CAUSE AMONG NON-HISPANIC WHITES AGES 40-64 YEARS, 1995-2014								RELATIVE INCREASE IN AGE-ADJUSTED (CRUDE) MORTALITY RATE (%) [§]	
	1995-1999		2000-2004		2005-2009		2010-2014		FROM 1995-99	FROM 2000-04
	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)		
CONGENITAL DISORDERS										
Down's syndrome (Q90)	90	0.3 (0.3)	174	0.6 (0.6)	267	0.8 (0.9)	267	0.8 (0.9)	129.6 (169.9)	35.6 (NS) (54.9)

* ICD-10 codes refer to deaths from 1999 forward. Deaths in 1995-1998 were classified under ICD-9 codes using the conversion dictionary provided in the online supplement, Table 2-S.

§ All mortality rate increases were statistically significant (p < 0.05) unless otherwise noted as non-significant (NS).

¶ Excluding pulmonary hypertension secondary to kyphoscoliosis.

‡ Data refer to epilepsy due to unspecified causes.

NA=Not available: Crude mortality rates are not provided if there were fewer than 10 deaths over the five-year period. According to suppression rules, age-adjusted rates are not provided if the average number of deaths per year during the five-year period was less than 10.

NC=No conversion: deaths not reported because deaths during this period (1995-1999) were classified under ICD-9 codes that were not comparable to those in ICD-10.

Notes: Causes of death responsible for no more than 100 deaths in any time period are excluded. Population counts for calculating crude rates were 26,199,818 (1995-1999), 29,077,191 (2000-2004), 29,607,180 (2005-2009), and 28,798,410 (2010-2014).

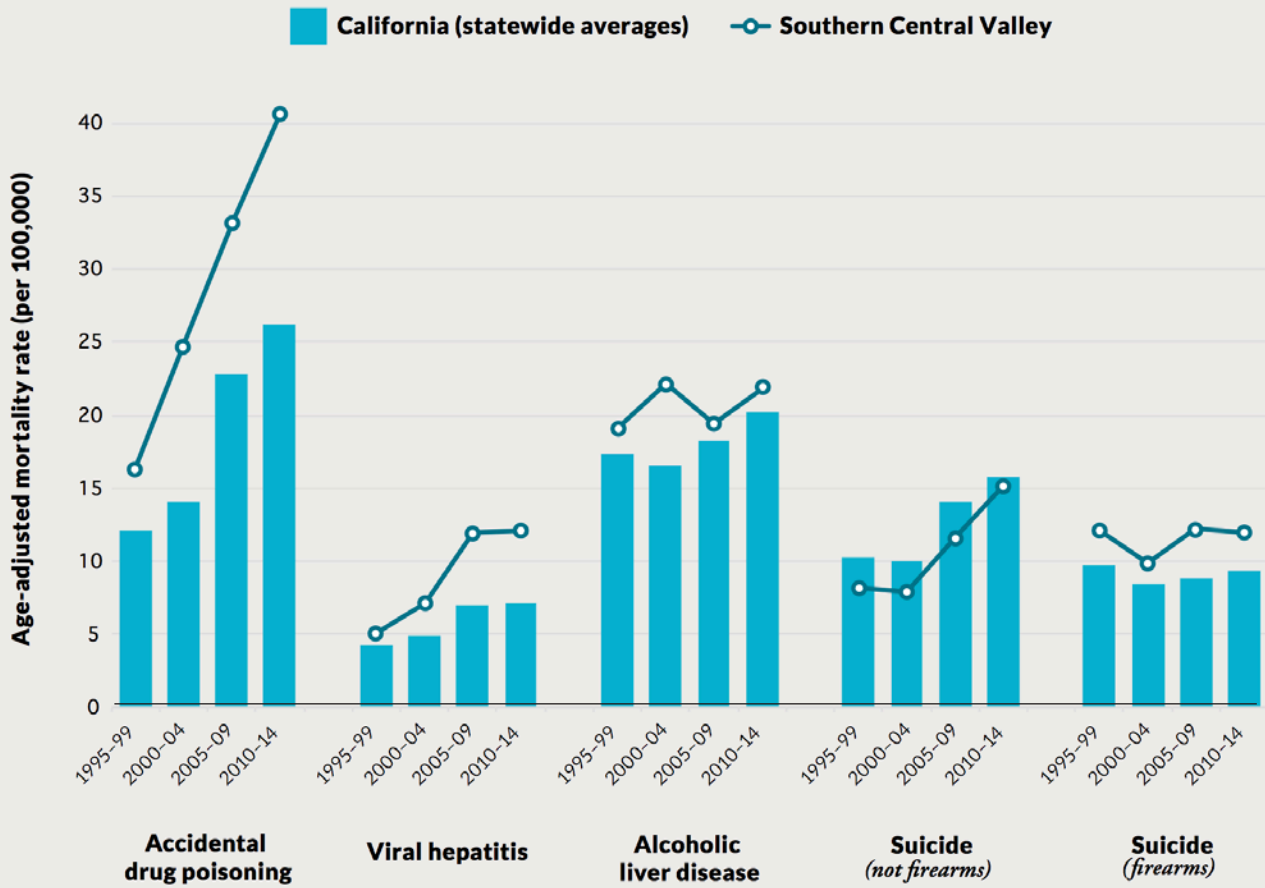
Differences By Sex

Although death rates were almost always higher for men than women, women experienced a disproportionate increase in mortality rates for many conditions. For example, the age-adjusted rate of fatal drug overdoses increased by 226.7% after 1995 among women, compared to 76.0% among men (data not shown).

Differences By Geography

Mortality patterns differed across the state. Table 9 presents all-cause mortality rates by county; cause-specific mortality data by county are available on request. Increases in mortality from substance abuse, suicide, and related conditions were greatest in rural northern California and the Central Valley (Figure 4). Increases in unadjusted rates—the most relevant metric for local communities—were often dramatic. For example, in Humboldt County in northern California, the unadjusted rate of fatal drug overdoses among those ages 40-64 years increased 231.0% after 1995-1999 (versus 117.3% statewide) and mortality from alcoholic liver disease increased 101.8% (versus 29.0% statewide). Deaths in Humboldt County from liver cancer tripled among those ages 40-64 years. By 2010-2014, the unadjusted suicide rate in this and three nearby counties (Lake County, Mendocino County, and Shasta County) had exceeded 40.0 per 100,000 (versus 25.6 per 100,000 statewide).

Figure 4. Age-adjusted mortality from stress-related conditions, southern Central Valley, 1995-2014



Age-adjusted mortality rates (per 100,000) are portrayed for the combined populations of Fresno County, Kern County, Kings County, and Tulare County. Unadjusted mortality rates for accidental alcohol poisoning in these four counties increased more than 15-fold after 1995-1999, from 0.3 to 4.6 deaths per 100,000 ($p < 0.01$), but the death counts were too low to calculate age-adjusted rates.

Although death rates from tobacco-related illnesses decreased statewide, mortality from chronic lower respiratory diseases among NH whites ages 40–64 years increased after 1995–1999 (by 0.3% to 53.7%) in at least 24 counties, most located in rural northern California and the Central Valley. Since at least 2003, the average smoking rate for these counties exceeded the average for other counties in California.⁴¹

We studied the 33 counties where death rates rose among whites age 40–64 years,^b all of which were located outside of large metropolitan areas. We compared the characteristics of the 14 counties with the largest increases in death rates (death rates rising more than 50 deaths per 100,000) versus the 19 other counties with more modest increases. People living in the 14 most impacted counties had less education, lower household incomes, higher rates of poverty and food insecurity, and a larger proportion of foreign-born residents. Residents of these counties had less access to health insurance, health care providers (primary care, dentistry, and mental health), a vehicle, or public transit. The 19 counties with more modest increases in mortality had more urban characteristics, including greater air pollution and housing that was older, substandard, and overcrowded (Table 10).

We also examined socioeconomic trends in these counties between 1990 and 2014. The four largest metropolitan areas (Los Angeles, Sacramento, San Diego, and San Francisco) consistently fared better than the 35 counties in which white mortality rates increased. As shown in the issue brief, counties with the largest increases in mortality had consistently lower incomes since the 1970s. They also had higher poverty rates (Figure 5) and slightly higher unemployment rates (Figure 6).

^b This place-based analysis focused on counties that experienced an increase in deaths among middle-aged whites, and not younger whites, because the middle-aged population accounted for the largest number of excess deaths. We suspect that many of the same findings apply to counties in which death rates among younger white adults also increased.

Table 9.
ALL-CAUSE MORTALITY RATES AMONG NON-HISPANIC WHITES, BY COUNTY, CALIFORNIA, 1995-2014

COUNTY	DEATHS AND ALL-CAUSE MORTALITY RATES AMONG NON-HISPANIC WHITES, 1995-2014								RELATIVE INCREASE IN AGE-ADJUSTED (CRUDE) MORTALITY RATE (%)	
	1995-1999		2000-2004		2005-2009		2010-2014		FROM 1995-99	FROM 2000-04
	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)		
AGES 25-34 YEARS										
Alameda County	463	91.0 (92.2)	290	69.2 (69.5)	206.0	59.1 (58.4)	220.0	57.7 (57.6)	-36.6 (-37.4)	-16.6 (-17.0)
Alpine County	NA	NA NA	NA	NA NA	NA	NA NA	NA	NA NA	NA NA	NA NA
Amador County	23	NA (164.3)	14	NA (115.8)	19	NA (152.7)	12	NA (94.8)	NA (-42.3)	NA (-18.1)
Butte County	125	128.7 (127.7)	95	111.2 (111.5)	137	156.8 (155.5)	137	144.1 (144.2)	11.9 (12.9)	29.6 (29.3)
Calaveras County	29	NA (189.8)	17	NA (125.9)	24	NA (167.0)	24	NA (160.7)	NA (-15.3)	NA (27.6)
Colusa County	NA	NA NA	10	NA (244.6)	NA	NA NA	NA	NA NA	NA NA	NA NA
Contra Costa County	346	92.5 (94.0)	243	82.7 (82.2)	215	87.2 (86.9)	234	88.0 (87.9)	-4.9 (-6.5)	6.4 (6.9)
Del Norte County	14	NA (109.9)	24	NA (242.1)	18	NA (182.0)	28	NA (262.6)	NA (138.9)	NA (8.5)
El Dorado County	74	98.9 (102.8)	77	125.0 (124.5)	84	132.7 (134.1)	83	124.4 (124.6)	25.8 (21.3)	-0.5 (0.1)
Fresno County	258	117.6 (117.9)	193	103.5 (103.5)	186	103.1 (99.9)	208	110.1 (109.0)	-6.4 (-7.5)	6.3 (5.3)
Glenn County	12	NA (121.2)	11	NA (132.9)	15	NA (180.4)	14	NA (170.4)	NA (40.6)	NA (28.2)
Humboldt County	110	154.7 (150.7)	84	132.5 (130.8)	103	146.6 (145.3)	113	154.9 (154.4)	0.1 (2.4)	16.9 (18.0)
Imperial County	32	NA (161.6)	15	NA (96.0)	13	NA (90.3)	14	NA (103.2)	NA (-36.1)	NA (7.5)
Inyo County	NA	NA NA	10	NA (208.7)	NA	NA NA	NA	NA NA	NA NA	NA NA
Kern County	280	119.8 (120.2)	264	134.7 (134.8)	297	148.1 (147.6)	331	155.5 (154.6)	29.8 (28.6)	15.4 (14.7)
Kings County	57	123.8 (123.9)	37	NA (84.0)	48	NA (108.4)	36	NA (84.9)	NA (-31.5)	NA (1.1)
Lake County	32	NA (141.1)	46	NA (225.2)	31	NA (146.8)	51	225.3 (223.9)	— (58.7)	— (-0.6)
Lassen County	23	NA (129.5)	16	NA (100.4)	22	NA (139.0)	19	NA (127.2)	NA (-1.8)	NA (26.7)

Table 9. (continued)

ALL-CAUSE MORTALITY RATES AMONG NON-HISPANIC WHITES, BY COUNTY, CALIFORNIA, 1995-2014

COUNTY	DEATHS AND ALL-CAUSE MORTALITY RATES AMONG NON-HISPANIC WHITES, 1995-2014								RELATIVE INCREASE IN AGE-ADJUSTED (CRUDE) MORTALITY RATE (%)	
	1995-1999		2000-2004		2005-2009		2010-2014		FROM 1995-99	FROM 2000-04
	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)		
AGES 25-34 YEARS										
Los Angeles County	2779	111.2 (111.9)	1614	77.0 (77.3)	1321	69.4 (68.3)	1364	67.7 (67.1)	-39.1 (-40.0)	-12.0 (-13.1)
Madera County	36	NA (109.6)	38	NA (132.7)	38	NA (131.7)	39	NA (132.2)	NA (20.6)	NA (-0.4)
Marin County	95	77.3 (78.6)	67	73.1 (72.8)	52	79.8 (77.1)	36	NA	NA (-100.0)	NA (-100.0)
Mariposa County	15	NA (194.3)	NA	NA NA	NA	NA NA	NA	NA NA	NA NA	NA NA
Mendocino County	49	NA (137.6)	37	NA (120.3)	56	182.3 (180.8)	46	NA (144.5)	NA (5.0)	NA (20.1)
Merced County	71	118.9 (120.2)	69	137.9 (138.2)	68	141.1 (140.9)	63	131.0 (130.3)	10.2 (8.4)	-5.0 (-5.7)
Modoc County	NA	NA NA	NA	NA NA	NA	NA NA	NA	NA NA	NA NA	NA NA
Mono County	12	NA (157.6)	NA	NA NA	NA	NA NA	NA	NA NA	NA NA	NA NA
Monterey County	80	69.4 (69.6)	89	95.3 (95.8)	58	73.5 (73.7)	82	101.8 (100.7)	46.7 (44.7)	6.8 (5.1)
Napa County	47	NA (93.5)	42	NA (102.6)	25	NA (69.4)	39	NA (99.5)	NA (6.4)	NA (-3.0)
Nevada County	47	NA (121.0)	60	173.5 (172.3)	41	NA (113.7)	53	132.6 (132.8)	— (9.8)	-23.6 (-22.9)
Orange County	976	84.9 (85.6)	683	73.7 (74.1)	617	78.7 (77.8)	662	81.7 (81.5)	-3.8 (-4.8)	10.9 (10.0)
Placer County	105	87.9 (87.4)	110	89.0 (89.6)	106	80.8 (80.8)	128	87.3 (87.3)	-0.7 (-0.1)	-1.9 (-2.5)
Plumas County	12	NA (142.1)	NA	NA NA	NA	NA NA	15	NA (218.7)	NA (53.9)	NA —
Riverside County	666	134.1 (135.9)	494	112.1 (113.0)	486	107.2 (107.3)	545	111.8 (111.5)	-16.6 (-17.9)	-0.3 (-1.3)
Sacramento County	661	118.4 (118.7)	422	83.6 (83.5)	426	89.0 (88.0)	492	100.8 (100.4)	-14.8 (-15.4)	20.7 (20.2)
San Benito County	15	NA (98.9)	NA	NA NA	NA	NA NA	10	NA (93.4)	NA (-5.6)	NA —
San Bernardino County	693	124.3 (124.7)	498	110.6 (110.8)	504	120.0 (118.1)	508	120.8 (118.6)	-2.8 (-4.9)	9.2 (7.1)

Table 9. (continued)

ALL-CAUSE MORTALITY RATES AMONG NON-HISPANIC WHITES, BY COUNTY, CALIFORNIA, 1995-2014

COUNTY	DEATHS AND ALL-CAUSE MORTALITY RATES AMONG NON-HISPANIC WHITES, 1995-2014								RELATIVE INCREASE IN AGE-ADJUSTED (CRUDE) MORTALITY RATE (%)	
	1995-1999		2000-2004		2005-2009		2010-2014		FROM 1995-99	FROM 2000-04
	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)		
AGES 25-34 YEARS										
San Diego County	1168	93.7 (93.6)	859	78.1 (77.8)	714	68.0 (66.8)	857	75.1 (74.3)	-19.9 (-20.6)	-3.9 (-4.4)
San Francisco County	638	133.3 (131.9)	285	59.8 (59.7)	228	54.5 (54.1)	181	39.6 (38.9)	-70.3 (-70.6)	-33.8 (-35.0)
San Joaquin County	256	139.5 (141.6)	217	137.8 (138.7)	170	120.8 (120.2)	170	118.7 (118.1)	-14.9 (-16.6)	-13.9 (-14.9)
San Luis Obispo County	96	89.6 (89.9)	82	93.5 (93.4)	96	107.2 (106.9)	95	94.9 (93.8)	5.9 (4.3)	1.4 (0.4)
San Mateo County	230	84.0 (84.7)	122	56.4 (57.9)	107	66.2 (66.2)	100	59.4 (59.4)	-29.3 (-29.9)	5.2 (2.6)
Santa Barbara County	143	95.0 (95.7)	94	81.0 (81.0)	88	82.3 (83.7)	105	92.7 (93.4)	-2.4 (-2.4)	14.4 (15.3)
Santa Clara County	485	74.3 (75.0)	310	63.5 (63.9)	227	60.0 (59.7)	237	59.2 (59.2)	-20.3 (-21.2)	-6.8 (-7.4)
Santa Cruz County	115	95.1 (96.0)	91	91.6 (92.7)	68	81.4 (81.3)	92	107.9 (107.4)	13.5 (11.9)	17.8 (15.8)
Shasta County	123	148.4 (149.7)	102	140.7 (141.1)	110	146.4 (145.3)	130	155.8 (154.7)	5.0 (3.3)	10.8 (9.6)
Sierra County	NA	NA NA	NA	NA NA	NA	NA NA	NA	NA NA	NA NA	NA NA
Siskiyou County	24	NA (135.6)	23	NA (164.7)	32	NA (217.1)	41	NA (247.2)	NA (82.3)	NA (50.1)
Solano County	156	104.5 (105.3)	95	77.9 (78.6)	102	98.6 (99.0)	109	99.7 (98.4)	-4.6 (-6.5)	27.9 (25.3)
Sonoma County	255	117.1 (119.0)	182	102.3 (102.9)	134	85.0 (82.2)	156	86.4 (85.6)	-26.3 (-28.1)	-15.6 (-16.8)
Stanislaus County	235	130.1 (130.4)	188	118.5 (118.7)	175	120.1 (116.6)	194	129.4 (128.9)	-0.5 (-1.2)	9.3 (8.6)
Sutter County	41	NA (131.8)	42	NA (156.0)	25	NA (88.7)	42	NA (151.5)	NA (14.9)	NA (-2.9)
Tehama County	30	NA (120.9)	21	NA (98.4)	29	NA (128.3)	46	NA (191.1)	NA (58.1)	NA (94.2)
Trinity County	13	NA (249.1)	NA	NA NA	16	NA (339.6)	21	NA (425.0)	NA (70.6)	NA NA
Tulare County	151	148.4 (150.2)	119	140.6 (141.2)	119	144.0 (142.2)	126	149.9 (149.3)	1.0 (-0.6)	6.6 (5.7)

Table 9. (continued)

ALL-CAUSE MORTALITY RATES AMONG NON-HISPANIC WHITES, BY COUNTY, CALIFORNIA, 1995-2014

COUNTY	DEATHS AND ALL-CAUSE MORTALITY RATES AMONG NON-HISPANIC WHITES, 1995-2014								RELATIVE INCREASE IN AGE-ADJUSTED (CRUDE) MORTALITY RATE (%)	
	1995-1999		2000-2004		2005-2009		2010-2014		FROM 1995-99	FROM 2000-04
	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)		
AGES 25-34 YEARS										
Tuolumne County	27	NA (113.3)	36	NA (172.9)	30	NA (141.1)	33	NA (147.8)	NA (30.5)	NA (-14.5)
Ventura County	239	83.1 (84.4)	192	83.1 (84.2)	192	97.1 (97.2)	208	99.3 (99.3)	19.5 (17.6)	19.5 (18.0)
Yolo County	57	82.1 (81.8)	48	NA (78.5)	36	NA (57.9)	44	NA (66.8)	NA (-18.3)	NA (-14.9)
Yuba County	40	NA (136.0)	30	NA (119.6)	41	NA (138.9)	35	NA (111.6)	NA (-17.9)	NA (-6.7)
AGES 40-64 YEARS										
Alameda County	5325	529.9 (512.4)	5085	445.1 (451.1)	4769	397.8 (435.0)	4546	364.9 (427.1)	-31.1 (-16.6)	-18.0 (-5.3)
Alpine County	NA	NA NA	NA	NA NA	NA	NA NA	NA	NA NA	NA NA	NA NA
Amador County	292	519.5 (565.5)	349	513.1 (568.0)	404	524.8 (601.9)	385	533.5 (623.4)	2.7 (10.2)	4.0 (9.8)
Butte County	1545	629.1 (652.1)	1832	638.1 (674.1)	2053	629.6 (705.1)	2022	604.3 (719.8)	-3.9 (10.4)	-5.3 (6.8)
Calaveras County	356	498.9 (545.2)	417	491.3 (535.5)	448	466.9 (531.3)	442	468.2 (573.7)	-6.2 (5.2)	-4.7 (7.1)
Colusa County	120	736.8 (768.0)	91	502.5 (536.7)	112	548.0 (625.5)	98	525.3 (610.6)	-28.7 (-20.5)	4.5 (13.8)
Contra Costa County	4282	449.0 (443.4)	4493	406.7 (417.8)	4468	379.6 (416.8)	4187	342.3 (400.3)	-23.8 (-9.7)	-15.8 (-4.2)
Del Norte County	255	764.2 (775.2)	283	753.2 (786.3)	347	809.3 (898.5)	301	724.8 (842.9)	-5.2 (8.7)	-3.8 (7.2)
El Dorado County	1027	458.5 (450.2)	1200	421.8 (429.2)	1331	392.0 (430.6)	1372	373.5 (450.4)	-18.5 (0.0)	-11.5 (4.9)
Fresno County	2981	567.0 (576.6)	3213	539.3 (564.4)	3609	557.4 (619.8)	3568	542.2 (643.0)	-4.4 (11.5)	0.5 (13.9)
Glenn County	178	623.8 (656.1)	190	614.4 (647.8)	200	585.9 (662.1)	209	608.0 (737.4)	-2.5 (12.4)	-1.0 (13.8)
Humboldt County	1014	603.6 (597.9)	1330	685.3 (701.7)	1412	640.2 (719.8)	1419	620.8 (752.8)	2.8 (25.9)	-9.4 (7.3)
Imperial County	423	772.1 (828.0)	381	690.4 (754.2)	354	625.9 (728.2)	371	700.9 (857.2)	-9.2 (3.5)	1.5 (13.7)

Table 9. (continued)

ALL-CAUSE MORTALITY RATES AMONG NON-HISPANIC WHITES, BY COUNTY, CALIFORNIA, 1995-2014

COUNTY	DEATHS AND ALL-CAUSE MORTALITY RATES AMONG NON-HISPANIC WHITES, 1995-2014								RELATIVE INCREASE IN AGE-ADJUSTED (CRUDE) MORTALITY RATE (%)	
	1995-1999		2000-2004		2005-2009		2010-2014		FROM 1995-99	FROM 2000-04
	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)		
AGES 40-64 YEARS										
Inyo County	152	563.9 (592.8)	173	589.9 (634.4)	172	555.9 (632.4)	163	514.5 (655.9)	-8.8 (10.7)	-12.8 (3.4)
Kern County	3490	669.1 (676.9)	4073	682.8 (704.6)	4553	687.5 (747.3)	4465	660.6 (765.7)	-1.3 (13.1)	-3.3 (8.7)
Kings County	453	596.7 (590.6)	525	587.0 (590.7)	608	606.7 (641.5)	571	567.0 (634.0)	-5.0 (7.3)	-3.4 (7.3)
Lake County	627	736.6 (786.7)	823	802.2 (866.8)	877	750.2 (851.0)	918	780.3 (941.0)	5.9 (19.6)	-2.7 (8.6)
Lassen County	216	579.3 (563.2)	241	556.6 (558.7)	281	560.0 (597.7)	275	555.9 (623.9)	-4.0 (10.8)	-0.1 (11.7)
Los Angeles County	29685	565.5 (575.3)	28215	499.4 (517.3)	27373	461.3 (504.2)	25088	410.9 (476.9)	-27.3 (-17.1)	-17.7 (-7.8)
Madera County	551	524.4 (550.4)	686	568.1 (608.8)	689	517.9 (580.4)	755	575.3 (685.4)	9.7 (24.5)	1.3 (12.6)
Marin County	1351	348.8 (347.8)	1428	321.1 (339.3)	1324	274.3 (316.2)	1246	256.3 (306.5)	-26.5 (-11.9)	-20.2 (-9.7)
Mariposa County	148	502.1 (549.5)	177	527.0 (577.9)	208	561.6 (623.1)	192	515.2 (625.5)	2.6 (13.8)	-2.2 (8.2)
Mendocino County	717	589.4 (598.3)	827	572.6 (614.4)	895	584.3 (673.0)	879	603.7 (728.1)	2.4 (21.7)	5.4 (18.5)
Merced County	892	639.2 (662.8)	963	601.8 (632.7)	986	584.6 (637.5)	1063	616.1 (725.9)	-3.6 (9.5)	2.4 (14.7)
Modoc County	74	458.6 (512.7)	91	528.0 (594.4)	121	670.7 (759.9)	112	629.3 (787.1)	37.2 (53.5)	19.2 (32.4)
Mono County	67	386.1 (378.9)	71	329.4 (331.2)	70	291.0 (321.3)	63	265.9 (305.6)	-31.1 (-19.3)	-19.3 (-7.7)
Monterey County	1354	489.4 (494.5)	1420	436.3 (460.2)	1400	424.3 (481.2)	1312	398.3 (492.3)	-18.6 (-0.5)	-8.7 (7.0)
Napa County	765	502.4 (515.4)	747	425.3 (456.1)	768	405.2 (474.6)	702	378.7 (456.8)	-24.6 (-11.4)	-11.0 (0.1)
Nevada County	602	401.9 (410.8)	758	407.8 (437.0)	809	378.4 (444.2)	813	391.6 (471.3)	-2.5 (14.7)	-4.0 (7.9)
Orange County	10778	437.5 (438.2)	10624	385.1 (397.0)	10720	368.7 (399.3)	10520	351.2 (402.8)	-19.7 (-8.1)	-8.8 (1.5)
Placer County	1266	410.2 (403.7)	1706	401.5 (412.9)	1919	361.2 (398.0)	2081	352.9 (412.1)	-14.0 (2.1)	-12.1 (-0.2)

Table 9. (continued)

ALL-CAUSE MORTALITY RATES AMONG NON-HISPANIC WHITES, BY COUNTY, CALIFORNIA, 1995-2014

COUNTY	DEATHS AND ALL-CAUSE MORTALITY RATES AMONG NON-HISPANIC WHITES, 1995-2014								RELATIVE INCREASE IN AGE-ADJUSTED (CRUDE) MORTALITY RATE (%)	
	1995-1999		2000-2004		2005-2009		2010-2014		FROM 1995-99	FROM 2000-04
	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)		
AGES 40-64 YEARS										
Plumas County	215	557.6 (612.4)	213	489.2 (549.7)	243	512.5 (619.0)	241	568.9 (714.1)	2.0 (16.6)	16.3 (29.9)
Riverside County	7294	603.4 (627.0)	8392	559.0 (588.2)	9601	544.5 (598.6)	9247	488.5 (574.6)	-19.0 (-8.4)	-12.6 (-2.3)
Sacramento County	6489	594.4 (588.6)	7229	561.2 (567.7)	7718	540.7 (585.2)	7807	515.0 (596.7)	-13.4 (1.4)	-8.2 (5.1)
San Benito County	141	409.5 (395.2)	177	384.8 (386.5)	188	379.2 (406.7)	171	330.0 (374.1)	-19.4 (-5.3)	-14.2 (-3.2)
San Bernardino County	7636	645.8 (638.6)	8657	638.0 (647.4)	9031	613.5 (665.3)	8860	592.9 (697.4)	-8.2 (9.2)	-7.1 (7.7)
San Diego County	11747	503.2 (496.1)	12681	462.7 (468.1)	13108	433.6 (471.9)	12771	397.1 (461.9)	-21.1 (-6.9)	-14.2 (-1.3)
San Francisco County	4359	853.4 (841.4)	3557	635.2 (639.8)	3251	531.1 (559.1)	2815	428.9 (459.9)	-49.7 (-45.3)	-32.5 (-28.1)
San Joaquin County	2748	653.3 (655.6)	3127	628.7 (645.4)	3224	597.6 (652.1)	3329	602.3 (698.7)	-7.8 (6.6)	-4.2 (8.3)
San Luis Obispo County	1279	438.6 (441.7)	1494	420.2 (434.8)	1724	426.3 (478.4)	1752	419.4 (502.3)	-4.4 (13.7)	-0.2 (15.5)
San Mateo County	2865	441.3 (445.8)	2561	371.8 (386.6)	2519	350.4 (388.6)	2268	301.7 (359.5)	-31.6 (-19.4)	-18.9 (-7.0)
Santa Barbara County	1675	451.4 (462.7)	1658	404.1 (424.2)	1800	420.0 (469.8)	1759	419.4 (491.3)	-7.1 (6.2)	3.8 (15.8)
Santa Clara County	5735	432.9 (431.2)	5213	374.5 (383.8)	5112	362.0 (388.9)	4957	337.7 (388.0)	-22.0 (-10.0)	-9.8 (1.1)
Santa Cruz County	1178	432.1 (407.3)	1392	424.4 (426.1)	1523	414.4 (463.2)	1445	375.8 (450.5)	-13.0 (10.6)	-11.5 (5.7)
Shasta County	1455	613.3 (635.3)	1711	612.4 (649.2)	1980	631.0 (709.7)	2195	678.1 (818.3)	10.6 (28.8)	10.7 (26.0)
Sierra County	25	NA (420.1)	46	NA (678.7)	31	NA (447.1)	44	NA (743.5)	NA (77.0)	NA (9.5)
Siskiyou County	433	607.5 (638.4)	435	538.8 (584.3)	524	612.4 (690.8)	519	619.0 (750.2)	1.9 (17.5)	14.9 (28.4)
Solano County	1685	568.3 (540.8)	1875	522.0 (520.3)	2077	531.7 (579.2)	1948	476.5 (562.4)	-16.2 (4.0)	-8.7 (8.1)
Sonoma County	2816	498.6 (485.0)	2951	428.1 (438.7)	3167	411.9 (468.0)	3164	392.8 (481.9)	-21.2 (-0.6)	-8.3 (9.9)

Table 9. (continued)

ALL-CAUSE MORTALITY RATES AMONG NON-HISPANIC WHITES, BY COUNTY, CALIFORNIA, 1995-2014

COUNTY	DEATHS AND ALL-CAUSE MORTALITY RATES AMONG NON-HISPANIC WHITES, 1995-2014								RELATIVE INCREASE IN AGE-ADJUSTED (CRUDE) MORTALITY RATE (%)	
	1995-1999		2000-2004		2005-2009		2010-2014		FROM 1995-99	FROM 2000-04
	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)	DEATHS (NO.)	AGE-ADJUSTED MORTALITY RATE (CRUDE)		
AGES 40-64 YEARS										
Stanislaus County	2733	697.3 (699.9)	2919	634.1 (650.6)	3135	632.3 (683.5)	3162	617.1 (714.3)	-11.5 (2.1)	-2.7 (9.8)
Sutter County	450	567.0 (593.3)	545	609.3 (650.7)	578	598.3 (654.6)	593	618.9 (704.9)	9.2 (18.8)	1.6 (8.3)
Tehama County	493	645.1 (690.7)	560	641.6 (707.1)	545	571.0 (633.6)	620	631.1 (741.6)	-2.2 (7.4)	-1.6 (4.9)
Trinity County	171	709.6 (750.5)	185	676.1 (727.1)	208	691.5 (783.5)	208	703.8 (858.1)	-0.8 (14.3)	4.1 (18.0)
Tulare County	1751	667.9 (692.1)	1912	670.8 (710.1)	2021	661.8 (737.7)	1912	640.6 (742.0)	-4.1 (7.2)	-4.5 (4.5)
Tuolumne County	466	560.4 (591.3)	579	574.2 (621.4)	591	543.5 (616.9)	568	540.6 (655.4)	-3.5 (10.8)	-5.8 (5.5)
Ventura County	2949	421.6 (411.0)	3179	382.5 (388.5)	3392	374.8 (407.1)	3392	357.7 (419.7)	-15.2 (2.1)	-6.5 (8.0)
Yolo County	779	559.7 (548.9)	898	533.4 (544.0)	917	482.1 (526.8)	902	440.9 (526.5)	-21.2 (-4.1)	-17.3 (-3.2)
Yuba County	531	860.4 (890.6)	620	887.8 (934.6)	647	792.3 (866.3)	628	727.7 (844.0)	-15.4 (-5.2)	-18.0 (-9.7)

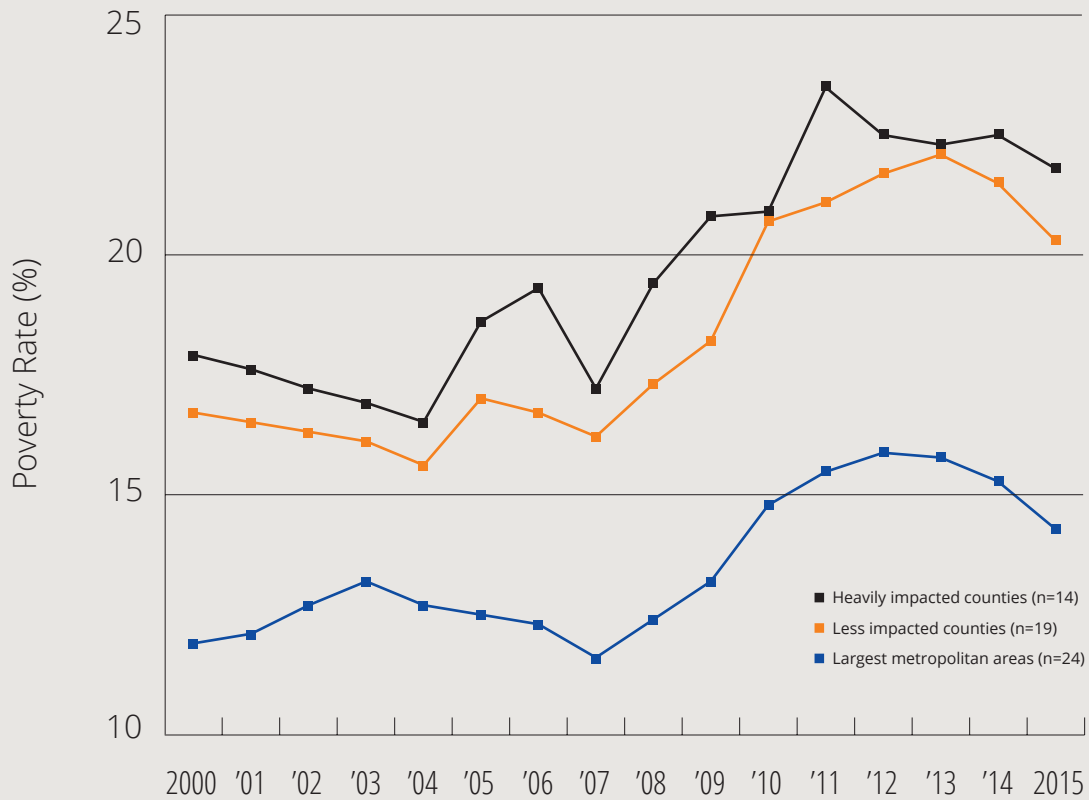
NA=Not available: Crude mortality rates are not provided if there were fewer than 10 deaths over the five-year period. According to suppression rules, age-adjusted rates are not provided if the average number of deaths per year during the five-year period was less than 10.

Table 10.
CHARACTERISTICS OF CALIFORNIA COUNTIES, BY CHANGES IN ALL-CAUSE MORTALITY AMONG
NON-HISPANIC WHITES AGES 40-64 YEARS BETWEEN 1995-99 AND 2010-14

	LARGEST METROPOLITAN AREAS (N=24 COUNTIES)	MODEST INCREASE IN MORTALITY (0-50 DEATHS PER 100,000) (N=19 COUNTIES)	LARGE INCREASES IN MORTALITY (> 50 DEATHS PER 100,000) (N=14 COUNTIES)	RATIO (LARGE/MODEST INCREASE)
Geographic characteristics				
Rural (%)	2.7	14.3	22.6	1.57***
Urban (%)	97.3	85.7	77.4	0.90***
Demographic characteristics				
Single parent households (%)	31.2	35.3	37.2	1.05***
Diversity Index	59.7	49.0	42.3	0.86
Foreign born population (%)	28.7	23.3	26.5	1.14***
Socioeconomic conditions				
Limited English proficiency (%)	10.7	10.9	9.5	0.87***
Some college or more education (%)	61.2	62.0	59.2	0.95***
Bachelor's degree or more education (%)	32.0	30.8	29.4	0.95***
Unemployment (%)	7.0	10.5	10.5	1.00
Median household income (\$)	\$69,142	\$49,072	\$43,293	0.88*
Poverty (%)	16.5	15.0	17.1	0.87***
Poverty (adult only, %)	15.2	14.2	15.6	1.10***
Child poverty (%)	20.9	29.4	31.5	1.07***
Gini Index	0.46	0.45	0.46	1.05
Physical environment				
Close proximity to highways (%)	5.9	4.8	4.9	1.01***
Ozone days (per year)	18.1	15.0	11.6	0.77
Access to parks (%)	58.6	56.7	58.9	1.04***
Low food access (%)	11.7	14.5	17.1	1.18***
Violent crime rate (per 1,000)	4.1	5.0	5.6	1.12***
Housing				
Overcrowding (%)	12.1	4.7	1.0	0.22***
Cost burden (homeowners, %)	38.8	36.7	35.4	0.96***
Cost burden (renters, %)	54.9	53.2	53.5	1.00***
Severe housing disrepair (%)	28.8	27.5	25.9	0.94***
Housing built before 1950 (%)	20.0	14.4	8.7	0.60***
Transportation				
No vehicle access (%)	4.4	2.8	2.4	0.84***
Commuting to work by motor vehicle (%)	83.6	85.0	90.0	1.06***
Commuting to work by public transit (%)	6.7	5.5	2.3	0.41***
Commuting to work by walking/cycling (%)	4.1	3.8	3.3	0.86***
Access to health care				
Primary care physician ratio	1216.8	1611.2	1789.1	1.11***
Mental health provider ratio	358.6	393.4	561.4	1.43***
Dentist ratio	1199.9	1640.1	1925.2	1.17***
Uninsured (%)	17.5	15.2	16.2	1.06***
Public insurance (%)	19.1	18.9	20.9	1.10***
Private insurance (%)	50.6	51.7	50.9	0.99***

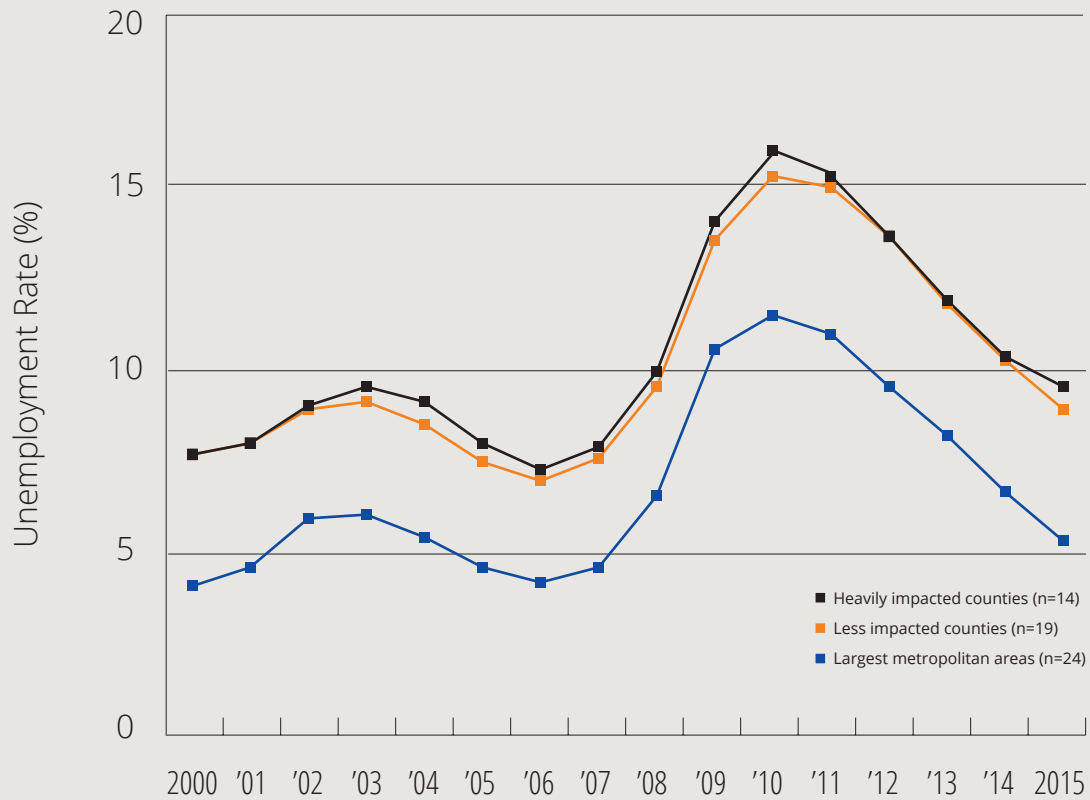
Notes: *Largest metropolitan areas* included the 24 counties in the Metropolitan Statistical Areas of Los Angeles, Sacramento, San Francisco, and San Diego. Heavily and less impacted counties included those in which the increase in age-adjusted mortality between 1999 and 2014 was greater than 50 per 100,000 deaths or 50 per 100,000 deaths or fewer, respectively.

Figure 5. Poverty rate by county, California, 2000-2015



Largest metropolitan areas included the 24 counties in the Metropolitan Statistical Areas of Los Angeles, Sacramento, San Francisco, and San Diego. Heavily and less impacted counties included those in which the increase in age-adjusted mortality between 1995-1999 and 2000-2014 was greater than 50 per 100,000 deaths or 50 per 100,000 deaths or fewer, respectively. Source: U.S. Census Bureau, Small Area Income and Poverty Estimates (SAIPE) Program, 1999-2015 (<https://www.census.gov/did/www/saie/data/statecounty/data/index.html>).

Figure 6. Unemployment rate by county, California, 2000-2015



Largest metropolitan areas included the 24 counties in the Metropolitan Statistical Areas of Los Angeles, Sacramento, San Francisco, and San Diego. Heavily and less impacted counties included those in which the increase in age-adjusted mortality between 1995-1999 and 2000-2014 was greater than 50 per 100,000 deaths or 50 per 100,000 deaths or fewer, respectively. Source: Bureau of Labor Statistics, LAUS, Labor force data by county, 2000-2015 annual averages.

CONCLUSIONS

Death rates have stopped declining among young and middle-aged NH whites in California and have increased in rural northern and Central Valley counties. All-cause mortality increased by more than 100.0 deaths per 100,000 in 11 counties after 1995-1999, all but one located in northern California, where the population is overwhelmingly white and poverty rates have been among the highest in the state for a period of years.⁴⁴⁻⁴⁶ NH whites in more affluent metropolitan centers and coastal California counties were largely spared.

Mortality trends represent a balance between averted and excess deaths. In Hispanic, NH black, and NH Asian populations, deaths averted between 1995 and 2014 outnumbered excess deaths, and mortality rates therefore declined. Deaths were also averted among NH whites, notably from HIV infection, ischemic heart disease, respiratory disease, and lung and breast cancer. However, these averted deaths were offset by a sharp increase in deaths from other causes. The net effect was the stabilization of all-cause mortality among NH whites statewide, and sharp increases in certain counties, driven by an increase in deaths from drug and alcohol abuse, suicides, accidents with potential links to intoxication, and diseases potentially precipitated by chronic stress and risky behaviors. Many of these deaths occurred in the prime of life, as early as ages 25-34 years.

Understanding this phenomenon is a public health priority; US life expectancy stopped increasing in 2015 for the first time since 1999, due largely to increasing mortality among NH whites.⁴⁷ Other studies have investigated this issue.²⁻⁴ In their widely cited analysis of national vital statistics, Case and Deaton reported that mortality rates had increased after 1999 among NH whites ages 45-54 years.² That 2015 study was criticized for not including age adjustment or distinguishing males from females, who had considerably greater increases in mortality.¹² Their 2017 follow-up study and a report by Shiels et al. did calculate age-adjusted rates and reported increases in NH white mortality from ages 25 to 64 years.^{3,4} Both studies implicated overdoses, suicides, cirrhosis, and accidents as important causes.

This study adds to the literature by examining a specific state and studying causes of death in greater detail, showing that medical disorders with potential links to these behaviors may be claiming as many lives. For example, middle-aged NH whites experienced a doubling in death rates from hepatitis C, a potential complication of injectable drug use, and from liver cancer, for which both viral hepatitis and alcohol abuse are risk factors.^{48,49}

This study also adds new information by examining mortality patterns at the county level, showing alarming trends not seen in statewide averages.

We showed that the most heavily impacted counties had experienced lower median household incomes since the 1970s than did less impacted counties. These counties tended to have lower educational attainment, higher poverty rates, greater food insecurity, and a larger proportion of foreign-born residents. Residents of these counties were more likely to be uninsured, experience shortages in health care providers (primary care, dentistry, and mental health), and lack access to a vehicle or public transit. For more than a decade, these counties have consistently experienced higher poverty and unemployment rates than did less impacted counties or the four largest metropolitan areas of California.

The concentration of this phenomenon in economically depressed counties is noteworthy. Socioeconomic status is already known to increase disease risk⁵⁰⁻⁵² but exposure to prolonged economic distress may accelerate specific pathological responses. Overdoses, suicides, and related conditions occurred more dramatically in counties with persistent poverty. It is plausible that these behaviors, and the diseases and deaths they cause, could be downstream consequences of chronic stress and emotional and physical pain.⁵³

Frustration and hopelessness over difficult living conditions would be expected to increase anxiety and depression (and fatal outcomes like suicide), as well as unhealthy coping mechanisms (e.g., overeating, smoking, problem drinking, drug use, and violence).^{54,55} An increase in these behaviors, if confirmed, could explain some of the mortality trends observed between 1995 and 2014. For example, intoxication could explain the sharp increase in fatal accidents, notably accidental poisoning but also pedestrian and motorcycle accidents, falls, and choking.⁵⁶ Middle-aged NH whites experienced higher death rates from hypertensive disease, cardiomegaly, arrhythmias, liver disease, and acute pancreatitis—for which alcohol abuse is a risk factor.^{57,58} Liver disease, in turn, might explain increasing death rates from secondary pulmonary hypertension. Dietary responses to stress (e.g., overeating) could contribute to deaths from diabetes, and higher smoking rates could explain rising chronic lower-respiratory mortality in certain counties. Chronic stress itself can cause organ disease via neuroendocrine pathways;^{59,60} it may also heighten pain sensitivity,^{61,62} thereby increasing demand for opioids.

With greater speculation, other mortality patterns reported here could also be linked to the increase in suicides, fatal overdoses, and other accidents. For example, a larger number of resuscitated poisoning and trauma victims reaching the hospital might explain the sharp increase in deaths from pneumonitis (e.g., aspiration pneumonia), as well as higher mortality rates from interstitial pneumonia, peritonitis, sepsis, renal failure, and anoxic brain damage.⁶³⁻⁶⁷ Further research is necessary to understand why death rates in this population are increasing for certain cancers (e.g. uterine cancer),

epilepsy, and motor neuron disease (e.g., amyotrophic lateral sclerosis) (Table 8). Improved childhood survival could explain higher death rates from congenital disorders (e.g., cerebral palsy) among young and middle-aged NH whites.⁶⁸ Increasing midlife mortality from Alzheimer's and Parkinson's diseases also requires further study.

The disproportionate increase in mortality among NH white women is consistent with the health disadvantage others have reported among US women.⁶⁹⁻⁷² For males and females alike, the mortality increases among whites should not distract attention from the much higher death rates facing NH blacks, who (despite encouraging declines in mortality) remain far more likely than NH whites to die before age 65.^{73,74} Future research should examine mortality rates in minority populations; the role of overdoses, suicides, and other causes; and the dramatic increase in mortality among NH American Indians and Alaskan Natives in California. Of particular interest is why the NH black population, which has experienced more adverse and multigenerational socioeconomic distress and discrimination than have NH whites, is not experiencing increased mortality from stress-related conditions.

Responding to criticisms of prior studies,¹² this study performed age adjustment of mortality rates, including age-specific mortality rates. Age adjustment is important when crude mortality rates are calculated for a large age range or, as in this study, when analyzing a time period when aging Baby Boomers caused marked population redistributions. Age adjustment corrects for these changes by recalculating mortality rates as if the age distribution matched that of a reference population. These standardized values provide a level playing field for comparing mortality rates, but they are artificial⁴⁴ and introduce a special complication in this study: Mortality is associated not only with the "natural" effects of aging but also with conditions brought on by years of exposure to risky behaviors and stress. In effect, age adjustment potentially removes the influence of time, a mediator that may be instrumental in these deaths. If persons in older age groups are increasingly exposed to cumulative disadvantage, only age-specific crude rates will accurately quantify how greatly mortality rates have increased.⁴⁴ Accordingly, this study presents both unadjusted and age-adjusted rates to help readers compare changes independent of the age distribution with actual changes in the number of deaths. The unadjusted values are important for policymakers (e.g., for estimating health care needs).⁴⁴

This study had limitations, beginning with sample size. Even in a state as large as California, deaths in some population subgroups can be too few to calculate stable mortality rates. The study examined deaths and not the prevalence of diseases. Cause-of-death attribution on death certificates is notoriously imprecise,³²⁻³⁸ and putative associations with chronic stress or substance abuse are often speculative. The study did not examine

cohort effects, as others have done.³ Some increases in death rates may be artifacts of secular changes in coding practices, especially in 1999 when the 10th revision came into effect. Finally, the results are not adjusted for socioeconomic status.

In summary, this study demonstrates that the opioid epidemic⁷⁵ is the tip of an iceberg. Policies that focus narrowly on drug addiction, although urgent, should not distract clinicians from the broader spectrum of diseases and injuries causing premature death among NH whites. Research to clarify factors responsible for these trends is important, as are efforts to enhance access to treatments, a particular challenge for the uninsured or those living in rural counties. Perhaps more urgent, however, is for the public, and elected officials, to consider the role of the economy, inadequate educational attainment, and public policy as root causes. Deficiencies in protective policies may expose the population to greater adversities from a rapidly shifting economy. Disadvantaged living conditions and the policies behind them may be fundamental in explaining the deteriorating health, substance abuse, and suicides among NH whites and the longstanding health inequities endured by people of color.

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REFERENCES

- ¹ National Center for Health Statistics. Health, United States, 2015: With Special Feature on Racial and Ethnic Health Disparities. Hyattsville, MD. 2016.
- ² Case A, Deaton A. Rising morbidity and mortality in midlife among white non-Hispanic Americans in the 21st century. *Proc Natl Acad Sci U.S.A.* 2015;112(49):15078–15083.
- ³ Case A, Deaton A. *Mortality and Morbidity in the 21st Century*. Washington, DC: Brookings Papers on Economic Activity. Washington, DC: Brookings Institution, 2017.
- ⁴ Shiels MS, Chernyavskiy P, Anderson WF, et al. Trends in premature mortality in the USA by sex, race, and ethnicity from 1999 to 2014: an analysis of death certificate data. *Lancet*. 2017 Jan 25. pii: S0140-6736(17)30187-3. doi: 10.1016/S0140-6736(17)30187-3. [Epub ahead of print]
- ⁵ Olshansky SJ, Antonucci T, Berkman L, et al. Differences in life expectancy due to race and educational differences are widening, and many may not catch up. *Health Aff (Millwood)*. 2012 Aug;31(8):1803-1813.
- ⁶ Sasson I. Trends in life expectancy and lifespan variation by educational attainment: United States, 1990-2010. *Demography*. 2016 Apr;53(2): 269-293.
- ⁷ Jemal A, Ward E, Anderson RN, Murray T, Thun MJ. Widening of socioeconomic inequalities in U.S. death rates, 1993-2001. *PLoS One*. 2008 May 14;3(5):e2181. doi: 10.1371/journal.pone.0002181.
- ⁸ Montez JK, Zajacova A. Trends in mortality risk by education level and cause of death among U.S. white women from 1986 to 2006. *Am J Public Health*. 2013 Mar;103(3):473-479.
- ⁹ Wang H, Schumacher AE, Levitz CE, Mokdad AH, Murray CJ. Left behind: widening disparities for males and females in U.S. county life expectancy, 1985-2010. *Popul Health Metr*. 2013 Jul 10;11(1):8.
- ¹⁰ Hendi AS. Trends in U.S. life expectancy gradients: the role of changing educational composition. *Int J Epidemiol*. 2015 Jun;44(3):946-955.
- ¹¹ United Health Foundation. America's health rankings annual report. Minnetonka, MN: United Health Foundation, 2015.
- ¹² Woolf SH, Aron L, Chapman DA, et al. *Health of the States*. Richmond, VA: Center on Society and Health; 2016.
- ¹³ University of Wisconsin Population Health Institute. *2016 County Health Rankings: Key Findings Report*. Madison: University of Wisconsin Population Health Institute; 2016.
- ¹⁴ Dwyer-Lindgren L, Bertozzi-Villa A, Stubbs RW, et al. U.S. county-level trends in mortality rates for major causes of death, 1980-2014. *JAMA*. 2016 Dec 13;316(22):2385-2401.

- ¹⁵ Basu S, Siddiqi A. Geographic disparities in U.S. mortality: “hot-spotting” large databases. *Epidemiology*. 2014;25:468-470.
- ¹⁶ Braveman P, Cubbin C, Egerter S, Pedregon V. *Neighborhoods and Health*. Issue brief 8. Princeton: Robert Wood Johnson Foundation; 2011.
- ¹⁷ Macintyre S, Ellaway A. Methodological and conceptual approaches to studying neighborhood effects on health. In: Kawachi I, Berkman LF, editors. *Neighborhoods and Health*. New York, NY: Oxford University Press; 2003: pp. 20–44.
- ¹⁸ Braveman P, Gottlieb L. The social determinants of health: it’s time to consider the causes of the causes. *Public Health Rep*. 2014 Jan-Feb;129 Suppl 2:19-31.
- ¹⁹ Galea S, Tracy M, Hoggatt KJ, DiMaggio C, Karpati A. Estimated deaths attributable to social factors in the United States. *Am J Public Health*. 2011;101:1456-1465.
- ²⁰ Gabler N. The secret shame of middle-class Americans. *The Atlantic*. May 2016. <https://www.theatlantic.com/magazine/archive/2016/05/my-secret-shame/476415/>
- ²¹ Chen VT. All Hollowed Out: The lonely poverty of America’s white working class. *The Atlantic*. January 2016. <https://www.theatlantic.com/business/archive/2016/01/white-working-class-poverty/424341/>
- ²² McGreal C. Financial despair, addiction and the rise of suicide in white America. *The Guardian*. February 2016. <https://www.theguardian.com/us-news/2016/feb/07/suicide-rates-rise-butte-montana-princeton-study>
- ²³ Vance JD. *Hillbilly Elegy: A Memoir of a Family and Culture in Crisis*. New York: Harper Collins; 2016.
- ²⁴ Putnam RD. *Our Kids: The American Dream in Crisis*. New York: Simon & Schuster, 2016.
- ²⁵ Chetty R, Hendren N, Kline P, Saez E. Where is the land of opportunity? The geography of intergenerational mobility in the United States. NBER Working Paper No. 19843. *Q Journal Econ Research*. 2014;129:1553-1623.
- ²⁶ Wiedrich K, Sims L, Jr., Weisman H, Rice S, Brooks J. *The Steep Climb to Economic Opportunity for Vulnerable Families: Findings from the 2016 Assets and Opportunity Scorecard*. Washington, D.C.: Corporation for Enterprise Development; 2016.
- ²⁷ Khazan O. Middle-aged white Americans are dying of despair. *The Atlantic*. November 2015. <https://www.theatlantic.com/health/archive/2015/11/boomers-deaths-pnas/413971/>
- ²⁸ German RR, Fink AK, Heron M, et al. Accuracy of Cancer Mortality Study Group. The accuracy of cancer mortality statistics based on death certificates in the United States. *Cancer Epidemiol*. 2011;35(2):126-131.
- ²⁹ Moyer LA, Boyle CA, Pollock DA. Validity of death certificates for injury-related causes of death. *Am J Epidemiol*. 1989;130(5):1024-1032.
- ³⁰ Drummond MB, Wise RA, John M, Zvarich MT, McGarvey LP. Accuracy of death certificates in COPD: analysis from the TORCH trial. *COPD*. 2010;7(3):179-185.

- ³¹Halanych JH, Shuaib F, Parmar G, et al. Agreement on cause of death between proxies, death certificates, and clinician adjudicators in the Reasons for Geographic and Racial Differences in Stroke (REGARDS) study. *Am J Epidemiol*. 2011;173(11):1319-1326.
- ³²McEwen LN, Karter AJ, Curb JD, Marrero DG, Crosson JC, Herman WH. Temporal trends in recording of diabetes on death certificates: results from Translating Research Into Action for Diabetes (TRIAD). *Diabetes Care*. 2011;34(7):1529-1533.
- ³³Lloyd-Jones DM, Martin DO, Larson MG, Levy D. Accuracy of death certificates for coding coronary heart disease as the cause of death. *Ann Intern Med*. 1998;129(12):1020-1026.
- ³⁴Sehdev A, Hutchins G. Problems with proper completion and accuracy of the cause-of-death statement. *Arch Intern Med*. 2001;161(2):277-284.
- ³⁵Woolf SH, Chapman DA, Buchanich JM. *Why are Death Rates Rising among Whites in California? The Role of Stress-Related Conditions*. Issue brief. Richmond, VA: Center on Society and Health, 2017.
- ³⁶Centers for Disease Control and Prevention. Mortality Multiple Cause Files. https://www.cdc.gov/nchs/nvss/dvs_data_release.htm. January 2017.
- ³⁷National Cancer Institute. US Population Data [database online]. Bethesda, MD: National Institutes for Health; 2017. <https://seer.cancer.gov/popdata/popdic.html>. January 2017.
- ³⁸California Department of Public Health, California Tobacco Control Program. *California Tobacco Facts and Figures 2016*, Sacramento, CA: California Department of Public Health; 2016.
- ³⁹Rothman KJ. *Modern Epidemiology*. Boston, MA: Little, Brown and Company; 1986.
- ⁴⁰Fay MP, Feuer EJ. Confidence intervals for directly standardized rates: A method based on the gamma distribution. *Statistics in Medicine*. 1997;16:791-801.
- ⁴¹U.S. Census Bureau, Small Area Income and Poverty Estimates (SAIPE) Program, 1999-2015 (<https://www.census.gov/did/www/saipe/data/statecounty/data/index.html>)
- ⁴²U.S. Census Bureau, Historical Income Tables, Counties, Table C4 (<https://www.census.gov/data/tables/time-series/dec/historical-income-counties.html>)
- ⁴³Bhopal RS. *Concepts of Epidemiology: Integrating the Ideas, Theories, Principles, and Methods of Epidemiology, 3rd ed*. Oxford: Oxford University Press, 2016.
- ⁴⁴U.S. Census Bureau. Poverty Status in 1999 by age (White alone, not Hispanic or Latino): White alone, not Hispanic or Latino population for whom poverty status is determined, Census 2000 Summary File 3 (SF 3) Sample Data. https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_00_SF3_P159I&prodType=table. February 1, 2017.

- ⁴⁵ U.S. Census Bureau. Poverty Status in the Past 12 months by age (White alone, not Hispanic or Latino): White alone, not Hispanic or Latino population for whom poverty status is determined (B17020H), 2005-2009 American Community Survey 5-year estimates. https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_09_5YR_B17020H&prodType=table. February 1, 2017.
- ⁴⁶ U.S. Census Bureau. Poverty Status in the Past 12 months by age (White alone, not Hispanic or Latino): White alone, not Hispanic or Latino population for whom poverty status is determined (B17020H), 2010-2014 American Community Survey 5-year estimates. https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_14_5YR_B17020H&prodType=table. February 1, 2017.
- ⁴⁷ Xu JQ, Murphy SL, Kochanek KD, Arias E. *Mortality in the United States, 2015*. NCHS data brief, no 267. Hyattsville, MD: National Center for Health Statistics. 2016.
- ⁴⁸ Dong C, Yoon YH, Chen CM, Yi HY. Heavy alcohol use and premature death from hepatocellular carcinoma in the United States, 1999-2006. *J Stud Alcohol Drugs*. 2011;72(6):892-902.
- ⁴⁹ Makarova-Rusher OV, Altekruze SF, McNeel TS, et al. Population attributable fractions of risk factors for hepatocellular carcinoma in the United States. *Cancer*. 2016;122(11):1757-1765.
- ⁵⁰ Commission on Social Determinants of Health. *Closing the Gap in a Generation: Health Equity Through Action on the Social Determinants of Health; Final Report of the Commission on Social Determinants of Health*. Geneva, Switzerland: World Health Organization; 2008.
- ⁵¹ Woolf SH, Braveman P. Where health disparities begin: the role of social and economic determinants—and why current policies could make matters worse. *Health Aff*. 2011;30(10):1852-1859.
- ⁵² Chetty R, Stepner M, Abraham S, et al. The association between income and life expectancy in the United States, 2001-2014. *JAMA*. 2016;315(16):1750-1766.
- ⁵³ Zajacova A, Montez JK. Macro-level perspective to reverse recent mortality increases. *Lancet*. 2017;389:991-992.
- ⁵⁴ Costello EJ, Compton SN, Keeler G, Angold A. Relationships between poverty and psychopathology: a natural experiment. *JAMA*. 2003;290(15):2023-2029.
- ⁵⁵ Costello EJ, Erkanli A, Copeland W, Angold A. Association of family income supplements in adolescence with development of psychiatric and substance use disorders in adulthood among an American Indian population. *JAMA*. 2010;303(19):1954-1960.
- ⁵⁶ Data U.S.A. Percentage of Driving Deaths Involving Alcohol (website). http://datausa.io/map/?level=state&key=alcoholimpaired_driving_deaths. Accessed September 9, 2016.

- ⁵⁷ O’Keefe JH, Bhatti SK, Bajwa A, DiNicolantonio JJ, Lavie CJ. Alcohol and cardiovascular health: the dose makes the poison...or the remedy. *Mayo Clin Proc.* 2014;89(3):382-393.
- ⁵⁸ Yadav D, Lowenfels AB. The epidemiology of pancreatitis and pancreatic cancer. *Gastroenterology.* 2013;144(6):1252-1261.
- ⁵⁹ McEwen BS, Gianaros PJ. Central role of the brain in stress and adaptation: links to socioeconomic status, health, and disease. *Ann NY Acad Sci.* 2010;1186:190–222.
- ⁶⁰ Kershaw KN, Diez Roux AV, Bertoni A, Carnethon MR, Everson-Rose SA, Liu K. Associations of chronic individual-level and neighbourhood-level stressors with incident coronary heart disease: the Multi-Ethnic Study of Atherosclerosis. *J Epidemiol Community Health.* 2015;69(2):136-141.
- ⁶¹ Crettaz B, Marziniak M, Willeke P, et al. Stress-induced allodynia—evidence of increased pain sensitivity in healthy humans and patients with chronic pain after experimentally induced psychosocial stress. *PLoS One.* 2013;8(8):e69460.
- ⁶² Geva N, Pruessner J, Defrin R. Acute psychosocial stress reduces pain modulation capabilities in healthy men. *Pain.* 2014;155(11):2418-2425.
- ⁶³ O’Brien BP, Murphy D, Conrick-Martin I, Marsh B. The functional outcome and recovery of patients admitted to an intensive care unit following drug overdose: a follow-up study. *Anaesth Intensive Care.* 2009;37(5):802-806.
- ⁶⁴ Hu X, Lee JS, Pianosi PT, Ryu JH. Aspiration-related pulmonary syndromes. *Chest.* 2015;147(3):815-823.
- ⁶⁵ Grigorakos L, Sakagianni K, Tsigou E, Apostolakos G, Nikolopoulos G, Veldekis D. Outcome of acute heroin overdose requiring intensive care unit admission. *J Opioid Manag.* 2010;6(3):227-231.
- ⁶⁶ Pfister GJ, Burkes RM, Guinn B, et al. Opioid overdose leading to intensive care unit admission: Epidemiology and outcomes. *J Crit Care.* 2016;35: 29–32.
- ⁶⁷ Martin MJ, Weng J, Demetriades D, Salim A. Patterns of injury and functional outcome after hanging: analysis of the National Trauma Data Bank. *Am J Surg.* 2005;190(6):836-840.
- ⁶⁸ Brooks JC, Strauss DJ, Shavelle RM, Tran LM, Rosenbloom L, Wu YW. Recent trends in cerebral palsy survival. Part I: period and cohort effects. *Dev Med Child Neurol.* 2014;56(11):1059–64.
- ⁶⁹ Woolf SH, Aron LY. The US health disadvantage relative to other high-income countries findings from a National Research Council/Institute of Medicine report. *JAMA.* 2013;309(8):771-772.
- ⁷⁰ Kindig DA, Cheng ER. Even as mortality fell in most US counties, female mortality nonetheless rose in 42.8 percent of counties from 1992 to 2006. *Health Aff.* 2013;32(3):451-458.
- ⁷¹ Montez JK, Zajacova A. Why is life expectancy declining among low-educated women in the United States? *Am J Public Health.* 2014;104(10):e5-e7. doi:10.2105/AJPH.2014.302146

- ⁷²Montez JK, Martikainen P, Remes H, Avendano M. Work-family context and the longevity disadvantage of US women. *Soc Forces*. 2015;93(4): 1567-1597.
- ⁷³Smedley BD. The lived experience of race and its health consequences. *Am J Public Health*. 2012;102(2):933-935.
- ⁷⁴Lee Y, Muennig P, Kawachi I, Hatzenbuehler ML. Effects of racial prejudice on the health of communities: a multilevel survival analysis. *Am J Public Health*. 2015;105(11):2349-2355.
- ⁷⁵Rudd RA, Aleshire N, Zibbell JE, Gladden RM. Increases in drug and opioid overdose deaths—United States, 2000-2014. *MMWR Morb Mortal Wkly Rep*. 2016;64(50):1378-1382.