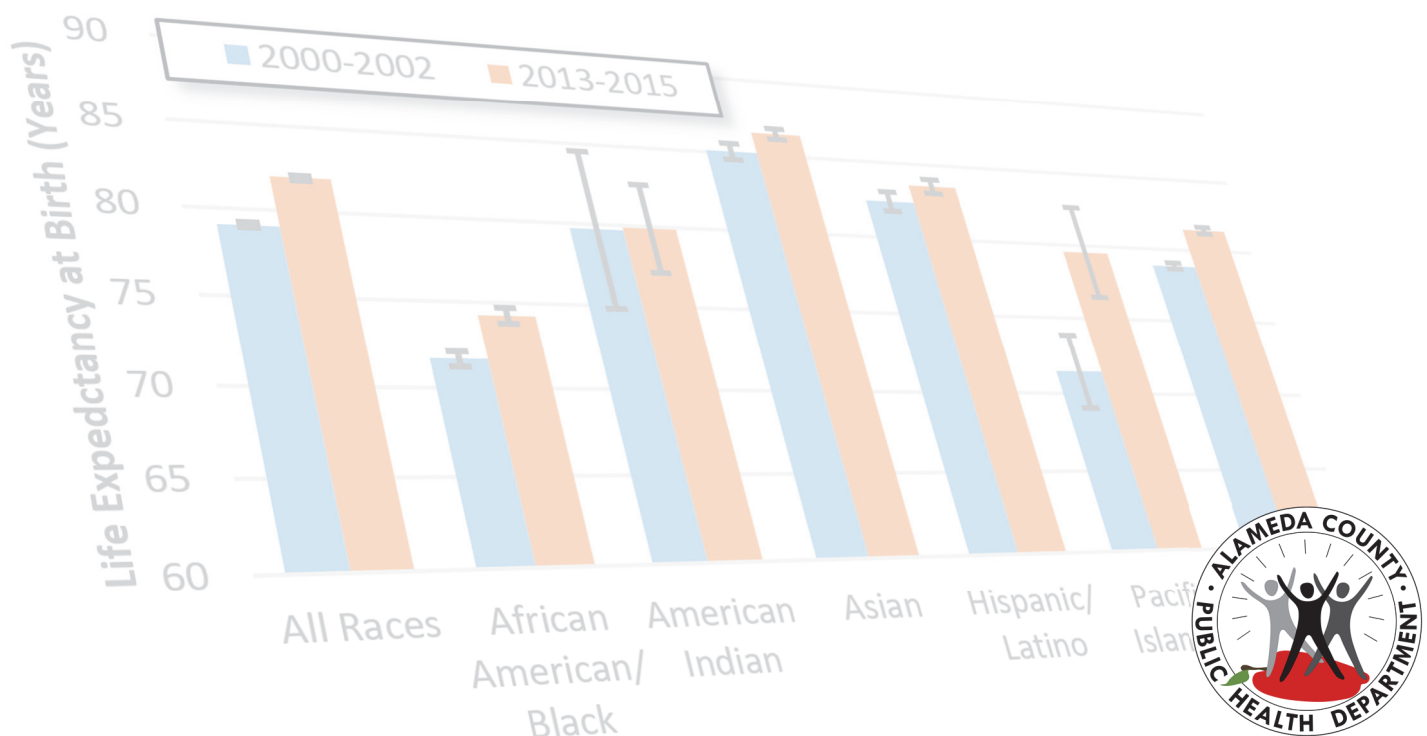


# An Introduction to Measures of Mortality

**Assessing Overall Health, Cause of Death Rankings, Health-Adjusted Life Expectancy, and Socioeconomic Conditions in Alameda County**

Alameda County Health Care Services Agency  
Alameda County Public Health Department  
November 2017



## **Acknowledgements**

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Suggested Citation: Alameda County Public Health Department. *An Introduction to Measures of Mortality: Assessing Overall Health, Cause of Death Rankings, Health-Adjusted Life Expectancy, and Socioeconomic Conditions in Alameda County*. Oakland, California. November 2017.

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# Contents

Overall Health _____	1
All-Cause Mortality Rate _____	1
Life Expectancy at Birth _____	2
Cause of Death Rankings _____	3
Leading Causes of Death _____	4
Cause-Specific Mortality Rates _____	5
Years of Life Lost (YLL) _____	6
Potential Gains in Life Expectancy (PGLE) _____	7
Health-Adjusted Life Expectancy (HALE) _____	8
Mortality Outcomes and Socioeconomic Conditions _____	9
Life Expectancy by Neighborhood Poverty Over Time _____	9
Life Expectancy and Nativity _____	11
Mortality Rate and Education _____	12
Conclusions _____	13
References _____	14
Appendix A: The Global Burden of Disease Project _____	16
Appendix B: Exhaustive List of Causes of Death and Measures of Cause-Specific Mortality _____	17
Appendix C: Leading Causes of Death by Race/Ethnicity _____	19
Appendix D: Leading Causes of Death by Age Group _____	21

# An Introduction to Measures of Mortality

This is an introduction to several ways to look at mortality statistics. While some of the data may be useful for program planning, it is meant more as a way to compare various measures of mortality.

The paper begins with two measures that are useful for estimating the overall health of the population: all-cause mortality rate and life expectancy. Next, to look at cause-specific mortality, four statistics are compared side by side—leading causes of death, cause-specific mortality rates, years of life lost (YLL), and potential gains in life expectancy (PGLE) due to eliminating specific causes of death. The modified health-adjusted life expectancy (HALE), or years of expected disability-free life, is also presented. Finally, recognizing the importance of the social determinants of health, some mortality data related to socioeconomic measures are included—life expectancy by neighborhood poverty, life expectancy by nativity (born in the U.S. or outside the U.S.), and mortality rate by education.

Supplementary information is in the appendices. Appendix A has a summary of the Global Burden of Disease (GBD) project and gives some background to the development and use of the YLL and HALE. Appendix B lists the four cause-specific mortality measures for every disease group. Appendices C and D include data on leading causes of death by race/ethnicity and by age group.

## Overall Health

### All-Cause Mortality Rate

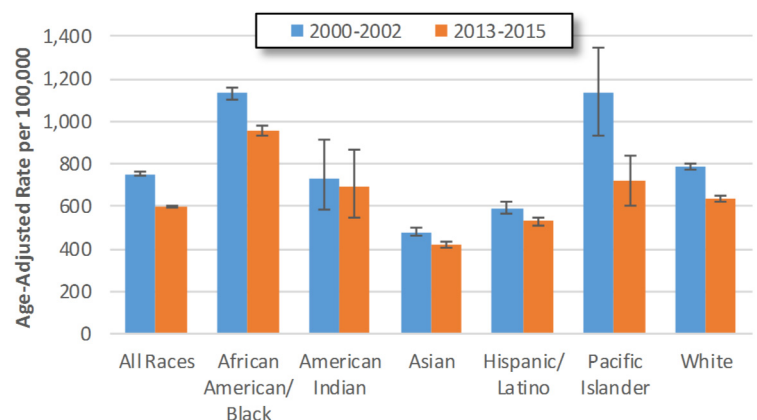
The age-adjusted all-cause mortality rate is the rate of all deaths in a specific population regardless of cause. It is a good overall measure of health and can be used to look at trends in overall health over time, compare over geographic areas, and to identify inequalities between groups.

Age adjusting is a method that accounts for differences in age structure or age composition so that populations of different age distributions can be directly compared. For instance, an area with a high number of people of old age almost always has higher crude mortality rates (simply dividing the numbers of deaths by the population) because the population is older. So comparing that crude rate to that of an area with a young age distribution is not recommended. One might incorrectly attribute the higher rates of death to something other than age. The same distortions can happen when comparing between races/ethnicities or time periods. We use direct age adjustment based on the 2000 U.S. standard population.

As seen in figure 1, African Americans/Blacks in Alameda County had the highest age-adjusted mortality rate in 2000-2002 and 2013-2015. For each of the categories of race/ethnicity, the mortality rate decreased between 2000-2002 and 2013-2015.

For both American Indians and Pacific Islanders, we have less confidence in these rates. This is both because of small population numbers—reflected in the rather large 95% confidence intervals shown in the error bars—and because of differences in reporting such races/ethnicities between the Census and death certificates. The large change for Pacific Islanders,

Figure 1: All-Cause Mortality Rate by Race/Ethnicity



Source: Alameda County vital statistics files, 2000-2002 and 2013-2015.

dropping 36% in the nominal value between 2000-2002 and 2013-2015, could be the result of changes to reporting, such as how the Census and death certificates now allow multiple races to be reported.

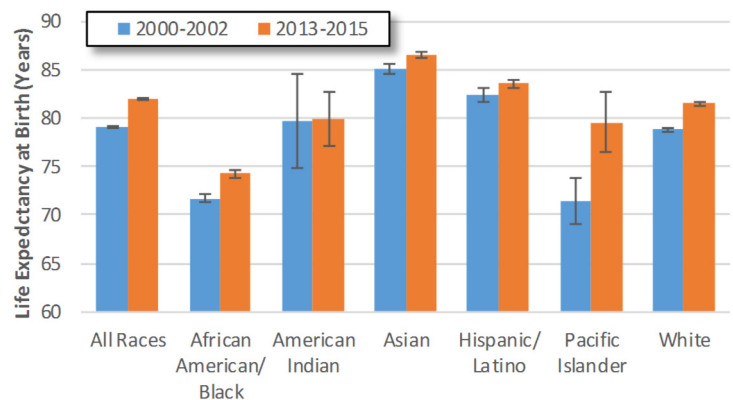
## Life Expectancy at Birth

Life expectancy, like all-cause mortality, is a measure of the overall health of a population. It is a snapshot of the mortality rates in the year of death (e.g., 2000-2002 and 2013-2015) compared to the population's age composition at that time. In other words, a current life table is used rather than a cohort life table, which would follow the entire population from birth through death. Life expectancy is a statistical construct, which assumes that current mortality rates continue throughout each person's lifespan, and thus represents how long babies are expected to live in a completely hypothetical way. One of the advantages of using life expectancy is that it does not require the use of a standard population (as in age-adjusted mortality), so it is easily comparable across subgroups, time periods, and areas. Although the math is complex, life expectancy is basically analogous to the inverse of all-cause mortality—as mortality rates go down, life expectancy goes up.

The life expectancy at birth increased for nearly all groups in Alameda County between 2000-2002 and 2013-2015 (figure 2). As with all-cause mortality rate, the life expectancy for American Indians and Pacific Islanders should be interpreted with caution. The change of 8.1 years for Pacific Islanders may be mostly due to small numbers.

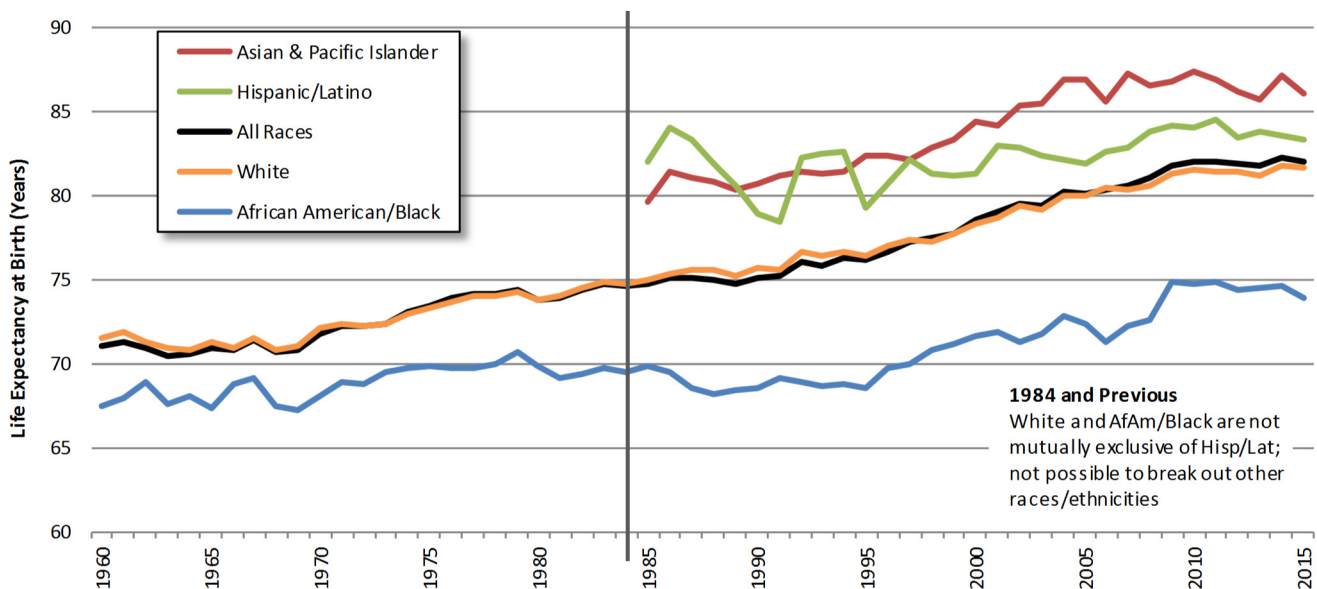
As seen in figure 3, life expectancy for all groups in Alameda County has been increasing since 1960. For African Americans, it has not increased as fast as that for Whites. Asian & Pacific Islanders (shown together) have tended to have the highest life expectancy, and Hispanics/Latinos the second highest. In general, recent declines in mortality rates—and the associated rise in life expectancy—for many leading causes of death reflect the influence of healthier lifestyles, greater use of preventive care, public

Figure 2: Life Expectancy by Race/Ethnicity



Source: Alameda County vital statistics files, 2000-2002 and 2013-2015.

Figure 3: Life Expectancy Trend, 1960-2015



Source: Alameda County vital statistics files, 1960-2015.

health efforts, and advances in medicine. However, the rising prevalence of overweight in children, adolescents, and adults, and the high percentage of physically inactive adolescents and adults create an added burden for future health outcomes.

The categories of races and ethnicities available both in mortality data and in Census data (with which we calculate rates) have changed over time. In 1984 and previous years, race and ethnicity were reported in different ways from the method starting in 1985. For instance, in 1984 the race variable was White, African American/Black, American Indian, Asian, Other, and unspecified. Beginning in 1985, Hispanics/Latinos started being represented in a separate variable. Also in 1985, the race variable included Pacific Islanders for the first time. These are reported together because the best population data we have for that time—California Department of Finance estimates—reports Asians and Pacific Islanders together. Starting in 2000, the Pacific Islander race category became separate from Asian. However, they are shown together here for consistency. Other races/ethnicities such as American Indian are too statistically unstable to be shown in this single-year chart.

## Cause of Death Rankings

For prevention and program planning purposes, it is helpful to understand the most common causes of death. These data inform resource allocation, program planning, and provision of services.

The most common causes of death can be measured in multiple ways. For this section, we look at four rankings: leading causes of death, cause-specific mortality rates, years of life lost (YLL), and potential gains in life expectancy (PGLE). The leading causes of death are based simply on numbers of deaths at any age. Age-adjusted cause-specific mortality rates tell a slightly different story from leading causes, in part due to the age at death for different causes, and also due to some causes being applicable only to either men or women. YLL is a measure that represents the leading causes of *premature* death, and is most influenced by deaths at younger ages. Finally, PGLE is especially good for program planning and resource allocation, as those deaths that affect life expectancy the most are at the top and can be targeted with interventions.

One question that arises when ranking causes of death is which list of causes to use. The International Classification of Diseases describes thousands of individual ICD-10 codes that are used to define cause of death. The National Center for Health Statistics, in their cause of death instruction manual,<sup>1</sup> proposes four lists of causes of death (not including lists of infant and fetal deaths) that combine these ICD-10 codes into groups:

- The first of these lists has 358 groupings, and is used to recreate mortality lists from the World Health Organization.
- The second, the list of 113 selected causes of death and enterocolitis due to *Clostridium difficile*, is used for the “general analysis of mortality and for ranking leading causes of death.” This list includes 23 separate cancer (malignant neoplasm) entries and 11 separate heart disease entries.
- From this list, a subset list of 50 causes (plus enterocolitis due to *Clostridium difficile*) is the list most used by local public health jurisdictions to rank causes of death. Cancers and heart diseases are each represented as a single cause.
- The NCHS’s final list of 39 selected causes of death is meant “to show mortality data for geographic areas.” This list has 11 cancer and three heart disease entries.

For the purposes of this report, we have chosen to align with the San Francisco Department of Public Health and use a new classification system with 115 mortality groups because of the differences between these lists and the desire to break up cancers and heart diseases into subgroups. The Population Health Division, Community Health Assessment and Impact Unit of SFDPH rigorously vetted this classification system with medical officials both inside and outside SFDPH. This list breaks up heart disease and cancer into subgroups to better understand the specific diseases that affect mortality. The complete table is provided in Appendix B, but the next four sections will go over the four rankings.

# Leading Causes of Death

This ranking looks simply at the number of deaths. This is a traditional measure for public health. It can be instructive to examine the burden each cause has on the population, keeping in mind that the population is generally getting older and that the population is growing. This measure can be a little misleading, as an increase in percentage for one cause would lower the proportionate percentages for all other causes, because they must add up to 100%.

The top 20 leading causes of death for Alameda County are below. The exhaustive list of all causes of death is in appendix B, while leading causes by race/ethnicity and by age group are in appendices C and D.

Table 1: Leading Causes of Death, 2000-2002

Rank	Cause	Deaths	% of All Deaths
	Total	28,907	100.0%
1	Ischemic Heart Diseases	5,837	20.2%
2	Cerebrovascular Disease	2,456	8.5%
3	Lung/Trachea/Bronchial Cancer	1,841	6.4%
4	Chronic Obstructive Pulmonary Disorder	1,177	4.1%
5	Hypertensive Diseases	1,036	3.6%
6	Other Heart Diseases	942	3.3%
7	Influenza and Pneumonia	902	3.1%
8	Diabetes Mellitus	835	2.9%
9	Colorectal Cancer	696	2.4%
10	Alzheimer's Disease	607	2.1%
11	Female Breast Cancer	567	2.0%
12	Inflammatory Heart Disease	561	1.9%
13	Other Degenerative Diseases of the Nervous System (Non-Alcohol Related) and non-Alzheimer's Dementias	504	1.7%
14	Lymphoma and Multiple Myeloma	449	1.6%
15	Diseases of Arteries, Arterioles, and Capillaries	441	1.5%
16	Prostate Cancer	411	1.4%
17	Liver Cancer	397	1.4%
18	Assault (Homicide)	368	1.3%
19	Pancreatic Cancer	353	1.2%
20	Intentional Self-Harm (Suicide)	347	1.2%

Source: Alameda County vital statistics files, 2000-2002.

Table 2: Leading Causes of Death, 2013-2015

Rank	Cause	Deaths	% of All Deaths
	Total	28,646	100.0%
1	Ischemic Heart Diseases	3,308	11.5%
2	Cerebrovascular Disease	1,760	6.1%
3	Alzheimer's Disease	1,471	5.1%
4	Lung/Trachea/Bronchial Cancer	1,467	5.1%
5	Other Degenerative Diseases of the Nervous System (Non-Alcohol Related) and non-Alzheimer's Dementias	1,438	5.0%
6	Other Heart Diseases	1,371	4.8%
7	Chronic Obstructive Pulmonary Disorder	1,239	4.3%
8	Hypertensive Diseases	1,157	4.0%
9	Diabetes Mellitus	1,015	3.5%
10	Influenza and Pneumonia	670	2.3%
11	Colorectal Cancer	609	2.1%
12	Female Breast Cancer	518	1.8%
13	Pancreatic Cancer	497	1.7%
14	Inflammatory Heart Disease	486	1.7%
15	Drug Use Disorders	478	1.7%
16	Other Endocrine Disorders	466	1.6%
17	Alcohol-Attributable Diseases and Disorders	465	1.6%
18	Pneumonitis due to inhalation of food and vomit	454	1.6%
19	Intentional Self-Harm (Suicide)	454	1.6%
20	Lymphoma and Multiple Myeloma	437	1.5%

Source: Alameda County vital statistics files, 2013-2015.

Ischemic heart diseases and cerebrovascular disease (stroke) represented the first and second leading cause of death in Alameda County in both 2000-2002 and 2013-2015, although the percentage of each decreased. In the earlier period, lung/trachea/bronchial cancer, chronic obstructive pulmonary disease, and hypertensive diseases rounded out the top five. In the latter period, however, Alzheimer's disease and other degenerative diseases of the nervous system and non-Alzheimer's dementias came in third and fifth. This is because the aging population is growing—as a greater percentage of the population was elderly in 2013-2015, and so they are more likely to die due to age-related diseases like Alzheimer's. Other causes that increased in percentage between the two period were other heart diseases, diabetes mellitus, pancreatic cancer, and suicide. Several cancers are in each list in addition to those already mentioned: colorectal cancer ranked nine in 2000-2002 and 11 in 2013-2015; female breast cancer ranked 11 in 2000-2002 and 12 in 2013-2015; lymphoma and multiple myeloma ranked 14 then 20; prostate cancer ranked 16 and liver cancer ranked 17 in 2000-2002.

## Cause-Specific Mortality Rates

Age-adjusted cause-specific mortality rates are better than leading causes of death in that they adjust for the age composition of the population. These numbers reflect the probability of an individual dying per unit of time per population at risk. The rankings are only slightly different from those of leading causes of death with its percentages. The main differences are that there are certain diseases that affect only half the population, prostate cancer for example. The top 20 causes for Alameda County for 2000-2002 and 2013-2015 are below.

Table 3: Cause-Specific Mortality Rates, 2000-2002

Rank	Cause	Age-Adjusted Mortality Rate per 100,000
	Total	752.3
1	Ischemic Heart Diseases	155.4
2	Cerebrovascular Disease	65.4
3	Lung/Trachea/Bronchial Cancer	48.7
4	Chronic Obstructive Pulmonary Disorder	31.8
5	Prostate Cancer	29.2
6	Hypertensive Diseases	27.0
7	Female Breast Cancer	25.5
8	Other Heart Diseases	24.8
9	Influenza and Pneumonia	24.0
10	Diabetes Mellitus	21.9
11	Colorectal Cancer	18.3
12	Alzheimer's Disease	16.2
13	Inflammatory Heart Disease	14.5
14	Other Degenerative Diseases of the Nervous System (Non-Alcohol Related) and non-Alzheimer's dementias	13.5
15	Lymphoma and Multiple Myeloma	11.7
16	Diseases of Arteries, Arterioles, and Capillaries	11.7
17	Pancreatic Cancer	9.3
18	Intentional Self-Harm (Suicide)	8.1
19	Assault (Homicide)	8.0
20	Liver Cancer	7.8

Source: Alameda County vital statistics files, 2000-2002.

Table 4: Cause-Specific Mortality Rates, 2013-2015

Rank	Cause	Age-Adjusted Mortality Rate per 100,000
	Total	600.4
1	Ischemic Heart Diseases	69.7
2	Cerebrovascular Disease	37.3
3	Alzheimer's Disease	31.2
4	Lung/Trachea/Bronchial Cancer	31.2
5	Other Degenerative Diseases of the Nervous System (Non-Alcohol Related) and non-Alzheimer's dementias	30.6
6	Other Heart Diseases	28.9
7	Chronic Obstructive Pulmonary Disorder	26.6
8	Hypertensive Diseases	23.9
9	Diabetes Mellitus	21.3
10	Prostate Cancer	18.9
11	Female Breast Cancer	18.9
12	Influenza and Pneumonia	14.0
13	Colorectal Cancer	12.5
14	Pancreatic Cancer	10.3
15	Inflammatory Heart Disease	10.1
16	Other Endocrine Disorders	9.8
17	Pneumonitis due to inhalation of food and vomit	9.6
18	Drug Use Disorders	9.4
19	Lymphoma and Multiple Myeloma	9.3
20	Intentional Self-Harm (Suicide)	9.3

Source: Alameda County vital statistics files, 2013-2015.

As with leading causes, ischemic heart diseases and cerebrovascular disease are the first and second in each time period, although the rate for each decreased. Among the remainder, the rates of Alzheimer's disease, other degenerative diseases of the nervous system and non-Alzheimer's dementias increased for the reason cited earlier; other heart diseases, pancreatic cancer, and suicide increased as well.



## Years of Life Lost (YLL)

Years of life lost (YLL) measures premature death. It ranks the causes of death by the ones leading to more cumulative premature years lost; thus, dying at a younger age contributes more to the sum than dying at an older age. The age of death matters greatly in conjunction with the number of deaths. The YLL per death reflects this, showing the average number of years remaining for each death by that cause. The rates are useful for comparing populations of different sizes, and of course age-adjusting will account for different age structures.

This version of years of life lost (YLL) is based on the Global Burden of Disease's (GBD) latest method (see Appendix A). This method uses a 2050 *frontier life expectancy*—a life expectancy that is projected for the healthiest group in the world in 2050—for each year of age. In effect, there is no single cutoff for life expectancy, instead using a more typical life table approach where there is a life expectancy for each year of age. For instance, at birth the 2050 frontier life expectancy is 91.94 years, compared to 65 years when the 2050 frontier life expectancy is 27.86.

In the 1990 GBD study, YLL calculation were based on discounting, where a death at an earlier age counted more, or was weighted more, than a death at a later age.<sup>2</sup> Another method of calculating the YLL is to total across all deaths the number of years between the age of death and 75 years (or 65 or 85 years). This is sometimes age adjusted and sometimes expressed as a rate, either of the total population or the population under age 75.

Table 5: Leading YLL by Cause, 2000-2002

Rank	Cause	YLL per Death	Age-Adjusted YLL Rate per 100,000
	Total	22.7	16,277.5
1	Ischemic Heart Diseases	16.4	2,502.4
2	Lung/Trachea/Bronchial Cancer	23.3	1,106.3
3	Cerebrovascular Disease	16.2	1,034.5
4	Female Breast Cancer	29.6	752.2
5	Chronic Obstructive Pulmonary Disorder	17.7	556.8
6	Hypertensive Diseases	20.6	532.9
7	Diabetes Mellitus	22.6	475.9
8	Assault (Homicide)	60.2	472.5
9	Prostate Cancer	16.4	450.4
10	Other Heart Diseases	16.7	397.2
11	Road Traffic Accidents	52.5	394.3
12	Colorectal Cancer	22.1	390.8
13	Influenza and Pneumonia	15.2	354.7
14	Drug Use Disorders	47.7	342.4
15	Perinatal Conditions	91.9	340.3
16	Intentional Self-Harm (Suicide)	43.3	334.9
17	Inflammatory Heart Disease	23.7	324.2
18	Alcohol-Attributable Diseases and Disorders	40.0	304.4
19	Lymphoma and Multiple Myeloma	24.0	270.7
20	Congenital Malformations, Deformations, and Chromosomal Abnormalities	74.6	237.3

Source: Alameda County vital statistics files, 2000-2002.

Table 6: Leading YLL by Cause, 2013-2015

Rank	Cause	YLL per Death	Age-Adjusted YLL Rate per 100,000
	Total	21.1	12,421.5
1	Ischemic Heart Diseases	16.7	1,128.2
2	Lung/Trachea/Bronchial Cancer	21.4	636.6
3	Cerebrovascular Disease	15.6	570.4
4	Female Breast Cancer	25.9	495.4
5	Other Heart Diseases	15.2	437.4
6	Drug Use Disorders	45.2	431.5
7	Intentional Self-Harm (Suicide)	46.0	430.7
8	Diabetes Mellitus	20.9	428.2
9	Chronic Obstructive Pulmonary Disorder	15.9	413.6
10	Assault (Homicide)	59.5	406.0
11	Hypertensive Diseases	16.4	379.8
12	Alcohol-Attributable Diseases and Disorders	36.7	331.1
13	Other Degenerative Diseases of the Nervous System (Non-Alcohol Related) and non-Alzheimer's Dementias	9.7	307.2
14	Alzheimer's Disease	9.3	299.0
15	Road Traffic Accidents	47.4	282.7
16	Prostate Cancer	16.5	282.3
17	Colorectal Cancer	22.7	271.2
18	Perinatal Conditions	91.8	269.7
19	Inflammatory Heart Disease	25.7	253.0
20	Influenza and Pneumonia	16.2	222.7

Source: Alameda County vital statistics files, 2013-2015.

In Alameda County, the largest age-adjusted YLL rate for each time period are ischemic heart diseases, lung/trachea/bronchial cancer, cerebrovascular disease, and female breast cancer. Of these, female breast cancer strikes the youngest, with YLL per death reaching 29.6 years in 2000-2002 and 25.9 years in 2013-2015. The burden of each decreased according to this measure. Burdens that increased are other heart diseases; drug use disorders; suicide; and alcohol-attributable diseases and disorders. Other causes that have large YLL per death are homicide; road traffic accidents; drug use disorders; perinatal conditions; congenital malformations, deformations, and chromosomal abnormalities; suicide; and alcohol-attributable diseases and disorders.

## Potential Gains in Life Expectancy (PGLE)

Potential gains in life expectancy (PGLE) is another way to rank leading causes of death. In this case, the rank is by how many years of life expectancy could be gained at birth by eliminating specific causes of death. This gain is for the entire population, and so even small gains are very significant. For instance, if diabetes mellitus were eliminated, the life expectancy would have been 0.44 years more for *every person in the county* in 2013-2015.

The advantage of PGLE is that, like life expectancy, age adjustment is not needed to normalize. Thus the choice of standard population does not affect the results.

This measure can be calculated in one of two methods. The first method uses a multiple-decrement life table, subtracting deaths for a specific cause from the total by age group.<sup>3</sup> An easier method again subtracts the deaths for a specific cause, but the resultant life expectancy is calculated directly, not through a multiple-decrement life table.<sup>4</sup> Here we have used the latter method.

Table 7: Leading PGLE by Cause, 2000-2002

Rank	Group	Life Expectancy at Birth (Years)
	Total	79.06
	Female	81.39
	Male	76.54
	Cause	PGLE
1	Ischemic Heart Diseases	3.04
2	Cerebrovascular Disease	1.09
3	Lung/Trachea/Bronchial Cancer	0.87
4	Female Breast Cancer*	0.56
5	Chronic Obstructive Pulmonary Disorder	0.50
6	Hypertensive Diseases	0.46
7	Other Heart Diseases	0.40
8	Influenza and Pneumonia	0.38
9	Diabetes Mellitus	0.37
10	Prostate Cancer†	0.35
11	Colorectal Cancer	0.31
12	Assault (Homicide)	0.27
13	Inflammatory Heart Disease	0.25
14	Alzheimer's Disease	0.24
15	Road Traffic Accidents	0.23
16	Perinatal Conditions	0.21
17	Lymphoma and Multiple Myeloma	0.21
18	Other Degenerative Diseases of the Nervous System (Non-Alcohol Related) and Non-Alzheimer's Dementias	0.20
19	Intentional Self-Harm (Suicide)	0.20
20	Diseases of Arteries, Arterioles, and Capillaries	0.18

Source: Alameda County vital statistics files, 2000-2002.

Table 8: Leading PGLE by Cause, 2013-2015

Rank	Group	Life Expectancy at Birth (Years)
	Total	81.96
	Female	84.10
	Male	79.67
	Cause	PGLE
1	Ischemic Heart Diseases	1.54
2	Cerebrovascular Disease	0.78
3	Alzheimer's Disease	0.66
4	Other Degenerative Diseases of the Nervous System (Non-Alcohol Related) and Non-Alzheimer's Dementias	0.64
5	Lung/Trachea/Bronchial Cancer	0.64
6	Other Heart Diseases	0.61
7	Chronic Obstructive Pulmonary Disorder	0.53
8	Hypertensive Diseases	0.50
9	Female Breast Cancer*	0.46
10	Diabetes Mellitus	0.44
11	Prostate Cancer†	0.30
12	Influenza and Pneumonia	0.29
13	Intentional Self-Harm (Suicide)	0.27
14	Drug Use Disorders	0.27
15	Colorectal Cancer	0.26
16	Assault (Homicide)	0.25
17	Inflammatory Heart Disease	0.22
18	Alcohol-Attributable Diseases and Disorders	0.22
19	Pancreatic Cancer	0.21
20	Other Endocrine Disorders	0.21

Source: Alameda County vital statistics files, 2013-2015.

\* Female only; uses female life expectancy as reference.

† Male only; uses male life expectancy as reference.

Ischemic heart diseases and cerebrovascular disease were ranked one and two in each time period in Alameda County in 2000-2002 and 2013-2015. However, the gain in eliminating ischemic heart diseases nearly halved in that time, meaning the overall burden decreased. Most strikingly, in 2013-2015, diseases associated with the elderly, Alzheimer's disease as well as other degenerative diseases of the nervous system and non-Alzheimer's dementias gained substantially in PGLE and were ranked three and four. Other diseases that increased were chronic obstructive pulmonary disease, other heart diseases, hypertensive diseases, and diabetes mellitus. Lung/trachea/bronchial cancer and female breast cancer, ranked five and nine in 2013-2015, decreased slightly in PGLE from 2000-2002.

# Health-Adjusted Life Expectancy (HALE)

The idea of health-adjusted life expectancy—or average years of life in full health and free of disease or injury—was developed by Sullivan.<sup>5</sup> This is a measure that is also called disability-free life expectancy (DFLE) and that can be derived, as in the Global Burden of Disease, from knowing the morbidity rates by age group for every possible cause. The method applied here uses the estimates of the number with any disability in the population by age group from the American Community Survey.

The American Community Survey (ACS) reports disability rates for six age groups: 0-4 years, 5-17 years, 18-34 years, 35-64 years, 65-74 years, and 75+ years. This allows a modified life table to be used that is based on these abridged age groups. The six disability statuses reported in the ACS are hearing, vision, cognitive, ambulatory, self-care, and independent living.

It should be noted here that the California Health Interview Survey (CHIS) reports higher disability rates than those from the American Community Survey. However, the CHIS estimates disability only for those 18+ years, so it cannot be used to calculate HALE. However, the important point is that the numbers below can be assumed to be conservative estimates—the HALE may be much lower.

The life expectancy here is slightly different from that in the PGLE section. This is because a different abridged life table was used, built to match the age groups available in the American Community Survey for disability, and because this is five years of mortality data.

Table 9: Life Expectancy and Health-Adjusted Life Expectancy

Age	Life Expectancy	Health-Adjusted Life Expectancy
0	82.58	71.08
5	77.94	66.42
18	65.06	53.97
35	48.74	38.23
65	22.36	13.61
75	15.09	7.29

Source: Alameda County vital statistics files, 2011-2015 and American Community Survey 2015 5-year files.

As of 2011-2015 in Alameda County, the average life expectancy at birth was 82.58 years, with 71.08 years in full health and disability free. Those 65 years had a life expectancy of 22.36 years, 13.61 years of which would be in full health.

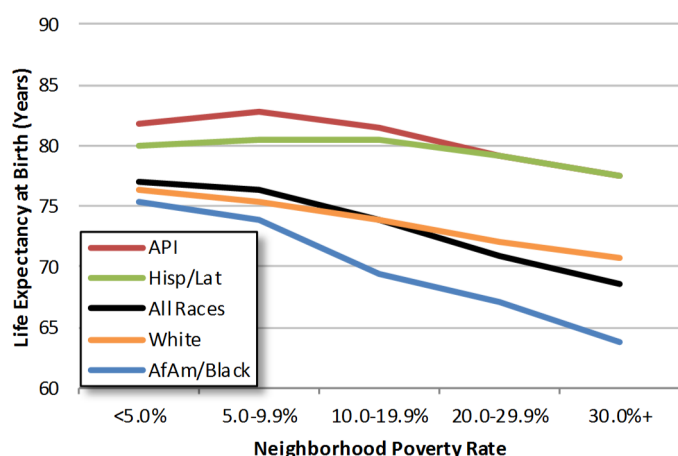
# Mortality Outcomes and Socioeconomic Conditions

Socioeconomic conditions have great influences on health outcomes. These conditions may be more important than genetics, biology, and access to medical care. We examine three indicators here based on information available from the death certificate: neighborhood poverty as taken by the residence at the time of death, nativity (those born in the United States vs. those not), and educational attainment.

## Life Expectancy by Neighborhood Poverty Over Time

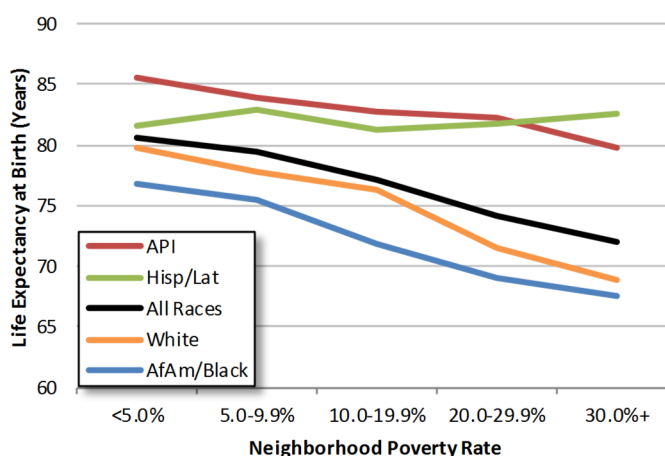
The social gradient is a method to examine the role of neighborhood poverty in life expectancy. Each residential address on the death certificate is placed into a neighborhood (census tract). The neighborhoods—and their constituent deaths and populations—in the county are aggregated into five groups: less than five percent poverty, from five percent to less than ten percent poverty, from ten percent to less than 20 percent poverty, from 20 percent to less than 30 percent poverty, and 30 percent poverty or more. For each of these groups, overall life expectancy and life expectancy by race/ethnicity is calculated. It should be noted that we drop several census tracts from the analysis. These include the tract where Santa Rita jail is located, and several tracts near UC Berkeley where more than 50% of the population is college students.

Figure 4: Social Gradient, 1989-1991



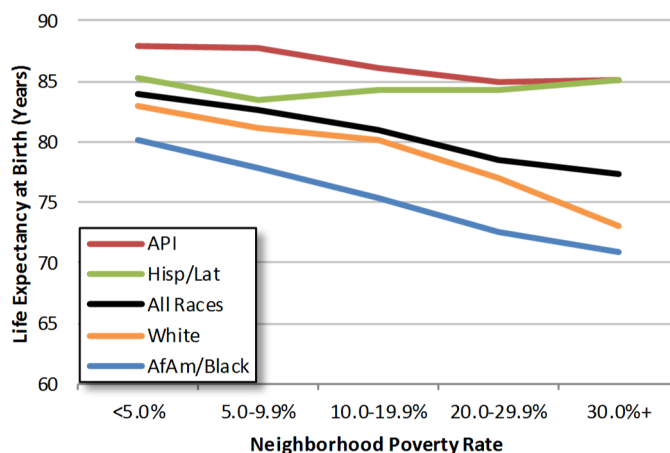
Source: Alameda County vital statistics files, 1989-1991.

Figure 5: Social Gradient, 1999-2001



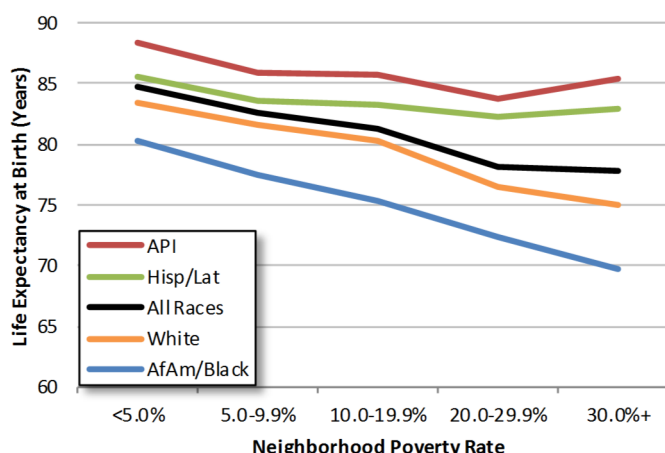
Source: Alameda County vital statistics files, 1999-2001.

Figure 6: Social Gradient, 2009-2011



Source: Alameda County vital statistics files, 2009-2011.

Figure 7: Social Gradient, 2013-2015



Source: Alameda County vital statistics files, 2013-2015.

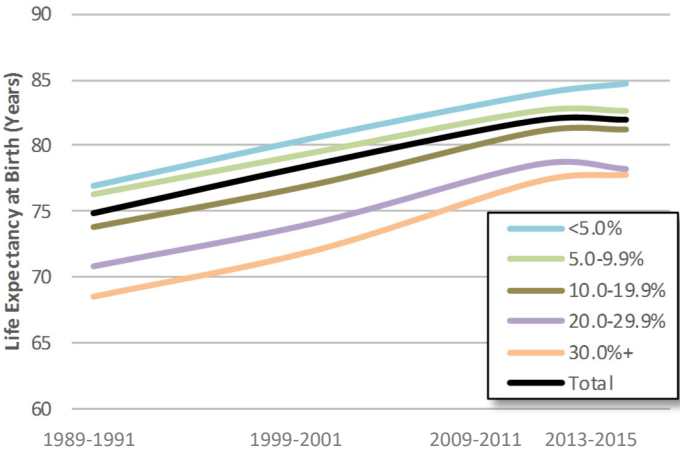
We have done the social gradient analysis for several sets of years, starting in 1989-1991 and continuing each decade, - and ending with the most recent time period. While the life expectancy increased for each race/ethnicity group in the county in each time period until 2009-2011, it did not change substantially between 2009-2011 and 2013-2015. This may reflect the leveling off in life expectancy that has been recorded at the national level.<sup>6</sup>

Generally, as neighborhood poverty increases, life expectancy decreases, with those in areas of 30.0%+ poverty having the lowest life expectancy. There is a wide variation in the experience of different racial/ethnic groups, however—there is about a 15-year difference between African Americans/Blacks and Asians in the highest poverty areas. In each time period, the Hispanic/Latino lines are fairly flat across neighborhood poverty groups. The Asian & Pacific Islander line is sloped slightly, while African American/Black and White lines are more highly sloped. For these two groups, with higher life expectancy in lower poverty areas, neighborhood poverty is more predictive of life expectancy.

Figure 8 shows the change in the social gradient over time for all races. The life expectancy of each poverty group increased until 2009-2011. Between that period and 2013-2015, however, the change is relatively flat (except for the least-poor neighborhoods). This is consistent with the national trend.

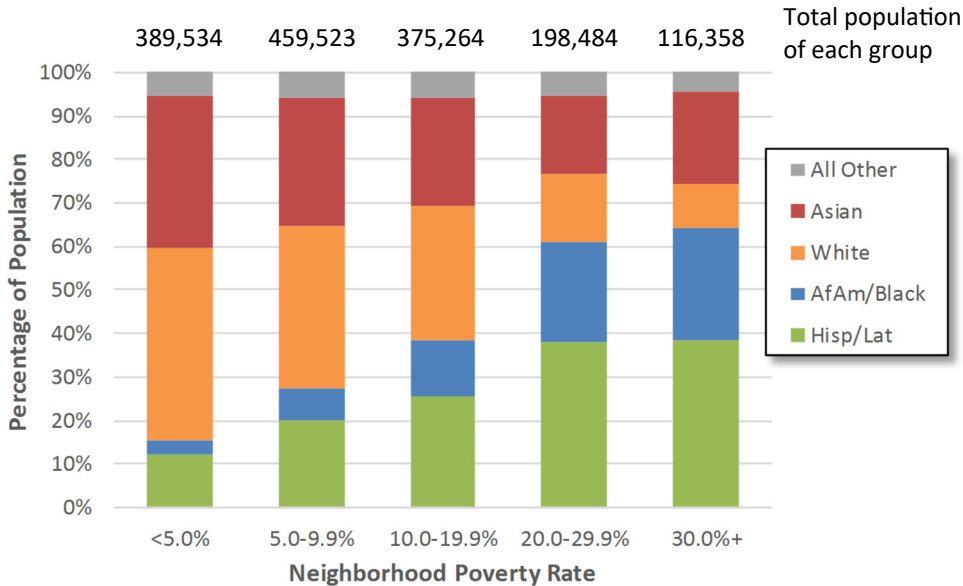
It is illustrative to examine the racial/ethnic composition of these poverty groups. Figure 9 shows us that, of those in very high-poverty neighborhoods (30.0%+ poverty), 64.1% are African American/Black and Hispanic/Latino. Compare this to very low-poverty neighborhoods (<5.0%), where a greater percentage, 79.0%, are White and Asian. Thus, even though African Americans/Blacks have the lowest life expectancies in the 30.0%+ poverty group, and Whites have the next lowest, these poor outcomes are affecting many fewer Whites than African Americans/Blacks.

Figure 8: Change in the Social Gradient



Source: Alameda County vital statistics files, 1989-1991, 1999-2001, 2009-2011, and 2013-2015.

Figure 9: Composition of Neighborhood Poverty Groups

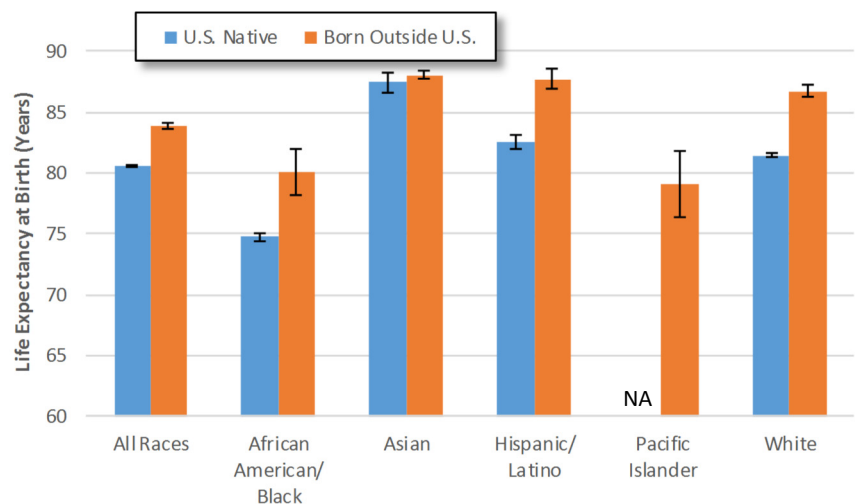


Source: CAPE, with data from Esri 2015.

## Life Expectancy and Nativity

Another variable available on death certificates is where people were born. We aggregated all those born in the United States (defined here as the fifty states and Washington DC) and those born outside of the United States. This aggregation covered five years of mortality data by race/ethnicity. To match the numerators, deaths, we pulled data from the American Community Survey PUMS data to get nativity by age group.

Figure 10: Nativity and Life Expectancy by Race



Source: Alameda County vital statistics files, 2011-2015.

In terms of race/ethnicity, those born outside the United States had a higher life expectancy than those native born. The exception is Pacific Islanders, for whom there were too few born in the United States to calculate. For Asians the effect is minimal, but for African Americans/Blacks, Hispanics/Latinos, and Whites the differences in life expectancy are each about five years.

Explanations for this have been proposed in the literature.<sup>7</sup> A large component of this is that healthy people are more likely to migrate. Also, before the acculturation that usually begins with assimilation over time or with second-generation immigrants, the hypothesis is that immigrants bring with them healthier lifestyles than those in the United States in terms of what type of food they eat and attitudes toward exercise. Family structure and social support also play a role. A corollary is the salmon effect: many immigrants may go to the country of their birth to die, though this has been shown not to hold true for Hispanics/Latinos.<sup>8</sup>

There is also some evidence that immigrants experience poorer health outcomes.<sup>9</sup> Some explanations for this are that immigrants are negatively affected by the immigration process itself, that they live in poor conditions in the United States because of low employment status, predisposition to certain poor outcomes, and poorer access to health care.

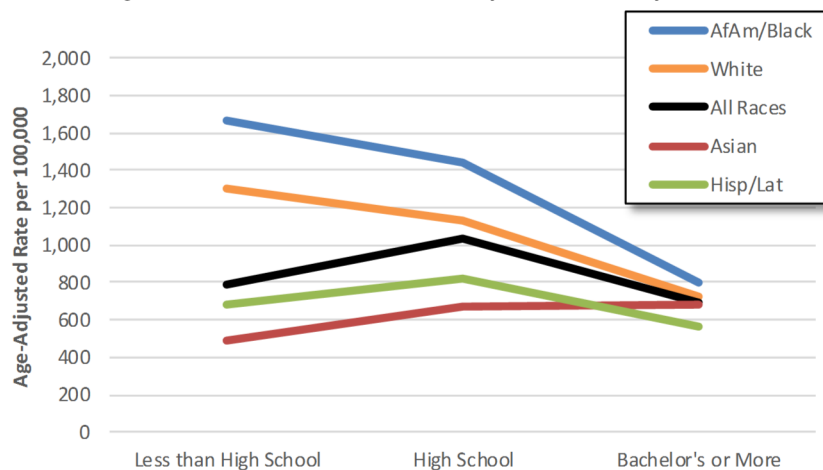
## Mortality Rate and Education

With the implementation of the Electronic Death Registration System (EDRS) in Alameda County in 2007 and improved data quality for the education variable, it is possible to do analyses of education and mortality.

For this analysis, as with the nativity analysis, we pulled data from the American Community Survey PUMS data to calculate denominators by race, age, and educational attainment. These denominators were matched with data similarly aggregated from the death certificates.

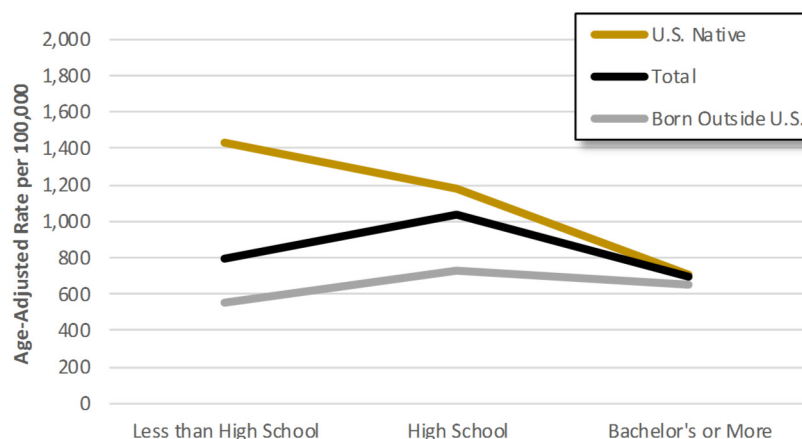
To look at mortality rate by level of education, we restrict the analysis to people 25 years or older. This restriction gives people time to have completed their education and matches the American Community Survey variable. For this reason, we are limited to looking at all-cause age-adjusted mortality rate and cannot look at life expectancy.

Figure 11: Education, Race/Ethnicity, and Mortality Rate



Source: Alameda County vital statistics files, 2011-2015.

Figure 12: Education, Nativity, and Mortality Rate



Source: Alameda County vital statistics files, 2011-2015.

Education seems to have a bigger effect on Whites and African Americans/Blacks than for Asians and Hispanics/Latinos. For African Americans/Blacks, the age-adjusted all-cause mortality rate more than halves from 1,670.2 per 100,000 for those who haven't completed high school to 796.6 per 100,000 for those who have completed a bachelor's degree or more.



To investigate the effect of immigration and education, which primarily concerns Asians and Hispanics/Latinos, we looked at those born outside the United States versus those native to the United States. For those born outside, the effect of education is minimal, while for those born in the United States the rate halves from 1,426.3 per 100,000 for those with less than a high school education to 705.3 per 100,000 for those with a bachelor's degree or more. This may be due to some combination of the healthy immigrant effect and the effect of ethnic enclaves in the county where someone with less formal education can still thrive.

## Conclusions

There are advantages and disadvantages to each of the measures presented in this paper. These are explained in the following table.

	Measure	Advantages	Disadvantages
Overall Health	Age-adjusted all-cause mortality rate	<ul style="list-style-type: none"> <li>Widely used.</li> <li>Age adjusting evens out the distortions between groups of different age structures.</li> </ul>	<ul style="list-style-type: none"> <li>Cannot be compared cross-nationally except when specifically using a world population standard.</li> <li>Age adjusting can be difficult to explain.</li> </ul>
	Life expectancy	<ul style="list-style-type: none"> <li>Starting to be more widely used.</li> <li>More intuitive than age-adjusted all-cause mortality rate.</li> <li>Can be compared cross-nationally.</li> </ul>	<ul style="list-style-type: none"> <li>Sometimes too intuitive, as some believe we are actually predicting how long today's children will live.</li> <li>Changes that seem small can be very meaningful.</li> </ul>
Cause of Death Rankings	Leading causes of death	<ul style="list-style-type: none"> <li>Easy to do.</li> <li>Widely used, though lists of causes of deaths differ.</li> <li>Doesn't require population (denominator) statistics.</li> </ul>	<ul style="list-style-type: none"> <li>Doesn't differentiate between varying age structures.</li> <li>Skewed toward causes of death of older persons.</li> </ul>
	Cause-specific mortality rates	<ul style="list-style-type: none"> <li>Widely used.</li> </ul>	<ul style="list-style-type: none"> <li>Tends to over-emphasize deaths of older persons.</li> <li>Age adjusting can be difficult to explain.</li> </ul>
	Years of life lost (YLL)	<ul style="list-style-type: none"> <li>Starting to be more widely used, though methods differ.</li> <li>Identifies those dying at younger ages.</li> </ul>	<ul style="list-style-type: none"> <li>Difficult to grasp intuitively.</li> <li>Age adjusting can be difficult to explain.</li> </ul>
	Potential gains in life expectancy (PGLE)	<ul style="list-style-type: none"> <li>Can be compared cross-nationally.</li> </ul>	<ul style="list-style-type: none"> <li>Difficult to grasp intuitively.</li> <li>Changes that seem small can be very meaningful.</li> </ul>
HALE	Health-adjusted life expectancy (HALE)	<ul style="list-style-type: none"> <li>Combines disability (or morbidity) and mortality into a single indicator.</li> </ul>	<ul style="list-style-type: none"> <li>Not enough morbidity statistics exist on a sub-national level to do it using the more nuanced method.</li> <li>Limited disability statistics; California Health Interview Survey does not provide disability numbers for those less than 18 years.</li> </ul>
Socioeconomic Conditions	Life expectancy by neighborhood poverty	<ul style="list-style-type: none"> <li>Shows relationship between socioeconomic status and life expectancy in a simple, easy-to-understand manner.</li> </ul>	<ul style="list-style-type: none"> <li>Ecological poverty data, not based on individual economic status.</li> </ul>
	Life expectancy and nativity	<ul style="list-style-type: none"> <li>Takes advantage of birthplace data on death certificates.</li> </ul>	<ul style="list-style-type: none"> <li>Can be difficult to explain why the differences exist.</li> </ul>
	Mortality rate and education	<ul style="list-style-type: none"> <li>Takes advantage of improvement in education variable on California death certificates.</li> </ul>	<ul style="list-style-type: none"> <li>Results not as intuitive (i.e., more education leads to lower mortality rates) as might be expected.</li> </ul>



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# Appendix A: The Global Burden of Disease Project

As part of public health's ten essential services, epidemiologists play a role in monitoring health status to identify community health problems and educate people about health issues. Toward this end, the World Health Organization (WHO) and the Institute of Health Metrics and Evaluation (IHME) at the University of Washington have developed and published mortality and morbidity indicators as part of the Global Burden of Disease (GBD) project.

The GBD project seeks to quantify disease burden primarily through the metric disability-adjusted life years (DALY), which combines years lost to disability with life expectancy. One DALY is equivalent to one lost year of healthy life. The burden of different types of diseases are the sum of these DALYs across the population, and thus can be thought of as a measurement of the disparity between current health status and ideal health where each person in the population lives to an elevated age free of disease.<sup>9</sup> Years lived with disability (YLD) and years of life lost (YLL) due to premature death comprise the DALY. A related metric, health-adjusted life expectancy (HALE), takes into account morbidity and mortality rates. The HALE is based on life expectancy at birth but has an adjustment for time spent in poor health. It is the number of years in full health that can be expected.<sup>10</sup>

To do the YLD and thus the DALY, one needs to have morbidity rates for every cause by age. Unfortunately these rates are only available at large geographic areas like countries. However, we can present the YLL and a modified form of the HALE that relies on disability by age in the American Community Survey rather than needing every morbidity rate.

# Appendix B: Exhaustive List of Causes of Death and Measures of Cause-Specific Mortality

Table B-2 represents all the causes of death. From this table, the top 20 causes in each section—leading causes of death, cause-specific mortality rates, years of life lost (YLL), and potential gains in life expectancy (PGLE)—were derived. Every death in 2000-2002 and 2013-2015 is represented. In the case of deaths that are only applicable to females, they are marked with an asterisk (\*) and, for males, they are marked with a dagger(†). The reference life expectancy for potential gains in life expectancy (PGLE) is in Table B-1 below.

Table B-1: Gender-Specific Life Expectancy Used in PGLE

Group	Life Expectancy at Birth (Years) 2000-2002	Life Expectancy at Birth (Years) 2013-2015
Total	79.06	81.96
Female	81.39	84.10
Male	76.54	79.67

Table B-2: Measures of Cause-Specific Mortality

Cause	Deaths 2000-2002	Deaths 2013-2015	% of All Deaths 2000-2002	% of All Deaths 2013-2015	Age- Adjusted Rate 2000-2002	Age- Adjusted Rate 2013-2015	YLL per Death 2000-2002	Age- Adjusted YLL 2000-2002	YLL per Death 2013-2015	Age- Adjusted YLL 2013-2015	PGLE 2000-2002	PGLE 2013-2015
Total	28,907	28,646	100.0%	100.0%	752.3	600.4	22.7	16,277.5	21.1	12,421.5	79.06	81.96
Tuberculosis	18	21	0.1%	0.1%	0.5	0.5	25.8	11.5	19.6	8.4	0.01	0.01
Syphilis	0	1	0.0%	0.0%	NA	0.0	NA	NA	11.4	0.3	NA	0.00
Non HIV STDs, Excluding Syphilis	0	2	0.0%	0.0%	NA	0.0	NA	NA	37.5	1.3	NA	0.00
HIV	209	101	0.7%	0.4%	4.6	2.0	47.6	214.3	37.0	72.9	0.11	0.05
Shigellosis and Amebiasis	0	0	0.0%	0.0%	NA	NA	NA	NA	NA	NA	NA	NA
Salmonella Infections	1	0	0.0%	0.0%	0.0	NA	26.9	0.7	NA	NA	0.00	0.00
Certain Other Intestinal Infections	18	118	0.1%	0.4%	0.5	2.6	13.1	6.3	18.3	45.5	0.01	0.05
Vaccine-Preventable Childhood Diseases	6	3	0.0%	0.0%	0.2	0.1	26.5	4.0	17.5	1.2	0.00	0.00
Tetanus	0	0	0.0%	0.0%	NA	NA	NA	NA	NA	NA	NA	NA
Meningitis	15	11	0.1%	0.0%	0.3	0.2	49.2	17.0	38.9	8.9	0.01	0.01
Hepatitis A and E	1	0	0.0%	0.0%	0.0	NA	23.2	0.7	NA	NA	0.00	0.00
Hepatitis B	14	14	0.0%	0.0%	0.3	0.3	34.1	11.1	23.3	5.8	0.01	0.01
Hepatitis C	68	128	0.2%	0.4%	1.6	2.3	36.3	57.1	29.8	64.9	0.03	0.05
Hepatitis: Other or Unspecified	2	0	0.0%	0.0%	0.0	NA	49.8	2.1	NA	NA	0.00	0.00
Other Infectious & Parasitic Diseases	285	261	1.0%	0.9%	7.3	5.5	25.5	178.4	20.7	111.5	0.13	0.12
Mouth & Oropharynx Cancer	106	110	0.4%	0.4%	2.7	2.2	28.8	74.8	26.7	56.4	0.05	0.05
Esophagus Cancer	151	144	0.5%	0.5%	4.0	2.9	25.0	96.2	24.1	67.7	0.07	0.06
Stomach Cancer	209	201	0.7%	0.7%	5.5	4.1	22.1	117.1	22.2	87.6	0.09	0.09
Colorectal Cancer	696	609	2.4%	2.1%	18.3	12.5	22.1	390.8	22.7	271.2	0.31	0.26
Liver Cancer	259	397	0.9%	1.4%	6.7	7.8	26.6	171.3	24.8	184.2	0.12	0.17
Pancreatic Cancer	353	497	1.2%	1.7%	9.3	10.3	22.1	201.1	21.3	209.4	0.16	0.21
Lung/Trachea/Bronchial Cancer	1,841	1,467	6.4%	5.1%	48.7	31.2	23.3	1,106.3	21.4	636.6	0.87	0.64
Melanoma and other Skin Cancer	115	118	0.4%	0.4%	3.0	2.4	25.3	70.8	22.6	51.2	0.05	0.05
Breast Cancer	569	526	2.0%	1.8%	14.2	10.6	29.6	401.5	25.9	266.7	0.27	0.23
<i>Female Breast Cancer*</i>	567	518	2.0%	1.8%	25.5	18.9	29.6	752.2	25.9	495.4	0.56	0.46
Cancer Cervix Uteri*	51	48	0.2%	0.2%	2.2	1.8	31.9	72.0	30.0	54.2	0.05	0.04
Cancer Corpus Uteri*	85	126	0.3%	0.4%	3.9	4.7	21.9	86.9	24.5	114.8	0.08	0.11
Ovarian Cancer*	178	173	0.6%	0.6%	8.1	6.5	29.0	234.6	25.3	164.5	0.18	0.15
Prostate Cancer†	411	358	1.4%	1.2%	29.2	18.9	16.4	450.4	16.5	282.3	0.35	0.30
Bladder Cancer	136	160	0.5%	0.6%	3.6	3.5	20.1	71.5	16.3	55.1	0.06	0.07
Lymphoma and Multiple Myeloma	449	437	1.6%	1.5%	11.7	9.3	24.0	270.7	21.3	190.3	0.21	0.19
Leukemia	253	268	0.9%	0.9%	6.6	5.7	27.2	171.3	24.3	136.2	0.13	0.12
Cancer of Larynx	40	28	0.1%	0.1%	1.0	0.6	26.5	26.6	22.9	11.9	0.02	0.01
Cancer of Kidney and Renal Pelvis	122	145	0.4%	0.5%	3.2	3.0	25.4	77.5	23.4	69.4	0.06	0.06
Cancer of Meninges, Brain, and other Parts of CNS	160	196	0.6%	0.7%	4.0	3.9	34.8	131.6	30.5	118.6	0.09	0.09
Other Digestive Organ Cancers	82	89	0.3%	0.3%	2.2	1.9	19.8	42.7	20.6	37.0	0.04	0.04
Other Respiratory/Intrathoracic Organs Cancers	13	8	0.0%	0.0%	0.3	0.2	25.9	8.5	33.3	5.3	0.01	0.00
Mesothelial and Soft Tissue Cancers	83	123	0.3%	0.4%	2.2	2.5	24.2	50.0	28.5	72.3	0.04	0.06
Other Cancers of the Female Genital Organs*	17	26	0.1%	0.1%	0.8	0.9	23.6	18.5	18.1	16.3	0.02	0.02
Other Cancers of the Male Genital Organs†	10	3	0.0%	0.0%	0.5	0.2	37.6	17.9	7.7	1.3	0.01	0.00
Thyroid and Endocrine Cancers	27	33	0.1%	0.1%	0.7	0.7	30.8	20.0	26.2	16.7	0.01	0.01
Cancer: Site Unspecified	305	348	1.1%	1.2%	8.0	7.3	24.1	185.5	20.7	144.1	0.14	0.15

Table B-2: Measures of Cause-Specific Mortality (continued)

Cause	Deaths 2000-2002	Deaths 2013-2015	% of All Deaths 2000-2002	% of All Deaths 2013-2015	Age- Adjusted Rate 2000-2002	Age- Adjusted Rate 2013-2015	YLL per Death 2000-2002	Age- Adjusted YLL 2000-2002	YLL per Death 2013-2015	Age- Adjusted YLL 2013-2015	PGLE 2000-2002	PGLE 2013-2015
Cancer: Secondary or Ill-Defined Site	161	117	0.6%	0.4%	4.2	2.4	22.1	89.9	21.4	49.4	0.07	0.05
Cancer: Multiple Sites	23	43	0.1%	0.2%	0.6	0.9	29.3	16.0	19.4	16.8	0.01	0.02
All Other Malignant Neoplasms	23	22	0.1%	0.1%	0.6	0.5	34.7	18.9	30.1	14.0	0.01	0.01
In Situ, Benign, or Unknown Behavior Cancers	154	159	0.5%	0.6%	4.1	3.5	20.1	80.0	20.3	67.8	0.07	0.07
Blood/Immune Diseases	91	110	0.3%	0.4%	2.3	2.3	28.7	63.2	28.3	63.9	0.05	0.05
Diabetes Mellitus	835	1,015	2.9%	3.5%	21.9	21.3	22.6	475.9	20.9	428.2	0.37	0.44
Other Endocrine Disorders	259	466	0.9%	1.6%	6.7	9.8	23.9	152.9	21.9	209.0	0.12	0.21
Schizophrenia	5	4	0.0%	0.0%	0.1	0.1	10.6	1.4	15.4	1.5	0.00	0.00
Unipolar and Bipolar Depression Disorders	6	5	0.0%	0.0%	0.2	0.1	9.7	1.6	14.8	1.9	0.00	0.00
Alcohol-Attributable Diseases and Disorders	335	465	1.2%	1.6%	7.8	9.0	40.0	304.4	36.7	331.1	0.17	0.22
Drug Use Disorders	332	478	1.1%	1.7%	7.3	9.4	47.7	342.4	45.2	431.5	0.18	0.27
Alzheimer's Disease	607	1,471	2.1%	5.1%	16.2	31.2	10.3	168.3	9.3	299.0	0.24	0.66
Other Degenerative Diseases of the Nervous System (Non-Alcohol Related) and non-Alzheimer's Dementias	504	1,438	1.7%	5.0%	13.5	30.6	10.8	146.6	9.7	307.2	0.20	0.64
PTSD, OCD, and Panic Disorders	0	1	0.0%	0.0%	NA	0.0	NA	NA	7.1	0.1	NA	0.00
Parkinson's Disease	169	293	0.6%	1.0%	4.6	6.6	13.7	63.5	12.8	86.6	0.06	0.12
Multiple Sclerosis	43	49	0.1%	0.2%	1.0	1.0	35.7	35.7	28.5	27.2	0.02	0.02
Epilepsy	20	19	0.1%	0.1%	0.5	0.3	41.9	18.7	37.5	13.0	0.01	0.01
Other Neuro-Psychiatric Diseases	201	273	0.7%	1.0%	5.1	5.7	30.3	147.3	29.0	161.3	0.10	0.13
Glaucoma	0	0	0.0%	0.0%	NA	NA	NA	NA	NA	NA	NA	NA
Cataract	0	0	0.0%	0.0%	NA	NA	NA	NA	NA	NA	NA	NA
Otitis Media	1	1	0.0%	0.0%	0.0	0.0	91.9	2.2	3.2	0.1	0.00	0.00
Other Diseases/Disorders Related to the Sense Organs (Eye & Ear)	1	1	0.0%	0.0%	0.0	0.0	44.3	1.0	34.6	0.5	0.00	0.00
Acute Rheumatic Fever and Chronic Rheumatic Heart Disease	37	44	0.1%	0.2%	1.0	0.9	21.7	19.9	20.9	18.9	0.02	0.02
Hypertensive Diseases	1,036	1,157	3.6%	4.0%	27.0	23.9	20.6	532.9	16.4	379.8	0.46	0.50
Ischemic Heart Diseases	5,837	3,308	20.2%	11.5%	155.4	69.7	16.4	2,502.4	16.7	1,128.2	3.04	1.54
Inflammatory Heart Disease	561	486	1.9%	1.7%	14.5	10.1	23.7	324.2	25.7	253.0	0.25	0.22
Cerebrovascular Disease	2,456	1,760	8.5%	6.1%	65.4	37.3	16.2	1,034.5	15.6	570.4	1.09	0.78
Other Heart Diseases	942	1,371	3.3%	4.8%	24.8	28.9	16.7	397.2	15.2	437.4	0.40	0.61
Diseases of Arteries, Arterioles, and Capillaries	441	291	1.5%	1.0%	11.7	6.1	17.3	197.2	18.9	115.3	0.18	0.13
Diseases of Veins, Lymphatic Vessels, and Lymph Nodes; and Unspecified Disorders of Circulatory System	78	52	0.3%	0.2%	2.0	1.0	29.0	53.2	29.3	29.3	0.04	0.02
Influenza and Pneumonia	902	670	3.1%	2.3%	24.0	14.0	15.2	354.7	16.2	222.7	0.38	0.29
Upper Respiratory Infections	1	3	0.0%	0.0%	0.0	0.1	15.2	0.4	51.6	3.1	0.00	0.00
Other Lower Respiratory Infections	1	8	0.0%	0.0%	0.0	0.2	21.3	0.6	35.3	6.2	0.00	0.01
Chronic Obstructive Pulmonary Disorder	1,177	1,239	4.1%	4.3%	31.8	26.6	17.7	556.8	15.9	413.6	0.50	0.53
Asthma	75	59	0.3%	0.2%	1.9	1.2	25.7	46.9	26.0	30.4	0.04	0.03
Pneumonitis due to Inhalation of Food and Vomit	293	454	1.0%	1.6%	7.8	9.6	14.0	107.7	14.8	138.6	0.12	0.19
Other Respiratory Diseases Principally Affecting the Interstitial	200	273	0.7%	1.0%	5.3	5.9	19.7	102.0	17.1	100.4	0.09	0.12
Other Diseases of the Respiratory System	84	105	0.3%	0.4%	2.2	2.3	21.0	44.1	22.6	51.7	0.04	0.05
Lung Disease Due to other External Agents	4	14	0.0%	0.0%	0.1	0.3	19.1	2.0	23.5	6.4	0.00	0.01
Oral Health Diseases	2	3	0.0%	0.0%	0.1	0.1	11.7	0.6	13.5	1.0	0.00	0.00
Peptic Ulcer Disease	85	69	0.3%	0.2%	2.2	1.4	20.6	44.7	22.6	30.0	0.04	0.03
Diseases of Appendix	6	3	0.0%	0.0%	0.2	0.1	31.1	4.5	20.6	1.3	0.00	0.00
Hernia	23	27	0.1%	0.1%	0.6	0.6	15.4	9.2	19.1	10.8	0.01	0.01
Non-Infective Gastroenteritis and Colitis	34	23	0.1%	0.1%	0.9	0.5	21.4	18.8	18.8	9.2	0.02	0.01
Digestive Vascular Disorders and Intestinal Obstruction without Hernia	162	153	0.6%	0.5%	4.3	3.2	19.2	79.4	17.8	54.9	0.07	0.06
Diverticular Disease of Intestine	41	59	0.1%	0.2%	1.1	1.2	18.6	19.4	14.4	18.1	0.02	0.02
Diseases of the Liver (Non-Alcohol Related)	267	233	0.9%	0.8%	6.6	4.6	32.2	203.8	28.7	127.3	0.13	0.10
Cholelithiasis and other Disorders of the Gallbladder	41	45	0.1%	0.2%	1.1	0.9	15.1	16.7	14.9	13.7	0.02	0.02
Disorders of Biliary Tract and Pancreas	53	54	0.2%	0.2%	1.4	1.1	24.6	31.8	26.6	29.4	0.02	0.03
Other Diseases of the Digestive System	139	171	0.5%	0.6%	3.6	3.6	20.4	70.5	17.7	61.4	0.06	0.07
Skin Diseases	59	55	0.2%	0.2%	1.5	1.1	21.3	31.0	21.7	23.3	0.03	0.02
Rheumatoid Arthritis	33	26	0.1%	0.1%	0.9	0.6	21.3	17.6	17.7	10.0	0.01	0.01
Other Musculo-Skeletal Disorders	166	126	0.6%	0.4%	4.2	2.6	27.8	108.8	24.0	62.2	0.08	0.06
Nephritis, Nephrotic Syndrome, and Nephrosis	252	348	0.9%	1.2%	6.6	7.4	18.7	119.6	17.6	128.0	0.11	0.15
Infections of Kidney	18	7	0.1%	0.0%	0.5	0.1	22.6	9.6	24.5	3.5	0.01	0.00
Urinary Tract Infection	252	173	0.9%	0.6%	6.8	3.7	13.6	91.3	14.7	54.2	0.10	0.07
Hyperplasia of Prostate	11	22	0.0%	0.1%	0.3	0.4	12.6	3.6	10.9	4.9	0.00	0.01
Other Genito-Urinary System Diseases	35	42	0.1%	0.1%	0.9	0.9	24.3	21.6	21.0	17.1	0.02	0.02

Table B-2: Measures of Mortality (continued)

Cause	Deaths 2000-2002	Deaths 2013-2015	% of All Deaths 2000-2002	% of All Deaths 2013-2015	Age- Adjusted Rate 2000-2002	Age- Adjusted Rate 2013-2015	YLL per Death 2000-2002	Age- Adjusted YLL 2000-2002	YLL per Death 2013-2015	Age- Adjusted YLL 2013-2015	PGLE 2000-2002	PGLE 2013-2015
Abortion*	1	0	0.0%	0.0%	0.0	NA	70.1	3.1	NA	NA	0.00	0.00
Complications of Pregnancy, Childbirth, and the Puerperium*	6	12	0.0%	0.0%	0.2	0.5	56.7	13.7	57.2	30.4	0.01	0.02
Perinatal Conditions	157	120	0.5%	0.4%	3.7	2.9	91.9	340.3	91.8	269.7	0.21	0.17
Congenital Malformations, Deformations, and Chromosomal Abnormalities	136	106	0.5%	0.4%	3.2	2.4	74.6	237.3	70.4	174.3	0.15	0.11
SIDS	47	21	0.2%	0.1%	1.1	0.5	91.9	101.9	91.9	47.3	0.06	0.03
Symptoms, Signs, and Abnormal Findings; and Ill-Defined and Unknown Causes (Non-SIDS)	104	146	0.4%	0.5%	2.4	2.9	48.6	110.3	34.2	100.8	0.07	0.08
Road Traffic Accidents	337	287	1.2%	1.0%	7.8	5.9	52.5	394.3	47.4	282.7	0.23	0.18
Other Transport Accidents	44	39	0.2%	0.1%	1.0	0.8	44.0	43.0	42.2	35.1	0.03	0.02
Falls	161	233	0.6%	0.8%	4.2	5.0	22.3	87.8	18.2	88.9	0.07	0.10
Other Non-Transport Accidents	233	230	0.8%	0.8%	5.8	4.8	36.7	201.0	34.6	165.5	0.13	0.12
Intentional Self-Harm (Suicide)	347	454	1.2%	1.6%	8.1	9.3	43.3	334.9	46.0	430.7	0.20	0.27
Assault (Homicide)	368	325	1.3%	1.1%	8.0	6.8	60.2	472.5	59.5	406.0	0.27	0.25
Operations of War and their Sequelae	0	0	0.0%	0.0%	NA	NA	NA	NA	NA	NA	NA	NA
Legal Intervention	6	2	0.0%	0.0%	0.1	0.0	53.2	6.6	51.3	1.8	0.00	0.00
Injuries of Undetermined Intent and their Sequelae	28	9	0.1%	0.0%	0.6	0.2	45.6	28.6	51.9	9.8	0.02	0.01
ICD 10 Code Missing	0	1	0.0%	0.0%	NA	NA	NA	NA	NA	NA	NA	NA

## Appendix C: Leading Causes of Death by Race/Ethnicity

The overall decrease in the number of deaths of Whites and African Americans/Blacks is due mostly to the loss of population between the two time periods. Similarly, the numbers of Hispanics/Latinos and Asians increased in the intervening time, leading to an increase in the number of deaths.

Table C-1: Leading Causes of Death, Asians, 2000-2002

Rank	Cause	Deaths	% Deaths
	Total	3,125	100.0%
1	Ischemic Heart Diseases	567	18.1%
2	Cerebrovascular Disease	341	10.9%
3	Lung/Trachea/Bronchial Cancer	201	6.4%
4	Diabetes Mellitus	108	3.5%
5	Hypertensive Diseases	107	3.4%
6	Influenza and Pneumonia	105	3.4%
7	Chronic Obstructive Pulmonary Disorder	103	3.3%
8	Colorectal Cancer	101	3.2%
9	Liver Cancer	76	2.4%
10	Road Traffic Accidents	75	2.4%

Source: Alameda County vital statistics files, 2000-2002.

Table C-2: Leading Causes of Death, Asians, 2013-2015

Rank	Cause	Deaths	% Deaths
	Total	4,912	100.0%
1	Ischemic Heart Diseases	568	11.6%
2	Cerebrovascular Disease	384	7.8%
3	Lung/Trachea/Bronchial Cancer	347	7.1%
4	Other Degenerative Diseases of the Nervous System (Non-Alcohol Related) and non-Alzheimer's Dementias	237	4.8%
5	Diabetes Mellitus	221	4.5%
6	Alzheimer's Disease	207	4.2%
7	Hypertensive Diseases	193	3.9%
8	Other Heart Diseases	184	3.7%
9	Chronic Obstructive Pulmonary Disorder	163	3.3%
10	Influenza and Pneumonia	135	2.7%

Source: Alameda County vital statistics files, 2013-2015.

For Asians, ischemic heart disease, cerebrovascular disease, and lung/trachea/bronchial cancer are the top three causes of death in 2000-2002 and 2013-2015. In 2013-2015, we see Alzheimer's disease and other degenerative diseases of the nervous system and non-Alzheimer's dementias, as well as influenza and pneumonia, enter the top ten.

Table C-3: Leading Causes of Death, African Americans/Blacks, 2000-2002

Rank	Cause	Deaths	% Deaths
	Total	6,150	100.0%
1	Ischemic Heart Diseases	1,080	17.6%
2	Cerebrovascular Disease	505	8.2%
3	Lung/Trachea/Bronchial Cancer	409	6.7%
4	Hypertensive Diseases	399	6.5%
5	Diabetes Mellitus	254	4.1%
6	Assault (Homicide)	245	4.0%
7	Other Heart Diseases	175	2.8%
8	Chronic Obstructive Pulmonary Disorder	153	2.5%
9	Inflammatory Heart Disease	146	2.4%
10	Colorectal Cancer	128	2.1%

Source: Alameda County vital statistics files, 2000-2002.

Table C-4: Leading Causes of Death, African Americans/Blacks, 2013-2015

Rank	Cause	Deaths	% Deaths
	Total	5,332	100.0%
1	Ischemic Heart Diseases	540	10.1%
2	Cerebrovascular Disease	321	6.0%
3	Hypertensive Diseases	305	5.7%
4	Lung/Trachea/Bronchial Cancer	280	5.3%
5	Other Heart Diseases	245	4.6%
6	Diabetes Mellitus	222	4.2%
7	Chronic Obstructive Pulmonary Disorder	213	4.0%
8	Alzheimer's Disease	212	4.0%
9	Other Degenerative Diseases of the Nervous System (Non-Alcohol Related) and non-Alzheimer's Dementias	207	3.9%
10	Assault (Homicide)	184	3.5%

Source: Alameda County vital statistics files, 2013-2015.

For African Americans/Blacks, diabetes mellitus and assault rank among the top ten in 2000-2002 and 2013-2015. In 2013-2015, Alzheimer's disease and other degenerative diseases of the nervous system and non-Alzheimer's dementias are in the top ten and assault has fallen from number six to number ten.

Table C-5: Leading Causes of Death, Whites, 2000-2002

Rank	Cause	Deaths	% Deaths
	Total	17,050	100.0%
1	Ischemic Heart Diseases	3,759	22.0%
2	Cerebrovascular Disease	1,411	8.3%
3	Lung/Trachea/Bronchial Cancer	1,133	6.6%
4	Chronic Obstructive Pulmonary Disorder	863	5.1%
5	Other Heart Diseases	617	3.6%
6	Influenza and Pneumonia	611	3.6%
7	Hypertensive Diseases	474	2.8%
8	Alzheimer's Disease	469	2.8%
9	Colorectal Cancer	415	2.4%
10	Other Degenerative Diseases of the Nervous System (Non-Alcohol Related) and non-Alzheimer's Dementias	364	2.1%

Source: Alameda County vital statistics files, 2000-2002.

Table C-6: Leading Causes of Death, Whites, 2013-2015

Rank	Cause	Deaths	% Deaths
	Total	14,643	100.0%
1	Ischemic Heart Diseases	1,802	12.3%
2	Alzheimer's Disease	923	6.3%
3	Other Degenerative Diseases of the Nervous System (Non-Alcohol Related) and non-Alzheimer's Dementias	854	5.8%
4	Cerebrovascular Disease	850	5.8%
5	Other Heart Diseases	804	5.5%
6	Chronic Obstructive Pulmonary Disorder	768	5.2%
7	Lung/Trachea/Bronchial Cancer	719	4.9%
8	Hypertensive Diseases	544	3.7%
9	Diabetes Mellitus	395	2.7%
10	Influenza and Pneumonia	356	2.4%

Source: Alameda County vital statistics files, 2013-2015.

For Whites, the percentage and number of deaths from most diseases went down between 2000-2002 and 2013-2015. The exceptions were Alzheimer's disease, other degenerative diseases of the nervous system and non-Alzheimer's dementias, influenza and pneumonia, and diabetes mellitus. The former three are evidence of the aging population.

Table C-7: Leading Causes of Death, Hispanics/Latinos, 2000-2002

Rank	Cause	Deaths	% Deaths
	Total	2,224	100.0%
1	Ischemic Heart Diseases	366	16.5%
2	Cerebrovascular Disease	170	7.6%
3	Diabetes Mellitus	103	4.6%
4	Lung/Trachea/Bronchial Cancer	83	3.7%
5	Road Traffic Accidents	71	3.2%
6	Other Heart Diseases	68	3.1%
7	Alcohol-Attributable Diseases and Disorders	65	2.9%
8	Diseases of the Liver (Non-Alcohol Related)	53	2.4%
9	Influenza and Pneumonia	51	2.3%
10	Hypertensive Diseases	50	2.2%

Source: Alameda County vital statistics files, 2000-2002.

Table C-8: Leading Causes of Death, Hispanics/Latinos, 2013-2015

Rank	Cause	Deaths	% Deaths
	Total	3,001	100.0%
1	Ischemic Heart Diseases	300	10.0%
2	Cerebrovascular Disease	173	5.8%
3	Diabetes Mellitus	136	4.5%
4	Other Degenerative Diseases of the Nervous System (Non-Alcohol Related) and non-Alzheimer's Dementias	119	4.0%
5	Other Heart Diseases	113	3.8%
6	Alcohol-Attributable Diseases and Disorders	110	3.7%
7	Alzheimer's Disease	106	3.5%
8	Hypertensive Diseases	93	3.1%
9	Lung/Trachea/Bronchial Cancer	89	3.0%
10	Assault (Homicide)	73	2.4%

Source: Alameda County vital statistics files, 2013-2015.

For Hispanics/Latinos, as with other groups, ischemic heart diseases and cerebrovascular disease are the top two causes of death in 2000-2002 and 2013-2015. Unlike others, diabetes mellitus is number three in each period. In 2013-2015, other degenerative diseases of the nervous system and non-Alzheimer's dementias and Alzheimer's disease—again, evidence of the aging population—and assault enter the top ten.

# Appendix D: Leading Causes of Death by Age Group

The four age groups chosen for this summary are <1 year (infants), 1-14 years, 15-24 years, 25-59 years, and 60+ years. These tables are limited to five deaths or more in any group, and limited to a maximum of ten causes of death.

One important factor to look at is that the age structure of the county changed significantly between the two time periods, as shown in Table D-1 below. For example, while the number of infant deaths decreased by 26.9% between 2002-2002 and 2013-2015, the number of infants declined 4.1%; thus, infant mortality decreased during this time. Also significant are the comparative changes in those 1-14 years and 60+ years.

Table D-1: Alameda County Change in Age and Deaths by Age

	Age Group	Total	<1	1-14	15-24	25-59	60+
Population	2001	1,465,564	19,535	281,115	196,761	764,821	203,332
	2014	1,580,083	18,731	276,576	213,017	781,560	290,199
	% Change	7.8%	-4.1%	-1.6%	8.3%	2.2%	42.7%
Deaths	2000-2002	28,907	323	141	350	5,569	22,524
	2013-2015	28,646	236	73	360	4,806	23,171
	% Change	-0.9%	-26.9%	-48.2%	2.9%	-13.7%	2.9%

Table D-2: Leading Causes of Death, <1 Year, 2000-2002

Rank	Cause	Deaths	% Deaths
	Total	323	100.0%
1	Perinatal Conditions	157	48.6%
2	Congenital Malformations, Deformations, and Chromosomal Abnormalities	76	23.5%
3	SIDS	47	14.6%
4	Symptoms, Signs, and Abnormal Findings; and Ill-Defined and Unknown Causes (Non-SIDS)	5	1.5%
4	Digestive Vascular Disorders and Intestinal Obstruction without Hernia	5	1.5%

Source: Alameda County vital statistics files, 2000-2002.

Leading causes in each time period for infants less than one year old were led by perinatal conditions; congenital malformations, deformations, and chromosomal abnormalities; and SIDS. The number and percentage of SIDS deaths decreased between the two time periods. Factoring in the change in the numbers of infants, overall <1 year mortality decreased from 16.5/1,000 population in 2000-2002 to 12.6/1,000 population in 2013-2015, a 23.8% decrease.

Table D-3: Leading Causes of Death, <1 Year, 2013-2015

Rank	Cause	Deaths	% Deaths
	Total	236	100.0%
1	Perinatal Conditions	119	50.4%
2	Congenital Malformations, Deformations, and Chromosomal Abnormalities	56	23.7%
3	SIDS	21	8.9%
4	Symptoms, Signs, and Abnormal Findings; and Ill-Defined and Unknown Causes (Non-SIDS)	6	2.5%

Source: Alameda County vital statistics files, 2013-2015.

Table D-4: Leading Causes of Death, 1-14 Years, 2000-2002

Rank	Cause	Deaths	% Deaths
	Total	141	100.0%
1	Road Traffic Accidents	23	16.3%
2	Congenital Malformations, Deformations, and Chromosomal Abnormalities	15	10.6%
3	Non-Transport Accidents	15	10.6%
4	Leukemia	8	5.7%
5	Cancer of Meninges, Brain, and other parts of CNS	8	5.7%
6	Other Neuro-Psychiatric Diseases	7	5.0%
7	Blood/Immune Diseases	5	3.5%

Source: Alameda County vital statistics files, 2000-2002.

Table D-5: Leading Causes of Death, 1-14 Years, 2013-2015

Rank	Cause	Deaths	% Deaths
	Total	73	100.0%
1	Congenital Malformations, Deformations, and Chromosomal Abnormalities	8	11.0%
2	Non-Transport Accidents	7	9.6%
3	Road Traffic Accidents	6	8.2%
4	Leukemia	5	6.8%

Source: Alameda County vital statistics files, 2013-2015.

In the 1-14 age group in 2013-2015, congenital malformations, deformations, and chromosomal abnormalities were the leading cause of death, followed by non-transport accidents. Road traffic accidents decreased from 23 deaths and 16.3% of all deaths to only six deaths and 8.2%. There were far fewer deaths in the age group in 2013-2015 than in 2000-2002. Including the decrease in population, the death rate decreased 47.4% for this group between the two time periods.



Table D-6: Leading Causes of Death, 15-24 Years, 2000-2002

Rank	Cause	Deaths	% Deaths
	Total	350	100.0%
1	Assault (Homicide)	124	35.4%
2	Road Traffic Accidents	76	21.7%
3	Intentional Self-Harm (Suicide)	27	7.7%
4	Non-Transport Accidents	20	5.7%
5	Symptoms, Signs, and Abnormal Findings; and Ill-Defined and Unknown Causes (Non-SIDS)	11	3.1%
6	Leukemia	10	2.9%
7	Drug Use Disorders	9	2.6%
8	Congenital Malformations, Deformations, and Chromosomal Abnormalities	6	1.7%
9	Other Neuro-Psychiatric Diseases	5	1.4%
9	Lymphoma and Multiple Myeloma	5	1.4%
9	Other Musculo-Skeletal Disorders	5	1.4%

Source: Alameda County vital statistics files, 2000-2002.

Table D-7: Leading Causes of Death, 15-24 Years, 2013-2015

Rank	Cause	Deaths	% Deaths
	Total	360	100.0%
1	Assault (Homicide)	133	36.9%
2	Intentional Self-Harm (Suicide)	58	16.1%
3	Road Traffic Accidents	48	13.3%
4	Drug Use Disorders	25	6.9%
5	Non-Transport Accidents	11	3.1%
6	Other Neuro-Psychiatric Diseases	10	2.8%
7	Symptoms, Signs, and Abnormal Findings; and Ill-Defined and Unknown Causes (Non-SIDS)	6	1.7%
8	Inflammatory Heart Disease	5	1.4%
8	Falls	5	1.4%

Source: Alameda County vital statistics files, 2013-2015.

Homicide was the leading cause of death for those 15-24 years in both time periods. In 2013-2015, homicide was followed by suicide, road traffic accidents, drug use disorders, and non-transport accidents. Suicide increased from 27 deaths and 7.7% of all deaths in 2000-2002 to 58 deaths and 16.1% of deaths in 2013-2015. Drug use disorders saw an increase from nine deaths and 2.6% of all in 2000-2002 to 25 deaths and 6.9% of deaths in 2013-2015.

Table D-8: Leading Causes of Death, 25-59 Years, 2000-2002

Rank	Cause	Deaths	% Deaths
	Total	5,569	100.0%
1	Ischemic Heart Diseases	573	10.3%
2	Lung/Trachea/Bronchial Cancer	335	6.0%
3	Drug Use Disorders	299	5.4%
4	Breast Cancer	244	4.4%
5	Alcohol-Attributable Diseases and Disorders	237	4.3%
6	Assault (Homicide)	227	4.1%
7	Cerebrovascular Disease	219	3.9%
8	Intentional Self-Harm (Suicide)	216	3.9%
9	Hypertensive Diseases	214	3.8%
10	HIV	190	3.4%

Source: Alameda County vital statistics files, 2000-2002.

Table D-9: Leading Causes of Death, 25-59 Years, 2013-2015

Rank	Cause	Deaths	% Deaths
	Total	4,806	100.0%
1	Drug Use Disorders	356	7.4%
2	Ischemic Heart Diseases	339	7.1%
3	Alcohol-Attributable Diseases and Disorders	289	6.0%
4	Intentional Self-Harm (Suicide)	282	5.9%
5	Lung/Trachea/Bronchial Cancer	197	4.1%
6	Diabetes Mellitus	175	3.6%
7	Assault (Homicide)	162	3.4%
8	Cerebrovascular Disease	159	3.3%
9	Road Traffic Accidents	157	3.3%
10	Breast Cancer	151	3.1%

Source: Alameda County vital statistics files, 2013-2015.

For those 25-59 years, drug use disorders increased from the third-leading cause (299 deaths and 5.4% of all deaths) in 2000-2002 to the first-leading cause (356 deaths and 7.4%) in 2013-2015. Ischemic heart diseases came in second in 2013-2015, followed by alcohol-attributable diseases and disorders, suicide, and lung/trachea/bronchial cancer. Of those, alcohol-attributable diseases and disorders saw the largest gain in percentage, from 4.3% of deaths in 2000-2002 to 6.0% in 2013-2015.

Table D-10: Leading Causes of Death, 60+ Years, 2000-2002

Rank	Cause	Deaths	% Deaths
	Total	22,524	100.0%
1	Ischemic Heart Diseases	5,263	23.4%
2	Cerebrovascular Disease	2,228	9.9%
3	Lung/Trachea/Bronchial Cancer	1,506	6.7%
4	Chronic Obstructive Pulmonary Disorder	1,098	4.9%
5	Other Heart Diseases	828	3.7%
6	Influenza and Pneumonia	823	3.7%
7	Hypertensive Diseases	820	3.6%
8	Diabetes Mellitus	668	3.0%
9	Alzheimer's Disease	604	2.7%
10	Colorectal Cancer	555	2.5%

Source: Alameda County vital statistics files, 2000-2002.

Table D-11: Leading Causes of Death, 60+ Years, 2013-2015

Rank	Cause	Deaths	% Deaths
	Total	23,171	100.0%
1	Ischemic Heart Diseases	2,968	12.8%
2	Cerebrovascular Disease	1,596	6.9%
3	Alzheimer's Disease	1,466	6.3%
4	Other Degenerative Diseases of the Nervous System (Non-Alcohol Related) and non-Alzheimer's Dementias	1,431	6.2%
5	Lung/Trachea/Bronchial Cancer	1,270	5.5%
6	Other Heart Diseases	1,236	5.3%
7	Chronic Obstructive Pulmonary Disorder	1,168	5.0%
8	Hypertensive Diseases	1,006	4.3%
9	Diabetes Mellitus	837	3.6%
10	Influenza and Pneumonia	596	2.6%

Source: Alameda County vital statistics files, 2013-2015.

Ischemic heart disease and cerebrovascular disease were the top two leading causes of death for those 60+ years in both 2000-2002 and 2013-2015. Alzheimer's disease was third in 2013-2015, up from ninth in 2000-2002. Similarly, other degenerative diseases of the nervous system and non-Alzheimer's dementias was fourth in 2013-2015, from not in the top ten in 2000-2002. These are evidence of the aging population. While this population grew significantly, 42.7%, the number of deaths increased only 2.9%. Thus, the age-specific death rate decreased 27.9% between 2000-2002 and 2013-2015.