CHAPTER 3

# Life Expectancy in California's Diverse Population: Recent Estimates by Race/Ethnicity and Neighborhood Social Class

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## INTRODUCTION

In the current economic downturn, scholars, journalists and lawmakers are paying close attention to the impact of increasing life expectancy on defined-benefit pension and health care programs including Social Security and Medicare. The age for full Social Security benefits has already been raised to 67 and policymakers are debating whether age at eligibility for entitlements should be raised even further for younger workers. The justification for raising the age at eligibility relates largely to recent improvements in life expectancy, particularly among working-age adults. However, life expectancy differs widely across population subgroups defined by race and social class; further, disparities between some groups have been widening over time. Accounting for life expectancy differentials among population subgroups is important to accurate projection of future retirement policy for Californians, one of the most diverse populations in the United States with respect to race, ethnicity, immigration, education, and wealth. **Table 3.1** shows this diversity as reflected in the 2000 US Census. This article reviews existing research on differences in life expectancies by population groups in the United States (US) and presents detailed life expectancy estimates for the California population according to four important dimensions: age, sex, race/ethnicity, and socioeconomic status (SES).

## 1. BACKGROUND

### Historical Trends

The twentieth century in the US has been characterized by a vast improvement in life expectancy and years of healthy life lived. A male born in 2010 could expect to live on average 25.7 years longer than a male born in 1910, from 49.9 to 75.6 years of age. Moreover, while historic gains in life expectancy were made through improvements in infant mortality, the second half of the twentieth century marked a shift towards improvements in working age and older ages (Cutler, Rosen, & Vijan, 2006; Lichtenberg, 2004).

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**Table 3.1**

**Detailed California Population Characteristics, 2000 and 2010**

| | 2000 | | 2010 | |
|---|---|---|---|---|
| ***Total Population*** | ***33,871,648*** | ***100.0*** | ***37,253,956*** | ***100.0*** |
| **Sex** | | | | |
| Male | 16,874,892 | 49.8 | 18,517,830 | 49.7 |
| Female | 16,996,756 | 50.2 | 18,736,126 | 50.3 |
| **Age** | | | | |
| Under 19 years | 10,234,571 | 30.1 | 10,452,042 | 28.1 |
| 20 to 34 years | 7,610,350 | 22.4 | 8,083,826 | 21.7 |
| 35 to 44 years | 5,485,341 | 16.2 | 5,182,710 | 13.9 |
| 45 to 54 years | 4,331,635 | 12.8 | 5,252,371 | 14.1 |
| 55 to 59 years | 1,467,252 | 4.3 | 2,204,296 | 5.9 |
| 60 to 64 years | 1,146,841 | 3.4 | 1,832,197 | 4.9 |
| 65 to 74 years | 1,887,823 | 5.6 | 2,275,336 | 6.1 |
| 75 to 84 years | 1,282,178 | 3.8 | 1,370,210 | 3.7 |
| 85 years and over | 425,657 | 1.3 | 600,968 | 1.6 |
| **Race** | | | | |
| One race specified | 32,264,002 | 95.3 | 35,438,572 | 95.1 |
| White | 20,170,059 | 59.5 | 21,453,934 | 57.6 |
| Black or African American | 2,263,882 | 6.7 | 2,299,072 | 6.2 |
| Asian | 3,697,513 | 10.9 | 4,861,007 | 13.0 |
| Other single race | 6,132,548 | 18.1 | 6,824,559 | 18.3 |
| Two or more races | 1,607,646 | 4.7 | 1,815,384 | 4.9 |
| **Hispanic Ethnicity** | | | | |
| Hispanic or Latino (of any race) | 10,966,556 | 32.4 | 14,013,719 | 37.6 |
| Not Hispanic or Latino | 22,905,092 | 67.6 | 23,240,237 | 62.4 |
| White alone | 15,816,790 | 46.7 | * | * |
| ***Total Population age 25 years and over*** | ***21,298,900*** | ***100.0*** | * | * |
| **Educational Attainment** | | | | |
| Less than 9th grade | 2,446,324 | 11.5 | * | * |
| 9th to 12th grade, no diploma | 2,496,419 | 11.7 | * | * |
| High school graduate (includes equivalency) | 4,288,452 | 20.1 | * | * |
| Some college, no degree | 4,879,336 | 22.9 | * | * |
| Associate degree | 1,518,403 | 7.1 | * | * |
| Bachelor's degree | 3,640,157 | 17.1 | * | * |
| Graduate or professional degree | 2,029,809 | 9.5 | * | * |

* 2010 US Census data not yet available at time of publication

Source: U.S. Census Bureau, Census 2000 Summary File 1, Matrices P1, P3, P4, P8, P9, P12, P13, P,17, P18, P19, P20, P23, P27, P28, P33, PCT5, PCT8, PCT11, PCT15, H1, H3, H4, H5, H11, and H12. 2010 Census Summary File 1, Tables P5, P8, PCT4, PCT5, PCT8, P12, P13,PCT11 and PCT12.

However, life expectancy at birth in the US is lower than most parts of Western Europe and other parts of the industrialized world. In addition, variability in the age at death seems to be greater in the US than in other economically developed nations (Wilmoth & Horiuchi, 1999). It has long been recognized that persons of lower socioeconomic status (SES) have higher mortality in the US (Kitagawa & Hauser, 1973). Socioeconomic differences in mortality, however, are likely confounded by race, ethnicity, gender, and even geography. Moreover, it is likely that each of these factors have complex influences on life expectancy, exerting independent but also compounding effects.

## Understanding Life Expectancy in Sociodemographic Subgroups

In the US, it is difficult to routinely monitor life expectancy according to certain sociodemographic characteristics like race/ethnicity and SES because they require two disparately collected sources of data (death certificates and population estimations) categorized uniformly with the same measure. It is also complicated because the very concepts of race/ethnicity and social class can be nebulous in the US. Different administrative or health data resources may not categorize race and ethnicity uniformly, especially with respect to persons of multi-racial background. These same data resources may not collect social class indicators and there is no universal consensus on how to measure them anyway. Thus, varying methodologies have been adopted by prior studies exploring racial and socioeconomic differences in life expectancy. Moreover, the compounding effects of various dimensions of SES with race, region, and other factors may make it difficult to correctly model and interpret estimates. Despite these complications, researchers have reported on persistent gaps in mortality between sociodemographic groups in the United States.

### *Race*

Race is perhaps the most frequently studied demographic factor with respect to life expectancy and mortality. Large mortality differentials have been well-studied between Black and White populations in the United States in prior decades, although there is suggestive evidence that these gaps have been shrinking. National life tables show a difference in life expectancy at birth of 8.3 years between Blacks and Whites around 1950, which dropped to 6.9 years around 1990. Still, that gap remains when life expectancy is measured for adults; at age 30, the Black-White difference in life expectancy fell more modestly, from 5.9 years around 1950 to 5.6 years around 1990 (Wilmoth & Dennis, 2006).

Existing studies do not agree on the question of whether Black-White mortality differences can be explained by variation in SES. Some authors (Lantz et al., 1998; Menchik, 1993) report that excess mortality among Blacks disappears after taking account of differences in SES. On the other hand, some studies with larger samples (Hummer, Rogers, Nam, & LeClere, 1999; Rogers, 1992; Sorlie, Rogot, Anderson, Johnson, & Backlund, 1992; Sorlie, Backlund, & Keller, 1995) found that Blacks have a statistically significant mortality disadvantage even after controlling for SES. This ambiguity is in part due to differing effects of SES and race across causes of death; Black-White mortality differentials for homicide and some forms of cancer can be explained largely by differences in SES while for others, including cardiovascular disease, the most common cause of death, disparities still persist.

Reliable information on mortality rates among Hispanic and Asian populations is available only since 1990; there have been a handful of studies suggesting lower relative mortality (Barringer, Gardner, & Levin, 1993; Liao et al., 1998; Sorlie, Backlund, Johnson, & Rogot, 1993). Relative mortality estimates for Native Americans are still difficult to obtain (Snipp, 1997; Young, 1997). The mortality difference between Hispanics and non-Hispanics is especially intriguing because Hispanics in the United States have low levels of mortality in spite of their socioeconomic disadvantage, a phenomenon that has been called "an epidemiological paradox" (Markides & Coreil, 1986). This advantage is most pronounced at middle and older ages (Sorlie et al., 1993). Mortality among Asian and Pacific Islander populations, generally classified into a single "Asian/Pacific Islander" grouping, is generally lower than among any other group (Barringer et al., 1993; Gardner, 1980; Hummer et al., 1999; R. G. Rogers, Hummer, & Nam, 2000). This advantage has been observed across all adult age groups and for all major categories of cause of death. Still, there is considerable nativity and SES diversity among Asian sub-populations that are hidden by grouping them together.

### *Education and income*

Ever since a seminal study by Kitagawa and Hauser (1973), showing differences of 4 (women) to 6 (men) years of life expectancy at age 25 between persons with the highest and lowest levels of education, studies of mortality differentials in the US have favored the use of educational attainment as the primary indicator of social class. A number of studies conclude that in the last four decades, educational differences in mortality have been increasing and widening (Feldman, Makuc, Kleinman, & Cornoni-Huntley, 1989; Pappas, Queen, Hadden, & Fisher, 1993; Rogot, Sorlie, Johnson, & Schmitt, 1992). Some studies suggest a widening for adult males but a narrowing for females (Preston & Elo, 1995; Rogot et al., 1992), and estimates of the comparable differences between low and high education levels range from 2 years to a remarkable 7.6 years of added life from birth.

Duleep (1989) used records from the Social Security Administration (CPS-SSA) to compare relative mortality differences by income during 1973–1978 and found that the relative mortality differences by income had widened over the period. Pappas et al. (1993) also concluded that relative mortality differences by income widened between 1960 and 1986 for all major population subgroups (race, sex, etc.). Schalick et al. (2000) showed similar results using data from 1967 and 1986. Their findings show that, using a relative measure of inequality, mortality differences have increased.

Measures of healthy life expectancy, calculated as the number of remaining years of life free of disability or major illness, reveal even starker differences among educational levels. Differentials between 1970 and 1990 for those with high and low education are large and widening for Black men and women and White men (Crimmins & Saito, 2001; Geronimus, Bound, & Waidmann, 1999). For White men, for example, healthy life expectancy at young adult ages (24–45 years old) are up to 200 percent higher for college graduates than those with only a high school diploma.

### *Residential context*

It is well established that the risk of death is related to the socioeconomic and racial/ethnic characteristics of individuals, but it is also argued that community features (e.g., built environment) have a direct impact on the health and mortality of individuals residing in that community (Wilmoth & Dennis, 2006). A number of studies spanning the period 1960 to 1990 demonstrate a consistent mortality advantage to rural areas (Kitagawa & Hauser, 1973; Smith, Anderson, Bradham, & Longino, 1995), with estimates that rural residents have death rates 5–9% lower than urbanites.

The interaction between poverty, race and geography is well documented by Geronomus et al. (1999) who found that poor Blacks in the rural South display a much smaller mortality disadvantage compared to poor Blacks in the urban North at comparable levels of socioeconomic status. These findings also highlight that variation in life expectancy exists by urbanity and also by region as separate and independent factors. Moreover, the excess mortality of these poor communities is explained little by the widely publicized causes of homicide and AIDS, but rather by higher levels of chronic disease, especially cardiovascular disease.

### *Studies using area-based measures of socioeconomic status*

Death certificates are filled out by physicians at the time of death and generally do not include detailed individual level race/ethnicity, income, education or other measures of SES. However, residential address at death is a common, uniform data item that can be linked to U.S. Census data regarding neighborhood SES. Depending on the geographic granularity of the Census data available for the time period in question, larger areas like counties or smaller areas like census tracts (averaging 4,000 persons) or census block groups (average size 1,500 persons) can be used to define the area-level measure. One caveat in using area-level measures is that in the absence of individual-level measures of SES, they represent a mix of individual-level and contextual influences that are not easy to disentangle.

Singh and Siahpush (2006) used a deprivation index consisting of 11 education, occupation, wealth, income distribution, unemployment, poverty, and housing quality indicators to assign SES to all U.S. counties. They found that those in less-deprived counties experienced a longer life expectancy at each age than their counterparts in more-deprived groups, and importantly, that the gap widened over their study time frame. In 1980–82, the overall life expectancy at birth was 2.8 years longer for the least-deprived group than for the most-deprived group. By 1998–2000, the absolute difference in life expectancy at birth had increased to 4.5 years. In another novel approach, Murray, Kulkarni, and Ezzati (2006) divided the US population into eight distinct groups based on race, income and county characteristics, calling them the "Eight Americas." They found that life expectancy for males in the lowest status group was 21 years lower than life expectancy for females in the highest status group. Kulkarni et al. (2011) updated these county-based studies by estimating life expectancies by age, sex and county for the U.S. from 2000 to 2007 and found that the gap in life expectancy remained relatively unchanged, at 20.1 years between the highest and lowest groups in the US.

Using a similar methodology, we (Clarke et al., 2010) assigned a smaller, census block group-based SES index measure to all deaths occurring in California during a three year period (1999–2001) and found a 19.6 year gap in life expectancy between the socioeconomic groups with the longest life expectancy and the shortest. We also clearly showed that race/ethnicity and neighborhood SES had independent influences on mortality in California's diverse population.

Overall, our review of the existing work addressing sociodemographic differences in life expectancy confirms that life expectancy and mortality differentials for demographic sub-groups of the US population are substantial and may be growing. Still, data limitations and methodological differences make precise estimates difficult to compare across studies. Newer methodologies such as those based on residential attributes provide a promising way to bridge the gap between disparate data sources. Using such a methodology, we present detailed estimates of life expectancy for Californians according to race, age and neighborhood-specific SES.

## 2. METHODS

Our methods were originally developed to examine SES differentials in the occurrence of cancer in California (Clarke, Glaser, Keegan, & Stroup, 2005; Parikh-Patel, Bates, & Campleman, 2006; Yost, Perkins, Cohen, Morris, & Wright, 2001), but they also allowed us to calculate neighborhood-specific death and life expectancy rates, on which we have reported previously from a health disparities standpoint (Clarke et al., 2010). These rates thereby represent a snapshot of the life expectancy experience of the entire California population, and as such, do not capture the life expectancy experience of a single birth cohort in California. Furthermore, they may underestimate the experience of the workforce.

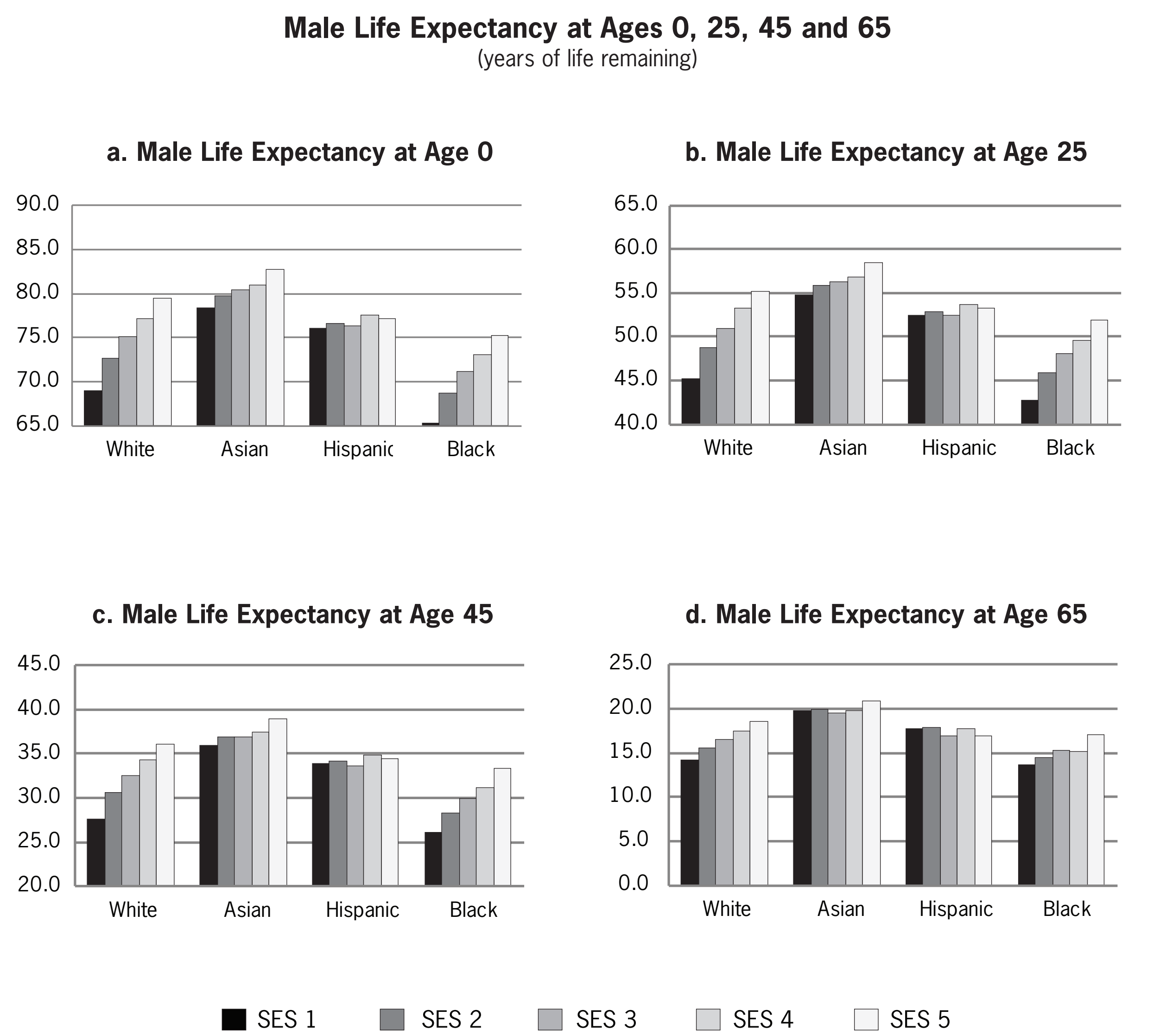
In brief, our method required detailed, neighborhood-level data from the California Department of Health Services and the US Census Bureau. From the former, we obtained data for all 689,036 deaths recorded in California during the 3-year period January 1, 1999 to December 31, 2001 (one year before and after the 2000 US census). We defined mutually exclusive racial/ethnic groups for analysis as Hispanic (regardless of race), Asian/Pacific Islander, Black, and White. Each decedent's residential address was geocoded to one of the 21,920 US Census Bureau-defined census block groups in California and assigned to each of these block groups an SES index derived by Yost et al. (2001) from principal components analysis of seven census data items: education level, proportion with a working-class job, proportion unemployed, median household income, proportion below 200% of poverty threshold, median rent, and median home value. From the 2000 US Census, we obtained population counts for each California block group by age, sex, and racial/ethnic classification and estimated block-group populations for racial/ethnic categories comparable to the death certificate data. Finally, we calculated mortality rates and life tables (Oreglia, 1981) for groups defined by age, sex, race/ethnicity and neighborhood SES quintiles. A detailed description of our method is available in the **Appendix**.

## 3. RESULTS

**Figures 3.1 and 3.2** show life expectancy estimates at different ages (birth, ages 25, 45, and 65) for diverse populations in California, confirming substantial variation across age, sex, race/ethnicity, and neighborhood SES. For males, life expectancy at birth ranged over 17 years, from 65.3 years for Black males living in the lowest 20% of neighborhoods categorized by SES up to 82.7 years for Asian males living in the highest 20% of neighborhoods. For females, life expectancy at birth ranged 12 years from a low of 72.8 for Black women in the poorest neighborhoods to 84.9 for Asian women in the third (middle) and fourth 20% of neighborhoods. **Tables 3.2 and 3.3** summarize life expectancy estimates for ages 45 and 65 with associated 95% confidence intervals indicating their statistical stability.

Several important patterns are apparent from the data shown in these figures. First, as is well-recognized, females had higher life expectancy at birth than males even when matched for

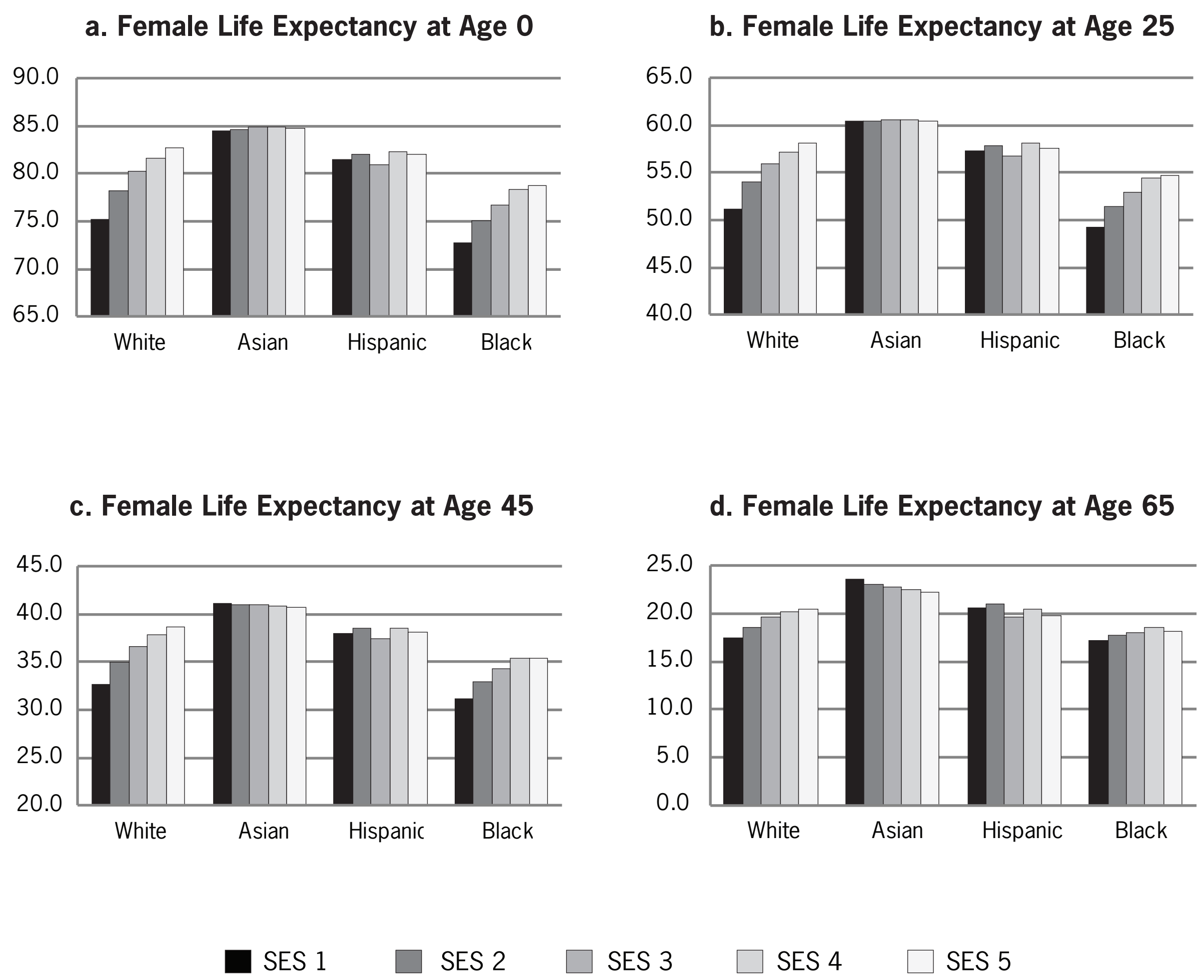
Figure 3.1




race/ethnicity and neighborhood SES, 2–8 more years than their male counterparts. By age 65, this difference decreased to 1–4 years. Second, the influence of neighborhood SES on life expectancy varied among racial/ethnic groups. It was an important mediator of life expectancy among Whites and Blacks, and to some extent Asian males at early ages, but had minimal influence among Hispanics and Asian women. SES differentials in life expectancy among Whites and Blacks were clearly more pronounced at birth and in youth, but still marked at retirement age. Third, Asians had the highest and Blacks had the lowest life expectancy when matched for sex and neighborhood SES, generally a difference of 5–7 years. Life expectancy at birth exceeded 80 years for all Asian and Hispanic women regardless of socioeconomic ranking, and White women and Asian men living in higher SES neighborhoods.

**Figure 3.2**

**Female Life Expectancy at Ages 0, 25, 45 and 65**
(years of life remaining)




Looking in more detail at life expectancy at 65, currently the normative retirement age, Figures 3.1d and 3.2d show that the group with the highest life expectancy, Asian women living in the lowest quintile of neighborhoods ranked by SES (23.6 years), had nearly 4 more years of life expected than men in the same group (19.8 years) and 10 years more than that of the group with the lowest life expectancy, Black males living in the lowest 20% of SES neighborhoods (13.6 years). Among Whites and Black males, SES remained an important predictor of life expectancy, with 3–4 years of difference between the lowest and highest categories of neighborhoods. However, race/ethnicity was a more profound discriminator of life expectancy, with differences of about 4-6 years between most Black and Asian groups, matched for sex and neighborhood SES.

**Table 3.2**

**Life Expectancy at Age 45 by Sex, Race/Ethnicity, and Socioeconomic Status (SES)**

| Population Group | Neighborhood SES Quintile | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 (lowest) | | 2 | | 3 | | 4 | | 5 (highest) | | Overall | |
| | $e_0$ | *(95% ci)* | $e_0$ | *(95% ci)* | $e_0$ | *(95% ci)* | $e_0$ | *(95% ci)* | $e_0$ | *(95% ci)* | $e_0$ | *(95% ci)* |
| **Males** | | | | | | | | | | | 33.5 | *(33.4,33.6)* |
| White | 27.6 | *(27.4,27.8)* | 30.6 | *(30.5,30.7)* | 32.5 | *(32.4,32.6)* | 34.3 | *(34.2,34.4)* | 36.1 | *(36.0,36.2)* | 33.2 | *(33.1,33.3)* |
| Asian | 36.0 | *(35.6,36.4)* | 36.9 | *(36.6,37.2)* | 36.9 | *(36.6,37.2)* | 37.5 | *(37.2,37.8)* | 38.9 | *(38.6,39.2)* | 37.5 | *(37.4,37.6)* |
| Hispanic | 33.9 | *(33.7,34.1)* | 34.2 | *(34.0,34.4)* | 33.6 | *(33.4,33.8)* | 34.8 | *(34.5,35.1)* | 34.4 | *(34.0,34.8)* | 34.0 | *(33.9,34.1)* |
| Black | 26.1 | *(25.8,26.4)* | 28.3 | *(27.9,28.7)* | 29.9 | *(29.5,30.3)* | 31.1 | *(30.6,31.6)* | 33.3 | *(32.6,34.0)* | 28.8 | *(28.6,29.0)* |
| **Females** | | | | | | | | | | | 37.3 | *(37.2,37.4)* |
| White | 32.7 | *(32.5,32.9)* | 35.0 | *(34.9,35.1)* | 36.7 | *(36.6,36.8)* | 37.8 | *(37.7,37.9)* | 38.7 | *(38.6,38.8)* | 36.9 | *(36.8,37.0)* |
| Asian | 41.2 | *(40.8,41.6)* | 41.0 | *(40.7,41.3)* | 41.0 | *(40.7,41.3)* | 40.9 | *(40.7,41.1)* | 40.8 | *(40.6,41.0)* | 41.0 | *(40.9,41.1)* |
| Hispanic | 38.0 | *(37.8,38.2)* | 38.6 | *(38.4,38.8)* | 37.4 | *(37.2, 37.6)* | 38.6 | *(38.3,38.9)* | 38.1 | *(37.8,38.4)* | 38.1 | *(38.0,38.2)* |
| Black | 31.2 | *(30.9,31.5)* | 33.0 | *(32.7,33.3)* | 34.3 | *(33.9,34.7)* | 35.4 | *(34.9,35.9)* | 35.4 | *(34.8,36.0)* | 33.3 | *(33.1,33.5)* |

**Table 3.3**

**Life Expectancy at Age 65 by Sex, Race/Ethnicity, and Socioeconomic Status (SES)**

| Population Group | Neighborhood SES Quintile | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 (lowest) | | 2 | | 3 | | 4 | | 5 (highest) | | Overall | |
| | $e_0$ | *(95% ci)* | $e_0$ | *(95% ci)* | $e_0$ | *(95% ci)* | $e_0$ | *(95% ci)* | $e_0$ | *(95% ci)* | $e_0$ | *(95% ci)* |
| **Males** | | | | | | | | | | | 17.1 | *(17.0,17.2)* |
| White | 14.2 | *(14.0,14.4)* | 15.5 | *(15.4,15.6)* | 16.5 | *(16.4,16.6)* | 17.5 | *(17.4,17.6)* | 18.5 | *(18.4,18.6)* | 16.9 | *(16.8,17.0)* |
| Asian | 19.8 | *(19.4,20.2)* | 19.9 | *(19.6,20.2)* | 19.5 | *(19.2,19.8)* | 19.8 | *(19.5,20.1)* | 20.9 | *(20.6,21.2)* | 20.0 | *(19.9,20.1)* |
| Hispanic | 17.7 | *(17.5,17.9)* | 17.9 | *(17.7,18.1)* | 16.9 | *(16.7,17.1)* | 17.8 | *(17.5,18.1)* | 16.9 | *(16.5,17.3)* | 17.5 | *(17.4,17.6)* |
| Black | 13.6 | *(13.3,13.9)* | 14.4 | *(14.0,14.8)* | 15.3 | *(14.9,15.7)* | 15.2 | *(14.7,15.7)* | 17.0 | *(16.3,17.7)* | 14.6 | *(14.4,14.8)* |
| **Females** | | | | | | | | | | | 19.8 | *(19.7,19.9)* |
| White | 17.5 | *(17.3,17.7)* | 18.6 | *(18.5,18.7)* | 19.6 | *(19.5,19.7)* | 20.2 | *(20.1,20.3)* | 20.4 | *(20.3,20.5)* | 19.6 | *(19.5,19.7)* |
| Asian | 23.6 | *(23.2,24.0)* | 23.0 | *(22.7,23.3)* | 22.8 | *(22.5,23.1)* | 22.5 | *(22.3,22.7)* | 22.2 | *(22.0,22.4)* | 22.8 | *(22.7,22.9)* |
| Hispanic | 20.6 | *(20.4,20.8)* | 21.0 | *(20.8,21.2)* | 19.6 | *(19.4,19.8)* | 20.5 | *(20.2,20.8)* | 19.8 | *(19.5,20.1)* | 20.4 | *(20.3,20.5)* |
| Black | 17.2 | *(16.9,17.5)* | 17.7 | *(17.4,18.0)* | 18.0 | *(17.6,18.4)* | 18.5 | *(18.0,19.0)* | 18.1 | *(17.5,18.7)* | 17.7 | *(17.5,17.9)* |

# 4. DISCUSSION

This broad assessment of life expectancy in the general population of California, to our knowledge the first to consider race/ethnicity and social class simultaneously, suggests several dynamics key to future planning of retirement security. As would be expected in a diverse population, life expectancy varied substantially among groups defined by sex, race, and neighborhood SES, with absolute differences in life expectancy at age 65 varying 10 years between the group with the lowest expectancy of 13.6 years (Black males living in the poorest neighborhoods) and that with the highest expectancy of 23.6 years (Asian women living in the poorest neighborhoods). Thus, sex, race, and SES are important but complex mediators of life expectancy in California and all should be considered in meaningful projections of life expectancy and associated retirement needs.

Among White and Black populations, we observed substantial variation in life expectancy (about 6–10 years) according to our multidimensional measure of neighborhood SES. Notably, this variation declined as populations aged, but nonetheless indicates that neighborhood SES is a meaningful differentiator of health status and life expectancy in these populations. We were not able to remove from these general population estimates those persons who are permanently disabled or otherwise not in the workforce, who may have been disproportionately concentrated in lower SES neighborhoods, which may mean that the SES variation in life expectancy among members of the workforce are less pronounced.

Asian and Hispanic populations, two of the most rapidly growing in California, had some of the highest absolute life expectancy estimates calculated here. Our estimates suggest that Asian and Hispanic women in California born in 2000, regardless of SES group, will live well past age 80, potentially two decades after retirement age. Further work should be done to disentangle the influence of nativity on these absolute estimates, as it is likely an important differentiator of life expectancy. Immigrants tend to be self-selected for their health and resilience, giving them longer life expectancies than their contemporaries in their home countries, and important to death registration, may be more likely to return to their home country (Palloni & Arias, 2004) when ill. The combined effect of these ''immigrate when-healthy'' and ''emigrate-when-sick'' movements may lead to overall inflation of life expectancy calculations for immigrant groups. Thus, it is possible that the life expectancy estimates reported here represent slight overestimates of the true experience of Asian and Hispanic populations in California. As these populations represent an ever-changing mix of foreign-born and US-born populations with varying levels of acculturation, it is also not surprising that neighborhood SES did not meaningfully influence life expectancy in these groups. It would be important to assess life expectancy separately for Asian ethnic groups, including the largest groups of Chinese, Filipino, Japanese, and Korean, and also for Hispanic ethnic subgroups, as these are well-recognized to be heterogeneous with respect to nativity, age at immigration, occupation and other characteristics relevant to both health and retirement.

Our method of using neighborhood information to assign a uniform, area-based metric for SES from existing health and administrative databases has allowed us to detect and measure health and life expectancy disparities among various California subpopulations. This strategy could have represented an important resource for future planning, but unfortunately, the 2010 census did not include a long-form, and thereby did not collect neighborhood information regarding SES or its proxies. Thus, it is uncertain if in the future it will be feasible to update these assessments with more current data.

In this chapter, we reviewed research findings on variations in life expectancy by race and social class as well as widening disparities in life expectancy among some groups. We also analyzed mortality among California residents, finding significant variation in life expectancy by race and neighborhood SES. Variation in life expectancy across diverse populations is substantial at age 65, albeit of a lower magnitude than at birth. Policymakers may wish to take such variation into account in order to understand how the many sociodemographic groups comprising the California population will be differentially affected by retirement age policy.

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## Appendix: Detailed Methodology

We obtained detailed, census block group-level data regarding deaths from the California Department of Health Services and population counts from the US Census Bureau. From the former, we obtained data for all 689,036 deaths recorded in California during the 3-year period January 1, 1999 to December 31, 2001 (one year before and after the 2000 US census). This data contained information regarding the decedents' age, sex, race/ethnicity, causes of death, and residential address at death, but, notably, does not include information about workforce participation. Using the race/ethnicity information, we defined mutually exclusive racial/ethnic groups for analysis: Hispanic (regardless of race), Asian/Pacific Islander, Black, and White. We additionally used a US Census-based Hispanic surname list to reclassify 8,420 (9.6%) additional persons as Hispanic, as Hispanic classification has been shown previously to be underreported on death certificates (Rosenberg, Maurer, Sorlie, Johnson, et al., 1999) and in other health studies, surname lists have improved overall validity of ethnic classifications compared to self-report (Morgan, Wei, & Virnig, 2004; Perez-Stable, Hiatt, Sabogal, & Otero-Sabogal, 1995; Stewart, Swallen, Glaser, Horn-Ross, & West, 1999; Wei, Virnig, John, & Morgan, 2006). Using the residential address information, we geocoded each address to one of the 21,920 US Census Bureau-defined census block groups in California and assigned to each of these block groups an SES index derived previously (Yost et al., 2001) from principal components analysis of seven census data items: education level, proportion with a working-class job, proportion unemployed, median household income, proportion below 200 percent of poverty line, median rent, and median home value. We grouped the indices into SES quintiles based on the statewide distribution. For the 24,613 (3.7%) death certificates which lacked the address detail needed for accurate geocoding, we imputed an SES quintile value through proportional allocation by race/ethnicity within the smallest known geographic area (ZIP code when available, county otherwise). All analyses were repeated to exclude imputed data, and differences were negligible.

From the 2000 US Census, we obtained population counts for each California block group by age, sex, and racial/ethnic classification. Because the death certificate data were based on single race categories, we reclassified the 5% of California residents who reported at least two races into single race categories using the National Center for Health Statistics' county-level bridged-race population estimates for 2000 (National Center for Health Statistics, 2005). Because the US Census Bureau publicly releases block group-level population counts by age and sex for each race separately, for

Hispanics, and for non-Hispanic Whites, but not for non-Hispanic Blacks, non-Hispanic Asians/Pacific Islanders, or non-Hispanic Native Americans, we used a ranking procedure (iterative proportional fitting) (Deming & Stephan, 1940) to estimate these populations by age and sex using the known marginal totals.

Finally, we constructed life tables using mortality rates calculated by age, sex, race/ethnicity and neighborhood SES quintiles. Mortality rates were calculated using average annual deaths over the period 1999 to 2001 divided by the population estimates. Thus, we produced 40 abridged life tables, one for each combination of sex, race/ethnicity, and SES quintile, tabulated using California's Center for Health Statistics methodology (Oreglia, 1981). Our life tables for Blacks, Whites, and Asians/Pacific Islanders were very similar to published tables (Ficenec, 2004; Johnson, 2004), whereas our life expectancy estimates for Hispanics were 1 to 1.5 years lower than published estimates, presumably related to our use of a Hispanic surname list to classify more deaths as Hispanic. We used bootstrap methods to estimate 95 percent confidence intervals (Shao, 1996) for each life expectancy estimate to account for uncertainty due to sample size and the imputation of neighborhood SES for those death certificates that could not be precisely geocoded.

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