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Adult Mortality Among Asian Americans and Pacific Islanders:
A Review of the Evidence

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ABSTRACT

Mortality estimates have consistently pointed to a sizable health advantage for Asian Americans and Pacific Islanders compared to white Americans, but a question remains as to whether mortality estimates for Asian/Pacific Islanders are reliable. This paper presents mortality estimates for Chinese, Japanese, Filipinos, Other Asian and Pacific Islanders, all Asian and Pacific Islanders combined, and for white Americans in 1989-91 based on vital statistics and census data, and for Asian and Pacific Islanders and whites based on the National Longitudinal Mortality Survey. The paper reviews evidence on data quality and discusses possible biases in estimated death rates. It ends with a brief discussion of cause-specific mortality differentials. Relative to whites, Asian and Pacific Islanders are found to have lower mortality at ages 25 and above. Lower death rates from heart disease and cancer among Asian/Pacific Islanders than white Americans account for most of the all cause differentials at ages 45+. Substantial uncertainty remains, however, about the exact level of mortality among Asian Americans and Pacific Islanders residing in the United States.

Introduction

Mortality estimates based on vital statistics and census data have consistently pointed to a sizable health advantage for Asian Americans and Pacific Islanders compared to white Americans. The Census Bureau's estimates of life expectancies at birth for 1995, which are the basis for the Bureau's latest population projections, for example, show life expectancies at birth of 79.3 and 84.9 years for Asian and Pacific Islander males and females respectively compared to 73.6 and 80.1 for white males and females (Day, 1996). The above estimates for Asian and Pacific Islanders place them above those recorded for Japan with the highest documented life expectancies in the world based on good quality data: 76.6 for males and 83.0 for females in 1994 (Japan Aging Research Center, 1996). The question is, of course, whether the U.S. estimates are reliable. Inconsistencies in the coding of race on birth, death, and census records raise serious questions about the reliability of mortality estimates for Asian Americans and Pacific Islanders based on these data sources (Elo and Preston, 1994; McKenney and Bennett, 1994).

This paper reviews and evaluates recent evidence on mortality estimates among Asian Americans and Pacific Islanders in the United States by age, sex, and ethnic origin. The emphasis is on mortality at adult ages in 1989-1991 in comparison to white Americans. Main attention is given to mortality from all causes combined although reference will also be made to cause-specific differentials. Several recent studies have drawn attention to the limited availability of data for the study of health and mortality among Asian Americans and Pacific Islanders, particularly among the many cultural subgroups that make up this population in the United States (e.g., Yu and Liu, 1992; Hahn and Stroup, 1994). The large influx of Asian immigrants since the liberalization of U.S. immigration laws in 1965 has greatly diversified the composition of the Asian and Pacific Islander population in the United States relative to what it was in earlier decades of this century. Due to lack of data on health conditions among the many Asian and Pacific Islander subgroups, however, relatively little is known about the

variability in health conditions among them. The lack of available data also necessarily restricts the scope of this investigation.

I begin by discussing the ethnic and demographic composition of the Asian and Pacific Islander population in the United States and the availability of national-level data for the study of health and mortality among this population subgroup to set the subsequent discussion of mortality in a broader context. I then examine mortality differentials at adult ages among Chinese, Japanese, Filipinos, Other Asian and Pacific Islanders and all Asian and Pacific Islanders combined with reference to white Americans. The availability of data dictates the focus on the above Asian Pacific Islander subgroups. As will become clear from the following discussion, the "Other Asian and Pacific Islander" category is a composite of numerous Asian and Pacific Islander-origin populations whose mortality experience may vary substantially. In the discussion of mortality among Asian and Pacific Islanders I also review issues related to data quality. Here I examine evidence of studies that have investigated the consistency of reporting of race in vital statistics and census data among Asian and Pacific Islanders, including Japanese, Chinese and Filipinos. The focus then shifts to an analysis of mortality among Asian and Pacific Islanders based on linked data files, and I end with a discussion of cause-specific mortality differentials.

Demographic Structure

Asian Americans and Pacific Islanders are the fastest growing racial/ethnic group in the United States. The Asian American population grew by 141% between 1970 and 1980 and by 99% between 1980-1990. Respective figures for the U.S. as a whole were 11% and 9% (Barringer et al., 1993:Table 2.4A). The absolute number of Pacific Islanders, who make up only about 5% of the Asian and Pacific Islander population, increased by 46% between 1970 and 1980 and by 41% between 1980 and 1990 (Barringer et al., 1993:268; U.S. Bureau of the Census, 1992). The rapid growth of Asian Americans and Pacific Islanders is expected to continue well into the 21st century. The Census Bureau's latest

population projections estimate faster growth for this population subgroup than for any other for which separate projections are made. According to the Bureau's medium range projections, the number of Asian Americans and Pacific Islanders will increase by 267.1% between 1995 and 2050 compared to 35.1% and 82.8% projected increases for whites and African Americans, respectively. Only the projected growth of the Hispanic-origin population, estimated at 258.3% between 1995 and 2050, approaches that of Asian Americans and Pacific Islanders (Day, 1996: Table K). According to the Census Bureau's medium range projections, Asian Americans and Pacific Islanders will make up 8.7% of the total U.S. population by 2050, up from 2.9% in 1990 (Day, 1996: Table J; U. S. Bureau of the Census, 1992).

The key factor determining the growth and composition of the Asian and Pacific Islander population in the United States has been and continues to be immigration. It has been estimated, for example, that close to 3.5 million Asian immigrants and refugees entered the United States between 1971 and 1990 (Barringer et al., 1993: Tables 2.1 and 2.3). The continued net inflow of immigrants in the early decades of the 21st century is also the main factor in the Census Bureau's projections discussed above. Shifts in immigrant flows among various Asian countries and the rapid increase in the total number of in-migrants during the last two decades in turn has dramatically changed the composition of the Asian and Pacific Islander population relative to what it was in earlier decades of this century (see Barringer et al., 1993 for a discussion of Asian immigration to the United States).

For most of this century, the Japanese were the largest Asian-origin population representing over half of all Asian Americans as late as 1960 (Barringer et al., 1993:38). By 1980, however, both Chinese and Filipinos had surpassed the size of the Japanese due to the large increase in the number of Chinese and Filipino immigrants following the liberalization of the U.S. immigration laws in 1965, while immigration from Japan during this period has remained modest. By 1990, the Chinese made up about 23% of all Asian Americans and Pacific Islanders, Filipinos 19%, and Japanese only about 12%

(Table 1). The remaining 46% consists of many diverse subgroups, among whom the most prominent are Asian Indians, Koreans, and Vietnamese whose numbers in the U.S. had been relatively small prior to 1970. Others include many relatively small Asian-origin populations, including Cambodians, Hmong, Laotians, Thais, and many others. ¹ Among Pacific Islanders, Hawaiians dominate accounting for about 58% of the total (Table 1). Other groups in this category include relatively small numbers of individuals from Samoa, Guam, Micronesia, and individuals from other islands of the Pacific.

Since net immigration from Asia has been the predominant factor in the growth of the Asian and Pacific Islander population in the U.S., a very large percentage of this population is foreign born compared to other racial and ethnic groups enumerated in the 1990 Census. Over 60% of all Asian Americans and Pacific Islanders were foreign born compared to only 6.3% of the rest of the U.S. population (Table 1; U.S. Bureau of the Census, 1993). The percentage foreign born also varies among the Asian and Pacific Islander subgroups. Among the three largest Asian populations, the Japanese stand out in having a relatively small percentage of their population enumerated as having been born outside the United States in comparison to the Chinese and the Filipinos. Overall 32.4% of the Japanese are foreign born compared to 69.3% of the Chinese and 64.4% of the Filipinos. Among the Japanese, the percentage foreign born seems particularly low at ages 65+; only 17.2% of Japanese Americans in this age range were foreign born in contrast to over 80% and over 90% of the Chinese and the Filipinos, respectively. ² An extremely high proportion of Other Asian Americans is also foreign born, 74.0% overall and over 90% at ages 25 and above (Table 1). In contrast to Asian

¹ According to the 1990 Census, there were, for example, 815,447 Asian Indians, 798,849 Koreans, 614,547 Vietnamese, 147,411 Cambodians, 90,082 Hmong, 149,014 Laotians, and 91,275 Thais living in the United States (U.S. Bureau of the Census, 1992: Table 23).

² This foreign born percentage seems particularly low, but appears consistent with the enumeration in the 1980 Census of Population which shows that at ages 55+ 23.9% of the Japanese population was foreign born (U.S. Bureau of the Census, 1988: Table 30). In 1990, the percentage foreign born is lower at ages 65-84 (12.1%) than 85+ (70.0%) (U.S. Bureau of the Census, 1993).

Americans, the percentage foreign born among Pacific Islanders residing in the U.S. is low, only 13% (Table 1).

The growing heterogeneity of the Asian and Pacific Islander population calls into question the logic of grouping these population subgroups under the rubric of Asian and Pacific Islander. Of all federal data collection agencies, however, only the Census Bureau has substantially changed the way it collects and publishes information for Asian Americans and Pacific Islanders over time. The race question in the 1970 Census, for example, included 9 separate so-called race items, 5 of which pertained to Asian Americans and/or Pacific Islanders, namely Chinese, Filipino, Japanese, Korean, and Hawaiian. Separate tabulations were also published for these population subgroups (U.S. Bureau of the Census, 1973). In the 1980 Census, the race question was expanded to include 15 items, 9 of which pertained to Asian Americans and Pacific Islanders - Japanese, Chinese, Filipino, Korean, Vietnamese, Asian Indian, Hawaiian, Guamanian, and Samoan, with space for write-in responses provided under a category "Other" (U.S. Bureau of the Census, 1983). The 1990 race question was similar to the one included in the 1980 Census, except that an "Other API" category with space for a write-in response was added (U.S. Bureau of the Census, 1992). Separate tabulations in both years were published for 19 Asian- and Pacific-Islander origin populations, namely Chinese, Filipino, Japanese, Korean, Asian Indian, Vietnamese, Laotian, Thai, Cambodian, Pakistani, Indonesian, Hmong, Polynesian, Hawaiian, Samoan, Tongan, Micronesian, Guamanian, and Melanesian (U.S. Bureau of the Census, 1988; 1993).

Other federal agencies for the most part follow the Office of Management and Budget Directive No. 15 that sets standards for the collection of federal statistics and for administrative reporting on race and ethnicity. According to this directive, race must be classified at least into four broad categories - White, Black, American Indian or Alaskan Native, and Asian and Pacific Islander

(Office of Management and Budget, 1978; see also Hahn, 1992).³ This classification is used by the National Center of Health Statistics in its survey programs including the Health Interview Survey and the National Health and Nutrition Examination Survey, two key sources of information on health status and prevalence of selected chronic conditions among the U.S. civilian non-institutionalized population. Because Asian and Pacific Islanders represented only about 2.9% of the entire U.S. population in 1990, routine tabulations of health status or prevalence of chronic conditions even for the Asian and Pacific Islander population as a whole is problematic based on these or other NCHS surveys (see, for example, Yu et al., 1982; Yu and Liu, 1992; 1994).

Only in NCHS vital statistics data is it possible to make some distinctions among Asian Americans and Pacific Islanders. Since 1979 NCHS has published data separately for the three largest Asian American populations, Chinese, Filipino, and Japanese. In some prior years, data were available for Chinese and Japanese. In addition, data are published for one Pacific Islander group, Hawaiian (including part-Hawaiian), with the rest of Asian Americans and Pacific Islanders making up the residual category (National Center for Health Statistics, 1984). In 1992, NCHS expanded the racial detail included in mortality statistics. The new coding scheme expanded the subcategories under Asian and Pacific Islander to include Chinese, Japanese, Hawaiian, Filipino, Asian Indian, Korean, Samoan, Vietnamese, Guamanian, and other (Yu and Liu, 1992). Because intercensal estimates of population are available only for the Asian and Pacific Islander population as a whole (e.g., Hollman, 1993), however, mortality estimates for Asian- and Pacific Islander-origin subgroups are possible only around the time of the Decennial Censuses.

The lack of national-level data on health conditions among Asian and Pacific Islanders has meant that evidence on health conditions among them have mostly come from smaller scale epidemiologic investigations. State- and national-level vital statistics data in turn have provided the

³ Reporting of whether an individual is of Hispanic origin is also required.

basis for mortality estimates (Yu and Liu, 1992; Barringer et al., 1993). Below I examine national-level mortality estimates among Japanese, Chinese, Filipinos, and Other Asian and Pacific Islanders in reference to white Americans around the time of the 1990 Decennial Census.

Mortality Estimates Based on Vital Statistics and Census Data

Data for mortality estimates come from 1989-1991 vital statistics data on deaths and the 1990 Census of Population. Death rates are obtained in a conventional manner using deaths from vital statistics in the numerator and the Census Bureau's estimates of population in the denominator. Information on deaths are obtained from 1989-1991 NCHS Mortality Detailed Files, which differentiate deaths among whites, blacks, American Indians, Chinese, Hawaiians (including part-Hawaiians), Japanese, Filipinos, Other Asian or Pacific Islanders, and "Others" (National Center for Health Statistics, 1992; 1993a; 1993b).⁴ Based on place-of-birth information we further estimate mortality among the foreign born. Because place of birth is not fully reported in the Mortality Detail Files, a range of estimates is shown for the foreign born; first deaths for which place of birth information is missing are assumed to be deaths of the native born and second these deaths are assigned to the foreign born.

The population data for the denominator in the construction of mortality estimates are based on the 1990 Census of Population. The 100% count data are employed in the estimation of mortality for the Asian and Pacific Islander population as a whole and for selected Asian American subgroups in our comparison of their mortality to that of white Americans (U.S. Bureau of the Census, 1992). To

⁴ When more than one race is listed on the death certificate the following rules apply in the classification of the death into a particular racial category. Whenever Hawaiian-origin is indicated on the death certificate, the death is coded as Hawaiian. When a mixture of white and any other race is listed, the death is coded to the relevant nonwhite race. When only nonwhite races are listed, the death is coded to the first race specified. When the race listed on the death certificate is either unknown, not stated, or unclassifiable, these records are assigned as either black or white. In 1989, only 0.2% of death certificates fell into this last category. Both in 1990 and 1991, the respective figure was 0.3% (National Center for Health Statistics, 1993c, 1994a, 1996).

examine mortality among the foreign born Asian and Pacific Islanders, we must rely on population estimates based on sample data from the 1990 Census (U.S. Bureau of the Census, 1993). Data on place of birth are not available from the 100% census count. Although sampling error throws some uncertainty on the exact level of mortality among the foreign born, the size of the error is unlikely to alter the broader conclusions.⁵ Because the Census of Population is taken on April 1, 1990 I have further adjusted the population counts used in the denominator in the construction of mortality rates to July 1, 1990. To make these adjustments I use the ratios of the estimated resident population on July 1, 1990 to that of April 1, 1990 by age group for the entire Asian/Pacific Islander population (Hollman, 1993). Separate estimates for Asian/Pacific Islander subgroups are not available. The population data used in the calculation of death rates have not been adjusted for Census undercount. No estimates of census undercount are available for Asian and Pacific Islanders. The lack of adjustment has the effect of slightly overestimating death rates at younger ages, particularly for males, where the estimated net census undercount rates are the highest (Robinson et al., 1993).⁶

To examine cause-specific mortality differentials among Asian Americans and Pacific Islanders relative to white Americans, age-standardized cause-specific mortality rates were calculated for the three most important causes of death at ages 45 and above, namely diseases of the heart, malignant neoplasms, and cerebrovascular diseases, and for all other causes combined.⁷ Age-

⁵ A comparison of total age-specific death rates, i.e., the native and foreign born combined, based on sample and 100% count data, show differentials in the range of 2-3 percent with somewhat larger differentials for the oldest age group.

⁶ A comparison of the estimated death rates for whites with the 1990 life table estimates reveal that the rates shown here are slightly higher below age 65 and slightly lower at ages 85+ than the 1990 life table rates (National Center for Health Statistics, 1994b). A similar comparison is not possible for the Asian and Pacific Islanders.

⁷ The ICD-9 codes associated with the cause of death categories are the following: diseases of the heart (390-398, 402, 404-429), cerebrovascular diseases (430-438), and malignant neoplasms(140-208). All other causes of death are included in the residual category - all other causes combined (National Center for Health Statistics, 1992, 1993a, 1993b).

standardized death rates are calculated for the age interval 45-84. The standard population used in these calculations is the estimated total U.S. resident population on July 1, 1990 (Hollman, 1993). The death rates shown for the open-ended age interval, 85+, have not been age standardized.

Results

Death rates for white Americans, Chinese, Filipinos, Japanese, other Asian and Pacific Islanders and for the Asian and Pacific Islander population as a whole are shown in Tables 2, 3, and 4 and Figures 1 and 2. Relative to white Americans, mortality among Asian and Pacific Islanders appears to be extremely low. For the group as a whole, the advantage appears greater at younger than at older ages. Estimated death rates for Asian and Pacific Islander males, for example, are less than half of the white rates below age 50. At ages 75+ they are 32-36% below those of white males. The advantage of Asian and Pacific Islander females relative to white females appears to be somewhat less but nevertheless substantial; death rates for Asian and Pacific Islander females are 37-46% below white female rates at ages 25-29 through 80-84; and 29% below the white rates at ages 85+.

As noted above, Asian Americans and Pacific Islanders residing in the United States represent a composite of numerous subpopulations who are likely to have very different health profiles. Some of this potential variability is evident when we examine death rates among the three largest Asian-origin populations relative to all Other Asian and Pacific Islanders combined. According to our tabulations, mortality is lower among the Chinese, Japanese and Filipinos at all, except at the very highest ages, than among Other Asian and Pacific Islanders combined (Tables 2 and 3, and Figures 1 and 2). Little is known about the level of mortality among the many subpopulations that make up the "all other category." The only population in this group for which separate mortality estimates are available is the Hawaiian-origin subgroup. Mortality among Hawaiians has been estimated to be higher than among Japanese, Chinese, and Filipinos. Estimates of life expectancies at birth for 1980 in Hawaii, for example, show life expectancy at birth to be lowest for Hawaiians, 74.0, and highest for Chinese, 80.2,

with intermediate values recorded for Japanese, 79.7, and Filipinos, 78.8 (Barringer et al., 1993: Table 3.5).

Estimates of age-specific death rates for Chinese, Japanese and Filipinos shown in Tables 2 and 3 and Figures 1 and 2 are also well below those of whites. The age-specific rates for Filipino males are 34-59% below white male rates; the respective figures are 36-72% for Chinese males and 37-78% for Japanese males. The figures for females range from 39-55% below white rates for Filipinos, 34-61% for Chinese, and 30-55% for Japanese. The differences in death rates are much smaller among the three Asian subgroups.

Age-specific death rates for the foreign born in most instances are lower than the overall age-specific death rates (Table 4). For the entire Asian and Pacific Islander population, the age-specific death rates for the foreign born are lower than for the group as a whole, except at the oldest ages; the same is true for individuals who fall within the category "Other Asian and Pacific Islander." For Chinese and Filipinos, age-specific death rates for the foreign born are not consistently lower or higher than the overall rates. In general, the differences in overall death rates and those of the foreign born are not large, which is expected given that a very substantial proportion of Other Asian and Pacific Islanders, Chinese and Filipinos are foreign born. The largest fraction of native born individuals are found among the Japanese. A comparison of overall death rates to those of the foreign born among the Japanese show higher mortality among the foreign born women in all but one of the age intervals shown. For Japanese males, the death rates of the foreign born are lower than the overall rates at ages 35-44 through 65-74 and higher at the youngest and the oldest ages. The above conclusions are unaffected by whether deaths for which place of birth is missing are assigned to the native- or the foreign born category.

Estimates of age-specific mortality rates presented here are similar to findings from previous less detailed studies based on vital statistics and census data, except for the foreign born (Yu et al.,

1985; U.S. Department of Health and Human Services, 1985, Figures 6 and 7). Yu et al. (1985), for example, estimated mortality among Chinese, Japanese, and Filipinos in 1979-1981; no sex-specific tabulations were shown. All estimated age-specific rates above age 25, shown for ten-year age intervals, were well below the rates for whites with the estimates for Filipinos showing strikingly low mortality. In addition, state-level studies from California and Hawaii have found mortality to be lower for Japanese and Chinese than for white Americans. In 1960, life expectancies at birth were estimated to be 72.9 for Chinese and 77.9 for Japanese compared to 71.8 for whites. In 1979-81, estimated life expectancy at birth for Japanese and Chinese combined was 82.5 versus 74.9 for whites (Barringer et al., 1993: Table 3.5). Similarly, based on 1980 data from Los Angeles County, estimated age-adjusted mortality rates for Japanese, Chinese, Koreans, Filipinos were all well below those estimated for white Americans, with lowest rates recorded for Filipinos. Japanese had the highest estimated age-adjusted rate among Asian Americans followed by Koreans, Chinese and Filipinos (Frerichs, Chapman, and Maes, 1984).

Mortality estimates for Fiscal Year 1992 for Asian and Pacific Islanders prepared by the Bureau of the Census in conjunction with its population projections from 1993 to 2050 also place Asian and Pacific Islander death rates well below those of whites for both men and women (Day, 1993). In the age range from 25-29 to 80-84, the death rates for Asian/Pacific Islander males are 30-45% below white male rates; for females, the relative advantage ranges from 19-50%, except at ages 35-39 where the Asian and Pacific Islander rate is only 3% below the white rate, an obvious aberration from the general pattern (Bureau of the Census, unpublished tabulations). The Bureau's estimates are also based on vital statistics and census data, although the definition of Asian and Pacific Islanders differs from that used in Tables 2 and 3. For the calculation of age-specific death rates the estimated number of deaths was obtained by subtracting deaths of American Indians, provided by the Indian Health Service, from the deaths of "other races." This procedure was employed because NCHS death data were

available only for whites, blacks and other races for the time period of interest. Thus, deaths of the Asian and Pacific Islander population are a residual category once deaths for whites, African-Americans, and American Indians are excluded (Day, 1993: xxxvii). The denominator data come from the 1990 census with adjustment for net census coverage error using demographic analyses. Despite the differences in methodology, these results are consistent with the results shown here for 1989-1991. As noted previously, the Census Bureau's most recent population projections also show very low mortality among Asian and Pacific Islanders compared to white Americans. Estimated life expectancies at birth for 1995 imply a 5.7 year advantage for Asian and Pacific Islander males relative to white males ($e_0=79.3$ vs $e_0=73.6$) and a 4.8 year advantage for Asian and Pacific Islander females relative to white women ($e_0=84.9$ vs $e_0=80.1$) (Day, 1996:Table B-1).

Yu et al. (1985) also examined mortality among the foreign born Chinese, Filipinos, and Japanese, both sexes combined, with vital statistics and census data from 1979-1981. The authors' findings stand in contrast to those recorded here. Age-adjusted death rates apparently were higher among the foreign than the native born in 1979-81, as were age-specific death rates in all age intervals examined. At ages 25-34 through 65-74, the ratio of age-specific death rates of the foreign born to the native born ranged from 5.78 to 1.50 for Chinese, 4.78 to 1.59 for Japanese, and 2.86 to 0.89 for Filipinos. No estimates are available for Other Asian Pacific Islanders or for the Asian Pacific Islander population as a whole. In Table 4, mortality estimates for the foreign born are contrasted to the overall death rates for Japanese, Chinese and Filipinos. The death rates among the foreign born in 1989-91 for these Asian-origin subgroups do not appear to be consistently lower or higher than the overall age-specific death rates estimated for each of three Asian-origin populations, suggesting that neither are they consistently lower or higher than those of the native born.

What could account for the differences in the results from 1979-81 to 1989-91 is not clear. The higher mortality among foreign born Chinese, Filipinos, and Japanese in 1980 stands in contrast to other

recent studies that have documented lower mortality among the foreign than the native born adults in the United States, most notably among Hispanics (Elo and Preston, 1994; Kestenbaum, 1986, Rosenwaike, 1987). The results from 1990 appear somewhat more consistent with previous studies in this regard. Both sets of estimates, however, may be biased by inconsistencies in the reporting of place of birth in vital statistics and census data. Results from the 1960 Matched Records Study, which linked death certificates registered in May-August 1960 to the 1960 Census of Population, found a tendency for individuals described as foreign born on death records to be enumerated as native born in the 1960 Census. This tendency had the effect of overestimating mortality among the foreign born relative to the native born (Kitagawa and Hauser, 1973). It is thus possible that estimates of mortality among the foreign born Chinese, Filipinos, Japanese and other Asian and Pacific Islanders are similarly biased. It is also possible that the degree of discrepancy in reporting of place of birth in vital statistics and census data has changed over time, which could lead to the above differences in estimated mortality among foreign born Chinese, Japanese and Filipinos in 1980 and 1990. Alternatively, changes in the health status of Chinese, Japanese, and Filipino immigrants over time could be partly responsible. Without further detail it is impossible to know the reasons for these differentials in findings. They do suggest, however, that we should be cautious in drawing conclusions about the relative mortality differentials between the foreign and native born Asian Americans and Pacific Islanders.

Problems with Mortality Estimates based on Vital Statistics and Census data

The quality of mortality estimates based on vital statistics and census data for Asian Americans and Pacific Islanders is unquestionably worse than for whites or African Americans. An indication of potential problems is evident in the estimates of age-specific death rates for Japanese males, which suggest a lower death rate at ages 30-34 than 25-29 (Table 2). The main difficulty in estimating mortality for Asian Americans and Pacific Islanders from dual data sources stems from problems of comparability in the reporting of race in the two sources. The complication arises in part from

differences in the way information on race is collected in each source. On the death certificate, information on the decedent's race is provided by the death certificate informant, typically by the next of kin, who is simply asked to identify the race of the decedent as “American Indian, Black, White, etc. (*Specify*)” (NCHS, 1994a:7-3). This information is then filled in on the death certificate by the funeral director, who is responsible for completing all personal information on the death certificate. In the absence of an informant, race of the decedent is recorded by the funeral director by observation. To what extent funeral directors make independent assessments of race of the decedent is not known (e.g., National Center for Health Statistics, 1969). NCHS then provides death tabulations for the following groups: white, black, American Indian, Chinese, Hawaiian, Japanese, Filipino, Other Asian or Pacific Islander, and Other. On the 1990 Census questionnaire, on the other hand, an individual’s racial identity is self-reported. As discussed above, on the 1990 Census form nine distinct categories for Asian or Pacific Islanders are listed with a separate category for “Other API”. As noted above, individuals who identify themselves as "Other API" are further asked to specify their origin (for a detailed listing of the responses considered by the Bureau of the Census to fall under the Asian American and Pacific Islander group, see U.S. Bureau of the Census, 1993: B29-B30).

Thus, there is considerable room for inconsistencies in the classification of race in the two sources. We might expect, for example, a more complete enumeration of the Asian and Pacific Islander population in the Census than on death certificates at least in part due to the fact that distinct categories for various Asian populations are listed separately on the Census form but not on the death certificate. The reporting of race is likely to be particularly problematic for individuals of mixed racial parentage. Furthermore, the large influx of Asian immigrants since the mid-1960s and the increasing diversity of the Asian and Pacific Islander population as a whole undoubtedly has contributed to the problems of racial identification in various sources of government data. Recent immigrants, for example, may have had little exposure to the concept of race/ethnicity as understood in the United

States, and thus may not be prepared to answer questions on race on survey forms or to provide such information at the time of death. It has also been suggested that a person's group identity may change over time and vary by context (e.g., Hahn, 1992; Yu and Liu, 1992; Hahn and Stroup, 1994; McKenney and Bennett, 1994).

Several recent studies have examined agreement in the reporting of race on death records and in population data and/or on birth records, the usual sources of denominator data in the calculation of mortality estimates. Findings of all such studies suggest that mortality is underestimated for Asian Americans and Pacific Islanders when dual data sources are used. Most of these studies have focused on estimates of infant mortality and revealed substantial discrepancies in the coding of race in the two sources for Asian Americans. Hahn et al. (1992), for example, reported in a study based on linked birth and infant death records from 1983-1985 that "almost as many infants classified as Filipino and Japanese at birth were classified as white at death (44.9% and 40.4%, respectively) as were consistently classified as Filipino and Japanese at both birth and death (47.6% and 45.9%, respectively)"(p. 261). Similarly, only 52.4% of the Chinese and 54.6% of Other Asian and Pacific Islander births were classified as Chinese and Other Asian and Pacific Islander at death. Most of the remainder were classified as white. Consistent classification of infants by race at birth and at death increased infant mortality rates by 33.3% for Chinese, 48.8% for Japanese, 78.7% for Filipinos, and 37.7% for Other Asian/Pacific Islanders. Nevertheless, estimates of infant mortality based on consistent racial classification at birth and at death, were lower for Chinese (7.6 per 1,000), Japanese (6.4) and Filipinos (8.4) than for whites. Only Other Asian and Pacific Islanders (9.5) had higher infant mortality rate than did white Americans (9.3). The pattern of misreporting found in the Hahn et al. (1992) study is similar to that reported elsewhere (e.g., Norris and Shipley, 1971; Frost and Shy, 1980; Yu, 1984).

Two other studies have examined possible biases in mortality estimates for Asian and Pacific Islanders resulting from misclassification of race in the numerator and denominator data. The most

recent of these studies is by Sorlie et al. (1992). This study covers the entire age range but is limited to the Asian and Pacific Islander group as a whole and is based on a linkage of records from 12 Current Population Surveys (CPS) with the National Death Index for 1979-1985. The discrepancies between the baseline race identification taken from the CPS and the matching death certificate were larger for Asian and Pacific Islanders than for whites, African-Americans or Hispanics. The percentage agreement for Asian and Pacific Islanders was only 82.4% and the race of the decedent was classified more often as white on the death certificate than in the CPS. No detail by age or sex was available, although the authors noted that “rates of agreement did not vary much by sex or age group of the decedent” (Sorlie et al., 1992:182). The total number of deaths classified as Asian/Pacific Islander on the CPS survey was 272 versus 242 on the matching death records, leading the authors to conclude that death rates for Asian/Pacific Islanders calculated from vital statistics and census data are likely to be underestimated by 12% ($272/242=1.12$). Multiplying the Asian and Pacific Islander death rates in Tables 2 and 3 by 1.12, however, would still leave the rates well below those of white Americans.

The only national-level study that has examined the comparability of reporting of race for selected Asian subpopulations is the 1960 Matched Records Study mentioned above. This study revealed high agreement in the reporting of race in the two sources for Japanese (97.0%), somewhat lower for Chinese (90.3%) and very low for Filipinos (72.6%). The estimated net difference rates were -1.4 for Japanese, -6.8 for Chinese, and -22.0 for Filipinos.⁸ The most common source of discrepancy was for the person to be reported as white on the death certificate and nonwhite on the census record (National Center for Health Statistics, 1969). Adjusting the age-specific death rates of Japanese, Chinese and Filipinos in Tables 2 and 3 by the above misreporting tendencies would still leave their death rates below those of white Americans.

⁸ The net difference rate has as its numerator the difference between the total number of responses in a given category on the death and census record and as its denominator the census record total (National Center for Health Statistics, 1969:2-3)

A comparison of adjusted mortality indexes based on the 1960 study suggested that mortality among the Japanese was particularly low in comparison to white Americans; “the corrected mortality indexes for Japanese males and females 5 and over were about one-third lower than the corresponding indexes for white males and females” (Kitagawa and Hauser, 1973:101). Estimated life expectancies at birth, based on uncorrected death rates, were 74.4 for Japanese males and 80.4 for Japanese females, the respective figures for white males and females were 67.6 and 74.7. On the other hand, the corrected mortality index at ages five and above was around 10% higher for Chinese males than for white males; for Chinese females the corresponding index was 9% below of that for white females. Estimates of life expectancies at birth for Chinese were not reported, and no mortality estimates were presented for Filipinos (Kitagawa and Hauser, 1973). The above results for Japanese are consistent with findings for 1960 from Hawaii and California, mentioned previously, that similarly documented lower mortality for the Japanese than for whites, Chinese or Filipinos.

Thus, based on the results from the Kitagawa and Hauser study, we would expect the death rates for the Japanese shown in Tables 2 and 3 to be fairly accurate. These results show age-specific death rates for the Japanese to be well below the white rates, by 27-60% for males, ignoring ages 30-34 and 35-39 where the male rates for Japanese seem particularly low, and by 19 to 48% below the white rates for females. Based on the Kitagawa and Hauser results, the data for Chinese would appear to be somewhat less accurate than for the Japanese, particularly for males, although corrections for coding discrepancies would still probably leave their death rates below those of whites. Data quality for Filipinos seems to be particularly problematic and casts doubt on the accuracy of mortality estimates shown in Tables 2 and 3.

Another potential problem with the use of vital statistics and census data is inconsistency in the reporting of age on death certificates and census records. I know of no studies that have examined consistency of age reporting in vital statistics and census data for Asian Americans and Pacific

Islanders. However, a strong emphasis on age in East Asian cultures appears to be associated with unusually accurate age reporting and thus potential biases caused by age misreporting are likely to be less important than those produced by inconsistencies in the reporting of race (Coale and Bannister, 1994). Finally, mortality estimates can be affected by population undercount in the Decennial Censuses. Although the Bureau of the Census provides estimates of net census undercounts based on demographic analyses (Robinson et al., 1993), undercount estimates are not available for Asian and Pacific Islanders. As noted above, the population data used here have not been adjusted for underenumeration in the 1990 Census of Population. The effect on estimated mortality, however, again is likely to be much smaller than the distortions introduced by the lack of comparability in the reporting of race in vital statistics and census data.

Mortality Estimates based on Linked Data Files

Estimates of mortality based on data sources where information for deaths and population at risk come from a single file avoid the racial and ethnic classification problems created by dual data sources discussed above. Data sources of this type available for estimating mortality among older Americans are Social Security and Medicare files, the National Longitudinal Mortality Survey, the National Health Interview Survey files linked to the National Death Index, and sub-national studies. These data sources are, however, less useful for analyses of mortality among Asian and Pacific Islanders than other population subgroups.

I know of no studies that have used Social Security/Medicare data to estimate mortality among Asian Americans and Pacific Islanders. The racial detail available in these data do not permit the classification of individual records into the Asian and Pacific Islander category. The only way to investigate mortality among Asian Americans in these data would be to use a classification system

based on surnames (e.g., Choi et al., 1993) or to identify individuals by place of birth. ⁹

An alternative source of data for estimating mortality among Asian and Pacific Islanders as a whole is the National Longitudinal Mortality Survey (NLMS). Below, I show mortality estimates obtained from the NLMS Public Use File, Release 2, which is based on five Current Population Surveys (CPS) conducted between March 1979 and March 1981. The NLMS contains 637,162 individual records that have been linked to the National Death Index (NDI) for the years 1979-1989. ¹⁰ This record linkage identified 42,919 deaths that had occurred within the nine-year maximum followup period following the date of the CPS interview to members of the five CPS cohorts (for details on the linkage procedure, see Rogot et al., 1986). ¹¹ Because no other follow-up of individuals in the five CPS cohorts was attempted, all individuals who were not linked to the NDI were considered to be alive at the end of the follow-up period. These procedures are likely to result in some deaths being missed because of a lack of perfect detection of deaths in the NDI. Rogot et al. (1992:2) have noted that "there is some ascertainment loss, of perhaps 5%, occurring in the matching process because of recording errors in the files being matched."

There are reasons to suspect that the success in matching to the NDI differs by characteristics of the decedent, including his or her race. Curb et al. (1985) found, for example, significant variation by race and sex in the identification of known deaths in the NDI in 1979-81. Deaths of African

⁹ Mortality among Hispanic-origin individuals based on Social Security/Medicare data has been investigated in conjunction with the Census Bureau's projections of the Hispanic population (Spencer, 1986).

¹⁰ The NLMS Public Use File is a subset of the larger NLMS database consisting of 12 census samples numbering about 1.3 million persons in the United States. Eleven of the 12 cohorts were taken from Current Population Surveys conducted during the period from March 1973 through March 1985 with one sample drawn from the 1980 Census of Population. Sample individuals were then matched to the National Death Index (NDI) beginning in 1979, when the NDI was established, with plans to continue mortality follow-up through March 1993 (Rogot et al., 1992).

¹¹ The five CPS surveys were conducted in March 1979, April, August, and December 1980, and March 1981.

Americans and women were less likely to be located in the NDI than those of whites and men. The main explanation given for this finding was Social Security number discrepancies in the NDI and in the identifying information of the decedent used in the match. We do not know whether the linkage rates varied by race or ethnicity in the NLMS, but it is possible that they were more complete for whites than for Asian and Pacific Islanders. As noted above, a missing Social Security number is one reason for a failure to link to the NDI. At ages 45 through 89, the age range on which the following estimates are based, Social Security numbers were missing for 12.2% of whites in contrast to 13.1% of Asian and Pacific Islanders in the NLMS. The difference is not large and suggests only a very slight possibility that deaths of Asian and Pacific Islanders were more likely to be missed in the linkage to the NDI than those of whites due to differences in the presence of a Social Security number on the CPS record. Another reason for a linkage failure is that deaths of the foreign born may not be recorded in the US death records because some of these individuals may have died abroad. The percentage of the population that is foreign born is extremely high among Asian and Pacific Islanders compared to whites and thus it is possible that a larger proportion of deaths of the former are not captured in US vital statistics records.

The NLMS data on socioeconomic and demographic characteristics come from the interview data from the CPS surveys, in which the interviewer contacts, by personal interview or by telephone, the most knowledgeable adult member of the household who provides information on all household members. Our samples for these analyses consist of 79,689 males and 94,983 females aged 45-89, of whom 18,359 and 15,623 respectively had died during the nine-year follow-up period. Because of the small number of deaths for Asian and Pacific Islanders, direct calculation of death rates is not possible. There were only 197 male and 105 female deaths among Asian and Pacific Islanders during the nine-year follow-up period (based on unweighted data). Therefore, to assess ethnic differences in mortality we estimate a logit regression model where the dependent variable is the log odds of the probability of

dying during the nine-year follow-up period. The estimated coefficients are then translated into age-specific death rates by five-year age groups. Race/ethnicity distinguishes between whites and Asian and Pacific Islanders.

Table 5 presents the estimated coefficients from the logit models. Model 1 presents the main effect for Asian and Pacific Islanders relative to whites; Model 2 further distinguishes between native and foreign born Asian Pacific Islanders. Because place of birth was missing for a sizable fraction of the sample, I have further distinguished this group from the foreign- and native-born Asian and Pacific Islanders. The purpose of Model 2 is to investigate the hypothesis that the relatively low mortality of Asian and Pacific Islanders reflects the fact that many of these individuals are recent migrants to the United States. Table 6 presents the age-specific death rates by five-year age groups up to age 85-89 that are predicted from the coefficients shown in Table 5, Model 1. ¹²

The results based on the NLMS suggest that mortality among Asian Americans and Pacific Islanders is low relative to whites and that a portion of the low mortality of Asian and Pacific Islanders is in part attributable to the low mortality of the foreign born. We should, however, be somewhat cautious in drawing firm conclusions concerning the relative advantage of the foreign versus native born Asian and Pacific Islanders. As noted above, it is possible that the advantage of the foreign born reflects in part difficulties in following them up in U.S. death records, since some may have died abroad. Thus, it is possible that the linkage of the CPS cohorts to the NDI was more successful for native than for foreign born Asian and Pacific Islanders, an outcome that would lead to an underestimate of mortality among the foreign born. At the same time, however, the findings for the native-born Asian Americans and Pacific Islanders imply that their mortality is also lower than that of white Americans.

¹² The coefficients were translated into age specific death rates as follows: $[\ln(E^{k+1})]/9 = {}_5\mu_{a+2}$; where k represents the sum of appropriate coefficients from Model 1 Table 5. The calculations use more precision than the coefficients shown in Table 5.

The results from the NLMS further indicate that mortality estimates based on vital statistics and census data exaggerate the relative mortality advantages of Asian and Pacific Islander males in comparison to white males. Ratios of Asian and Pacific Islander male death rates to those of white males range from 0.59 to 0.71 in Table 6, compared to a range of 0.49 to 0.68 in Table 2. This exaggeration is most likely the result of underestimation of mortality for this ethnic group based on data obtained from dual data sources. As noted above, the consistency of race reporting for this subpopulation in death statistics and census records is low, much lower than for other racial and ethnic groups. The respective figures for females in Tables 6 and 3 are similar ranging from 0.59 to 0.67 in Table 6 and 0.59 to 0.71 in Table 3.

An analyses of the linked National Health Interview Survey-National Death Index (NHIS-NDI) files by Rogers et al. (1996) are consistent with our results from the NLMS; both indicate that mortality among Asian/Pacific Islanders is well below that of whites. Although potential linkage problems to the NDI may lead to underestimates of mortality based on data linked to the NDI, it is unlikely that such problems would account for the all of the estimated mortality differences between whites and Asians and Pacific Islanders obtained from the NLMS and NHIS-NDI. That mortality of native-born Asian and Pacific Islanders also appears lower than that of whites leads further credence to the finding that mortality among this population subgroup is indeed lower than that of white Americans.

Cause-specific Mortality

The major causes of death for individuals aged 45 and above are diseases of the heart, malignant neoplasms, and cerebrovascular diseases. It would be surprising if differences in death rates from all causes combined between whites and Asian and Pacific Islanders were not principally attributable to differences in death rates from these causes. Tables 7 and 8 present age-standardized death rates at ages 45-84 and the overall rate at 85+ from the above causes and all other causes combined in 1989-91 for whites, Chinese, Japanese, Filipinos, other Asian and Pacific Islanders and the

Asian and Pacific Islander group as a whole. These estimates are based on vital statistics and census data; the sample size for Asian and Pacific Islanders in the NLMS is too small for an examination of cause-specific mortality differentials.

Asian Americans and Pacific Islanders have lower estimated age-standardized death rates than white Americans from heart disease, cancer and all other causes combined. Heart disease and cancer account for a majority of the all cause discrepancy between whites and the various Asian and Pacific Islander subgroups and the API group as a whole (Tables 7 and 8). In contrast, differences in cerebrovascular disease mortality are minor and not always consistent in direction. The age-standardized death rate from stroke, for example, is lower for white males than for Filipino and Other Asian Pacific Islander males at ages 45-84 and lower than that of Japanese males at ages 85+. Among women, white females have lower stroke mortality than Other Asian Pacific Islander females at ages 45-84 and lower than Japanese females at ages 85+. In other cases, cerebrovascular diseases account only between 0.3 to 10.1% of the differential in death rates from all causes combined between whites and Japanese, Chinese, Filipinos and other Asian and Pacific Islanders (Tables 7 and 8).

Cerebrovascular disease thus appears to be a more important cause of death among Asian Americans and Pacific Islanders than white Americans. Its contribution to all cause mortality ranges from 7.9 to 16.6% among Chinese, Japanese, Filipinos and Other Asian Pacific Islander males and females at ages 45-84 and 85+. The respective figures for whites are 5.2 and 11.7%. On the other hand, heart disease is a less important contributing factor to all cause mortality among Chinese and Japanese than Filipinos, Other Asian Pacific Islanders or white Americans, particularly at ages 45-84. The contribution of heart disease to all cause mortality at these ages ranges from 26.9 to 30.0% among Chinese and Japanese males and females in contrast to 31.9-35.6% among Filipinos and Other Asian and Pacific Islanders and 31.9-36.5% among whites. Despite much lower age-standardized death rates from cancer among Chinese and Japanese than whites, cancer mortality makes a larger contribution to

all cause mortality among Chinese and Japanese at ages 45-84 than among whites, Filipinos and Other Asian and Pacific Islanders (calculations based on death rates shown in Tables 7 and 8).

Analyses of cancer incidence and mortality by specific site further reveal that the distribution of various cancer types differs among whites, Chinese, Japanese and Filipinos. Gardner (1994) cites results of a National Cancer Institute study which show age-adjusted site-specific death rates for Chinese, Japanese, and Filipinos as well as white Americans. Age-adjusted cancer mortality rates for the three Asian-origin populations were below the estimated rates for whites; 131.5 per 100,000 for Chinese, 104.2 for Japanese, 69.7 for Filipinos, and 163.6 for white Americans (Gardner, 1994: Table 3.3; Table 9). Despite the lower overall mortality from malignant neoplasms, age-standardized death rates for some specific sites were nonetheless higher for Japanese and Chinese than for white Americans. These sites included cancer of the rectum, corpus uteri, esophagus among Chinese, lung cancer among Chinese females, and most importantly stomach cancer, particularly among Japanese for whom the age-adjusted death rate from stomach cancer was over three times as high as that for white Americans. Other sites for which differentials were relatively small between whites and Japanese and Chinese involved cancer of the cervix uteri, colon, and pancreas. In contrast, death rates from breast and prostate cancer appeared low relative to the white rates. For Filipinos, age-adjusted death rates for all specific sites were lower than those of white Americans and lower or similar to the estimated rates for Japanese and Chinese (Table 9). No estimates were presented for other Asian Americans or Pacific Islanders, except for Hawaiians, whose age-adjusted cancer death rate (200.5 per 100,000) was higher than that of whites (Gardner, 1994).

It is important to keep in mind that the above estimates based on vital statistics and census data are subject to the same numerator-denominator bias as death rates from all causes combined. The National Cancer Institute data also have not been examined for possible ethnic classification inconsistencies (Gardner, 1994). Thus, estimated cause-specific mortality rates for Asian Americans

and Pacific Islanders are also likely to be biased downward. There is no reason to suspect, however, that the relative importance of various causes of death is seriously distorted. As long as the inconsistency in race reporting in vital statistics and census data does not vary by cause of death, the cause-specific mortality data should provide a general picture of the relative importance of the major causes of death.

The results discussed above are in general agreement with what we know about cause of death patterns among Chinese and Japanese populations more generally and what is known about cause-specific mortality among Chinese and Japanese Americans from epidemiological investigations. Campbell (1995), for example, has noted certain similarities in non-communicable disease mortality among ethnic Chinese populations worldwide. These include "1) extremely high death rates from cancers of the nasopharynx and esophagus ...; 2) relatively high death rates from cancers of the liver, stomach and among females, the lung; 3) relatively low death rates from cancers of the colon, and among females the breast ...; 4) relatively low death rates from many forms of heart disease ...; 5) relatively high death rates from hemorrhagic stroke" (Campbell, 1995:334-335; also see Hanley et al., 1995). These observations are in general agreement with the relative importance of various causes of death among Chinese residing in the United States discussed above. The main exception is colon cancer in which case changes in dietary habits, i.e., increased intake of meats and saturated fats, among Chinese immigrants to the United States may have played a role. Since a very large proportion of Chinese Americans are recent arrivals to the United States it is not surprising that the cause of death patterns among them would resemble those of their countries of origin. ¹³ Factors that are hypothesized to be related to the prevalence of particular site-specific cancers among ethnic Chinese include diet

¹³ This is not say that the cause of death structures among Chinese populations everywhere are identical, only that the contribution of various causes of death to all cause mortality has historically differed from that found in most Western countries in ways suggested in the text. Recent evidence indicates a growing similarity in the cause of death patterns in Singapore, Taiwan, Hong Kong and in western countries (Campbell, 1995).

(Hildesheim and Levine, 1993; Armstrong, 1980), environmental factors such as domestic air pollution, and infectious agents (Nomura et al., 1991; Parsonnet et al., 1991; see the discussion of the role of the various factors in Campbell, 1995). Diet has also been implicated in low heart disease and high stroke mortality among elderly Chinese Americans (Choi et al., 1990).

Supporting evidence for the role of environmental factors, including diet, in patterns of cause-specific mortality among Chinese comes from studies that have compared mortality among the foreign born and native born Chinese Americans. These results are consistent with studies of other migrants to the U.S. that have suggested that the level of acculturation has a potential influence on health outcomes through changes in lifestyles and health habits (e.g., Espino and Maldonado, 1990; Mitchell et al., 1990). The studies of Chinese migrants have shown first generation Chinese to have higher mortality from stomach, esophagus, and liver cancer, and especially from cancer of the nasopharynx in comparison to second generation Chinese. Prostate cancer, which remains a relatively minor cause, tended to be somewhat lower in first than second generation Chinese males, while mortality from breast cancer was low among both first and second generation Chinese females (King and Haenszel, 1973; King and Locke, 1980; King et al., 1985; Hanley et al., 1995). It has been further suggested that mortality from heart disease is higher among Chinese immigrants to the U.S. than those in the countries of origin, but lower than U.S. whites (King and Locke, 1987). A recent study of elderly Chinese immigrants residing in Boston further found that their risk profiles for heart disease and stroke resembled those of mainland Chinese living in urban areas predisposing them to mortality from hemorrhagic stroke while being protective against heart disease (Choi et al., 1990).

The most extensively studied Asian American population in the United States is the Japanese. The results of these studies are similar to those of the Chinese in that a mortality gradient between Japanese in Japan and Japanese in the United States have been documented for selected causes of death (e.g., Gardner, 1994). Among the best known studies of Japanese in the United States are the Ni-Hon-

San studies based on a collaborative epidemiological investigation of Japanese males in Japan, Hawaii and California. Reed and Yano (1994:12) summarized the results of these studies with respect to cardiovascular disease mortality as follows: "there is a two to three fold higher risk of CHD among Japanese in the US compared to those in Japan, and that this difference can be accounted for largely by differences in the major risk factors, especially serum cholesterol, serum glucose, blood pressure, smoking and alcohol intake." According to Reed and Yano (1994: 13) the key factor in elevated heart disease mortality among Japanese Americans compared to Japanese in Japan is "change from traditional Japanese life style involving high physical activity and an Asian diet low in animal fat and protein to a sedentary lifestyle combined with a high calorie Western diet leading to obesity, hypertension, diabetes and high serum cholesterol." Despite the higher death rates from heart disease among Japanese residing in the United States than in Japan, heart disease remains a less important cause of death among Japanese than white Americans with Japanese in the US having intermediate rates between Japanese in Japan and U.S. whites (Haenszel and Kurihara, 1968; Kasl and Berkman, 1983).

In contrast, mortality from cerebrovascular diseases shows an opposite gradient with the highest rates recorded in Japan. A comparison of stroke mortality in Tables 7 and 8 show similar rates between Japanese and whites at ages 45-84 and somewhat elevated rates among the Japanese at ages 85+, where the proportion of foreign born among the Japanese is higher than at younger ages. It has also been suggested that diet, such as high intake of salt and low intake of fat, may be related to differences in stroke mortality among Japanese Americans and Japanese in Japan (Reed, 1990; Goldman and Takahashi, 1996). Similarly, the prevalence of specific cancers among Japanese Americans reflects patterns observed in Japan with relatively high death rates from stomach cancer and low death rates from breast cancer (see Gardner, 1994).

Among Filipinos, heart disease appears to be a more important cause of death than among

either Japanese and Chinese. This finding is consistent with studies that have examined cardiovascular risk factors among Asian Americans and Pacific Islanders, which have documented a higher prevalence of hypertension among Filipinos than either Chinese or Japanese (Stavig et al., 1984; Klatsky and Armstrong, 1991). In general, however, relatively little is known about risk factor distributions or cause-specific mortality differentials among Asian Americans and Pacific Islanders other than Chinese and Japanese. Further studies are needed to gain a better understanding of the variation in risk profiles among them. We could expect substantial variation among the various Asian and Pacific Islander subgroups and we must be cautious in generalizing findings from one group to another (see Zane et al., 1994).

Conclusions

All mortality estimates for Asian and Pacific Islanders, including Chinese, Japanese and Filipinos, place their level of mortality well below that of white Americans. Except for estimates based on the National Longitudinal Mortality Survey, all others rely on vital statistics and census data. Results from studies that have examined discrepancies in the coding of race for Asian and Pacific Islanders in these data sources suggest that mortality estimates based on them for this population subgroup are too low. It is difficult to know the precise extent of underestimation in the recorded rates, which also is likely to vary by Asian and Pacific Islander subgroup. The most recent study that has compared the discrepancies in coding of race between death certificates and census records concludes that death rates for Asian and Pacific Islanders based on vital statistics and census data are likely to be underestimated by 12%. If the 1989-91 Asian and Pacific Islander death rates are adjusted by this amount, they would still be 20-39% below the white rates for males and 17-34% below the white rates for females at ages 25+.

Among the Asian American subgroups, the data for Japanese are likely to be of highest quality. The 1960 Match Records Study showed very little discrepancy in the coding of Japanese ethnicity in

vital statistics and census data. This is the only study that has examined coding inconsistencies among Asian American subgroups at adult ages. It is, of course, possible that the 1960 results no longer accurately reflect coding discrepancies for Japanese. One of the principal reasons why this might be the case relates to the increase in the proportion of individuals of mixed racial parentage. Such an increase, however, would not affect the older cohorts. The proportion foreign born is also low among Japanese relative to other Asian and Pacific Islanders, which should increase the probability that their deaths are captured by the U.S. vital statistics system. The 1989-91 mortality estimates place the level of mortality among Japanese Americans well below that of whites. At ages 45 and above, the ratio of Japanese age-specific death rates to those of whites range from 0.43 to 0.73 for males and 0.48 to 0.81 for females. A comparison of mortality of Japanese Americans to that in Japan further suggest that mortality among Japanese Americans is very low. At ages 45-49 through 75-79, the ratio of 1989-91 age-specific death rates of Japanese Americans to 1990 rates in Japan range from 0.60 to 0.71 for males and from 0.69 to 1.15 for females (Japan Aging Research Center, 1996). Even if the estimated death rates for Japanese are slightly underestimated, we can be confident in concluding that their level of mortality is low and below that of whites.

We have less confidence in the results for Chinese and Filipinos. The 1960 Kitagawa and Hauser study showed coding discrepancies to be somewhat greater for Chinese and substantially larger for Filipinos than for Japanese. The Chinese rates are thus likely to be underestimated by a somewhat larger amount than the rates for Japanese, while we put little confidence in the mortality estimates for the Filipinos. Without additional studies of consistency of reporting of race in vital statistics and census data that could be used to correct mortality estimates based on these data, at present it seems impossible to provide accurate mortality estimates for Asian and Pacific Islander subgroups with the possible exception of Japanese. The use of indirect estimation techniques, developed to estimate mortality among populations with poor quality data, are also not suitable for the problem at hand, the principal

reason being the very high net migration rates among Asian Americans and Pacific Islanders.

At the same time, however, mortality estimates based on the NLMS suggest that the level of mortality among Asian and Pacific Islanders as a whole is well below that of whites. These results are consistent with recent estimates based on the NHIS-NDI linked files. In both data sources, information for deaths and population at risk come from a single source and thus the racial classification problem created by dual data sources is avoided. These data, however, are not without limitations. It is not known, for example, to what extent the success in linkage to the NDI differs by race/ethnicity. A very large fraction of Asian and Pacific Islanders is foreign born, which in turn may result in deaths being missed in U.S. death records as individuals may have died abroad. Such linkage problems would have to be substantial, however, to raise the mortality estimates for Asian/Pacific Islanders to the level estimated for whites. The NLMS results further suggest that mortality of native-born Asian and Pacific Islanders is lower than that of whites. These estimates show that male mortality (the log odds of dying during the nine-year follow-up period) among native-born Asian and Pacific Islanders is 37% below that of whites ($e^{-0.4601}=0.63$, Table 5), the respective figure for females is 30% ($e^{-0.3567}=0.70$; Table 5). Since the proportion foreign born is extremely high among all Asian Americans other than Japanese, mortality among the native-born reflects in large part the mortality experience of Japanese Americans. These results are consistent with the notion that mortality among the Japanese is below that of whites.

A comparison of cause-specific mortality differentials at ages 45+ between whites and Asian and Pacific Islanders suggest that heart disease and cancer, the two leading causes of death at ages 45+, account for the majority of all cause discrepancy. Only death rates from cerebrovascular diseases appear similar among whites and Asian and Pacific Islanders and in some cases are higher among select Asian and Pacific Islander subgroups than among white Americans.

In this paper, we have attempted to distinguish among the various Asian and Pacific Islander populations to the extent permitted by available data. At present, however, separate estimates are only

possible for Japanese, Chinese, Filipinos, Hawaiians, and all other Asian and Pacific Islanders combined. We can only speculate about how mortality may vary among the many subgroups that make up the Other Asian and Pacific Islander category and the variation may well be substantial. Health conditions among Southeast Asian refugees, for example, are likely to differ from those of Koreans and Asian Indians, the two largest population subgroups in this category. Studies focusing on specific populations are needed to gain a better understanding of health conditions among them. National-level data presently available will not help us in this regard.

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Table 1: Asian and Pacific Islanders and Selected Asian and Pacific Islander Subgroups, United States, 1990

Ethnic Origin	#	% Foreign Born	Ethnic Origin	#	% Foreign Born
All API	7,273,622	63.1%	Pacific Islanders	365,024	13.0%
Age 25+	4,300,113	78.5%	Age 25+	182,274	17.9 %
Age 65+	454,458	69.7%	Age 65+	14,735	13.6 %
Median Age	29.8	35.2	Median Age	25.0	31.6
All Asian	6,908,638	65.6%	Hawaiian	211,014	2.9 %
Age 25+	4,117,839	81.1%	Age 25+	110,763	2.6%
Age 65+	439,723	71.6%	Age 65+	10,233	2.3 %
Median Age	30.1	35.2	Median Age	26.3	30.5
Chinese	1,645,472	69.3%			
Age 25+	1,067,213	83.6%			
Age 65+	133,977	83.5%			
Median age	32.1	36.7			
Filipino	1,406,770	64.4%			
Age 25+	852,405	84.7%			
Age 65+	104,206	94.6%			
Median Age	31.3	38.7			
Japanese	847,562	32.4%			
Age 25+	607,463	35.4%			
Age 65+	105,932	17.2%			
Median Age	36.3	38.5			
Other Asian	3,008,834	74.0%			
Age 25+	1,590,758	95.7%			
Age 65+	95,605	92.6%			

Note: The percentage foreign born and the median age of the foreign born are based on sample data; the size of the population and the median age of the entire population are based on 100% count data.

Source: U.S. Bureau of the Census, 1992: Table 23; 1993: Table 1.

Table 2: Death Rates based on Vital Statistics and Census Data: White and Asian and Pacific Islander Males, 1989-1991 (death rates per 1,000)

Age Group	Males					
	Death Rates (per 1,000)					
	Whites	Asian/Pacific Islanders	Chinese	Japanese	Filipino	Other Asian/Pacific Islander
25-29	1.70	0.83	0.47	0.68	0.71	1.09
30-34	2.03	0.81	0.57	0.46	0.88	1.00
35-39	2.47	1.11	0.94	0.84	1.08	1.29
40-44	3.09	1.44	1.23	1.23	1.48	1.61
45-49	4.46	2.19	1.65	2.01	1.83	2.63
50-54	7.03	3.61	3.00	3.05	3.21	4.27
55-59	11.52	6.05	5.56	5.40	5.13	7.14
60-64	18.47	9.98	8.44	9.81	8.88	12.37
65-69	27.63	16.01	14.48	14.98	14.23	20.36
70-74	42.84	24.75	23.34	24.09	21.85	29.85
75-79	65.13	41.67	41.45	40.86	37.44	48.96
80-84	101.35	65.18	64.90	61.12	66.46	66.31
85+	181.05	123.32	123.64	132.47	122.39	110.49
	Ratios of Asian American and Pacific Islander Rates to White Rates					
25-29		0.49	0.28	0.40	0.42	0.64
30-34		0.40	0.28	0.22	0.44	0.49
35-39		0.45	0.38	0.34	0.44	0.52
40-44		0.47	0.40	0.40	0.48	0.52
45-49		0.49	0.37	0.45	0.41	0.59
50-54		0.51	0.43	0.43	0.46	0.61
55-59		0.53	0.48	0.47	0.45	0.62
60-64		0.54	0.46	0.53	0.48	0.67
65-69		0.58	0.52	0.54	0.51	0.74
70-74		0.58	0.54	0.56	0.51	0.70
75-79		0.64	0.64	0.63	0.57	0.75
80-84		0.64	0.64	0.60	0.66	0.65
85+		0.68	0.68	0.73	0.68	0.61

Sources: National Center for Health Statistics, 1992; 1993a;1993b; U.S. Bureau of the Census, 1992.

Table 3: Death Rates based on Vital Statistics and Census Data: White and Asian and Pacific Islander Females, 1989-1991 (death rates per 1,000)

Age Group	Females					
	Death Rates (per 1,000)					
	Whites	Asian/Pacific Islanders	Chinese	Japanese	Filipino	Other Asian/Pacific Islander
25-29	0.57	0.35	0.26	0.31	0.31	0.41
30-34	0.73	0.41	0.29	0.40	0.36	0.51
35-39	0.98	0.61	0.50	0.44	0.60	0.72
40-44	1.48	0.88	0.63	0.77	0.81	1.08
45-49	2.43	1.42	0.98	1.29	1.21	1.79
50-54	4.04	2.43	1.89	2.84	1.96	2.88
55-59	6.52	3.98	3.11	3.79	3.32	5.25
60-64	10.29	5.60	4.50	5.56	4.85	7.28
65-69	15.38	8.63	7.55	7.91	7.28	11.59
70-74	24.26	13.49	12.71	11.69	11.26	17.67
75-79	38.08	23.80	25.29	23.86	17.12	27.94
80-84	63.46	40.19	41.55	39.52	30.35	46.86
85+	141.91	100.05	100.10	114.25	73.50	90.81
	Ratios of Asian American and Pacific Islander Rates to White Rates					
25-29		0.61	0.46	0.55	0.55	0.73
30-34		0.57	0.39	0.55	0.49	0.70
35-39		0.62	0.51	0.45	0.61	0.73
40-44		0.59	0.43	0.52	0.55	0.73
45-49		0.59	0.40	0.53	0.50	0.74
50-54		0.60	0.47	0.70	0.48	0.71
55-59		0.61	0.48	0.58	0.51	0.80
60-64		0.54	0.44	0.54	0.47	0.71
65-69		0.56	0.49	0.51	0.47	0.75
70-74		0.56	0.52	0.48	0.46	0.73
75-79		0.63	0.66	0.63	0.45	0.73
80-84		0.63	0.65	0.62	0.48	0.74
85+		0.71	0.71	0.81	0.52	0.64

Sources: National Center for Health Statistics, 1992; 1993a;1993b; U.S. Bureau of the Census, 1992.

Table 4: Death Rates (per 1,000), Asian and Pacific Islanders, Total and Foreign-born, 1989-1991

Age	Asian/Pacific Islander		Chinese		Japanese		Filipino		Other Asian/Pacific Islander	
	All	Foreign-born	All	Foreign-born	All	Foreign-born	All	Foreign-born	All	Foreign-born
		Males								
25-34	0.83	0.80-0.82	0.52	0.47-0.52	0.53	0.55-0.55	0.79	0.81-0.81	1.07	0.97-1.00
35-44	1.26	1.15-1.19	1.05	0.96-1.02	0.99	0.78-0.79	1.26	1.21-1.22	1.46	1.27-1.32
45-54	2.74	2.53-2.61	2.23	2.24-2.36	2.36	1.90-1.96	2.34	2.24-2.26	3.28	2.85-2.94
55-64	7.92	7.16-7.33	6.97	6.69-6.91	7.61	6.97-7.20	6.84	6.46-6.48	9.54	7.98-8.17
65-74	20.14	19.05-19.50	18.38	18.53-19.06	18.67	14.68-15.86	18.58	18.18-18.35	25.34	20.79-21.32
75-84	52.88	52.82-53.78	51.28	52.17-53.44	50.02	53.87-54.37	51.30	51.90-52.31	61.38	55.93-57.70
85+	125.99	127.78-129.05	128.12	125.00-127.35	138.84	158.31-158.51	116.61	117.06-117.51	125.64	130.46-133.92
Females										
25-34	0.38	0.38-0.39	0.27	0.27-0.29	0.34	0.40-0.40	0.33	0.35-0.35	0.47	0.44-0.46
35-44	0.72	0.70-0.71	0.55	0.55-0.57	0.57	0.60-0.60	0.68	0.66-0.67	0.88	0.81-0.82
45-54	1.81	1.64-1.68	1.36	1.29-1.35	1.94	1.89-1.89	1.48	1.38-1.39	2.19	1.94-1.97
55-64	4.78	4.40-4.48	3.85	3.60-3.71	4.51	4.66-4.66	4.04	3.79-3.81	6.40	5.40-5.50
65-74	10.74	10.23-10.48	9.72	9.29-9.68	9.23	9.39-9.39	9.09	8.79-8.91	14.71	12.79-13.06
75-84	30.62	29.67-30.21	31.94	31.82-32.64	29.49	33.31-33.31	22.01	22.21-22.36	37.69	34.19-34.88
85+	102.27	107.70-108.83	108.35	110.72-112.92	107.14	121.78-121.78	72.77	75.04-75.70	101.91	100.97-102.29

Source: National Center for Health Statistics, 1992, 1993a, 1993b; U.S. Bureau of the Census, 1993.

Notes: In the calculation of age-specific death rates shown here, the 1990 Census sample data are used in the denominator. Because of sampling variability, the rates differ somewhat from those shown in Tables 2 and 3 where 100% count data are employed. The two rates shown for the foreign-

born allocate all deaths of unknown place of birth first to native born and then to foreign born.

Table 5: Coefficients of Equations Predicting the Log Odds of Dying in a Nine-Year Period: Males and Females Aged 45-89, 1979-1989, National Longitudinal Mortality Survey

	Males		Females	
	Model 1	Model 2	Model 1	Model 2
Age	0.1029 (0.001)	0.1029 (0.001)	0.1028 (0.001)	0.1028 (0.001)
Race/Ethnicity				
White	---	---	---	
Asian/Pac. Islander	-0.5384 (0.098)		-0.5384 (0.1198)	
Asian/Pac. Islander Native Born		-0.5289 (0.1935)		-0.4026 (0.233)
Asian/Pac. Islander Foreign Born		-0.6937 (0.1333)		-0.5442 (0.154)
Asian/Pac. Islander Birth Place Unkn		-0.1068 (0.2090)		-0.7420 (0.321)
Constant	-7.6465 (0.063)	-7.6493 (0.063)	-8.3447 (0.066)	-8.3449 (0.066)
Log-Likelihood	-35945.4	-35942.7	-35192.0	-35191.7
Sample Size	79,689	79,689	94,983	94,983

--- reference category; standard errors in parentheses.

Table 6: Predicted Death Rates: Whites and Asian and Pacific Islanders, National Longitudinal Mortality Survey, 1979-1989 (death rates per 1,000)

Age Group	Death Rates (per 1,000)			
	Males		Females	
	Whites	Asian/Pacific Islanders	Whites	Asian/Pacific Islanders
45-49	4.13	2.43	2.07	1.21
50-54	6.83	4.04	3.44	2.02
55-59	11.20	6.67	5.69	3.36
60-64	18.14	10.94	9.35	5.55
65-69	28.87	17.75	15.23	9.14
70-74	44.77	28.27	24.40	14.88
75-79	67.16	43.90	38.23	23.87
80-84	96.75	65.96	58.08	37.45
85-89	133.43	95.22	84.96	56.99
	Ratios of Asian and Pacific Islander Rates to White Rates			
45-49		0.59		0.59
50-54		0.59		0.59
55-59		0.60		0.59
60-64		0.60		0.59
65-69		0.61		0.60
70-74		0.63		0.61
75-79		0.65		0.62
80-84		0.68		0.64
85-89		0.71		0.67

Sources: National Center for Health Statistics, 1992; 1993a;1993b; U.S. Bureau of the Census, 1992.

Table 7: Age-Standardized Death Rates for Selected Major Causes of Death: White and Asian and Pacific Islander Males, 1989-1991 (deaths per 1,000)

Age and Cause	White	Chinese	Japanese	Filipino	Other API	All API
45-84						
All Causes	25.24	14.07	14.22	13.70	17.42	14.95
Diseases of the Heart	9.21	4.22	4.11	4.89	5.73	4.81
Cerebrovascular Diseases	1.31	1.11	1.17	1.47	1.40	1.28
Malignant Neoplasms	7.21	4.47	4.46	3.35	4.86	4.31
All Other Causes	7.51	4.28	4.49	3.98	5.43	4.55
85+						
All Causes	181.04	123.64	132.48	122.40	110.69	123.32
Diseases of the Heart	75.11	46.77	43.89	50.24	39.73	46.21
Cerebrovascular Diseases	15.40	11.55	18.50	13.18	10.47	13.58
Malignant Neoplasms	26.74	17.37	19.65	16.15	18.24	17.61
All Other Causes	63.79	47.96	50.44	42.83	42.25	45.92

Source: National Center for Health Statistics, 1992, 1993a, 1993b; U.S. Bureau of the Census, 1992.

Table 8: Age-Standardized Death Rates for Selected Major Causes of Death: White and Asian and Pacific Islander Females, 1989-1991 (deaths per 1,000)

Age and Cause	White	Chinese	Japanese	Filipino	Other API	All API
45-84						
All Causes	14.64	8.22	8.38	6.90	10.80	8.70
Diseases of the Heart	4.67	2.21	2.27	2.29	3.45	2.58
Cerebrovascular Diseases	1.04	0.94	0.88	0.84	1.27	1.00
Malignant Neoplasms	4.60	2.71	2.82	1.84	2.87	2.60
All Other Causes	4.33	2.36	2.42	1.92	3.22	2.52
85+						
All Causes	141.91	100.09	114.25	73.51	90.80	100.05
Diseases of the Heart	64.90	41.73	43.83	31.98	37.86	40.53
Cerebrovascular Diseases	16.66	11.43	18.92	8.27	11.48	13.71
Malignant Neoplasms	13.54	12.42	10.82	7.32	8.18	10.40
All Other Causes	46.81	34.52	40.67	25.94	33.29	35.41

Source: National Center for Health Statistics, 1992, 1993a, 1993b; U.S. Bureau of the Census, 1992.

Table 9: Average Annual Age-Adjusted Cancer Mortality Rates per 100,000 by Primary Site and Ethnicity, United States, 1978 to 1981

Primary Site	Whites	Japanese	Chinese	Filipinos
All Sites	163.6	104.2	131.5	69.7
Bladder	3.9	1.8	1.7	1.5
Breast, female	26.6	9.9	13.0	8.0
Ages < 40	1.6	1.1	0.8	0.9
Ages 40+	70.2	25.2	34.6	20.6
Cervix uteri	3.2	2.7	2.9	1.6
Colon and Rectum	21.6	17.2	19.3	8.1
Colon	18.1	13.6	15.5	5.8
Rectum	3.5	3.6	3.8	2.3
Corpus uteri	3.9	3.9	4.3	2.0
Esophagus	2.6	1.9	3.3	1.9
Larynx	1.3	0.2	0.7	0.4
Lung, male	69.3	32.7	48.2	20.0
Lung, female	20.2	8.6	21.2	6.8
Multiple myeloma	2.4	1.2	1.2	1.2
Ovary	8.1	4.3	4.2	2.8
Pancreas	8.4	7.0	7.4	3.3
Prostate	21.0	8.8	7.5	8.2
Stomach	5.3	17.5	7.8	3.3

Source: Gardner, 1994: Table 3.14.

Figure 1: Death Rates, Whites and Asian and Pacific Islanders, Females 1989-1991

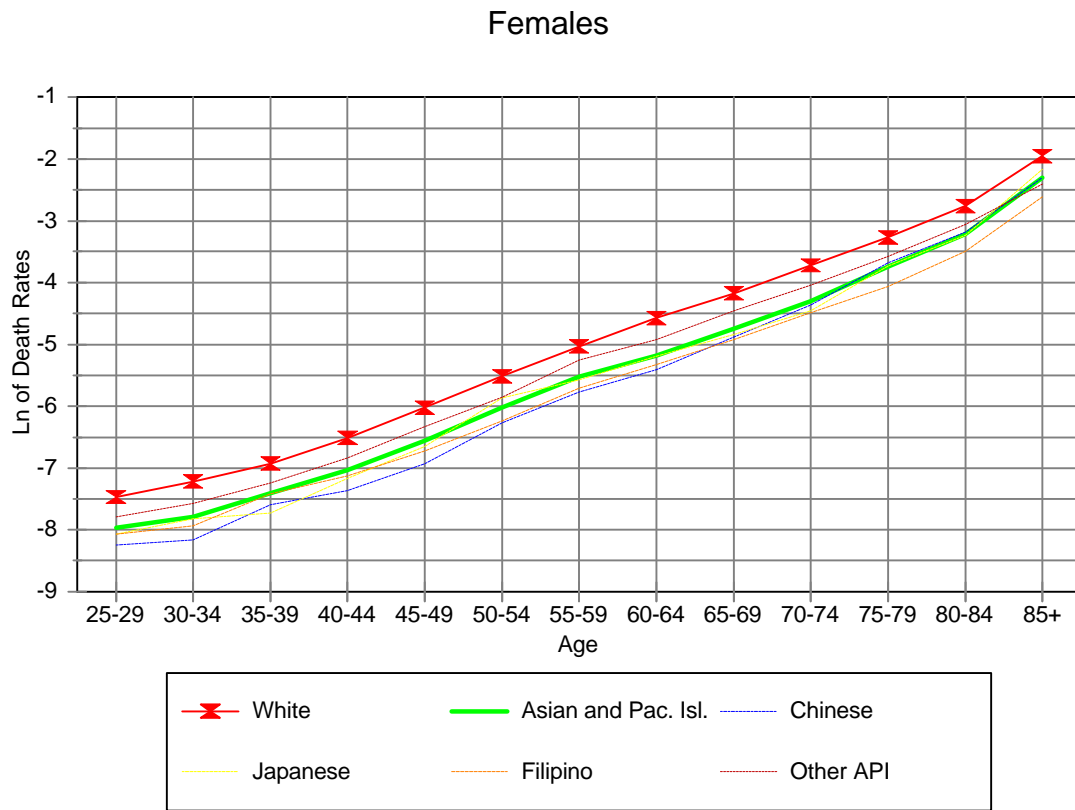


Figure 2: Death Rates, Whites and Asian and Pacific Islanders, Males 1989-1991

