Center for Demography and Ecology

University of Wisconsin-Madison

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Karen C. Swallen

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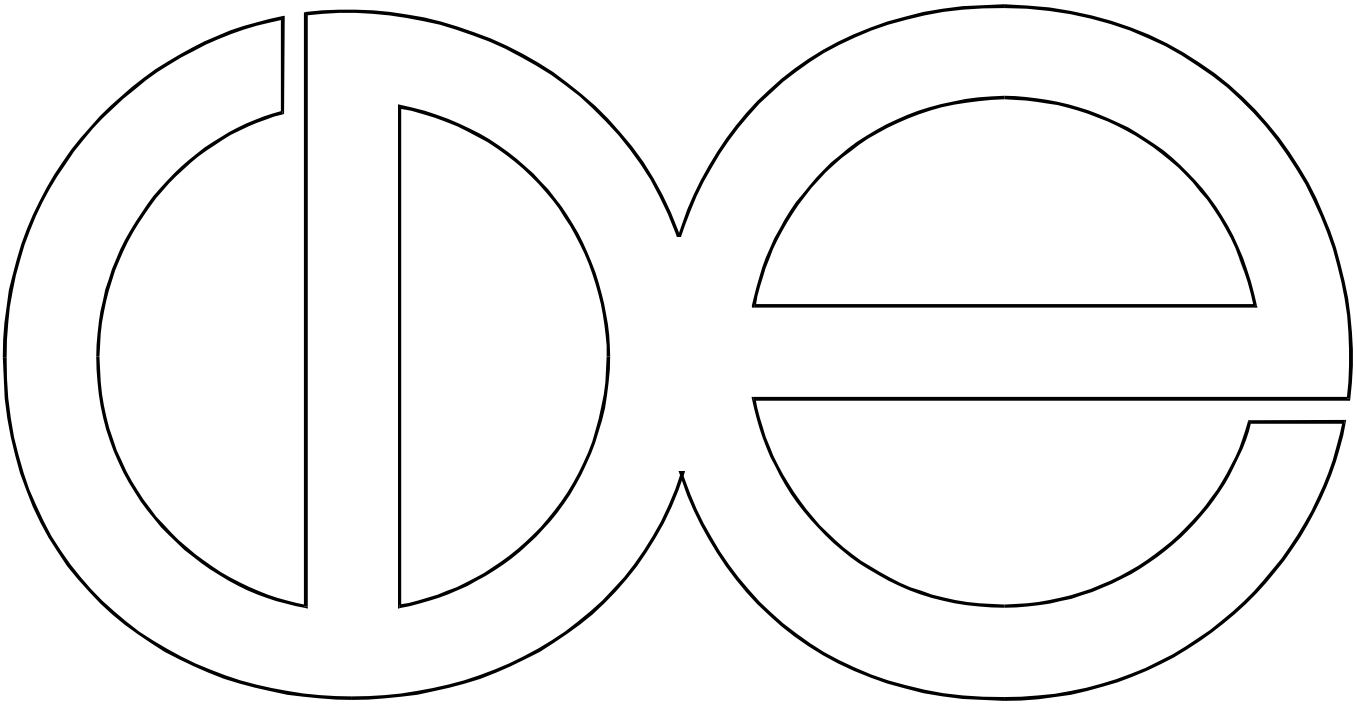

Mortality in the US: Comparing Race/Ethnicity and Nativity

Karen C. Swallen*

Direct correspondence to

Karen C. Swallen,

Center for Demography and Ecology,

Department of Sociology,

4424 Social Sciences, 1180 Observatory Drive

University of Wisconsin

Madison WI 53706

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Abstract: Mortality differentials by nativity have not received as much attention as have mortality differentials by race. We examine the joint effects of race/ethnicity and nativity. Race- and nativity-specific life tables are created using US vital statistics for 1989-1991 for each gender; death rates are compared to the reference category (white US-born person). Both race/ethnicity and nativity modify mortality. Generally, immigrants have increased mortality at young ages and a slight advantage later. Possible explanations for the age variation include differences in country of origin, occupation, and socioeconomic status by age, cohort, or gender. Asians, regardless of nativity, have low mortality. The Hispanic mortality differences vary by gender. US-born blacks have especially high mortality, but foreign-born blacks do well. Among the possible explanations of these results are SES and racism.

Introduction

Mortality differentials commonly are assessed in order to determine how mortality for disadvantaged groups can be improved. Among the disadvantaged groups commonly studied in the Untied States are those based on race and socioeconomic status. Another group of differentially advantaged persons are immigrants to the United States. Immigrants could be disadvantaged (due to such factors as exposure to disease environments or poor nutrition) or advantaged (if high socioeconomic status or good health is required to immigrate). Immigrant mortality has not been well studied, partly due to data limitations. However, the US population is approximately ten percent foreign-born. Among the over-65 population, ten percent are foreign-born while only eight percent are black (Treas 1996). This paper focuses on the joint risks of being a racial minority as well as an immigrant.

Racial differentials in mortality are well established. Mortality rates by race were reported as early as 1900 (Department of Commerce 1922). Ewbank's (1987) study of historical black mortality and health demonstrated that American blacks have been disadvantaged as long as there have been accurate records. Kington and Nickens (2001) describe the persistence of differential health by race and ethnicity as one of the two central findings in the story of health in the twentieth-century United States. (The other is the marked improvement of health for all populations from 1900 to 2000). The most recent national statistics for life expectancy report white female life expectancy at birth to be 80.0 years, compared with 74.5 for white males, 74.8 for black females, and only 67.3 for black males (Murphy 2000).

Most comparisons of racial mortality differences in the United States have focused on black-white health and mortality differentials, although even in 1922 (Department of Commerce) there was data reported on the deaths of “Chinese, Japanese and other colored” in addition to blacks and American Indians. However, national data on Asians has been available only since the 1960s (Yu and Liu 1992). Generally, Asians are described as living longer than whites; Asians are possibly the most diverse of the race categories collected by the U.S. Census Bureau. A study of mortality rates by specific Asian sub-group living in the United States found that Japanese, Asian Indians and Koreans were especially long-lived, while Hawaiians and Samoans had mortality rates that were extremely high (Hoyert and Kung 1997).

In addition to racial differences in health, data can be collected on the influence of Hispanic ethnicity. In American data, ethnicity and race data are collected separately; a person of Hispanic ethnicity can be of any race. Since the late 1980s, there has been an increasing focus on the “paradox” of Hispanic good health. The paradox, as first described by Markides and Coreil (1986) surrounds the question of why lower socioeconomic status does not seem to predict poor health outcomes for Hispanics compared with other socioeconomically deprived groups in the US. A growing body of research has proclaimed the overall advantage that Hispanic Americans have in mortality (Council on Scientific Affairs AMA 1991; Liao et al 1998NCHS 1991; Polednak 1990; Shai and Rosenwaike 1987; Sorlie et al 1993). The mortality pattern is not universally better for Hispanics—death rates among Hispanic children and young adults appear to be elevated relative to non-Hispanic whites (Liao et al 1998). In addition, certain causes of

death (e.g. homicide) are elevated while others (e.g. cardiovascular disease) are decreased (Becker et al 1988; Smith, Mercy and Rosenberg 1986; Sorlie et al 1993). Hispanic infants born to US-born mothers have higher rates of infant mortality than Hispanic infants born to Mexico-born mothers do (Collins et al 1994; Ventura and Taffel 1985).

In addition to examinations of racial differences in mortality, some scholars have explored differences in mortality that depend on nativity. Marmot, Adelstein and Bulusu (1984) looked at four common migrant groups in England, and compared their mortality rates (using standardized mortality ratios) with those of England as a whole, and with the country of origin. They found that immigrants tended to have lower mortality than both persons born in England and persons who remained in the sending country, with the exception of Irish immigrants. Kestenbaum (1986) compiled simple statistics on the influence of birthplace on mortality in the United States. He found that persons born outside the United States had lower mortality rates than native-born Americans in 1980. Recently, Rogot, Sorlie, Johnson and Schmitt (1992) used the National Longitudinal Mortality Survey (NLMS), a dataset that uses 11 samples from the Current Population Survey from March 1973 through March 1985, and one sample from the 1980 census matched with the National Death Index from 1979 to 1985, to create standardized mortality ratios (SMRs) for a number of demographic and other factors, including nativity. They found that foreign-born persons have lower mortality ratios than do US-born persons.

A few scholars have focused on the joint race/ethnicity and nativity problem. Much of the research on immigrant mortality explicitly included Hispanic immigrant groups

(Fang, Madhavan and Alderman 1997; Hummer, Rogers and Nam 1999; Rosenwaike 1987). Rosenwaike examined the differences in cause-of-death for specific ethnic groups in the United States (1987; Rosenwaike and Hempstead 1990). However, he did not compare these foreign-born groups with ethnically similar native-born groups. Rather, he compared Hispanics born in Mexico, Puerto Rico and Cuba with whites and blacks, not with Hispanics born in the United States. Hummer, Rogers and Nam (1999) use a population sample survey (the National Health Interview Survey) linked with the National Death Index to compare race/ethnic groups by nativity. They found that foreign-born persons generally have lower odds of death, with native-born blacks having the highest odds of death and foreign-born blacks and Asians the lowest odds. This paper extends on their work by using the complete mortality statistics of the US, rather than a sample survey. The sample survey is more limited in the age range (there are no persons included under age 18 and very few over age 70). Since much of the deaths occur in these age ranges, it is unfortunate to omit them. In addition, it is possible that the matching technique for the NHIS-NDI undercounts non-US-born persons since one of the primary matching criteria is social security number.

As mentioned above, studies of Hispanic immigrants have reported better birth outcomes for immigrant mothers than for US-born mothers (Collins et al 1994; Ventura and Taffel 1985). Others have reported better health outcomes, including self-reported health, chronic conditions, and activities of daily living, for immigrants (Stephen et al 1994; Swallen 1997).

The odds of death, or more generally mortality, can be conceptualized as a complex web of genetic, environmental and social factors, along with a random component. All of these factors may differ by country of origin, either raising or lowering the odds. Genetic factors might include genetic predisposition to certain diseases (such as Tay-Sachs disease for Ashkenazi Jews or sickle cell anemia among blacks) as well as the general finding that longevity is in part inherited (McGue et al 1993). Environmental factors is a reference to the physical environment people live in—obviously this can vary by country of origin. The environment might include exposure to environmental toxins and infectious diseases, as well as nutritional factors. Social factors also include a broad range of factors, ranging from classic socioeconomic factors such as wealth and poverty to more structural factors such as access to health care to social psychological factors like social support and religiosity. Again, many of the social factors vary by country of origin.

Since the web of causal factors related to mortality is complex, and thus the effect of nativity is not immediately clear since the directionality of the factors related to both nativity and mortality is not uniform. Thus if there is a strong positive selection effect in migration for good health, or for socioeconomic status, then the mortality risk of the foreign-born would be expected to be lower. If, on the other hand, migration imposes a severe stress or hardship upon a person, then it would seem likely that the mortality risk would be raised. Finally, health behaviors might differ significantly between those who are migrants and those who are native-born. This could lead to increased mortality for the foreign-born if they had the unhealthy behavior (or decreased mortality if the native-born

behavior was less healthy). In reality, there are likely some factors that increase the odds of death for the foreign-born and others that decrease the odds of death.

In addition, the pattern may vary by age, gender, or race. For example, there may be both positive health selection and stress related to immigration. At some ages, the effect of stress may be greater than the effect of selection—leading to increased mortality for the foreign-born. If the effect of stress is greatest during the working years, then we might expect elevated mortality for immigrants during mid-life and lower mortality with old age. On the other hand, some have argued that older immigrants may be in poor health and seeking better care or living conditions (Longino 1981). Thus, older immigrants might have higher mortality.

Gender may also influence the results. Who makes the migration decision? Whose health might be considered? Do families move as a unit, or do individuals migrate alone? Does socioeconomic position matter? The answers to these questions may indicate be depicted in differential mortality rates. For example, among high-status immigrants in Singapore, seventy-seven percent of women indicated that their husband's employment was the cause of the move, while only five percent of the men reported moving for their wife's employment (Yeoh and Khoo 1998). Evidence has been accumulating on "tied moves", or the propensity of women to migrate with their spouses regardless of personal economic gain or loss (Chattopadhyay 1997; Mincer 1978). Ever since the work of Boserup (1970) it has been understood that the consequences of migration are not uniformly positive for women. Historically, migrant streams were dominated by men (Seller 1994). Different hypotheses can be proposed that might focus on many factors

linked to mortality; for example, the effect of stress is greater for those who immigrate without their families (for example Hispanic men) and less for those who immigrate with families (for example Hispanic women). Thus, we might expect to see lower mortality for Hispanic immigrant women than for Hispanic immigrant men.

Models of migration determinants have been evolving. Neo-classical models, based on human capital theory, are commonly phrased in terms of "push" and "pull" factors. Push factors are those which "push" migrants to leave while "pull" factors are those which draw migrants to new places. Both economic and non-economic factors are usually considered; many of the factors measured are related to the labor force economics, such as the relative wage or relative rates of unemployment.

More recently, migration theory has also incorporated a structural perspective (Heisler 1992) and finally, some migration theories have tried to integrate both the macro-level structural with the micro-level human capital approaches (Gos and Lindquist 1995). Social factors commonly included in migration models include social networks and the presence of previous migrant populations. Political factors, mainly related to immigration policy, also play a role. European immigration to the United States was also influenced by democratic factors (Hatton 1995). These factors are used to explain why some people migrate and some do not, both on the individual and national level. (For a general review of migration theory see Massey 1990.) Some research has demonstrated that the importance of these factors differs by race (Lee and Roseman 1999). Health, an individual-level factor, has generally not been considered as a strong push or pull factor. Health is usually also not measured by those who are interested in explaining migration

structurally. Some researchers have examined the role of health on migration and vice versa (Findley 1988). An examination of the migration data in the Current Population Survey indicates that about one percent of movers within the United States, both intra-country and inter-country, cite health as the reason for the move (Schachter 2001). However, health may factor into many migration decisions without being the primary factor involved (Findley 1988).

Socioeconomic status, specifically measures of income, assets, housing, occupation, education and social class has been linked to both mortality and to migration patterns. Socioeconomic status and health are entangled in complex ways. Most studies find that persons with higher socioeconomic status have better health (Blane 1995; Marmot et al 1997; Mheen, Stronks and Makenbach 1998; Lynch, Kaplan and Salonen 1997). One study even claimed that the black-white mortality gap in the United States could be explained by considering both individual and neighborhood socioeconomic characteristics (LeClere, Rogers and Peters 1997). Socioeconomic status affects not only mortality, but also the related use of medical services (Gornick et al 1996).

Socioeconomic status (SES) varies with both race/ethnicity and nativity. Recent population surveys of the United States indicate that racial minorities have lower SES than whites, on average (Humes and McKinnon 2000; McKinnon and Humes 2000; Therrien and Ramirez 2000). Blacks are especially disadvantaged, with lower education, income, wealth, and occupational prestige, and higher poverty rates, and rates of unemployment (McKinnon and Humes 2000). Hispanics also have low SES on average.

Only 57% of Hispanics are high school graduates and Hispanics are also over employed in service and labor-intensive occupations (Therrien and Ramirez 2000).

On average, the foreign-born population in the United States has lower socioeconomic status than US-born persons. The foreign-born population in the United States is, on average, less well educated than the native-born population. 22.2% of the foreign-born population had less than a ninth grade education compared with only 4.7% of the native-born population (Lollock 2001). Educational attainment varies by country of origin (and thus also race/ethnicity, although not reported in this manner by Lollock) with Europeans and Asians much better educated than Hispanic or Black immigrants. Foreign-born Americans also have less income than native-born Americans do. The socioeconomic status of immigrants needs to be considered in two contexts: that of the sending country and that of the receiving country. Immigrants often have lower socioeconomic status than the average person does in the receiving country (Enchautegui and Malone 1997; Rosmond, Lapidus and Bjorntorp 1996). However, some immigrant groups, particularly Asians in the United States, have higher socioeconomic status (Ghasarian 1994; Hirschman and Wong 1981).

The links between race, socioeconomic status and health also are well established (Adler et al 1994, Kington and Nickens 2001). DuBois (1899) was aware of the complexity of the link between socioeconomic status, race and mortality over one hundred years ago. Socioeconomic status continues to be one of the primary factors that explains some of the variation in health and mortality by race (Menchik 1993; Rogers 1992). In addition to risks that are linked to poverty and social class, related risks may be

overt in certain occupations. An examination of workplace injuries and illnesses in California in 1986 indicated that blacks and Hispanics were at elevated risk compared with non-Hispanic whites (Robinson 1989). A recent report of the Institute of Medicine (1999) indicates that non-whites are exposed to higher levels of environmental hazards.

In addition to standard social influences on health, such as SES, there is increasing evidence that other social influences, for example stress and social networks, may contribute to mortality and poor health.

The work on stress and health has come from both descriptive epidemiology (Cassej 1967; Romano, Bloom and Syme 1991; Shapiro et al 1979; Syme 1967; Syme 1970) as well as laboratory biology, for example, descriptions of complex physiological pathways (Weiner 1992). Many forms of stress have been included in the literature. Stressors can be either eventful or chronic. Low socioeconomic status is an example of a chronic stressor. Additionally, a potential chronic stressor for some groups described here is racism. US-born blacks are most likely subject to lifelong experiences of racism. Some authors have reported that black psychological distress and life satisfaction is, in part, explained by exposure to unfair treatment (Schulz, Williams, Israel 2000). Discrimination can act not only through individual behaviors, but also through inequities in societal institutions (Williams and Rucker 2000). Hispanics may also be subject to stress from racism; some evidence of differential pain management therapy for Hispanics has recently been reported (Cleeland et al 1997) Foreign-born populations may be subject to chronic stressors such as racism and poverty, but the act of immigration is also an eventful stressor. Occupations that are more common among some immigrant groups may also be

sources of stress. Common occupational stressors have been defined as work barriers, time pressure, monotonous conditions, and lack of control of work timing (Greiner et al 1997). For migrant farm laborers, often Hispanic immigrants, all of these stressors are common.

One source of stress can be limited social networks. While sociologists have been aware of the links between social integration and mortality for many years (Durkheim 1951), epidemiologists have more recently gravitated toward social features as explanatory factors in mortality and morbidity. Thus, the literature on the links between social support is wide and growing. Researchers have demonstrated that social support helps not only in very specific cases—such as post-traumatic stress disorder patients and suicide (Kotler et al 2001)—but also for all-cause mortality (Glass et al 2000; Rosengren ,Orth-Gomer, and Wilhelmsen 1998; Steinbach 1992; Sugisawa, Liang, and Liu 1994).

When considering period data, as here, it is always important to consider how the various cohorts who make up the age ranges throughout the period may differ from each other. Historically, the "immigrant" population has been thought of as new arrivals from Europe. In 1922, the Statistical Abstract did not even measure nativity for the "colored" population while nativity for whites was reported in detail to the second generation (e.g. one parent native-born, both parents native-born, neither parent native-born). Today, immigrants are most likely to be from the Americas or Asia. The most recent estimates indicate that over half of America's foreign-born population is originally from a Latin American country and a quarter were born in Asia. In addition, the foreign-born are geographically concentrated (more reside in central cities, and more reside in the West

than among the native-born population). In 2000, over three-quarters of the foreign-born were between the ages of 18 and 64 (Lollock 2001). The population of foreign-born blacks, many of whom are of Caribbean descent, is growing rapidly. By 2010, it is estimated that 10% of black Americans will be either foreign-born or the children of foreign-born (Reid 1986).

For an overview of the patterns of immigration to the United States, see Massey (1995) and the P-20 series of the United States Census Bureau (e.g. Lollock 2001). Prior to about 1930, over three-quarters of immigrants to the United States were Europeans. The remainder tended to come from the Americas, with very small numbers from elsewhere. More recently, especially in since 1970, the Americas have been the source of approximately half the new immigrants, with Asia the second contributor with about a third, and Europe contributing only a little over 10% (Massey 1995). Several factors including the passage of restrictive legislation on immigration in 1921 and 1924 and the ending of national origin as an explicit factor in immigration policy in 1965 have driven these changes. While Massey (1995) argues that the importance of this legislation has been overstated, citing, for example, the decline in European immigration prior to the passage of the 1965 Act, it is clear that the current Asian migration owes much to the end of the ban on Asians in that act.

The foreign-born population is not just recent immigrants, but rather is a combination of all waves of immigrants who are still living in the United States. More of the foreign-born did enter the United States recently, but 32.2% entered 20 years or longer ago. Thus, although recent immigrants are more likely to be Asian or Hispanic, 15.3% of the current

foreign-born population was born in Europe (Lollock 2001). It is also important to note that most black immigrants are from the Caribbean, although some are also from Africa, and the rest of the world (Bashi 1997).

Methods

Using the complete mortality records for the United States for 19989-1991 compared with the 1990 US census, we create life tables by race, sex, age and nativity.

The data used to determine mortality rates and calculate life tables by place of birth consists of the 1990 decennial census of the United States and the Vital Statistics record of all deaths in 1989, 1990, and 1991 in the United States. For the census, information on age, sex, race, Hispanic ethnicity, and place of birth is utilized. Place of birth information is available in the census data by state and by country. From the death records, the central information used is on age, sex, race, Hispanic ethnicity, and place of birth. In the death records, place of birth information is available only by state, by 6 specific foreign countries or U.S. territories (Puerto Rico, Virgin Islands, Guam, Canada, Cuba, and Mexico), and by "Remainder of the World". Therefore, the calculations presented here dichotomize the data into foreign or US birthplace.

We extracted the population data from the Public Use Microdata Sample (PUMS). The counts of population are reweighted to get the complete count for each life table calculated. We recoded the variables of interest to match the standards life table. Age was recoded from 0 to 90 years and over, as 0 years, 1 to 4 years, and in five-year intervals for age 5 to 90 years. The open age group 90 and over is the highest age group

provided by the census data. Although the deaths were tabulated to over 100 years, we had to limit the life tables at 90 years because the census data are not tabulated beyond this age. We tabulated the census data by race, nativity, and Hispanic origin according to the same standard age groups, for both males and females.

For consistency in matching the deaths to the statistics of the population, we defined U.S. born as deaths of persons born the 50 states and the District of Columbia. This definition excludes some populations of U.S. territories for the benefit of a strict matching of deaths and population statistics (given that these territories are not coded strictly in the same way in the census and the deaths data). The states of Louisiana, New Hampshire, and Oklahoma did not provide Hispanic origin on the deaths certificates and were excluded from calculations for Hispanics. We filtered out these three states from the census data for the calculation of life tables where "Hispanic origin" is involved. The death statistics included an unknown age group, as well as unknown "Hispanic origin". We distributed the deaths with unknown nativity among the age group/sex according to the weight of the age group to the total within sex category. The deaths with unknown age were also distributed among age groups according to the weight of each age group within the total deaths, separately for males and females.

Standard period life table calculations were performed. Complete life tables were created for populations in the United States, by race and ethnicity, sex and nativity. Results reported include death rates (nMx), conditional probability of death (nqx), and additional years of life expected on average. Although complete life tables were created, only 5 values are reported for each group: ages 5, 25, 45, 65 and 85. Generally, life

expectancy at birth gives an overall picture of the expected longevity of the person. However, life expectancy at birth is a somewhat artificial measure for the foreign-born population[1]. Life expectancy at age 45 is a picture of the expected longevity of persons who have survived to age 45--this is more influenced by chronic diseases and eliminates the effect of different infant mortality rates, as well as other different risks up to age 45, including differences in the size of the accident hump[2]. Finally, life expectancy at age 65 and 85 shows the expected longevity for those who have survived into the oldest age groups. Life expectancy depends on all the age groups above the reference category in the table; thus problems in the open-ended category may influence life expectancy throughout the table. The conditional probability of death is also possibly influenced by errors in previous age calculations—the 0-1 category being most problematic for the foreign-born category. The death rates (nMx) are least influenced by data errors at either end of the life table. In addition to the life table values, a standardized mortality ratio is created using the US-born white nMx as the standard. A value equal to one implies no difference between the white US-born nMx and the race or nativity group of interest, while values below one imply better mortality for the interest group, and values above one imply higher mortality.

Data Quality

Before considering the life tables calculated from the vital statistics, it is important to be aware of the potential problems with this data source. Whenever demographers use two data sources to create one measure, in this case mortality rate, it is important to assess

how comparable the populations are in the two sources. Also, the direction of the potential biases created in the rates must be addressed.

In this case, the main calculation is the death rate (${}_nM_x$). ${}_nM_x$ is calculated by dividing the number of deaths in a given age group by the number of persons in that age group. The source of the deaths is the vital statistics record, while the population is derived from census records. If the number of deaths is inflated, the death rate will be biased upward. If the number of deaths is deflated, the rate will be biased downward. On the other hand, if the number of persons counted in the census is deflated, the death rate will be biased upward; if the number of persons counted in the census is inflated, the rate will be biased downward.

There are two main sources of error in these data: either people are assigned to the wrong group, or people are missed altogether. For example, if illegal immigrants are missing from the census, but are included in the counts of deaths, mortality rates for foreign-born persons will be artificially high. Another example might indicate that if the census counts are correct, but foreign-born persons' place of birth is improperly attributed to the United States on the death certificate, then the mortality rates for foreign-born persons will be artificially low. Errors of misattribution are possible since place of birth on the death certificate is not necessarily completed by the family of the individual and may be completed by someone who is unaware of the place of birth of the person. However, there is some evidence that birthplace is accurate on death certificates. In the National Longitudinal Mortality Survey, birthplace agreed between the death record and

the Current Population Survey interview 99.4% of the time (Sorlie, Rogot, and Johnson 1992).[3]

In addition to problems with birthplace, comparisons by race/ethnicity must be aware of possible errors in race/ethnic-specific data. Examinations of the NLMS indicate that white death rates are overstated by approximately 1.0% and black death rates are overstated by approximately 5.0%. These errors mainly are due to undercounts in the census. Other racial populations have death counts that are generally understated, by 11% for Asian/Pacific Islanders and by 2% for Hispanics (Rosenberg et al 1999). Nativity may also be misclassified. It is unclear how errors in reporting of nativity might alter these error rates since the direction of bias is unknown.

Another potential source of bias is return migration, or what has been referred to as the "salmon bias" (Abraido-Lanza et al 1999). If immigrants leave the country to die after being counted in the census, immigrant mortality rates would be biased downward. By including the years surrounding the census, we have tried to minimize the return migration bias, as well as any other one-year anomalies. The three-year average strategy does assume that immigration is a relatively linear process; this may be a false assumption, however there is no reason to suppose a jag in the pattern of immigration from 1989-1991.[4] Abraido-Lanza, Dohrenwend, Ng-Mak and Turner (1999) found no evidence that the "salmon bias" influenced mortality rates for Hispanics using the NLMS.

To try and further assess the degree of error in the counts of deaths and the census, several strategies were employed. First, intercensal estimates were created for foreign-born persons ages 35 and older in 1980 (45 and older in 1990). The predicted population in 1990 was calculated by subtracting the deaths and adding the net migrants from the 1980 census population. The predicted population in 1990 was then subtracted from the 1990 census figure to calculate the difference between the actual and predicted population size in 1990 (error of closure). The error of closure was then divided by the actual 1990 census population to create a proportional measure of the magnitude of the difference (See Figure 1).

$$PredPop_{1990} = Pop_{1980} - Deaths_{1980\text{-}1990} + Net\ Migrants_{1980\text{-}1990}$$

$$EC = CensusPop_{1990} - PredPop_{1990}$$

$$Proportional\ Measure = EC/CensusPop_{1990}$$
$$= (CensusPop_{1990} - PredPop_{1990})/CensusPop_{1990}$$

[FIGURE 1 ABOUT HERE]

Until age 81, the 1990 census population of foreign-born persons consistently is larger than the predicted 1990 census population. This could be due to: 1) a 1980 census undercount of foreign-born persons; 2) a net undercount of migration in the decade; 3) an overcount of deaths (or more people being reported as foreign-born than actually were); or 4) a 1990 census over-count of foreign-born. Generally, the migration information is the least accurate. Emigration is based on estimates, since no direct counts are available. In addition, illegal immigrants are not included in the immigration figures. If the error is in the deaths, then the foreign-born mortality rates are too high. If the error is in the 1990

census population, then the foreign-born mortality rates are too low. If the error is due to missing illegal immigrants during the intercensal period (the most likely of the explanations), then the 1990 mortality rates are correct.

At age 81, the predicted population of foreign-born persons becomes larger than the 1990 census population. Again, this could be due to several factors: 1) undercounted deaths; 2) a 1990 census undercount of foreign-born persons; 3) a net overcount of migration (most likely due to unmeasured return migration); or 4) a 1980 census overcount of foreign-born persons. The migration numbers clearly are the least accurate. A net overcount of migration of the elderly would indicate that the death rates for 1990 are correct, since the error is in neither the deaths nor the population for that particular year.

In addition to the errors described previously, it is possible that there are differences in age assignment that depend on birthplace. If migrants are more likely to inflate their age on the census than are the native-born, then the death rate will be underestimated for migrants at older ages. If, on the other hand, age is more likely to be inflated for foreign-born persons on the death certificate, then the death rate will be underestimated for migrants at extreme old age.

Heaping is the tendency for persons to report their age as a number ending with a 0 or 5. An examination of the reported number of deaths by single years of age does not show more heaping for migrants than for native-born.[5] Another way to measure heaping is to examine the percentage of deaths at age *x*, as a percent of the 5-year age interval

surrounding age *x*. If deaths follow a grossly linear pattern then each year should contain approximately 20% of the deaths in a 5-year period. There is some heaping apparent in this data, for both US and foreign-born persons. There is a large peak of foreign-born persons at age 70, and dearth at ages 71-74, which is due to the odd population structure of the foreign-born (see footnote 3). At ages 80, 85, and 90, the foreign-born have higher peaks than do US-born persons. The analysis reported here uses 5-year age groups rather than single years of age throughout the analysis, to help minimize the problem of differential heaping on ages ending in 0 and 5.

Since these calculations depend on matching between two data sources, it is also important that categories match within the sources. Age misreporting was discussed above. In addition, there could be mismatches on gender, race, ethnicity or nativity. Some reports have indicated that birthplace is as likely to match between death certificates and self-report as is gender (Rogot et al 1992) and others find that ethnicity is only rarely in error comparing death certificates and next-of-kin reports (Poe et al 1993). These findings are based on overall agreement, and ignore the fact that for some groups misclassification may be more severe. That is, ethnicity and nativity may be reported correctly for those who are white US-born, but a foreign-born Hispanic may be highly likely to be misreported on one or both identities. In general, misclassification of race and ethnicity are fairly well known problems (Blustein 1994; Hahn 1992; Polednak 1995; Swallen et al 1997; Swallen et al 1998).

Results

Table 1 describes the life table for populations residing in the United States by age, race, sex and nativity. Additional years of life expected (ex in the table) shows the clear disadvantage of US-born blacks relative to all other groups, but also demonstrates a strong advantage for Asians regardless of nativity. Foreign-born Hispanic males age 5 can expect to live two years longer than can US-born whites. All other males are generally within 1 year of the life expectancy of US-born males. US-born black females aged 5 can only expect another 69.83 years of life—a decrease of 5.03 years from US-born white females.

Table 1 does not show values for age 0 (or birth) because to be included in the foreign-born mortality tables, the child would have to be born outside the United States, move to the United States and die all in the first year of life. Thus, infant mortality for foreign-born white males is 5.14 per 1,000 compared with 11.71 per 1,000 US-born white male babies. Including these figures and looking at life expectancy at birth does appear to show strong health selection for immigrants.

[TABLE 1 ABOUT HERE]

Figures 2 and 3 show the SMRs by age, race/ethnicity, and nativity graphically. Figure 2 shows males and Figure 3 females.

[FIGURE 2 ABOUT HERE]

For males (in Figure 2), the picture is less clear, as the SMRs jump about more with age. Again, US-born blacks have extremely high mortality rates and all Asians have extremely low mortality rates, relative to all other groups. Otherwise, the immigrant

populations tend to have higher mortality rates until around age 45, and then tend to have relatively lower rates. Unlike their female counterparts, foreign-born Hispanic males have similar mortality to the other immigrant groups, and are not an advantaged population.

[FIGURE 3 ABOUT HERE]

For females (in Figure 3), the graph is fairly striking—the white and black immigrant groups appear extremely similar, with elevated mortality relative to US-born whites prior to age 45 and lower but converging mortality rates after age 45. On the other had, foreign-born Asians and Hispanics have consistently low mortality, nearly as low or lower as US-born Asian women do. Black US-born females have age-specific mortality rates one-and-a-half to two times as high as their white US-born counterparts until age 85, when the difference seemingly disappears.[6] US-born Asian females, on the other hand, have extremely low mortality throughout the life course.

Discussion

An examination of the vital statistics of the United States for the intracensal years 1989-1991 demonstrates that nativity is an important predictor of mortality differentials. However, the differentials are not uniform for all groups, and age, gender, race, ethnicity and nativity should all be considered when health disparities are discussed.

There are three very intriguing findings from the vital statistics data: 1) the tremendous mortality disadvantage for US-born blacks over the life course, relative both the US-born whites and to foreign-born blacks; 2) the unimportance of nativity for

Asians, with death rates very low regardless of nativity; and 3) the gender disparities in the Hispanic death rates.

For both male and female US-born blacks, the mortality rates are two to three times higher than that of US-born whites. While the mortality rates of foreign-born blacks are slightly elevated compared with US-born whites, the rates are no where near the US-born mortality rates. Possible explanations for this difference need to be explored, and might include differential socioeconomic status, residential segregation, positive health selection for the foreign-born, and increased experiences of racism among the US-born. Since many black immigrants are from the Caribbean, return migration close to the time of death is also a potential confounder of these results.

Asians, regardless of nativity status, have very low mortality rates. Regardless of age, gender, or nativity, no Asian SMR ever reaches one. Thus, Asians appear highly advantaged in mortality. The Asian advantage could be real or it could be an artifact of the data. Possible explanations for the Asian advantage include nutritional patterns, social class, social support and stress, and long-term migrant selectivity. The US-born Asian population is a relatively recent arrival. Very few Asians have been in the United States for multiple generations. The Asian advantage supports the notion that the immigrant advantage may be perpetuated through the generations. Since all the Asians are relatively recent immigrants, most of them still are advantaged in mortality.

It is possible that part of the Asian advantage is due to data artifacts. Previous studies have indicated that Asian ethnicity is sometimes misclassified, but more likely within the

broad race category than to another race (Swallen et al 1998). Other potential sources of errors in the data, such as return migration or age heaping, are likely less of a problem for Asians than for some of the other race/ethnic groups included.

The other most recent immigrant group in the United States is the Hispanic population. As was found in previous studies (Abraido-Lanza et al 1999), Hispanic immigrants have quite low mortality rates. Unlike the NMFS study, the vital statistics do not indicate uniform low mortality for Hispanics, but rather, an age and gender-specific pattern of different mortality. Hispanic males do not have lower mortality than white US-born males until old age. For males, the US-born Hispanic rate is slightly elevated compared with the foreign-born rate. For Hispanic females, the foreign-born advantage is both more pronounced and more consistent. In addition, regardless of nativity, Hispanic females appear to have a mortality advantage relative to US-born whites.

What are the possible explanations for the gender disparity in the Hispanic mortality rates? It is possible that data quality explains part of the gendered effect; previous research has indicated that Hispanic women married to non-Hispanic men (and with non-Hispanic surnames) might be especially likely to be misclassified as non-Hispanic (Swallen et al 1997). However, this is unlikely to be the whole explanation of the pattern depicted in Table 1 and Figures 2 and 3. For young Hispanic men, nativity is not an interesting predictor of mortality while for young Hispanic women, being foreign-born is significantly protective (for a 25-year-old foreign-born Hispanic female SMR=0.78, with female Hispanic US-born SMR=1.0).

Possible explanations for the gender difference might include socioeconomic status, stress, social networks or migrant selectivity. Socioeconomic status could explain lower female mortality if women are, on average, of higher SES than men are. It could be that higher SES women migrate (a selection for migration hypothesis) or that women are more likely to migrate in or into households with higher SES (another selection hypothesis, with selection operating both for migration and marital propensities). Stress could explain the findings if male migrants experience higher stress and/or have a lower ability to cope with stress. For example, occupational stress might be higher for males than females. Occupational stress is especially interesting since the gender gap is the largest at age 25 and narrows from there on; by age 65, Hispanic men are doing about as well as Hispanic women, regardless of nativity status, when compared with US-born whites.

Stress researchers know well that the same stressor does not have the same effect of all people. Generally, three factors are described as influencing how people deal with stress: coping, social support, and mastery (Pearlin and Skaff 1996). It is possible that there are differences in these three factors for Hispanic immigrants by gender. Previous research on Salvadorean women found that for women only, having non-coresident relatives in the United States led to higher wages (Greenwell, Valdez and De Vanzo 1997). While generally women report stronger social support than do men (Turner and Marino 1994), previous reports on Hispanic immigrants indicate that women may report less perceived social support (Allen, Amason and Holmes 1998).

Another possible explanation for the gender gap is migrant selectivity that differs by gender. If selection is the explanation, then Hispanic females would have to be more

select than Hispanic males. While the evidence for this claim is lacking, the convergence of rates is what demographers expect to as select populations age and frailty differentials diminish (Jordan 1975; Vaupel, Manton and Stallard 1979).

The vital statistics, due to their large size, allow an exploration of the intersection of the influences of age, gender, race, ethnicity and nativity on mortality rates. However, without a single source for the numerator and the denominator, we cannot eliminate misclassification errors or other errors of omitted data from our findings. In addition, it remains possible that out-migration of sick persons could cause the relatively low foreign-born death rates. Further explorations of these findings in single-source data are important.

Endnotes

1. By definition, a foreign-born person must be born somewhere else, and then must live long enough to immigrate to the United States.

2. The increased mortality during late teenage and early adult years due to accidental deaths.

3. The matching rate for birthplace (99.4%) compares with 99.5% correctly identified sex, 99.4% correctly identified race, 98.7% correctly identified Hispanic origin, and 95.2% Veteran status (Sorlie, Rogot, and Johnson, 1992).

4. Obviously, some three-year intervals might have a significant jag, such as 1923, 1924 and 1925—when there were profound changes in U.S. immigration policy.

5. There is a significant dearth of deaths among foreign-born persons who were among the cohort born in the late 1910s. These persons are likely missing due to 1) low birth rates in Europe in that period and 2) high death rates among that cohort, especially males, during World War II.

6. This finding of extreme convergence is likely related to age misreporting by Blacks (Preston et al 1996).

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Figure 1. Proportional error of closure for the foreign-born population in the United States between 1980 and 1990.

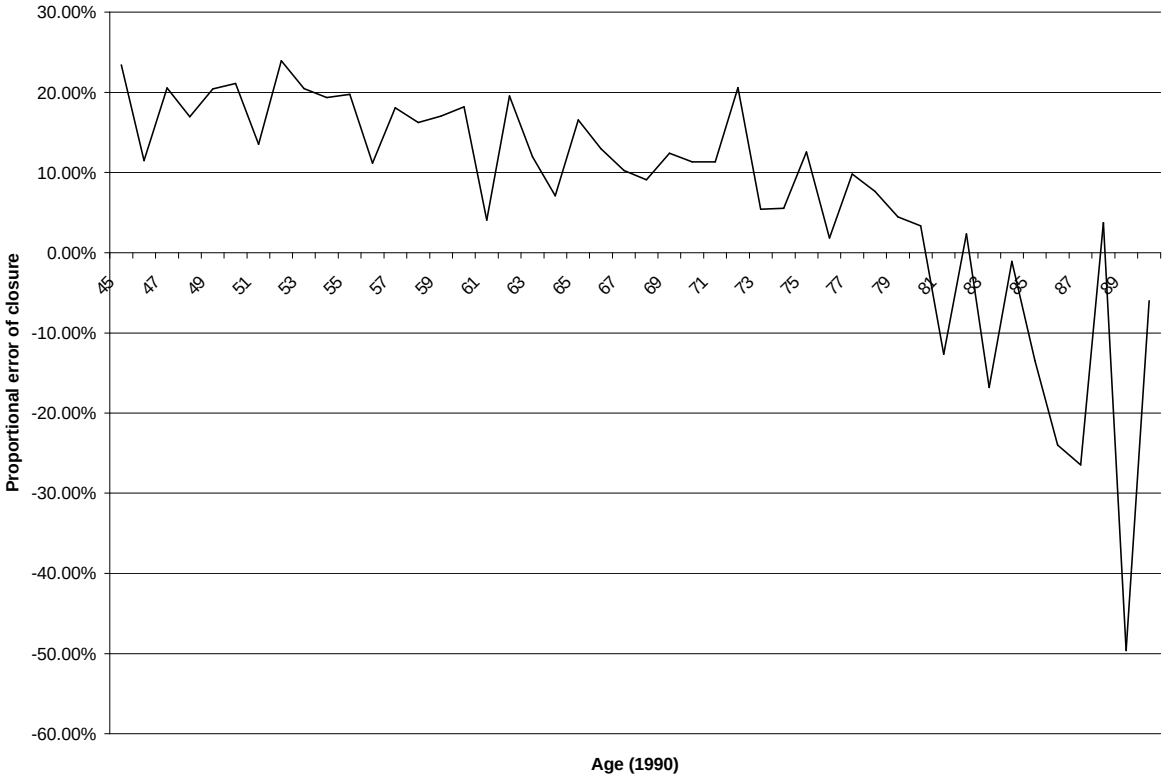


Table 1. Summary of life tables by age, sex, race/ethnicity and nativity (US-born or non-US-born). Based on life tables calculated from 1989-1991 Vital Statistics and 1990 US Census.

A. Males

		White		Black		Asian		Hispanic*	
		US	NonUS	US	NonUS	US	NonUS	US	NonUS
death rate									
	5	0.0003	0.0005	0.0004	0.0003	0.0002	0.0003	0.0002	0.0003
	25	0.0016	0.0030	0.0040	0.0028	0.0009	0.0009	0.0022	0.0022
	45	0.0044	0.0057	0.0115	0.0041	0.0028	0.0022	0.0052	0.0047
	65	0.0278	0.0236	0.0448	0.0238	0.0199	0.0158	0.0246	0.0190
	85	0.1628	0.1486	0.1494	0.2499	0.1003	0.1140	0.1171	0.1014
$_5q_x$[1]	5	0.0012	0.0024	0.0020	0.0013	0.0009	0.0013	0.0012	0.0016
	25	0.0079	0.0147	0.0198	0.0139	0.0047	0.0044	0.0111	0.0110
	45	0.0216	0.0279	0.0557	0.0205	0.0137	0.0111	0.0256	0.0231
	65	0.1299	0.1113	0.2013	0.1123	0.0949	0.0759	0.1158	0.0910
	85	0.5785	0.5419	0.5438	0.7690	0.401	0.4435	0.4529	0.4044
e_x[2]	5	68.20	66.90	60.44	68.28	73.47	74.16	68.14	70.26
	25	49.09	48.72	41.96	49.57	54.00	54.82	49.17	51.53
	45	30.82	31.60	25.90	32.12	35.18	35.74	31.79	34.05
	65	15.06	15.87	13.18	15.78	18.72	18.43	16.18	17.99
	85	5.20	5.29	5.87	3.83	7.78	6.20	7.02	7.35

* Not including census counts/death occurring in LA, OK, NH.

[1]. Conditional survival to age x+5 given survival to age x.

[2]. Additional years of life expected on average (given survival to age x).

B. Females

		White		Black		Asian		Hispanic*	
		US	NonUS	US	NonUS	US	NonUS	US	NonUS
death rate									
	5	0.0002	0.0003	0.0003	0.0003	0.0002	0.0002	0.0002	0.0002
	25	0.0006	0.0008	0.0014	0.0008	0.0004	0.0004	0.0007	0.0005
	45	0.0024	0.0025	0.0054	0.0024	0.0021	0.0014	0.0023	0.0018
	65	0.0156	0.0132	0.0251	0.0148	0.0111	0.0089	0.0145	0.0110
	85	0.1077	0.1154	0.1070	0.0995	0.0572	0.0789	0.0739	0.0975
$_5q_x$[1]	5	0.0009	0.0017	0.0014	0.0013	0.0007	0.0008	0.0008	0.0011
	25	0.0028	0.0037	0.0068	0.0042	0.0020	0.0018	0.0033	0.0026
	45	0.0121	0.0125	0.0268	0.0117	0.0106	0.0068	0.0114	0.0089
	65	0.0751	0.0640	0.1183	0.0715	0.0540	0.0435	0.0701	0.0534
	85	0.4244	0.4479	0.4221	0.3985	0.2502	0.3295	0.3112	0.3921
e_x[2]	5	74.86	75.01	69.83	75.94	78.94	79.88	76.01	77.60
	25	55.30	55.67	50.43	56.39	59.25	60.22	56.43	58.02
	45	36.11	36.70	32.38	37.50	39.88	40.76	37.41	38.80
	65	19.04	19.37	17.32	20.39	22.51	22.64	20.22	21.07
	85	6.62	6.20	7.02	8.34	9.69	8.59	7.72	7.66

* Not including census counts/death occurring in LA, OK, NH.

[1]. Conditional survival to age x+5 given survival to age x.

[2]. Additional years of life expected on average (given survival to age x).

Figure 2. Standardized age-specific mortality ratios for males, 1989-1991 U.S. vital statistics and 1990 U.S. Census.

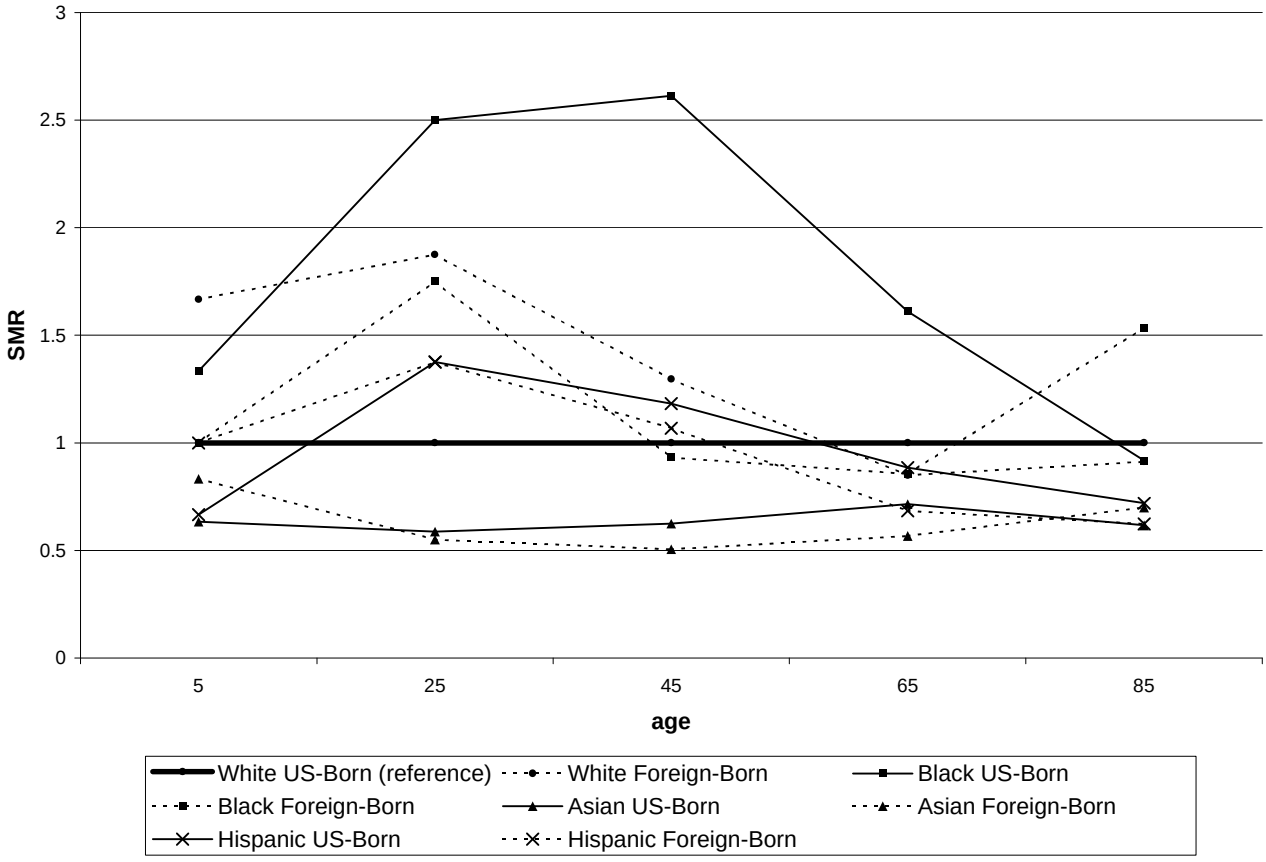
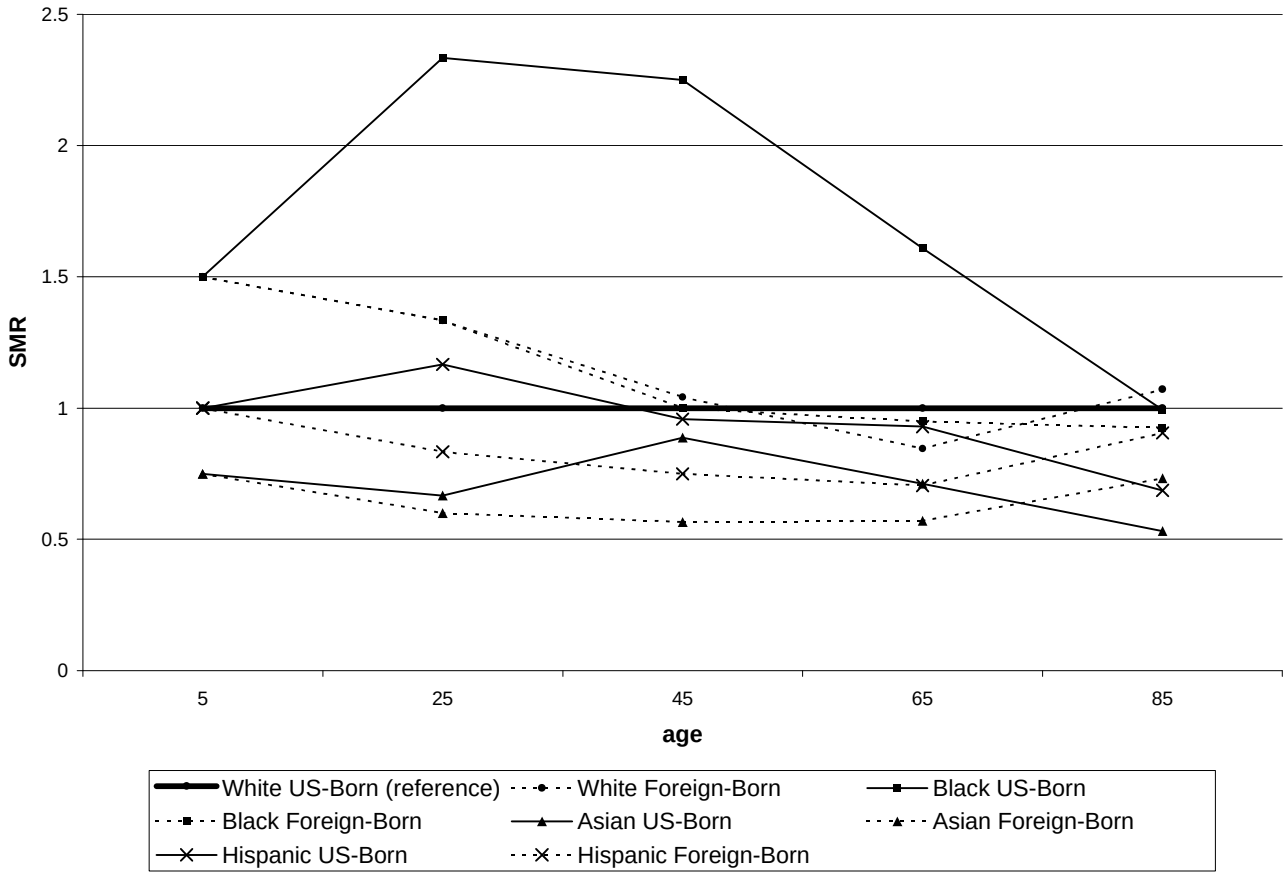


Figure 3. Standardized age-specific mortality ratios for females, 1989-1991 U.S. vital statistics and 1990 U.S. Census.



Center for Demography and Ecology
University of Wisconsin
1180 Observatory Drive Rm. 4412
Madison, WI 53706-1393
U.S.A.
608/262-2182
FAX 608/262-8400
comments to:kswallen@ssc.wisc.edu
requests to: cdepubs@ssc.wisc.edu