Chapter 11
Health Demography

Abstract Health demography is a subdiscipline of demography that has gained in significance over recent years as a result of the increased interest in the health status of the U.S. population and the operation of the healthcare system. This chapter describes the activities of health demographers and the ways in which demographic data, concepts and techniques are applied to the study of concrete health problems related to health and healthcare.

11.1 Introduction

Health demography is a subdiscipline within the field of demography that involves the application of the content and methods of demography to the study of health and healthcare. It focuses on the application of demographic concepts and methods to the understanding and solution of concrete problems in healthcare and it informs health policy setting. "Health" and "healthcare" refer, respectively, to the condition of health as experienced by individuals and populations and to efforts in place—both formal and informal—for managing a population's health. Health demography further concerns itself with the manner in which demographic attributes influence both the health status and health behavior of populations and how, in turn, health-related phenomena affect demographic attributes.

The scope of health demography is quite broad, and there is little within the discipline of demography that does not have some relevance for the study of health and healthcare. At the same time, virtually every aspect of "health" is amenable to study by means of demographic techniques and perspectives. Whether the issue is the cause or consequence of disease, variations in health status among populations, utilization levels for various health services, the attitudes of health professionals, the study of medical outcomes, or even the organization of the healthcare delivery system, it can be better understood through the use of demographic perspectives, concepts, methods, and data.

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The scope of health demography is quite broad, and virtually every aspect of health and healthcare can benefit from the application of demographic concepts, techniques and data.

The subject matter of health demography is not new. Its roots are found in a number of existing disciplines. In fact, health demography represents a synthesis and reformulation of concepts and substantive data previously developed in a variety of other fields. Health demography's ancestry includes epidemiology which in its modern usage refers to the study of the origin and progression of illness within a population. The scope of the field has steadily broadened from a focus on epidemic diseases to the study of the cause, course, and correlates of a wide variety of health conditions. The notion of "social epidemiology" has become widely accepted by a variety of disciplines and emphasizes the distribution of illness within the population and the health behavior of various social groups. Its emphasis on populations rather than individuals makes it akin to demography, and epidemiological investigations have increasingly shifted from the relationship between environmental disease agents and human health conditions toward the link between demographic characteristics and the prevalence and distribution of various health risks.

Medical sociology has also contributed to the evolution of the field of health demography. By the 1960s medical sociology had taken on a strong social epidemiology flavor. Research findings that established a connection between poverty and poor health generated interest in the social and demographic correlates of health status and health behavior. Medical sociologists have subsequently led the effort to document the relationship between health characteristics and age, sex, race, marital status, religion, and other demographic variables. They have also demonstrated the extent of interaction among various demographic factors and have been influential in redefining of the concepts of health and illness. Currently, much of the emphasis in medical sociology—and, indeed, in all health-related disciplines—is focused on the persistent health disparities found within the U.S. population, disparities that exist primarily along demographic dimensions. Other contributors to health demography include medical anthropology, medical geography and medical economics.

11.2 Applications of Demography to the Study of Health and Healthcare

There are at least three different realms in which health demography can make an impact. First, the contribution that health demography can make to the field of social epidemiology is becoming increasingly apparent. As chronic disease came to dominate the morbidity configuration, the distribution of morbidity and mortality

along demographic dimensions became more and more obvious. Today, to understand patterns of disease distribution within the U.S. population is to understand the demographics of disease. Emerging morbidity configurations reflect demographic attributes as, for example, children (particularly those at low socioeconomic levels) increasingly exhibit chronic disease once reserved for older adults. Changing patterns of mortality and life expectancy are being driven by certain subgroups within the population and, now, the epidemic of opioid addiction and overdose exhibits clear-cut demographic correlates.

The most direct application of the insights developed by demographers involves the search for solutions to the health problems that plague the U.S. population. The problems are numerous as the population appears to be getting sicker, chronic disease prevalence is increasing faster than warranted by demographic trends, communicable diseases are re-emerging as health threats, and "diseases of despair" take an increasing toll on the population. These are no longer strictly medical problems but increasingly social problems. As such their solution cannot be found under a microscope but in the demographically patterned behaviors of the population and its various subgroups.

A second area in which health demography can and does make an important contribution is to the "business" of healthcare. Healthcare accounts for nearly 20% of the gross domestic product and nearly 11% of the U.S. workforce. It is a three trillion dollar "industry" that is increasingly driven by the characteristics of the population it is designed to serve. There is virtually no aspect of the business of healthcare that does not lend itself to the application of demographic concepts, techniques and data. Decisions are made every day by health planners, administrators and business developers that rely heavily on an understanding of the demographics of patients and the general population. These decisions relate to such diverse tasks as product/service development, site selection, facilities planning, staffing allocation, acquisition decisions and myriad other activities associated with healthcare as a business. Even the large not-for-profit sector of the healthcare industry has to pursue business principals in order to achieve its mission. (Case Study 11.1 describes one way in which demographics can be applied to a concrete problem within the healthcare sphere.)

There are three major "realms" in which demography can be applied to healthcare—social epidemiology, the "business" of healthcare, and healthcare policy-making.

Today, the business of healthcare is rapidly moving toward a "population health model", opening up numerous opportunities for the application of demography (Thomas, 2017). The emerging population health model turns the traditional healthcare system on its head and emphasizes the management of populations rather than individual patients. Healthcare providers are increasingly being rewarded for improving the health status of groups of consumers rather than individual patients.

In order to accomplish this health professionals need to understand the characteristics of various groups within the population along with their health-related attributes. Demographers are uniquely positioned to assist health professionals in identifying and profiling key segments of the population allowing healthcare providers to more efficiently manage targeted groups. Importantly, it is necessary to identify the factors that distinguish one segment from another in order to tailor interventions to the particular characteristics of the targeted group.

The third area in which health demographers can have an impact is in the area of health policy. Much of the controversy surrounding the delivery of health services in the U.S. today reflects the issues related to access to care for various segments of the population. The headlines are filled with articles highlighting the issues surround the Medicare program for seniors, the Medicaid program for the disadvantaged, the Affordable Care Act (ACA), the effectiveness of Veterans Administration health services, and so forth. These are not medical problems per se but they reflect the changing demographic attributes of the U.S. population. The aging of the baby boomers is beginning to make its mark on the healthcare system, while the surge in the number of people living in poverty places strains on the Medicaid program. A major impetus for the introduction of the ACA was the large proportion of the population that lacked health insurance, and a new generation of veterans has different characteristics from those of the past (in particular the high proportion of females). These policy-related issues can only be understood when viewed with "demographic eyes."

While the development of a baseline understanding of morbidity is important, ultimately the challenge is to apply this information to concrete problems in the real world. Applied demographers, population scientists, epidemiologists and others use this information to plan public health initiatives, develop treatment modalities, improve the delivery of care, and develop marketing programs for healthcare organizations. In order to address the pressing challenges of the day, morbidity data can be utilized to better manage chronic conditions, for the development of effective health insurance plans (private and public), to address the financial challenges facing Medicare, and to deal with myriad other challenges within the healthcare arena. Case Study 11.1 illustrates an application of demography to the business of healthcare.

Case Study 11.1: Planning an Obstetrical Facility

Planning for any health facility represents a challenge and the establishment of an obstetrical facility can be a complicated process. From the first step on, the process requires considerable research and the application of a number of demographic concepts. The first challenge involves the delineation of the service area for an OB unit. How far is it reasonable to expect pregnant women to travel to deliver a baby (or for prenatal and postnatal services)? The administrators may already have some idea of the facility's service area for general care, but are OB patients different? They are, in fact, and a hospital is likely to attract OB patients from a broader area than patients for many other

services. The delineation of the OB service area will, therefore, depend on the availability of competing services, the location of obstetricians' offices, and access to transportation.

Having delineated the appropriate service area, it is then necessary to calculate the demand for obstetrical services. How many deliveries can be expected annually from the population being served? This, of course, can be calculated in a number of ways. The simplest—and probably most misleading—of these would be to determine the crude birth rate for the target population. This rate could be misleading, however, in that the denominator is the entire population and large segments of the population (e.g., men, very young and very old women) are not "eligible" for obstetric services. Nor does the crude birth rate take such factors as age, race, and marital status into consideration. Further, if the data are only available for the entire county, applying the countrywide crude birth rate to the target population at the ZIP Code level may mean that an average is being used that may not be reflective of the characteristics of the population within that service area.

A more refined indicator (e.g., general fertility rate) would be preferable and would better indicate the actual fertility experience of the target population. If it is not available, one could apply some standard rate that accounts for age, sex, race, and even income distribution. Any ethnic concentrations within the service area should also be noted, as many such groups (e.g., Hispanics) are likely to display different fertility patterns than the general population.

Once the fertility behavior of the target population has been determined, it should be possible to apply the appropriate rate and estimate the yield of births from the service area. However, it will be a year or two before the facility is operational, and perhaps five years before its financial viability can be determined. Thus, the projected number of births for future time periods is more crucial than the number of current births. Here the various projection techniques available to the demographer can be employed. One might first want to examine overall population trends; that is, is the service area population increasing, decreasing, or stable? Is the service area growing, i.e., are housing units being added? A projected decline in the population base does not bode well for a new facility. More importantly, however, how is the composition of the population changing? A growing population will not be meaningful if it is rapidly aging.

Once a future population has been established, the potential number of births can be projected. The planning does not end here, however, since a number of other factors need to be taken into consideration. The economic status of the target population needs to be evaluated. Further, the availability of medical manpower needs to be considered, since a new facility with no physician support or an inadequate number of neonatal nurses will not be viable. The risk level of the population must also be considered. Is this a population with high rates of premature and low birth-weight babies or a

population that utilizes significant levels of prenatal care? If so, special facilities and services may be necessary.

The projected birth figure for the service area population is only meaningful if there is no competition. In most areas, there will be more than one facility competing for obstetrical cases. The new facility cannot expect to obtain all potential births, but only its market share. The current distribution of births among existing facilities must be determined in order to estimate the share that the new facility will capture, assuming all other factors remain constant. Of course, market shares can shift and are affected by numerous factors. Information on deliveries can often be obtained from state health agencies or purchased from data vendors who calculate market shares. Some realistic estimate of the capturable market share must subsequently be made in order to determine the true potential utilization for the planned facility.

As can be seen, virtually all aspects of demography are utilized in the planning of this type of facility, and the process can even be more complicated than outlined above. This helps explain the booming business in the sale of demographic data and the growing number of individuals with demographic training being utilized by healthcare organizations.

11.3 Demographic Processes and Health Demography

The emergence of health demography as a sub-discipline had its roots to a certain extent in the study of fertility and mortality, two of the major demographic processes. These two areas of demographic study were discussed earlier in the text and will only be summarized here. A related topic, morbidity, has not been previously addressed but will be introduced in this chapter.

11.3.1 Fertility Analysis

Fertility behavior is viewed broadly here and includes pre-pregnancy behavior, prenatal care, health-related activities during pregnancy (e.g., cigarette smoking), pregnancy outcome (e.g., birth, miscarriage and induced abortion), and post-natal care. Demographic applications to the study of fertility have been particularly useful when it comes to the impact of demographic attributes on health-related pregnancy outcomes.

There are a number of adverse outcomes associated with fertility and most exhibit a correlation with demographic attributes. In fact, the significant disparities that are found within the population are almost always a function of demographic differences within that population. The U.S. population exhibits levels of adverse

outcomes that compare unfavorably to comparable countries. The level of premature births and low birth-weight births place the U.S. near the bottom of industrialized nations. The level of out-of-wedlock births—with all of the social and economic implications that carries—far exceeds those of similar countries, and the rate of teen births would be considered outrageous by most.

11.3.2 Mortality Analysis

A previous chapter was devoted to mortality so the discussion here will focus on the health-related aspects of mortality analysis. Demographers have contributed greatly to our understanding of mortality and health-related issues both in terms of the development of mortality measures and the identification of death patterns within the population. Comparisons of deaths, death rates and life expectancy across geographic units provide insights into variations in health conditions and health services. Compiling death counts over a period of years has helped identify trends with regard to increases or decreases in mortality. Deaths are also cross-classified by the medical, social, and economic characteristics of the deceased (e.g., cause of death and age at death).

Health demography has a lot to contribute to our understanding of basic demographic processes such as fertility and mortality.

Death like other health-related phenomena is not distributed randomly within a population. The preponderance of chronic diseases in the U.S. and other comparable societies means there are significant demographic correlates with mortality. The key contribution of health demography to the study of mortality is the insights developed into the correlation between demographic attributes and aspects of mortality—comparative death rates, differences in causes of death and, more recently, disparities in morbidity and mortality among various subgroups in society. Different demographic subgroups exhibit different mortality rates with some groups clearly more "burdened" than others. Causes of death are clearly distributed along demographic lines, and emerging causes of death (e.g., opioid overdose, "diseases of despair") and increasing mortality rates are restricted to certain demographic subgroups.

One frequently utilized mortality indicator is the infant mortality rate, and this is sometimes considered a proxy for a population's overall health status. Although this measure only applies to a limited segment of the population (i.e., those under 1 year of age), it is considered by many as more useful than the overall mortality rate. The premise is that the infant mortality rate is much more than an outcome measure for the healthcare system. Rather, the level of infant mortality is a function of environmental safety, diet, prenatal care, the educational and economic status of

the parents, the age of the mother, the occurrence of neglect and abuse, and a number of other factors. Thus, infant mortality is thought to reflect the combined impact of multiple contributors to health and well-being.

As with the overall mortality rate, however, infant deaths occur rarely enough that measures of infant mortality have less salience as indicators of a population's health than they did historically. Although infant mortality was dramatically reduced as a cause of death for African-Americans during the last century, it continues to be a serious health threat for nonwhites. The infant mortality rate for African-Americans in 2011 was more than twice that for whites (Hoyert & Xu, 2012). Other racial and ethnic groups recorded quite disparate rates of infant death. Certain Asian-American groups, for example, report much lower than average infant mortality, while Hispanics as a group record infant mortality rates between those of whites and blacks. Native Americans and native Alaskans historically have recorded very high infant mortality rates; however, since the 1950s, their rates have come to resemble the U.S. average. The Hispanic infant mortality rate is something of an anomaly, given the relatively poor health status of this population and this group's lower level of access to health services. The low Hispanic infant mortality rate is generally attributed to the emphasis on family within this culture.

11.3.3 Morbidity Analysis

Morbidity analysis has become a major area of emphasis for health demographers. As morbidity has come to be more reflective of the nature of a society's health problems than mortality, the interest in the study of morbidity has increased. The current concern over disparities in health status—disparities most often described in demographic terms—has attracted increased attention to what demography can bring to this discussion, and as a result the study of morbidity is a key component of health demography.

While "morbidity" may be used to refer to the health status of an individual or a group, demographers are almost exclusively interested in morbidity as associated with populations and rarely with the morbidity of individuals. The exception to this might be the situation in which the identified health status of individuals based on some assessment tool is aggregated to generate the morbidity status of the population in question. The interest in morbidity analysis has increased concomitant to the growing appreciation of the demographic correlates of health status and health behavior. The fact that the distribution of morbidity within the U.S. population mirrors the distribution of demographic characteristics has reinforced the importance of health demography.

Public health officials have a particular interest in morbidity patterns, although from a different perspective than clinicians. With their emphasis on population health, public health officials focus on broad patterns of disease within the population and examine the association between disease incidence and the population's

demographic attributes. Efforts by public health officials to reduce morbidity begin with an understanding of the demographic characteristics of the target population.

Health policy analysts and policy-makers have a keen interest in the morbidity conditions that affect the U.S. population and its various subgroups. Given the impact on the U.S. economy of activities within the healthcare arena there is significant and growing interest in the factors that contribute to the increasing cost of providing for the healthcare needs of the U.S. population. Government policy analysts responsible for programs such as Medicare, Medicaid and Social Security have an urgent need for comprehensive, timely and detailed data on American morbidity patterns. Such information is used to inform policy decisions with regard to issues as basic as reimbursement rates for physicians under Medicare to issues as broad as eligibility for the Medicaid program. The role of the epidemiological transition in changing the nature of illness is discussed in Exhibit 11.1.

Exhibit 11.1: Demographics and the Epidemiological Transition

During the 20th century, the United States and most other developed countries experienced an "epidemiologic transition". The epidemiologic transition involved a shift from a predominance of acute conditions to a predominance of chronic conditions within their populations. This phenomenon was primarily a consequence of the demographic transition affecting these countries earlier in the century and to advances in society's ability to manage health problems. In the former case, the aging of the population resulted in a dramatic change in the types of health conditions affecting its members. In the latter case, the introduction of public health measures and, to a lesser degree, advances in clinical medicine eliminated certain health conditions and inadvertently brought other conditions to the fore.

Prior to the epidemiologic transition, the most common health conditions were respiratory conditions, gastrointestinal conditions, infectious and parasitic conditions, and injuries. Even today, in traditional societies and populations with a younger age structure cholera, yellow fever, skin diseases, nutritional deficiencies and similar acute conditions remain common. Acute conditions appeared to affect a cross-section of the population sometimes seemingly at random, while chronic diseases appeared to be much more selective in their impact. In the 20th century, emergent chronic diseases reflected the combined affect of heredity, environment, lifestyles and even access to healthcare.

Post-epidemiologic transition, populations in developed countries and those with older populations are more likely to be affected by heart disease, cancer, diabetes, arthritis, chronic respiratory diseases and similar chronic conditions. As a practical matter, most members of traditional societies did not live long enough to contract chronic conditions and, when they did contract them, they could not be managed and early death ensued. From a demographic perspective, this meant that, for the first time, demographically related disparities in health status might become common within a

population. For demographers and others concerned about the population's morbidity profile, the shift from a predominance of acute conditions to a predominance of chronic conditions has been momentous.

One of the consequences of the epidemiological transition was the repatterning of health conditions along demographic lines. A significant body of research has documented the differential distribution of disease among various subgroups within the U.S. population. An association can be demonstrated between morbidity rates and such factors as age distribution, sex ratio, racial and ethnic makeup, and even attributes such as marital status, income and education. The fact that disease patterns can be determined based on geography is more often than not a function of the demographic attributes of residents of different geographic areas. Widespread health disparities have been observed based on analyses of the differential distribution of disease among various demographically delineated subpopulations.

11.4 Measuring Morbidity

As the study of morbidity has gained importance demographers have developed measurement techniques or adopted then from other disciplines. Most of the measurement techniques are straightforward although some borrowed from epidemiology can be complex. Exhibit 11.2 provides basic calculations for morbidity rates.

Exhibit 11.2: Calculating Morbidity Rates
The morbidity rate can be calculated using a simple formula assuming the necessary data area available. The examples below present morbidity calculations with the results shown as a percent and as a rate:

Morbidity percent:

$$\text{Morbidity proportion} = \frac{\text{Number of cases of disease}_x \text{ during time}_x}{\text{Population at risk during time}_x} = \_\_\_\_\_\%$$

$$\text{Morbidity proportion} = \frac{100 \text{ cases of asthma in 2010}}{1000 \text{ population in 2010}} = 10.0\%$$

Morbidity rate:

$$\text{Morbidity rate} = \frac{\text{Number of cases of disease}_x \text{ during time}_x}{\text{Population at risk at time}_x} \times 1000 = \_\_\_/1000$$

$$\text{Morbidity rate} = \frac{100 \text{ cases of asthma in 2010}}{1000 \text{ population in 2010}} \times 1000 = 100/1000$$

While the overall morbidity rate offers a global view of a population's health status, more detail is often required. Two measures used by epidemiologists for further quantifying the level of morbidity—incidence and prevalence rates—represent variations on the morbidity rate. An *incidence rate* refers to the number of new cases of a disease or condition identified over a certain time period expressed as a proportion of the population at risk (or the number of reported cases during a specific time period divided by the population at risk). A *prevalence rate* represents the totality of morbidity at a specific point in time. The prevalence rate is calculated by dividing the total number of persons with the disease or condition in question by the population at risk at a specific point in time. Thus, the prevalence rate includes all cases extant at a point in time (i.e., existing cases plus newly diagnosed cases).

The prevalence rate always exceeds the incidence rate, since the latter includes both new cases identified during the time period and existing cases. The only time the two rates are nearly comparable is when the condition is acute and of very short duration. For example, the incidence rate would almost equal the prevalence rate at the height of a 24-hour virus epidemic since victims recover almost as quickly as they are affected. Exhibit 11.3 describes the calculation of incidence and prevalence rates.

Exhibit 11.3: Calculating Incidence and Prevalence Rates

The calculation of the incidence and prevalence rates for AIDS illustrates the use of the two different rates. The incidence rate for persons diagnosed as having AIDS in 2005 in the United States was:

$$\frac{\text{AIDS cases diagnosed during 2005}}{\text{Population at risk mid-2005}} = \text{cases per } 100,000 \text{ population}$$

The prevalence rate for AIDS at the end of 2005, on the other hand, would be calculated as follows:

$$\frac{\text{AIDS cases diagnosed during 2005} + \text{existing cases of AIDS}}{\text{Population at risk at the end of 2005}} = \text{cases per } 100,000 \text{ population}$$

The incidence rate is a valuable measure in epidemiological investigations. If a new or mysterious condition afflicts a population, epidemiologists can trace the spread of the condition through the population by backtracking using incidence data. The cause or population of origin of a new disease can often only be determined by identifying the characteristics of the victims and the conditions under which the disease was contracted. The exact date of occurrence becomes crucial if the epidemiological detective is to link the onset of the disease to a particular set of circumstances. AIDS is a case in point wherein the means of transmission may be identified based on the characteristics of the affected individuals.

The prevalence rate can be used in much the same way when the condition is a chronic one. There is less interest in determining the origin and progression of a disorder within a population than in determining the number of patients with that condition within a population at a given pint in time. This is precisely how many hospitals and other healthcare providers forecast demand for their services.

A related measure that might be utilized is the *proportional morbidity rate (PMR)* or the proportion of *all* diseased individuals in the population with the particular disease under discussion. In this case, the denominator is not the total population but the population of affected individuals. Among the population with any chronic disease, for example, what proportion suffers from diabetes? The PMR can also be used to track changes in morbidity levels over time by comparing the PMR for a population for two or more time periods. The proportional morbidity ratio can be used to compare the relative morbidity for two populations (comparative morbidity) by simply dividing the PMR for Population A by the PMR for Population B. Exhibit 11.4 describes the calculation of proportional and comparative morbidity ratios.

Exhibit 11.4: Calculating Proportional and Comparative Morbidity Ratios

The proportional morbidity rate is calculated using the following formula:

$$\text{Proportional morbidity ratio} = \frac{\text{Number of cases of a specified condition during time}_x}{\text{Total cases during time}_x} = \text{\_\_\_\_\_}$$

Using a concrete example, the following proportional morbidity rate is generated:

$$\text{Proportional morbidity ratio} = \frac{\text{100 diabetes cases during time period x}}{\text{1000 total cases during time period x}} = 10.0$$

The proportional morbidity ratio can be used to compare the relative morbidity for two populations by simply dividing the PMR for Population A

by the PMR for Population B. This generates a proportional morbidity ratio. To wit:

$$\text{Comparative morbidity ratio} = \frac{\text{PMR}_{\text{PopA}}}{\text{PMR}_{\text{PopB}}} = \text{\_\_\_\_}$$

or

$$\text{Comparative morbidity ratio} = \frac{10}{15} = 0.67$$

This measure could also be considered an indicator of *relative risk* determined by the ratio of two incidence or prevalence rates. Typically, the rate for the population being analyzed would be divided by the rate for a control or reference population. Relative risk is useful for comparing populations affected by a certain condition to populations not affected by that condition. For example, the prevalence rate for asthma in a city characterized by a high level of air pollution might be compared to the rate for a city with a low level of pollution. Dividing the rate for the former by the rate for latter will generate a measure of relative risk.

Two additional rates utilized by demographers are case rates and case fatality rates. A *case rate* is merely an expression of the reported incidence of a disease per 1000, 10,000, or 100,000 persons and is not as finely tuned as a rate that is adjusted for the population at risk. This is comparable to the basic morbidity rate described above. The *case fatality rate* is generated by dividing the number of persons who die from a certain disease by the number of persons who contracted that disease. The quotient is expressed as a percentage. For example, through 1996, 7629 children had contracted AIDS and 4406, or about 58%, had died.

One other way of looking at the likelihood of one population being affected compared to other populations is through the calculation of *odds ratios*. The odds represent the chances of one population having a condition compared to the chances in other populations—e.g., the chances of being exposed to a disease in one population compared to the chances of exposure in another population. As with relative risk, the calculation involves dividing the odds for one population by the odds for another population. For calculating relative risk and odds ratios the numerators are the same; it is the denominators that differ.

Another consideration when calculating rates for morbidity and mortality is the determination of the population at risk. The population at risk is the number of persons who have some non-zeroprobability of contracting the condition in question. In most cases, the calculation of morbidity rates requires information on the number of identified cases for the disease(s) in question (the numerator) and the number of people at risk for contracting that disease or diseases (the denominator). The numerator—that is, the existing number of cases of the condition within the denominator—would be drawn from epidemiological data (with all the caveats that implies). The denominator in this equation—the population at risk—is usually

readily available since it is typically a known quantity. As noted elsewhere, identifyingthe population at risk is often a challenge in its own right.

For many conditions, the population at risk is synonymous with the total population, and the infection rate is relatively easy to calculate. For a condition that is pandemic—e.g., seasonal flu—essentially the entire population is at risk. Thus, the CDC calculates the influenza rate using the number of new cases identified for a specified time period and assumes that the total population is essentially at risk. Selective risk has become more common as chronic diseases—particularly those that are lifestyle related—have come to dominate the morbidity spectrum. Certain subsets of the population may have a predisposition toward a specific disease (e.g., African-Americans and sickle cell anemia), be at risk due to selective exposure (e.g., coal miners and black lung disease), attend the same event (e.g., food poisoning at a banquet), or practice risky behavior (e.g., male homosexuals and HIV/AIDS). For these reasons the specification of the denominator may be a challenge, requiring the analyst to have an in-depth understanding of the health condition under study.

11.5 Standardizing Health Data

It is sometimes necessary to standardize the morbidity rate so that it is expressed as a proportion of the expected rate compared with a standard group. Standardization is necessary when two or more populations are being compared in terms of their morbidity status or when a population's morbidity status is being analyzed over time. A general morbidity rate, while useful for some purposes, may offer a misleading view of a population's morbidity status if the population does not exhibit a "normal" demographic profile.

A case in point involves the state of Florida where morbidity rates for chronic disease are found to be inordinately high. These rates defy the conventional wisdom that Florida is a healthy place to live. Even a casual observer is likely to note the "abnormal" age structure of the state's population, since Florida exhibits a much older age structure than the nation as a whole. In order to determine the "true" overall morbidity rate or the rates for specific diseases, the population structure must the statistically adjusted to resemble some "standard" population (most often the U.S. population). Once the age structure has been standardized, new morbidity rates can be calculated that represent a more accurate depiction of the state's actual morbidity level.

This approach is referred to as *direct standardization*. *Indirect standardization* involves a similar methodology but, in that case, the morbidity rate for each disease (rather than the population) is adjusted to reflect a more "normal" disease rate. This produces the number of "expected case" that can then be compared to the number of "observed cases," allowing the analyst to draw conclusions about the morbidity status of the two populations based on the differences between expected cases and

observed cases. Exhibit 11.5 describes the process (originally presented in Chap. 7) used to standardize health data.

Exhibit 11.5: Standardization of Health Data

Standardization is a method used by epidemiologists and population scientists to adjust measures of vital processes for compositional factors that have an effect on those rates. The number of cases of disease occurring in any year is a function of three components: health status, population size and demographic attributes (e.g., age). In comparing morbidity rates for two or more populations, it is important to hold population size and age structure (and perhaps other attributes) constant when morbidity rates are being constructed.

The calculation of rates addresses concerns over differences in population size and allows the analyst to compare the health status of two populations that are different demographically. A basic morbidity rate that uses the total population as the denominator is likely to be the first rate calculated. However, the overall morbidity rate may be misleading since the level of morbidity is influenced by differences in the age structures of the populations in question. That is, areas with relatively young populations (and hence less risk of chronic disease) are likely to report low morbidity rates, while areas with relatively old populations (and greater risk of chronic disease) are likely to report high morbidity rates independent of the size of the respective populations. For this reason, the unadjusted morbidity rate is not a good measure for comparative purposes.

It is possible to adjust or standardize rates in order to control for age structure and, often, other factors (e.g., race). One method for accomplishing this is to select a "standard" age structure (e.g., the age structure for the United States), apply the incidence rate from two different populations to the standard age distribution, and then compare the number of cases after the adjustment. This process generates the number of cases for the respective populations *as if* their age structures were the same. The revised number of deaths (the numerator) can then be divided by the population size and an age-adjusted morbidity rate generated.

Using a specific disease as an example, the following table illustrates a method for adjusting the incidence rate for a particular population.

Standardizing the incidence rate for diabetes

Age group	Community population	Rate[a]	Cases	Standard population	Rate[a]	Cases
0–14	13,000	15	195	5000	15	75
15–24	12,000	30	360	5000	30	150
25–44	10,000	65	650	14,500	65	9425
45–64	8000	250	2000	15,500	250	3875
	7000	425	2975	5000	425	2125

(continued)

(continued)

Age group	Community population	Rate[a]	Cases	Standard population	Rate[a]	Cases
65 and over						
Total	50,000		6180	50,000		15,650
Incidence rate			123.6/1000	313.0/1000		

[a]Rate per 1000 population

An inspection of the data indicates that the community exhibits a very young population reporting relatively few cases of diabetes. However, when this community's population is adjusted to resemble a more "normal" population, the number of expected cases increases dramatically, and the prevalence rate increases from 123.6 to 313.0 per 1000.

The same principles of standardization can be used to adjust rates for other factors, such as education, race, and ethnicity. A similar process can be utilized to adjust mortality rates by holding certain factors constant. For example, the death rates for a predominantly white population and a predominantly African-American population might be recalculated using a standardized method that assumes that the populations have comparable racial characteristics.

These examples represent a relatively "crude" view of a morbidity rate since they do not take into account the demographic makeup of the population in question. For many health conditions a rate calculated based on the total population may not be appropriate. If data are available a better estimate can be generated by using rates specific to age, sex, race or some other factor known to affect the amount of morbidity attributable to the condition under study. At a minimum, it would be desirable to adjust the estimates for the age structure and sex breakdown for the population being analyzed.

11.6 Demographics and Health Indicators

The morbidity characteristics of a population are related directly and indirectly to demographic structure of that population. On the one hand, the demographic makeup of the population is a key determinant of the type of health problems exhibited by that population. On the other hand, the morbidity profile of a population influences the demographic structure of that population. In addition, the key

demographic processes characterizing a population (i.e., fertility, mortality and migration) each influences the morbidity patterns of the population, while that population's morbidity patterns concurrently influence its morbidity processes. For the U.S. population today, factors such as age distribution, sex ratio, racial and ethnic makeup, and even attributes such as marital status, income and education influence the extant types of health problems.

An overriding issue in America today is the changing age distribution and its implications for morbidity. As the U.S. population has aged it has undergone an epidemiological transition in which chronic conditions have replaced acute conditions as the predominant health problems and most frequent causes of death. The aging of the population has resulted in a growing "excess" of women further affecting the morbidity profile. Increasing racial and ethnic diversity (not to mention unprecedented levels of immigration) has had an impact on morbidity patterns, and even such factors as changing household structures and occupational patterns influence a population's morbidity profile.

With the emergence of chronic disease as the major health threat, the importance of demographic attributes as a factor in morbidity patterns became much more important.

Similarly, the morbidity profile of the population has implications for its demographic makeup. Sickness (and subsequent death rates) have a significant impact on population size and composition. A reduction in infant and childhood diseases with a concomitant reduction in infant and child mortality has been a major determinant of increased life expectancy. On the other hand, higher morbidity rates for some segments of the population result in higher levels of disability which in turn impact the educational and economic potential of these populations. Preventable deaths at an early age ultimately modify the demographic profile of these populations. Exhibit 11.6 describes the demographic roots of the opioid epidemic.

Exhibit 11.6: The Demographic Roots of the Opioid Epidemic

The emergence of opioid addiction as a public health problem is being increasingly recognized, and recent epidemiological data indicate that deaths from opioid overdose are skyrocketing. Opioids are a class of drugs that include the illicit drug heroin as well as the licit prescription pain relievers oxycodone, hydrocodone, codeine, morphine, fentanyl among others. Opioids are chemically related and interact with opioid receptors on nerve cells in the brain and nervous system to produce pleasurable effects and relieve pain. Addiction is a primary, chronic and relapsing brain disease characterized by an individual pathologically pursuing reward and/or relief by substance use and other behaviors.

Recent research indicates that opioid addiction is a growing problem. Some 24 million Americans (9.2% of the population) used an illicit drug in 2012, which was an increase from 8.1% in 2008, numbers that are expected to continue to rise. Of the 20.5 million Americans 12 or older that had a substance use disorder in 2015, 2 million had a substance use disorder involving prescription pain relievers and 591,000 had a substance use disorder involving heroin. It is estimated that 23% of individuals who use heroin develop opioid addiction.

Drug overdose is the leading cause of accidental death in the US, with 52,404 lethal drug overdoses in 2015. Opioid addiction is driving this epidemic, with 20,101 overdose deaths related to prescription pain relievers, and 12,990 overdose deaths related to heroin in 2015. From 1999 to 2008, overdose death rates and substance use disorder treatment admissions related to prescription pain relievers increased in parallel. The overdose death rate in 2008 was nearly four times the 1999 rate; sales of prescription pain relievers in 2010 were four times those in 1999; and the substance use disorder treatment admission rate in 2009 was six times the 1999 rate. In 2012, 259 million prescriptions were written for opioids, which is more than enough to give every American adult his own bottle of pills.

While the number of older addicts is growing, the very young (those aged 12–17 years) still comprise a large proportion—about 26%—of the total population of those with opioid addiction. In 2015, 276,000 adolescents were current nonmedical users of pain reliever, with 122,000 having an addiction to prescription pain relievers. In 2015, an estimated 21,000 adolescents had used heroin in the past year, and an estimated 5000 were current heroin users. Additionally, an estimated 6000 adolescents had a heroin use disorder in 2014. Most adolescents who misuse prescription pain relievers are given them for free by a friend or relative. The prescribing rates for prescription opioids among adolescents and young adults nearly doubled from 1994 to 2007.

The image of the opioid addict as a young person, however, is fast becoming outdated as a new demographic has emerged. According to various sources, Americans aged 50–69 years represent the fastest growing population of opioid addicts, and the number of people aged 65 years and over who have at some point abused opioids increased by 34% from 2011 to 2012. Young college students are yielding the stage to working-age people and older adults. Women are more likely to have chronic pain, be prescribed prescription pain relievers, be given higher doses, and use them for longer time periods than men. Women may become dependent on prescription pain relievers more quickly than men, and 48,000 women died of prescription pain reliever overdoses between 1999 and 2010.

Although the largest segment (41%) of opioid abusers lives in large urban areas, followed by smaller urban centers and then rural areas, the abuse rate per person is higher in rural areas. There are lot of people who are

inappropriately using opioids at any age, and that includes senior citizens. Until recently, there were not many people over the age of 50 who were abusing opioids because they weren't exposed. While in the past older patients may not have received any pain therapy at all, today they may be getting an opioid because there are few other treatment options available.

The surging rate of opioid addiction and overdoes among rural white residents was also associated with certain other demographic variables. Monnat (2016) found that a high proportion of the affected population that was poor, unemployed, disabled, in single-parent families, living on public assistance, or living without health insurance.

Sources: American Society of Addiction Medicine (2017), Anderson (2014), and Monnat (2016).

11.6.1 Biosocial Characteristics and Health

The health of a population is influenced by a number of factors and biosocial attributes are correlated with a number of health indicators. There has been long-standing acceptance of the notion that morbidity patterns are linked closely with age. Conventional wisdom suggests that as a person ages, health problems become more numerous and more serious. While there is some truth to this assertion, research conducted in recent years indicates that the situation is more complex than had been previously thought. Patterns of morbidity, disability, and mortality display complicated relationships with the age structure of the population.

The conventional wisdom that the number of health problems increases as the population ages is a somewhat misleading notion. Although it is true that the prevalence of *chronic* conditions does increase with age, and there appears to be a clear cumulative effect, the incidence of *acute* conditions actually declines with age. Thus, while the younger age cohorts are characterized by high rates of respiratory conditions, injuries, and other acute conditions, the elderly are relatively free of these. Instead, they face a growing number of chronic conditions such as hypertension, arthritis, and cancer. It has been suggested that the average *number* of conditions does not differ much from the youngest age cohorts to the oldest. The differential is primarily in the types of conditions common to the various age cohorts and in the severity of those conditions (National Center for Health Statistics, 2012).

There is a well-documented relationship between the prevalence of mental illness and age, although the nature of the relationship has undergone substantial modification in recent years. Until the 1970s, it was believed that aging had a cumulative effect on mental health just as it did on physical health (U.S.

Department of Health and Human Services, 1999). However, many observers argued that this pattern reflected selectivity in terms of the mental disorders measured, use of statistics on institutionalized patients, and the tendency to attribute many symptoms of old age to mental illness. In terms of observed cumulative prevalence of mental disorders, in fact, those 30–44 years exhibit the highest rate (55.0%) while those 60 years and older the lowest (26.1%). Figures from this same study indicate that the age of greatest mental illness risk is a function of the type of disorder. Depression, for example, is more common among those 18–25 years and least common among those 50 years and older (with an average age of unset of 23 years). Similarly, those 18–29 years exhibit the highest rates of bipolar disorder, those 30–44 years the highest rate for anxiety disorders and obsessive-compulsive disorders, and those 45–59 years the highest rate for post-traumatic stress disorders. For essentially every mental disorder examined, the elderly exhibited the lowest rate.

The relationship between age and health status is complicated. It is not so much that people have more health problems as they age but that they suffer from different kinds of health problems.

These figures suggest a non-monotonic and much more irregular relationship, primarily reflecting a rethinking of the conditions classified as mental disorders. The inclusion of alcoholism, drug abuse, and suicide under the heading of mental illness has created a "morbidity bulge" in the 15–25 age cohort. At the same time, attributing many symptoms of aging to Alzheimer's disease has reduced the perceived prevalence of mental illness among the elderly.

Not surprisingly, there is a clear correlation between age and the level of disability characterizing a population. The proportion of the population experiencing some level of activity limitation increases steadily with age, and the oldest age cohorts are characterized by limited-activity days several times as numerous as those for younger age cohorts. For example, 6% of the 15–44 age cohort in 2010 reported *some* limitation of activity. The comparable figure for the 65–74 age group was over 26% (National Center for Health Statistics, 2011).

The most well-established relationship has been the association between age and mortality, with mortality sometimes used as a proxy for morbidity. Overall, there is a direct and positive relationship between age and mortality in contemporary U.S. society. The 2014 age-specific mortality rate of 11.5/1000 for those aged 5–9, the cohort with the lowest death rate, increases gradually up through age 50. From the mid-fifties on the increase in the mortality rate is dramatic (Kochanek, Murphy, Xu, & Tejada-Vera, 2016).

More important from a morbidity analysis perspective the causes of death vary widely among the age cohorts. For example, the leading causes of death for infants (under 1 year) are birth defects, respiratory conditions, and infectious diseases. The leading causes for young adults are accidents and suicide; for young adult

African-Americans homicide is added to the list. The elderly are more likely to fall victim to the major killers: heart disease, cancer and stroke. Ultimately, each age cohort has its own peculiar cause-of-death configuration. To a certain extent these differences in mortality patterns reflect differences in morbidity patterns. However, the emergence of chronic diseases has complicated the relationship between morbidity and mortality in that chronic diseases are not necessarily the direct cause of death.

One of the most perplexing but important associations discussed in this context is that between sex and morbidity. There is perhaps no other demographic variable for which differentials in health status are so clear-cut. Yet, at the same time, there is probably none for which more questions are raised concerning the meaning of the findings and the possible explanations for observed relationships.

Any discussion of the relationship between sex and health status must begin with what has become a maxim: Women are characterized by higher levels of morbidity than men, but men have a higher mortality rate. Although this is a somewhat simplistic summary of a complex situation, there is a great deal of evidence to suggest that, by any measure of morbidity one would care to use, women are "sicker." On the other hand, there is no doubt that mortality rates are higher and life expectancy is lower for males in contemporary U.S. society (Centers for Disease Control and Prevention, 2015).

Any discussion of the relationship between sex and health status must begin with what has become a maxim: Women are characterized by higher levels of morbidity than men, but men have a higher mortality rate.

When the prevalence of chronic diseases is reviewed, it is found that males report higher rates of heart disease (e.g., coronary heart disease, hypertension), although the rate for strokes is similar for males and females (National Center for Health Statistics, 2012). On the other hand, females report higher rates for respiratory conditions (e.g., asthma, chronic bronchitis) although males and females report similar rates for emphysema. Women account for virtually all cases of breast cancer and men for all cases of prostate cancer. Arthritis is more common among women as are migraines and severe headaches. While females report an even higher level of chronic conditions than acute conditions, these tend to be conditions that are not life-threatening. Although males are sick less often and report fewer symptoms, when men do become ill the condition is likely to be more serious or even fatal.

The relationship between sex and mental health status is fairly well documented, although the conclusions are not without controversy. Based on reported symptoms, clinical evaluations by community researchers, and frequency of presenting themselves for mental health care, females appear to be characterized by a higher level of mental disorder. Women are more likely to report frequent feelings of sadness, with this condition reported by 14% of women and 10% of men. Women

also report higher levels of nervousness and restlessness (National Center for Health Statistics, 2012). Women exhibit higher scores on indices of depression, hysteria, and paranoia as well as on less severe mental disorders, but men exhibit a greater prevalence of antisocial disorders, authority problems, and Type A behavior (World Health Organization, N.D.). In the major national study conducted on psychiatry morbidity, women were 70% more likely to experience a major depressive disorder (Kessler et al., 2003). This same study, however, concluded that there was little difference in the lifetime prevalence between men and women when all disorders are considered.

Males, while scoring "better" on the indicators of morbidity discussed above, are at greater risk of mortality. In effect, the age-adjusted mortality rate for males is slightly higher than that of females, with males recording a mortality rate of 8.2 per 1000 in 2011 compared to 6.3 per 1000 for females. For each of the 15 leading causes of death in 2007, males recorded a higher mortality rate, and for three causes the male/female ratio was over 3:1 (Xu, Kochanek, Murphy, & Tejada-Vera, 2010). The mortality rate for males is in fact higher at every age. Indeed, the death rate for males is even higher than that for females during the prenatal period, indicating that the greater mortality risk characterizing males predates birth. At ages 15–24 and 35–44, the mortality rate for males is almost three times as high. The differential in sex-specific mortality rates translates into differential life expectancy, with females born in 2010 expected to live 81.0 years on the average compared to a life expectancy of 76.2 years for males (National Center for Health Statistics, 2013).

A major killer of infants is chronic respiratory disease, a condition more common among male infants. Accidents are the major cause of death for children aged 1–14, with males having approximately twice the risk of accidents. Homicide is a major cause of mortality for those 15–25, with males accounting for most of the homicide deaths. Similar patterns can be found for subsequent age cohorts and other health conditions (National Center for Health Statistics, 2010).

With regard to disability, comparable proportions of males and females are characterized by some level of activity limitation. The 2012 National Health Interview Survey found 18% of females and 13% of males to exhibit at least one physical disability. Females, however, accumulate on the average more work-loss days, more school-loss days, and more bed-restricted days (National Center for Health Statistics, 2012). Women reported an average of six bed-days per year related to some disability compared to 4 bed-days for men.

The most commonly observed disparities in health status are between whites and African-Americans with the latter exhibiting more unfavorable health status on virtually every indicator.

When the various racial groups in the United States are examined in terms of morbidity patterns, significant differences are found. The major distinction is between whites and blacks, with Asian-Americans and American Indians

manifesting less distinct morbidity characteristics (National Center for Health Statistics, 2011). The discrepancy by race is substantial, however, with African-Americans reporting much less favorable health conditions than whites. Given that blacks have a younger age structure, the true differential is even larger than observed disparities.

Clear-cut differences in morbidity are found primarily between whites and African-Americans. The number of symptoms, the number of illness episodes, and the severity of the conditions all place African-Americans at a morbidity disadvantage. Although relatively more prone to acute health conditions, African-Americans actually suffer higher rates of both acute and chronic conditions than whites. African-Americans represent 12% of the population, for example, but account for 28% of the diagnosed hypertension (Lloyd-Jones et al., 2010). The morbidity disadvantage for African-Americans is reflected in the proportion overweight or obese, with a rate of 69% recorded for this group compared to 54% for whites (Mead et al., 2008). Further, all things being equal, African-Americans contracting life-threatening conditions are more at risk of death than are whites with the same condition (see, for example, American Lung Association, 2011). Even at higher income levels, African-Americans report higher levels of chronic disease than comparable whites.

Differences in cause-specific morbidity exist between various racial and ethnic groups, with the epidemiology of cancer reflecting this phenomenon. Whites in the United States are more likely to suffer from colon/rectal cancer, breast cancer, and bladder cancer, for example, than are African-Americans. On the other hand, the incidence of lung, prostate, stomach, and esophageal cancer is higher for African-Americans. Asian-Americans and Hispanics are less likely to suffer from heart disease and respiratory disorders than either whites or African-Americans (National Center for Health Statistics, 2012). Rates for HIV/AIDS are particularly associated with race and ethnicity, with the incidence for African-Americans many times higher than that for non-Hispanic whites and the Hispanic rate notably higher than that for whites (Mead et al., 2008).

The distribution of mental illness with regard to race and ethnicity has been of great interest to researchers and health professionals. Contrary to the conventional wisdom, the leading national study on psychiatric morbidity (Kessler et al., 2003) found that African-Americans were actually 30% *less* likely to experience *any* mental disorder over their lifetimes compared to whites. To the extent that differences do exist, the disparity appears to be not in prevalence but in types of disorders. Blacks seem to be characterized by more severe forms of disorders (e.g., psychoses), and whites by milder forms (e.g., neuroses), although this same study indicated that blacks were 40% less likely to experience a major depression disorder over their lifetimes.

Indicators of disability are found to be higher among African-Americans than among other racial groups. Data from the 2010 National Health Interview Survey indicated that 12.2% of the white population had some limitation due to disability, compared to 16.5% of the African-American population (National Center for Health Statistics, 2011). In addition, African-Americans are characterized by higher

levels of disability than whites, whether measured by the actual presence of handicaps or by such proxy measures as work-loss days and bed-restricted days. This disability disparity for African-Americans exists at even high income levels. The disability rate for Hispanics is one-third lower than the average.

Non-Hispanic whites have historically exhibited the most favorable mortality rates but are now being displaced by Asian-Americans as the population with the lowest risk of death.

Mortality rates for the black population are considerably higher than those for the white population. When mortality rates are examined for 2011, the overall mortality rate for the U.S. population is 7.4 per 1000 population. The age-adjusted mortality rate for the white population as a whole was 7.4 deaths, compared to 8.8 for blacks (National Center for Health Statistics, 2010). Age-adjusted mortality rates for other groups in 2011 were 5.4 for Hispanics, 6.0 for American Indians and 4.1 for Asian-Americans. African-Americans are characterized by higher mortality risks at nearly all ages and for nearly all causes (Rogers, Hummer & Nam, 2000). (Note that all of these rates are age adjusted, thereby eliminating any distortion caused by differentials in age distribution.)

Further, important differences exist between blacks and whites in terms of the common causes of death, and to a great extent these differentials reflect differences in morbidity characteristics. Whites in the United States are more likely to die from chronic conditions, especially those associated with aging. Blacks and members of certain ethnic groups are relatively more likely to die from acute conditions. Further, nonwhites are more likely to be affected by environmentally caused health problems and life-threatening problems associated with lifestyles (such as homicide, HIV/AIDS, and accidents). In contrast, the dominant causes of death among the white population are heart disease, cancer, and stroke. African-Americans, on the other hand, are more likely to die as a result of infectious conditions, respiratory and digestive systems conditions, and the lifestyle-associated problems noted above. Mortality disparities for some health conditions are found to exceed the morbidity disparity.

Much of the mortality advantage characterizing Asian-Americans and Hispanics has been attributed to the foreign-born among these populations. Subsequent generations of Asian-Americans and Hispanics, it seems, do not fare as well in comparative mortality analyses. Interestingly, Native Americans have made the greatest gains of any group in reducing mortality in recent years, with an age-adjusted mortality rate in 2011 of 6.0 per 1000 (National Center for Health Statistics, 2010). Native Americans record the lowest mortality for cancer of any group but by far the highest mortality rates for diabetes, suicide, and accidents.

Another relatively important cause of death for blacks is infant mortality. Although infant mortality was dramatically reduced as a cause of death in the United States during the last century, it continues to be a serious health threat for

nonwhites. The infant mortality rate for African-Americans in 2011 was more than twice that for whites, 11.4 per 1000 live births versus 5.1 (Hoyert & Xu, 2012). The rates for both groups have declined since the late 1980s, with the gap between the two actually narrowing in recent years. The Hispanic infant mortality rate is something of an anomaly, given the relatively poor health status of this population and this group's lower level of access to health services. The low Hispanic infant mortality rate is generally attributed to the emphasis on family within this culture. Exhibit 11.7 presents evidence that Americans are getting sicker.

Exhibit 11.7: Are Americans Getting Sicker?: Tracking the Level of Morbidity

An issue that is increasingly raised is whether Americans are becoming sicker or healthier than they used to be. While conventional wisdom suggests that we have steadily become healthier as a population over time, there is statistical evidence dating in some cases as far back as the 1980s to suggest otherwise. While it could be argued that more Americans are living longer, healthier lives than their ancestors, there is a growing body of evidence that the U.S. population may be experiencing a reversal of health fortunes.

The answer to this question is complicated by the lack of a standard measure of morbidity. Researchers on this topic do not have access to any global indicator that they can point to. Aggregate measures (e.g., the combined prevalence of chronic conditions, overall disability) might be considered although there is likely to be disagreement over what diseases to include in any aggregate measure. Specific conditions could be considered (e.g., major health threats like heart disease and cancer, contributors to poor health such as obesity) but, again, there is likely to be disagreement over with conditions to include.

A common although subjective approach to determining the overall morbidity level is through the use of self-reported health status. Various surveys ask respondents to rate their health status on a scale from poor to excellent. The results on some surveys have indicated, in fact, a decline in the proportion of the U.S. population rating their health as "very good" or "excellent", and an increase in the proportion rating their health as "poor" or "fair" between 1997 and 2010. This level of self-reported health status reflects a departure from the steadily increasing health status reported prior to 1997. These findings of decreasing health status are not consistent across all surveys, with a continued improvement in health status noted in others.

Other researchers have pointed to the steady increase in the prevalence of chronic disease within the U.S. population. Of course, with the aging of the population, one should expect a decline in the incidence of acute conditions and an increase in the prevalence of chronic conditions. However, the prevalence rates for many chronic conditions are higher today for various older age groups than they were a generation ago, suggesting that more people are living longer but with more chronic conditions. Further, it is noted

that certain acute conditions remain at epidemic levels (e.g., sexually transmitted infections) while many communicable diseases long eliminated if not eradicated from our population are making a comeback (e.g., measles, mumps, malaria).

Of particular concern are rising rates of non-communicable chronic conditions such as obesity, diabetes, high blood pressure, heart disease, and cancer. In 2005, nearly half of adults—133 million—had at least one chronic illness. In 2009–2010, more than one third (35.7%) of U.S. adults were obese, and 8.3% had diabetes. In 2005–2008, over 30% had high blood pressure. The prevalence of these conditions has grown substantially over the last 20 years and these trends are eroding previous advances the U.S. made in life expectancy and other determinants of population health. This notion is reinforced by the fact that a higher proportion of the population (in all age groups) is classified as disabled.

Of even more concern is the purported declining health status of America's children. The Institute of Medicine (IOM) reported in 2012 that "the current generation of children and young adults in the United States could become the first generation to experience shorter life spans and fewer healthy years of life than those of their parents." Of particular concern is the increase—driven to a great extent by the high and increasing rate of obesity—in the rise of chronic conditions among children. Conditions such as heart disease and diabetes were unknown among children in past generations but, along with other chronic conditions typically associated with the elderly, are becoming increasingly common.

Given all of the available evidence it is difficult to definitively conclude whether Americans are continuing to get healthy or are now becoming sicker. At the end of the day, the answer is probably: It depends. That is, depending on the metrics examined, the time period under consideration, and the population included, it is possible to end up with either result. However, the fact that a growing number of indicators suggest that Americans are becoming sicker is noteworthy. Clearly additional research is required to settle this issue.

Sources:

Institute of Medicine (2012), Saloman, Nordhagen, Oza, &Murray (2001).

11.6.2 Sociocultural Characteristics and Health

Differences in health status are similarly substantial when sociocultural characteristics are considered. Early on in the study of demographic influences on morbidity, it was concluded that marital status was a predictor of both health status and health behavior (Verbrugge, 1979). Married individuals are found to have lower levels of morbidity and to perceive themselves as being in much better health than their unmarried counterparts. Married persons also report a higher level of physical and psychological well-being than those who are not married (Shoenborn, 2004). Further, it has been found that married individuals, when affected by a health condition, experience less serious episodes, face more favorable prognoses, and report more favorable outcomes than unmarried individuals facing the same condition. For some conditions, however, the never married are better off than the married (National Center for Health Statistics, 2012).

A notable exception to these patterns relates to the incidence of acute conditions and certain chronic conditions. Married men and women report slightly more acute conditions than never married men and women. However, the married are still better off overall than the divorced and widowed. It has been suggested that the never married may suffer fewer episodes of acute conditions but are affected by more serious and prolonged conditions. It may be the case that married persons are more likely to have their acute conditions diagnosed.

The preponderance of research now indicates that the different marital statuses are at varying risks of mental illness. While the married appear to be much better off overall in terms of mental health than are those in any of the other marital categories, there is less consensus concerning the relative risk for mental disorders for the never married, the divorced, and the widowed. When mental health is measured in terms of feelings of sadness, hopelessness and worthlessness, the married report the lowest rates across the board. The never married report the second lowest rates with the widowed and divorced exhibiting much higher rates that either of these two groups (National Center for Health Statistics, 2012).

Married individuals exhibit more favorable health status for virtually every indicator than the unmarried, although some suggest that being in a stable relationship regardless of marital status supports better health.

With regard to disability, only 13% of married people were found to have physical limitations in the 2009 National Health Interview Survey, compared to 15% or more for those in other marital status categories. The pattern is similar with regard to other indicators of disability. However, the NHIS found that married individuals report more work-loss days per year (3.4) compared to 2.8 days for the

never-married, but less than the 5.4 days reported for the divorced and 6.0 days for the widowed (Pleis, Ward & Lucas, 2010).

It has been found that no matter what indicator is utilized, there is generally an inverse relationship between income and level of morbidity for both physical and mental disorders. As income increases, the prevalence of both acute and chronic conditions decreases. When symptom checklists are utilized, the lower the income the larger the number of symptoms identified. Morbidity differences based on income are particularly distinct for chronic conditions. For the lowest income group the prevalence rate is higher for heart disease, diabetes, emphysema, kidney disease and arthritis. An exception is found in the case of cancer, wherein the highest income group reports a slightly higher rate (National Center for Health Statistics, 2012). Higher rates are also recorded among the lowest income groups for most chronic respiratory conditions. Note that, if the lowest income group is broken down further (e.g., into <$15,000, $15,000–$24,999, etc.), the disparities exhibited would be even greater at the lowest income levels.

Not only are there more episodes of certain types of both acute and chronic conditions recorded as income decreases, but the severity of a condition is likely to be greater when income is lower. When afflicted by acute conditions, the poor tend to have more prolonged episodes characterized by greater severity. Interestingly, in a society that has become characterized by chronic health conditions, acute disorders remain surprisingly common among the lower income groups. In fact, the disease profile of many low-income communities more closely resembles that of a less developed nation than it does the United States. It has also been found that living in poverty in childhood can have detrimental health effects later in life (Evans & Kim, 2007).

Early on in the study of the social epidemiology of mental disorder, it was asserted that the lower classes were more prone to psychiatric pathology than the affluent (Hollingshead & Redlich, 1958). However, more recent studies have failed to consistently demonstrate a clear relationship. What has been demonstrated is the fact that the relative prevalence of mental illness by social class depends heavily on the type of disorder examined. Further, for some disorders apparent correlations with other variables (e.g., race and age) are moderated when socioeconomic status is controlled (Mossakowski, 2008). A more recent study (Jitender, Afifi, McMillan & Asmundson, 2011) found a direct relationship between income levels and psychiatric symptoms, with the number of DSM indicators increasing with decreasing income.

Although the possibility of diagnostic bias is always present, the preponderance of evidence indicates that different disorders characterize those at different socioeconomic levels. Further, those at the lower income levels are likely to be characterized by more severe disorders. This explains why early studies concluded that mental disorders were concentrated within lower-income groups; the available statistics were for schizophrenia cases recorded at public mental hospitals. It is still felt that schizophrenia, certain forms of depression, and sociopathy are more common among lower income groups. Manic-depression and neuroses, on the other

hand, appear to be more common among upper income groups. The rate of suicide, it should be noted, is much higher for the affluent than for the non-affluent.

Income is considered to be one of the best predictors of health status, with virtually every indicator of ill-health exhibiting an inverse relationship with income.

There is also an inverse relationship between income and indicators of disability. Among the population with annual household incomes in 2010 less than $35,000, 20.6% reported some limitation of activity due to chronic conditions. This figure drops dramatically to 8.9% for the $35,000–49,999 income group. The rate continues to drop to a level of only 6.6% for those with household incomes of $100,000 or more (National Center for Health Statistics, 2011). When examined in terms of poverty status, it is found that 28% of the poor report disabilities, compared to 22% of the near-poor and 12% of the non-poor. Further, the lower the income, the greater the number of bed-disability days, work-loss days, school-loss days, and restricted activity days.

The mortality rate for the lowest income group is considerably higher than that of the most affluent, even after adjusting for age (Rogers et al., 2000). The poor are also characterized by relatively high levels of infant mortality and even maternal mortality. Virtually all infant mortality in the United States today is accounted for by the lowest income groups, and maternal mortality (which has been virtually eliminated society-wide), is disturbingly common among the poor and appears to be increasing.

The relationship between educational level and morbidity exhibits a similar pattern to that for income. The better educated report fewer episodes of acute conditions and fewer chronic conditions than the poorly educated (National Center for Health Statistics, 2012). The prevalence of heart disease (e.g., coronary heart disease, hypertension) increases as educational level decreases. The same pattern—higher rates with declining education holds—for chronic respiratory conditions, arthritis and diabetes. The proportion of the population reporting diabetes, for example, decreases from 15% for those with less than a high school education to 7% for those with at least a bachelor's degree.

The relationship between educational level and mental illness, like that for physical illness, appears fairly clear cut. In fact, some researchers have suggested that the income differentials noted above are in reality a function of differing levels of education. For example, adults with less than a high school education report the highest rates of sadness, hopelessness and worthlessness, while those with at least a bachelor's degree report the lowest rates. Further, the poorly educated are more likely to report feelings of nervousness and restlessness. As the level of education increases, there appears to be an increase in the prevalence but a decrease in the severity of disorders. The better educated appear to be more characterized by

neurotic conditions, while the less educated appear to be more frequently psychotic. Ironically, the rate of suicide is much higher among the better educated.

The level of disability exhibits a clear pattern with regard to educational attainment. Research by the National Center for Health Statistics (2011) found that 25% of those with less than a high school diploma reported difficulties with physical functioning, compared to 20% of those with a high school diploma, 17% of those with some college, and 10% of those with at least a bachelor's degree. Further, adults with less than a high school education reported eight bed-days annually due to some disability, compared to three bed-days annually for the best educated. This is true for disability arising from both acute and chronic physical conditions. An analysis of data from the National Health Interview Survey found an inverse relationship between educational levels and chronic conditions, limitation of activities, and number of bed days for disability.

The pattern with regard to mortality also resembles that exhibited for income. The death rate for the poorly educated is much higher than for those with higher educational achievement (National Center for Health Statistics, 2010). According to NCHS data, the risk of mortality for those with a high school education is 60% higher than that for those with a graduate degree (Rogers et al., 2000).

Like the poor, the causes of death for the poorly educated are more likely to be the acute problems associated with less developed countries than the chronic conditions characterizing much of American society. Also like the poor, the poorly educated are likely to be characterized by lifestyle-related deaths such as homicides and accidents. Education, in fact, has been shown to demonstrate a stronger association with mortality than does income (Rogers et al., 2000).

Infant mortality, once a leading cause of death, has been virtually eliminated from the groups with the highest educational levels. The poorly educated as it turns out account for the bulk of infant deaths. The correlation between educational level and infant mortality rates is reflected in differences in low birth weight babies and premature births for those at different educational levels. Nine percent of mothers with less than a high school education deliver low birth weight babies, while this figure drops to 5.5% for women with one or more years of college (National Center for Health Statistics, 2010).

Morbidity patterns related to the workforce can be examined in terms of occupation, industry and employment status. There is a direct and positive relationship between the status of the occupation one holds and morbidity. In general, the higher the occupational prestige, the better the health status. Those at lower occupational levels tend to be characterized by higher rates of morbidity and disability. Like the poor and the uneducated, they tend to be characterized both by more conditions and by more serious conditions. Levels of disability (as measured by restricted activity days and lost days from work and school) are higher for lower occupational levels.

One of the few studies on morbidity and occupational status found that living and working conditions, psychosocial stress, and health and sickness behavior were more deleterious among blue-collar workers than among white-collar workers, resulting in higher morbidity and mortality rates for blue-collar workers. Psychosocial stressors at work were related to mental strain, perceived health, and

absenteeism. Stress symptoms were strongly associated with perceived health, locomotor symptoms, smoking, drinking, and absenteeism. In follow-up research the baseline indicators of stress predicted future chronic illness and angina pectoris, but not hypertension or myocardial infarction.

Mortality rates and longevity vary directly with occupational status. Mortality rates for professionals are significantly lower than those for unskilled laborers, for example. A study in Sweden and Germany found a link between mortality and occupational status, with the risk of death for the lowest occupational group (unskilled laborers) being nearly twice that of the highest (professionals), although the authors note that income and education are confounding factors (Geyer et al., 2006). Additional research by Rogers et al. (2000) has reaffirmed this finding as it relates to the U.S. population. The causes of death for those lower in terms of occupational status are similar to those for the poor and uneducated.

The relationship between various occupations and industries and health status can also be examined. It is found that certain occupations tend to be characterized by inordinately high levels of both morbidity and mortality. High-morbidity occupations often include those whose workers are exposed to environmental risks. Healthcare workers, for example, are characterized by high levels of work-related injuries and illnesses (but very low levels of work-related deaths). The single most dangerous occupation today is cellphone tower workers, having recently edged out commercial fisherman and lumberjacks.

It is also found that certain industries tend to be characterized by inordinately high levels of both morbidity and mortality. Among the standard industrial categories utilized by the U.S. Department of Labor the industry recording the highest level of occupational illnesses and injuries is manufacturing, with a rate of 373 per 1000 workers in 2008. This compares to a rate of 10 per 1000 for utilities workers. The highest death rates by industry in 2008 were recorded by farming/fishing/forestry with 30.4 deaths per 100,000 employed workers. This compares to finance and insurance with 0.3 deaths per 100,000 workers (National Center for Health Statistics, 2010). While those employed in healthcare are characterized by a relatively high level of occupation-related illness and injury, the death rate for healthcare and social assistance workers is only 0.5 per 100,000.

One other consideration when examining work-related morbidity is the issue of employment status. Employment status may be more significant than that of occupational differentials and has garnered renewed attention in the light of the recent recession. When the employed are compared to the unemployed, clear-cut differences surface in terms of physical and mental illness (Brown et al., 2012). The unemployed appear to be sicker in terms of most health status indicators, with higher levels of morbidity and higher levels of disability than the employed. While it could be argued that poor health leads to unemployment, it has been found that otherwise healthy individuals who have undergone loss of employment often develop symptoms of health problems. In fact, even perceived threats to job security have been associated with an increase in morbidity (Ferrie, Shipley, Marmot, Stansfeld, & Smith, 1998). It has also been suggested that, among those who cannot find employment, developing an illness serves as something of a

rationale for a failure to find work. Recent research on 54 countries (including the U.S.) found that the 2008 global recession contributed to a jump in suicide rates. The suicide rate in 2009 was 6.4% higher in developed countries than expected, with males aged 45–64 exhibiting the greatest risk of suicide during this period (Chang et al., 2013).

The same pattern holds for employment status and mental illness. The unemployed tend to be characterized by higher levels of mental illness symptoms than the employed. In fact, for both physical and mental disorders, it has been suggested that the lack of social integration resulting from unemployment serves as a "trigger" for various health problems.

Conclusions concerning the distribution of disease based on demographic characteristics have to take into consideration the likelihood of the interaction of various demographic variables. There are correlations, for example, between income and education with these two variables often interacting with each other. If first-order analyses are conducted erroneous conclusions may, in fact, be generated. Perhaps the best-known example of this is the perceived relationship between race and health status. The generally negative health status associated with African-Americans relative to non-Hispanic white Americans can be virtually eliminated when socioeconomic status is factored into the equation (Williams & Collins, 1995).

Examining the factors affecting the morbidity of the population as a whole often masks important differences that exist among subgroups. It is not unusual to have a figure for a county, for example, that reports an average rate when virtually no subpopulation actually exhibits that rate. In Shelby County, Tennessee, in 2005 the county-wide infant mortality rate was 13 per 1000 live births. What this rate doesn't tell us, however, is that the figure for African-Americans is 19 per 1000 and that for whites is 6 per 1000. For that reason it is important to decompose these figures and examine subsets of the population under study based on race, sex, age or some other attribute relevant under the circumstances.

It is also important to examine morbidity for segments of the population that reflect a combination of different variables. For example, when levels of morbidity for various conditions are examined, the study population is often broken down into the race/sex categories of white males, white females, black males and black females, with the differences between the subgroups examined. This allows for a more in-depth appreciation of the morbidity indicator under study and should be a prerequisite for anyone seeking to understand an indicator's significance within that population.

One other issue when considering the demographic correlates of health and illness is the potential interrelationship of the variables in question. While demographic attributes are addressed separately in the sections that follow, the likelihood of interaction between the attributes being considered needs to be kept in mind. An obvious example is the well-known relationship between education and income, but there are other potential interactions as well (e.g., race and income, occupational status and education). While every possible interaction cannot be addressed in this chapter, readers should remain sensitive to the possibility of the interaction of demographic variables with one another.

Exercise 11.1: Planning Hospital Services

Your hospital has been given responsibility for the care of the total county population. This population has a high proportion of children and a low proportion of seniors (median age = 30). The population is 85% white and living primarily in family households. Income and educational levels are higher than average.

On the list of services below, indicate with a check those services that you would plan to offer to this population. Be prepared to present any assumptions you are making and to justify the services that are being provided.

	Adult day care		Obstetrics services
	Inpatient substance abuse		Occupational health services
	Outpatient substance abuse		Oncology services
	Arthritis treatment center		Open heart surgery
	Assisted living		Outpatient surgery
	Birthing room/LDR		Pediatric intensive care services
	Breast ca screening		Physical therapy inpatient
	Burn care		Physical therapy outpatient
	Cardiac intensive care		Psychiatric acute inpatient care
	Case management		Psychiatric child adolescent services
	Children wellness program		Psychiatric geriatric services
	Community outreach		Psychiatric outpatient services
	Crisis prevention		Psychiatric partial hospitalization services
	CT scanner		Radiation therapy
	Emergency department		Reproductive health
	End of life care		Skilled nursing
	Freestanding outpatient center		Social work services
	Geriatric services		Sports medicine
	Transportation to health services		Support groups
	Health screenings		Teen outreach
	HIV/AIDS services		Transplant services
	Hospice program		Trauma center
	Med-surg intensive care		Ultrasound
	Neonatal intensive care		Urgent care center
	Nutrition program		Women's health center

The class can be divided in groups and the following populations used as the basis for determining the configuration of services:

- The county's nursing home population. This population has an age range of 50–95 and a median age of 72. The population is 80% female and in frail health.

- The county's large population of orphans. This population has an age range of 1–18 and a median age of 10. The population is 45% female and 55% male and in reasonably good health.
- The county's large prison population. This population has an age range of 18–80 and a median age of 35. The population is 100% male, 50% African-American, 15% Hispanic and suffers from the range of health problems associated with a rough life and incarceration.

References

American Lung Association. (2011). *Trends in asthma morbidity and mortality*. Washington: American Lung Association.

American Society of Addiction Medicine. (2017). *2016 opioid addiction facts and figures*. Downloaded from URL: https://www.asam.org/docs/default-source/advocacy/opioid-addiction-disease-facts-figures.pdf.

Anderson, P. (2014). The changing face of opioid addiction. *Medscape Medical News.* Downloaded from URL: http://www.medscape.com/viewarticle/831319#vp_2.

Brown, J., Demou, E., Tristram, M. A., et al. (2012). Employment status and health: Understanding the health of the economically inactive population in Scotland. *BMC Public Health, 12,* 327.

Centers for Disease Control and Prevention. (2015). Underlying cause of death 1999–2014. Downloaded from URL: http://www.kff.org/other/state-indicator/death-rate-by-gender/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D.

Chang, S.-S., Stuckler, D., Yip, P., et al. (2013). Impact of 2008 global economic crisis on suicide: Time trend study in 54 countries. *British Medical Journal, 347,* f5239.

de Hollingshead, A. B., & Redlich, F. C. (1958). *Social class and mental illness: A community study*. New York, NY, USA: Wiley.

Evans, G. W., & Kim, P. (2007). Childhood poverty and health: Cumulative risk exposure and stress dysregulation. *Psychological Science, 8*(11), 953–957.

Ferrie, J. E., Shipley, J. J., Marmot, M. G., Stansfeld, S. A., & Smith, G. D. (1998). An uncertain future: The health effects of threats to employment security in white-collar men and women. *American Journal of Public Health, 88*(7), 1030–1036.

Geyer, S., Hemstrom, O., Peter, R., et al. (2006). Education, income, and occupational class cannot be used interchangeably in social epidemiology. *Journal of Epidemiology and Community Health, 60*(9), 804–810.

Hoyert, L., & Xu, J. (2012). *Deaths: Preliminary data from 2011*. Downloaded from URL: http://www.cdc.gov/nchs/data/nvsr/nvsr61/nvsr61_06.pdf.

Institute of Medicine. (2012). *For the public's health: Investing in a healthier future*. Downloaded from URL: http://www.iom.edu/Reports/2012/For-the-Publics-Health-Investing-in-a-Healthier-Future.aspx.

Jitender, S., Afifi, T. O., McMillan, K. A., & Asmundson, G. J. G. (2011). Relationship between household income and mental disorders: Findings from a population-based longitudinal study. *Archives of General Psychiatry, 68*(4), 419–427.

Kessler, R. C., Berglund, P., Demler, O., et al. (2003). The epidemiology of major depressive disorder: Results from the National Comorbidity Survey Replication (NCS-R). *Journal of the American Medical Association, 289*(23), 3095–3105.

Kochanek, K. D., Murphy, S. L., Xu, J. Q., & Tejada-Vera, B. (2016). Deaths: Final data for 2014, *National Vital Statistics Reports 65*(4). Hyattsville, MD, USA: National Center for Health Statistics.

Lloyd-Jones, D., Adams, R. J., Brown, T. M., et al. (2010). Heart disease and stroke statistics—2010 update: A report from the American Heart Association. *Circulation, 121,* e1–e170.

Mead, H., Cartright-Smith, L., Jones, K., et al. (2008). *Racial and ethnic disparities in U.S. health care: A chartbook*. Downloaded from URL: http://www.commonwealthfund.org/Publications/Chartbooks/2008/Mar/Racial-and-Ethnic-Disparities-in-U-S–Health-Care–A-Chartbook.aspx.

Monnat, S. M. (2016). "Deaths of despair and support for trump in the 2016 presidential election," The Pennsylvania State University Department of Agricultural Economics, Sociology and Education Research Brief. Downloaded from URL: http://aese.psu.edu/directory/smm67/Election16.pdf.

Mossakowski, K. N. (2008). Dissecting the influence of race, ethnicity, and socioeconomic status on mental health in young adulthood. *Research on Aging, 30*(6), 649–671.

National Center for Health Statistics. (2010). *Death rates for 358 selected causes, by 10-year age groups, race, and sex: United States, 1999–2007*. Bethesda, MD, USA: National Center for Health Statistics. Downloaded from URL: http://www.cdc.gov/nchs/data/dvs/MortFinal2007_Worktable12.pdf.

National Center for Health Statistics. (2011). *Summary health statistics for the U.S. population: National Health Interview Survey, 2010*. Bethesda, MD, USA: National Center for Health Statistics.

National Center for Health Statistics. (2012). *Health, United States 2012*. Bethesda, MD, USA: National Center for Health Statistics.

National Center for Health Statistics. (2013). *Health United States 2012*. Hyattsville, MD, USA: National Center for Health Statistics.

Pleis, J. R., Ward, B. W., & Lucas, J. W. (2010). Summary health statistics for U.S. adults: National Health Interview Survey, 2009. *Vital Health Statistics, 10*(249).

Rogers, R. G., Hummer, R. A., & Nam, C. B. (2000). *Living and dying in the USA: Behavioral, health and social differentials of adult mortality*. New York, NY, USA: Academic Press.

Saloman, J. A., Nordhagen, S., Oza, S., & Murray, C. J. L. (2001). Are Americans feeling less healthy? The puzzle of trends in self-rated health. *American Journal of Epidemiology, 170*(3), 343–351.

Shoenborn, C. A. (2004). "Marital status and health: 1999–2002," *Advance Data* (No. 351). Hyattsville, MD, USA: National Center for Health Statistics.

Thomas, R. K. (2017). The population health movement: Implications for demography and demographers. Presented at the *Applied Sociology Conference*, Houston, TX, January 6, 2017.

U.S. Department of Health and Human Services. (1999). *Mental health: A report of the surgeon general—Executive summary*. Rockville, MD, USA: U.S. Department of Health and Human Services, Substance Abuse and Mental Health Services Administration, Center for Mental Health Services, National Institutes of Health, National Institute of Mental Health.

Verbrugge, L. M. (1979). Marital status and health. *Journal of Marriage and the Family, 41*(2), 267–285.

Williams, D.R., & Collins, C. (1995). US socioeconomic and racial differences in health: Patterns and explanations. *Annual review of sociology, 121*, 349–386.

World Health Organization. (N.D.). Gender and women's mental health. Downloaded from URL: http://www.who.int/mental_health/prevention/genderwomen/en/.

Xu, J., Kochanek, K. D., Murphy, S. L., & B. Tejada-Vera. (2010, May 20). Deaths: Final data for 2007. *National Vital Statistics Reports, 58*, 19.

Additional Resources

Montague, T. (2006). "The Dangers of Being Poor and Nonwhite," *Rachel's Democracy and Health News* #848. Downloaded from URL: http://www.rachel.org/en/node/6405.

National Center for Health Statistics. (Various years). *Health, United States [various years]*. Bethesda, MD, USA: National Center for Health Statistics.