Chapter 2
Are Americans Getting Sicker? An Analysis of Emerging Morbidity Trends

Richard K. Thomas

Background: A Century of Health Status Improvement

One of the undisputed trends over the past century has been the steady improvement in the health status of the U.S. population. Using the year 1900 as a convenient starting point, it is possible based on a variety of indicators to trace a continuous decline in mortality, an increase in life expectancy, the reduction or elimination of many of the major killers at the beginning of the 20th century, and an overall improvement in health status based on both objective and subjective measures. Over the course of the century, it is agreed, Americans became bigger, stronger and generally healthier.

This improvement in the health status of the U.S. population can be confirmed by a number of indicators. A basic measure of health status (although somewhat of a proxy) is mortality rates. At the beginning of the 20th century, the crude mortality rate was over 17 deaths per 1000 population. By the end of the century it had dropped to less than 8 per 1000. The age-adjusted death rate was over 25 per 1000 in 1900, dropping to less than 8 by 2000 (Martin et al. 2002) (see Fig. 2.1). During the early years of the century both crude and age-adjusted death rates dropped by as much as 10% per year.

Even more dramatic reductions were recorded for infant mortality, with the 1900 rate of around 80 infant deaths per 1000 live births dropping to around 10 per 1000 by 2000. A similar pattern was recorded for maternal mortality, with the rate declining from 80 deaths per 10,000 live births to around 2 per 10,000 over the

R.K. Thomas (✉)
Department of Sociology and Anthropology, University of Mississippi, University, Oxford, MS 38677, USA
e-mail: richardkthomas@att.net

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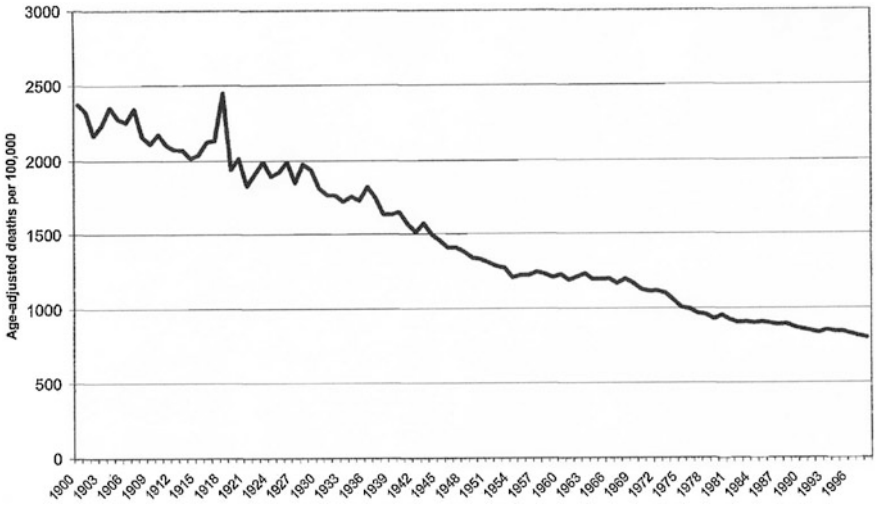

Fig. 2.1 All cause mortality. *Source* United States vital statistics data. *Note* Death rates shown are adjusted to the standard population of the United States in 1940

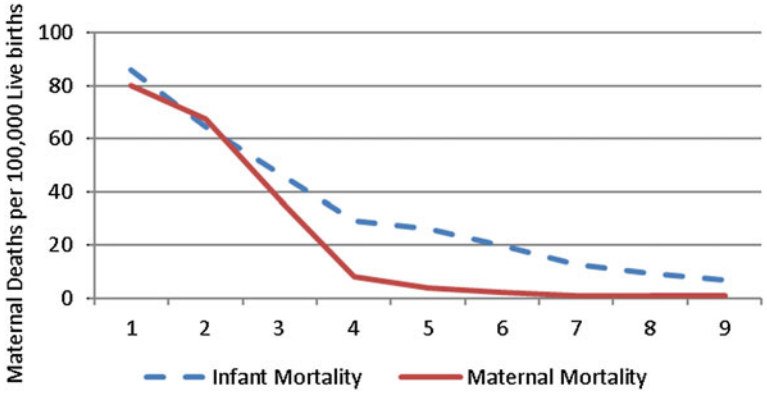

Fig. 2.2 Trends in infant and maternal mortality, U.S.: 1900–2000. *Source* United States vital statistics data

century (see Fig. 2.2). This reduction in mortality rates, particularly infant mortality, resulted in increased longevity, with life expectancy at birth increasing from less than 50 years in 1900 to nearly 80 years in 2000 (see Fig. 2.3).

More directly related to the morbidity of the population is the constellation of diseases that determine the population's health status. During the course of the 20th century, remarkable progress was made in eliminating the diseases that accounted

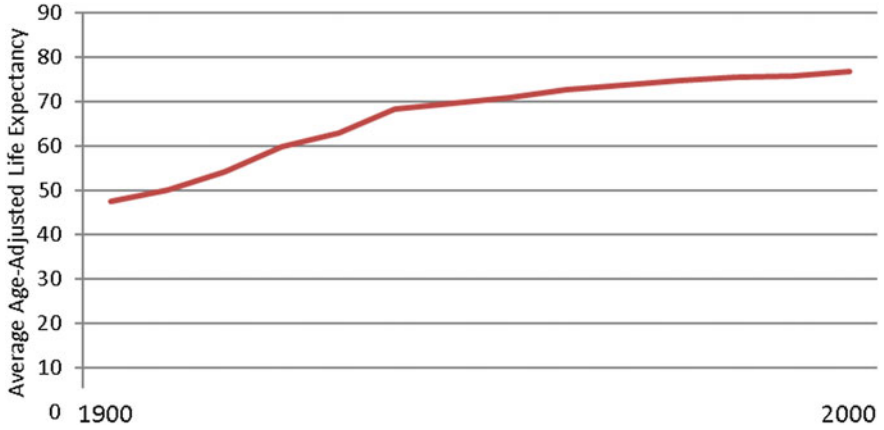

Fig. 2.3 Trends in life expectancy, U.S.: 1900–2000. *Source* United States vital statistics data

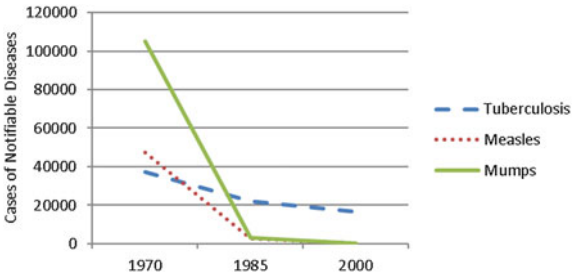

Fig. 2.4 Trends in selected notifiable diseases, U.S.: 1970–2000. *Source* United States vital statistics data

for high rates of both morbidity and mortality. The communicable and infectious diseases ("notifiable diseases" in CDC parlance) that were the scourge of the population at the beginning of the 20th century were reduced in importance if not eliminated by the end of the century. Yellow fever, cholera, malaria and other communicable diseases were virtually eliminated, and everyday conditions that posed serious health threats like mumps, measles and whooping cough were relegated to bit roles in the overall morbidity scheme (Schlipköter and Flahault 2010). The major killers of 1900—like tuberculosis, diphtheria, and diarrhea—were supplanted by heart disease, cancer and stroke during the course of the century (see Fig. 2.4). Although most of the improvement in health status was recorded during the first half of the 20th century, many communicable diseases remained common well into the post-WWII period. It is only in the last quarter of the century that some diseases were effectively eliminated.

Growing Evidence of Declining Health Status

This author's own journey to this point reflects the typical pattern involved in the discovery of a paradigm shift. In compiling statistics on the morbidity characteristics of the U.S. population and developing trend lines for that analysis, the author began to note occasional statistics that did not appear to be in keeping with the notion of steadily improving health status. Some of the figures on chronic disease, for example, from as early as the 1980s and 1990s suggested that the assumed improvement in health status was not consistent across the board. There appeared to be certain conditions for which the prevalence rate was increasing over time rather than decreasing. Given the conditions in question this fragmentary evidence was not necessarily reason for concern; it was well documented that the chronic conditions associated with an aging population were displacing acute conditions as the primary health problems. Indeed, the CDC reports that today chronic diseases are responsible for 70% of the deaths and 75% of the healthcare costs (National Center for Health Statistics 2013). It was entirely possible that, within the context of overall improving health status, one or more specific conditions might be increasing in prevalence.

Other evidence that emerged from statistics from the end of the 20th century suggested that although health status indicators like life expectancy and mortality rates continued to improve, the rate of improvement appeared to be slowing or even leveling off (Crimmins and Beltrán-Sánchez 2011). The declines in both the crude death rate and the age-adjusted death rate had slowed dramatically by the end of the century (Hoyert 2012), and as far back as the early 1990s upticks in mortality were actually being observed (Matthews et al. 1994). Again, this was not a major reason for concern given the dramatic improvement recorded in life expectancy during the 20th century (particularly the first half) and the dramatic reduction in mortality (particularly infant and maternal mortality) during that period. Obviously, the rate of improvement experienced in the early 20th century could not be maintained indefinitely, so the slowing and even leveling off of rates was not totally unexpected. Nevertheless, these trends did raise a red flag, especially since the data for comparable countries indicated continued increases improvement in life expectancy and continued reductions in mortality rates over the same time period (Woolf and Laudan 2013).

What was cause for concern, however, was the fact that, for certain subsets of the U.S. population, the mortality rate was found to be increasing and life expectancy decreasing (Kindig and Cheng 2013). The most adverse trends in morbidity patterns were admittedly limited to a small segment of the population with characteristics detrimental to good health, but the Kindig and Cheng study found declining longevity to be relatively widespread among females. The fact that any segment of the U.S. population was demonstrating negative trends in mortality was worthy of note. While the negative mortality trend noted above could be rationalized away to a certain extent, it was harder to smooth over the increase in maternal mortality reported by Kassenbaum (2014).

In the past it was easy to rationalize increases in prevalence rates for chronic diseases; the epidemiological transition was thought to explain this phenomenon. As the epidemiological transition unfolds, it is argued, the acute conditions characteristic of pre-modern populations are supplanted by the chronic diseases—the "diseases of civilization"—characterizing modern populations. One should expect an increase in the prevalence of chronic conditions as the incidence of acute conditions declines. However, according to Crimmins and Beltrán-Sánchez (2011) the prevalence of disease has actually increased more than would be anticipated in recent years. Some negative indicators related to morbidity can actually be traced as far back as the 1980s but until recently had gone essentially unnoticed, while accompanied by continued high or resurging rates for certain acute conditions. Additional evidence of adverse trends has been identified by others based on statistics from the 1990s (Murray et al. 2013).

Challenges in Assessing Morbidity Trends

The question—are Americans getting sicker?—is much easier to ask than to answer. Our inability to conclusively say whether or not Americans are getting sicker is primarily due to the difficulty in measuring health status with any degree of confidence. There is no easy way to determine the health status of the population, and the sections that follow will review the challenges involved in determining the morbidity level of this or any other population. Each of the challenges will be addressed in turn, after which the available data will be reviewed.

Population Base

The first consideration in assessing the health status of the U.S. population is: what "population"? Normally, for an analysis such as this one would routinely assess the entire population—that is, all Americans. When we say "Americans" to whom are we referring? Ideally, we would want to generate a comprehensive measure—that one number that would take into account all residents of the U.S. However, the U.S. population is obviously large and highly differentiated. In reality, there are no doubt a number of different patterns of morbidity (and morbidity change) affecting different segments of the population at any point in time. Given that fact, does it make sense to look at the total population as the baseline for assessing health status or does that approach mask too much difference? Would we be generating an "average" that may not mean anything? Even if one insisted upon "scoring" the entire population, should temporary U.S. residents be included? U.S. citizens living abroad? If not the entire population, than who?

Perhaps examining the health status of some subset of the population might give a clearer picture. Does it make sense to look at adults (excluding children and the

elderly) as the most meaningful population? Or does the health of seniors [which has changed dramatically over time (Robinson 2007; Crescioni et al. 2010)] provide a more meaningful framework? Others may argue for a focus on children because they may be more susceptible to the effects of various etiological factors and certainly represent a foretaste of the future health status of the population. Given the large number of immigrants within the U.S. population, is it reasonable to include them in the mix? Or should the analysis focus on the native-born only? It is well documented that immigrants have different health status from the native born (and, even then, not all in the same way) (Jasso et al. 2004). Does excluding recent immigrants or even all foreign-born residents create a more relevant population for assessing health status?

Measuring Morbidity

Assuming the population base can be agreed upon, a second issue relates to the type of measures to be used to determine the level of morbidity within the population. Unfortunately, there is no one accepted indicator for measuring the level of morbidity (however defined). The closest that we come to a "global" indicator is self-reported health status as collected by the National Center for Health Statistics (NCHS) . This subjective measure generates a global estimate of the population's health status on a scale ranging from poor to excellent. While this is useful information, obviously there are issues with self-reports of health status (Kuhn et al. 2006). Despite reservations about the validity of this measure, some—as seen below—have used changes in reported health status as evidence of changing morbidity status (Wilson et al. 2007).

In the past, although less so today, mortality rates have been used as a proxy for morbidity. This indicator does have the advantage of being that one number that presumably reflects the combined impact of various aspects of morbidity. Historically, there was a fairly close correlation between common maladies and common causes of death. The immediate cause of death was typically the primary cause of death, with few complicating factors. Further, mortality data have long been relatively complete and easily attainable. The connection between mortality and morbidity can still be made today to a certain extent, in that the leading causes of death reflect common maladies within the U.S. population (National Center for Health Statistics 2010).

There are, however, two major drawbacks to the use of mortality measures as proxies for health status today. Over time the mortality rate has become a less meaningful proxy for morbidity. In the U.S. the mortality rate has dropped to the point that death is a relatively rare event. Further, the correspondence between mortality and morbidity has become diminished. Because of the preponderance of chronic disease within the U.S. population, data extracted from death certificates may not always indicate the underlying causes. Chronic diseases typically do not kill people, but affected individuals die instead from some complication

(of diabetes, AIDS or cancer, for example). This is not to say that mortality analysis cannot provide insights into morbidity patterns, but that the situation is much more complicated than in the past. Contemporary analyses of mortality data require a better understanding of disease processes (and the vagaries of death certificate preparation).

A more objective approach commonly used is to determine the symptoms characterizing a sample of individuals in a population and combine the scores from a symptom checklist into an index that presumably represents the level of morbidity within a population. This information can be obtained either from self-reports—raising again the question of validity—or from on-site physical examinations. This approach has the advantage of gathering data directly from members of the population. However, in addition to the reliance in most cases on subjects' perceptions, this method does not collect data on diseases per se, only symptoms. The only data collection effort that comes anywhere close to generating the data for such an approach is the National Health Interview Survey (NHIS) conducted annually by NCHS. Although data on symptoms is collected the data are not tied to geography and are linked to demographic traits in only a limited sense.

Another objective option would be an aggregate measure of health status based on the combined scores for all morbidity indicators—that is, a morbidity rate based on the combined incidence/prevalence of conditions affecting a population that are deemed to be relevant and, importantly, for which the necessary data are available. Thus, the totality of identified diseases within the population could be combined to determine the level of morbidity. While this approach seems intuitively useful it raises questions about the indicators to be included in the aggregate figure. Calculating the "totality" of disease, of course, is impossibly ambitious and would create an unwieldy measure even if the relevant data were available.

Given the impracticality of generating a total morbidity rate, a fallback approach might be to create an index that combines the rates for conditions that might be thought of as "sentinel" indicators for overall morbidity. Are there certain conditions that could be considered emblematic and particularly reflective of overall health status? If this approach were to be used, the standard calculations for the morbidity rate could be employed—that is, the ratio of diseased (with any disease) to healthy individuals in the population could be calculated. The logistics of this approach require considerable thought. Should this measure include a summation of rates for acute conditions, chronic conditions, reproductive health conditions, or even indicators of disability? How does one determine what conditions should be considered as sentinel?

One other option is to focus on specific diseases or health conditions and track them individually over time. The argument here would be that an individual indicator could be monitored without dealing with the challenges of aggregating indicators. This makes sense from a practical perspective, but raises questions as to the indicator or indicators to be employed. Any approach that attempts to combine rates for a number of diseases raises questions about the relative importance of

candidates for inclusion. Given that there are a wide range of indicators that might be examined, do some indicators carry more weight than others? For example, a case could be made for continued improvement in health status based on the dwindling number of "notifiable diseases" that are reported to the CDC. Does the century-long decline in the incidence of diphtheria, measles, mumps and tuberculosis carry as much weight as the increase in the prevalence of heart disease, diabetes and arthritis within the population?

Even if one or several specific conditions might be chosen as indicators to track, another issue surfaces: the fact that definitions of various conditions may change over time or the criteria used may change. The constellation of diseases listed in the International Classification of Diseases (ICD) system is fluid, and conditions are added, deleted and renamed over time. New conditions may be identified (e.g., AIDS, Legionnaire's disease), common syndromes may be reclassified as morbid conditions (e.g., pre-menstrual syndrome, attention deficient disorder, irritable bowel syndrome), and even the disease status of certain conditions may change over time (e.g., homosexuality).

Data Availability

One problem inherent in longitudinal analyses such as this is having access to the necessary data for the time period under study. Certainly in recent years efforts have been made (primarily by the National Center for Health Statistics) to generate data that are comparable year to year to allow for tracking changes over time. Data on mortality can be traced back for decades with relative confidence in the quality of the data. However, morbidity data is not as well documented, and 50 years ago much more emphasis was placed on collecting data on acute conditions than chronic conditions; today, the emphasis has been reversed with data on chronic conditions receiving most of the attention.

Even if there was a central repository and all relevant parties had access to efficient means of reporting morbid cases, the actual recording of cases would still be limited. While the reporting of certain conditions (e.g., HIV/AIDS, tuberculosis) is required by law, there is no mechanism for enforcing these requirements on the hundreds of thousands of healthcare providers and healthcare organizations that might encounter these cases. For certain types of health conditions it is felt that the reporting is fairly complete—that is, most cases are actually reported to the appropriate authorities. However, for the majority of conditions a significant—and often unknown—level of underreporting exists. This means that for many if not most conditions being tracked, there will be inevitable undercounts.

Without a central repository, the researcher must access data wherever it is available. This typically means having to address a variety of issues related to the nature of the data. These include issues of case-finding, coverage, and timeliness, among others.

Case-Finding

Beyond limitations in the reporting of data on morbidity, the usefulness of data on cases that are actually identified is affected by a number of factors. A major consideration is what constitutes a "case" for calculation of morbidity rates. While the medical profession establishes agreed-upon guidelines for when a condition constitutes a case, issues remain with regard to the establishment of a diagnosis. Thresholds for the specification of a disease are established based on the best available evidence supported by professional consensus (although this may be difficult to reach for some conditions). These are not absolute indicators but represent best estimates of when a non-case becomes redefined as a case. Because of their somewhat arbitrary nature, such standards are prone to change over time and sometimes in response to factors other than advances in medical science.

Even if complete agreement could be reached with regard to the definition of a case for each of the thousands of diseases catalogued, measurement issues would still remain. To a certain extent, the diagnosis of disease is as much an art as a science, and this often leads to wide variations in the diagnosis of conditions from one practitioner to another or from one community to another, especially when being tracked over a long period of time (in this case for a century or more). In addition to the fluid nature of thresholds for the identification of some conditions there is also the issue of inaccurate diagnoses. In some cases this may involve a truly egregious misdiagnosis, the type of error that results in adverse events and malpractice suits. A much more common incident, however, relates to tests that yield false positives or false negatives. In the case of the former, the test result indicates the presence of pathology when in fact it is not present; in the case of the latter, the test result fails to detect the presence of pathology when in fact it is present. The point, for our purposes, is that any figures that are used are likely to reflect a certain amount of "slippage" in terms of accuracy of diagnosis (Kistler et al. 2010).

Another confounding factor involves changes in our ability to diagnosis a condition. Clearly, methods of detection are much improved today and the healthcare system is much more aggressive in ferreting out health conditions of various types. Thus, the reported increase in the prevalence of certain types of cancer may reflect better detection rather than an actual change in prevalence. Adjusting prevalence rates to account for improved diagnosis is difficult since it is almost impossible to determine the impact of this development for most conditions.

Coverage

Given the fact that there is no central repository of data on morbidity, the extent of coverage for any indicator is an issue. What we know about the level of sickness and disability is a function of data reported to health authorities (e.g., notifiable

disease reporting to the Centers for Disease Control and Prevention) and data collected through national sample surveys (e.g., the National Health Information Survey conducted by the NCHS). The reporting of data on notifiable diseases is mandated but effectively voluntary. This means that the completeness of reporting varies from disease to disease.

The ability to track morbidity trends depends on all cases being counted, yet numerous analyses have demonstrated that the true prevalence of many conditions is much greater than that reported based on the available data. This shortfall in identified cases reflects the facts that: (1) a large number of cases go undiagnosed for certain conditions; (2) conditions may have been diagnosed yet no treatment has been obtained (thereby keeping them out of "official" records); and (3) the lack of a mechanism to assure that all identified cases are counted in determining the level of morbidity.

This situation exists to a greater or lesser extent for any number of health conditions and would apply to, for example, most behavioral health conditions for which underreporting is substantial. While data extracted from "reported cases" drawn from physicians' records is a valuable source of information on morbidity patterns, the data are limited to reported cases.

A related issue is that data may have been collected for certain subgroups within the population at various points in time. This means that, in tracking morbidity patterns over time, we may end up mixing apples and oranges. For example, some morbidity studies focus on seniors, others on children, and still others are restricted to certain segments of the population. Despite the rigor generally displayed by the NCHS, for various reasons the target subjects for data collection may change over time or vary from survey to survey. Thus, for some studies "children" may mean anyone under 19 years of age while in others it may mean anyone under 16. Some studies may carve out an age group (say, children 5–8 years) or limit the subjects to preschoolers for example.

Questionnaire Content

Another challenge is related to the fact that the topics addressed through sample surveys sometimes change over time. For example, information on high cholesterol and body mass has only been collected in recent years and this information is, thus, not available for the distant past. There also may be issues of wording changes or revisions of the measures used. What appears to be a simple wording change can have important implications for the data collected. For example, "Have you ever been told by a physician that you have diabetes?" generates different results from "Have you ever been treated for diabetes?".

Although the NCHS administers surveys to the general population (the National Health Information Survey being the most relevant here), these national surveys are limited in terms of their ability to track the thousands of diseases that would affect a population. NCHS interviewers as a practical matter can only elicit information

from respondents for a limited number of diseases, and, to make matters worse, the list for which data are collected is prone to change over time. Changes in the methods of reporting health conditions and, indeed, in the definitions of the conditions themselves are mitigating factors.

Timeframe

Perhaps the most critical issue for an analysis of trends is the fact that certain data are not available for the timeframes under study. Certainly, there is limited morbidity data available for the early decades of the 20th century, before organizations like the CDC and NCHS started systematically collecting morbidity data. Even mortality data cannot be assigned the same level of confidence prior to the institution of universal coverage and standardized forms mid-century. "Hard data" from pre-WWII 20th century are not likely to exist for many health conditions—and certainly not in formats compatible with more recent attempts at data capture.

This situation is further complicated by the fact that various data-collection entities may collect data on a certain health condition for a specified time period and subsequently discontinue data collection on that topic, perhaps to resume data collection years later. After decades of reporting an aggregate rate for acute conditions, the NCHS not only discontinued the calculation of the aggregate rate but ceased collecting data in a manner that would allow others to calculate an aggregate rate going forward. Unfortunately, this situation is likely to be common for health conditions for which no alternative sources of data are available.

Determining Trend Direction

A final issue relates to the question of what constitutes a reversal of the trend. What evidence would cause us to conclude that the health status of the U.S. population is getting worse? Would it have to involve a reversal of past trends—e.g., a decline in life expectancy or an increase in death rates? Would even a slowing of rates of improvement suggest a downturn in health status under certain conditions? Or should we examine changes in the prevalence rates for chronic conditions or some aggregate measure of chronicity and identify patterns where conditions that were in decline in the past are now showing increased prevalence? Should the real test involve a comparison of U.S. morbidity trends with those of similar countries?

The most obvious indicator would be an indisputable decline in measures of health status that represents a reversal of past trends. Thus, if survey research had indicated a steady increase in perceived health status historically, a downturn in average self-reported health status could be thought to represent a reversal. Similarly, a decline in life expectancy might also be considered a reversal of previous trends. If we are using life expectancy as our indicator, do we need to see

an overall decline in life expectancy for a reversal of fortunes to be verified, or should we consider a decline in life expectancy for any segment of the population as evidence of a reversal. Similarly, an increase in the death rate—not common but certainly not impossible (see post-Soviet Russia)—may signal a decline in health status.

While documented reversals in certain traits may be considered clear evidence of a reversal in morbidity trends, there may be other considerations. In some cases, a failure to improve or a slowing of rates of improvement for certain conditions may be thought to signal a reversal. Admittedly, there are limits to the extent to which some indicators of health status can improve. Life expectancy cannot be expected to increase indefinitely, for example. The question becomes: To what extent does a leveling off of improvement in life expectancy or any other measure represent a reversal of health status fortunes?

Another approach would involve an observed increase in certain measures of morbidity—an increase in the prevalence of chronic disease or a higher proportion of the population being classified as disabled, for example. An increase in some aggregate measure of chronicity may suggest a decline in health status, depending on the circumstances. Thus, continued or newly identified increases in the prevalence of key chronic conditions might signal a sickening of the population.

Even here, however, first-order relationships may be misleading. For example, an increase in the total prevalence of chronic diseases within the U.S. population would not necessarily indicate declining health status. Given the extent to which the population has aged over the past three decades, one would expect an increase in chronicity. The key is how today's level of chronic disease compares to a demographically standardized population from 20, 50 or 100 years ago.

An even thornier question relates to the interpretation of the continued high incidence of certain acute conditions in the light of the epidemiological transition. Does the re-emergence of long-eliminated communicable diseases by itself indicate a reversal of morbidity trends? The fact that some epidemiologists and public health officials use terms like "shocking" to describe the situation certainly suggests a worsening of health status. Is our failure to fully eradicate certain communicable diseases an indicator of faltering health status? Do the high—and increasing—incidence rates for sexually transmitted infections indicate a disruption of the trend toward improving health status?

One final consideration in adjudging the direction of morbidity trends is the use of comparative data from similar populations. Is it meaningful to compare U.S. morbidity trends to those exhibited by other countries? Given the fluidity of the U.S. healthcare environment and the variety of factors that could influence health status indicators, is the best measure of U.S. health status against some standard—in this case the experiences of similar countries? There could be circumstances in which it appears that an indicator of U.S. health status is improving but, in actuality, the U.S. is improving at a much slower rate than similar countries. Cross-national statistics that indicate that the U.S. population has fallen behind other countries in terms of improvement in life expectancy and reduction of overall mortality, infant mortality and maternal mortality could be interpreted as indicators of declining health status.

Research Plan

At the end of the day, there is no easy solution to the challenge of tracking health status. As is often the case in healthcare, analyses are limited by the data that are available. That is, we have to do the analysis with the data we have rather than the data we would like to have. Using primarily data generated by the National Center for Health Statistics, supplemented by data from a variety of other sources, it is possible to piece together an admittedly fragmented view of recent trends in morbidity. Few of the available data cover the entire century-plus time period, making definitive conclusions concerning long-term trends problematic. Nevertheless, it is possible to draw some tentative conclusions based on the data that are available.

While the initial intent of this analysis was to compare data for the 20th century with data from the years 2000 and beyond, the patterns of morbidity observed required a modification of this approach. Some of the changes being tracked actually started appearing in the 1980s and 1990s. Further, while some developments clearly unfolded 20 or more years ago, some of the changes in trends actually do relate to 2000 or later. This situation tended to further muddy the waters in that not only was the point in time when the reversal began not clear cut but any observed reversals varied from diagnosis to diagnosis in terms of their timeline. While it was appropriate to use pre-2000 and post-2000 figures for some measures, there were cases in which the observed "reversal" occurred in the 1980s or 1990s in which case an earlier cut point was used. For this initial review of the available data the intent was not to analyze the trends identified or to explain the patterns that were observed. Where possible data have been obtained from previously published reports, although in some cases the author compiled raw data and produced the time series. Because of the need to draw data from such disparate sources, as a practical matter not all relevant tables can be included in this paper.

The goal was to highlight statistics drawn from disparate sources that suggest a reversal of the past trend toward improved health status. The data are presented at face value without drawing conclusions with regard to what they say about the changing health status of the U.S. population. While changes—especially those that represent a negative trend—are noted, no attempt is made here to interpret the meaning of these changes. However, many of the figures presented represent actual data rather than data based on a sample, eliminating the any concern over sampling error. Figures that are based on a sample survey (e.g., certain NCHS statistics) should of course be interpreted with caution and no effort was made to test the significance of the observed changes. As noted above, there is no established barometer for determining whether the population is getting sicker or not. It is hoped that the data presented will stimulate more intensive investigation of indicators of morbidity.

The Findings

The following section summarizes the available data on trends in morbidity for the U.S. population. Each indicator or set of indicators has important limitations, and the best that can be hoped for is a fragmentary view of the population's changing morbidity patterns. A discussion of any identified trends in morbidity based on the available evidence from disparate sources will be presented as a conclusion to these findings. An important question to be considered relates to the feasibility of actually assessing whether or not Americans are getting sicker.

Global Indicators

Self-reported health status is essentially the only "global" indicator available for this analysis. Survey respondents were asked to rate their health status on some type of scale, with the most common response categories being "poor," "fair," "good," "very good," and "excellent". Data are available annually for 1997–2013 with additional data available from selected prior years. Based on data collected by the National Center for Health Statistics, self-reported health status for Americans has gradually declined over the past 15 years. The proportion reporting excellent or very good health declined from an age-adjusted 68.5% in 1997 to 61.1% in 2011. The proportion reporting only fair or poor health status increased from an age-adjusted 9.2 to 12.8% between 1997 and 2011 (National Center for Health Statistics 2013). While the youngest age cohort (under 18 years) reported little change (from 2.1 to 2.0%), all other age cohorts except seniors (65 years and older) reported decreases in health status. In contrast, the proportion of seniors reporting fair or poor health status decreased from 26.7 to 24.4%, reinforcing the notion that seniors have in fact experienced improved health status over time [Note that not all surveys have reported declining health status (Salomon et al. 2009)].

The decline in self-reported health status after 1997 indicates a reversal of the previous trend. Throughout the 1980s and into the 1990s self-reported health status steadily improved, only to be followed by a decline for the post-1997 period. This evidence suggesting a leveling off or even a decline in health status among Americans clearly requires further investigation.

Evidence that emerged from statistics from the end of the 20th century suggested that, although health status indicators like life expectancy and mortality rates continued to improve, the rate of improvement appeared to be slowing or even leveling off (Crimmins and Beltrán-Sánchez 2011). Using mortality as a proxy for health status, data collected by the National Center for Health Statistics indicate that overall mortality rates for Americans, while continuing to improve, were improving at a declining rate. Rates of decrease equaling as much as 10% per year for crude birth rates prior to WWII dropped to 0.5% per year for the 1970–2000 period and to 0.2% for the 2000–2010 period. Age-adjusted death rates averaging more than 10%

per year in the pre-war decades dropped to 0.16% per year for the 1970–2000 period and to 0.07% for 2000–2010 (Hoyert 2012).

While a slowing of the improvement in mortality rates was not unexpected, an actual increase in mortality rates was. In nearly half of U.S. counties, female mortality rates actually increased between 1992 and 2006, compared to 3% of counties that saw male mortality increase over the same period (Kindig and Cheng 2013).

The most dramatic improvement in mortality rates, of course, had been for infant mortality, with most of the decline occurring within the first half of the 20th century. As with overall mortality, the rate of improvement slowed notably after WWII. Between 1970 and 2000 the rate per 1000 live births dropped by an average of 0.4 per year. Between 2000 and 2010 the rate of improvement declined to half that or 0.2 per year. The fact that the infant mortality rate continues to improve is encouraging but, as shown below, the rate of improvement has fallen off world standards.

The figures for trends in maternal mortality display perhaps the most disturbing pattern and, in fact, offer some solid evidence of a reversal of health status in recent years. As with other mortality rates, the maternal mortality rate declined rapidly during the first half of the 20th century, with the rate of improvement slowing after WWII up until the 1980s. Death during childbirth in the U.S. it seemed had been relegated, as they say, to the dustpan of history. However, unlike other mortality rates, the trend eventually began to reverse itself, hitting its lowest mark around 1980, stagnating during the 80s and 90s and actually increasing moving into the 21st century. The rate of less than 1.2 maternal deaths per 10,000 live births in the 1980s increased to a modern high of nearly 2.5 deaths per 10,000 live births in 2010. The rate has dropped slightly (to 1.85 in 2013) but the fact that the U.S. is the only developed country for which the maternal mortality rate is increasing is certainly noteworthy (Kassenbaum 2014).

While the negative mortality trends noted above could be rationalized away to a certain extent, it is harder to smooth over the increase in maternal mortality. Admittedly, the numbers are still small but nearly double the rate of 20 years ago. This raises the question of why this is occurring in a system that has "medicalized" childbirth to an extent exceeding any other nation. Despite the micro-management of the childbearing process, all comparable countries continue to report declines in maternal mortality at a time when that for the U.S. in increasing.

While the mortality rates for many conditions have declined in recent years, there are a number of diseases for which death rates have increased over the past decade or so. These include: influenza/pneumonia, diabetes, chronic lower respiratory disease, liver disease and cirrhosis, and pneumonitis (National Center for Health Statistics 2010). While the aging of the population could explain higher rates of death for certain diseases, there is evidence that the rates are still higher when age is held constant.

As noted previously, life expectancy at birth increased from less than 50 years in 1900 to nearly 80 years in 2000. As with other indicators, however, much of the decline was recorded during the first half of the 20th century when life expectancy

was increasing by nearly 0.4 years annually. While life expectancy increased nearly as fast between 1970 and 1990 (0.35 years annually), the increase between 1990 and 2006 was only 0.11 years annually. While life expectancy cannot be expected to increase indefinitely, the slowing of the rate of increase is certainly noteworthy.

For some segments of the U.S. population, there is evidence of declining life expectancy—a phenomenon not experienced within demographic memory. Recent mortality data indicates a sharp drop in life expectancy for the least-educated white Americans (Olshansky et al. 2012). The drop is greatest for those without a high school diploma, with poorly educated white women actually "losing" five years of life between 1990 and 2008. White men without a high school diploma saw a three-year decrease in life expectancy over this time period. Thus, the life expectancy for white women without a high school diploma was 73.5 years in 2008 (compared to 83.9 years for women with a college degree) and for white men it was 67.5 years (compared to 80.4 years for those with a college degree). The fact that any segment of the U.S. population was demonstrating negative trends in mortality is worthy of note. Another study found that inequality in women's health outcomes steadily increased between 1985 and 2010, with female life expectancy stagnating or declining in 45% of U.S. counties (Wang et al. 2013). Recent research, thus, suggests that women in some parts of the country are dying younger than they were a generation ago.

Aggregate Indicators

As noted, there is no acceptable aggregate measure of morbidity, although the NCHS has periodically considered the totality of acute conditions and chronic conditions for reporting purposes. The Center no longer compiles an aggregate rate for acute conditions but does present data on the prevalence of multiple chronic conditions. In the United States, almost 125 million persons (45% of the population) have at least one chronic condition, and this proportion has steadily increased over time. The proportion of Americans with a chronic condition was projected to increase from 44.7% in 1995 to 47.0% in 2010 with the proportion expected to continue to increase in subsequent years (Wu and Green 2000). Subsequent studies based on NCHS data have found, for adults 45–46 years, noteworthy increases between 2001 and 2010 in the proportions reporting 2–3 chronic diseases or 4 or more chronic diseases. For adults 65 years or older substantial increases were also reported in the proportions reporting 2–3 chronic diseases or 4 or more chronic diseases (National Center for Health Statistics 2013). What is telling is the fact that contemporary cohorts report higher aggregate rates of chronic diseases than comparable cohorts a generation ago.

The National Longitudinal Survey of Youth (ages 2–8) found the prevalence of any chronic health condition to increase from 12.8% in 1988 to 25.1% in 2000 and then again to 26.6% in 2006. There is growing evidence that American children are

experiencing increasing levels of a number of chronic conditions typically attributed to older adults (Halfon and Newacheck 2010).

Another aggregate measure of a sort is the disability rate for the population. Based on data from the National Center for Health Statistics, the proportion of the U.S. population reporting activity limitation increased from 11.8% in 1970 to 28.7% in 2010, although the rate of increase has slowed since the 1990s. The proportion of respondents reporting any disability did increase from 27.0 to 30.3% between 1997 and 2009. It has been suggested that a higher proportion of the U.S. population and a greater absolute number is disabled than at any time in the past. This trend is thought to reflect the facts that a higher proportion of the population is elderly and our ability thanks to medical technology to preserve the lives of many who would have died prematurely in previous generations. This has also meant that a higher proportion of seniors report disabilities than in the past, suggesting that more people are living longer but not necessarily with the same quality of life as their forebears.

Over the last few decades, the rise in the rates of potentially disabling childhood conditions deserves special consideration in the analysis of activity limitation trends in children. During the early 1970s, when the rates of severe limitations grew from 2.7 to 3.7%, Halfon and Newacheck (2010) found increasing rates of several health conditions, especially mental health conditions, asthma, orthopedic conditions, and hearing loss. Unfortunately, changes in the questions as part of the redesign of the National Health Interview Survey in 1997 make comparisons over the entire time period impossible.

Disease-Specific Indicators

In the absence of adequate global or aggregate measures, we are left with an examination of trends in specific diseases. An examination of morbidity trends based on specific diseases requires us to revisit the notifiable diseases noted earlier. Although the effect of the epidemiological transition has been to replace acute conditions with chronic conditions as the predominant health problems, we see that certain acute conditions continue to be reported at high rates and some, in fact, at rates that are unprecedented in the modern age. These include increased rates for a variety of communicable diseases—including Legionnaire's disease, malaria, pertussis, and valley fever (Centers for Disease Control and Prevention 2014) (see Fig. 2.5). Many conditions that are associated with less healthy populations continue to generate a disturbing number of cases annually (e.g., tuberculosis, chicken pox and salmonella). In addition, sexually transmitted infections remain at epidemic levels with a recent resurgence of syphilis noted. While chronic conditions comprise the preponderance of health problems, the persistence exhibited by a number of acute conditions is noteworthy.

Understandably, much of the emphasis is on chronic disease since these types of conditions have become the predominant health threats in contemporary America.

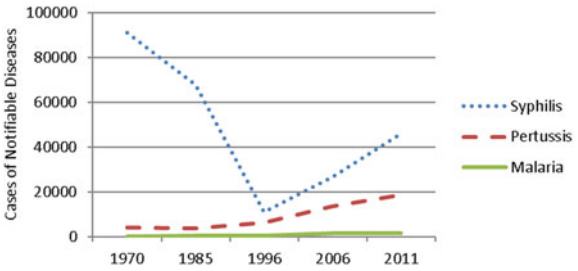

Fig. 2.5 Trends in selected notifiable diseases, United States: 1970–2011. *Source* Centers for disease control and prevention

The rise in the overall prevalence rate for chronic disease was noted above. A more nuanced view is provided when the rates for specific diseases are examined. For adults the prevalence rates for a number of conditions have increased in recent years. These include: high blood pressure (from 25.8% in1988–1994 to 30.7% in 2007–2009); coronary heart disease from 6.0% in 1997–1999 to 6.4% in 2009–2011); stroke from 2.2% in 1997–1999 to 2.6% in 2009–2011; and cancer (all sites) (from 6.5% in 1997–1999 to 8.0% in 2009–2011) among others (e.g., asthma and depression). A good case in point is diabetes for which the prevalence rate has increased substantially over the past two decades even when aging is taken into consideration. During 2003–2006 more than a quarter of older men (65 + years) suffered from diabetes, up 5 percentage points from the 1994–1998 period. The increase in diabetes prevalence has been even more dramatic for older African-American men, with rates for this group rising three times faster than those for white males. As another example, the prevalence rate for emphysema increased from 14.0 per 1000 in 2000 to 19.8 in 2010. The rate increased for all racial and ethnic groups and rose particularly fast for blacks and other non-white groups, women and older adults. Here is one case where we can examine apples and apples —that is, prevalence rates for the same age groups over time (American Lung Association 2013). For those 45–64 in 2000 the rate was 18.9 per 1000, a figure that increased to 21.2 in 2010 (with a major jump for 2011 [26.6]).

The prevalence rate for stroke has increased dramatically for the U.S. population. The rate per 1000 population increased from 9.8 in 1990 to 15.7 in 2010 (Feigin et al. 2013). Younger Americans are increasingly being affected by stroke, with obesity, diabetes and high blood pressure all contributing to an increase in the number of strokes reported for younger age cohorts. Worldwide, the incidence of stroke increased by a quarter for those 20–64, with similar figures reported for the U.S. population.

Most of the available data point to increasing health status among elderly Americans. However, there are some counter trends to note. The rate of diabetes for both older men and older women increased between 1988–1994 and 2003–2006—from 19.6% of the older male population to 24.4% and 23.0 % for women.

Hypertension rates also increased during this period, from 57.3% for males 65 and older to 64.6% and from 64.5 to 75.3% for women.

In assessing morbidity trends for the U.S. population one further health condition that should be considered is obesity. Obesity rates for men and women 65 and older also increased substantially from 1988–1994 to 2003–2006—for men from 18.9 to 28.7% and for women from 23.2 to 30.6%. The increasing obesity level of the U.S. population is well documented, and this factor by itself could be presented as evidence of declining health status. But the real measure of the impact of obesity on health status is prospective. A wide range of health conditions—some of them potentially fatal—is associated with obesity (National Heart, Lung and Blood Institute 2013). Some of this is already taken into consideration when the health status of adults is analyzed. The prevalence of persons who are overweight and obese, characteristics that have been associated with increased prevalence of and morbidity from type 2 diabetes, hypertension, arthritis, and some cancers, has more than doubled during the last 40 years. The high rate of heart disease reflects the obesity level of the population (among other factors).

Thinking in terms of trends, however, it could be argued that the high rate of obesity among youth is more of a concern than adult obesity since childhood obesity is a harbinger of serious health problems in later life. A study by the Institute of Medicine has described the increasing prevalence of childhood obesity as a "startling setback" for child health (Institute of Medicine 2006). Americans, particularly women, are becoming obese at increasingly early ages (Trust for America's Health 2012). The full impact of the obesity "epidemic" is only likely to be felt within a decade or two.

A major consideration in evaluating the changing health status of the U.S. population is the apparent declining health status of American children (Delaney and Smith 2012). The available data, in fact, suggests sharp increases in the prevalence of most childhood physical and mental health problems. Further, there appears to be a proportionate shift away from acute health conditions to chronic health conditions. From the beginning of the twentieth century to the end of that century, the available data indicate a decline in childhood diseases such as measles and mumps and a subsequent decline in chicken pox by the end of the twentieth century. At the same time, these same data indicate an increase in many other acute and chronic conditions over the course of that century.

Major increases are identified in the incidence or prevalence of asthma, other respiratory illnesses, allergies and depression. In fact, some chronic conditions that were unknown among children in the past (e.g., diabetes, heart disease) are becoming increasingly common and at increasingly younger ages. The National Longitudinal Survey of Youth (ages 2–8) found the prevalence of any chronic health condition to increase from 12.8% in 1988 to 25.1% in 2000 and then again to 26.6% in 2006. Less dramatic but still important increases were noted for speech impediments, heart trouble, headaches/migraines, stomach problems, diabetes, epilepsy, and hypertension. Other research has found that the number of children

with asthma has more than doubled since 1980 and with an increase in incidence of nearly 10% between 2001 and 2010 (Akinbami et al. 2012). Research has uncovered increases in levels of autism and ADHD, with a reported increase in the prevalence of ADHD for those 5–17 years from 6.5% in 1998–1999 to 9.6% in 2009–2011 (National Center for Health Statistics 2013). For children under 18 years, an increase in food allergies was reported from 3.4% (1997–1998) to 5.1% (2009–2011) and for skin allergies from 7.4 to 12.5%.

Cross-National Comparisons

Comparing the health status of Americans with that of citizens of other countries is instructive and generally reveals a drop in the health status of Americans relative to those of comparable societies. In terms of overall mortality rates, the U.S. dropped from 24th to 49th (or dead last) among similar countries between 1999 and 2010, a noteworthy decline for barely a decade. This relative decline is being driven by American women—a startling finding considering that white women have historically displayed the best health status of any age-sex category in the U.S. In 2010 American women ranked 41st in life expectancy among the world's countries, down from 14th in 1985. Among developed countries, American woman sank from the middle of the life expectancy range to dead last in 2010 (Hausmann et al. 2012).

In terms of mortality rates, the U.S. rate continued to decline between 1998 and 2010 as did rates for other developed countries but, as illustrated by Fig. 2.6 the rate of decline for the U.S. has slowed relative to that of other countries. In this comparison the U.S. reports a higher overall mortality rate and is the only country that exhibits a leveling off in the rate of decline.

A similar pattern is displayed for infant mortality, with the U.S. dropping off the pace of comparable countries. While the U.S. initially had an advantage in infant mortality over most other countries,that advantage has been eliminated for the most part, with the U.S. currently ranking worse than other developed countries in terms of infant mortality (see Fig. 2.7).

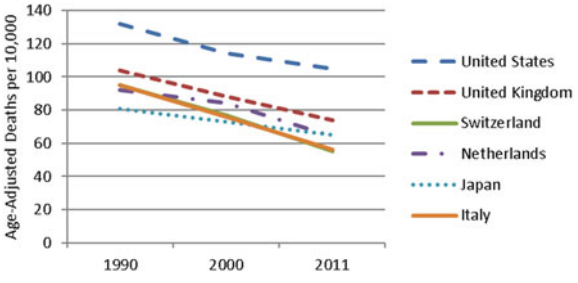

Fig. 2.6 International adult mortality (ages 15–60) 1990–2011. *Source* World health organization

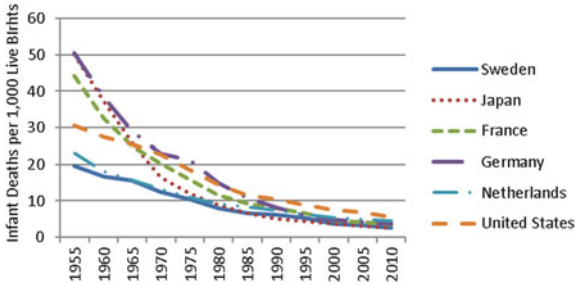

Fig. 2.7 International trends in infant mortality 1955–2010. *Source* World health organization

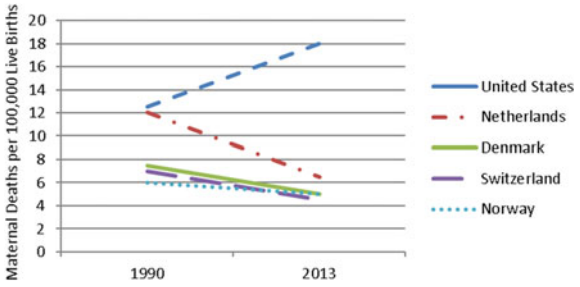

Fig. 2.8 International trends in maternal mortality 1990 and 2013. *Source* Institute for health metrics and evaluation

The most noteworthy cross-cultural comparison related to mortality, however, involves maternal mortality. As noted above, the U.S. maternal mortality rate has actually increased over the past 20 years. This increase in maternal mortality stands in stark contrast to the on-going improvement in the rates for other developed countries and the worldwide decline in maternal mortality (Kassenbaum 2014). Although it has been suggested that the methodology for calculating maternal mortality may produce misleading statistics, the international statistics displayed in Fig. 2.8 certainly suggest a negative trend (Maron 2015).

Discussion

Clearly, any attempt to identify overall trends in morbidity for the U.S. population faces a number of challenges. The first critical challenge involves developing agreement as to what measure or measures are appropriate for use in assessing the health status of the population. The lack of any global measure of morbidity leaves

the door open for debate over what indicator(s) best depicts health status. Beyond this major conceptual hurdle, there are additional challenges related to data availability. Some potential indicators may have to be discarded in the absence of relevant data. Even for indicators for which data are available over an extensive period of time, there are issues related to definitions, data coverage (e.g., population, timeframe), and changes in the manner of data collection and the wording of survey items. Even if these challenges could be addressed, there remains the issue of interpretation as to what constitutes a negative trend or a reversal of health status fortunes.

Although all indicators of morbidity do not carry equal weight, this review attempted to cast a wide net in order to develop as comprehensive a view of morbidity trends as possible. While a number of observers have argued that Americans are getting sicker based on a specific indicator (e.g., mortality rates, self-reported health status, disease prevalence), there does not yet appear to be professional consensus regarding a reversal of health fortunes for the U.S. population. Based on this comprehensive compilation of indicators on morbidity, what can we conclude about emerging morbidity trends? Unquestionably, observed trends in overall mortality, infant mortality and maternal mortality—to the extent that mortality is representative of morbidity—suggest stagnation with regard to improvement in health status, a phenomenon not exhibited by the populations of other comparable countries. Prevalence rates for certain chronic conditions, while expected to increase with an aging population, appear to be increasing at a rate beyond that warranted by demographic changes. While there is no overarching indicator that allows us to definitively conclude that Americans are getting sicker, there are enough specific indicators to lead one to think that this is in fact the case.

These findings could be interpreted as anomalies within the context of continuous improvement in the health of the population, or, alternatively, as further evidence that Americans as a whole are getting sicker. It is too early in the assessment process to consider the possibility of a paradigm shift, but emerging morbidity patterns suggest a need to reconsider our morbidity model and the assumptions that support it. Conventional wisdom holds that the U.S. is on a path of continuous health status improvement. However, enough anomalies have been noted that the conventional wisdom requires reconsideration. Clearly, more evidence of a potential paradigm shift is required before the conventional wisdom can be abandoned.

At this point in time the most appropriate answer to the question—are Americans getting sicker—is probably “it depends”. It depends on the segment of the U.S. population being analyzed and the indicators that are being employed. It remains to be seen if a clear change in direction for the health status of the U.S. population is occurring. Any conclusive answer to this question will require consensus on how to best measure health status and the ability to access the necessary data to support a definitive assessment.

References

Akinbami, L. J., Moorman, J. E., Bailey, C., et al. (2012). Trends in Asthma prevalence, health care use, and mortality in the United States, 2001–2010. *NCHS Data Brief, 94*, 1–8.

American Lung Association. (2013). *Trends in COPD (Chronic Bronchitis and Emphysema): Morbidity and mortality*. Washington, DC: American Lung Association.

Centers for Disease Control and Prevention. (2014). Summary of notifiable disease—United States, 2011. Downloaded from URL: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6053a1.htm

Crescioni, M., Gorina, Y., Bilheimer, L., et al. (2010). Trends in health status and health care use among older men. Hyattsville, MD: National Center for Health Statistics. Downloaded from URL: http://www.cdc.gov/nchs/data/nhsr/nhsr024.pdf

Crimmins, E. M., & Beltrán-Sánchez, H. (2011). Mortality and morbidity trends: Is there compression of morbidity? *Journal of Gerontology and Psychological Social Sciences, 66B*(1), 75–86.

Delaney, L., & Smith, J. P. (2012). Childhood health: Trends and consequences over the life course. *The Future of Children, 22*(1), 43–63.

Feigin, V. L., Forouzanfar, M. H., Krishnamurthi, R., et al. (2013). Global and regional burden of stroke during 1990–2010: Findings from the global burden of disease study 2010. *The Lancet*. Online. Downloaded from URL: http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(13)61953-4/fulltext

Halfon, L., & Newacheck, P. W. (2010). Evolving notions of childhood chronic illness. *JAMA, 303*(7), 665–666.

Hausmann, R., Tyson, L. D., & Zahidi, S. (2012). *The global gender gap report 2012*. Geneva: World Economic Forum.

Hoyert, D. (2012). 75 Years of mortality in the United States: 1935–2010. *NCHS Brief, 88*, 1–8.

Institute of Medicine. (2006). *Preventing childhood obesity: How do we measure up?* Washington, DC: National Academies Press.

Jasso, G., Massey, D. S., Rosenzweig, M. R., et al. (2004). Immigrant health: Selectivity and acculturation. In N. B. Anderson, R. A. Bulatao & B. Cohen (Eds.), *Critical perspectives on racial and ethnic differences in health in late life*. Washington: National Academies Press.

Kassenbaum, N. J. (Ed.). (2014). Global, regional, and national levels and causes of maternal mortality during 1990–2013: A systematic analysis for the global burden of disease study 2013. *The Lancet* (May 2). Downloaded from URL: http://download.thelancet.com/flatcontentassets/pdfs/S0140673614604979.pdf

Kindig, D. A., & Cheng, E. R. (2013). Even as mortality fell in most US counties, female mortality nonetheless rose in 42.8 percent of counties from 1992 to 2006. *Health Affairs, 31*(3), 451–458.

Kistler, C. E., Walter, L. C., Mitchell, C. M., & Sloane, P. D. (2010). Patient perceptions of mistakes in ambulatory care. *Archives of Internal Medicine, 170*(16), 1480–1487.

Kuhn, R., Rahman, O., & Menken, J. (2006). Survey measures of health: How well do self-reported and observed indicators measure health and predict mortality. In B. Cohen & J. Menken (Eds.), *Aging in sub-Saharan Africa*. Washington, DC: National Academies Press.

Maron, D. F. (2015). Has maternal mortality really doubled in the U.S.? *Scientific American* (June 6). Downloaded from URL: http://www.scientificamerican.com/article/has-maternal-mortality-really-doubled-in-the-u-s/

Martin, J. A., Hamilton, B. E., Ventura, S. V., et al. (2002). *Vital statistics of the United States, 1971–2001*. Hyattsville, MD: National Center for Health Statistics.

Matthews, T. J., Clarke, S., & Singh, G. (1994). Annual summary of births, marriages, divorces, and deaths: United States, 1993. *Monthly Vital Statistics Report, 42*(13), 1–36.

Murray, C. J. L., Abraham, J., Ali, M. K., et al. (2013). The state of US health: 1990–2010: Burden of diseases, injuries and risk factors. *Journal of the American Medical Association*. Downloaded from URL: http://jama.jamanetwork.com/article.aspx?articleid=1710486&utm_source

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: National Center for Health Statistics. Downloaded from URL: http://www.cdc.gov/nchs/data/dvs/MortFinal2007_Worktable12.pdf

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

National Heart, Lung and Blood Institute. (2013). What are the health risks of overweight and obesity? Downloaded from URL: http://www.nhlbi.nih.gov/health/health-topics/topics/obe/risks.html

Olshanky, S. J., Antonucci, T., Berkman, L., et al. (2012). Differences in life expectancy due to race and educational differences are widening, and many may not catch up. *Health Affairs, 2012*(31), 1803–1813.

Robinson, K. (2007). Trends in health status and health care use among older women. Hyattsville, MD: National Center for Health Statistics. Downloaded from URL: http://www.cdc.gov/nchs/data/ahcd/agingtrends/07olderwomen.pdf

Saloman, J. A., Nordhagen, S., Oza, S., & Murray, C. J. L. (2009). Are Americans feeling less healthy? The puzzle of trends in self-rated health. *American Journal of Epidemiology, 170*(3), 343–351.

Schlipköter, U., & Flahault, A. (2010). Communicable diseases: Achievements and challenges for public health. *Public Health Reviews, 32*(1), 90–119.

Trust for America's Health. (2012). *Bending the obesity cost curve: Reducing obesity rates by five percent could lead to more than $29 billion in health care savings in five years*. Washington, DC: Trust for America's Health.

Wang, H., Schumacher, A. E., Levitz, C. E., et al. (2013). Left behind: Widening disparities for males and females in US county life expectancy, 1985–2010. *Population Health Metrics, 11*, 8.

Wilson, K., Elliott, S. J., Eyles, J. D., et al. (2007). Factors affecting change over time in self-reported health. *Canadian Journal of Public Health, 98*(2), 154–158.

Woolf, S. H., & Laudan, A. (Eds.). (2013). *U.S. health in international perspective: Shorter lives, poorer health*. Washington: National Academies Press.

Wu, S., & Green, A. (2000). *Projection of chronic illness prevalence and cost inflation*. Santa Monica, CA: Rand Corporation.

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