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Mortality Among Old Populations: Drivers, Recent Improvements and Future Expectations

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Mortality Among Old Populations: Drivers, Recent Improvements and Future Expectations

Narges Dorratoltaj

An overall increase in life expectancy since 1900 due to medical advancements—including vaccines, antimicrobials, and medical devices and procedures—impacted quality of life and changed the leading causes of death over time. Increases in overall life expectancy were more significant for people born after World War II. These cohorts of population are able to live longer thanks to the medical advancements that let them control their chronic conditions and experience lower cancer and cardiovascular disease mortality risk. However, this increase in life expectancy also increases the chance of dementia, specifically Alzheimer's disease (AD), death with the potential to change the horizon of seniors' mortality causes in the future. In this study, we review the main drivers of mortality among senior citizens and discuss the variations in mortality rates among these age groups.

MORTALITY TRENDS, LEADING CAUSES OF DEATH AMONG 65+ YEAR OLDS

Leading causes of death are not similar among all age groups. For those 20 to 40 years old, intentional and unintentional injuries are considered leading causes of death, compared to middle age people with cardiovascular disease and cancer the leading causes of death. For those older than 65, over time and with an increase in life expectancy, leading causes of death are changing. For the 65- to 74-year-old population, cardiovascular disease was the leading cause of death until 2001 (Centers for Disease Control and Prevention 2018). Since then, because of medical advancements in controlling cardiovascular conditions, cancer has become the leading cause of death, with cardiovascular disease now second. However, since 2010, there has been a slowdown in cardiovascular disease mortality improvements while cancer is keeping the same slope in mortality improvement.

For 75- to 84-year-olds, cardiovascular disease has been the leading cause of death, before cancer, since 1999. Like 65- to 74-year-olds, the mortality improvement for this cause has slowed since 2010, as shown in Figure 1.

Figure 1
LEADING CAUSES OF DEATH AMONG 65- TO 84-YEAR-OLDS, 1999–2017
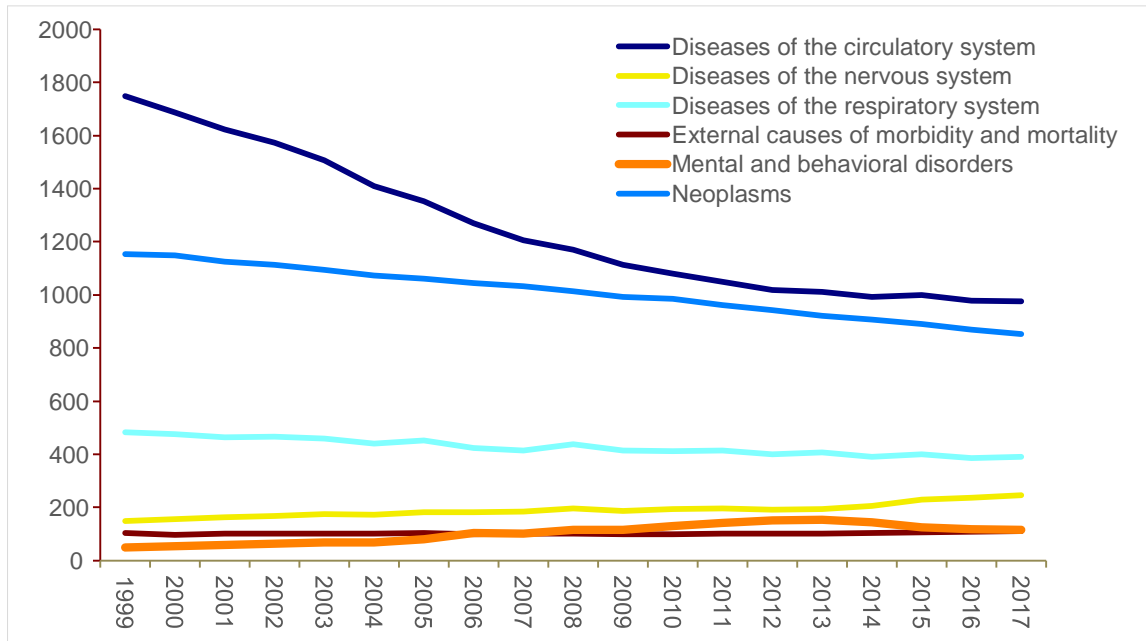
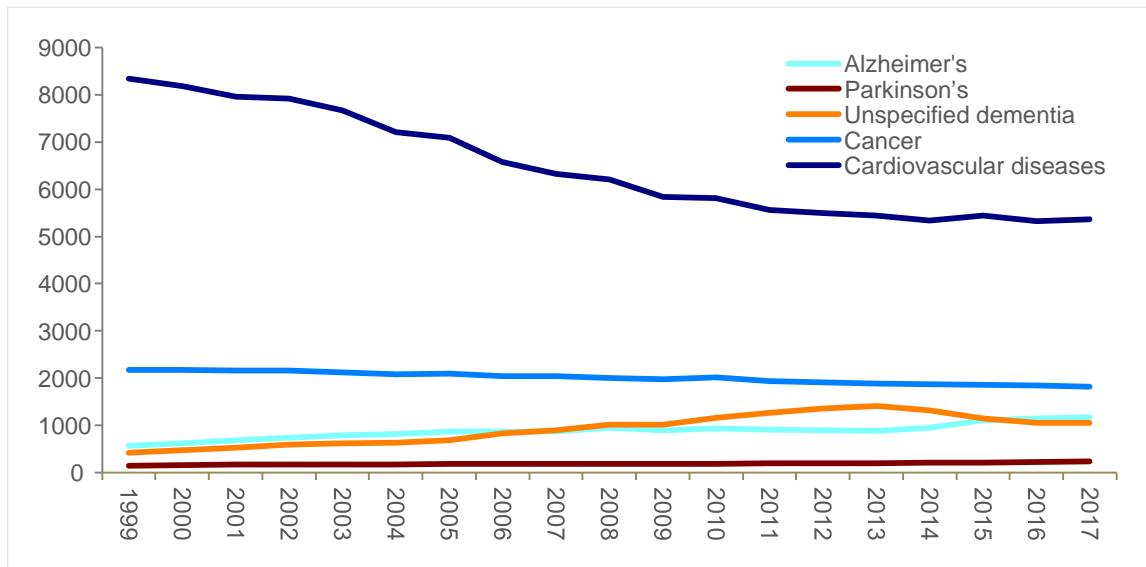Source: Centers for Disease Control and Prevention (CDC). Wide-ranging Online Data for Epidemiologic Research (WONDER). *http://wonder.cdc.gov/ucd-icd10.html*. Accessed March 14, 2019.

Note: Mortality per 100,000 people among 65- to 84-year-olds. Among diseases of the nervous system, Alzheimer's, and among mental and behavioral disorders, unspecified dementia, are the major causes of death in these age groups.

Among those 85+ years old, cardiovascular disease is still the leading causes of death with a decline in mortality improvement starting in 2010. What is more concerning for this age group is the increase in nervous system mortality, which is dominated by Alzheimer's and Parkinson's diseases. Figure 2 shows the leading causes of death for this age group. Unspecified dementia is categorized separately in this plot to demonstrate the change in the trend of mortality due to this condition.

Figure 2
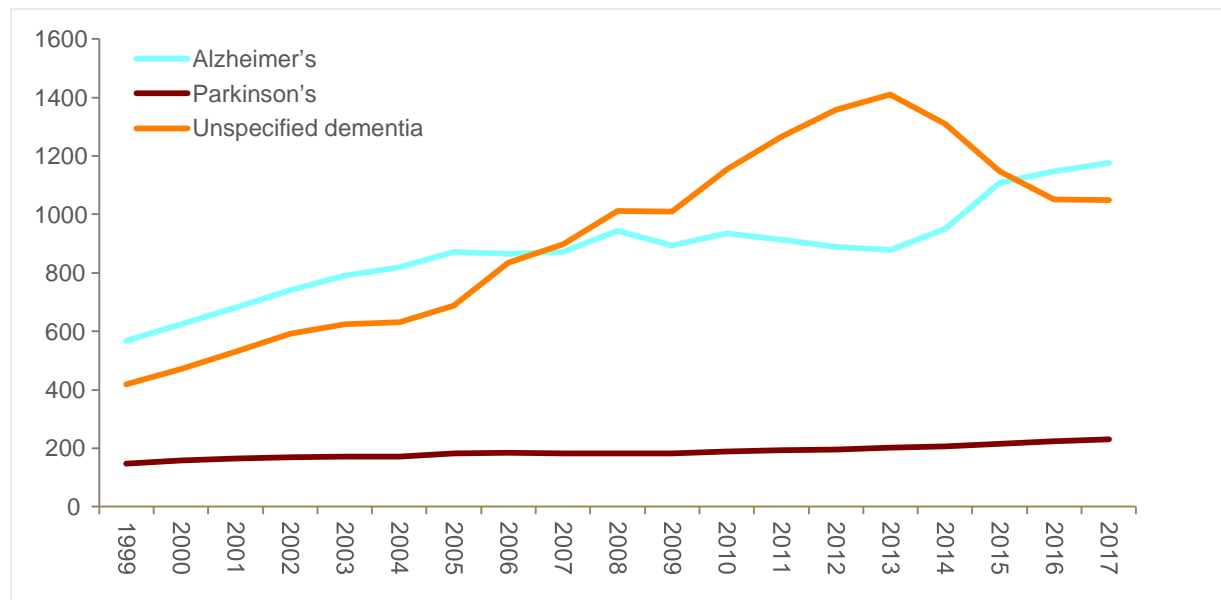LEADING CAUSES OF DEATH AMONG 85+ YEAR OLDS, 1999–2017

Source: Centers for Disease Control and Prevention (CDC). Wide-ranging Online Data for Epidemiologic Research (WONDER). *http://wonder.cdc.gov/ucd-icd10.html*. Accessed March 14, 2019.

Note: Mortality per 100,000 people.

DEMENTIA AS ONE OF THE LEADING CAUSES OF DEATH AMONG SENIORS

Dementia is characterized by memory loss and cognitive decline. Alzheimer's is the most common form of dementia with symptoms that start with cognitive losses which interfere with daily activities and problem solving. As the disease progresses, the brain's ability to control language and reasoning are impaired. There are other forms of dementia and they may coexist with Alzheimer's. In the United States, 11% of people older than 65 have Alzheimer's. For those 85 and older, this value is 32% (Taylor et al. 2017). Figure 3 shows the mortality rate due to Alzheimer's, unspecified dementia and Parkinson's among those 85 and older.

Figure 3

ALZHEIMER'S, PARKINSON'S AND UNSPECIFIED DEMENTIA MORTALITY AMONG AGE 85+, 1999–2017

Source: Centers for Disease Control and Prevention (CDC). Wide-ranging Online Data for Epidemiologic Research (WONDER). http://wonder.cdc.gov/ucd-icd10.html. Accessed March 14, 2019.

Note: Neural, mental and behavioral causes of mortality per 100,000 people 85+ years.

Over the years, there has been an increase in the dementia-related mortality rate among seniors. Availability of better treatment helps these age groups to live longer and survive for a longer period, causing the number affected to rise. Furthermore, more people survive other conditions thanks to medical advancements, so they live longer and have a higher chance of getting dementia. In other words, because of improved survival from cardiovascular disease and cancer, more people survive long enough to be at greater risk for dementia. The older population is growing faster than the younger population and, among older people, there is a higher chance of developing dementia compared to the younger population (Prince et al. 2016). According to the CDC, improved diagnosis rates, cause-of-death determination, dementia prognoses and treatment of other diseases are among the reasons that the number of people who die from Alzheimer's is rising at the same time the older population is growing. It means that with the same conditions, there is a higher chance the code for cause of death will be recorded as Alzheimer's now compared to 20 years ago (Kramarow and Tejada-Vera 2019; Taylor et al. 2017).

There are external causes that may impact the possibility of getting Alzheimer's. Among them are fewer years of education (Taylor et al. 2017). Also, getting more aggressive treatments for heart disease and diabetes reduces the chance of developing Alzheimer's.

Overall, as the population ages and mortality due to other chronic conditions decline, a larger proportion survives to ages where there is a high risk for dementia. Studies estimated that in 40 years (Kramarow and Tejada-Vera 2019), more than 23% of the U.S. population will be older than 65, which could mean more than 10 million cases of dementia and Alzheimer's by then. Historical evidences along with the aging population provides enough reasoning to invest more on research related to dementia and build the infrastructure to be able to provide care for elderly who have dementia.

CARDIOVASCULAR DISEASES AND CANCER DEATHS

Heart disease and cancer are the leading causes of death in the United States, not only among seniors. Since the 1960s, there has been a decline in the cardiovascular disease mortality rate and, with a few decades delay, cancer

mortality started to decline in the 1990s. The decline in the rate of cancer mortality is mainly due to more frequent screening, earlier diagnosis, availability of better treatments and reduction in risk factors such as smoking. However, due to the aging of the U.S. population in general, the number of people diagnosed with cancer is increasing. Historically, the magnitude of heart disease risk reduction has offset the increase in cardiovascular disease deaths from population growth and aging, while the decline in the risk of cancer death only partially offset the increase in cancer death due to population growth and aging. However, since 2010 the rate of cardiovascular disease morality improvement has slowed. One of the reasons for this slowdown in mortality improvement is believed to be the increase in obesity (Fryar et al. 2012) and diabetes. See Figure 4. Observations show that about three decades after the start of the obesity and diabetes epidemic in the U.S., we are witnessing a slowdown in cardiovascular disease mortality improvement, which is offsetting the positive role of the decline in smoking prevalence in the United States. The lag between the onset of diabetes and obesity and decline in cardiovascular improvement (Preston et al. 2018) is believed to be because of the chronic nature of these conditions. The CDC projects that cancer will soon become the leading cause of death in the United States (Weir et al. 2016); however, with the recent slowdown in cardiovascular disease mortality improvement, some concerns have been raised from the scientific community that we may see cardiovascular disease as the leading cause of death for a longer time, specifically among seniors.

Figure 4
TREND OF DIAGNOSED DIABETES IN THE U.S. SINCE 1975
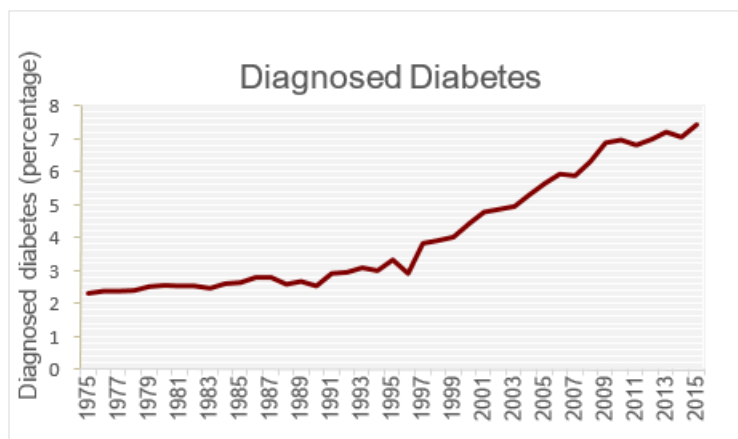
Source: Centers for Disease Control and Prevention (CDC). Division of Diabetes Translation, Data and Statistics. Accessed March 14, 2019.

RURAL SETTINGS AND SENIORS' MORTALITY RATE

Currently, about 15% of the U.S. population lives in rural settings (CDC 2017a). Studies show that people living in rural areas have a higher probability of mortality due to the leading causes of death. It also includes a higher portion of potentially preventable deaths (Moy et al. 2017). Residents of rural areas in the U.S. tend to be older compared to those in urban areas. Higher smoking rates, blood pressure and obesity, and lower physical activity, seatbelt use and access to health care contribute to these gaps (Moy et al. 2017; Singh and Siahpush 2014). Figure 5A shows the disparity in the mortality rate among all age groups based on the metropolitan or nonmetropolitan categories. Urbanicity has a direct correlation with the low mortality rate based on the observed data and due to the reasons discussed. However, aging partially offset the role of urban settings in reducing the mortality rate as shown in Figure 5B and the gap between different areas is mostly stable with better mortality improvement in urban settings.

Figure 5

MORTALITY IN DIFFERENT LEVELS OF RURAL AND URBAN AREAS, 1999–2017, ALL AGES (A) VS. 65+ (B)
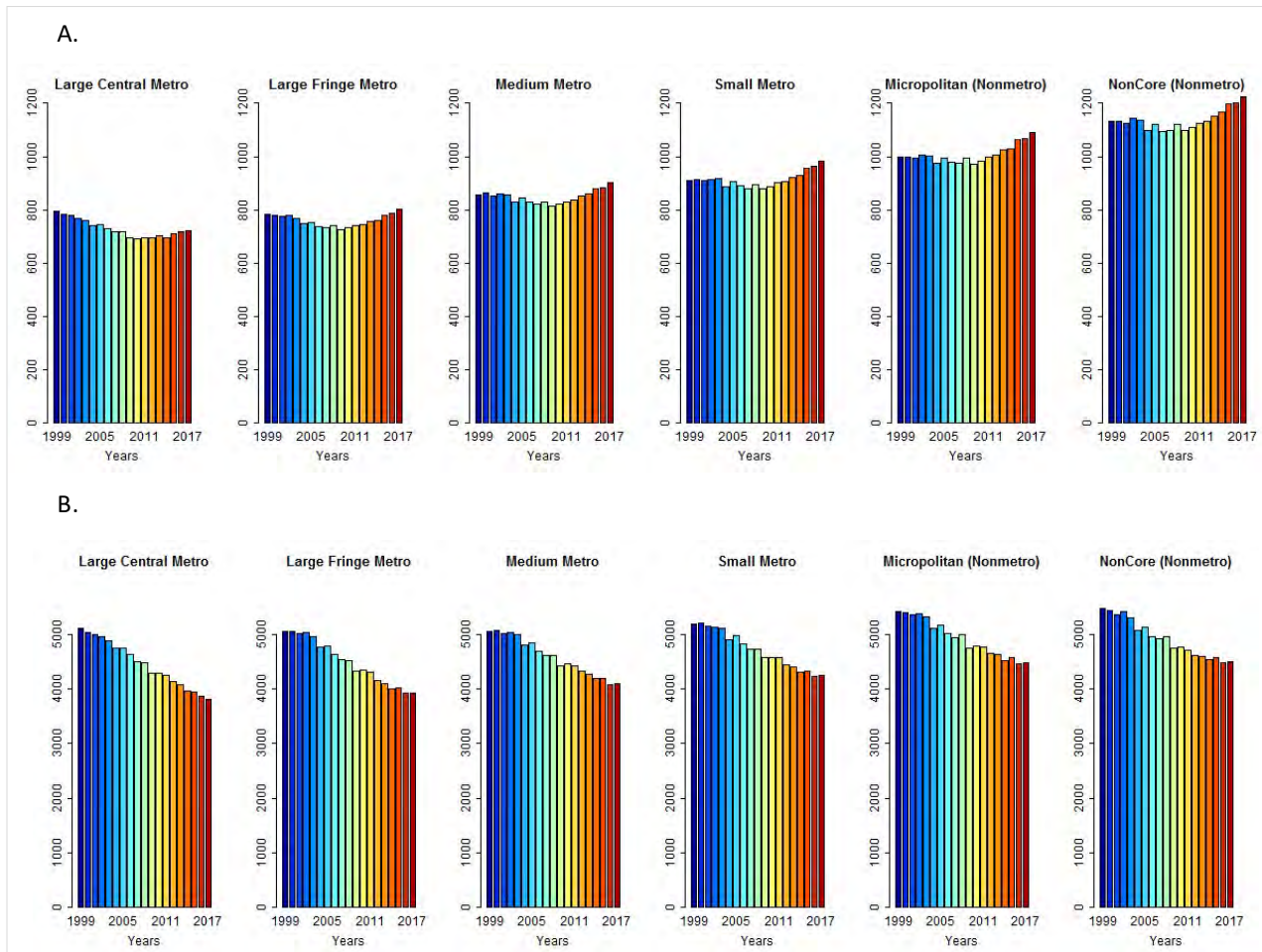
Sources: Centers for Disease Control and Prevention (CDC). Wide-ranging Online Data for Epidemiologic Research (WONDER). Underlying Cause of Death; Multiple Causes of Death Files, 1999-2017, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program. *http://wonder.cdc.gov/ucd-icd10.html*. Accessed March 14, 2019. Centers for Disease Control and Prevention (CDC). 2017b. NCHS Urban-Rural Classification Scheme for Counties. *https://www.cdc.gov/nchs/data_access/urban_rural.htm*. Accessed Feb. 28, 2019.

Note: Mortality per 100,000 people.

DISCUSSION

The United States population is aging, and it is expected that in the next 40 years, more than 20% of the population will be older than 65. Cardiovascular disease, cancer and dementia are among the leading causes of death in seniors older than 65. It is important to understand the dynamics of causes of death for this age group to be able to estimate and project the mortality based on the risk factors and population risk. Cardiovascular disease-related mortality rates have been declining since the 1960s. However, there has been a slowdown in this improvement since 2010. The continuous increase in the obesity and diabetes prevalence among the population may partially offset the improvement in other risk factors that impact cardiovascular disease mortality. That said, the decline in cardiovascular disease mortality in the future may not be as steep as we observed for the last 40 years, due to the chronic characteristic of diabetes. If we can control the incidence of diabetes among children, it may help change the current trend of increases in diabetes. Among seniors, dementia is another increasing cause of death. Having the older population survive for more years, we should expect to have more increases in the rate of dementia and

Alzheimer's diagnosis and mortality. Furthermore, an increase in the dementia-related deaths in nursing homes, long-term care facilities or hospice facilities show the difficulty of care for unpaid caregivers (Taylor et al. 2017).

All these changes in the trends of mortality among the older population require more in-depth understanding of the underlying causes and changes in the dynamics of aging and risk factors. Strategic planning and mathematical models of causes of death considering the underlying risk factors are among solutions that may help decisionmakers in evaluating the current status and making informed decision for future mortality trends for elderly.

Narges Dorratoltaj, Ph.D., MPH, is a senior scientist, manager at AIR Worldwide. She can be reached at *NDorratoltaj@AIR-Worldwide.com*.

SOURCE OF DATA

Source of data for mortality for each age group and cause are based on the Center for Disease Control and Prevention (CDC) Wide-ranging Online Data for Epidemiologic Research (WONDER) database from 1999 to 2017. The underlying cause of death was assigned according to the International Classification of Disease (ICD) in use at time of death, revision 10 (ICD10). The urban vs. rural areas are based National Center for Health Statistics (NCHS) Urban-Rural Classification in 2013 (CDC NCHS 2017).

REFERENCES

Centers for Disease Control and Prevention (CDC). 2017a. Rural Americans at Higher Risk of Death from Five Leading Causes: Demographic, Environmental, Economic, Social Factors Might be key to Difference. Press release. *https://www.cdc.gov/media/releases/2017/p0112-rural-death-risk.html*.

———. 2017b. NCHS Urban-Rural Classification Scheme for Counties. *https://www.cdc.gov/nchs/data_access/urban_rural.htm*. Accessed Feb. 28, 2019.

———. 2018. Wide-ranging ONline Data for Epidemiologic Research (WONDER). Underlying Cause of Death; Multiple Causes of Death Files, 1999-2017. Accessed March 14, 2019. *http://wonder.cdc.gov/ucd-icd10.html*.

Fryar, Cheryl D., Margaret D. Carroll and Cynthia L. Ogden. 2012. Prevalence of Overweight, Obesity, and Extreme Obesity Among Adults: United States, Trends 1960–1962 Through 2009–2010. *Health E-Stats*. National Center for Health Statistics. *https://www.cdc.gov/nchs/data/hestat/obesity_adult_09_10/obesity_adult_09_10.htm*.

Kramarow, Ellen A., and Betzaida Tejada-Vera. 2019. Dementia Mortality in the United States, 2000–2017. National Vital Statistics Reports 68, no 2. *https://www.cdc.gov/nchs/data/nvsr/nvsr68/nvsr68_02-508.pdf*.

Moy, Ernest, Macarena C. Garcia, Brigham Bastian, Lauren M. Rossen, Deborah D. Ingram, Mark Faul, Greta M. Massetti, et al. Leading Causes of Death in Nonmetropolitan and Metropolitan Areas—United States, 1999–2014. *Morbidity and Mortality Weekly Report: Surveillance Summaries* 66, no. 1:1–8. *https://www.cdc.gov/mmwr/volumes/66/ss/ss6601a1.htm*.

Preston, Samuel H., Yana C. Vierboom and Andrew Stokes. 2018. The Role of Obesity in Exceptionally Slow U.S. Mortality Improvement. Proceedings of the National Academy of Sciences 115, no. 5:957–61. *https://doi.org/10.1073/pnas.1716802115*.

Prince, Martin, Gemma-Claire Ali, Maelenn Guerchet, A. Matthew Prina, Emiliano Albanese and Yu-Tzu Wu. 2016. Recent Global Trends in the Prevalence and Incidence of Dementia, and Survival with Dementia. *Alzheimer's Research & Therapy* 8, no. 1:23. *https://doi.org/10.1186/s13195-016-0188-8*.

Singh, Gopal K., and Mohammad Siahpush. 2014. Widening Rural–Urban Disparities in All-Cause Mortality and Mortality from Major Causes of Death in the USA, 1969–2009. *Journal of Urban Health* 91, no. 2:272–92. *https://doi.org/10.1007/s11524-013-9847-2*.

Taylor, Christopher A., Sujay F. Greenlund, Lisa C. McGuire, Hua Lu and Janet B. Croft. 2017. Deaths from Alzheimer's Disease—United States, 1999–2014. *Morbidity and Mortality Weekly Report* 66, no. 20:521–26. *https://doi.org/10.15585/mmwr.mm6620a1*.

Weir, Hanna K., Robert N. Anderson, Sallyann M. Coleman King, Ashwini Soman, Trevor D. Thompson, Yuling Hong, Bjorn Moller and Steven Leadbetter. 2016. Heart Disease and Cancer Deaths—Trends and Projections in the United States, 1969–2020. *Preventing Chronic Disease* 13. *https://doi.org/10.5888/pcd13.160211*.