By David A. Kindig and Erika R. Cheng

Even As Mortality Fell In Most US Counties, Female Mortality Nonetheless Rose In 42.8 Percent Of Counties From 1992 To 2006

ABSTRACT Researchers increasingly track variations in health outcomes across counties in the United States, but current ranking methods do not reflect changes in health outcomes over time. We examined trends in male and female mortality rates from 1992–96 to 2002–06 in 3,140 US counties. We found that female mortality rates increased in 42.8 percent of counties, while male mortality rates increased in only 3.4 percent. Several factors, including higher education levels, not being in the South or West, and low smoking rates, were associated with lower mortality rates. Medical care variables, such as proportions of primary care providers, were not associated with lower rates. These findings suggest that improving health outcomes across the United States will require increased public and private investment in the social and environmental determinants of health—beyond an exclusive focus on access to care or individual health behavior.

David A. Kindig (dakindig@ wisc.edu) is a professor emeritus of population health sciences and founder of the Population Health Institute at the School of Medicine and Public Health, University of Wisconsin–Madison.

Erika R. Cheng is a doctoral candidate and research assistant in the Department of Population Health Sciences, School of Medicine and Public Health, University of Wisconsin–Madison.

Increasing attention is being paid to the variation in health outcomes across the United States, most recently with the Robert Wood Johnson Foundation/ University of Wisconsin Population Health Institute's County Health Rankings project.[1] Begun in 2010, the initiative measures the overall health of each county in the United States, including mortality rates and several morbidity measures such as rates of low birthweight and number of physically and mentally unhealthy days per month. Such ranking methods reveal a county's current health status, but they do not reflect change—for better or worse— during recent time periods.

Rarely does an entire state demonstrate an absolute increase, or worsening, in mortality rates. Rather, some states' mortality rates simply decline, or improve, less rapidly than others' rates do. Measuring mortality at the county level reveals more granular changes in outcomes throughout a state's diverse populations.

In 2006 Christopher Murray and colleagues divided counties in the United States into "eight Americas" based on mortality data and found large variations in life expectancy across them from 1982 to 2001.[2] In 2008 Majid Ezzati and coauthors reported on county life expectancy changes from 1961 to 1999 and found increases in county mortality rates from 1961 to 1981, as well as increases in those rates from 1983 to 1999 in 11 counties for males and 180 counties for females.[3]

More recently, Sandeep Kulkarni and colleagues examined changes in county life expectancy between 2000 and 2007 and reported that large numbers of US counties have fallen behind the average life expectancy of the ten countries with the lowest mortality rates from 1950 to 2010.[4]

These studies provided evidence of demographic and clinical correlates of mortality changes, such as health care use and race. However, they did not investigate socioeconomic and behavioral factors that might be associated with county-level health improvement or decline.

In previous research, we examined health outcomes among low- and high-income US counties during 2002–06 and highlighted factors associated with their corresponding mortality rates.[5] The present study extends this research to examine trends in age-adjusted mortality rates in US counties between 1992 and 2006 and to identify factors associated with improvement—that is, declines—in county mortality rates. This research is of particular importance because of the slow rates of reductions in geographic, racial, and socioeconomic health disparities, despite repeated calls for action.

Study Data And Methods

DATA Our sample consisted of 3,140 counties or county equivalents—for example, administrative divisions of a state such as parishes or boroughs—in the United States. We compiled county-level data from four sources, including the County Health Rankings,[1] the Behavioral Risk Factor Surveillance Survey (1994–2000 survey panels), the Centers for Disease Control and Prevention's compressed mortality database,[6,7] and the 2000 US census.

We examined the county-level percentage change in all-cause, age-adjusted mortality rate per 100,000 residents age seventy-five or under for two five-year time periods, 1992–96 and 2002–06. Annual sex-specific mortality rates were pooled over five years to improve the stability of the estimates. We adjusted the mortality rates using age distributions from the 2000 standard population, which allowed us to compare the rates over time and eliminated the potential for confounding by age.[8]

Some US counties have small population sizes and thus reported relatively few deaths during the study period. We were concerned that the observed variations in mortality rates in these counties might reflect their small population sizes rather than trends or patterns in the underlying mortality risk. Indeed, an initial examination of the raw mortality estimates showed a very wide distribution in the rates, ranging from a −67 percent change to a 276 percent change in male mortality and a −82 percent change to a 680 percent change in female mortality across the counties (results not shown).

To adjust for the greater instability of rates from areas with small populations, we used a technique called spatial empirical Bayes smoothing.[9,10] This method generated mortality rates that were essentially the weighted average of the county's raw mortality rate and the overall sample mean, with more weight given to mortality rates in larger areas.[11] The empirical Bayes technique generated mortality rates using all

of the other covariates in our model.

Empirical Bayes smoothing techniques are being applied increasingly in public health research. They have been found to provide substantial improvements over crude rate estimates when estimating disease risk in small areas.[9,11]

REGRESSION ANALYSES We performed regression analyses to examine which county-level factors were associated with changes in mortality rates for males and females during the study period. The covariates were selected based on a model of population health adapted from the County Health Rankings[1] and with support from the empirical literature.[12–15]

We included the following covariates: geographic region (Northeast, Midwest, South, and West); population density; and race or ethnicity—that is, percentages of non-Hispanic white, non-Hispanic black, and Hispanic. Other covariates included the following aspects of the socioeconomic environment: median household income; and percentages of high school graduates, adults with a bachelor's degree, single-parent households, and children living below the federal poverty level. The behavioral covariates were percentages of adults who smoked or were obese.

Finally, the medical care covariates included the number of primary care providers per 100,000 people, percentage of adults under age sixty-five without insurance, and number of preventable hospitalizations per 1,000 people. Descriptive statistics are presented in Appendix Exhibit 1.[16]

We estimated weighted linear regression models using standardized coefficients (mean = 0; standard deviation = 1) for the county-level covariates. The regression coefficients can be interpreted as the percentage change in mortality between the two time periods (1992–96 and 2002–06) associated with a change of one standard deviation in the predictor variable—that is, the percentage increase or reduction in county-level mortality rates expected in a county that has one standard deviation more of the coefficient, independent of the other factors in the model. Coefficients for the regional variables can be interpreted as the percentage change in mortality among counties in the Midwest, South, or West compared to those in the Northeast.

The regression models included state-level random effects and a measure of change in population size as a proxy for population changes such as migration in and out of counties and population growth. To further adjust for population size, all regression models were weighted by the inverse variance of the mortality estimates.

LIMITATIONS A few limitations to this study

should be noted. First is the use of ecologic analysis—in this case, using a county population rather than an individual as the unit of analysis—to identify associations that suggest causal relationships. For this reason, interpretations of specific associations between the variables and mortality changes should not be made at the level of the individual.[17] However, ecologic analyses are valuable to determine the role of upstream factors, such as social and environmental policies, on health and are often the method of choice when public health action is being considered.[17,18]

Second, the interpretations of some of our findings may be complicated because the data for our independent variables were not always collected prior to the period of our mortality measures. In addition, many of the variables, such as income and education, could take a long time to have an impact on health outcomes. The time span of our study means that we were unable to fully observe the effects of these determinants of health. Future work should attempt to appropriately lag as many determinant variables over the life course as possible, and over longer periods than examined here.

Third, we studied mortality rates only. Future work should examine county-level trends for other outcomes, such as health-related quality of life, infant mortality, low birthweight, and disparity measures. Our analysis also highlighted the challenges associated with assessing changes in mortality in places with small populations and relatively few numbers of deaths during the study period. Several of the covariates in our analysis, including those generated from national surveys, may also have large sampling errors because of small population sizes. Public health researchers should examine larger samples in nonmortality measures, perhaps using health care or other administrative data, such as those from employers or schools.

Finally, we did not control for the major economic trends—such as changes in the rate of growth in gross domestic product or employment—that occurred during the study period. Future research should examine the impact of such macroeconomic trends, especially given well-established patterns of mortality change in the United States related to the economic cycle—for example, the rise in mortality when unemployment falls.[19-21] Research should also determine and examine community-level investment and patterns of the use of strong policies as opposed to weak ones that have been shown to produce more rapid improvement in health outcomes.[22]

Study Results

During the study period, county-level male mortality rates decreased by 9.8 percent on average (standard deviation: 6.0; range: −61.4 percent to 22.6 percent), and county-level female mortality rates decreased by 1.5 percent on average (standard deviation: 6.8; range −40.7 percent to 37.3 percent). The majority of counties experienced a reduction in male and female mortality. However, although male mortality increased in 108 counties (3.4 percent), female mortality increased in 1,334 counties (42.8 percent). The relationship between county-level mortality for males and females over the 1992–96 period (baseline mortality) and mortality change between the periods 1992–96 and 2002–06 is displayed in Appendix Exhibit 2.[16]

Although 96.5 percent of the counties experienced a reduction in average male mortality rates among all residents, the degree of change varied considerably (Exhibit 1). There was also substantial variation in the rate of change of female mortality (Exhibit 2), but only 56.6 percent of the counties experienced a reduction, or improvement.

Factors Associated With Changing Mortality Rates

Our multivariable regression identified factors associated with the sex-specific mortality changes among the counties. The full results are reported in Appendix Exhibit 3.[16]

For males, the factors most significantly associated with a reduction in mortality rates were percentages of Hispanic residents in the county (β: −2.30; 95% confidence interval: −3.67, −0.92) and of adults with a college degree (β: −3.20; 95% confidence interval: −4.82, −1.59). An increase of one standard deviation in adults with a college degree at the county level was associated with a reduction of more than 3 percent in male mortality rates from 1992–96 to 2002–06, independent of regional, racial or ethnic, behavioral, medical, and other socioeconomic factors.

In addition, counties with higher population densities (β: −0.56; 95% confidence interval: −0.83, −0.28) and median household incomes (β: −1.94; 95% confidence interval: −3.42, −0.47) experienced greater reductions in male mortality. The region where the county was located also had significant associations with male mortality change. Counties in the West experienced an increase of more than 3 percent in mortality rates for males compared to counties in the Northeast, our reference category (β: 3.34; 95% confidence interval: −0.15, 6.83).

Surprisingly, none of the medical care

EXHIBIT 1

Change In Male Mortality Rates From 1992–96 To 2002–06 In US Counties

● Substantial improvement
● Minimal improvement
● Worsening
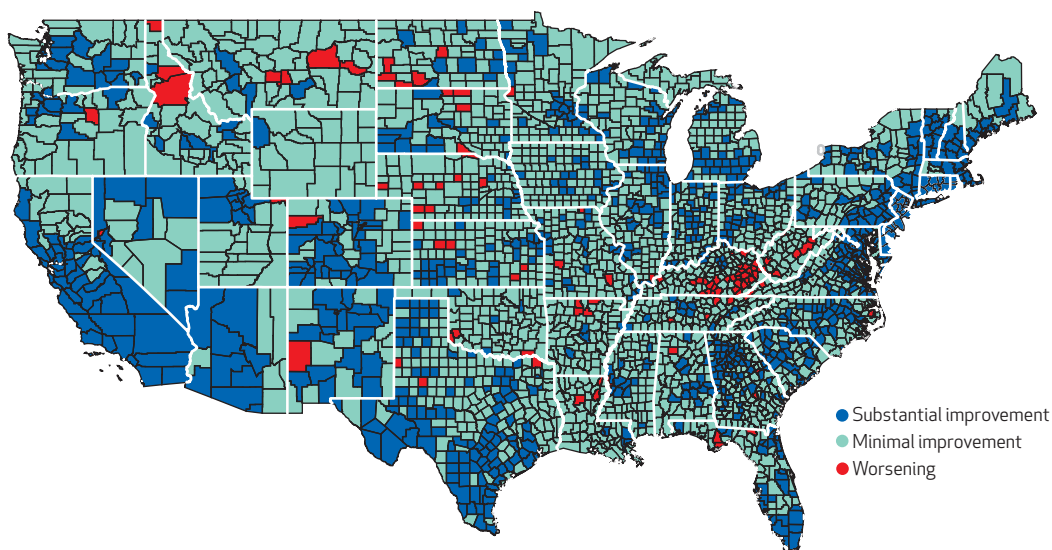
SOURCE Authors' calculations. **NOTES** Of the 3,140 counties in the sample, 1,012 (32.3 percent) experienced substantial improvement (a reduction of 11.7–61.4 percent) in male mortality rates, and 2,020 counties (64.3 percent of the sample) experienced minimal improvement (a reduction of <1 percent–11.6 percent). We grouped the 3 counties that experienced no change in male mortality rates with the 105 counties that experienced worsening male mortality rates (any increase). Mortality estimates represent smoothed rates that were generated using a technique called spatial empirical Bayes smoothing, which adjusted for instability of rates from areas with small populations. Alaska and Hawaii are not shown on this map but can be seen in the online Appendix (see Note 16 in text).

EXHIBIT 2

Change In Female Mortality Rates From 1992–96 To 2002–06 In US Counties

● Substantial improvement
● Minimal improvement
● Worsening
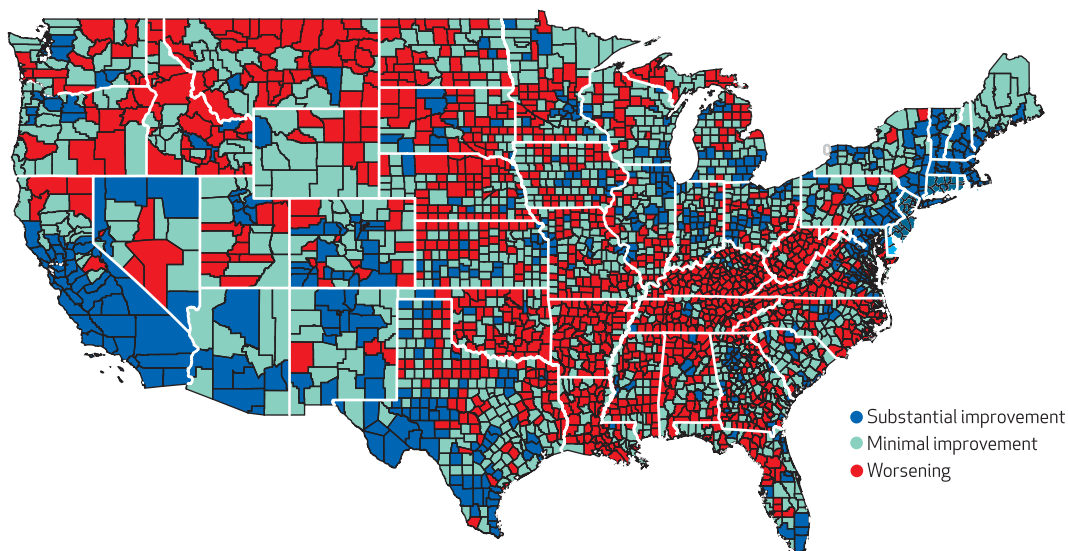
SOURCE Authors' calculations. **NOTES** Of the 3,140 counties in the sample, 603 (19.2 percent) experienced substantial improvement (a reduction of 6.6–40.7 percent) in female mortality rates, and 1,193 counties (38.0 percent of the sample) experienced minimal improvement (a reduction of <1 percent–6.5 percent). We grouped the 28 counties that experienced no change in female mortality rates with the 1,316 counties that experienced worsening female mortality rates (an increase of <1 percent–37.3 percent). Estimated rates were generated from smoothed rates using the global empirical Bayes estimator, as explained in Exhibit 1 Notes (also see Notes 9 and 10 in text). Alaska and Hawaii are not shown on this map but can be seen in the online Appendix (see Note 16 in text).

factors—such as rates of primary care providers or preventable hospitalizations or percentage of uninsured—predicted changes in male mortality during the study period.

For females as for males, higher proportions of Hispanics (β: −3.06; 95% confidence interval: −4.41, −1.71) and adults with a college degree (β: −3.17; 95% confidence interval: −4.60, −1.74) were associated with reductions in mortality rates. An increase of one standard deviation in the percentage of adult residents with a college degree was associated with a reduction of more than 3 percent in female mortality (β: −3.17; 95% confidence interval: −4.60, −1.74).

Counties with higher population densities (β: −0.32; 95% confidence interval: 0.53, 0.11) experienced greater reductions in female mortality rates than counties with lower population densities. Higher median household incomes also were associated with reductions in female mortality rates (β: −1.62; 95% confidence interval: −2.89, −0.34).

The percentage of adults (males and females combined) who smoked was associated with increasing female mortality rates. For example, an increase of one standard deviation in the percentage of adults who smoked was associated with a 2.5 percent increase in female mortality rates, when we controlled for all other factors (β: 2.45; 95% confidence interval: 1.10, 3.80).

Geography had the strongest association with female mortality change, specifically among counties located in the South (β: 6.35; 95% confidence interval: 3.50, 9.20) and West (β: 5.74; 95% confidence interval: 2.16, 9.33). Counties in those regions had female mortality rates about 6 percent higher than rates in the Northeast.

As with male mortality rates, female mortality rates were not predicted by any of the medical care factors, such as rates of primary care providers.

Discussion

This study investigated trends in sex-specific mortality rates and the socioeconomic, demographic, geographic, behavioral, and medical care factors associated with changes in these rates among US counties between 1992 and 2006. Our results call attention to the large number of US counties that have seen mortality rates increase, particularly among women. Although we are accustomed to seeing varying rates of mortality reduction in states and nations, it is striking and discouraging to find female mortality rates on the rise in 42.8 percent of US counties, despite increasing medical care expenditures and public health efforts.

This finding indicates that a much more robust population health strategy—one that would increase resources and redirect them across sectors, including medical care, public health, education, and the physical environment—is needed to accelerate improvement and reduce disparities.[23] Such a strategy would include redirecting savings from reductions in health care inefficiency and increasing the health-promoting impact of policies in other sectors such as housing and education.

Our regression analysis goes beyond the descriptive findings to suggest reasons for the mortality disparities we found. Many people believe that medical care and individual behaviors such as exercise, diet, and smoking are the primary reasons for declines in health.[24] We did find significant associations between mortality rates and some of these factors, such as smoking rates for both sexes. But socioeconomic factors such as the percentage of a county's population with a college education and the rate of children living in poverty had equally strong or stronger relationships to fluctuations in mortality rates.

This finding corresponds with a "multiple determinants of health" perspective[25] and with previous research.[12–14] Nonetheless, health policy in the United States still focuses primarily on improving access to medical care and encouraging people to improve their diet and become more active. However, none of the medical care variables that we examined had significant relationships with mortality change.

These findings lend support to the contention that meaningful health improvement efforts must extend beyond a focus on health care delivery and include stronger policies affecting health behaviors and the social and environmental determinants of health, with corresponding investments in those areas. For example, voters in San Antonio, Texas, recently approved by referendum a tax increase of one-eighth of a cent to fund an expansion of pre-kindergarten education. Similarly, the Department of Housing and Urban Development is providing new housing and human services support to older adults and adults with disabilities.

Counties with higher percentages of Hispanics were more likely to experience reductions in mortality rates than other counties. This finding supports the existence at the county level of the so-called Hispanic paradox—the paradoxical relationship between health and socioeconomic status of Hispanics identified in prior research.[26]

We were surprised to find that the percentage of black residents was not also significantly associated with county mortality change in this study. This may be because the racial composition of a county is likely to reflect the presence of other social determinants of health in the area,

such as poverty and education, which were controlled for in our analyses.[27]

It is well known that rural, less dense communities have poorer health outcomes than more dense urban and suburban communities.[28] This and the strong association between mortality and geographic region may be the result of a number of factors, such as disparities in the level or quality of health care across regions;[29] patterns in health care use and treatments;[30] social trends;[31] and government spending on infrastructure resources or other social and behavioral resources, including public safety, social and welfare services, affordable housing, and education.[32] As seen in Exhibits 1 and 2, counties located in Appalachia were the most likely to experience increasing mortality rates for both sexes—a geographic pattern similar to that found for life expectancy by Kulkarni and colleagues.[4]

Our results do not indicate why mortality increased in many more counties for females than it did for males. However, the regression shows much stronger regional associations for females, indicating that the effect of region may be stronger for them than for males. These findings emphasize the need for further research, such as that called for by the National Rural Health Association,[33] to explore geographic patterns in health disparities and identify the possible importance of cultural, political, or religious factors not measured in this study.

Our finding that many counties experienced no mortality reductions, particularly for females, during the study period should be of great concern to policy makers in the public and private sectors. Given the length of time that many of the factors, such as level of education and percentage of children living in poverty, take to affect health, the nation cannot afford to wait before investing in ways to improve those factors. Not only do these poor outcomes reduce the length and quality of life for individuals, but they also contribute to growing health expenditures that the United States cannot afford.

Indeed, our results underline the lack of value obtained from ever-increasing health care expenditures. Poor outcomes also lower the productivity of the workforce and reduce private-sector competitiveness.

According to the "epidemiology of politics,"[34] evidence of poor health outcomes alone will not produce policy change. However, the large number of counties with no reduction in mortality rates demands that policy makers create a broad investment strategy across all health determinants.

Many national reports have called for such action, including the recent series of reports from the Institute of Medicine that addressed public health policy and investment strategies.[35,36] In addition, the National Prevention Strategy Action Plan[37] recently released by the surgeon general highlighted a broad array of health-promoting policies and programs across most federal departments.

One useful development is the Affordable Care Act's requirement that nonprofit hospitals work in partnership with public health agencies to develop a community health needs assessment every three years, as a condition of the hospitals' maintaining their tax-exempt status. New business and governance models are urgently needed to support the joint efforts of all sectors—including health care, public health, business, and social service agencies—if population health is to be improved.

Conclusion

To our knowledge, this is the first study to examine the socioeconomic and behavioral correlates of mortality change at the county level in recent years. Our findings support and strengthen the existing evidence from person-level studies that focused on demographic and clinical correlates of recent mortality change. The findings also reinforce the large volume of evidence stressing the importance of socioeconomic and behavioral factors as determinants of population health.

Mortality rates are falling in most US counties, but we found a large number of counties with no reductions in female mortality rates during the study period. We identified a number of factors most strongly associated with mortality change, including education levels, the region the county was located in, and smoking rates. Our results underscore the complicated policy reality that there is no single silver bullet for population health improvement. Investments in all determinants of health—including health care, public health, health behaviors, and residents' social and physical environments—will be required.

Every county is different. Each one needs to examine its outcomes and data on the determinants of health to determine what set of cross-sectoral policies would address its own situation most effectively and quickly.[38]

For some counties, the most glaring deficiencies will be in the areas of access to and the quality of medical care. Other counties may conclude that it is most important to address smoking and obesity rates. Still others will need to tackle poverty reduction, job creation, and school quality in the near term.

Additional information on the relative cost-effectiveness of different policies and programs is needed so that decisions about where to focus

limited government and private-sector dollars can be made with more confidence.[39] In addition, more information regarding the utility and impact of public health reporting mechanisms, such as health rankings of counties and states, is needed to determine what dissemination methods might be most useful for local policy makers.

Although better causal evidence is needed, existing theory and evidence argue for prompt action on a balanced population health investment strategy by public and private policy makers, who have a moral and economic interest in reversing these worsening mortality rates. ∎

Pat Remington, Bridget B. Catlin, Paul Peppard, Alberto Palloni, Jenna Nobles, David Vanness, James Broesch, Hyojun Park, and Anne Roubal.

NOTES

1 University of Wisconsin Population Health Institute. County health rankings and roadmaps [Internet]. Madison (WI); University of Wisconsin; [cited 2013 Feb 12]. Available from: http://www.countyhealthrankings.org

2 Murray CJ, Kulkarni SC, Michaud C, Tomijima N, Bulzacchelli MT, Iandiorio TJ, et al. Eight Americas: investigating mortality disparities across races, counties, and race-counties in the United States. PLoS Med. 2006;3(9):e260.

3 Ezzati M, Friedman AB, Kulkarni SC, Murray CJ. The reversal of fortunes: trends in county mortality and cross-county mortality disparities in the United States. PLoS Med. 2008;5(4):e66.

4 Kulkarni SC, Levin-Rector A, Ezzati M, Murray CJ. Falling behind: life expectancy in US counties from 2000 to 2007 in an international context. Popul Health Metr. 2011;9(1):16.

5 Cheng ER, Kindig DA. Disparities in premature mortality between high- and low-income US counties. Prev Chronic Dis. 2012;9:E75.

6 Centers for Disease Control and Prevention, National Center for Health Statistics. Compressed mortality file 1999–2008. CDC WONDER online database, compiled from compressed mortality file 1999–2008, Series 20, No. 2N [Internet]. Hyattsville (MD): NCHS; 2011 [cited 2013 Feb 19]. Available for download from: http://wonder.cdc.gov/mortSQL.html

7 Centers for Disease Control and Prevention, National Center for Health Statistics. Compressed mortality file 1979–1988. CDC WONDER Online Database, compiled from compressed mortality file (CMF) 1968–1988, Series 20, No. 2A, 2000, and CMF 1989–1998, Series 20, No. 2E, 2003 [Internet]. Hyattsville (MD): NCHS; selected years [cited 2013 Feb 19]. Available for download from: http://wonder.cdc.gov/mortSQL.html

8 Hoyert DL, Anderson RN. Age-adjusted death rates: trend data based on the year 2000 standard population. Natl Vital Stat Rep. 2001;49(9):1–6.

9 Clayton D, Kaldor J. Empirical Bayes estimates of age-standardized relative risks for use in disease mapping. Biometrics. 1987;43(3):671–81.

10 Morris CN. Parametric empirical Bayes inference: theory and applications. J Am Stat Assoc. 1983; 78(22):47–55.

11 Maciel EL, Pan W, Dietze R, Peres RL, Vinhas SA, Ribeiro FK, et al. Spatial patterns of pulmonary tuberculosis incidence and their relationship to socio-economic status in Vitoria, Brazil. Int J Tuberc Lung Dis. 2010;14(11):1395–402.

12 McGinnis JM, Williams-Russo P, Knickman JR. The case for more active policy attention to health promotion. Health Aff (Millwood). 2002;21(2):78–93.

13 Kindig D, Peppard P, Booske B. How healthy could a state be? Public Health Rep. 2010;125(2):160–7.

14 Woolf SH, Braveman P. Where health disparities begin: the role of social and economic determinants—and why current policies may make matters worse. Health Aff (Millwood). 2011;30(10):1852–9.

15 Evans RG, Barer ML, Marmor TR, editors. Why are some people healthy and others not? The determinants of health of populations. New York (NY): Aldine de Gruyter; 1994.

16 To access the Appendix, click on the Appendix link in the box to the right of the article online.

17 Szklo M, Neito FJ. Epidemiology: beyond the basics. 2nd ed. Sudbury (MA): Jones and Bartlett; 2006.

18 Morgenstern H. Ecologic studies in epidemiology: concepts, principles, and methods. Annu Rev Public Health. 1995;16:61–81.

19 Ruhm CJ. Commentary: mortality increases during economic upturns. Int J Epidemiol. 2005;34(6): 1206–11.

20 Ruhm CJ. A healthy economy can break your heart. Demography. 2007;44(4):829–48.

21 Granados JAT. Increasing mortality during the expansions of the US economy, 1900–1996. Int J Epidemiol. 2005;34(6):1194–202.

22 Casper T, Kindig DA. Are community-level financial data adequate to assess population health investments? Prev Chronic Dis. 2012;9: E136.

23 Kindig DA, Isham G. A community business model that engages all sectors is necessary for population health improvement. Unpublished manuscript.

24 Robert SA, Booske BC. US opinions on health determinants and social policy as health policy. Am J Public Health. 2011;101(9):1655–63.

25 Evans RG, Stoddart GL. Producing health, consuming health care. Soc Sci Med. 1990;31(12):1347–63.

26 Franzini L, Fernandez-Esquer ME. Socioeconomic, cultural, and personal influences on health outcomes in low income Mexican-origin individuals in Texas. Soc Sci Med. 2004; 59(8):1629–46.

27 House JS, Williams DR. Understanding and reducing socioeconomic and racial/ethnic disparities in health. Chapter 3 in: Smedley BD, Syme SL, editors. Promoting health: intervention strategies from social and behavioral research. Washington (DC): National Academies Press; 2000. p. 81–124.

28 National Center for Health Statistics. Health, United States, 2001, with urban and rural health chartbook [Internet]. Hyattsville (MD): NCHS; 2001 [cited 2013 Feb 4]. (DHHS Publication No. 01-1232). Available from: http://www.cdc.gov/nchs/data/hus/hus01.pdf

29 Baicker K, Chandra A, Skinner J. Geographic variation in health care and the problem of measuring racial disparities. Perspect Biol Med. 2005; 48(1 Suppl):S42–53.

30 Chandra A, Skinner J. Geography and racial health disparities. Cambridge (MA): National Bureau of Economic Research; 2003. (NBER Working Paper No. 951).

31 Adler NE, Rehkopf DH. US

disparities in health: descriptions, causes, and mechanisms. Annu Rev Public Health. 2008;29:235–52.

32 Singh GK, Siahpush M. Widening socioeconomic inequalities in US life expectancy, 1980–2000. Int J Epidemiol. 2006;35(4):969–79.

33 Morgan A. A national call to action: CDC's 2001 Urban and Rural Health Chartbook. J Rural Health. 2002; 18(3):382–3.

34 Fox DM. The politics of achievable mortality. Public Health Rep.

2010;125(2):168.

35 Institute of Medicine. For the public's health: the role of measurement in action and accountability. Washington (DC): IOM; 2010 Dec.

36 Institute of Medicine. For the public's health: investing in a healthier future. Washington (DC): IOM; 2012 Apr 10.

37 National Prevention Council. National prevention strategy: America's plan for better health and wellness. Rockville (MD): Office of

the Surgeon General; 2011 Jun.

38 Kindig DA. Locally customized population health policy packages? Improving Population Health [blog on the Internet]. 2011 Aug 31 [cited 2013 Feb 4]. Available from: http://www.improvingpopulationhealth.org/blog/2011/08/locally-customized-population-health-policy-packages.html

39 Kindig D, Mullahy J. Comparative effectiveness—of what? JAMA. 2010;304(8):901–2.

## ABOUT THE AUTHORS: DAVID A. KINDIG & ERIKA R. CHENG

David A. Kindig is a professor emeritus at the University of Wisconsin–Madison.

In this month's *Health Affairs*, David Kindig and Erika Cheng report on their analysis of trends in male and female mortality rates from 1992 to 2006 in 3,140 counties in the United States. Although mortality rates for men and women fell in most counties, female mortality nonetheless increased in 42.8 percent of counties, while male mortality increased in only 3.4 percent. Noting that factors such as smoking, education, and region of the country played a role, the authors argue that increased public and private investment in the social and environmental determinants of health will be needed to turn the tide.

Kindig is a professor emeritus of population health sciences, vice chancellor emeritus for health sciences, and founder of the Population Health Institute at the University of Wisconsin–Madison School of Medicine and Public Health. He codirects the Robert Wood Johnson Foundation (RWJF) Society and Health Scholars Program at the university and is the editor of the Improving Population Health blog (http://improvingpopulationhealth.org). He was co–principal investigator of RWJF's Mobilizing Action toward Community Health grant.

Kindig was elected to the Institute of Medicine in 1996 and served as president of the Association for Health Services Research (now AcademyHealth) in 1997–98. He earned a medical degree and a doctorate in experimental pathology from the University of Chicago.
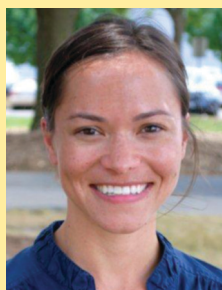
Erika R. Cheng is a doctoral candidate and research assistant at the University of Wisconsin–Madison.

Cheng is a doctoral candidate and research assistant in the Department of Population Health Sciences, School of Medicine and Public Health, at the University of Wisconsin–Madison. She has worked as a project assistant in the County Health Rankings and Roadmaps project at the university's Population Health Institute and is a member of the Lifecourse Epidemiology and Family Health Lab in the Department of Population Health Sciences.

Cheng has received numerous honors, including a Science and Medicine Graduate Research Scholars Advanced Opportunity Fellowship, from the College of Agricultural and Life Sciences and School of Medicine and Public Health at the University of Wisconsin–Madison, and the American Public Health Association's 2012 Disability Section Annual Meeting Scholarship Award. She earned a master's degree in public affairs from the University of Wisconsin–Madison.