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What Changes In Survival Rates Tell Us About US Health Care

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ABSTRACT Many advocates of US health reform point to the nation's relatively low life-expectancy rankings as evidence that the health care system is performing poorly. Others say that poor US health outcomes are largely due not to health care but to high rates of smoking, obesity, traffic fatalities, and homicides. We used cross-national data on the fifteen-year survival of men and women over three decades to examine the validity of these arguments. We found that the risk profiles of Americans generally improved relative to those for citizens of many other nations, but Americans' relative fifteen-year survival has nevertheless been declining. For example, by 2005, fifteen-year survival rates for forty-five-year-old US white women were lower than in twelve comparison countries with populations of at least seven million and per capita gross domestic product (GDP) of at least 60 percent of US per capita GDP in 1975. The findings undercut critics who might argue that the US health care system is not in need of major changes.

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In 1950, the United States was fifth among the leading industrialized nations with respect to female life expectancy at birth, surpassed only by Sweden, Norway, Australia, and the Netherlands.[1] The last available measure of female life expectancy had the United States ranked at forty-sixth in the world.[2] As of September 23, 2010, the United States ranked forty-ninth for both male and female life expectancy combined.[3,4] The United States does little better in international comparisons of mortality. Americans live 5.7 fewer years of "perfect health"—a measure adjusted for time spent ill—than the Japanese.[5]

Meanwhile, per capita health spending in the United States increased at nearly twice the rate in other wealthy nations between 1970 and 2002.[6] As a result, the United States now spends well over twice the median expenditure of industrialized nations on health care, and far more than any other country as a percentage of its gross domestic product (GDP).[7]

The observation that Americans are spending relatively more on health but living relatively shorter, less healthy lives has led some critics to allege that the US health care system is "uniquely inefficient."[8] Although these statistics appear to suggest that the US system performs poorly, some policy experts claimed that the system was not to blame for this apparently dismal picture. They also quibbled with the data, arguing that life expectancy figures could be biased by variation in the way births are coded or by differences in reproductive health policy.[9,10] Whether a fetus or newborn infant who dies is considered a case of infant mortality or a fetal demise can very from nation to nation. Thus, the United States might count some cases as an infant death, and other countries might not.

Critics who were skeptical about health reform also questioned the validity of international comparisons of existing health outcomes data. They argued that variations in international outcomes might result from differences in demo-

graphics or population health risk factors.[11,12] And given Americans' expanding waistlines, poor health habits, car culture, and homicide rates, the critics argued, the United States might rank worse without its costly health system.[10]

Is the US health system at least partly to blame for this deterioration in international rankings for life expectancy and medical costs? Or can the declines be better explained by statistical, demographic, behavioral, and social factors? In this paper we explore changes in fifteen-year survival at middle and older ages, alongside per capita health care spending, in the United States and twelve other wealthy nations. We then examine the extent to which the survival and cost variations over time among these nations can be explained by demographics, obesity, smoking, or mortality events that are not closely related to health care, such as traffic accidents and homicide. By comparing health system costs and mortality rates over time, it is possible to assess whether trends in risk factors for health or causes of death can explain the observed relative decline in broad health outcomes among American men and women over the past thirty years.

Study Data And Methods

COMPARISON COUNTRIES We compared the performance of the United States to that of twelve nations that have populations of at least seven million and per capita GDP of at least 60 percent of the US per capita GDP since 1975. These nations are Australia, Austria, Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Sweden, Switzerland, and the United Kingdom.

These comparison countries all provide universal health insurance coverage. However, they have a fairly diverse set of health care systems, ranging from care that is organized and paid for by the government to regulated private insurance markets.[13] Note that data on all indicators are not available for all comparison countries at all points in time.

OUTCOMES We examined relative changes in two measures of system performance—cost and fifteen-year survival—from 1975 to 2005, a period for which good comparative data are available. We focused on forty-five- and sixty-five-year-old men and women and measured costs as health care spending per capita, adjusted to constant US dollars using purchasing power parity. We chose to study adult survival, rather than measures at birth, because variations in family planning policy and coding at birth may affect life expectancy at birth. Most of the important chronic diseases that can be successfully prevented or treated with health interventions—such as cardiovascular disease, stroke, and diabetes—arise in midlife, and deaths due to these diseases cluster in the second half of life.[14]

We measured fifteen-year survival rather than life expectancy because the latter can be biased by the survival experiences of a small number of elderly people, among whom coding errors are common.[15] Focusing on survival also allowed us to distinguish between the experiences of specific cohorts. We explored fifteen-year survival for men and women separately because risk-factor profiles differ greatly by sex and country.[16]

DATA SOURCES We obtained cross-national data on obesity and health system costs from the Organisation for Economic Co-operation and Development (OECD),[17] which in turn collected the data from each of the countries. In many cases, the survey year varied slightly by country. In other cases, there were changes in the national survey data reported to the OECD over time. For instance, in Australia, earlier data came from the Risk Factor Prevalence Survey of the National Heart Foundation, and later data from the National Nutrition Survey of the Australian Bureau of Statistics.

Overall survival data were supplied by member countries to the World Health Organization (WHO), from which we obtained the information. Data for US non-Hispanic whites came from the Centers for Disease Control and Prevention (CDC), which is the original source of the US data reported to the WHO. The CDC database contains race-specific data, while the WHO information does not.[18] In our analysis of deaths by cause, we also used data from the CDC.[19]

Finally, we used the International Mortality and Smoking Statistics (IMASS) software, version 4.04, to examine smoking data by period and birth cohort. The software database is populated with international data from the WHO. In these data, we constructed birth cohorts by combining period and age data. Even though the sample differs from period to period, it is nationally representative; thus, different samples may be treated as if they are a single cohort followed over time. We assumed that subjects who were age five in the 1950 sample and age ten in the 1955 sample were drawn from the same longitudinal cohort, when, in fact, they were different nationally representative samples.

Although the birth cohort data are not as complete as cross-sectional data across all countries and age groups, they offer the distinct advantage of providing information on the life course of each of our comparison groups by age, sex, and time period.

LIFE-EXPECTANCY CALCULATIONS We used Wolfram Alpha—an online "data engine," which allows various types of calculations using rigorous, scientific tools—to calculate survival prob-

abilities for people between ages 45–60 and ages 65–80 in all of the countries under study.[20] This engine uses compiled mortality data from the WHO. The methods used for estimating survival probabilities are described in detail elsewhere.[21]

Briefly, we employed standard life table methods, in which age-specific mortality probabilities were applied to a hypothetical cohort of 100,000 people. Using life-table data, we calculated the fifteen-year survival probability for forty-five-year-olds and sixty-five-year-olds.

To hold race constant, we also examined US data for non-Hispanic whites. Because race-specific data were not available from Wolfram Alpha, we used life tables from 1975, 1985, 1995, and 2004—the latest year for which data were available—to generate sex- and age-specific mortality ratios for whites relative to all Americans in the same age groups.[18]

Below we present temporal trends by sex for the outcomes of interest. Our graphical results present outcomes for 1975 and 2005 only.

LIMITATIONS Our study used longitudinal data, which helped eliminate idiosyncratic findings and allowed us to observe the temporal relationship between changes in behavioral risk factors, costs, and life expectancy. In addition, we focused on survival for people ages forty-five and sixty-five, which improved the comparability of the data across countries.

Nevertheless, our study was subject to a number of important limitations. First, it necessarily relied on diverse sources of data compiled by the OECD. Although it is likely that both random and nonrandom errors were introduced by the use of disparate sources of data, we minimized the range of error by including only larger industrialized nations in our analysis.

Second, we did not use comparative data on specific causes of death. Some researchers have argued, for instance, that the United States does much better than other nations in terms of spending on some types of preventive care and cancer care, leading to increased survival.[11] Comparative data on specific causes of death over time could provide additional insights into health system performance.

However, comparisons over time and across nations are muddied by differences in coding and changes in disease coding over time in some countries but not others, and by the availability of prevalence data only. For instance, a high prevalence of heart disease could reflect either a systematic failure of efforts to prevent heart disease or a highly successful effort to prevent mortality from heart disease.

Finally, we examined only relative changes in smoking and obesity over time. There may be other important, but unidentified, sociocultural factors that differentiate the United States from other industrialized nations. One example is social capital, which is hypothesized to contribute to population health through both health-inducing social ties and the greater likelihood of voter support for social programs, such as mass transit and education.[22,23] Unfortunately, there are no good international measures of social capital over time, so we could not include this variable in our analysis.

Study Results

CHANGES IN COST AND LIFE EXPECTANCY Exhibit 1 shows the relative change in per capita health spending—adjusted for inflation and purchasing power parity—and fifteen-year survival for forty-five-year-old women in the countries under study for 1975 and 2005. Comparable figures for sixty-five-year-old women and for forty-five- and sixty-five-year-old men are available in the online Appendix.[24]

In 1975 the United States was in last place with respect to fifteen-year survival at age forty-five for people of both sexes. However, it ranked highly in fifteen-year survival for women and men at age sixty-five. Per capita US health care costs were above the mean for other nations in 1975 but were comparable to those in some of the nations under study.

Between 1975 and 2005, survival probabilities and health costs increased for all groups in all nations, which is consistent with prior research on the United States.[25] By 2005, however, the United States had become a high outlier in spending and a low outlier in fifteen-year survival.

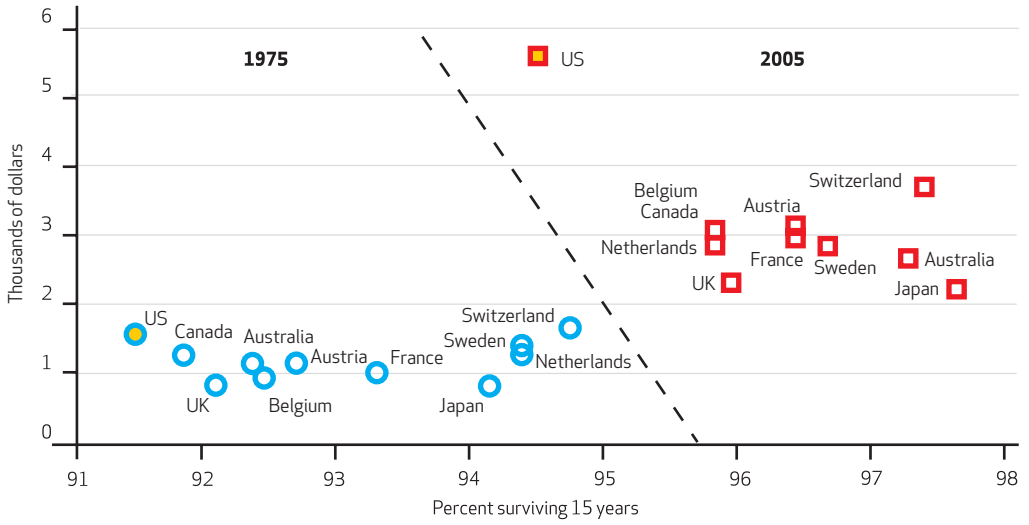
By 2005, not only were fifteen-year survival rates for forty-five-year-old US white women lower than in all comparison countries, but they had not even surpassed 1975 fifteen-year survival rates for Swiss, Swedish, Dutch, or Japanese women (Exhibit 1). Sixty-five-year-old US white women showed large relative declines in fifteen-year survival as well (see the Appendix).[24]

US white men ages forty-five and sixty-five had relative declines in fifteen-year survival, but these were not as marked as they were for women. Finally, US costs per capita increased from rough parity with the highest spenders in 1975 to 50 percent higher than those of the next most costly system (Switzerland) in 2005.

Exhibit 2 presents information on survival gains for all groups by decade, expressed as percentage points. Over the 1975–1985 decade, the United States ranked third in survival gain among forty-five-year-old men, behind only Australia and Canada. For every other group, and in every subsequent decade, the United States was

EXHIBIT 1

Per Capita Health Spending And 15-Year Survival For 45-Year-Old Women, United States And 12 Comparison Countries, 1975 And 2005



SOURCE Authors' analysis based on data from the sources described in the text. **NOTES** The dashed line separates 1975 values (blue circles) and 2005 values (red squares). Values are presented for the percentage of forty-five-year-old women surviving fifteen years.

no higher than eighth in overall survival gains.

POPULATION DIVERSITY One explanation for poor US performance is that the population of the United States is more diverse than those of most of the comparison countries. According to this argument, lower health status or lower survival gains for ethnic or racial minorities would tend to depress overall health outcomes for Americans relative to the residents of other countries. To address this potential confounding factor, Exhibit 2 presents results for American non-Hispanic whites as well as for Americans overall.

In most cases, the relative US performance deteriorated from decade to decade. Relative survival gains for non-Hispanic whites between 1995 and 2005 were the lowest among nations

EXHIBIT 2

Gain In 15-Year Survival Rates For Men And Women, Ages 45 And 65, United States And 12 Comparison Countries, 1975–2005

	45-year-old men		45-year-old women		65-year-old men		65-year-old women	
Interval/outcome	**All**	**White**	**All**	**White**	**All**	**White**	**All**	**White**
1975–1985								
Mean gain of comparison countries	2.2		1.3		5.7		6.7	
US gain	2.7	2.7	1.2	1.1	5.1	5.6	3	3.5
US rank[a]	3rd	3rd	8th	10th	8th	6th	13th	11th
1985–1995								
Mean gain of comparison countries	2.4		0.9		7.1		5.5	
US	1.8	1.7	0.7	0.7	6.1	6	2	1.8
US rank[a]	10th	11th	9th	9th	9th	9th	13th	13th
1995–2005								
Mean gain of comparison countries	1.7		0.7		8.9		5.3	
US	1.2	0.42	0.6	0	6.4	5.4	2.7	2.1
US rank[a]	12th	13th	8th	13th	13th	13th	13th	13th
1975–2005								
Mean gain of comparison countries	6.3		2.9		21.6		17.4	
US	5.7	4.8	2.5	1.8	17.6	17	7.7	7.5
US rank[a]	8th	11th	9th	11th	11th	11th	13th	13th

SOURCE Authors' analysis based on data from the sources described in the text. **NOTE** Data for gains are in percentage points. [a]Rank of the United States in fifteen-year survival relative to the twelve comparison countries.

in each category. Forty-five-year-olds in Australia, Italy, Canada, and (for women) Japan experienced the largest survival gains in this decade. For sixty-five-year-old men, Austria, Australia, and the United Kingdom experienced the largest gains. For women of the same age, the gains were greatest in Austria, Belgium, and Japan.

As a consequence, the relative survival gains of non-Hispanic American whites, compared to all residents of the comparison countries, ranked next to last or last for each of the sex and age groups over the full period—even worse than overall performance (note that not all data were available for all countries for all years). Contrary to the diversity hypothesis, including the experience of diverse groups in the US data improves the comparative performance of the United States, since the superior survival gains of other Americans relative to non-Hispanic whites boosts the overall performance of the United States relative to that of other countries.

BEHAVIORAL RISK FACTORS

▶ **SMOKING:** The current smoking rate in the United States is generally lower than in the twelve comparison nations (data not shown). In 2006, the US smoking rate was 15 percent for women and 19 percent for men, while the comparison-country smoking rates ranged from a low of 14 percent for Japanese women to a high of 41.3 percent for Japanese men (data not shown). Moreover, the United States has realized faster declines in smoking than most of the twelve comparison nations for both males and females (Exhibit 3). One exception to this trend occurred for US males during 1995–2005, when only three other countries showed a smaller decline in smoking prevalence.

We repeated this trend analysis focusing on the prevalence of smoking and number of cigarettes consumed across consecutive birth cohorts to assess the potential impact of lifetime smoking behavior (these analyses are available in the Appendix).[24] As with prevalence by period, a decline in smoking prevalence was noted across more recent birth cohorts, and across all comparison nations; the decline was sharper in the United States relative to some nations and shallower relative to others.

Like smoking prevalence, the number of cigarettes consumed declined in all countries over time. Although fewer American women than European women smoke, those American women who do smoke consume more cigarettes, on average. However, the pattern of US cigarette consumption relative to other countries is not

EXHIBIT 3

Changes In Obesity And Smoking Rates Among Men And Women In The United States And 12 Comparison Countries, 1975–2005

	Female (percentage points)			Male (percentage points)		
Country	**1975–85**	**1985–95**	**1995–2005**	**1975–85**	**1985–95**	**1995–2005**
SMOKING						
Australia	−1.30	−2.90	−3.20	−2.90	−2.50	−3.70
Austria	3.60	0.70	0.30	−0.30	−1.30	−1.00
Belgium	—[a]	−1.10	−3.40	1.50	−4.10	−1.30
Canada	−1.30	−2.10	−3.90	−2.60	−1.90	−3.80
France	3.20	0.60	0.00	0.00	−2.50	−1.70
Germany	0.80	−0.20	0.70	−2.30	−0.80	−0.60
Italy	0.70	0.00	−0.50	−4.80	−1.90	−1.50
Japan	−1.00	1.00	−0.90	−1.70	−0.90	−3.20
Netherlands	−1.60	−0.90	−1.60	−4.30	−0.50	−1.20
Sweden	−2.10	−1.40	−2.70	−3.90	−3.10	−4.60
Switzerland	—[a]	—[a]	−1.50	—[a]	—[a]	−1.60
United Kingdom	−2.00	−1.40	−1.60	−2.70	−1.90	−2.30
United States	−1.50	−4.20	−1.90	−2.80	−3.90	−1.30
OBESITY[b]						
Australia	9.00	5.50	2.30	−1.90	7.00	2.30
France	—[a]	—[a]	3.90	—[a]	—[a]	3.60
Japan	−3.30	2.70	3.60	2.60	5.60	4.80
Netherlands	—[a]	2.60	4.00	—[a]	4.10	5.10
United Kingdom	5.80	4.70	2.90	4.10	8.10	4.00
United States	0.30	3.20	2.10	0.50	3.70	3.20

SOURCE Authors' analysis based on data from the sources described in the text. [a]Not available. [b]Obesity data are based on national surveys that were not consistently collected at ten-year intervals, and data for many nations were not available or were obtained from different nationally representative surveys.

consistent with the pattern of deteriorating health outcomes. American smokers consume more cigarettes, but this consumption did not increase over time or across birth cohorts relative to other nations.

If smoking is an important explanation of poor US health outcomes, this should be apparent in indicators of health that are closely linked to smoking. To assess this, we examined patterns of mortality from lung cancer, a disease mostly related to lifetime cigarette smoking, across countries over time (see the Appendix).[24] Because lung cancer takes many decades to develop, on average, lung cancer mortality serves as a good measure of the long-term effects of smoking.

For both age cohorts, the mortality from lung cancer over time has increased in the United States relative to some other groups, such as sixty-five-year-olds in Australia and Austria. However, US mortality from lung cancer has declined relative to other groups, including sixty-five-year-olds in Belgium and France. Lung cancer mortality rates varied greatly by country, age, and sex over the four time periods, and no clear relationship emerged.

Finally, we examined the relative performance over time of the country most similar to the United States with respect to the level and pattern of smoking: Australia. If earlier levels of smoking are a very important contributor to the poor US performance on outcome measures, Australia's rankings should also have declined compared to countries with lower smoking levels and consumption. This was not the case. Australia ranked above the comparison-group median in survival gains for all four periods.

▶ **OBESITY:** Obesity has been blamed for a large share of the increase in US health care spending and of the decline in US health outcomes.[26] The US population is much heavier, on average, than the populations of other countries. More than one-third of the adult US population is obese, while the twelve comparison countries have obesity rates ranging from a low of 3.4 percent for adult Japanese males to a high of 24.2 percent for adult British females (data not shown). But there is nothing new about this pattern: In 1975, US obesity rates were also much higher than those in other countries.

For obesity to explain the decline in US life expectancy or the increase in health spending relative to the twelve comparison countries, Americans would have to be becoming obese at a faster rate than people in the comparison nations over time. Exhibit 3 shows that the United States has generally had a slower rate of growth in the percentage of obese men and women over this period, relative to many of the comparison countries for which data were available. Across both sexes and all time periods, there were only three instances in which obesity was growing at a more rapid rate in the United States than in the comparison countries for which data were available.

Including the experience of diverse groups in the US data improves the comparative performance of the United States.

Although less likely, it is possible that the absolute level of obesity, rather than changes in that level, might explain the pattern of changes over time. If that were true, those countries most similar to the United States in terms of obesity would be expected to have had a similar pattern of outcomes. We examined the relative performance over time of those most similar countries: Australia and the United Kingdom. If level of obesity, rather than the change in its prevalence, is an important contributor to the poor US performance in fifteen-year survival over time, these countries' rankings should also have declined compared to countries with lower obesity levels.

This was not the case. Australia ranked above the comparison-group median in survival gains for males and females at both ages, and the United Kingdom ranked above the comparison group median for all groups except sixty-five-year-old women (see the Appendix).[24]

▶ **TRAFFIC ACCIDENTS AND HOMICIDES:** Finally, Americans are much more likely than are residents of the twelve comparison nations to die in a homicide or traffic accident.[10] Unfortunately, data on these causes of death are not systematically available over time in the comparison countries. Therefore, to assess the potential contribution of these causes, we examined changes in the share of US deaths attributable to homicide and traffic accidents over time. If declines in other causes of death were offset by rising numbers of deaths from homicides and traffic accidents, then homicides and accidents should account for a growing share of all mortality within the United States

over time.

In fact, the share of all deaths in the age groups under study attributable to homicides and traffic accidents has been relatively low and quite stable over time. These causes of death are therefore unlikely to account for the deteriorating survival probabilities of Americans (Exhibit 4).

Discussion

We find that even as relative health care spending has increased in the United States, the nation has fallen behind the twelve comparison countries with respect to fifteen-year survival for men and women ages forty-five and sixty-five during the past three decades. These findings are consistent with prior work suggesting that the value of health care spending in the population over age sixty-five has been declining over time.[27]

By focusing on survival at these ages, we have eliminated biases due to cross-national differences in coding practices at birth or in age coding among the elderly. We controlled for the effect of changing demographic diversity by exploring fifteen-year survival for both non-Hispanic whites and all Americans. We found that fifteen-year survival for non-Hispanic whites is deteriorating more rapidly relative to other comparison nations than is survival for Americans overall. Our high homicide and accident rates also do not appear to explain poor US performance in health outcome measures.[10]

RISK FACTORS Smoking and obesity constitute the two most important behavior-related risk factors for health in the overall US population.[28–30] Both are major public health problems that merit considerable attention. However, they do not appear to explain the relative performance deterioration of the US health system over time. The prevalence of obesity has grown more slowly in the United States than in other nations, while smoking prevalence has declined more rapidly in the United States than in most of the comparison countries.

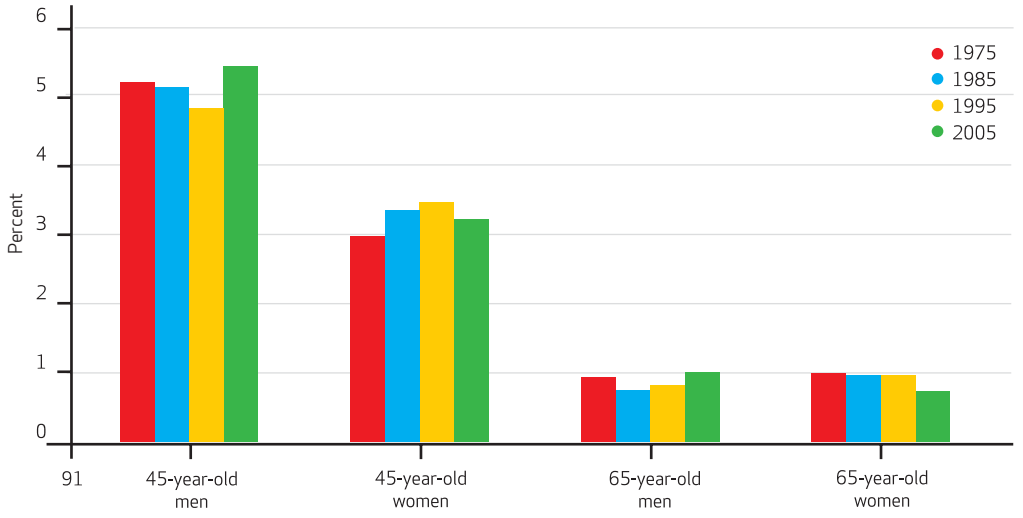
Moreover, there are no trends in data on birth cohort, cigarette consumption, or lung cancer mortality that provide substantive support to the hypothesis that US smoking habits are pulling down the national relative life expectancy. In fact, Australia is very similar to the United States with respect to patterns of smoking and obesity over time, but Australia was one of the best-performing countries in this period with respect to gains in fifteen-year survival.

SURVIVAL AMONG WOMEN Survival has deteriorated most rapidly for white American women relative to women in the twelve comparison countries, so it is worthwhile to explore this subgroup in more detail. Although fewer American women smoked overall, they consumed more cigarettes and weighed more relative to women in the comparison nations in 1975. They have gained weight over time, but they did so more slowly than women in most countries. US women also quit smoking at a rate that was comparable to women in the other countries. Finally, the cross-cohort patterns of US women's lifetime exposure to cigarette smoke were similar to those of women in other countries.

ROLE OF HEALTH CARE One possible explana-

EXHIBIT 4

Percentage Of US Deaths Attributable To Homicides And Accidents, By Age And Sex, Selected Years 1975–2005



SOURCE Authors' analysis based on data from the sources described in the text.

tion for the poor US performance is the relative increase in the number of uninsured people during much of the study period.[31] People without health insurance have worse access to medical care, which may contribute to declining life expectancy.[27]

Moreover, the effects of uninsurance before age sixty-five have been shown to persist even when the uninsured gain Medicare coverage, which potentially explains the effects we saw in the data for the older age group.[32]

Direct tests of the impact of health insurance on mortality have not found very substantial impacts, however. Estimates based on the RAND Health Insurance Experiment, for example, find that coverage has large effects on use of health care but only small effects on mortality, which are concentrated in low-income groups.[33] Likewise, regression-based estimates suggest that health insurance is associated with a risk ratio of between 1.3 and 1.6—a difference of just weeks of life expectancy for the population as a whole.[34,35] Still, there is considerable uncertainty on this point.[36]

SPENDING AND HEALTH It is possible that rising US health spending is itself responsible for the observed relative decline in survival. There are three reasons why this might be so.

First, as health spending rises, so, too, does the number of people with inadequate health insurance.[37] Notwithstanding the uncertainty surrounding the impact of lacking insurance on the health of the US population, higher spending could be reducing survival by decreasing the number of insured people.[38]

Second, rising health spending may be choking off public funding on more important lifesaving programs. Health spending now constitutes a sizable proportion of the federal budget.[39] At current spending levels, investments in public health, education, public safety, safety-net, and community development programs may be more efficient at increasing survival than further investments in medical care.[40–43]

Finally, unregulated fee-for-service reimbursement and an emphasis on specialty care may contribute to high US health spending, while leading to unneeded procedures and fragmentation of care.[8] Unneeded procedures may be associated with secondary complications. Fragmentation of care leads to poor communication between providers, sometimes conflicting instructions for patients, and higher rates of medical errors. For example, two separate physicians are probably more likely than a single primary care provider to prescribe two incompatible drugs to a single patient.[44–48] The extent to which these factors are determinants of population health is uncertain, though.

One possible explanation for the poor US performance is the relative increase in the number of uninsured people.

We found that none of the prevailing excuses for the poor performance of the US health care system are likely to be valid. On the spending side, we found that the unusually high medical spending is associated with worsening, rather than improving, fifteen-year survival in two groups for whom medical care is probably important.

We speculate that the nature of our health care system—specifically, its reliance on unregulated fee-for-service and specialty care—may explain both the increased spending and the relative deterioration in survival that we observed. If so, meaningful reform may not only save money over the long term, it may also save lives. ■

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NOTES

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