Measuring The Health Of Nations: Updating An Earlier Analysis

One measure of the health of Americans—deaths from treatable conditions—still does not compare well with rates in other industrialized countries.

by Ellen Nolte and C. Martin McKee

PROLOGUE: Approaches to measuring health system performance can be as numerous as the systems themselves are complex. Health care disparities research illuminates one such prism through which to view systemic effectiveness. In 2006 the Agency for Healthcare Research and Quality (AHRQ) issued the most recent *National Healthcare Disparities Report*—the first national initiative measuring differences in access to and use of health services among races and ethnicities. The 2006 report asserts that "disparities related to race, ethnicity, and socioeconomic status still pervade the American health care system." By way of illustration, it points out that many minorities are more likely than others to be diagnosed with late-stage breast and colorectal cancers, are disproportionately affected by diabetes and heart disease, and are more likely to die from HIV.

Remedial policy solutions to address disparities come with their own challenges. As we learned from Kenneth Keppel and colleagues (Sep/Oct 2007), for example, reducing the overall disease burden and improving overall health care quality do not necessarily go hand in hand with improving the health of subpopulations. Further complicating matters, sometimes these goals even conflict. Accordingly, reducing disparities requires an independent commitment. And when the interests of the few conflict with those of the majority, policymakers inevitably face difficult resource allocation decisions.

The paper that follows by Ellen Nolte (ellen.nolte@lshtm.ac.uk) and Martin McKee, both of the London School of Hygiene and Tropical Medicine, represents another metric through which health system performance might reasonably be gauged. This work measures the extent to which deaths that would not have occurred but for the presence of effective health care have been reduced among Organization for Economic Cooperation and Development (OECD) countries over time. Cause for concern can be seen in the authors' finding that despite being the most prolific health care spender, the United States is falling farther behind its peer nations in overall health system performance, as measured by what the authors term "amenable mortality."

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ABSTRACT: We compared trends in deaths considered amenable to health care before age seventy-five between 1997–98 and 2002–03 in the United States and in eighteen other industrialized countries. Such deaths account, on average, for 23 percent of total mortality under age seventy-five among males and 32 percent among females. The decline in amenable mortality in all countries averaged 16 percent over this period. The United States was an outlier, with a decline of only 4 percent. If the United States could reduce amenable mortality to the average rate achieved in the three top-performing countries, there would have been 101,000 fewer deaths per year by the end of the study period. [*Health Affairs* 27, no. 1 (2008): 58–71; 10.1377/hlthaff.27.1.58]

IDENTIFYING SIMPLE, PRACTICAL, AND UNDERSTANDABLE ways to assess health system performance, with its complex interlinked dimensions, remains a challenge. Health systems are complex, with multiple functions, and performance assessment frameworks are increasingly using a range of indicators to better capture these different aspects.[1]

A fundamental issue relates to how to attribute population health outcomes to health care. One approach uses mortality data, which are readily available at a population level in many countries, and is based on the concept of "amenable mortality," referring to deaths from certain causes that should not occur in the presence of timely and effective health care.[2] Originally developed in the 1970s in the United States, the concept was subsequently adopted and updated by many researchers, especially in Europe, where it has been used to assess the quality of health care systems.[3] This concept been revitalized recently as a potentially useful tool to assess the quality and performance of health systems and track changes over time.[4]

Previous work compared nineteen countries that are members of the Organization for Economic Cooperation and Development (OECD), using the concept of amenable mortality.[5] This work illustrated how the U.S. "health system falls far short of what is attainable."[6] However, it used data from 1998, and much has changed since then. This paper updates that work, examining how the U.S. position has changed in comparison with other industrialized countries.

Study Data And Methods

■ **Data.** We compared the United States with fourteen countries in western Europe plus Canada, Australia, New Zealand, and Japan, selected for comparability with earlier work. Mortality and population data were extracted for the period 1997–2003 from the World Health Organization (WHO) files.[7] Data include deaths, coded according to the ninth and tenth revisions of the *International Classification of Diseases* (ICD), by sex and five-year age bands (with infant deaths listed separately).

■ **Selection of ages and causes of death.** The selection of causes of death considered amenable to health care is based on our previous systematic review.[8] In brief, for this paper we considered conditions such as bacterial infections, treatable cancers, diabetes, cardiovascular and cerebrovascular disease, and complications of

common surgical procedures. We also included ischemic heart disease (IHD); however, in line with accumulating evidence suggesting that only up to half of premature mortality from IHD may be potentially amenable to health care, we here considered only half of IHD deaths to be "amenable."[9] Throughout this paper, the term "amenable" mortality always includes half of IHD deaths.

A general age limit was set at seventy-five years, because the extent to which deaths can be prevented by health care and the reliability of death certification become increasingly questionable at older ages.[10] To be consistent with other research, we set different age limits for diabetes mellitus (under age fifty) because the preventability of deaths at older ages from diabetes, and in particular the effectiveness of good diabetic control in reducing vascular complications, remains controversial. For some other causes (intestinal infectious diseases, whooping cough, measles, and childhood respiratory diseases), we set a limit of under age fifteen, because deaths other than in childhood from these causes are likely to reflect the presence of other disease processes. For leukemia, we set the age limit at age forty-four because of recent evidence showing improvements in mortality from leukemia in the European Union up to age forty-four since 1960, largely attributed to advances in treatment.[11]

■ **Analysis.** To calculate amenable mortality, we combined single causes and groups of causes. We computed age-standardized death rates (SDRs) per 100,000 population by sex, by direct standardization to the European standard population for the years 1998 and 2003 (for Italy and the United States, 2002).[12] Where the population of a country is below ten million, we computed SDRs for data from two years combined, for 1997–98 as the starting point and 2002–03 (or latest available) as the end point, to reduce variation due to small numbers.[13] For simplicity, we refer to 1997–98 and 2002–03 as the two reference points in the analysis.[14]

We generally present sex-specific SDRs; however, when constructing country rankings, we combined sex-specific SDRs using a simple average, weighted for the distribution of males and females in the population.

Study Results

■ **Amenable mortality.** Amenable mortality constitutes an important proportion of total mortality in all countries studied here, accounting, in 2002–03, for an average of 23 percent (from 15 percent in France to 27 percent in the United Kingdom) of total mortality under age seventy-five in males (Exhibit 1) and 32 percent in females (from 25 percent in France to 36 percent in Greece and Portugal; Exhibit 2).

In 1997–98, amenable mortality among males in the United States was, at 128.5 per 100,000 population, exceeded by Ireland, Portugal, Finland, the United Kingdom, and Austria. The U.S. rate was about 8 percent higher than the average rate (119.5) and 50 percent higher than in France, which at 85.9 had the lowest rate of amenable mortality among males. For females in the United States, amenable mortality was lower than in the United Kingdom, Ireland, Denmark, Portugal, and

EXHIBIT 1
Age-Standardized Death Rates (Per 100,000) Among Males Ages 0–74 From Selected Causes In Nineteen Organization For Economic Cooperation And Development (OECD) Countries, 1997–98 And 2002–03

	1997–98				2002–03			
Country	Amenable causes	IHD (50%)	Other causes	Total	Amenable causes	IHD (50%)	Other causes	Total
Australia	99.41	40.81	272.63	412.86	79.00	28.25	234.74	341.99
Austria	132.17	53.60	328.72	514.49	99.30	36.50	310.15	445.95
Canada	99.38	42.27	294.17	435.83	85.67	34.44	272.29	392.40
Denmark	120.83	43.43	383.51	547.77	105.48[a]	34.15[a]	355.24[a]	494.87[a]
Finland	150.39	69.57	341.86	561.81	119.77	53.72	310.88	484.37
France	85.87	20.35	397.33	503.55	72.62	16.79	368.92	458.33
Germany	125.25	48.29	343.63	517.17	105.80	36.96	317.48	460.24
Greece	113.32	40.74	298.70	452.76	101.13	40.25	268.68	410.06
Ireland	157.57	72.47	322.34	552.38	118.44	48.01	281.54	447.99
Italy	101.20	30.73	321.30	453.23	83.49[b]	24.01[b]	280.11[b]	387.61[b]
Japan	101.60	13.61	276.97	392.18	88.80	12.66	254.43	355.89
Netherlands	106.03	39.16	322.22	467.41	88.03	27.23	294.80	410.07
New Zealand	126.52	55.99	289.15	471.67	102.78	41.70	264.19	408.67
Norway	115.48	49.23	286.58	451.28	88.79	32.40	269.75	390.94
Portugal	153.96	28.17	408.85	590.98	124.78	23.39	360.70	508.87
Spain	99.74	29.00	346.97	475.71	87.75	24.17	315.99	427.91
Sweden	104.73	46.93	245.18	396.85	89.85[c]	37.30[c]	231.16[c]	358.31[c]
United Kingdom	148.62	63.05	280.41	492.09	116.62	46.28	270.81	433.71
United States	128.51	48.69	374.76	551.95	123.36[b]	47.78[b]	344.63[b]	515.76[b]

SOURCE: Authors' calculations based on data from the World Health Organization mortality database.
NOTE: IHD is ischemic heart disease.
[a] 2000–01.
[b] 2002.
[c] 2001–02.

New Zealand, but at 101.6 it exceeded the average rate of 86.9 by 17 percent and the lowest rate (Japan, 62.1) by 64 percent.

By 2002–03, mortality from amenable causes had fallen in all countries studied, although the scale and pace of change varied. Exhibits 3 and 4 display the relative changes in mortality from amenable causes between 1997–98 and 2002–03 for males and females separately, with the relative change in mortality from causes that are considered not amenable to health care ("other") as defined here included for comparison. Among males, amenable mortality fell by 17 percent on average and by more than 10 percent in all countries except the United States, where the decline was only 4 percent. This contrasts with Austria, Ireland, the United Kingdom, and Finland, which began with very high rates, as well as Norway and Australia, where amenable mortality fell by more than 20 percent during that period.

Among females, the United States again showed the smallest reductions in amenable mortality—just over 5 percent—compared with an average decline of 14 percent across all nineteen countries. Only Sweden and Denmark also showed reductions of less than 10 percent; however, this has to be interpreted in the knowledge that Sweden started from a rate much lower (89.9) than the U.S. rate (123.4)

EXHIBIT 2
Age-Standardized Death Rates (Per 100,000) Among Females Ages 0–74 From Selected Causes In Nineteen Organization For Economic Cooperation And Development (OECD) Countries, 1997–98 And 2002–03

	1997–98				2002–03			
Country	Amenable causes	IHD (50%)	Other causes	Total	Amenable causes	IHD (50%)	Other causes	Total
Australia	76.64	14.13	135.66	226.42	63.74	8.90	123.39	196.04
Austria	87.00	16.74	141.27	245.01	70.54	11.91	137.88	220.33
Canada	78.57	14.08	159.04	251.70	68.15	10.78	157.51	236.44
Denmark	105.38	15.13	232.75	353.26	96.31[a]	12.17[a]	220.43[a]	328.91[a]
Finland	83.73	18.05	141.68	243.47	68.06	12.80	133.66	214.52
France	65.89	4.83	144.62	215.33	57.40	3.75	141.71	202.86
Germany	88.05	16.01	152.80	256.86	75.14	11.41	143.70	230.24
Greece	81.52	11.54	129.93	222.99	67.81	10.94	109.94	188.69
Ireland	111.48	24.08	175.57	311.12	88.58	14.73	154.75	258.06
Italy	77.08	8.62	133.42	219.13	65.09[b]	6.69[b]	120.17[b]	191.95[b]
Japan	62.06	4.43	112.42	178.92	54.34	3.80	100.55	158.69
Netherlands	87.94	13.26	158.43	259.62	75.81	9.00	165.46	250.27
New Zealand	102.89	18.08	164.29	285.26	88.63	14.46	159.65	262.73
Norway	82.16	13.56	146.75	242.48	70.94	9.47	145.72	226.14
Portugal	104.57	9.30	157.66	271.53	85.13	8.21	143.17	236.51
Spain	69.45	7.40	119.95	196.80	60.39	6.06	113.83	180.28
Sweden	72.53	14.14	137.95	224.62	66.90[c]	12.07[c]	137.80[c]	216.78[c]
United Kingdom	111.93	22.60	164.20	298.72	89.64	15.44	163.58	268.66
United States	101.59	19.95	207.10	328.65	96.41[b]	19.48[b]	200.03[b]	315.92[b]

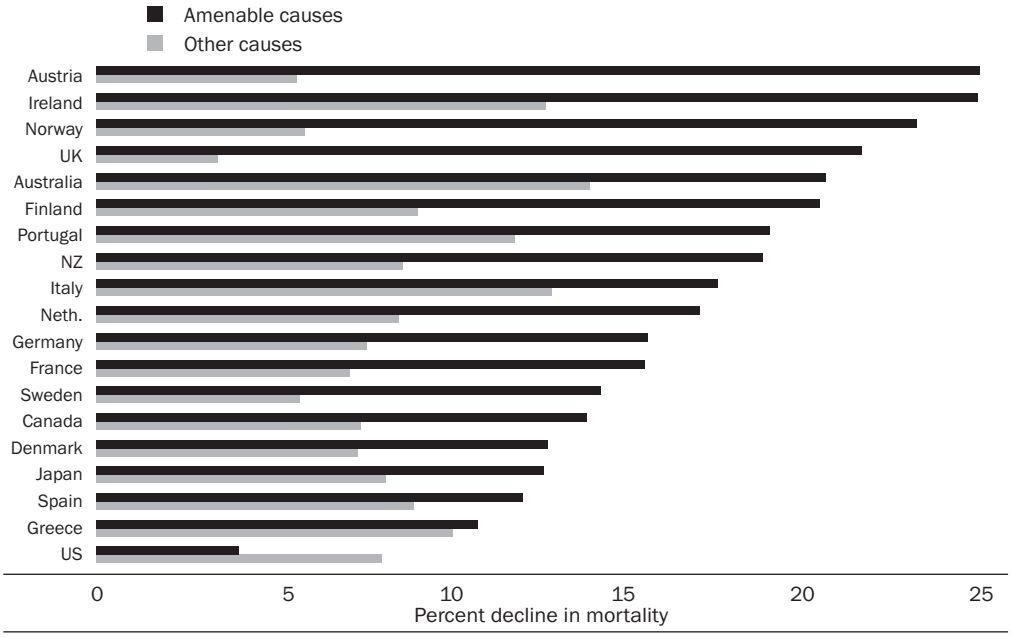
SOURCE: Authors' calculations based on data from the World Health Organization mortality database.
NOTE: IHD is ischemic heart disease.
[a] 2000–01.
[b] 2002.
[c] 2001–02.

in 1997–98. Data for Denmark cover the period 1997–98 through 2000–01 only, thus possibly underestimating the "true" decline of amenable mortality there.

Mortality from causes considered as not amenable to health care as defined here also fell in most countries (except among females in the Netherlands, reflecting the early uptake of smoking among Dutch females). However, the decline was generally much less steep than the decline in amenable mortality (Exhibits 3 and 4). The only exception was the United States, where, at least for males, other mortality fell more rapidly than amenable mortality: 8 percent compared with 4 percent. In Greece, amenable and other mortality among males and females declined at a comparable pace. Elsewhere, amenable mortality improved at a faster rate than other mortality in the population.

As a consequence of these varied changes, the United States fell increasingly behind on the measure of amenable mortality. This can be seen more easily when analyzing amenable mortality for males and females combined (Exhibit 5). Thus, although ranking fifteenth in 1997–98 and performing considerably better than Ireland, the United Kingdom, and Portugal, by 2002–03 the United States had the highest rate of amenable mortality, just above Ireland and the United Kingdom but

EXHIBIT 3
Percentage Decline In Mortality From Amenable Causes And Other Causes Of Death Among Males Ages 0–74 In Nineteen Countries From 1997–98 To 2002–03



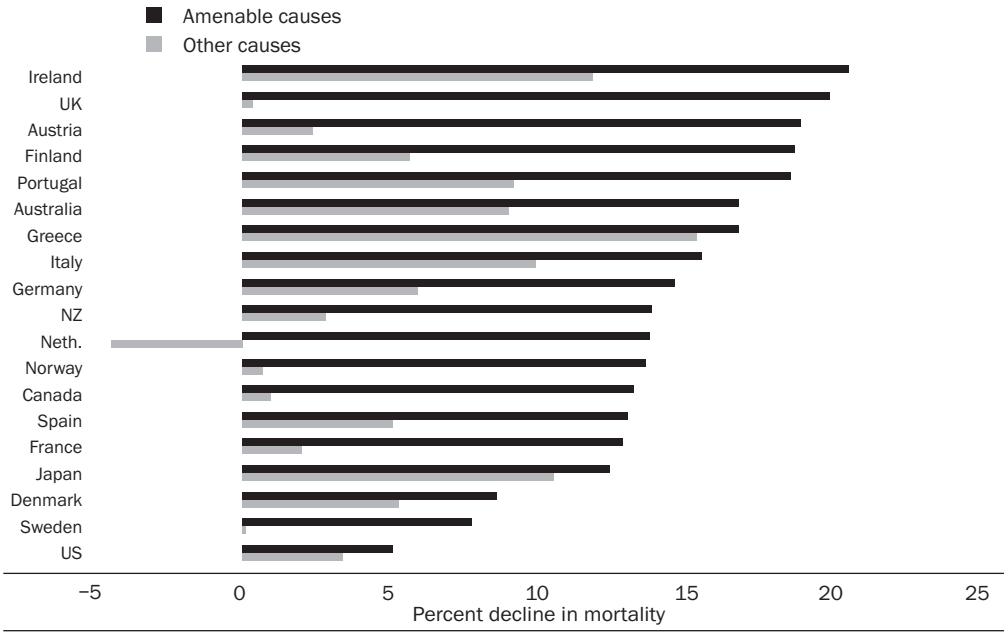
SOURCE: Authors' calculations based on data from the World Health Organization mortality database.
NOTE: Denmark: 2000–02; Sweden: 2001–02; Italy, US: 2002.

far above countries such as France, Japan, and Australia.

■ **Excess deaths in the United States.** Between 1997–98 and 2002–03, amenable mortality in the United States did not decline as rapidly as in other industrialized countries. As a result, by 2002–03 the United States had among the highest amenable mortality rates of the countries studied, for both males and females. It is possible to estimate the consequences if the United States would achieve the amenable mortality rate seen in other comparator countries. We have estimated a lower and upper bound of the number of deaths that could have been saved in 2002 if the United States had achieved (1) the average of all countries analyzed excluding the United States (lower bound) or (2) the average of the three top-performing countries (France, Japan, and Australia; Exhibit 5) as an upper bound. Applying the corresponding death rates to the U.S. population, we estimated that between just under 75,000 deaths (average of eighteen OECD countries) and just over 101,000 deaths (top three performers) under age seventy-five could be saved in the United States. Thus, even the more conservative estimate of 75,000 deaths is almost twice the Institute of Medicine's (lower) estimate of the number of deaths attributable to medical errors in the United States each year.[15]

■ **Beyond aggregate data.** As an aggregate indicator, the rate of amenable mortality conceals a wealth of detail about patterns and trends in deaths from particular causes. It is thus important to explore whether the relatively poor U.S. performance

EXHIBIT 4
Percentage Decline In Mortality From Amenable Causes And Other Causes Of Death Among Females Ages 0–74 In Nineteen Countries From 1997–98 To 2002–03



SOURCE: Authors' calculations based on data from the World Health Organization mortality database.
NOTE: Denmark: 2000–02; Sweden: 2001–02; Italy, US: 2002.

over the study period can be linked to particular conditions or, indeed, whether the overall limited progress conceals some areas of improvement, perhaps counterbalanced by areas of deterioration.

Given the many options provided by these data, the choice of comparator countries is essentially arbitrary. We chose two countries for comparison: the United Kingdom and France. In the United Kingdom, death rates from amenable causes in 1998 were between 10 percent (women) and 15 percent (men) higher than U.S. rates, yet the percentage reductions in amenable mortality were, at around 21 percent, four to five times greater than U.S. reductions. We also included France as an example of a country with traditionally low mortality from amenable conditions. Both countries have populations of around sixty million; thus, the numbers of deaths are large enough to give confidence in the comparisons.

Exhibit 6 shows the death rates from selected amenable causes at the beginning and end of the study period for both males and females in the three countries, illustrating how countries experienced both improvement and deterioration in selected indicators. However, this must be interpreted against the background of actual mortality levels. Thus, the most important contributors to amenable mortality are treatable cancers and circulatory diseases. All three countries experienced a reduction in mortality from treatable cancers; as a result, mortality from this cause in the United States and France has remained fairly similar over time (if

EXHIBIT 5
Comparison Of Rankings Based On Age-Standardized Death Rates (SDRs) Per 100,000 From Amenable Mortality (Both Sexes Combined) In Nineteen Organization For Economic Cooperation And Development (OECD) Countries, 1997–98 And 2002–03

Rank, 1997–98	Country	Amenable mortality (SDR, ages 0–74) 1997–98	2002–03	Rank, 2002–03	Change in rank
1	France	75.62	64.79	1	–
2	Japan	81.42	71.17	2	–
3	Spain	84.26	73.83	4	–1
4	Australia	87.95	71.32	3	+1
5	Sweden	88.44	82.09	9	–4
6	Italy	88.77	74.00	5	+1
7	Canada	88.88	76.83	6	+1
8	Netherlands	96.89	81.86	8	–
9	Greece	97.27	84.31	10	–1
10	Norway	98.64	79.79	7	+3
11	Germany	106.18	90.13	12	–1
12	Austria	108.92	84.48	11	+1
13	Denmark	113.01	100.84	15	–2
14	New Zealand	114.54	95.57	14	–
15	United States	114.74	109.65	19	–4
16	Finland	116.22	93.34	13	+3
17	Portugal	128.39	104.31	18	–1
18	United Kingdom	129.96	102.81	16	+2
19	Ireland	134.36	103.42	17	+2

SOURCE: Authors' calculations based on data from the World Health Organization mortality database.
NOTES: Denmark: 2000–01; Sweden 2001–02; Italy, U.S.: 2002. SDR is standardized death rate.

marginally lower in the United States), whereas the United Kingdom, because of the somewhat steeper decline in both sexes, narrowed the cancer mortality gap with the United States by about six percentage points in males and about five percentage points in women.

Similarly, all countries experienced declines in mortality from treatable circulatory diseases other than IHD (mostly cerebrovascular disease), of between 8 percent in the United States and 17 percent in the United Kingdom and France. The larger reductions in the United Kingdom meant that by 2002–03, death rates had fallen below U.S. levels, whereas in France, the mortality advantage over the United States had increased further, from 24 percent in 1998 to 38 percent in 2002–03 in males and from 70 percent to 90 percent in women.

This widening of the amenable mortality gap is also reflected in the greater progress in reducing mortality under age seventy-five from IHD in both France and the United Kingdom by, respectively, about 20 percent and 30 percent, compared to the United States, where IHD mortality fell by 2 percent only (both sexes). As a result, IHD mortality in the United Kingdom, which in 1998 had exceeded U.S. rates by 29 percent among males and 13 percent among women, had fallen to below U.S. levels in 2002–03. Also, the greater decline in France resulted

EXHIBIT 6
Age-Standardized Death Rates (SDRs) Per 100,000 Among Males And Females Ages 0–74, From Selected Causes In The United States, United Kingdom, And France, 1998 And 2002 or 2003

	Males								
	United States			United Kingdom			France		
Disease	1998	2002	Ratio	1998	2003	Ratio	1998	2003	Ratio
All amenable	128.51	123.36	0.96	148.62	116.62	0.78	85.87	72.62	0.85
Infectious diseases	4.77	6.06	1.27	1.90	2.03	1.07	1.87	3.35	1.79
Neoplasms	17.06	16.22	0.95	19.12	17.18	0.90	17.36	16.38	0.94
Diabetes	1.93	2.09	1.08	0.70	0.65	0.93	0.56	0.69	1.23
IHD (50%)	48.69	47.78	0.98	63.05	46.28	0.73	20.35	16.79	0.83
Other circ. diseases	30.08	27.64	0.92	31.21	25.87	0.83	24.20	20.07	0.83
Resp. diseases	10.41	6.68	0.64	17.52	9.79	0.56	7.26	4.06	0.56
Surgical cond. and medical errors	8.38	8.09	0.96	7.37	7.21	0.98	4.64	4.82	1.04
Perinatal, maternal, and congenital cond.	6.56	8.23	1.26	5.82	5.44	0.93	7.71	4.19	0.54
Other[a]	0.63	0.58	0.92	1.93	2.16	1.12	1.92	2.28	1.19
	Females								
All amenable	101.59	96.41	0.95	111.93	89.64	0.80	65.89	57.40	0.87
Infectious diseases	3.78	5.05	1.34	1.43	1.53	1.08	0.89	1.80	2.02
Neoplasms	35.19	31.73	0.90	40.75	35.29	0.87	34.85	31.86	0.91
Diabetes	1.31	1.37	1.05	0.36	0.38	1.05	0.25	0.34	1.35
IHD (50%)	19.95	19.48	0.98	22.60	15.44	0.68	4.83	3.75	0.78
Other circ. diseases	22.50	20.74	0.92	23.88	19.56	0.82	13.26	10.97	0.83
Resp. diseases	6.51	4.46	0.69	11.83	6.48	0.55	2.88	1.58	0.55
Surgical cond. and medical errors	7.11	6.83	0.96	5.89	6.20	1.05	4.18	3.96	0.95
Perinatal, maternal, and congenital cond.	4.68	6.21	1.33	4.04	3.45	0.85	3.65	1.91	0.52
Other[a]	0.57	0.55	0.97	1.15	1.33	1.16	1.10	1.23	1.12

SOURCE: Authors' calculations based on data from the World Health Organization mortality database.

NOTE: IHD is ischemic heart disease.

[a] Thyroid disease, epilepsy.

in 2002–03 U.S. rates' exceeding French rates by a factor of three (men) to five (women).

Discussion

This analysis of mortality from causes potentially avoidable through timely and effective health care in nineteen industrialized countries found a clear decline in these deaths between 1997–98 and 2002–03 in all of the countries studied, although the scale and pace of change varied. The largest reductions were seen in countries with the highest initial levels, including Portugal, Finland, Ireland, and the United Kingdom, but also in some countries that had been performing better, such as Australia and Italy. In contrast, the United States also started from a relatively high amenable mortality level but experienced smaller reductions.

■ **Potential data problems.** Any analysis that involves comparing aggregate data across countries must consider potential data problems. Before discussing our findings, it is therefore necessary to explore some of the limitations.

The concept of amenable mortality. It is important to recognize that the development of any list of indicators of amenable mortality involves a degree of judgment, as a death from any cause is typically the final event in a complex chain of processes that include issues related to underlying social and economic factors, lifestyles, and preventive and curative health care. As a consequence, interpretation of findings requires an understanding of the natural history and scope for prevention and treatment of the condition in question. Thus, in the case of IHD, we find accumulating evidence that suggests that advances in health care have contributed to declining mortality from this condition in many countries, yet it is equally clear that large international differences in mortality predated the advent of effective health care, reflecting factors such as diet and rates of smoking and physical activity.[16] To account for this variation, we included only half of the mortality from IHD, although, based on the available evidence, figures between, say, 25 percent and 70 percent would be equally justifiable. A similar case could of course be made for mortality from cerebrovascular disease, although evidence points to a potentially greater impact of health care on stroke mortality compared with IHD, in terms of both increasing survival after stroke and reducing incidence, by means of better treatment of high blood pressure.[17] We chose to not apply a relative weight to this cause of death to maintain comparability with the earlier analysis this paper seeks to update.[18] Also, we do not believe that the underlying evidence is sufficiently sound to enable assessment of the precise impact of particular interventions on some conditions at this stage, given the multifactorial nature of most outcomes and the phases involved in developing the actual condition.

The categorization of a condition as amenable is essentially based on a judgment about the effectiveness of different interventions that might prevent death. Amenable conditions are those from which it is reasonable to expect death to be averted even after the condition develops. This includes causes such as appendicitis and hypertension, where the medical nature of the intervention is apparent; it also includes causes of deaths susceptible to secondary prevention through early detection and effective treatment, such as cancer of the cervix uteri, for which effective screening programs exist, and tuberculosis, where, although the acquisition of disease is largely driven by socioeconomic conditions, timely treatment is effective in preventing death.

The list of conditions considered "amenable" in this analysis is based on a comprehensive review of earlier work, which has, in different variations, been used widely.[19] Certainly, what is considered amenable to health care will change over time as new pharmaceuticals and management strategies are developed. Thus, testicular cancer is now largely curable, although the extent to which this is achieved by different health care systems varies.[20]

One further issue is the choice of an upper age limit. We included deaths only up to age seventy-five, although it is also clear that advances in medical care are making an increasingly large contribution to survival of people at older ages. Conversely, there remains uncertainty about the validity of death certification at these ages in many countries, not least because of the problems created by the frequent existence of multiple comorbidities.

Data quality. Observed differences in mortality from selected conditions, including those considered amenable to health care, may be attributable in part to differences in diagnostic patterns, death certification, or coding of cause of death.[21] This problem is common to all analyses that employ geographical or temporal analyses, or both, of mortality data.[22] An evaluation of cause-of-death statistics in the European Union found the quality and comparability of cardiovascular and respiratory death reporting across the region to be sufficiently valid for epidemiological purposes.[23] Problems that were identified were insufficient to explain observed variations in mortality from selected causes of cardiovascular or respiratory death.

One obvious challenge arises from the periodic revisions of the ICD. Eight countries included in this analysis moved from ICD-9 to ICD-10 during the period under consideration; three of them (Austria, Portugal, and the United Kingdom) showed particularly large declines in amenable mortality—more than 15 percent—between 1997–98 and 2002–03. Considerable reductions were also observed for Canada, France, New Zealand, and Spain. However, the United States was also one of the countries that changed from ICD-9 to ICD-10, but, as already noted, observed U.S. declines were much less rapid.

The consequences of the move from ICD-9 to ICD-10 have been analyzed in some detail in the United States and the United Kingdom (England and Wales), demonstrating an impact on reported numbers of death from cerebrovascular disease (net increase of 6 percent and 9–13 percent) and pneumonia (net "decline" of 30–35 percent in both countries).[24] These changes have been attributed to changes in the rules that determine direct sequelae (Rule 3), and the observed increases in cerebrovascular disease have been interpreted as the consequence of a redistribution of deaths from pneumonia.[25] However, no substantial changes were observed for IHD in either country.

Although we cannot exclude entirely the possibility that the introduction of ICD-10 during the study period might have led to an overestimation of observed declines in amenable mortality in some countries, we believe this impact to be small. This is mainly because some countries that did not undergo a change in ICD, such as Finland, Ireland, and Greece, recorded reductions in amenable mortality that were of a similar scale. Furthermore, Austria and Portugal also experienced large declines in total mortality (not shown), which cannot have been affected by changes in ICD. Also, we combined single causes and cause groups, so any redistribution of amenable deaths between categories will have been captured in our analysis. Finally, analyses from England and Wales demonstrated that ob-

served changes following the introduction of ICD-10 were more likely to occur at age seventy-five and older, which were not included here, thereby further minimizing any effect from possible variation in certification and coding practices.[26]

■ **Interpretation.** By 2002–03 the United States had among the highest death rates from causes amenable to health care of the countries studied, for both males and females. From the preceding discussion of potential limitations, it does not seem plausible to dismiss the comparatively poor performance of the U.S. health care system as an artefact of the data.

The rate of amenable mortality is a valuable indicator of health care system performance, although it is important to note that the underlying concept should not be mistaken as definitive evidence of differences in effectiveness of health care but rather as a an indicator of potential weaknesses in health care that can then be investigated in more depth.[27] At the same time, the findings presented here are consistent with other cross-national analyses, demonstrating the relative underperformance of the U.S. health care system in several key indicators compared with other industrialized countries.[28] The underlying reasons for the observed lack in progress in the United States as a whole are likely to be manifold; however, it is equally clear that an aggregate national figure of amenable mortality as presented here will inevitably conceal large variations in terms of geography, race, and insurance coverage, among many other factors. This was recently demonstrated in the State Scorecard on Health System Performance, which revealed a twofold difference across the fifty states and District of Columbia on the measure of amenable mortality in 2002.[29] It also estimated that if all states achieved levels seen in the best-performing state on this measure, about 90,000 premature deaths might be avoided annually. However, this figure still falls short of the 101,000 deaths that could be avoided if the United States were to achieve levels of amenable mortality seen in the three top-performing countries.

Of course, as indicated above, any further interpretation of such information needs to go beyond the aggregate figure at the subnational level if these findings are to inform policy. The concept of amenable mortality captures the potential impact of health care on population health only; thus, assessment of overall health system performance also requires analyses of indicators that measure the relative success of policies outside the direct control of the health care sector that also affect the public's health, such as tobacco and alcohol policies.[30] Although such an analysis would enrich the picture painted here, it clearly goes beyond the scope of this paper. Even in the absence of such an analysis, it is important to highlight the comparatively slow U.S. progress in reducing mortality from IHD and other circulatory diseases, largely stroke. Further interpretation of these observations must remain speculative. It is, however, difficult to disregard the observation that the slow decline in U.S. amenable mortality has coincided with an increase in the uninsured population, an issue that is now receiving renewed attention in several states and among potential presidential candidates from both parties.[31]

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NOTES

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8. Nolte and McKee, *Does Healthcare Save Lives?* The causes of death considered amenable to health care were as follows. For ages 0–14: intestinal infections, whooping cough, measles (1–14), and all respiratory diseases except pneumonia and influenza (1–14). For ages 0–44: malignant neoplasm of cervix uteri and body of cervix, leukemia, and diabetes (0–49). For ages 0–74: tuberculosis; other infections (diphtheria, tetanus, septicemia, and poliomyelitis); malignant neoplasm of colon and rectum, skin, breast, cervix uteri, and testis; Hodgkin's disease; diseases of the thyroid; epilepsy; chronic rheumatic heart disease; hypertensive disease; ischemic heart disease (half of deaths); cerebrovascular disease; influenza; pneumonia; peptic ulcer; appendicitis; abdominal hernia; cholelithiasis and cholecystitis; nephritis and nephrosis; benign prostatic hyperplasia; misadventures to patients; maternal death; congenital cardiovascular anomalies; and perinatal deaths, all causes, except stillbirths. A table containing these causes of death, along with their ICD-9 and ICD-10 codes, is available as an online appendix at http://content.healthaffairs.org/cgi/content/full/27/1/58/DC1.
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25. This can be seen in the data used in this analysis: In 1998, deaths from cerebrovascular disease (under age seventy-five) accounted for 25 percent of all amenable deaths in that age group among U.S. males (England and Wales: 34 percent), and pneumonia accounted for 13 percent (England and Wales: 21 percent). In 2002, the corresponding proportions were 23 percent (33 percent) and 8 percent (14 percent). This implies that part of the observed declines in amenable mortality in these countries might be attributable to the introduction of ICD-10.
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