

# Health Spending In OECD Countries: Obtaining Value Per Dollar

There is still scant evidence that the United States gets better value for its higher health care spending.

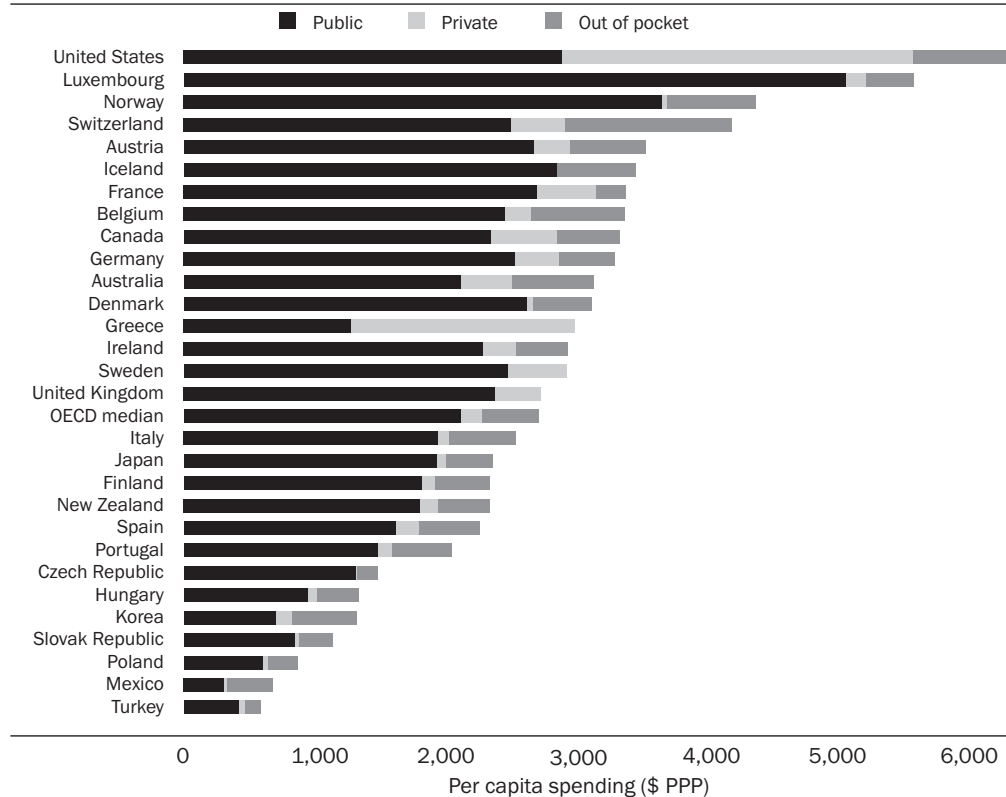
by **Gerard F. Anderson and Bianca K. Frogner**

**ABSTRACT:** In 2005 the United States spent \$6,401 per capita on health care—more than double the per capita spending in the median Organization for Economic Cooperation and Development (OECD) country. Between 1970 and 2005, the United States had the largest increase (8.3 percent) in the percentage of gross domestic product (GDP) devoted to health care among all OECD countries. Despite having the third-highest level of spending from public sources, public insurance covered only 26.2 percent of the U.S. population in 2005. The United States was equally likely to be in the top and bottom halves for sixteen quality measures compiled by the OECD. [*Health Affairs* 27, no. 6 (2008): 1718–1727; 10.1377/hlthaff.27.6.1718]

**I**N 2005, U.S. PER CAPITA SPENDING ON HEALTH CARE was greater than that of any other country, according to data published by the Organization for Economic Cooperation and Development (OECD).<sup>1</sup> The United States spent \$6,401 per capita on health care in 2005—more than double the median per capita expenditure (\$2,922) of the thirty industrialized countries that form the Organization for Economic Cooperation and Development (OECD) (Exhibit 1). The United States also spent the highest percentage of its gross domestic product (GDP) on health care (15.3 percent) compared to the OECD median of 9.1 percent (Exhibit 2). The country with the second-highest percentage of GDP devoted to health care was Switzerland (11.6 percent).

In previous papers, we examined numerous hypotheses that could explain why the United States has higher health spending per capita and dedicates the largest share of its overall economy to health care. Topics have included administrative complexity, aging of the population, threat of malpractice litigation, defensive medicine, waiting lists, chronic disease burden, supply and utilization rates, access to care, and resource allocation.<sup>2</sup> The papers have also examined investment

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**EXHIBIT 1****Public, Private, And Out-Of-Pocket Per Capita Spending In Thirty Organization For Economic Cooperation And Development (OECD) Countries, 2005**

**SOURCE:** Organization for Economic Cooperation and Development, *OECD Health Data, 2007* (Paris: OECD, 2007).

**NOTES:** Data for Australia, Hungary, and Japan are from 2004. PPP is purchasing power parity.

levels in health information technology (IT) that would make health care delivery more efficient and eventually could lead to lower spending and improved health outcomes.<sup>3</sup> Other papers have compared health outcomes.<sup>4</sup>

Our previous work has consistently shown that the United States has lower utilization rates than most other OECD countries (for example, numbers of hospital days and physician visits per capita). In addition, the supply of many medical services (hospital beds per capita) and expensive technologies such as magnetic resonance imaging (MRI) units and computed tomography (CT) scanners is lower in the United States than in many other OECD countries (Exhibit 2).<sup>5</sup> In each of these papers, we have returned to the conclusion that much of the spending differences are attributable to the higher per capita income of the United States and the fact that Americans pay much higher prices for medical care services (“It’s the Prices, Stupid”).<sup>6</sup>

In this paper we return to an issue that we examined several years ago: the re-

**EXHIBIT 2**  
**Selected Health Statistics For Countries In The Organization For Economic Cooperation And Development (OECD), 2005**

Country	Health care spending			Supply	Utilization
	Percent of GDP	Change (percentage points) in share of GDP, 1970–2005	Real average annual growth rate, 1970–2005 (%)	Acute care beds (per 1,000)	Inpatient acute care bed days (per capita)
Australia (AU)	9.5 <sup>a</sup>	4.5 <sup>b</sup>	3.5 <sup>c</sup>	3.6 <sup>a</sup>	1.0 <sup>a</sup>
Austria (AT)	10.2	5.0	4.3	6.1	1.8
Belgium (BE)	10.3	6.4	5.0	4.4	1.2 <sup>d</sup>
Canada (CA)	9.8	2.9	3.0	2.9 <sup>a</sup>	0.9 <sup>a</sup>
Czech Republic (CZ)	7.2	– <sup>e</sup>	– <sup>e</sup>	5.7	1.7
Denmark (DK)	9.1	1.2 <sup>b</sup>	2.3 <sup>f</sup>	3.1 <sup>a</sup>	– <sup>e</sup>
Finland (FI)	7.5	2.0	3.4	2.9	0.9
France (FR)	11.1	5.7	4.1	3.7	1.0
Germany (DE)	10.7	4.7	3.2	6.4	1.8
Greece (GR)	10.1	4.7	4.4	3.8 <sup>a</sup>	– <sup>e</sup>
Hungary (HU)	8.1 <sup>a</sup>	– <sup>e</sup>	– <sup>e</sup>	5.5	1.6
Iceland (IS)	9.5	4.8	4.9	– <sup>e</sup>	– <sup>e</sup>
Ireland (IE)	7.5	2.4	5.3	2.8	0.9
Italy (IT)	8.9	– <sup>e</sup>	– <sup>e</sup>	3.3	0.9 <sup>a</sup>
Japan (JP)	8.0 <sup>a</sup>	3.4 <sup>c</sup>	4.1 <sup>c</sup>	8.2	2.1
Korea (KR)	6.0	– <sup>e</sup>	– <sup>e</sup>	6.5	– <sup>e</sup>
Luxembourg (LX)	7.9	4.8	5.9	5.2	1.3
Mexico (MX)	6.4	– <sup>e</sup>	– <sup>e</sup>	1.0	0.4
Netherlands (NL)	9.2 <sup>a</sup>	2.3 <sup>g</sup>	2.8 <sup>g</sup>	3.1	0.7
New Zealand (NZ)	9.0	3.8	2.9	– <sup>e</sup>	– <sup>e</sup>
Norway (NO)	9.1	4.7	5.1	3.0	0.9
Poland (PL)	6.2	– <sup>e</sup>	– <sup>e</sup>	4.7	– <sup>e</sup>
Portugal (PT)	10.2	7.7	6.8	3.0	0.8
Slovak Republic (SK)	7.1	– <sup>e</sup>	– <sup>e</sup>	5.0	1.2
Spain (ES)	8.3	4.8	4.9	2.6 <sup>a</sup>	0.8 <sup>a</sup>
Sweden (SE)	9.1	2.3	2.6	2.2	– <sup>e</sup>
Switzerland (CH)	11.6	6.2	3.1	3.6	1.1
Turkey (TR)	7.6	– <sup>e</sup>	– <sup>e</sup>	2.0	– <sup>e</sup>
United Kingdom (UK)	8.3	3.8	3.9	3.1	0.9
United States (US)	15.3	8.3	4.4	2.7	0.7
OECD median	9.1	4.7	4.1	3.5	1.0

**SOURCE:** Organization for Economic Cooperation and Development, *OECD Health Data, 2007* (Paris: OECD, 2007).

**NOTE:** Country abbreviations are used in Exhibit 3.

<sup>a</sup>2004.

<sup>b</sup>1971–2004.

<sup>c</sup>1970–2004.

<sup>d</sup>2003.

<sup>e</sup>Data not available for 2003–2005.

<sup>f</sup>1971–2005.

<sup>g</sup>1972–2004.

turn on investment in health care. We begin with a crude measure of outcomes—life expectancy—to examine which countries have better-than-expected longevity, given their level of health care spending and controlling for their per capita income. We then take a closer look at how the United States compares to other

OECD countries on sixteen different process and outcome measures collected by the OECD.

## Health Spending Growth In 2005

The Congressional Budget Office (CBO), Federal Reserve Bank, and other government agencies are forecasting that the percentage of GDP spent on health in the United States will continue to increase, and some policymakers are forecasting serious economic implications if this percentage exceeds certain thresholds.<sup>7</sup> One concern is that all of the real growth in the economy will be devoted to health care once the percentage of GDP spent on health exceeds a certain threshold.<sup>8</sup> These forecasts are based on the realization that the percentage of GDP spent on health care in the United States between 1970 and 2005 increased approximately 2.5 percentage points faster than the overall growth rate of the economy as measured by the GDP, in spite of numerous efforts to control health spending. The percentage increased steadily: 7.0 percent in 1970, 8.8 percent in 1980, 11.9 percent in 1990, 13.2 percent in 2000, and 15.3 percent in 2005.

Between 1970 and 2005, the percentage of GDP devoted to health care increased 8.3 percentage points (from 7.0 percent to 15.3 percent). This was the largest increase in the percentage of GDP spent on health care during this time period among all thirty OECD countries. For example, Canada spent approximately the same percentage of GDP on health care as the United States in 1970 (6.9 percent versus 7.0 percent) but in 2005 spent only 9.8 percent. Denmark actually spent a greater percentage of its GDP on health care in 1970 than the United States (7.9 percent versus 7.0 percent) but now spends only 9.1 percent. In 2005, the median OECD country spent 9.1 percent of its GDP on health care, and only seven other countries spent more than 10 percent (Exhibit 2).<sup>9</sup> This raises the concern over opportunity costs: as more resources are devoted to health care, fewer resources are left to be spent on other goods and services.

## Public, Private, And Out-Of-Pocket Revenues

In most OECD countries, more than 75 percent of health revenues were from public sources in 2005 (Exhibit 1).<sup>10</sup> Only the United States, Mexico, and Greece had less than half of their revenues coming from public sources. However, in absolute-dollar terms, a different picture emerges. Adjusting for purchasing power parity (PPP), the United States spent \$2,884 from public sources. Only Luxembourg and Norway spent more public dollars per capita than the United States, and these countries were able to cover their entire populations using public funds. In the United States, only 26.2 percent of the population was covered by public insurance in 2005.<sup>11</sup>

Although in most other OECD countries, private health insurance represents a small proportion of total health revenues, in the United States private insurance accounted for almost the same percentage of health care revenues (45.1 percent) as

*“Out-of-pocket spending in the United States was about twice the OECD median in 2005.”*

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public insurance (41.8 percent) in 2005 (Exhibit 1). The United States spent \$2,675 per person on private health insurance in 2005, compared to only \$162 per capita spent by the median OECD country. Greece spent the second-highest amount on private insurance: \$1,703 per capita.

Out-of-pocket spending is often identified as a way to reduce moral hazard.<sup>12</sup> It is also a measure of underinsurance. Out-of-pocket spending in the United States was about twice the OECD median in 2005. Switzerland had the highest out-of-pocket spending per capita (\$1,276), with the United States second (\$842).

### **Value Per Dollar Spent**

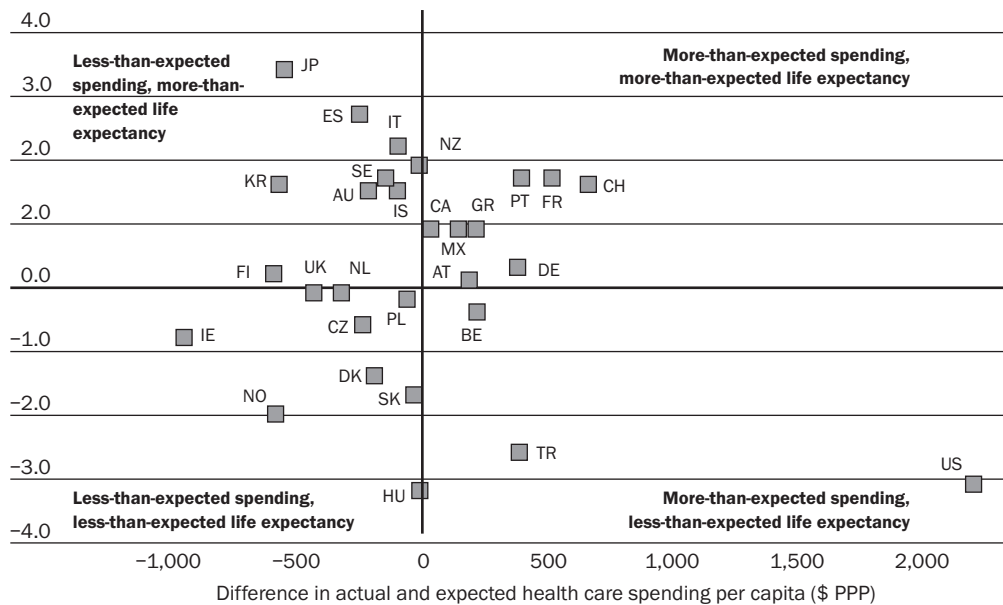
A number of recent studies have compared health care quality, on both process and outcome measures, in the United States with that of other countries.<sup>13</sup> One question these studies are trying to answer is whether the United States is obtaining value for its higher level of health spending. Their consistent finding is that despite the higher spending, the United States scored average or slightly worse than average on many quality-of-care indicators compared to other industrialized countries. Perhaps even more troubling is that improvements in health status are occurring at a lower rate than in most other OECD countries.<sup>14</sup>

We chose one commonly used indicator of health care quality—life expectancy—and attempted to see which countries were receiving the greatest value per dollar spent. We plotted the difference between the actual average life expectancy in a country and the predicted average life expectancy based on a bivariate regression of life expectancy and GDP per capita (measured in PPP; Exhibit 3).<sup>15</sup> For example, actual U.S. life expectancy for 2005 was 77.8 years, and predicted life expectancy based solely on the U.S. per capita income was 80.9 years. The difference in the two numbers (3.1 years) is plotted in Exhibit 3. On the horizontal axis, we plotted the difference between actual average health care spending per capita and predicted spending based on a similar bivariate regression of per capita spending on per capita GDP, adjusted for differences in cost of living.<sup>16</sup> For example, actual U.S. per capita health spending was \$6,401, and predicted health spending based solely on per capita income was \$4,204 in 2005.

Exhibit 3 shows four quadrants.<sup>17</sup> The upper-left-hand quadrant is where the country spent less than predicted on health care and yet had better-than-expected length of life. Japan, the country with the highest life expectancy among all OECD countries, had the largest gap between actual and expected life-years (3.5). Spain and Italy also had better-than-expected life expectancy and lower-than-expected per capita spending. The lower-right-hand quadrant is where a country spends more than expected on health care yet has worse-than-expected

**EXHIBIT 3****Difference Between Actual And Expected Health Care Spending Per Capita And Actual And Expected Life Expectancy In Organization For Economic Cooperation And Development (OECD) Countries, 2005**

Difference in actual and expected life expectancy (years)

**SOURCE:** Organization for Economic Cooperation and Development, *OECD Health Data, 2007* (Paris: OECD, 2007).**NOTES:** Regression equation for expected health spending is  $y = 0.1174x - 706.35$  with  $R^2 = 0.79$ , where  $y$  is health care spending per capita (\$ purchasing power parity, or PPP) in 2005 and  $x$  is gross domestic product (GDP) per capita (\$ PPP) in 2005. Regression equation for expected life expectancy is  $y = 0.0002x - 72.503$  with  $R^2 = 0.57$ , where  $y$  is life expectancy in years in 2005 and  $x$  is GDP per capita (\$ PPP) in 2005. For details, see Notes 15, 16, and 18 in text. For Australia, Hungary, Japan, and the Netherlands, health spending data for 2004 are used. For Canada and the United States, life expectancy data for 2004 are used. Country abbreviations are spelled out in Exhibit 2. Luxembourg (LX) is omitted from this analysis.

life expectancy. The United States is a clear outlier, with the largest spending gap of any country and the largest differences in life expectancy. Only Turkey and Belgium joined the United States in the lower-right-hand quadrant.<sup>18</sup>

The relationship between life expectancy and health spending is admittedly a crude analysis of value per health care dollar.<sup>19</sup> Many other factors influence life expectancy, and life expectancy is only one measure of health status. An extensive literature has further explored other determinants of life expectancy. For example, Ellen Nolte and Martin McKee showed that the United States had the most lives (75,000–101,000 fewer deaths per year) to gain compared to eighteen other industrialized countries by treating preventable diseases with “timely and efficient health care.”<sup>20</sup> A study by Ken Thorpe and colleagues concluded that the United States could reduce health spending by reducing “treated prevalence” rates—the product of the prevalence rate of chronic diseases and medication use for conditions—for which the United States is significantly higher compared to European countries.<sup>21</sup> Other nonmedical factors (such as social solidarity, income distribu-

tion, and job loss) also could affect life expectancy and the value of health spending. Other analyses have examined whether the type of health system influences health outcomes. For example, Eddy van Doorslaer and colleagues found no significant differences between health systems and equity (an alternative quality measure) in the delivery of health care, although the United States and United Kingdom were notable outliers.<sup>22</sup>

## Quality Comparisons

In 2001 the OECD began a process to collect comparable data on risk, process, and outcome indicators for as many of the thirty OECD countries as possible.<sup>23</sup> The methodology was loosely based on the methodology created in a five-country comparison of outcomes.<sup>24</sup> The most recent list includes nineteen measures for which comparable data were available for measures chosen for their impact on health status, policy importance, how likely they are to be influenced by the health care system, face and content validity, and reliability.<sup>25</sup> In spite of considerable work by analysts from the various countries, the indicators remain a convenience sample, and many areas in medical care are not represented.

The United States submitted data on all but three indicators, and more are in progress with the cooperation of the Agency for Healthcare Research and Quality (AHRQ) Prevention Quality Indicator project.<sup>26</sup> Although the results are dependent on the number of countries reporting and which countries report, the results suggest the United States is not receiving good value for a country that spends more than any other OECD country (Exhibit 4). Overall, the United States is about as likely to be in the top half as in the bottom half of the countries submitting data.

For some indicators the United States ranked at or near the top. For example, it ranked highest on cervical cancer screening and second on relative survival rates for breast and colorectal cancer. For some vaccination measures the United States scored high (lowest incidence of measles), but on other measures it did relatively poorly (pertussis vaccinations for two-year-old children). On the two avoidable risk measures, the United States ranked high on one indicator (the second-lowest percentage of smokers among the total population) but had one of the highest asthma admission rates per 100,000 discharges.<sup>27</sup> The latter is deemed a sign of lack of access to appropriate medical care, because hospitalization resulting from asthma is considered to be avoidable with appropriate medical care.

## Conclusion

In 2005 the United States continued to spend much more on health care than any other OECD country. In spite of myriad cost containment initiatives during the past thirty-five years, the annual rate of increase in real U.S. health care spending is slightly above the average annual rate of increase in the median OECD country. And the United States experienced the largest increase in the percentage of its

**EXHIBIT 4**  
**Rank Of United States Out Of Total Number Of Organization For Economic Cooperation And Development (OECD) Countries' Most Recent Reporting Of Selected Health Care Quality Indicators**

	U.S. rank	Total number of countries reporting
Avoidable risk indicators		
Smoking rate (percent of total population)	2 <sup>a</sup>	29
Asthma admission rate (discharges per 10,000 age 18 and older)	16 <sup>b</sup>	17
Process indicators		
Cervical cancer screening rate (percent of women ages 20–69 screened)	1 <sup>c</sup>	22
Retinal exams in diabetics (rate per 100 for diabetics ages 18–75)	5 <sup>b</sup>	12
Influenza vaccination (percent over age 65 offered vaccination)	9 <sup>a</sup>	23
Mammography screening rate (percent of women ages 50–69 screened)	12 <sup>c</sup>	23
Coverage for basic vaccination program (percent fully immunized at age 2)		
Overall	8 <sup>d</sup>	11
Hepatitis	9 <sup>d</sup>	14
Measles	15 <sup>d</sup>	24
Pertussis	23 <sup>d</sup>	24
Outcome indicators		
Cervical cancer five-year survival rate		
Relative survival rate (crude rate)	8 <sup>e</sup>	18
Observed survival rate (crude rate)	9 <sup>e</sup>	19
Breast cancer five-year survival rate		
Relative survival rate (crude rate)	2 <sup>e</sup>	18
Observed survival rate (crude rate)	5 <sup>e</sup>	19
Colorectal cancer five-year survival rate		
Relative survival rate (crude rate)	2 <sup>e</sup>	18
Observed survival rate (crude rate)	5 <sup>e</sup>	20
Asthma mortality rate, per 100,000 ages 5–39		
Incidence of vaccine-preventable diseases per 100,000	21 <sup>c</sup>	25
Measles	1 <sup>d</sup>	23
Pertussis	14 <sup>d</sup>	21
Hepatitis	15 <sup>d</sup>	23

**SOURCE:** S.G. Armesto et al., "Health Care Quality Indicators Project 2006 Data Collection Update Report," OECD Health Working Papers no. 29, 2007, <http://www.oecd.org/dataoecd/57/22/39447928.pdf> (accessed 3 November 2007).

**NOTES:** Relative survival rate numerator is the observed rate of women diagnosed with cancer surviving five years after diagnosis, and denominator is the expected survival rate of a comparable group from the general population. Observed survival rate numerator is the number of people diagnosed with cancer surviving five years after diagnosis, and denominator is the number of people with cancer.

<sup>a</sup>2005.

<sup>b</sup>2002.

<sup>c</sup>2003.

<sup>d</sup>2004.

<sup>e</sup>1998–2002.

GDP dedicated to health care among all OECD countries during 1970–2005. What does the country have to show for this higher level of spending? U.S. life expectancy is lower than would be predicted based on U.S. per capita income. The United States is just as likely to be in the bottom or top half on a series of health indicators. The value per dollar for health care in the United States is further complicated by limitations in access to care; the country is not able to provide univer-



sal insurance coverage, despite its high levels of private and public spending per capita. Health reform efforts should focus on improving the value per dollar spent on health care, in addition to other reform goals of extending coverage to all and reducing unnecessary health care spending, so that Americans get the health care system they are already paying for.

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## NOTES

1. Organization for Economic Cooperation and Development, *OECD Health Data, 2007* (Paris: OECD, 2007). Total U.S. health care spending reported in the OECD data set is lower than reported in the National Health Expenditures Accounts collected by the Centers for Medicare and Medicaid Services, which includes spending on research and equipment.
2. G.F. Anderson, B.K. Frogner, and U.E. Reinhardt, "Health Spending in OECD Countries in 2004: An Update," *Health Affairs* 26, no. 5 (2007): 1481-1489; G.F. Anderson et al., "Health Spending in the United States and the Rest of the Industrialized World," *Health Affairs* 24, no. 4 (2005): 903-914; U.E. Reinhardt, P.S. Hussey, and G.F. Anderson, "U.S. Health Care Spending in an International Context," *Health Affairs* 23, no. 3 (2004): 10-25; G.F. Anderson et al., "It's the Prices, Stupid: Why the United States Is So Different from Other Countries," *Health Affairs* 22, no. 3 (2003): 89-105; U.E. Reinhardt, P.S. Hussey, and G.F. Anderson, "Cross-National Comparisons of Health Systems Using OECD Data, 1999," *Health Affairs* 21, no. 3 (2002): 169-181; G. Anderson and P.S. Hussey, "Comparing Health System Performance in OECD Countries," *Health Affairs* 20, no. 3 (2001): 219-232; G.F. Anderson et al., "Health Spending and Outcomes: Trends in OECD Countries, 1960-1998," *Health Affairs* 19, no. 3 (2000): 150-157; and G.F. Anderson and J.P. Poullier, "Health Spending, Access, and Outcomes: Trends in Industrialized Countries," *Health Affairs* 18, no. 3 (1999): 178-192.
3. G.F. Anderson et al., "Health Care Spending and Use of Information Technology in OECD Countries," *Health Affairs* 25, no. 3 (2006): 819-831.
4. P.S. Hussey et al., "How Does the Quality of Care Compare in Five Countries?" *Health Affairs* 23, no. 3 (2004): 89-99; J. Banks et al., "Disease and Disadvantage in the United States and in England," *Journal of the American Medical Association* 295, no. 17 (2006): 2037-2045; C. Schoen et al., "U.S. Health System Performance: A National Scorecard," *Health Affairs* 25, no. 6 (2006): w457-w475 (published online 20 September 2006; 10.1377/hlthaff.25.w457); D.T. Ko, "Regional Differences in Process of Care and Outcomes for Older Acute Myocardial Infarction Patients in the United States and Ontario, Canada," *Circulation* 115, no. ? (2007): 196-203; R. Smith-Bindman et al., "Comparison of Screening Mammography in the United States and the United Kingdom," *Journal of the American Medical Association* 290, no. 16 (2003): 2129-2137; M.J. Eisenberg et al., "Outcomes and Cost of Coronary Artery Bypass Graft Surgery in the United States and Canada," *Archives of Internal Medicine* 165, no. 13 (2005): 1506-1513; K.E. Thorpe, D.H. Howard, and K. Galactionova, "Differences in Disease Prevalence as a Source of the U.S.-European Health Care Spending Gap," *Health Affairs* 26, no. 6 (2007): w678-w686 (published online 2 October 2007; 10.1377/hlthaff.26.w678); and E. Nolte and C.M. McKee, "Measuring the Health of Nations: Updating an Earlier Analysis," *Health Affairs* 27, no. 1 (2008): 58-71.
5. In 2004 the United States had 32.2 CT scanners per million people. Australia had the most CT scanners (45.3 per million). In 2004 the United States had 26.6 MRI units per million people, but Japan had the most MRI scanners (40.1 per million) as of 2005. More recent data for the United States are not available.
6. Anderson et al., "It's the Prices, Stupid."
7. Peter R. Orszag, director, Congressional Budget Office, "Growth in Healthcare Costs," statement before the Committee on the Budget, United States Senate, 31 January 2008, <http://www.cbo.gov/ftpdocs/89xx/doc8948/01-31-Testimony.shtml> (accessed 26 August 2008); and Ben S. Bernanke, chairman, Federal Reserve, "Challenges for Health-Care Reform," speech at the Senate Finance Committee Health Reform Summit, Washington, D.C., 16 June 2008, <http://www.federalreserve.gov/newsevents/speech/bernanke20080616a.htm> (accessed 7 July 2008).
8. M.E. Chernew, R.A. Hirth, and D.M. Cutler, "Increased Spending on Health Care: How Much Can the United States Afford?" *Health Affairs* 22, no. 4 (2003): 15-25.

9. Austria, Belgium, France, Germany, Greece, Portugal, and Switzerland.
10. The exceptions are Mexico, which spent more out of pocket, and Greece, which spent more private funds.
11. OECD, *OECD Health Data*, 2007.
12. Moral hazard occurs when people with little cost sharing for insurance take greater risks because they are sheltered from the high costs of care. People with greater cost sharing or no insurance may take fewer risks because they would have to pay more up front if they sought care.
13. See Note 4.
14. Hussey et al., "How Does the Quality of Care Compare in Five Countries?"; Banks et al., "Disease and Disadvantage"; and Schoen et al., "U.S. Health System Performance."
15. Life expectancy =  $(0.0002 \times \text{GDP per capita}) + 72.503$  with  $R^2 = 0.57$ . GDP per capita is measured in purchasing power parity, or PPP. Luxembourg is excluded in the calculation. If it were included, life expectancy =  $(0.0001 \times \text{GDP per capita}) + 74.594$  with  $R^2 = 0.38$ , a loss of 19 percent of the variation explained due to one country. There are reasons to believe that the values for Luxembourg should be interpreted with caution, and we have traditionally left them out of the analysis.
16. Health expenditures =  $(0.1174 \times \text{GDP per capita}) - 706.35$  with  $R^2 = 0.79$ . Health expenditures and GDP per capita are measured in PPP. Luxembourg is excluded in the calculation. If it were included, health expenditures =  $(0.0978 \times \text{GDP per capita}) - 181.54$  with  $R^2 = 0.78$ —little loss in variation explained.
17. The clustering has a downward slope, indicating that as countries spend more than expected on health care per capita, the marginal return from additional investments in health care in terms of additional-than-expected years of life expectancy is minimal.
18. If Luxembourg is included in the expected value calculations, the United States is a clearer outlier and alone in this quadrant.
19. The pattern is similar if potential years of life lost (PYLL, an alternative measure of mortality that gives more weight to life lost at earlier ages) is used. Other alternative measures are not available in the OECD health data set.
20. Nolte and McKee, "Measuring the Health of Nations."
21. Thorpe et al., "Differences in Disease Prevalence."
22. E. van Doorslaer et al., "Equity in the Delivery of Health Care in Europe and the U.S.," *Journal of Health Economics* 19, no. 5 (2000): 553–583.
23. At least ten countries must report on the indicator for it to be included.
24. Hussey et al., "How Does the Quality of Care Compare in Five Countries?"
25. For more information about the project and data on other countries, see S.G. Armesto et al., "Health Care Quality Indicators Project 2006: Data Collection Update Report," OECD Health Working Papers no. 29, 2007, <http://www.oecd.org/dataoecd/57/22/39447928.pdf> (accessed 3 November 2007).
26. The United States did not submit information for three indicators: in-hospital mortality rate within thirty days of hospital admission for acute myocardial infarction, in-hospital mortality rate within thirty days of hospital admission for stroke, and in-hospital waiting times for surgery after hip fracture over age sixty-five.
27. The OECD admits that smoking rates are a less valid health system quality indicator; this is viewed as a work in progress until better indicators are discovered.