Analyzing Whether Countries Are Equally Efficient at Improving Longevity for Men and Women

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Objectives. We examined the efficiency of country-specific health care spending in improving life expectancies for men and women.

Methods. We estimated efficiencies of health care spending for 27 Organisation for Economic Co-operation and Development (OECD) countries during the period 1991 to 2007 using multivariable regression models, including country fixed-effects and controlling for time-varying levels of national social expenditures, economic development, and health behaviors.

Results. Findings indicated robust differences in health-spending efficiency. A 1% annual increase in health expenditures was associated with percent changes in life expectancy ranging from 0.020 in the United States (95% confidence interval [CI] = 0.008, 0.032) to 0.121 in Germany (95% CI = 0.099, 0.143). Health-spending increases were associated with greater life expectancy improvements for men than for women in nearly every OECD country.

Conclusions. This is the first study to our knowledge to estimate the effect of country-specific health expenditures on life expectancies of men and women. Future work understanding the determinants of these differences has the potential to improve the overall efficiency and equity of national health systems. (*Am J Public Health.* 2014;104:2163–2169. doi:10.2105/AJPH.2013.301494)

Growth in health expenditures has outpaced growth in gross domestic product (GDP) across countries in the Organisation for Economic Co-operation and Development (OECD) since the 1970s,[1] contributing, in some countries, to structural deficits and expanding national debts. In the United States, publicly-financed health care costs rose from $646 billion in 2001 to $1141 billion in 2009.[2] High rates of growth characterize most of the Group of Twenty leading economies, where health care spending continues to be a major contributor to public debt.[3] Combined with the fiscal constraints imposed by the recent economic downturn, the long-term debt situation is becoming unsustainable in some countries.[3,4] It is increasingly accepted that health care reform must be part of the solution for mitigating debt growth.

Proposals for reducing costs by increasing the efficiency of the health care system have been at the center of public discourse concerning health care reform. In previous research, the most accepted method for assessing health system efficiency has been to investigate the relation between health spending and life expectancy.[5,6] This notion of efficiency is predicated on the ability of nations to strategically finance their health systems to attain key health goals. As is common in the literature, efficiency is defined by the changes in life expectancy that result from variation in health expenditures.[7] International comparisons of health care efficiency allow researchers to identify stronger and weaker performers and may yield policies for improving health care efficiency.

Earlier studies that have examined health care efficiency among OECD countries demonstrated large international differences in spending, and unequal effectiveness of health interventions, suggesting that the productive efficiency of health systems may vary across nations.[5,8] However, prior work has not accounted for social expenditures across countries, which are associated with population health in the OECD.[9]

The identification of differential health-spending efficiencies across genders has been limited to the important contribution of Asiskovitch, who found that men gain more per dollar spent than women on average across the OECD.[7] Our study furthers this investigation by analyzing country-specific health expenditures. This is important because it addresses a fundamental question: is the gender disparity the same in every country? Answering this question provides insight into the extent to which they can be altered. Additionally, although Asiskovitch used health expenditures as percent of GDP, we analyze health expenditures per capita, in purchasing-power parity equivalent 2000 US dollars, to ensure international comparability, simultaneously avoiding fluctuations from inflation or exchange rates.

In this study, we estimated the relation between health expenditures and life expectancy in 27 OECD countries, using a health production model that controlled for social expenditures and overall levels of economic development. Furthermore, we assessed whether the efficiency of health care expenditures within countries varied for men and women. To the best of our knowledge, this study is the first to examine the efficiency of health expenditures in improving longevity of men and women in individual countries.

METHODS

We obtained the dependent variables, life expectancy at birth, at age 40 years, and at age 65 years, from the OECD's *Health Data 2010*,[10] and used them to capture the influence of health expenditures at different ages. Mortality is higher later in life, possibly increasing the potential for health expenditures to have an effect. Life expectancy at birth, however, is strongly affected by deaths in the first year of life, which again gives opportunity for health expenditures to influence longevity.

Independent Variables

The primary explanatory variable was national health expenditures per capita.[10] We

converted all currencies to purchasing power parity (PPP)-adjusted 2000 US dollars. Other covariates, specifically levels of social investment and economic development, were included to account for differences between countries that are critical to health outcomes. Social expenditure data for each nation were obtained from the 2007 OECD Social Expenditure Database. Social expenditures per capita include the sum of spending in the following social policy areas, used elsewhere in the literature[7,9]: old age, survivors, incapacity-related benefits, family, active-labor market programs, unemployment, housing, and other areas including noncategorical cash benefits to low-income households, and food subsidies.[11] Real gross domestic product (GDP) per capita was obtained from the OECD Statistical Extracts[12] and, similarly to previous work, was used to account for differences in levels of economic development between countries.[5,9]

Analyses Conducted

Our analytical objective was to assess the country-specific relation between total health expenditures per capita (TEH_{it-1}) and life expectancy (L_{it}), where i indexes country and t indexes year. Specifically, we estimated the country-specific effect of a 1% annual increase in health expenditures on the percent change in life expectancy, interpreted as an elasticity, by regressing the natural log of L_{it} on a vector of country dummy variables (α_i), a vector of cross-products between α_i and the natural log of TEH_{it-1}, the natural log of social expenditures ($SOCX_{it-1}$), and the natural log of GDP per capita (GDP_{it}):

$$(1)\quad lnL_{it} = \alpha_i + \beta_i(\alpha_i * lnTEH_{it-1}) + \gamma lnSOCX_{it-1} + \delta lnGDP_{it} + \varepsilon_{it}.$$

The coefficients, β_i, on the cross-product terms between α_i and $lnTEH_{it-1}$ represent the percent increase in life expectancy in country i associated with a 1% increase in health expenditures in the previous year, after accounting for time-invariant confounders that may vary between countries by including country fixed effects. The coefficient α_i, the country fixed effect, represents contributions to life expectancy by factors within a country that are external to money spent in the health care system, such as behavioral and demographic features of a population. We chose not to include year fixed effects because they imply a "natural" increase in life expectancy that occurs over time.[5,9] Rather, we controlled for potential confounding by time-varying social expenditures and levels of economic development, measured by GDP per capita.[13] Gender-specific associations between health expenditures and life expectancy were estimated by running separate models with male and female life expectancy as the dependent variable, similar to the work of Asiskovitch.[7] In all cases, efficiencies were estimated using ordinary least squares regressions with heteroscedasticity-consistent (White) standard errors.

Consistent with previous studies, data from Chile, Estonia, Hungary, Israel, Slovakia, Slovenia, and Turkey were omitted because of poor data quality, with many missing values, and limited comparability according to the OECD's notes on health-expenditure reporting consistency.[9,10] Our analyses are based on 453 country-year observations from a balanced panel of the 27 countries seen in Table 1, from 1991 to 2007.

Sensitivity Analyses

We performed additional analyses to assess the robustness of our main results. First, we controlled for GDP growth rate per year, in addition to GDP per capita and social expenditures. Second, although we omitted measures of population-age composition from our base specification because age structure is arguably a cause and effect of health care investments and economic development, we assessed whether controlling for the percentage of the population aged 65 years or older influenced results.[5] Third, we allowed for differential effects of social expenditures on life expectancy across countries by including cross-products representing the interaction between social expenditures and country fixed effects. Fourth, we included 4 measures of education (i.e., educational expenditures as a percentage of GDP, and percentage of population with tertiary, upper secondary, and primary education) to the base specification. Fifth, to test the possibility that health behaviors have time-varying effects that are not controlled for with country fixed effects, we included variables for smoking and alcohol-consumption behavior. Data were not available for enough country-years to include controls for overweight and obesity.

Lastly, although previous studies have also looked at data covering the years of the early 1990s and earlier, an argument can be made that health expenditures were not measured comparably across all OECD nations until the mid-1990s.[2] To account for this possibility, we ran an analysis on limited unbalanced panel that featured only country-years in which health expenditures were measured according to the OECD's System of Health Accounts (SHA).[14] This system, designed to foster international consistency in the reporting of expenditures, provides a common framework that defines a nation's total health expenditures as the sum of elements HC.1 to HC.9 in the International Classification for Health Accounts.

RESULTS

Through the 1990s and early 2000s, life expectancy increased by 2.76 months per year across the OECD, as health expenditures per capita increased by $68 per year (Table 1). Country specific elasticities, representing the percent change in life expectancy associated with a 1% increase in health expenditures, are shown in Table 2. Germany, Switzerland, Italy, Austria, New Zealand, Denmark, and France constituted the group of most efficient countries, with elasticities between 0.06 and 0.13. For these countries, a 1% increase in health expenditures was associated with a 0.06% to 0.13% increase in life expectancy at birth. Yet there were marked disparities in efficiency. Seven countries had coefficients between –0.005 and 0.020, including Greece, Luxembourg, Mexico, Ireland, Iceland, and the United States. Country rankings remained relatively similar with life expectancy at age 40 and 65 years as the dependent variables (Table 2).

Efficiency Disparities by Gender

We estimated the contribution of health expenditures to male and female life expectancy. First, for men and women, we calculated the predicted months in life expectancy gained from a 1% increase in health expenditures per capita, with 95% confidence intervals (CIs), based on the parameter estimates from gender-specific models (Table 2) and mean health expenditures and life expectancy (Figure 1). Increases in health expenditures were

TABLE 1—Summary Statistics: 1991-2007

	Total Health Expenditures Per Capita, US$			Non-Health Social Expenditures Per Capita, US$			Overall LE, Years			Female LE, Years			Male LE, Years		
Countries	Min	Max	Slope	Min	Max	Slope	Min	Max	Slope	Min	Max	Slope	Min	Max	Slope
Australia	1541	2776	73	2137	3675	90	77.4	81.4	0.24	80.4	83.7	0.19	74.4	79.0	0.27
Austria	2008	3314	77	4742	6606	110	75.7	80.3	0.27	79.1	83.1	0.24	72.3	77.4	0.30
Belgium	1749	3286	90	4386	5792	83	76.3	79.8	0.21	79.7	82.6	0.17	72.9	77.1	0.25
Canada	2164	3187	60	2896	3267	22	77.8	80.7	0.17	80.9	83.0	0.12	74.6	78.3	0.22
Czech Republic	636	1373	43	1493	2697	71	72.0	77.0	0.29	75.8	80.2	0.26	68.3	73.8	0.32
Denmark	1925	3074	68	5075	6459	81	75.2	78.4	0.19	77.8	80.7	0.17	72.5	76.2	0.22
Finland	1526	2571	61	4507	5916	83	75.4	79.5	0.24	79.5	83.1	0.21	71.4	76.0	0.27
France	1884	3024	67	4241	5814	93	77.0	80.9	0.23	81.1	84.4	0.19	72.9	77.4	0.26
Germany	2180	2946	48	4177	5407	72	75.5	80.0	0.26	78.8	82.7	0.23	72.2	77.4	0.31
Greece	1033	2316	75	1931	3689	103	77.2	79.6	0.14	79.6	82.0	0.14	74.7	77.1	0.14
Iceland	1900	3237	79	2373	4060	99	78.0	81.2	0.19	80.0	83.1	0.18	74.8	79.7	0.29
Ireland	1030	2762	102	1739	3813	122	75.1	79.8	0.28	77.9	82.2	0.25	72.3	77.4	0.30
Italy	1694	2378	40	3904	5249	79	77.1	81.5	0.26	80.4	84.2	0.22	73.8	78.7	0.29
Japan	1434	2301	51	1745	3695	115	79.1	82.6	0.21	82.1	86.0	0.23	76.1	79.2	0.18
Korea	454	1458	59	175	1071	53	71.8	79.4	0.45	75.9	82.7	0.40	67.7	76.1	0.49
Luxembourg	2083	3664	122	5899	9796	229	75.3	79.5	0.25	78.6	82.4	0.22	71.9	76.8	0.29
Mexico	400	648	15	137	506	22	71.4	75.0	0.21	74.2	77.4	0.19	68.5	72.6	0.24
Netherlands	1903	3183	75	4541	4839	18	77.0	80.2	0.19	80.0	82.3	0.14	74.0	78.0	0.24
New Zealand	1252	2195	55	2589	2847	15	75.8	80.2	0.26	78.7	82.2	0.21	72.9	78.2	0.31
Norway	2182	3721	91	5433	7386	115	77.1	80.5	0.20	80.1	82.7	0.15	74.0	78.2	0.25
Poland	408	901	29	1136	2155	60	70.7	75.4	0.28	75.3	79.7	0.26	66.1	71.0	0.29
Portugal	885	1759	55	1375	3005	96	74.1	79.1	0.29	77.7	82.3	0.27	70.5	75.9	0.32
Spain	1155	2044	52	2648	3756	65	77.1	81.1	0.24	80.8	84.4	0.21	73.5	77.8	0.25
Sweden	1837	2973	67	5723	7241	89	77.7	81.0	0.19	80.5	83.0	0.15	74.9	78.9	0.24
Switzerland	2647	3670	60	4419	6976	150	77.8	81.9	0.24	81.4	84.4	0.18	74.2	79.5	0.31
United Kingdom	1296	2571	75	2781	4362	93	75.9	79.7	0.22	78.7	81.8	0.18	73.1	77.6	0.26
United States	3598	6080	146	2646	3517	51	75.5	77.9	0.14	78.8	80.4	0.09	72.0	75.3	0.19
Mean	1585	2719	68	3143	4578	84	75.8	79.8	0.23	79.0	82.5	0.20	72.5	77.1	0.27

Note. LE = life expectancy (at birth). Canada data are not available for 1993. Slope is the change per year of the variable indicated in that country. Health expenditures and social expenditures are measured in purchasing power parity–adjusted 2000 US$ per capita.
Source. Social expenditure data were acquired from the 2007 Organisation for Economic Co-operation and Development (OECD) Social Expenditure Database; all other data are from the OECD Health Data 2010 file.

associated with a greater increase in life expectancy for men than women in nearly every country (Table 2), even after controlling for GDP and social expenditures.

Similarly, we calculated the months gained from a hypothetical $100 increase in total health expenditures per capita, for each year of the panel (Figure 2). Results pooled across OECD countries in our sample are derived from the OECD-pooled regression results (Table A, available as a supplement to the online version of this article at http://www.ajph.org). The OECD as a whole shows significantly better performance for men than for women, with a $100 per person per year increase yielding 2.62 (95% CI = 2.06, 3.17) average additional months of life expectancy at birth for men and 1.56 (95% CI = 1.13, 1.99) average additional months for women. Increases in health expenditures for men were associated with significantly greater life expectancy gains in Germany, Switzerland, Canada, the Netherlands, Belgium, and the United States. For example, a $100 per person per year increase in health expenditures was associated with an average additional 5.35 (95% CI = 4.45, 6.24) months of life expectancy at birth for German men, compared with 3.34 (95% CI = 2.64, 4.04) average additional months for German women. We confirmed the significance of the gender differences using the *z*-test of coefficient equivalence. Only Japan showed significantly greater gains for women than for men. Although the overall efficiency was better at higher ages, the gender disparity remained in tests of life expectancy at ages 40 and 65 years.

Sensitivity Analyses

Sensitivity analyses indicated results were robust to alternative model specifications (Table B, available as a supplement to the online version of this article at http://www.ajph.org).

TABLE 2—Regression Output With Country-Specific Health Expenditures

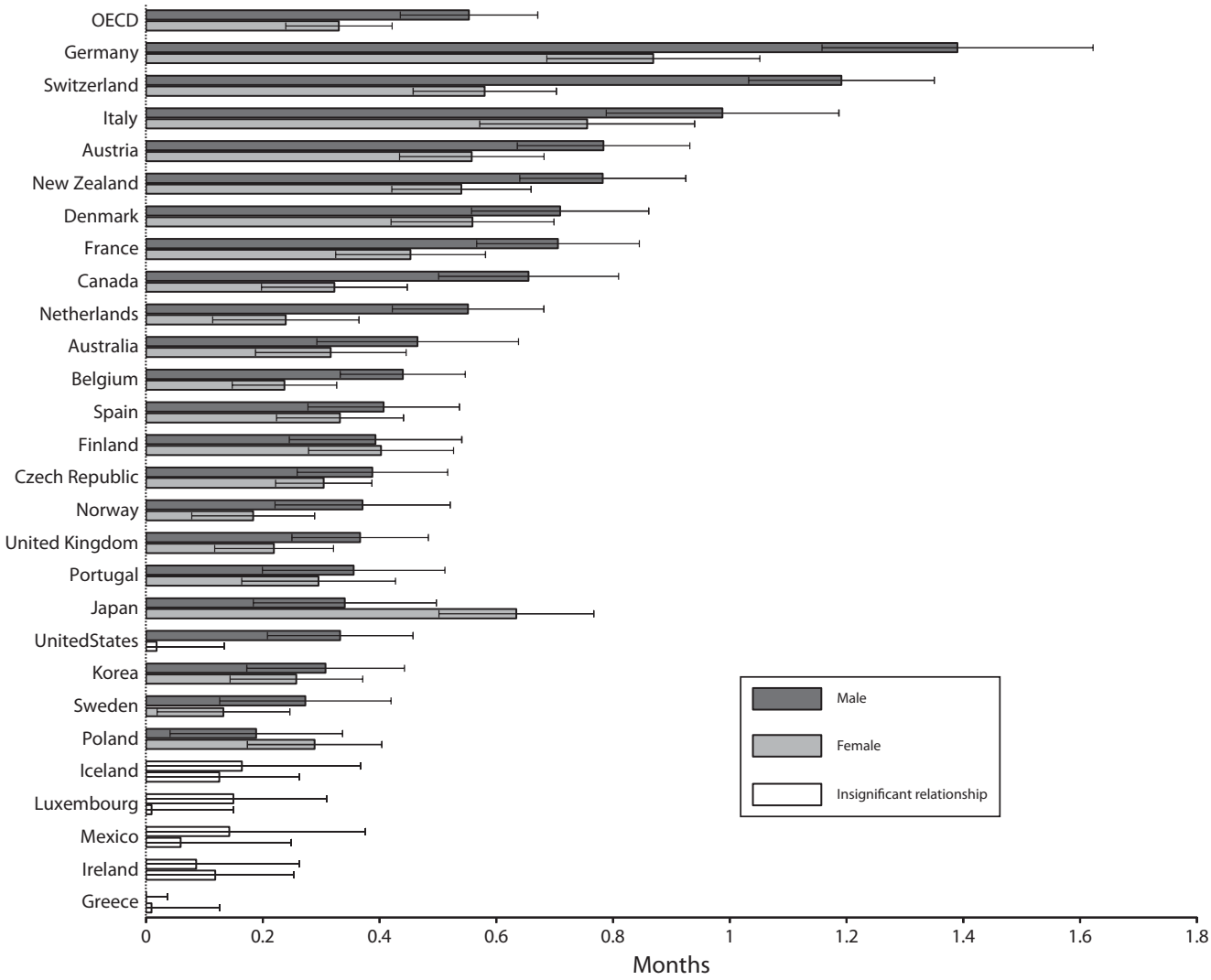
	Life Expectancy at Birth, b (SE)			Life Expectancy at Age 40 Years, b (SE)		Life Expectancy at Age 65 Years, b (SE)	
Dependent Variable	Overall (n = 426)	Female (n = 426)	Male (n = 426)	Female (n = 425)	Male (n = 425)	Female (n = 425)	Male (n = 425)
Social expenditures	0.020*** (0.004)	0.018*** (0.004)	0.022*** (0.005)	0.022*** (0.005)	0.020** (0.007)	0.033** (0.010)	0.030* (0.012)
GDP	0.044*** (0.008)	0.034*** (0.007)	0.055*** (0.010)	0.052*** (0.013)	0.094*** (0.016)	0.092*** (0.026)	0.137*** (0.031)
Countries							
Germany	0.121*** (0.011)	0.090*** (0.010)	0.155*** (0.013)	0.161*** (0.017)	0.272*** (0.023)	0.279*** (0.035)	0.490*** (0.049)
Switzerland	0.092*** (0.006)	0.058*** (0.006)	0.129*** (0.009)	0.095*** (0.012)	0.204*** (0.014)	0.174*** (0.024)	0.368*** (0.024)
Italy	0.092*** (0.010)	0.076*** (0.010)	0.108*** (0.011)	0.123*** (0.017)	0.176*** (0.019)	0.223*** (0.034)	0.295*** (0.037)
Austria	0.072*** (0.007)	0.057*** (0.007)	0.087*** (0.008)	0.103*** (0.011)	0.154*** (0.016)	0.187*** (0.022)	0.275*** (0.032)
New Zealand	0.069*** (0.007)	0.056*** (0.006)	0.086*** (0.008)	0.096*** (0.011)	0.143*** (0.013)	0.137*** (0.019)	0.267*** (0.022)
Denmark	0.069*** (0.008)	0.059*** (0.008)	0.080*** (0.009)	0.103*** (0.014)	0.143*** (0.014)	0.131*** (0.026)	0.280*** (0.026)
France	0.061*** (0.007)	0.046*** (0.007)	0.078*** (0.008)	0.072*** (0.012)	0.114*** (0.015)	0.126*** (0.024)	0.181*** (0.031)
Canada	0.051*** (0.007)	0.033*** (0.006)	0.072*** (0.009)	0.054*** (0.011)	0.117*** (0.015)	0.092*** (0.024)	0.229*** (0.028)
Japan	0.050*** (0.007)	0.063*** (0.007)	0.037*** (0.009)	0.128*** (0.010)	0.098*** (0.013)	0.264*** (0.020)	0.217*** (0.026)
Finland	0.043*** (0.007)	0.041*** (0.007)	0.044*** (0.009)	0.085*** (0.011)	0.091*** (0.014)	0.201*** (0.024)	0.231*** (0.028)
Netherlands	0.043*** (0.007)	0.025*** (0.007)	0.061*** (0.007)	0.042*** (0.012)	0.110*** (0.012)	0.081*** (0.022)	0.215*** (0.024)
Australia	0.040*** (0.008)	0.032*** (0.007)	0.051*** (0.010)	0.064*** (0.011)	0.101*** (0.014)	0.126*** (0.020)	0.214*** (0.026)
Czech Republic	0.039*** (0.006)	0.032*** (0.004)	0.045*** (0.008)	0.055*** (0.009)	0.090*** (0.013)	0.111*** (0.018)	0.150*** (0.022)
Spain	0.039*** (0.007)	0.033*** (0.006)	0.045*** (0.007)	0.052*** (0.010)	0.048*** (0.013)	0.103*** (0.023)	0.097*** (0.028)
Belgium	0.037*** (0.005)	0.024*** (0.005)	0.049*** (0.006)	0.038*** (0.009)	0.083*** (0.012)	0.075*** (0.020)	0.189*** (0.022)
Portugal	0.035*** (0.008)	0.031*** (0.007)	0.041*** (0.009)	0.049*** (0.011)	0.048*** (0.013)	0.095*** (0.021)	0.111*** (0.025)
United Kingdom	0.031*** (0.006)	0.023*** (0.005)	0.041*** (0.007)	0.053*** (0.009)	0.096*** (0.010)	0.097*** (0.021)	0.234*** (0.021)
Korea	0.031*** (0.007)	0.027*** (0.006)	0.036*** (0.008)	0.054*** (0.009)	0.076*** (0.012)	0.096*** (0.019)	0.104*** (0.022)
Norway	0.029*** (0.007)	0.019*** (0.006)	0.041*** (0.008)	0.040*** (0.010)	0.089*** (0.013)	0.077*** (0.019)	0.171*** (0.027)
Poland	0.027*** (0.007)	0.031*** (0.006)	0.023* (0.009)	0.053*** (0.011)	0.034* (0.015)	0.119*** (0.024)	0.074** (0.027)
Sweden	0.021** (0.007)	0.014* (0.006)	0.030*** (0.008)	0.030** (0.011)	0.062*** (0.013)	0.052* (0.022)	0.123*** (0.025)
United States	0.020** (0.006)	0.002 (0.006)	0.038*** (0.007)	0.005 (0.012)	0.058*** (0.011)	−0.004 (0.023)	0.108*** (0.021)
Iceland	0.015 (0.008)	0.013 (0.007)	0.018 (0.011)	0.034** (0.011)	0.043* (0.017)	0.043 (0.022)	0.090** (0.031)
Ireland	0.011 (0.008)	0.012 (0.007)	0.010 (0.010)	0.038** (0.012)	0.040* (0.016)	0.082** (0.025)	0.123*** (0.030)
Mexico	0.010 (0.012)	0.007 (0.011)	0.017 (0.014)	−0.026 (0.013)	−0.012 (0.017)	−0.082** (0.028)	−0.042 (0.032)
Luxembourg	0.008 (0.007)	0.001 (0.007)	0.017 (0.009)	−0.000 (0.013)	0.036* (0.015)	−0.019 (0.030)	0.076* (0.034)
Greece	−0.005 (0.007)	0.001 (0.006)	−0.011 (0.008)	0.003 (0.010)	−0.013 (0.012)	0.016 (0.020)	0.023 (0.022)

Note. GDP: gross domestic product. Output for heteroskedasticity robust ordinary least squares regression. All regressions feature country fixed effects. Dependent variables are the log of the life expectancy measure indicated. Health expenditure estimates are the unstandardized estimates on the interaction between log lagged total health expenditure per capita (measured in purchasing power parity [PPP]–adjusted 2000 US$) and a country indicator. Countries are ranked by their estimate in specification 1. Social expenditures are log lagged nonhealth social expenditures per capita (measured in PPP-adjusted 2000 US$).

Source. Social expenditures are from the 2007 Organisation for Economic Co-operation and Development (OECD) Social Expenditure Database. All other data are from the OECD Health Data 2010 file.

*$P < .05$; **$P < .01$; ***$P < .001$.

Controlling for levels of educational attainment (percentage of population with tertiary education, percentage with upper secondary education, and percentage with less than upper secondary education) did not substantively alter rankings relative to results from the base specification, nor did the inclusion of GDP growth rate (Table B). The inclusion of a population-composition variable did alter the results, but as was mentioned previously, this control is arguably a cause and effect of health expenditures (Table B). Variables for tobacco and alcohol were included, resulting in coefficients of slightly lower magnitude; however, the overall rankings of the countries and the relative efficiencies in reducing mortality by gender were largely unchanged (Table B). The magnitudes of the health expenditure coefficients were similar after inclusion of interactions between social expenditures and country fixed effects, intended to allow for the effects of social expenditures on life expectancy to vary across countries (Table B). Finally, results from the restricted panel of SHA consistent years of health expenditures did not substantially alter the international efficiency rankings, or the differential gender efficiencies (Table B).



Note. Whiskers indicate 95% confidence intervals. Estimates represent average change associated with a 1% increase in total health expenditures per capita each year for 1991–2007. Figures calculated using country-specific coefficients on total health expenditures and the mean figures for total health expenditure and life expectancy. Organisation for Economic Co-operation and Development (OECD) figure calculated using the OECD-wide coefficient, and the international means for health expenditures and life expectancy.

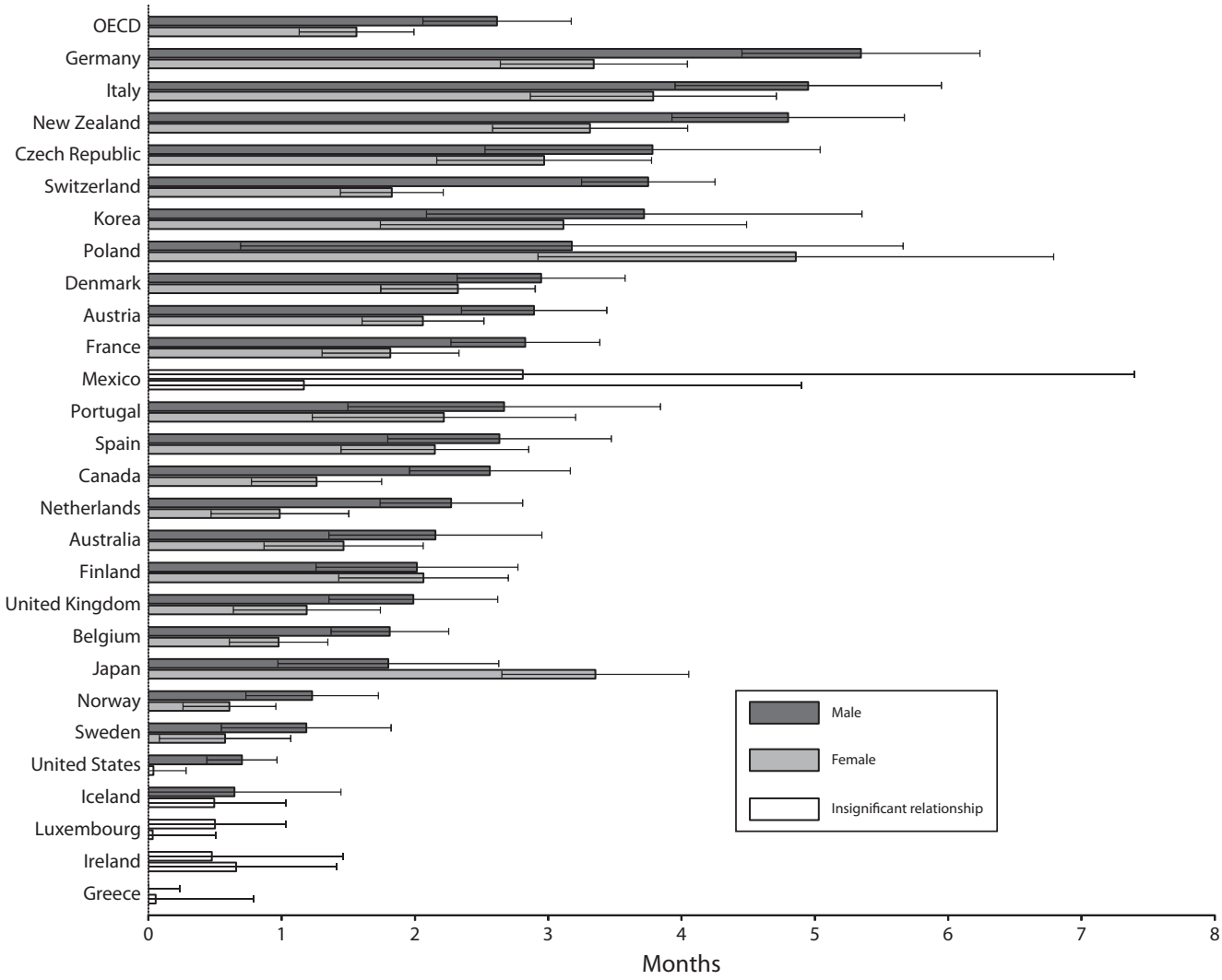
FIGURE 1—Months of life expectancy gained at birth from 1% increase in total health expenditures per capita: 1991–2007.

DISCUSSION

This study revealed marked differences in health system efficiency across 27 OECD countries over the past 2 decades. These results imply that there may be room to improve life expectancy without increasing health expenditures. Strikingly, we also found that the current pattern of health care expenditures is associated with greater gains for men than for women.

Our results suggest that men benefitted more from health expenditures throughout the OECD. There are at least 2 potential explanations for why health care expenditures would yield more gains for men than women. Men could either use more dollars, and thus utilize more care, or gain more health per dollar spent. The first explanation is unlikely, given evidence from countries like the United States, which show higher mean utilization for women, and higher female mean charges for primary care, specialty care, emergency treatment, diagnostic services, and annual total charges.[15,16] If women have higher expenditures across the OECD, then our efficiency gender differential is likely to be a lower bound of the actual differential.

Differences in aspects of productive efficiency, such as appropriateness and efficacy of care, may be a more likely explanation for gender disparities in health care efficiency. For example, it is possible that men may receive a more accurate diagnosis, higher quality or more effective treatment, as has been indicated in literature on coronary heart disease and congestive heart failure.[17,18] These types of differences also could have arisen if medical improvements, health policy focus, or research



Note. Whiskers indicate 95% confidence intervals. Estimates represent average change associated with a $100 increase in total health expenditures per capita each year for 1991–2007. Figures calculated using country specific coefficients on total health expenditures and the mean figures for total health expenditure and life expectancy. Organisation for Economic Co-operation and Development (OECD) figure calculated using the OECD-wide coefficient, and the international means for health expenditures and life expectancy.

FIGURE 2—Months of life expectancy gained at birth from $100 increase in total health expenditures per capita: 1991–2007.

agendas favored conditions that disproportionately affect men. Indeed, evidence has shown underrepresentation of women in published clinical trial literature.[19,20] Alternatively, it is possible that intervention programs led men to improve their health affecting behaviors at a faster rate than women over the time period. This could occur if, for example, smoking decreased more rapidly among men than women.[21] Another possibility is that the difference could arise from the lower initial life expectancy of men.[10] Gains in GDP also favorably improved men's life expectancy, perhaps attributed to greater access by men to income and assets. As was noted with the results, the association of spending with life expectancy later in life is greater than with life expectancy at birth (Table 2). Potential reasons for this include the large role of preventive measures in infancy, increased medical care utilization in later years of life,[22] and the different types of social expenditures used across ages.

Our other major finding is the relative efficiency rankings of the 27 OECD countries in our data set. Our results are supportive of large efficiency differences across countries. In the context of rapidly rising health care costs in many countries and budgetary constraints, further analyses of how health systems characteristics influence which countries spend more efficiently than others is a priority.

Limitations

Several caveats applied to our analyses. Given the data demands of an analysis with country specific health expenditures, sufficient longitudinal information was not available on country specific diet, exercise, or body-mass index to include these factors. Nonetheless, when consistently different over time, these factors and any other important differences between countries were accounted for by each

country's fixed effect. Although country fixed effects control for consistent differences in these factors across countries, they do not allow examination of differential rates of changes.

Another limitation was the lack of internationally comparable disaggregated health expenditure data, which would be valuable in examining how different expenditure mixes contribute to efficiency. In addition, this study primarily captures the acute contribution of health expenditure to life expectancy. This is a reasonable approach to estimation for curative care but will not capture the long-term effects of preventive investment. Lastly, it should be noted that our data did not include gender-specific health expenditures. Our results have raised key questions about the equality of spending and spending efficiency across genders, and highlight the need for the application of new data in these analyses as they become available.

Conclusions

With a large and increasing portion of public budgets being devoted to health expenditures, the desire to improve productive efficiency in the health systems of advanced economies has become a focal point of public discourse. Additional spending, without specific intent and monitoring, does not necessarily promote better service or better quality of life. Identifying efficient and inefficient practices is therefore an important research activity. This study, using data on life expectancy and health expenditures, has provided a next step in evidence on the relative efficiency of health systems throughout the OECD and on health care performance across genders.

Multivariate regressions revealed vast health expenditure efficiency differences across countries. Nearly every country showed a large and significant gender disparity in health expenditure efficiency, in which men received a greater gain in life expectancy for a given level of health expenditure.

Subsequent research should illuminate the sources of efficiency differences across countries and genders. Identification of the health system characteristics that define the best and worst performers, as well as the most equitable, could inform health policy efforts to curtail costs that are increasing faster than public budgets and could increase the quality and equity of outcomes. ■

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Contributors

J. Heymann and A. Nandi conceptualized the study, supervised the detailed design of the study and the analyses, and edited the article. D. Barthold and J. M. Mendoza Rodríguez designed the study, completed the statistical analyses, and led the interpretation of the results. D. Barthold led the writing. All authors approve of the final version of the article and have taken due care to ensure the integrity of this work.

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Human Participant Protection

No human participants were involved in this study, and therefore no approval was needed from the institutional review board.

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