Medical-Care Expenditure: A Cross-National Survey

Joseph P. Newhouse


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What determines the quantity of resources a country devotes to medical care? The question is important because of the presumed consequences of medical-care expenditure for well-being, although the nature of the link between medical-care services and well-being is not well understood. A substantial literature on this question is devoted to comparing and assessing the institutional settings for the delivery of medical-care services found in various countries (for example, Anderson [2], Glaser [5], White [16]). Variables such as the degree of centralization of medical-care delivery and the method of reimbursing providers are of central importance in these studies.

Rather than using these variables, this study began by examining the relationship between a country's medical-care expenditures and its income. As we shall see, this relationship yields inferences about the link between medical care and well-being and possibly also about the relationship between institutional settings and resource allocation.

AN ESTIMATED RELATIONSHIP BETWEEN MEDICAL EXPENDITURES AND INCOME

Table 1 shows per capita medical expenditure and the percentage of Gross Domestic Product (GDP) spent on medical care in recent years for 13 developed countries for which I could obtain data. The sample was limited to developed

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1 The sampling frame was taken from Western Europe (the members of the EEC, EFTA, Greece, Ireland, Spain), the United States, Canada, Japan, Australia, Israel, and New Zealand. The latter were non-European countries with per capita GDP above $1,500 in 1972 (excluding the Libyan Arab Republic).
<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Per Capita Gross Domestic Product (U.S. $)</th>
<th>Medical-Care Share as % of Gross Domestic Product</th>
<th>Per Capita Medical-Care Expenditure (U.S. $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>1972</td>
<td>3769</td>
<td>5.80</td>
<td>219</td>
</tr>
<tr>
<td>Austria</td>
<td>1972</td>
<td>2747</td>
<td>5.46</td>
<td>150</td>
</tr>
<tr>
<td>Canada</td>
<td>1971</td>
<td>4317</td>
<td>7.02</td>
<td>303</td>
</tr>
<tr>
<td>Finland</td>
<td>1972</td>
<td>2869</td>
<td>5.31</td>
<td>152</td>
</tr>
<tr>
<td>France</td>
<td>1970</td>
<td>2851</td>
<td>6.40</td>
<td>182</td>
</tr>
<tr>
<td>Germany, Federal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Republic</td>
<td>1968</td>
<td>2246</td>
<td>6.07</td>
<td>136</td>
</tr>
<tr>
<td>Greece</td>
<td>1972</td>
<td>1374</td>
<td>2.51</td>
<td>34</td>
</tr>
<tr>
<td>Italy</td>
<td>1972</td>
<td>2164</td>
<td>6.12</td>
<td>132</td>
</tr>
<tr>
<td>Netherlands</td>
<td>1972</td>
<td>3437</td>
<td>6.78</td>
<td>233</td>
</tr>
<tr>
<td>Norway</td>
<td>1972</td>
<td>3889</td>
<td>5.18</td>
<td>201</td>
</tr>
<tr>
<td>Sweden</td>
<td>1971</td>
<td>4431</td>
<td>7.38</td>
<td>227</td>
</tr>
<tr>
<td>U.K.</td>
<td>1972</td>
<td>2742</td>
<td>4.45</td>
<td>122</td>
</tr>
<tr>
<td>U.S.</td>
<td>1972</td>
<td>5551</td>
<td>6.51</td>
<td>361</td>
</tr>
</tbody>
</table>

Source: For per capita GDP, United Nations, Yearbook of National Accounts Statistics, 1973, Vol. III, Table 1a. For medical-care share, United Nations, Yearbook of National Accounts Statistics, Vols. I and II, table of individual country used for total GDP (denominator of share), private and government final consumption expenditure on health and medical care used for numerator of share, except for Canada, France, Germany (Federal Republic), and the Netherlands. For these (as well as other) countries, data on either private or public spending were missing from the U.N. publication. Medical-care spending (the numerator) for Canada, France, Germany (Federal Republic), and the Netherlands were taken from [7, pp. 59, 179 (medical research excluded), 241, 274]. The last column, per capita medical-care expenditure, is derived by multiplying GDP per capita and the share of medical care. Data on Japan, which were included in earlier drafts of this paper, have been excluded because no data were available through the U.N. publication and it was not clear that the data available (from the Japanese Medical Association) were comparable.

countries in order that the prevalence and type of disease and the amount of medical knowledge would be approximately constant.

Table 2 shows the results of regressing per capita medical-care expenditure upon per capita GDP. Because Greece has a markedly lower per capita GDP than the rest of the sample, equations have been estimated with and without the Greece observation. In spite of well-known problems in making international
TABLE 2
REGRESSION OF PER CAPITA MEDICAL-CARE EXPENDITURE ON GDP PER CAPITAv

<table>
<thead>
<tr>
<th>Equation</th>
<th>Sample</th>
<th>Intercept</th>
<th>Coefficient and t-Statistic</th>
<th>( R^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>Including Greece</td>
<td>-60</td>
<td>.0788 (11.47)</td>
<td>.92</td>
</tr>
<tr>
<td>(2)</td>
<td>Excluding Greece</td>
<td>-51</td>
<td>.0763 (9.29)</td>
<td>.90</td>
</tr>
</tbody>
</table>

\( \text{v The functional form is linear.} \)

TABLE 3
ESTIMATED INCOME ELASTICITIES FROM THE RESULTS IN TABLE 2

<table>
<thead>
<tr>
<th>Per Capita GDP Level</th>
<th>Elasticity Based on Equation (1)</th>
<th>Elasticity Based on Equation (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3416 (mean)</td>
<td>1.21</td>
<td>1.26</td>
</tr>
<tr>
<td>4000</td>
<td>1.24</td>
<td>1.20</td>
</tr>
<tr>
<td>5000</td>
<td>1.18</td>
<td>1.15</td>
</tr>
<tr>
<td>6000</td>
<td>1.15</td>
<td>1.13</td>
</tr>
</tbody>
</table>

comparisons, over 90 percent of the variance in per capita medical expenditure in these countries can be explained by variation in per capita GDP.\(^2\)

Data reported in Kleiman [8] for a different set of 16 countries (including much poorer areas) also support the finding that income can explain the great majority of variance in per capita expenditure. The \( R^2 \) between per capita health expenditure and per capita Net National Product is 0.96 for Kleiman's sample.

The magnitude of the change in medical-care expenditure as GDP changes is also of interest. In Table 3, I show the implied elasticities of medical care with respect to GDP at various levels of GDP. Note that the elasticities through the observed range substantially exceed one. As a more rigorous test of the hypothesis that the income elasticity exceeds one, I have regressed the medical sector's share of GDP on GDP. To maintain a functional form consistent with the well-fitting linear relationship in Table 2, the first line of Table 4 shows results using the reciprocal of GDP per capita as the explanatory variable.\(^3\) While the fit using the share of GDP as a dependent variable is not as good as when the abso-

\(^2\) Problems in making international comparisons are briefly discussed in the Appendix.

\(^3\) Dividing both sides of the equations shown in Table 2 by GDP per capita leads to the reciprocal form.
TABLE 4
REGRESSION OF SHARE OF GDP DEVOTED TO MEDICAL CARE ON PER CAPITA GDP

<table>
<thead>
<tr>
<th>Sample and Functional Form</th>
<th>Intercept</th>
<th>Coefficient and t-Statistic</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Including Greece, reciprocal (1/GDP)</td>
<td>8.16</td>
<td>-6883 (4.00)</td>
<td>.59</td>
</tr>
<tr>
<td>(2) Including Greece, linear</td>
<td>3.40</td>
<td>7X10^{-3} (2.77)</td>
<td>.41</td>
</tr>
<tr>
<td>(3) Including Greece, log-linear</td>
<td>-2.70</td>
<td>.55 (3.52)</td>
<td>.53</td>
</tr>
<tr>
<td>(4) Excluding Greece, reciprocal</td>
<td>7.24</td>
<td>-3798 (1.36)</td>
<td>.16</td>
</tr>
<tr>
<td>(5) Social Security Administration sample of seven countries, 1969, reciprocal</td>
<td>8.66</td>
<td>-7131 (4.00)</td>
<td>.76</td>
</tr>
</tbody>
</table>

The dependent variable is share of GDP; the explanatory variable is per capita GDP in 1969 from United Nations, *Yearbook of National Accounts Statistics*, Vol. III.

The absolute level of expenditure is the dependent variable, the coefficient of GDP per capita is significantly different from zero at the 1 percent level (two-tail test). The next two lines of Table 4 show that the result that the share of GDP in medical care rises with GDP is robust against changes in functional form. The fourth line, however, shows that the result is affected if Greece is omitted from the sample; while the sign is still negative, the coefficient is no longer significant at conventional levels.

The last line of Table 4 shows results using data on the share of GNP devoted to medical care in 1969 in seven of the 13 countries, as estimated by the Social Security Administration (Simanis [15]). These results are included because it was felt that the comparability of the figures is better for this sample than for the entire sample. For these countries, the coefficient of per capita GDP is again very significant and $R^2$ is noticeably higher.

**A FIRST IMPLICATION: MEDICAL CARE AS A LUXURY GOOD**

The results in Tables 3 and 4 indicate that the income elasticity of medical care exceeds one; thus, by the technical definition, at the margin medical care is a

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4. The sample includes Canada, Federal Republic of Germany, France, Netherlands, Sweden, United Kingdom, United States.
luxury good. Such a conclusion runs counter to conventional wisdom, but
time-series data also support this finding. It is well known that for virtually every
developed country the share of GNP devoted to medical care has tended to rise
over time (Simanis [15], Maynard [9, p. 259], [7]).

Cross-section data from the United States show that within the United
States, income elasticities (holding nothing else constant) are very low and may
well be negative. The same is probably true within other countries as well.
How can the discrepancy between the within-country cross-section and the inter-
national cross-section results be explained?

One argument that might be made is a so-called "norms" argument. Physi-
cians within a country might have a certain style of practice, such that they
tend to treat patients uniformly, irrespective of income, while these styles may
differ across countries. While this explanation has a certain appeal, it is not com-
pletely satisfying. First, whatever validity the argument may have, it is incom-
plete because physician norms have little to do with whether or not a patient
enters the medical-care system at all. Second, the norms argument assumes
that there is a considerable similarity of medical practice within countries,
whereas in fact there may be substantial difference between various regions or
between rural and metropolitan areas within the country. Third, the finding that
the share of medical care in GDP tends to rise over time cannot be explained by
a norms argument, unless the norms change steadily over time. If so, the norms
explanation becomes increasingly ad hoc.

A more satisfying explanation is that price is probably not an important
rationing factor within many countries at one point in time, whereas it is impor-
tant between countries and over time. Within many countries, medical care is
free to the consumer. Even in the United States, which relies on out-of-pocket
payments more than most countries, hospitalization insurance is nearly com-

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5 The income elasticity at the point of means in Kleiman's [8] sample is 1.22, although
his sample covers a much larger range of income.

6 Andersen and Benham [1] using 1963 survey data, find a simple income elasticity of
physician expenditure of 0.4 and a partial elasticity of 0.2. Newhouse and Phelps
[12], using the same data source, find a partial elasticity of hospital and physician
expenditure of around 0.1. Phelps [13], using 1970 survey data, estimates partial
income elasticities around 0.1 or below. Published National Health Survey data for
1968 imply a negative relationship between hospital days and income (National
Center for Health Statistics [11]), and published data for 1973 show a negative rela-
tionship between physician visits and income, although the curve is essentially flat
above $5000 income (National Center for Health Statistics [10]). These latter
do not control for health status, but the Newhouse and Phelps estimates, as well
as the Phelps estimates, do include health-status measures, thus mitigating against
the possibility that the across-individual results are not comparable with the across-
country results because of a much stronger relationship between sickness and in-
come at the individual level.

7 Although Kleiman [8] cited a study by Liviatan that estimates the income elasticity
within Israel to be 1.3.
plete. Phelps and I have elsewhere described a plausible model which predicts that as money price to the consumer goes toward zero, income elasticity will fall.\footnote{See Phelps and Newhouse [14], Equation A.4. As money price goes to zero, the term $NPH$ falls, and with it the responsiveness of demand to income. However, even if money price is zero, there is still reason to expect a nonzero income elasticity; those with higher values of time will tend to be those with higher incomes, and those may be incentives to consume more (or under certain as assumptions, less) medical care as the value of time rises. See Grossman [6]. There may also be complementarities or substitutability with other goods that show a positive income elasticity.} Additionally, there may be public subsidies of the poor (or perhaps price discrimination) such that a small (simple) income elasticity within the country also includes a price effect.

However, when making comparisons between countries, the country faces the full price of medical-care services (excepting grants from international organizations that are earmarked for medical care, which are not at issue in the countries under discussion). The same could be said for a time series within the country. Thus, one would expect that income would play a greater role in explaining consumption across nations (or in time-series data) than for cross-sections of individuals within nations.\footnote{Note the similarity with Buchanan's explanation for queues in the British National Health Service: there is chronic excess demand because the individual as a consumer faces a zero price, while the individual as a voter faces the true resource cost. See Buchanan [3].}

If medical care is indeed a luxury and not a necessity, there is an inference about what the marginal unit of medical care purchases. To draw this inference, however, it is important to establish that countries with a larger share of GDP devoted to medical care actually do devote more real resources and do not merely pay the same factors higher relative prices. I see little reason why the price of capital in medical care should be relatively higher in wealthier countries; indeed, it might well be lower. However, insofar as wealthier countries have higher capital/labor ratios and migration does not lead to equalization of salaries, one might expect higher salaries in the wealthier countries. But is there a more than proportionate rise in medical-care salaries as GDP rises (which could possibly account for an income elasticity over 1)? I see little theoretical reason to expect this, and the fragmentary evidence I have found indicates that physicians' salaries rise roughly proportionately rather than disproportionately with income levels. Table 5 shows the ratio of the average earnings of a physician to the average compensation of an employed person for five countries for which I could obtain data. The ratios are remarkably similar across countries. In fact, the country with the highest per capita income, the United States, actually has the lowest ratio.\footnote{If an average figure rather than a median figure were used for the United States, the ratio would be somewhat higher, but the figure is still likely to lie in the same range as for the other countries. The average is unavailable.} These data suggest that wealthier countries do not have higher...
TABLE 5
RATIO OF AVERAGE EARNINGS OF A PHYSICIAN TO AVERAGE EARNINGS, SELECTED DEVELOPED COUNTRIES

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Average Physician Income</th>
<th>Average Compensation Employed Person</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>1972</td>
<td>n.a.</td>
<td>n.a.</td>
<td>5.30a</td>
</tr>
<tr>
<td>France</td>
<td>1973</td>
<td>Fr 129,500</td>
<td>Fr 26,433b</td>
<td>4.90</td>
</tr>
<tr>
<td>Germany, Federal Republic</td>
<td>1971</td>
<td>DM 115,580</td>
<td>DM 17,720c</td>
<td>6.52</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>1972</td>
<td>£ 6,794</td>
<td>£ 1,367</td>
<td>4.97</td>
</tr>
<tr>
<td>United States</td>
<td>1971</td>
<td>$42,700d</td>
<td>$9,030e</td>
<td>4.72</td>
</tr>
</tbody>
</table>


a Ratio of average total incomes assessed for tax purposes to average income.

b Data on wage per employed calculated from Europa Yearbook, 1975, A World Survey (London: Europa Publications, Ltd), pp. 649, 656. The 1972 unemployment rate of 2.37 percent was applied to 1973 labor force data to derive an estimate of 21,343,000 employed.

c Reinhardt’s figure comes from the Gesellschaft für Sozialen Fortschritt e.V., “Der Wander der Stellung des Arztes im Einkommensgefüge.” United Nations data show a figure of DM 17,436.

d Median income.

e Excludes self-employed businessmen, professionals, and farmers.

relative factor prices for medical care resources, but are indeed devoting more real resources to medical care.\(^{11}\)

What, then, are these additional resources buying? The conventional view that medical care is a necessity is probably based on the presumption that the marginal unit of medical care produces an improvement in physiological health. Indeed, many who believe that income should not play a role in allocating medical-care resources would probably argue in this fashion; they might respond to the above data that countries have been able to achieve “equity” internally, although it has not been achieved internationally.

Yet there is little reason to believe that the marginal unit of medical care produces an improvement in physiological health. I am aware of no data suggesting that Swedes are healthier than Norwegians or Finns, or that Canadians are healthier than residents of the United Kingdom or Australia, despite much

\(^{11}\) Of course, to the extent that a higher relative factor price for a physician is based on additional investment in human capital by the physician (e.g., more training), the higher factor price reflects a greater commitment of real resources to medical care.
higher spending on medical care in Sweden and Canada. For example, infant mortality rates are similar in Norway and Sweden; they are also similar in the United Kingdom, Canada, and Australia.

While the marginal unit of medical care may do little or nothing for mortality and morbidity rates, it may well produce improvements in so-called subjective components of health. Additional resources in ambulatory care may alleviate symptoms (for example, pain, itching), relieve anxiety, and provide prognostic information. In both ambulatory and inpatient care, additional resources may marginally improve decision-making (for example, an additional test may make a physician 99 percent rather than 95 percent certain of a diagnosis). In inpatient care, some heroic, but costly, measures may have little effect on life expectancy in the population, but they may satisfy a norm (relieve guilt?) that "everything" should be done for an individual patient whose chances of recovery are remote. The nature of these services may well be quite discretionary and consumed in proportionately greater quantities as income rises. Put another way (and simplifying), countries that spend more may well buy more caring, but little additional curing.

A SECOND IMPLICATION: OTHER DETERMINANTS OF MEDICAL-CARE EXPENDITURE

The sample of countries in Table 1 is small, and data from other countries might somewhat change the results. Nonetheless, the conclusion that variation in per capita income accounts for the large majority of variance in per capita medical-care expenditure across developed countries seems unlikely to change. If so, the negative inference may be drawn that other factors hypothesized to affect medical-care spending are not of quantitative importance, and that the very simple approach of examining the relationship of expenditure to income may be sufficient.

It may seem surprising that the price paid by the patient and the method of reimbursing the physician are not important. But note that medical-care services are often rationed, that is, not supplied by a free market. (For example, hospital budgets are frequently set by a public authority.) Therefore, the unimportance of the price facing the user should not be surprising. One can infer from these results that medical services are rationed in a systematic manner, consistent with the wealth of the country. This conclusion is consistent with the findings of other cross-national studies that do not find price to be the user or the method of paying the physician to be of much power in explaining utilization and physician behavior (Glaser [5], White [16]).

When merits of centralized and decentralized control of the health services are discussed, it is frequently argued that a centralized system can keep expenditure lower than can a decentralized system (Anderson[2]). Assuming this
argument is correct, the results in Table 2 place a somewhat different interpretation on it. That the centralized British system keeps expenditure down relative to the more decentralized American and Swedish systems may be due to a bleaker economic picture generally. Moreover, if, as was argued above, medical care at the margin is a luxury good that is "caring-intensive," a decentralized system may be more efficient at producing caring. Thus, a wealthier country may desire and be able to pay for a more decentralized, but more expensive, medical-care system. If so, the organization of the delivery system is properly treated as endogenous.

CONCLUSIONS

Cross-national studies are subject to a great many well-known difficulties. Yet both cross-nation and time-series (within nation) data support the conclusion that the income elasticity of national medical-care expenditure is greater than one. Such a finding is consistent with the view that in the developed countries, medical-care services at the margin have less to do with common measures of health status such as mortality and morbidity and more to do with services that are less easily measured, such as relief of anxiety, somewhat more accurate diagnosis, and heroic measures near the end of life. That per capita income can explain much of the cross-national variation in expenditure also suggests that a country will find methods by which to ration services consistent with its income despite variation in out-of-pocket prices paid by the consumer in various countries or alternative methods of reimbursing the physician.

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APPENDIX

Problems in making international comparisons include: (1) Definitions are difficult to standardize. (2) Index number problems are present in comparing income. (3) Exchange-rate conversions have a certain degree of arbitrariness. Definitional errors would tend to be random error and thus lower the measured \( R^2 \). The editor has raised the issue of whether errors in the measurement of GDP, especially errors in exchange-rate conversion factors or variation in the amount of household production of medical care, affect the results. Assume that an error in the exchange-rate conversion factor (or population size) leads to a multiplicative error that is applied to both the dependent and explanatory variables; the error factor is an independent random variable with a mean of one. In general, the estimated slope coefficient will be inconsistent, but the inconsis-
tency does not appear to be of quantitative significance for the amount of measurement error (and size of $R^2$) likely to exist in this case (Casson [4]).

Errors in measurement caused by variation in the amount of household production are somewhat different. It is possible to dismiss such errors if one narrows the question to that of variation in market resources devoted to medical care. If one looks instead at variation in total (market and nonmarket) resources devoted to medical care, the relevant question is the propensity to consume nonmarket medical care from nonmarket income. If this relationship is approximately the same as the measured market propensity, then the total consumption of medical care as a function of full income can clearly be approximated by observation of the market component. If not, the reported results could be changed in either direction.

I am inclined to believe that errors from nonstandard definitions are at least as important as the second and third sources of error in this instance; in that event, the claim that income can explain most of the variance is conservative. Note also that if errors in the measurement of GDP are present, the coefficient in the shares regressions in Table 4 are inconsistent upward; yet the coefficients of the reciprocal terms are still negative.

REFERENCES

Toward a General Theory of Teeth

If economists could manage to get themselves thought of as humble, competent people, on a level with dentists, that would be splendid!

J. M. Keynes [2, p. 373]

As Alan S. Blinder has recently demonstrated [1], tooth-brushing behavior can easily be understood in terms of human capital theory, in that such behavior involves the diversion of time from work and entails long-run payoffs in the form of higher income. While this seminal contribution to the literature has advanced our understanding, it fails to address a much more fundamental issue, namely, the source of teeth per se. In what follows, I generalize the notion of human capital to develop a model of optimal life-cycle accumulation of teeth.

Assume that the individual in question lives in a world of perfect capital markets and complete certainty (relaxation of these assumptions would not alter...