Measuring Medical Care Productivity

A Proposal for U.S. National Health Accounts

By Allison B. Rosen and David M. Cutler

MEASURING productivity is a central challenge in medical care, as it is in all other service industries. Medical care is particularly important, however, because of the enormous share of gross domestic product (GDP) that it takes. The United States spent $2 trillion dollars, or 16 percent of GDP, on health care in 2005 (Catlin, et al. 2007). This compares with a median of 8.5 percent among other Organisation for Economic Co-operation and Development countries. Further, the productivity of U.S. health care is suspect. While some studies have suggested that productivity growth is reasonable in aggregate (Cutler and McClellan 2001; Cutler, Rosen, and Vijan 2006), others argue that there is substantial waste at the margin (Fisher et al. 2003). If we are to understand and improve the productivity of our health care spending, a more systematic approach to tracking productivity in the health care sector is needed.

This article discusses a proposed framework for measuring productivity in medical care via the creation and use of national health accounts. Such accounts would provide a comprehensive picture of population health in relation to health care spending within an integrated framework in which consistent definitions, measurement tools, and analytic conventions are used.

The challenges of productivity measurement in health care

Productivity is difficult to measure in every industry. Output indices for computers and automobiles have been changed many times over the years, for example. But medical care is particularly problematic for one fundamental reason: Consumer purchasing decisions are not a reliable guide to true value.

The conceptual basis for productivity measurement in virtually all industries is hedonic analysis (Griliches 1971). People are assumed to buy goods when they value them and not to buy them when they do not. Thus, the value of quality change can be inferred from the amount that people are willing to pay for that change. With a price for quality thus defined, productivity can be found as the residual growth in total spending not accounted for by pure price increases.

In medical care, however, the link between purchase and value is not clear. Many consumers do not know which services they need; the doctor is both an advisor and a service provider. As a result, physician reimbursement and ethics might affect consumption decisions as much as value and cost. And even when consumers know what they need, they tend to be very well insured for medical care services. For these reasons, most health care analysts do not assume that purchase decisions will reflect the true value of the good.

At the level of health insurance, it might be possible

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to use hedonic analysis (Fixler 1996). For example, relating insurance premiums to enrollment choices might be used to back out the value of medical advances. But insurance choices are affected by other features as well, including the age distribution of the enrollees in the purchasing group. Nor is it clear that consumers understand everything that is in an insurance plan, especially for services they do not yet need. Just how stringent are the mental health limits? Are the nephrologists in the plan good ones? These types of questions are essential in rational purchasing, but they are not well known by consumers.

As a result, our research, along with most other work in the field, uses a direct approach to measuring productivity. We measure the output of the medical care industry—health—and use medically informed decision models to determine the productivity of different inputs (medical care and public health, for example). In essence, we will determine the production function for health empirically and use that to estimate the productivity of the key inputs. We describe in the remainder of this article how we will do this.

**National health accounts: A conceptual basis**

National accounts play a central organizing role in economic measurement. The national income and product accounts (NIPAs) are the most well-known accounts. They give the total GDP as well as its division into major categories (consumption, investment, government spending, and net exports) across a range of industries. Further, the accounts permit the analysis of productivity changes by dividing spending increases into prices and quantities.

The NIPAs are organized around market activity; any activity where money changes hands is included in the accounts. However, it has long been recognized that GDP is not a measure of welfare. Most importantly, nonmarket activities such as personal investments in one’s own health and the environment are not included in GDP. To measure the costs and benefits of such activities, there have been repeated suggestions to establish “satellite” accounts that encompass all of these activities.

Satellite accounts derive their name from the fact that they would orbit around the NIPAs, overlapping with them in market activity and supplementing them in nonmarket activity. A recent report from the Committee on National Statistics recommended establishing satellite accounts for health, home production, the environment, education, and government/nonprofits (National Research Council 2005).

Table 1, taken from Beyond the Market: Designing Nonmarket Accounts for the United States (National

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Outputs</th>
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<td>Medical Care</td>
<td>Health status</td>
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<td>Market labor/capital</td>
<td>Longevity</td>
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<td>Volunteer labor</td>
<td>Quality of life</td>
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<td>Time invested in own health</td>
<td>Financial externalities</td>
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<td>Other consumption items</td>
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<td>Research and development</td>
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<td>Quality of the environment</td>
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We decompose population health into two parts: Mortality and quality of life. Mortality data are available from vital statistics. All deaths are recorded with great accuracy. Linking mortality to different diseases is less straightforward, however. Cause-of-death data is known to be inaccurate for many conditions (Zumwalt and Ritter 1987). To obtain more accurate mortality data, we will match the spending and health data described below with data on date of death. This will allow us to estimate regression models for death as a function of acute and chronic diseases and other sociodemographic information.

Data on various indicators of quality of life are available in a number of health assessment questionnaires, which are discussed below. The challenge in assessing quality of life in the United States is not so much lack of data as lack of consensus on an appropriate measure. We describe our approach, acknowledging that others may be appropriate as well. We first assess overall quality of life based on survey self-reports. We then assess the symptoms and impairments that individuals report and relate the two using regression analyses. Finally, we relate the symptoms and impairments to the diseases of interest. This allows us to track changes in quality of life over time as a function of changes in the prevalence of diseases or in the prevalence of symptoms and impairments associated with these diseases. Because we place quality of life on a 1 (for perfect health) to 0 (for death) utility scale, we can combine length of life with quality of life to form a single measure of health, quality-adjusted life expectancy (QALE). More details are available in Stewart and others (2006).

**Medical spending**

We know well what we spend on medical care; the actuaries at the Centers for Medicare and Medicaid Services (CMS) track aggregate medical expenditures in great detail in a series of national health expenditure accounts (NHEAs). These accounts, maintained since 1960, provide a comprehensive list of expenditures for health care-related goods and services.

However, the NHEA data are reported as aggregate spending by payer and service category, and they do not report spending at the disease level. To provide this disease-level data, we link three national expenditure surveys to the NHEAs. The Medical Expenditure Panel Survey (MEPS) and its precursor survey, the National Medical Expenditures Survey (NMES), both collected by the Agency for Healthcare Research and Quality (AHRQ), represent the civilian noninstitutionalized population. Both surveys include expenditure data as well as rich survey data on several aspects of health (including quality of life and the presence of diseases) and health care utilization. To provide data on the institutionalized population and larger sample sizes for the general Medicare population, the Medicare Current Beneficiary Survey (MCBS), collected annually by the CMS, is used to replace the Medicare eligible population in NMES and MEPS. The MCBS is a nationally representative survey of aged, disabled, and institutionalized Medicare beneficiaries, which includes information on health care utilization and expenditures as well as information on health status and the presence of diseases.

Building on the methods of Meara, White, and Cutler (2004) and Selden and others (2001), we match spending by payer and service type in MEPS, NMES, and MCBS to NHEA service totals. We adjust reported spending from the national surveys so that spending by payer and service category sums to that reported in the NHEAs. These individual data matched to national totals allow us to estimate medical spending by disease.

We also need to define the diseases of interest. The manner in which we define disease categories builds on work done at AHRQ. In particular, AHRQ classified all medical claims (or survey-based self-reports of diseases) into 262 mutually exclusive conditions using the Clinical Classification Software (CCS) (Elixhauser, Steiner, and Palmer 2007). For our purposes, this level is too disaggregated, since many categories have relatively low prevalence in national claims data, and a few would have relatively similar clinical manifestations. The CCS can be collapsed into 18 much broader categories (for example, infectious diseases, mental disorders, and injuries); however, this level is too aggregated for our purposes, with very heterogeneous categories. We therefore regroup the 262 categories into 65 clinically meaningful groups. A typical group is HIV/AIDS or diabetes.

After determining whether an individual has a disease of interest, we regress costs—or a variation, such as the logarithm of costs—on the individual’s disease profile. The resulting coefficients give the cost associated with each disease, controlling for the other health conditions that a person has.

It is worth noting that our approach builds on, but is somewhat different from, prior cost of illness studies. In that literature—which was pioneered by Dorothy Rice (Rice 1966) and colleagues and is still prominent (Hodgson and Cohen 1999; Druss et al. 2001; Thorpe, Florence, and Joski 2004)—each medical claim is assigned to a disease, and total spending is found by adding claims within the disease category. The difficulty with this prior approach is that many claims have multiple diagnosis codes; is an ACE inhibitor taken by a person with diabetes who has had a heart attack being taken for the diabetes or the heart...
attack? Our approach will determine the share of spending associated with each without an arbitrary assignment rule.

**Disease models**

The final step is to develop detailed disease models that relate health inputs to outputs. These models will allow us to infer the value of medical care at the disease level. We can then add across diseases to estimate the productivity of medical care as a whole.

There is a rich tradition of forming disease models in other disciplines that we will draw on for this goal, including substantial work in decision sciences and industrial engineering. A comprehensive catalogue of such models spanning over 25 years of the medical literature is maintained by a team of investigators at Tufts Medical School as an Internet-based resource (available at [www.tufts-nemc.org/cearegistry/data/default.asp](http://www.tufts-nemc.org/cearegistry/data/default.asp)). These models range from simple explanatory models of a single therapy for a single disease (for example, antibiotics for childhood ear infections) to broad policy models that consider several services simultaneously (for example, the prevention and management of coronary heart disease). However, there is no consistent set of modeling conventions that would allow these models to be merged together to provide a picture of the health care sector as a whole.

Building on this rich base, we will develop disease models using a consistent set of definitions and methodologic conventions. These more detailed disease models may help us identify clear targets for more nuanced policy interventions. Further, they will be designed specifically to fit into the larger framework of expanded health accounts in order to allow for comparisons of alternate resource allocation strategies across the whole health sector (rather than limited to a single disease).

**Conclusions**

The task we have laid out is ambitious. We are working with people around the country and will do so for a number of years. In addition, the collaboration and cooperation of several of our national data collection agencies will be critical to the success of these endeavors.

The obvious question is whether this work is worth the cost. We believe it is. A little history about the national income and product accounts indicates why. Today, we recognize these accounts as one of the singular achievements of economic science. In their introductory textbook, *Economics*, Paul Samuelson and William Nordhaus observed “While the GDP and the rest of the national income accounts may seem to be arcane concepts, they are truly among the great inventions of the twentieth century.” Former Commerce Secretary William M. Daley called national economic accounts “the Commerce Department’s greatest achievement of the 20th century.” Governments use national economic accounts to manage monetary and fiscal policy. Businesses use them to make investment and hiring decisions. Families use them, generally indirectly, in setting savings and consumption goals.

While the national income and product accounts are justly famous, it is surprising how recent an invention they are (see, for example, Moynihan 1999 and Fogel 2000). During World War I, there were substantial, unresolved debates about how civilian and military needs could coexist. After the War, a few economists decided to make a more quantitative assessment of the American economy to help with future economic planning efforts. The leaders in this group were Wesley Mitchell of Columbia and Edwin Gay of Harvard Business School who founded the National Bureau of Economic Research to coordinate those efforts. By 1930, the work on national accounting was led by Simon Kuznets. In the early 1930s, it became apparent that the United States was in a major downturn. The magnitude of the downturn was not known, however. In 1932, Congress passed a resolution directing the Secretary of Commerce to calculate and report national income in 1929, 1930, and 1931. Simon Kuznets joined the Commerce Department to construct such estimates, and after 2 years of work, the Department published the requested data. Those estimates were refined over the next few years and continue today.

Our knowledge of the health economy today is about where the measurement of national economic activity was in 1932. Health is very important; some aspects are good, but many are not. We want to know how we are doing in aggregate and what we can do to improve health. Initial steps to measure health care productivity taken today will allow us to learn how best to improve these accounts over time so that they may evolve, as the national income and product accounts have, into a complex system of true national health accounts with which to track the productivity of our ever-growing national investment in health care.

**References**


