

The “Genome” of Health Care Delivery Innovation: Productivity Research

The Harvard/Kennedy School Health Care Delivery Policy Program (HCDP) seeks to understand what changes would be needed to move the US health care delivery system toward a system that is effective, accessible, efficient and integrated.

Measurement of the benefits and costs of medical care services is central to this effort, and a productivity research group is among the core research projects associated with the Program. Indeed, Jerome Grossman, Director of the HCDP, sees productivity research as “the genome of health care delivery.” Now is the right time to invest a significant amount of resources in a focused set of projects to create a core knowledge base for designing the health care delivery system, not unlike how research on the human genome has created a core knowledge base for clinical science.

If we wish to design a delivery system to achieve efficiency and quality, we must be able to measure efficiency and quality. Yet in the current US health care system, we do not measure, report, nor act on such a measure of productivity. For example, in treating a patient with diabetes, the payment and accountability systems do not focus on the key health question, “did the patient get better?” but rather, “did the patient receive a lab test, a visit, etc.?” This system leads to misalignment of incentives and inefficiency.¹

There is an ambitious and well-defined research agenda within health economics on price indices and productivity in health care (e.g., Berndt et al. 2001; Newhouse 2001). Much of the research focuses on questions of the appropriate measure of

¹ To cite just one example, payment for blood tests analysis is based on accuracy. While accuracy may seem an admirable goal, much of the extremely sophisticated effort expended in its pursuit is ill-suited to the final purpose, treatment of the patient’s health condition, because the level of accuracy attained is often way beyond what would make a difference for the diagnosis.

economy-wide productivity in health care, with a focus on specific diseases as a preliminary step to “aggregating up” to overall health spending. For the HCDP and its focus on private initiatives in health care delivery, interest in the underlying theoretical and methodological issues stems more from the potential to disaggregate productivity measures to, say, the group practice level, and use them as a basis of payment. Rather than explicit focus on “macro” policy questions of evaluating technological change and health care spending, the HCDP seeks to apply productivity research to “micro” questions of defining, designing, and implementing private delivery system innovations, such as aligning payment with performance objectives. This rubric encompasses and is linked to many others: quality measurement, practice guidelines, best-practice diffusion, provider profiling, payment incentives, risk adjustment (especially measurement of appropriate costs as the ‘benchmark’ from which to adjust for risk), etc. Thus, the productivity research component of the HCDP can be seen as a bridge between the theory of productivity and private reform initiatives for health care delivery. As such, the focus is on how to use productivity measures to re-shape the health care system, rather than how to account for health care delivery system changes within productivity measures.

To clarify the role of productivity research in the HCDP, this paper first describes some of the current work and methodology of measuring productivity and price indices, drawing from Berndt et al. (2001) and Newhouse (2001). The next section describes the more recent focus on episodes of illness and priority conditions and the use of productivity measures as a basis for provider payment. The final section gives specific clinical examples of productivity improvement, describes the many uses to which such research can be put, and sketches next steps for productivity research within the HCDP.

Productivity Measurement and Price Indices

To ask any questions regarding real (i.e., inflation-adjusted) resource use, analysts require a measure of real quantities of inputs and outputs, such as obtained by dividing nominal data on spending or revenues by a price index. Two different sets of questions spawned two different price indices. The Producer Price Index (PPI) focuses on measuring prices sellers receive. Initially focusing on traditional industrial sectors, the PPI was expanded to include more service sectors in the 1980s as those sectors became increasingly important in the US economy (Berndt et al. 2001: 139). In applying the PPI to the health care industry, the BLS identifies specific sub-industries in the health sector (e.g., hospitals, physicians' office and clinics, and nursing homes) and regularly collects information on revenues and output prices for a specific bundle of services produced by each sub-industry. A different price index, the Consumer Price Index (CPI) for medical care, focuses in consumer out-of-pocket spending on medical services. As such, it excludes government spending and health coverage nominally paid by employers in pre-tax dollars. As a result, "almost two-thirds of medical spending is outside the scope of the American CPI" (Newhouse 2001: 13).

Both indices may be significantly biased if they do not properly account for changes in quality, which is a daunting task (Boskin et al. 1996; National Research Council 2002). Including new goods and services not present when the initial market basket of medical services was defined presents a related challenge. A third important difficulty for medical price indices is obtaining information on actual transaction prices for medical services rather than list prices. Perhaps more fundamentally, both price

indices were traditionally based on cost of buying a (fairly narrow) basket of medical services. Yet patients are seeking treatment for an episode of illness, not buying a day in the hospital or an office visit *per se*. Recent revisions in both price indices have moved away from measuring inpatient days and outpatient services toward accounting at least partially for the substitutability between inpatient and outpatient services for treating an episode of illness. This represents a significant improvement. Nevertheless, many deficiencies remain, as discussed in greater detail in Berndt et al. (2001) and Newhouse (2001).

An indication of the extent of the mismeasurement stemming from price index biases comes from the late 1980s and 1990s. Few would dispute that the widespread introduction of managed care in the US has, if nothing else, reduced costs. Yet the CPI for medical care indicated a continuing increase in costs of care relative to general price inflation in the US during this time period. This disparity seems to indicate that “something is, or at least was, amiss with the American CPI for medical care” (Newhouse 2001: 22).

Improving Productivity Measurement

Proposals for improvement in measuring price indices and productivity share a focus on disease-specific measurement of the benefits and costs of treatment.² For example, Berndt et al. (2000: 165) propose a medical care expenditure price index that would use recent research on outcomes and cost-effectiveness to help in determining the costs of treating an episode of a representative set of illnesses or conditions. “Health care

spending should have its own deflator that is built up from a sample of disease-specific deflators.... Ideally the sample would be chosen randomly with probability proportional to spending on the disease, and the weight of health care in the overall index would reflect the proportion of health care spending in the relevant aggregate (e.g., GDP)”

(Newhouse 2001: 35). A key challenge is to isolate and measure the impact of medical care on health outcomes when, as is well known, other factors such as lifestyle choices are often more important for health. Moreover, the influence of such factors, as well as the appropriate outcome measures for quality of life, differ by medical condition.

“Research that helps to identify an appropriate mix of illnesses and their treatments, ones for which outcomes measures and/or published treatment guidelines are available, and ones for which sample sizes in retrospective claims data bases are sufficiently large, would seem to be particularly helpful” (Berndt et al. 2000: 166). Large samples of retrospective claims, unlike data under capitation payment, allow researchers to measure all the costs of caring for patients with particular (constellations of) medical condition(s), a prerequisite for accurate measurement of the costs of treating an episode of illness. Data from disease management companies, while imperfect, might be a good starting point for further analysis. Use of such data in performance-based payment contracts enhances its scope and reliability (compared to other claims data). Disease management companies also usually stratify patients according to severity. Unfortunately, this kind of data is unlikely to extend back further than the early 1990s.

The Institute of Medicine, in the 2001 report *Crossing the Quality Chasm: A New Health System for the 21st Century*, focuses on the use of refined condition-specific

² Interestingly, Anne Scitovsky produced pioneering research on the cost of treating specific illnesses (Scitovsky 1964, 1967); as Triplett (2001) notes, the recent studies on episode-based productivity

measures for better aligning provider payment with quality improvement goals. The report notes that recent innovations in payment methods often feature “greater attention to sub-populations with common clinical needs” (p.202). This latter application of the research on productivity to provider payment is perhaps most relevant for the broader HCDP agenda. “Although it would be premature to recommend payment based on priority conditions, it is appropriate to study their feasibility as a tool for aligning the scope of services provided with the scope of payment.... Organizing care and payment around priority conditions could offer a framework for aligning payment incentives around a common clinical purpose that is consistent with meeting patient needs as completely and efficiently as possible” (ibid).

Over the past decade or so, medicine has philosophically evolved from a focus on each patient as a unique case requiring much subjective judgment to more objective evidence-based medicine and protocol-based disease management. A logical next step in this transformation is the application of engineering design to health care (e.g., “if A then B” branching logic in treatment protocols). We now know in medicine much more about what patients want and how to produce quality care. It does not therefore seem premature to suggest a research agenda that melds productivity analysis of a list of priority medical conditions with research on improved payment methods based on those same priority conditions.

Although some would want to wait until measures are proven reliable and perfected, it is unclear that measures will ever improve drastically until they are put to use. Healthcare providers need to receive economic signals accurately reflecting the goal of efficient, high-quality treatment of episodes of illness. The current FFS crazy-quilt

measurement appeared almost three decades after her work.

system of high-margin and low-margin services embodies perverse incentives and undermines initiatives that improve quality and/or reduced costs of treatment through better coordination, whereas capitation seems to shift onto providers too much risk outside clinicians' control (e.g. prevalence and incidence of diseases). Therefore an important complementary line of research might be a thorough epidemiological study of prevalence and incidence of diseases to inform design of payment so that clinicians bear the risk of treating an episode of illness yet risk is more broadly pooled regarding the prevalence and incidence of diseases.

What Specifically Do We Mean By Productivity Improvement?

Most people have a fairly clear idea of what it means to be productive or to increase productivity. Productivity in general refers to how much output one obtains from the inputs used. For medical care, measuring both outputs and inputs are problematic.³ Nevertheless, “at the conceptual level, an appropriate measure of medical care output is clear—the health gains resulting from medical care. If increased medical spending leads to health improvements worth more than their cost, then medical care productivity is increasing. If spending increases lead to less valuable increases in health, medical care productivity is falling” (Cutler and Berndt 2001: 1). By extension, the productivity of a particular organization in the delivery system—a hospital or physician group—increases when the organization produces health improvements more valuable than the cost of care.

³ Indeed, Triplett (2001: 15) argues that “among the hard-to-measure services, no task has been perceived as more difficult than measuring the output of the health sector.”

Productivity measurement unites the health policy triumvirate of cost, quality and access. Accurately measured productivity gives key insights into all three critical goals of health policy. Most fundamentally, productivity measures *quality per unit cost*. If (drawing on a United Health Care conceptual framework) health care value is a function of comfort, speed, efficacy, and affordability, then productivity improves when quality as measured by comfort, speed, and/or efficacy becomes more affordable (e.g., quality improves for a given price). Perhaps the most intuitive example is reduction of cost for a given health outcome. The IOM report *Crossing the Quality Chasm* speaks of continuous decrease of waste (p.62). But productivity enhancement also occurs whenever quality increases per unit cost. There could be better health outcomes for constant or lower cost, or significantly increased cost accompanied by an even greater increase in quality of health outcome.

Access is less directly involved in productivity measurement, but is far from unrelated, because productivity improvement expands access. Cutler and McClellan (2001) make a useful distinction between the “treatment substitution effect” when new technologies replace old technologies for treatment of established patients, and the “treatment expansion effect” of extending treatment to more people—that is, expanding access. Indeed, for some medical treatments, such as cataract extraction, this latter effect has been extremely significant (Shapiro et al. 2001). Diagnosis and treatment for major depression provides another clear example, with diagnosis rates doubling after the introduction of Prozac-like drugs (Cutler and McClellan 2001). Of course, many factors (outside the scope of the current article) shape the extent to which any given productivity improvement expands access for specific patient groups.

An accurate productivity measure needs to account for all resource use and all quality enhancements, which may differ according to the time period considered. Inputs include capital and information systems as well as all labor costs. Productivity improvement could in some cases flow from replacing some kinds of specialized labor (e.g., physician time) with others (e.g., nurse practitioners) and/or with information technology and decision support tools. Enhanced value may increasingly stem from better responsiveness to consumer demand for treatment protocols respecting individual preferences, just as “mass customization” has allowed consumers to order automobiles or computers online with their individual choice of components and features.

Productivity measurement is a tool that can be used for many different tasks. The same research can be the springboard for answering many questions. To enable users to apply the research to various tasks, several different kinds of measures or indices can be developed, perhaps tailored to given medical conditions. For example, in studying heart attack treatment, Cutler et al. (2001) present both a “service price index,” which prices specific treatments provided, and a “cost-of-living index,” which prices the health outcomes of patients. A service price index measures how much it costs to buy a specific bundle of medical services at different points in time. An aggregated service price index improves upon fee-for-service input pricing, “like pricing the automobile rather than the tires, brakes, headlights, windshield, and so on” (Cutler et al. 2001: 310). Such a measure is quite relevant for provider organizations and for developing “charter health systems” in private health care delivery. A cost-of-living index takes account of the fact that an increase in cost of a bundle of services may reflect increased quality and social benefit. Here the relevant question is how much people value (i.e., are willing to pay for) today’s

medical care at today's prices, compared to say 1960 medical care at 1960 prices. Such a measure is critical for accurate measurement of overall health care productivity at the macroeconomic level, and may be relevant for "charter health systems" to the extent that consumers are willing to pay for demonstrated quality improvements.

A few specific clinical examples help to illuminate the value of a productivity measurement system. First, consider evaluation of new medical technologies, such as for treatment of heart disease. A dilemma with current evaluation is lack of a holistic measure of value created by new medical technologies, allowing evaluators to weigh health gains against the large cost increases. A recent NBER volume of research on productivity in medical care concluded that "the conventional wisdom that technological advances in medicine are a driving force of increasing health care costs is much too simplistic" (Cutler and Berndt 2001: 10). In many cases the cost per treatment is falling, but many more people receive treatment. Higher total spending in such cases is driven by the aforementioned treatment expansion effect. Accurate measurement of the costs and benefits of treatment over significant periods of time and across many providers allows researchers to assess whether the benefits from technological change are worth their cost, taking account of the treatment expansion effect. Cutler and McClellan (2001) present current research on this issue, concluding that the quality-adjusted price of medical care has actually been decreasing rather than increasing. This result suggests a need to refocus the policy debate from cost control to broader issues of cost-effective quality improvement and welfare-improving technological change.

Productivity research thus enables a clear analysis the value of various technological advances. Lacking such measurement, the decision to cover and reimburse for any given technology is often almost entirely political.

Cutler and others have studied technological change in treatment of heart attacks in the 1980s and 1990s, covering the period when bypass surgery, catheterization and angioplasty were spreading, and angioplasty with stent was first introduced. If it were possible to obtain appropriate data going back as far as the 1950s as well as going forward beyond the 1990s, then researchers could document an even more sweeping story of technological change in medicine. The productivity changes from medical management of heart conditions in the 1950s to the introduction of cardiac surgeons in the 1960s and of angioplasty by cardiologists in the 1970s (to prescription of statins such as Lipitor by primary care physicians by 2000) are profound. Moreover, these technological changes intimately interconnect with medical education, manpower policy and the medical labor market. Costs have increased significantly as angioplasty, for example, evolved from balloon-angioplasty, to balloon-angioplasty with stents, to balloon-angioplasty with chemical-covered stents. Each is more expensive than the previous procedure. Each has been judged by clinical trials to improve the outcome (a longer period without closing, re-stenosis). Has productivity improved? If the procedure remains effective for five years instead of the original six months, the patient need no longer undergo multiple angioplasties during those five years, saving considerable resources and patient discomfort. In sum, Cutler and colleagues have documented a large societal ROI to technological change in heart disease treatment, and the story of productivity change for this condition is still unfolding.

A similar example comes from hip replacement. Over the last 20 years the quality and price of the prosthetic element has increased significantly. The overall value of the process has probably increased just as significantly, as a result of shorter length of stay, quicker return to normal life, and longer-lived hip replacements (25 years vs. 10 years previously).

Treatment for breast cancer provides yet another example. Looking at treatment costs and survival benefits for breast cancer treatment between 1996 and 1985, Cutler and McClellan (2001) conclude that technological change in treatment of this condition was neither clearly beneficial nor harmful. Continuing to study this condition over the coming several years, and including the costs and benefits of screening, could reveal a breakthrough in productivity of treatment for breast cancer with the introduction of chemoprevention targeted at the highest-risk women. As recently reported in *JAMA*, tamoxifen reduced breast cancer incidence among healthy women with the breast cancer disposing gene BRCA2 (King, Mary-Claire, Sam Wieand, Kathryn Hale et al. 2001). This evidence is likely to make the “treatment-expansion effect” of screening and tamoxifen use more cost-effective, since doctors can use genetic information to target treatment to those marginal patients most likely to benefit.

Few conditions merit careful productivity analysis as much as diabetes, a very common and costly condition in the US. For moderate (Type 2) diabetes, a widely held view is that good management brings large quality gains (such as fewer eye problems and less kidney disease), but since these benefits accrue over a five- to ten-year period, patient turnover prevents a provider group or insurer from reaping a significant ROI. And even for cases in which a disease management program attains clear short-term returns

(e.g., through reduced emergency room visits and episodes of hospitalization), those gains usually accrue to the insurer or self-funded purchaser, not the provider group which has the closest contact and role in managing patients. Payment incentives are misaligned (IOM 2001: 192). It should not be surprising to find that disease management programs are rapidly growing aspects of managed care companies (who bear financial risk), but often net revenue losers for provider groups (who stand to lose fee-for-service revenues from reduced utilization of services). Much more can be done to increase the productivity of diabetes treatment, especially since information systems and sophisticated management software can enable a nurse (rather than a physician) to deliver much of the care, without deterioration of outcome. To achieve such productivity improvements, however, will require confronting deep-rooted traditions regarding the nature of professionalism and turf.

A final example comes from prenatal care, where significant productivity gains could flow from prevention of infant prematurity or other complications occurring with both mother and child. A number of studies indicate that use of ethnically compatible health workers, even only with modest training (e.g., 3 months), can significantly reduce the incidence of prematurity or other perinatal events. In this case, reducing adverse events could have a staggering ROI. Treatments associated with significant prematurity can cost a half million dollars, and the continuing cost of managing the lifelong disabilities are often measured in the millions (as evidenced, for example, by court settlements of malpractice cases of badly managed pregnancies and deliveries).⁴

⁴ Cutler (2001) reports the value of the lifetime medical (and special education) spending of a low birthweight infant, *discounted to present value*, to be \$70,000 more than that of a regular infant. This is well below his estimated \$350,000 present value of the average 13 additional years of life that intensive

Such productivity improvements seem obviously important. Yet the current system of measurement and payment fails to encourage providers, insurers, and patients (through compliance, etc.) to undertake and support many of these innovations. As noted by the IOM report, incentives are misaligned, and well-meaning professionals too often face financial penalties—through loss of revenues, increased costs, and/or adverse selection—rather than rewards for raising quality per unit cost.

Uses of Improved Productivity Measurement

As emphasized by Newhouse (2001), among others, accurate measurement of price indices and productivity in health care requires taking account of the large amount of “off-frontier production” documented for the US system—deviations from best practice in the form of overuse, underuse, or misuse—and any changes in such production over time.⁵ Going a step further, accurate measurement is the first step to accelerating improvement toward best-practice “frontier production” by incorporating productivity measurement in provider payment.⁶

Of course, accurate productivity measures are vital inputs for many kinds of policy evaluations, not only providing accurate economic signals to providers. In addition to the aforementioned use in assessing the benefits of technological change, researchers can use similar techniques to evaluate other changes in the delivery system,

medical care yields for low birthweight infants. These figures suggest that prevention of low birthweight is clearly worth the cost for interventions costing less than \$70,000 in present value per infant.

⁵ Since the clinical definition of appropriateness tends to ignore cost (e.g., looking at whether expected benefit outweighs clinical risk), use of this definition likely underestimates the number of economically inefficient procedures (Newhouse 2001: 31).

⁶ Indeed, Newhouse (2002) argues that design of better incentives is critical for improving the performance of the health care system and shrink the quality chasm.

such as the rise of managed care, malpractice system reform, and provider competition (Cutler and McClellan 2001: 26).⁷

Productivity research is a critical investment to advance the health care industry. Consider just a few of the many important uses of this research for building a better health care system in the 21st century:

- ❖ Such research is key to pinpointing where the ROI comes from investments in re-engineering the health care delivery system. If we are to develop an innovative delivery system that is effective, accessible, efficient and integrated, we need to start with proper alignment of incentives. Productivity research aims to develop an episode-based payment system for specific priority conditions, which can then be used as part of experiments with “charter health systems.”
- ❖ Productivity measurement enables consumers and organized purchasers to become informed buyers, a prerequisite for a well-functioning market-based service industry. One of the fundamentals of a market is symmetry of information. In health care, dearth of information about productivity handicaps purchasers who seek to maximize value. The whole concept of choosing a service or product based on value—that is, by assessing quality relative to price—is virtually absent from the current system. Instead, we face a generalized shift of cost from third-party payers to consumers, in a complex, slow and painful way, through increased employee percentage of premiums and co-pays per encounter, higher deductibles, decreased scope of benefits, and so on. If consumers are to bear these responsibilities, they deserve the information necessary to make informed choices.

⁷ On the latter issue of evaluating the impact of competition, see for example Kessler and McClellan (2000).

- ❖ Productivity research underpins product and service development, allowing suppliers to determine the worth of their current products and services and in what direction their product development should aim to create more value added. The insurance industry and other intermediaries need such information to design and market products that demonstrate clear value to purchasers, and to continuously evaluate organizational and payment methods that create appropriate incentives for the contracting providers to deliver that value. Producers of services (the medical groups and hospitals), the producers of medical diagnostic and therapeutic instruments, the producers of pharmaceuticals and biologics, and the developers of software and hardware, all need this information if they are to develop products which increase efficiency and/or quality. The productivity measurement techniques and their associated software products themselves will likely be in high demand from participants ranging from individual providers to government regulatory and policymaking agencies.
- ❖ Accurate productivity measurement is vital at the “macro” level of health policy, to guide and help assess investments to ‘cross the quality chasm’ while simultaneously responding to the ever-increasing pressures for cost containment.

Workplan

The goal of this research component of the HCDP is threefold:

- (1) to describe how treatment has changed over time for given priority conditions, to assess whether productivity of treatment has increased or not;
- (2) to provide a solid empirical basis for evaluating specific clinical interventions such as disease management programs, perhaps also evaluating the productivity effect of disease management interventions implemented during the time period covered by current data; and
- (3) to develop an episode-based payment system for specific priority conditions, to be used as part of experiments with “charter health systems.”

The priority conditions (listed in the IOM report *Crossing the Quality Chasm*, p.91) include cancer, diabetes, emphysema, high cholesterol, HIV/AIDS, hypertension, ischemic heart disease, stroke, arthritis, asthma, gall bladder disease, stomach ulcers, back problems, Alzheimer’s disease and other dementias, and depression and anxiety disorders.

Next steps:

- Pick several priority conditions on which to focus initial research;
- Obtain disease management or other appropriate data for each priority condition, preferably large samples spanning a relatively long period of time;
- Complete detailed work of what data fields will be necessary and are available and how to describe the research outcome/product (technically, functionally and service);
- Conduct preliminary analyses on one or two specific conditions;
- Organize and hold a workshop jointly with the Boston Fed on productivity measurement in health care?

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