

Physician Productivity in the United States: Managerial, Organizational, and Policy Implications

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Abstract

This paper addresses several dimensions of physician productivity in the United States: (a) the concept itself and different measures of productivity; (b) the role(s) of public policy in shaping physician productivity; (c) theory and evidence regarding the effects of policy and other external factors on physician productivity; (d) a future research agenda to fill the gaps in theory and the relevant evidence base; and (e) suggested strategies for increasing physician productivity. I will argue that productivity metrics will differ, quite appropriately, based on the perspective of different stakeholders. The principal forces driving productivity will be discussed under the headings of behavioral incentives, structure, process, and technology; and I will posit that the effect of legislation and public policy on physician productivity is inherently likely to be relatively modest. The available evidence from cost and production function studies points to input mix, scale, and incentives as significant determinants of physician productivity, but there are several limitations in the extant data base -- failure to adjust for patient case mix differences, imprecise measures of inputs (especially physical capital and information technology), cross-sectional data that fails to capture technical change over time, and crude measures of physician output. The paper outlines a research agenda to address these shortcomings and concludes with a set of proposed strategies for increasing physician productivity in the United States.

Introduction

This paper addresses the subject of physician productivity in the United States on several dimensions:

- How is and should this concept be defined? Why does it matter? How should it be measured?
- What factors drive physician productivity: public policy, markets, internal-organizational arrangements, and other environmental factors?
- What are the effects of these various “drivers” on physician productivity – particularly those factors that can be directly altered either through some form of policy intervention or internal practice re-design?
- What additional research is required to craft more effective policy with respect to physician productivity?
- What types of strategy are being, or should be, formulated to improve clinical productivity?

The policy context for this paper’s examination of physician productivity is framed by the observation that per capita spending on health care in the United States is more than twice the median expenditure of the member countries of the Organization for Economic Cooperation and Development (OECD): \$4631 versus \$1983, respectively, as of the year 2000¹ (Anderson et al. 2003). In spite of this incremental expenditure, the

¹ These numbers are expressed in \$ of U.S. currency, adjusted for purchasing power parity.

U.S. actually ranks below average on most health services utilization measures. Anderson and his colleagues conclude that higher health care prices principally account for the relatively higher levels of health spending per capita in the U.S. Moreover, the relative performance of the U.S. on such quality and outcome domains as satisfaction, life expectancy, mortality, and general health status does not appear to support a thesis that the increased expenditure on health services is providing commensurately greater “value for money” than other developed countries.

Improved clinical productivity and its flip side -- reduced costs per unit of service -- represents one approach to reducing the apparent discrepancy between health care expenditure and health improvement that is suggested by international comparisons. This manuscript will combine theory with the best available evidence to motivate recommendations for management, operations, and policy that could significantly improve physician productivity.

Physician Productivity Measurement: The Ideal versus the Real

Fundamentally, productivity represents the level of output produced for a given level of inputs. This basic definition implies that the validity of a particular productivity assessment will depend on the corresponding validity of one’s specification and measurement of all relevant inputs and output(s). Once these measures have been specified, the methodology for evaluating productivity involves estimating either a production function or cost function (Silberberg 1991).²

² This interchangeable approach to estimating productivity relies on the “duality theorem” in the microeconomics of the firm, which states that in perfectly competitive labor and input markets and cost-

In the production function approach, one estimates an equation of the following form:

- (1) Output of firm “i” during period “t” = f (units of labor and capital employed by the firm “i”, respectively, during period “t”)

Alternatively, one could estimate the following cost function:

- (2) Total cost of the output(s) of firm “i” during period “t” = g(quantity of output(s) produced by firm “i” during period “t”, prices for inputs of labor and capital, respectively, during period “t”)

The purpose of this exposition is to set the stage for our evaluation of what is known about physician productivity in the U.S., as well as strategies for productivity improvement. Equations (1) and (2) directly state the data required for rigorous productivity assessment: valid measures of input levels or input prices, respectively, and of the quantity of output(s). The formal equations remind the analyst, for example, that measures of output per physician are not valid physician productivity metrics unless other inputs to the medical care production process -- nurses, non-nurse aides, other personnel, and physical capital (medical equipment, office space, other physical assets) – have been taken into account.

The definition of output is critical for discussions of management, policy, and practice. The demand for medical care is derived from the population’s underlying demand for health (Grossman 2000). In most practical applications, the production and cost functions of immediate interest to managers and policymakers focus on the quantity

minimizing firms, maximum productivity (output achieved for a given level of input) is exactly equivalent to minimum cost per unit of output (technical efficiency).

of medical care services delivered (e.g., office visits, relative value-weighted services delivered) as the relevant output. However, since consumer information on the benefits and costs of alternative services is imperfect, and realizing that medical care services are not exchanged in perfectly competitive markets, both theory and evidence lead one to conclude the following:

- (1) Even the technically efficient production of existing medical services will not necessarily satisfy the population's underlying demand for health because of the asymmetry of information concerning the health benefits and true costs of those services.
- (2) Given imperfect competition and the dominance of closely held, physician-owned firms in the markets for physician services, medical care services are produced under conditions of physician utility maximization, rather than profit maximization and cost minimization.
- (3) Accordingly, our estimates of physician productivity and clinical efficiency must take into account a set of structural and behavioral influences not generally acknowledged in neoclassical economics. These constitute the case for managerial and policy intervention in what otherwise would be solely matters for clinical action. The nature of the intervention is to change the market and internal-organizational conditions which shape physician production and clinical decision-making.

The social objective, therefore, is a reformulation of the physician's production problem. The broader purpose is to maximize population health for a minimum

expenditure of society's resources. In this case, the allocation of resources devoted to physician services must not only be technically efficient (least cost per unit of output, but **allocatively efficient** as well: that is, maximizing the net benefit of physician services, measured as the difference between the monetary value of the health benefits produced and the value of the resources devoted to physician services instead of other uses (i.e., their opportunity cost).

The practical implication of this technical argument is that -- in evaluating physician productivity, one needs to craft multiple measures to capture multiple perspectives: that of the population as a whole (society), the individual (patient), the organized group purchaser (often the employer), the health plan, and the physician or provider organization. Cost-benefit and cost-effectiveness of physician services are appropriate productivity indicators from the societal perspective, whereas from the individual patient's viewpoint the personal health benefit (both psychic and somatic) net of out-of-pocket monetary and opportunity costs of time will be relevant index of physician productivity. In the absence of perfect competition and complete information, market forces will not reconcile these alternative viewpoints.

The employer's view of physician productivity is, on the one hand, broader, in that the organization directly pays the health insurance premiums on behalf of the individual employee and also bears a major portion of the productivity losses associated with ill health, but also narrower, in the sense that the employer only captures the firm-specific share of the health and productivity benefits and cost-savings associated with efficient physician production. The personal income tax exemption further distorts employer/employee decision-making by encouraging both parties to purchase more first-

dollar health insurance than efficient risk protection would dictate (Chernick et al 1987).³

Gruber and Poterba (1996) estimate the loss in government revenues due to this tax subsidy for employer-sponsored health insurance at \$60 billion in 1994. The tax subsidy reduces physician productivity by inducing excess consumption and production of overly-insured medical care services.

The tax-subsidy-induced demand for excess medical care also distorts the physician's productivity calculus in several ways:

- Medical care prices are "bid up", given less than perfectly elastic market demand for health services, which signals providers to shift production toward relatively better insured services -- thereby distorting allocative efficiency in the delivery of medical care.
- The demand inducement generated by the tax subsidy indirectly reinforces the local market power of individual physicians by insulating employers (who collectively purchase health insurance on behalf of employees) and individual employees from the full price of their medical care purchases. In turn, this incremental increase in market power leads to reduced output and potentially distorted input decisions by physicians relative to choices that would be made under conditions of perfectly competitive markets and well-informed consumers.

To the extent that physicians maximize utility (including leisure, net income, and the health benefits accruing to their patients), instead of profit, increased market

³ Using base case (mid-range) assumptions, Chernick and colleagues estimate that complete elimination of the tax exemption of employer contributions to health insurance would lower demand for employer-sponsored health insurance by 16 to 27 percent and the overall demand for medical services by 4 to 10 percent.

power will lower physicians' overall productivity and re-direct their efforts toward artificially subsidized services⁴.

Policy Influences on Physician Productivity

If the preceding argument is cogent, the principal roles for public and private sector policy regarding physician productivity are clear:

- Evaluation of, and collective action to improve, the market conditions for the provision and financing of medical care
- Removal of artificial (policy-induced) distortions that strengthen market power on either side of the market -- for example, health plans on the demand side, or physicians and hospitals on the supply side (including antitrust policy and administered price-setting relative to physician services)
- Investment in technologies and research (informational and technical) that yield external net benefits to society as a whole, especially where private sector decision-makers cannot realistically capture these benefits⁵

⁴ In a nutshell, the argument is that the subsidy-induced incremental market power will encourage physicians to raise prices, cut output, and (if inputs are blended in variable proportions as the level of output changes) miss opportunities to substitute cheaper inputs (e.g., nurses and non-nurse aides) with equivalent productivity for specific services for the use of their own time -- as well as the converse. The key assumptions behind my assertion that inputs will be allocated inefficiently are: (1) the utility-maximizing physician will compromise cost minimization because market power provides a buffer allowing the physician to do so with minimal consumer-switching; (2) in the presence of market power and with utility rather than profit as the objective, the physician will tend to "purchase" marginally improved health benefit for the individual patient, rather than maximum net benefit (health value minus cost), at the expense of lower technical and allocative efficiency.

⁵ This is the typical "free rider" problem that emerges when the benefits of innovation (e.g., development of new models for financing and delivering integrated chronic care) are diffused throughout the industry as a whole, e.g., competing health plans or closed-panel HMOs, but the costs are concentrated on the innovator.

First, both public and private decision-makers must systematically examine the costs and prices of medical care services. The stylized facts are clear: (1) The United States spends appreciably more than other developed countries for personal health services, but without corresponding advantages in health improvement or patient satisfaction (Anderson et al. 2003). The substantial difference in health expenditure is not explained by investment in real resources. In fact, one study found that Americans were spending 40 percent more per capita than the German public, but receiving 15 percent less in real health care resources; a similar comparison to the National Health Service in Britain found that the U.S. health care prices for specific services were approximately 75% higher, yet input levels were only 30 percent higher (McKinsey Global Institute 1996)⁶ -- suggesting substantial higher **price-cost margins** in the United States. This tax expenditure distorts consumer choices of health insurance protection and indirectly tilts demand and production toward better-insured medical care services, while also diminishing provider incentives for technical and allocative efficiency. This evidence is consistent with the hypothesis that, on the whole, physicians in the U.S. are earning economic rents from their local market power -- not due to unique, physician-specific, non-duplicable factors of production.

Second, having argued the case that inadvertent policy-induced pricing distortions are a key impediment to physician productivity, consistency impels me also to recommend a role for thoughtful, but active antitrust policy in medical care markets. For example, Cuellar and Gertler (2002) find that integration between hospitals and physicians does not significantly improve efficiency, but is related to increased hospital prices -- particularly

⁶ The McKinsey study analyzed four tracer conditions: diabetes, gallstones (cholelithiasis), breast cancer, and lung cancer. They adjusted currency values to U.S. dollars, using exchange rates based on purchasing power parity.

in circumstances where the the physician-hospital arrangement is exclusive and in metropolitan areas (as contrasted with presumably less competitive rural markets)⁷.

Coherent antitrust policy in physician services markets will certainly be hampered in the short-run by the paucity of research pertaining to the effects of horizontal and vertical integration of physician services⁸. The extant evidence from the U.S. health economics literature (Pope and Burge 1992; Marder and Zuckerman 1985) strongly suggests that physician group practices are more technically efficient than solo practices, The evidence is more equivocal regarding variations in efficiency across groups of different size, but on balance seems to suggest that physicians in mid-sized groups are more productive.-- one form of horizontal integration among physicians -- on physician productivity and clinical efficiency.

Third, public policymakers should actively re-assess the current level of U.S. tax subsidy for employer-based health insurance. By eliminating the **deadweight losses**⁹ associated with such tax subsidies, in the long run not only would downward price pressure emerge, but also public resources would be freed up for investment in information technology (IT) and research that could go directly to physician productivity enhancements. The domains of IT infrastructure and carefully targeted health services

⁷ Their findings are not dispositive, however, because, as the authors acknowledge, the data did not include physician prices, nor is metropolitan area versus non-metropolitan location a sufficient measure of relative market competition.

⁸ For example, the review article of Gaynor and Vogt (1999) contains virtually no analysis of the antitrust issues relating to pricing policy and efficiency of physician firms, and an earlier piece (Haas-Wilson and Gaynor 1998) solely examined the implications of physician networks formed for the principal objective of collective contracting with insurers and, in some instances, with self-insured employers. The systematic review by Bazzoli et al. (2004) also offers no evidence on the effects of physician horizontal or vertical integration on market power or pricing behavior.

⁹ Deadweight loss refers to the difference between the well-informed consumer's total valuation of the quantity and quality of services delivered and the total opportunity cost of those services. These are "deadweight" losses to the economy in the sense that neither consumers nor producers capture the potential value added that could have occurred if physicians had provided the socially optimal level of quantity and quality. In contrast, for a given level and quality of output, prices above competitive levels are a **transfer** from consumers to providers and represent a "zero-sum" result for society as a whole.

and clinical research seem especially ripe for dramatically increased social investment. A recent paper by Hillestad et al. (2005) concluded that effective implementation of electronic medical record technology and networking ultimately would save roughly \$77 billion annually by enhancing efficiency and patient safety. The authors postulate that the bulk of these estimated, long run savings would be captured by payers -- about \$23 billion per annum by Medicare and \$31 billion by private payers; but in the short run physician productivity is likely to diminish in the start-up phase, and both private firms and public programs would be required to invest substantial capital upfront. Thus, significant public funding will be required to jump-start the public and private sector adoption of IT in physician services.

Theory and Evidence on Determinants of Physician Productivity

The market for physician services is not perfectly competitive, and both general observation and empirical studies reveal large gaps and asymmetries (especially vis a vis providers) in consumers' information on the price, quality and safety characteristics¹⁰, and outcomes of physician services. Accordingly, non-technological factors -- physician financial incentives, personal preferences, the nature and intensity of market competition, organizational structure and the physician firm's "culture" -- are likely to influence clinical productivity. The evidence is consistent with the hypothesis that physicians operate according to a **behavioral production function**, which includes not only labor and capital, but also non-technical factors as determinants of production (Gaynor and

¹⁰ For example, see the recent review article by Judith Hibbard et al. (2005), which concludes that engaging patients to prevent medical errors is difficult -- even when patients correctly recognize the threats to their safety and the requisite preventive behaviors. The authors conclude that the patient's "self efficacy" is significantly and positively related to the likelihood of the individual taking error-preventive steps.

Pauly 1990; Gaynor and Gertler 1995; Escarce and Pauly 1998; Conrad et al. 2002). In this section we consider the evidence regarding determinants of physician productivity.

Factor input productivity. Prevailing production function studies (Conrad et al 2002; Gaynor and Pauly 1990) reveal that the **physician's own time input** has the greatest impact on production. Estimated input-output elasticities for physician own time vary in a relatively tight range -- from 0.43 to 0.53 (Gaynor and Pauly 1990; Conrad et al. 2002)¹¹ -- suggesting that, other factors held constant, a 10% increase in physician hours worked leads to an increase in output ranging from 4.3 to 5.3%, depending on the estimation method and physician sample. The elasticities of other input variables are considerably smaller; for example, Gaynor and Pauly's largest estimate of the elasticity for number of examining rooms (the physical capital input measure) was 0.03, and the comparable elasticity estimate of Conrad et al. (2002) was 0.07, using building cost per physician FTE as the proxy for capital cost. The largest non-physician labor elasticity estimated by Conrad et al.(2002) was 0.05 for medical administrative personnel. One study has considered the effect of patient waiting time on physician productivity – thus considering patient time as an explicit input to medical care production; Headen (1991) found that a 5-minute increase in patient waiting time led to an increase of 2.3 visits per week (approximately a 2.8% increase in productivity).

¹¹ Conrad et al. (2002), using a more recent sample (1997) from the Medical Group Management Association, estimated a physician own-time elasticity of 0.46 in an ordinary least squares production function (pooled across different specialties) for physicians in medical groups – squarely in the middle of the range reported by Gaynor and Pauly (1990), based on a 1978 sample of primary care physicians practicing in partnerships of varying size.

Scale of inputs. The econometric studies of physician productivity generally find that physician productivity is substantially higher in medical groups¹² than in solo or 2-person practices. Pope and Burge (1992) report that group physicians deliver 17 percent more office visits per week than solo practitioners, after controlling for specialty, physician hours worked, other inputs, and practice and physician characteristics. Escarce and Pauly's (1998) findings are qualitatively similar for general internists; using two different methods, they estimate large economies of scale in medical practice. Using data from the 1988 HCFA Physicians' Practice Cost and Income Survey, Pope and Burge (1996) conclude that if all physicians were in the most efficient practice size, average office visits per physician hours worked would be as much as 13% higher¹³. These **scale inefficiencies** range from 14% among general surgeons, 9% among primary care and single-specialty practices, to less than 1% among multi-specialty group practices.

Survivorship studies (cf., Marder and Zuckerman 1985), which examine changes in the size distribution of medical practices over time, uniformly support the econometric findings of greater physician productivity in group practice, as compared to solo and 2-physician practice. For example, in the most recent data from the National Ambulatory Care Survey (Woodwell and Cherry 2004) 65.7 percent of reporting physicians were in single specialty or multispecialty groups. Both the AMA (Smart 2005) and 2004 NAMCS data indicate that smaller single-specialty groups are in the ascendancy. These smaller, single-specialty groups are growing modestly in size and dramatically in their

¹² The conventional definition of medical group practice in the U.S. (AMA, 2005) is 3 or more physicians practicing under a common organizational identity and sharing practice revenues, expenses, and financial risk.

¹³ The authors (Pope and Burge 1996) note that patient travel costs have not been included in their analysis. Since consideration of patient time costs would tend to lower optimal practice size, scale inefficiencies may be overestimated in their study.

number and proportion of all practicing physicians (Conrad et al. 1999). The modest growth in practice size of small, single-specialty practices is consistent with the earlier findings of Pope and Burge (1996), who estimated that lowest-cost practice size was 5.2 physicians, as contrasted with the average practice size of 2.4 physicians in their 1988 sample.

Mix of inputs. Most of the econometric studies of input mix (one aspect of technical efficiency) are quite dated, but may nonetheless might be instructive for current policy and practice when combined with more recent, non-econometric analyses. In his dissertation Reinhardt (1972, 1975) concluded that physician practices could profit by employing approximately double their observed number of aides per physician. Later studies by Brown and Lapan (1981) and Brown (1988) questioned Reinhardt's findings based on 1976 data, but a comprehensive survey by the Office of Technology Assessment (OTA 1986) adjudged that physician practices could substantially improve productivity by delegating more tasks to physician extenders. Pope and Burge (1992) interpret the extant evidence of that time to be consistent with the OTA's.

A recent Cochrane Collaboration systematic review of doctor-nurse substitution (Laurant et al. 2005) concluded:

“The findings suggest that appropriately trained nurses can produce as high quality care as primary care doctors and achieve as good health outcomes for patients. However, this conclusion should be viewed with caution given that only one study was powered to assess equivalence of care, many studies had methodological limitations, and patient follow-up was generally 12 months or less. While doctor-nurse substitution has the

potential to reduce doctor's workload and direct health care costs, achieving such reductions depends on the particular context of care." (p. 2)

On balance, it seems that "school is still out" on estimating the real gains to increased task delegation by physicians.

Technical efficiency. The econometric studies seem to agree, within a relatively tight range, that if the less productive practices historically have operated at roughly 65% of the technical efficiency of the most efficient practices in their respective samples (Pope and Burge 1992). This summary, based on three major studies (Pope 1988; Gaynor and Pauly 1990; Gillis et al. 1991), implies substantial room for improvement in physician productivity. 1995 data from a sample of 86 medical groups in Minnesota exhibited large variation across the clinics in mean health care cost per member per year (PMPY) -- from an average of less than \$1000 PMPY to more than \$3000 -- after adjusting for differences in patient case mix and fee schedules. This buttresses the conclusions from earlier econometric analyses.

Physician financial incentives. The evidence is consistent across the econometric production studies (Gaynor and Pauly 1990; Conrad et al. 2002): **"high-powered" individual physician compensation**, that is payment to the individual based on his or her own production, measured as office visits or relative value-weighted services, is associated with significantly higher physician productivity, when compared to fixed salary or other payment methods. Gaynor and Pauly's (1990) estimates, based on 1978 data, indicate that, other things equal, switching 10% of physician compensation from fixed salary to individual production-based compensation would increase office visits per

week by roughly 2.8%. Our findings (Conrad et al. 2002), based on a nationwide sample of MGMA member groups, suggest that the same switch would generate a 2.9% increase in relative value weighted services -- quite similar to Gaynor and Pauly's earlier estimates.

Interestingly, in their paper examining the determinants of case mix-adjusted health care costs per capita in Minnesota medical groups, Kralewski et al (2000) found that both salary and individual production-based compensation were associated with significantly higher per member per year costs¹⁴, whereas individual incentive compensation to control per capita costs (a capitation-like schema) lowered cost. If one defined **clinical efficiency** to mean the effective management of a given panel of members at least cost, the results of Kralewski and colleagues would imply that high-powered, production-based compensation actually could lead to lower physician efficiency in the production of health. Their findings illustrate how a radically different conception of physician productivity can lead to strikingly different implications for practice decision-making.

Neither our study nor Gaynor and Pauly's earlier work found any significant effect of group-level payment incentives (health plan reimbursement methods) on conventionally measured physician productivity. In contrast, Kralewski et al. (2000) estimated that a 10% increase in the share of capitation payment to the clinic led to a 0.04% reduction in per capita health care costs -- again exemplifying the distinct interpretations that accompany differing measures of clinical productivity.

¹⁴ The elasticities imply that, other things equal, compared to the reference compensation category of a share of total clinic revenue, a 10% increase in the proportion of compensation based on salary, individual productivity, or the physician's control of per capita costs is related to a 0.03% increase, 0.01% increase, and 0.32% decrease, respectively, in per member per year costs.

Organization structure and design. The extant empirical studies of physician productivity have incorporated three organizational factors: size of medical group, ownership form, and multi-specialty versus single-specialty group practice. Briefly put, the evidence strongly suggests that, other things equal, group size is negatively related to physician productivity. Using totally independent samples, some two decades apart, Gaynor and Pauly (1990) and Conrad et al. (2002) both find **diseconomies of group size**: an increase of 10% in the number of physicians is associated with a 1.7% decline in productivity.

The results for ownership form are equivocal: using actual group revenues as the measure of production, Conrad et al. (2002) found that not-for-profit practices were 17-18% less productive; but using relative value-weighted services, the difference was opposite in direction, but not significant¹⁵. Kralewski et al. (2000) did report that per capita costs were roughly 5.5% lower in for-profit clinics than not-for-profits.

The empirical literature does not point to clear conclusions regarding **economies of scope**. Pauly (1996) states that there is not consistent evidence regarding the efficiency of multi-specialty versus single-specialty practice for a given domain of care. Gaynor and Pauly (1990) found no significant effect of multi-specialty group practice in their study of productivity in primary care partnerships. Conrad et al. (2002) examined productivity differences for three different practice categories: multi-specialty, but only with primary care; multi-specialty with primary care and other specialty domains; and single-specialty. They estimated the model for surgeons, medical specialists, and primary

¹⁵ These distinct estimates are puzzling. Controlling for differences across clinics in estimated fees did not eliminate the paradox between the results with revenues versus relative value units.

care physicians; but the findings varied substantially by the measure of production (revenues versus relative value units) and no central tendency emerged.

A Future Research Agenda

In my judgment and in light of the state of current theory and evidence regarding physician productivity, future inquiry should focus on updated, micro studies at the level of the physician firm (solo and 2-physician practices, single specialty, and multi-specialty groups) and should attempt to more precisely measure all the relevant inputs to medical care production available at the practice level:

- Labor: specific personnel of different types, actual physician hours worked (distinguishing patient care and administrative activity)
- Information technology
- Physical capital: examining rooms, the mix of medical equipment, and clinical support facilities (e.g., laboratory and radiology)
- Patient inputs (such as average waiting time and the practice's overall patient case mix)

In addition to more accurate measures of factor inputs, future empirical studies should be designed **prospectively** to collect longitudinal data at the practice and individual physician level over periods of time exceeding a single year. This would allow researchers, practitioners, and policymakers to conduct more persuasive evaluations of the effect of different organizational, policy, and clinical choices on the efficiency of physician production. The current state of our knowledge prompts me to suggest that future research include the effect of such organizational design features as the method of

individual physician compensation, ownership form, and the specialty structure of the group.

Finally, I would suggest that a seminal future study would integrate the conventional output measures of physician services delivered (weighted by relative values and unweighted) per unit of time with a set of **outcome measures** (e.g., perceived health status over time, functional status). By doing so, one would be able to estimate the true underlying production function – the outcome of health in the physician’s and the practice’s defined population. The same study would measure input prices and costs at the level of the physician practice, thus allowing a comparison of the cost and production functions within a common data set.

Strategic Recommendations

I will conclude by briefly summarizing the implications of the previous discussion for future improvements in physician productivity in the United States. In my view, the evidence base supports several policy interventions:

- (1) Substantial investment by U.S. government agencies and private foundations in a considerably expanded physician productivity research program (especially large-sample analyses of cost, output, and price at the practice level)
- (2) Corresponding, carefully calibrated public funding and third party payer investment in information technology in physician practices and health systems
- (3) Active, rule of reason-based antitrust and health care purchasing policy that removes barriers to the evolution of group practice and other more efficient forms

- of physician practice – e.g., inflated prices from private and public third party payers that attenuate physician firms’ incentives to minimize cost
- (4) Public reporting of clinical efficiency and effectiveness (i.e., the quality of process and outcomes) that sheds a light on “best productivity practices” in the medical care community

If the community of research and practice in the United States will commit to this program of research and to a stream of thoughtfully targeted investments and policy interventions, I believe that substantial improvements are likely – both in physician productivity and in medical care-sensitive population health.

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