Will reengineering medical practice improve U.S. workforce efficiency?

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In the United States, the definition of health care and workforce efficiency depends upon the interests of the specific stakeholder, without necessarily a primary goal of patient or population benefit. One management objective, for example, of an "efficient" physician practice is to lower costs per unit of revenue generation or physician effort. Optimizing physician income, not population outcomes, is the primary goal. Some organizations take a somewhat less directly pecuniary view of efficiency, with the goal to produce more medical services - primary care visits, arthroscopic surgery, or MRI scans - at a constant or lower cost. The metric for this goal is the number of medical services or work relative value units (a standardized measure of physician work used for payment in the U.S.) per physician FTE. The re-engineering strategies used in delivery systems to lessen the reliance of physician labor include labor substitution (e.g. advanced practice nurses and physician assistants), collaborative efforts in care teams, and better information functions (i.e. electronic health records). If one accepts that the health care system reliably provides services that improve health status, piece of mind, or satisfaction, then producing more services is nearly always good, and the question is simply how to do it at a lower cost or with fewer physicians. Measuring patient outcomes is not a priority, because we can assume that more care (and more physician labor) is provided in response to patient wants and needs, and this care leads to improved patient wellbeing.

This author agrees that the primary goal of efficiency gains in the physician workforce is to produce greater wellbeing of the population, but makes no assumptions that this aim will necessarily be achieved by adding more physicians or a greater number of medical

services. This view derives from the fact that some medical services are highly effective (i.e. oral fluoride supplementation in children to prevent dental caries,[1] others make little difference but cost a lot of money (i.e. primary care physicians offering PSA screening for prostate cancer),[1] and some are have a relatively high chance of harming patients without a relatively greater benefit.(i.e. spine surgeons performing complex spinal fusion in spinal stenosis).[2] If individual care decisions vary in benefit, we need an empirical assessment of the effectiveness of the physician workforce labor in aggregate (i.e. supply) and the related costs in order to develop more efficient workforce strategies.

One challenge to the effort to improve physician workforce efficiency by reengineering medical care is the evidence that the U.S. physician workforce is inefficiently located. Overall physician supply per capita varies across regions in the U.S. varies by 200-400%.[3] Studies of the locational preferences of physicians find a strong tendency to locate in more affluent urban areas that are close to their graduate medical education training location, even if the supply is already very high.[4, 5]

Other analyses have examined the relationship of area physician supply to health status measures derived from individual patient records and find little relationship between supply and need. Two examples are provided in this paper.[6, 7] The number of neonatologists per live birth is not correlated with perinatal risk, including birth weight, or maternal risk factors. (Exhibit 1) Neither is the number of cardiologists per capita higher in regions with greater cardiac risk as measured by the incidence of acute myocardial infarctions. (Exhibit 2)

Exhibit 1. Neonatologists and percent low birth weight by neonatal intensive care regions. The percent of low birth weight births (<2500 grams) versus the number of clinically active neonatologists per 10,000 live births across neonatal intensive care regions, 1995. There is no meaningful relationship between the two. In other words, neonatologists are not more likely to practice where maternal-infant risk is higher. (Source: Goodman D, Fisher E, Little G, Stukel T, Chang C. Are neonatal intensive care resources located where need is greatest? Regional variation in neonatologists, beds, and low birth weight newborns. *Pediatrics.* 2001; 108: 426-431.)

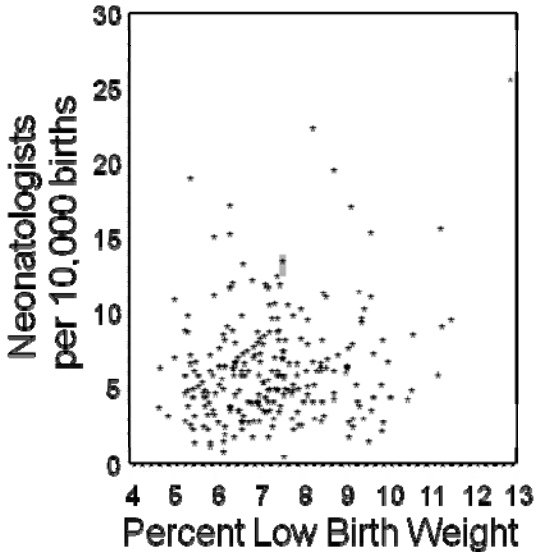
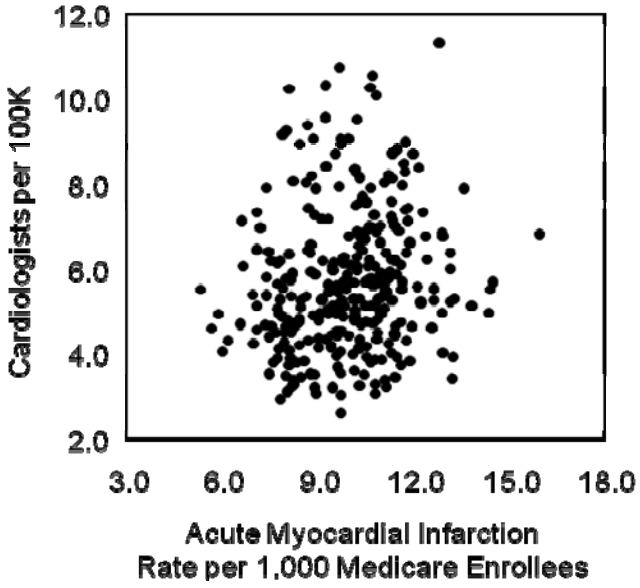


Exhibit 2. Cardiologists and acute myocardial infarction rates. The rate of acute myocardial infarctions per 1,000 Medicare fee-for-service beneficiaries versus the number of clinically active cardiologists per 100,000 population. There is little correlation between the two measures. Just like neonatologists, cardiologists do not practice where patients have higher need for their services. (Source: Wennberg DE. *The Dartmouth Atlas of Cardiovascular Health Care*. Hanover, NH: The Center for the Evaluative Clinical Sciences, Dartmouth College; 1999.)



These findings don't address the relative benefits of greater supply directly, but raise questions as to whether, in some regions, patient suffer from too few physicians while in other regions, patients suffer from too many. And while patients may not be harmed, system efficiency will be lower where there is an excess.

Using improved patient outcomes as the "product" of physician labor, we can infer physician supply efficiency from epidemiologic studies. In general, the research that has examined the outcomes associated with physician supply have found worse outcomes in areas with relatively very low supply, but that once supply reaches a level of low average, higher supply is not associated with better outcomes. While some studies are "pure

ecologic" analyses that regress area physician supply against area outcomes, such as mortality rates,[8, 9] other studies have employed hierarchal models with patients as the unit of analysis.[10] This method allows for patient level and small area (e.g. post code) covariates to adjust for health status, demographic factors, or community socioeconomic characteristics.[11, 12] The first example (Exhibit 3) shows that in areas with higher supply of family physicians, elderly have modestly lower discharge rates for preventable hospitalizations, but that this effect is no greater with a very high compared to moderate supply.

In the second example, (Exhibit 4) we have identified patients (> age 65 years) with chronic illness who have died, and find that the amount of physician clinical labor input in the last 6 months of life varies from hospital to hospital.[13] Despite controlling for differences in age, sex, race, and chronic illnesses, Mt. Sinai Hospital in Manhattan uses 29% less physician full time equivalents than New York University Medical Center in the care of patients the last 6 months of life. The patient population of these hospitals is very similar, except that NYU patients are somewhat more affluent. Neither hospital, nor their patients, knew the physician staffing levels before this data was published several years ago. The findings suggest that health care systems unknowingly adapt to varying physician capacity, with little positive or negative effects on patient outcomes.

Finally, we have studied the relationship of technical quality and patient perception of care to area physician supply, and observe little effect.[14] (Exhibit 5) There is little difference in composite quality scores for acute myocardial infarction, congestive heart failure, or

pneumonia. There was no difference in patient's report of access to care or in the satisfaction of care, despite greater than 55% variation in primary care and 85% variation in the per capita supply of medical specialists across regions.

These epidemiologic studies indicate that the efficiency of physician workforce varies substantially across locales. More physicians sometimes leads to better outcomes, but the effects are weak and tend to be measurable at the lower end of physician supply distribution. These finding raise serious questions about the benefits of increasing the pace of physician training. But regardless of one's opinion of the benefit of adding more physicians to the U.S. health care system, most health care observers can agree that improved physician supply efficiency would be beneficial. If one believes that there is a looming shortage, then higher efficiency could help address patient needs before the effects of higher training rates occur. If one thinks that we have too many physicians today in some area, than great efficiency with lower supply would decrease costs without harming patients.

Exhibit 3. The relationship between per capita supply of family physicians and the rate of hospital discharges for ambulatory sensitive conditions (preventable hospitalizations) in Medicare beneficiaries age > 65 years, 2005. In Primary Care Service Areas (N=6.542) with low (47 per 100,000) compared to very low (37 per 100,000) primary care physician supply, the rate of discharges was 3% lower, but no further decrease in discharge rates was noted for very high (87 per 100,000) supply. (Adapted from Chang C. Inter-specialty differences in outcomes associated with adult primary care physician supply. Ph.D Dissertation; AAT 3356192. Hanover, NH: Dartmouth College; 2009.)

Quintile of physician supply (median of PCSAs)	**Relative rate**	**Confidence interval**	**P value**
Very low (37 per 100k)	1		
Low (47 per 100k)	0.97	0.96 - 0.97	< 0.001
Middle (54 per 100k)	0.98	0.97 - 0.98	< 0.001
High (64 per 100k)	0.96	0.96 - 0.97	< 0.001
Very high (87 per 100k)	0.98	0.97 - 0.98	< 0.001

Methodological note: Study population was 2005 fee-for-service Medicare (< age 65) beneficiaries (N=27,053,059). Physician supply measure was derived from AMA post-GME hospital and office-based family and general practitioners, age-sex adjusted. Models assumed Poisson distribution with physician supply measures at the Primary Care Service Area level. Patient covariates include age, sex, race, and chronic condition. Models were insensitive to inclusion of terms for urban/rural and ZIP Code medium household income.

Exhibit 4. Physician full time equivalents caring for chronically ill Medicare patients in the last six months of life assigned to the primary hospital providing care, 2001-2005. Rates are adjusted for differences in age, sex, race, and mixture of chronic illness. The table shows that even within the same city or state, the number of physicians providing care for very similar patient populations differs by more than 2-fold. Benchmarks of physician care efficiency are also shown, and include hospitals in Ohio, Iowa, Minnesota, and Montana. (Source: Wennberg J, Fisher E, Goodman D, Skinner J. *Tracking the Care of Patients With Chronic Illness. The Dartmouth Atlas of Health Care 2008*. Hanover, NH: The Dartmouth Institute for Health Policy and Clinical Practice; 2008.)

Hospital Name	City, State	Number of Deaths	Physician full time equivalents in last 6 months of life per 1,000 decedents		
			Total	Medical Specialists	Primary Care
New York University Medical Center	New York, NY	2,534	27.8	17.6	6.8
Beth Israel Medical Center	New York, NY	4,108	23.4	10.4	10.2
Mount Sinai Hospital	New York, NY	4,985	19.6	8.5	8.6
New York-Presbyterian Hospital	New York, NY	6,061	15.4	6.9	6.1
Cedars-Sinai Medical Center	Los Angeles, CA	4,385	27.7	16.7	7.7
UCLA Medical Center	Los Angeles, CA	1,657	20.0	11.8	5.0
UCSF Medical Center	San Francisco, CA	1,420	13.3	4.6	6.0
Cleveland Clinic Foundation	Cleveland, OH	2,864	14.0	6.0	4.7
Mercy Medical Center	Des Moines, IA	4,583	12.2	6.5	4.2
Mayo Clinic (St. Mary's Hospital)	Rochester, MN	4,236	9.8	4.4	3.3
Billings Clinic	Billings, MT	1,797	7.9	3.9	2.3

Exhibit 5. The supply of physicians in U.S. Hospital-Referral Regions and associated quality of and access to care, 2005. This table shows that in regions with 20% to 89% higher physician supply, the quality of care is not better for acute myocardial infarction, congestive heart failure, and pneumonia. Also, in high physician supply regions Medicare beneficiaries do not perceive access to be higher, or care to be better. (Source: Adapted from Goodman DC, Fisher ES. Physician workforce crisis? Wrong diagnosis, wrong prescription. *The New England Journal of Medicine.* 2008; 358: 1658-1661.)

Measure	Regions in Lowest Quintile of Supply	Regions in Middle Quintile of Supply	Regions in Highest Quintile of Supply	Ratio of Lowest to Highest
Total number of physicians per capita (age- and sex-adjusted per 100,000 population)	169.4	204.8	271.8	1.60
Primary care	61.5	72.7	95.7	1.56
Medical specialists	34.1	44.3	64.3	1.89
Surgical specialists	37.4	43.2	53.4	1.43
Hospital-based specialists	23.8	26.1	28.7	1.21
Medicare composite quality scores				
Acute myocardial infarction	91.0	91.7	93.1	1.02
Congestive heart failure	84.1	85.9	88.6	1.05
Pneumonia	79.5	78.8	79.2	1.00
Medicare access and satisfaction				
Ever had a problem and didn't see a doctor? (% responding no)	91.7	92.8	93.2	1.02
Do you have a particular place for medical care? (% responding yes)	95.0	94.8	95.5	1.01
Satisfied with ease of getting to the doctor? (% responding yes)	94.9	93.5	94.7	1.00
Satisfied with doctor's concern for overall health? (% responding yes)	95.5	94.2	95.7	1.00
Satisfied with quality of medical care? (% responding yes)	96.7	96.3	97.0	1.00

Achieving better patient outcomes for a given supply of physicians (i.e. greater efficiency) has something to do with how medical care is organized and how physicians work. A physician who provides evidence-based care is more efficient. A team of providers that includes mid-level providers working with physicians may be more efficient. Better sharing of information across providers can reduce the need for duplicative tests and reduce errors leading to better outcomes with less physician work -- higher workforce efficiency. These examples mean that re-engineering care could lessen the "demand" for physicians and, in turn, workforce requirements. Better care would lower the need to hire more physicians. There would be fewer practice opportunities in these areas, and physicians would be more likely to settle in other areas.

This is an attractive idea -- temper physician requirements from the ground up -- but it ignores the remarkable capacity of areas with even the highest physician supply to absorb additional physicians.[15] The assumption that the given supply of an area is *caused* by the combination of patient needs and evidenced-based practice ignores the research just presented.

If physician supply is not located in accordance with patient need, and weakly influences patient outcomes, then we have a paradoxical situation of substantial physician labor slack at the same time that physicians are keeping busy delivering care that seems to be helpful. Truly, the physician labor market is like no other. Some of the care seems to be helpful, but actually provides no benefit. This needless utilization escapes rationalization in a fee-for-

service reimbursement environment, because payment is indifferent to effectiveness. On one hand, improving systems of care may lead to substantial improvements in technical quality and outcomes per physician FTE within a very specific area of improvement. On the other hand, since most care seems beneficial, any "savings" of labor in the area of improvement is simply applied to other services. At the end of the day (or clinical improvement cycle) the health system or area has the same number of busy physicians. Physicians always adapt their practice to the availability of time.

This phenomenon raises the important question as to whether lower physician supply, by accident or design, forces the evolution of health care organizations to more efficient care systems. Stated differently, relative physician supply may *cause* physician workforce efficiency, be it higher or lower. If this is true, than relative constraints on physician supply would lead to higher levels of efficiency as measured by better patient outcomes with fewer doctors.

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