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EXECUTIVE SUMMARY

Introduction

Health system capacity in the U.S. has continued to expand in recent years. More than $39 billion was spent on health care construction projects in the U.S. in 2007, with the majority of spending going to build new hospitals and expand existing ones. Growth in physician-owned specialty hospitals has been particularly rapid and strong continued growth is predicted. There has also been significant expansion of ambulatory surgery centers. This growth in facilities coincides with potential expansions in the physician workforce and ongoing advances in technology. Given these growth patterns, policy discussions about the amount and value of care delivered to Americans are increasingly focused on questions about the impact of changes in health system capacity. It is becoming more and more apparent to most observers that capacity may play a central role in determining health care spending and outcomes.

To better inform these discussions, a careful assessment is needed about the relationships between health system capacity and utilization, spending and quality. This report examines more than 100 studies published over the past 40 years to synthesize the evidence on these connections and evaluate the forces that seem to be driving capacity change. In light of these findings, the report then identifies a number of policy levers that might help to better manage existing capacity and influence future capacity change.

Current U.S. Capacity

Hospital Beds. Over the past 20 years, the number of hospital beds has been declining steadily – falling from 4.4 beds per 1,000 persons in the early 1980s to 2.7 beds per 1,000 persons in 2005. While this supply is at the low end among all OECD countries, the average daily occupancy rate is still only about 70 percent. The per-capita bed supply varies substantially from one part of the country to another. In 2003, for example, there was about a nine-fold difference in the number of short-term acute-care beds per capita among the 200 largest Metropolitan Statistical Areas. Hospital construction has been booming, with well over 300 new hospitals recently completed or underway, and more than 800 hospitals being expanded.

In recent years there have been two notable trends in hospital capacity: rapid expansion in the supply of specialty hospitals and a shift from inpatient to outpatient settings. The number of physician-owned specialty hospitals more than doubled between 2002 and 2008, while the number of ambulatory surgery centers grew by more than 50 percent between 2000 and 2006.

Physicians. The per-capita supply of physicians grew rapidly from the mid 1970s through the 1990s but has held relatively steady for the past several years at about 2.7 practicing physicians per 1,000 persons. As is the case for hospitals, this capacity varies by geographic region, particularly for specialists, and our physician supply once again appears poised for expansion. The Council on Graduate Medical Education has called for a 15 percent growth in medical school enrollment, the American Association of Medical Colleges is recommending a 30 percent increase in the number of U.S. medical school graduates, and medical schools increasingly are reporting expansions to their class sizes.

Capacity and Effects on Utilization

Most research on the relationship between health system capacity and utilization of health care services
identifies a positive correlation between the number of available providers of services and utilization rates for those services. Such correlations have been repeatedly documented for physicians (especially surgeons and other specialists), hospital beds (especially medical beds), advanced imaging capacity (CT and MRI scanners), and cardiac care services (cardiac catheterization facilities and bypass surgery capabilities).

These various studies have employed a range of data and methodologies in an attempt to establish a causal relationship between capacity and use. The best studies control for a host of other factors that might affect utilization as well as the area’s health system capacity (such as population characteristics and underlying preferences for capacity investments and use), account for the possibility that people may travel to higher capacity areas to receive services (border crossing issues), and use first differences and fixed effects estimation methods designed to control for changes over time in the underlying characteristics of local areas and their populations.

While the findings are not unequivocal, it is increasingly accepted that the positive link between capacity and utilization reflects a causal relationship, at least partly, and is not merely a statistical association. For one thing, variations in underlying preferences (that could cause an area to have both high capacity and high use) have not been able to explain all of the variations in capacity and use when researchers have attempted to address the role of preferences directly. Moreover, geographic variations in capacity are often quite dramatic, even among areas that are otherwise very similar, making it hard to attribute the capacity variation to underlying population preferences about service utilization. In addition, studies have found that physicians adapt their own practice patterns to their colleagues’ beliefs about how care should be delivered, suggesting that when there is more infrastructure available in an area, it may easily become the norm to make use of it. Acceptance that there is a causal relationship between capacity and use means that policy levers that are effective at controlling capacity could also help to control utilization.

The precise nature of the relationship between capacity and use is nuanced, however, with links being more clearly observed in certain situations. Most notably, conditions that have larger discretion in treatment choice appear to be more “supply sensitive” and have stronger associations with capacity than do conditions with less discretion. For example, the supply of hospital beds is essentially unrelated to hospitalizations for hip fractures (for which there is little discretion in treatment) but is largely correlated to hospitalizations for medical (as opposed to surgical) conditions, which have much greater discretion in the treatment approach and intensity. Similarly, research did not identify a clear relationship between capacity for cancer care and neonatal intensive care (both largely non-discretionary services) and use. It is also possible that different types of capacity may interact with each other as they influence utilization. For example, areas with more specialists may be characterized by more fragmented care, leading to greater use of hospital care among area residents. Although preliminary research exists, the circumstances in which these capacity interactions occur and the importance of their effects are not yet well understood.

Capacity and Effects on Spending

Under fee-for-service (FFS) payment systems, which use the service as the unit of payment, total spending is the product of the number of services used and the price paid per service. Thus, the impact of capacity on spending within these systems will depend not only on how use is affected, but also on the extent to which prices change. If FFS prices are determined competitively, such that market forces are reflected in price levels, higher system capacity can lead to competition among suppliers and downward pressure on prices. In this case, overall spending could fall in response to higher capacity, even if utilization increases. On the other hand, if FFS prices are set administratively rather than by direct market forces, capacity growth will not result in immediate downward pressure on prices and increases in use will be more directly passed through to higher spending.

The challenge of managing the cost impact of new capacity growth within administered pricing systems can be exacerbated in the case of emerging technology. Administered payment rates for new technologies may be set very high at the outset, perhaps reflecting the initial high unit cost, but are not adjusted downward in
The Challenges of Health System Capacity Growth

The studies examining the impact of physician capacity have documented a link with quality. It is also likely that the relationship between physician supply and quality is not linear, further complicating conclusions about how physician capacity affects quality. Specifically, a couple of studies suggest that areas with minimal access to physicians may see quality improvements as physician supply is increased initially, but experience declining marginal returns to continued capacity growth after the early gains. Given the significant geographic clustering of new physicians in areas that are already well served by physicians, this finding could mean that further expansions to the U.S. physician supply would be unlikely to produce substantial improvements in health outcomes as long as current physician location patterns hold.

Given the complex nature of the relationship between capacity and quality, it is important to consider the indirect ways that capacity change may affect health care quality, in addition to the direct associations just discussed. An extensive literature supports the idea that providers who perform higher volumes of services typically achieve higher levels of proficiency and better outcomes. Since system capacity can impact the number of services delivered by a given provider, capacity growth may lower quality through this volume-outcome relationship.

Empirical evidence on how capacity ultimately affects spending is limited. Several studies document links between higher Medicare spending and higher numbers of physicians (particularly specialists), more hospital beds, and greater MRI capacity. The literature also supports the existence of differential spending responses based on market and payment structure. For instance, while MRI capacity expansions led to higher use that was passed on to Medicare FFS spending, the impact on spending by private insurers was much smaller, perhaps because these insurers could bargain for lower per-service rates. The Institute of Medicine also suggests that managed care plans would be more likely to negotiate aggressively to drive down payment rates in places with greater physician capacity.

Capacity and Effects on Quality

The literature assessing the direct link between health system capacity and quality of care has largely focused on the impact of physician supply. Findings from a number of these studies indicate fairly definitively that a higher supply of generalist physicians is associated with a variety of favorable outcomes, whereas a higher supply of specialists is associated with poorer measured quality. The few similar studies that have investigated the impact of hospital capacity have generally not found a significant link between beds and outcomes. Since many of these studies rely on observing cross-sectional variation in capacity and outcomes, attributing a causal relationship is difficult. Additionally, not all of the studies examining the impact of physician capacity have documented a link with quality. It is also likely that the relationship between physician supply and quality is not linear, further complicating conclusions about how physician capacity affects quality. Specifically, a couple of studies suggest that areas with minimal access to physicians may see quality improvements as physician supply is increased initially, but experience declining marginal returns to continued capacity growth after the early gains. Given the significant geographic clustering of new physicians in areas that are already well served by physicians, this finding could mean that further expansions to the U.S. physician supply would be unlikely to produce substantial improvements in health outcomes as long as current physician location patterns hold.

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Capacity expansion could also have positive indirect impacts on quality of care, such as by making providers...
more accessible to patients geographically (increasing patient convenience and satisfaction) and permitting physicians to spend more time with patients (again improving patient satisfaction and, possibly, clinical outcomes).

**Determinants of Changes in Capacity**

Capacity changes in modern medicine are driven by a number of sources, however two forces are especially dominant – the desire to improve health care quality and health outcomes, and economic forces, including the profitability of new services. Advances in technology and clinical techniques can make it possible to deliver newer treatments more widely, and the desire to improve the quality of care frequently stresses the use of the most up-to-date approaches and technology, adding to pressure for capacity growth. At the same time, the relative profitability of certain services also appears to be a key driver of expanding capacity. Prominent examples of situations in which financial incentives appear to be associated with important changes in capacity include the recent rapid growth of physician-owned specialty hospitals, development of higher-profit lines of business within hospitals and by other providers, and growth in outpatient facilities. Over 90 percent of specialty hospitals are for-profit entities, and they tend to earn higher margins than general hospitals. Differences in Medicare payments across DRGs and by site of service allow opportunities for increased income depending on the service type and delivery location. Awareness of these payment differentials has contributed to expansion of higher-profit service lines, such as cardiac surgery and orthopedics, and promoted the development of free-standing outpatient facilities, such as ambulatory surgery centers and diagnostic imaging centers.

**Policy Implications**

Some capacity expansions produce benefits that exceed their costs while others contribute to overuse of expensive resources for which the reverse is true. To manage system capacity effectively, multi-faceted approaches are needed. These strategies should encourage more efficient use of existing capacity and also provide direction for decisions about future capacity growth. Several broad categories of approaches can be envisioned.

One group of policy strategies centers around providing improved information to consumers, providers, payers, and policymakers in an attempt to foster greater efficiency in health care utilization and capacity investment decisions. Information on the clinical and cost effectiveness of specific medical services, particularly relative to one another as generated by comparative effectiveness research, is at the fore of information-based strategies. Generating this comparative information will require improvements to available data, including collecting real-time evidence as new services are diffused into practice. This evidence would be enhanced by dissemination to payers, providers and patients to guide their payment strategies and utilization choices. Beyond data on effectiveness of specific services, greater attempts to educate consumers and physicians about general relationships between variations in capacity, service use, spending and outcomes could help to counter the prevailing belief that more medicine is always better medicine. Improving metrics for quality and value and increasing public reporting on these measures is a necessary step in these education efforts. Public policy decisions would also benefit from a fuller understanding of the relationships between capacity, use and costs.

A second category of policy approaches centers on minimizing financial incentives to invest in unnecessary new capacity or overuse existing capacity. One key strategy here is increased attention by payers to the pricing distortions that can result in very high profit potential for specific types of services or service locations. Minimizing such incentives will remove forces that have been behind some of the recent growth in high-profit service lines, specialty hospitals and outpatient facilities. Likewise, since financial rewards due to physician ownership seem to be a significant driver of capacity change, further regulatory efforts to manage physician ownership and self-referral might contribute to better capacity management. Payers also have a role to play through their benefit design. Use of strategies such as prior authorization, consumer directed health plans, tiered benefits and preferred high performance networks are expected to direct consumers to more efficient providers and affect the financial incentives of potential adaptors of new technology.
The Challenges of Health System Capacity Growth

Changes to the organization of the delivery system are also being widely discussed as a way of addressing the detrimental impact of capacity growth. At the heart of this strategy is the creation of more integrated delivery systems designed to better align the incentives of diffuse providers, and payment mechanisms that permit efficient providers to share in a portion of the savings that they generate in producing high quality care more efficiently. Proposals for Accountable Care Organizations indicate movement in this direction. Another type of delivery system change is the designation of Centers of Excellence, designed to concentrate certain types of services in specific high-performance facilities. This strategy capitalizes on the potential to improve quality through high volume for the best providers and, in the long run, can help to eliminate duplicative capacity. In the same vein, stronger accreditation programs that indicate to patients and providers which providers give the highest value care could also encourage more efficient delivery structures.

A final approach to managing capacity is Certificate of Need (CON) review and other forms of health planning. Despite historically mixed evidence regarding the effectiveness of CON programs as a means to control capacity, there is some indication that states with more effective reviews experienced less growth in their supply of ambulatory surgery centers and specialty hospitals. There may be lessons to be learned from the more effective state programs. Additionally, several widespread efforts to expand or replace capacity might benefit from a more informed and explicit policy discussion that incorporates information about the likely impact of such capacity changes. Examples of these situations include current calls to expand physician supply and natural opportunities to eliminate potentially excess hospital capacity, such as in the rebuilding of California hospitals for earthquake safety and replacement of aging facilities more generally. Failure to take a comprehensive look at how changes like these will affect overall system capacity represents a lost opportunity to manage capacity growth more rationally.

Conclusion

System capacity has emerged as an important driver of health care utilization and spending. As such, the U.S. health care system would likely benefit from strategies to better manage existing capacity and to control future changes. These strategies need to be designed and undertaken with attention to both cost and quality goals. While making significant changes to the way the U.S. health care system approaches capacity may be difficult, it is clear that this is an increasingly important area of focus.
1. Introduction

In 2007 ground was broken for health care construction projects worth more than $39 billion, the majority of which was for the construction of new hospitals and the expansion of existing ones [1]. One area of strong growth has been the construction of new physician-owned specialty hospitals; the number of these facilities is expected to increase between 33 percent and 50 percent over the next few years [2]. Expansions in the number of hospitals may be accompanied by growth in the number of physicians as well, as the American Association of Medical Colleges (AAMC) and many others have called for efforts to expand medical school class sizes [3, 4]. And, of course, technological advances in medicine have already produced rapid expansions in the availability of new techniques and services, with no end in sight.

Questions about the impact of changes in health system capacity can increasingly be found at the center of important policy debates about the amount of care delivered to American patients and the value we get from that care. As we build more hospitals, train more physicians, and develop more technologies and services, it is more and more clear that we cannot simply treat system capacity as innocuous background to discussions of spending and outcomes. Rather, it may play a central role.

Work on variations in health care delivery across geographic areas (e.g., [5-10]) provides one illustration of the importance of paying attention to capacity in discussions of utilization and spending. Severely ill Medicare patients treated in Los Angeles hospitals spend nearly 18 days in the hospital in the last 6 months of life and have more than 60 physician visits [11]. Similar patients treated in Sacramento average 11 days in the hospital with about 26 physician visits. Medicare spends more than twice as much per beneficiary in Miami as it spends in Minneapolis [7]. While the reasons for the existence of these kinds of variations are not fully understood, they often appear to be related to variations in capacity (e.g., [7]). Areas with more hospital beds, physicians, and other types of services are often precisely the areas with the highest levels of health care use and spending.

To support efforts to incorporate capacity considerations into policy discussions, useful information about the connections between capacity, health care utilization, spending, and quality will be needed. Questions about these relationships have a long history. Over the course of several decades, analysts have studied associations between the amount of capacity in different areas of medicine and health care system performance. This paper reviews important parts of this literature to investigate some of the key questions that arise around the role of capacity in the health care system. After presenting some background data on system capacity (Section 2), the paper discusses lessons from existing literature about the relationships between capacity and health care utilization, spending and quality (Section 3). The paper then turns to an examination of some of the forces that appear to be associated with capacity change (Section 4), with a view toward developing insights into ways that capacity can be better monitored and perhaps influenced. The paper concludes with a discussion of potentially important policy levers that might be used to manage capacity change (Section 5).

Capacity change is a term that has been used to describe a variety of changes in the health care system, from the development of new drugs and devices, to the construction of new wings on hospitals, to the training and hiring of more specialists. While all of these are important topics, this paper focuses on changes in the availability of infrastructure and equipment that are primarily aimed at
expanding the ability of the health care system to deliver already-developed services. The discussion focuses particularly on two key areas of capacity change, the supply of hospital beds and the number of physicians, though as the analysis develops other areas are discussed as well, such as diagnostic imaging, cardiac care, and outpatient surgery centers. While certainly not an exhaustive list of the different types of capacity changes one might possibly consider, these areas provide opportunities to investigate a broad range of issues using the available literature.

2. How Much Capacity Does the U.S. Have?

2.1 Hospital Beds

In 2005 there were about 800,000 hospital beds in community hospitals in the U.S., or about 2.7 beds per 1,000 persons. The number of beds has been declining steadily over the past 20 years – there were, for example, about 1 million beds, or 4.4 per 1,000 persons, in the early 1980s (Figure 1).1


![Graph showing the number of community hospital beds in the U.S. from 1981 to 2005.](https://example.com/graph)

Source: AHA Annual Hospital Survey Data and U.S. Census Bureau

1 The supply of hospital beds per capita in the U.S. appears relatively low compared to other developed countries. The OECD health data show that the U.S. was the fourth lowest of 28 OECD countries reporting hospital bed data in 2004, and had well below the OECD average of 4 beds per 1,000 persons [12].

2 Even though increasing, average occupancy rates have only averaged about 70 percent in recent years [13].
magazine’s annual surveys of hospital builders and architects have turned up reports of substantial building projects [16], including hundreds of hospitals being newly built or expanded in recent years, representing thousands of new beds as well as new outpatient and other facilities (see Table 1) [17]. While some of these new facilities and expansions would replace existing facilities, many would not and would instead augment hospital capacity. This new construction appears to be the result of a range of factors, including population growth in some areas, built up demand to replace aging facilities, and market opportunities. In some cases, hospital systems appear to have been seeking opportunities to expand market share and take advantage of favorable market conditions.

One area of rapid expansion over the past several years has been specialty hospitals. Analysis by the Medicare Payment Advisory Commission (MedPAC) and the Centers for Medicare and Medicaid Services (CMS) suggests that the number of physician-owned specialty hospitals more than doubled in just the last few years,

- The number of hospital beds per capita has been falling steadily for at least 20 years, and is lower than in most OECD countries, but the average occupancy rate is still only about 70 percent.
- There is about a 9-fold variation in per-capita bed supply across the 200 largest MSAs (at the tails) and about a 3-fold variation even in the core of the distribution.
- Construction of new hospital capacity has been booming in recent years, through new construction and expansions.
- The supply of physician-owned specialty hospitals more than doubled between 2002 and 2008 (to 128), and strong continued growth is projected.
- The supply of ambulatory surgery centers grew by more than 50% between 2000 and 2006 (to 4,707).
The Challenges of Health System Capacity Growth

As in the case of hospitals, there are substantial variations in the supply of physicians per capita from one part of the country to another. The number of specialists per 1,000 people ranged widely (Figure 4). Variation from 0.75 to 2 per 1,000 is commonly observed, and some areas range above 4 per 1,000. For generalist physicians there is similarly substantial variation, with supply commonly falling between 0.5 and 1 per 1,000 persons, and exceeding 2 per 1,000 in some areas (Figure 5).

2.2 Physicians
The U.S. has about 2.7 practicing physicians per 1,000 persons, or about 790,000 physicians total. On a per-capita basis, the supply of physicians in the U.S. has been relatively steady over the past several years, creeping up after having grown rapidly from the mid-1970s through the 1990s (Figure 3).  

- The number of physicians per capita grew rapidly through mid-1990s and has largely held steady since.
- There is substantial geographic variation in per-capita physician supply, particularly for specialists.
- Medical schools are in the midst of expanding class sizes fairly dramatically. COGME is calling for a 15% expansion, and the AAMC is recommending a 30% expansion.

As in the case of hospitals, there are substantial variations in physician capacity from one part of the country to another. Among the 200 largest MSAs, for example, the number of specialists per 1,000 people ranged from 0.75 to 2 per 1,000, with some areas ranging above 4 per 1,000. For generalist physicians, the supply commonly falls between 0.5 and 1 per 1,000 persons, and exceeding 2 per 1,000 in some areas (Figure 5).

TABLE 1: CONSTRUCTION OF NEW FACILITIES, 2006

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Construction Type</th>
<th>Completed, 2006</th>
<th>Underway</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Number</td>
<td>Beds</td>
</tr>
<tr>
<td>Acute Care Hospitals</td>
<td>New</td>
<td>144</td>
<td>8,445</td>
</tr>
<tr>
<td></td>
<td>Expansion</td>
<td>395</td>
<td>9,171</td>
</tr>
<tr>
<td>Specialty Hospitals</td>
<td>New</td>
<td>55</td>
<td>3,373</td>
</tr>
<tr>
<td>Freestanding Outpatient Facilities</td>
<td>New</td>
<td>198</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Expansion</td>
<td>177</td>
<td>—</td>
</tr>
</tbody>
</table>


3. Compared to other countries, the supply of physicians in the U.S. is moderate. In 2004, OECD health data report that the U.S. had 2.4 physicians per 1,000 persons, the tenth highest supply of physicians per capita of 30 OECD countries and a bit below the OECD country average of 3.0 per 1,000 [12]. For generalists, the OECD reports the U.S. at 1.0 per 1,000 persons, a bit above the OECD average of 0.8. For specialists, the OECD reports the U.S. at 1.4 per 1,000 persons, below the OECD average of 1.7. Note that because the ways physicians are categorized as generalists or specialists varies across countries, comparisons of generalist and specialist to population ratios across countries can be difficult to interpret.
We are in the midst of significant ongoing attempts to increase the number of physicians in the U.S. A number of medical schools have reported initiatives to expand their class sizes [20], and the AAMC reports that medical schools are planning to expand physician supply by 17 percent by 2012 [3]. These efforts are driven in part by official calls for expansion. The Council on Graduate Medical Education has recommended a 15 percent expansion in medical school enrollment [21], and the AAMC has reportedly called for 30 percent more U.S. medical school graduates annually [22].

One of the important features of these debates is the method used to estimate the number of physicians needed. Some studies, such as those by Cooper and colleagues [23], simply use past experience to forecast future demand – if we have kept the physicians we have busy, then it must be that we will need more in the future. But, as discussed below, this assumption may warrant further scrutiny. If existing physician supply produces more utilization but not necessarily better outcomes, this may be a poor guide for making decisions about future capacity.

3. Capacity and the Performance of the Health Care System

3.1 Effects on Utilization

Studies considering the relationship between capacity and the utilization of health care services go back several decades and span a wide range of service types. Most of these studies conclude that the number of hospitals and physicians is positively correlated with utilization. This correlation is not observed in every case, however, and debate continues about the precise mechanisms of causality. In some sense, a positive association is not surprising – one would scarcely expect persistent growth if it became clear that there was no way to use the new capacity – but it may be concerning if the relationship between the benefits and the costs of additional utilization is not clear.

**Physician Supply and Use of Services.** Some of the earliest studies of the relationship between capacity and utilization focus on the supply of physicians. In one early article published in the New England Journal of Medicine in 1970, John Bunker, an anesthesiologist...
Many studies have identified a positive correlation between the supply of hospital beds and physicians and the use of services.

- It is increasingly accepted that the relationship between capacity and use reflects causal influences (at least partly) and not just statistical associations.

- Conditions with greater discretion in treatment choice appear to be more 'supply sensitive' and to have stronger associations with capacity than those with less discretion.

- Different types of capacity may interact and affect use both directly and indirectly (e.g., more hospital capacity affects how specialists practice, compounding an independent impact of specialty supply on use).

from Stanford University, studied the performance of surgery in the United States and in England and Wales [24]. His specific interest was the then-current debate about whether there was a shortage of anesthesiologists in the U.S., but his study also presented information about the supply of surgeons and the use of surgery. In 1967, he reported, there were 39 surgeons per 100,000 persons in the U.S., and less than half as many – 18 per 100,000 – in England and Wales. He also found that the U.S. had a much higher rate of surgery: about 7,400 surgeries performed per 100,000 people, or about twice the 3,770 reported in England and Wales.

Bunker cast around for explanations, considering among other things the extent of group practice, public health practices, financial incentives for performing services, and the "disproportionate number of physicians [in] the practice of surgery." Though Bunker’s data were not entirely perfect, and not everyone accepted
his conclusions (e.g., [25]), his findings provide an early example of a link between physician supply and health care utilization.

Many later studies went on to add to the collection of evidence linking supply and utilization. In 1973, Wennberg and Gittlesohn reported that across 13 hospital service areas in Vermont, the supply of surgeons was correlated positively, and relatively strongly, with the number of surgeries performed [9]. In a 1978 study, Fuchs estimated that a 10 percent increase in the surgeon-to-population ratio resulted in about a 3 percent increase in per capita utilization of surgeries [26]. In the last few years, Fisher and colleagues argued that having more specialists per capita in an area is associated with higher surgery and procedure rates for the Medicare population [27, 28].

Hospital Capacity and Use of Services. Other studies have addressed the supply of hospital services. Over more than half a century, research has identified marked variations in the utilization of hospital services in different parts of the United States (e.g., [7-9, 29-31]) Various studies draw links between the supply of hospital beds and the utilization of hospital services. A study of care patterns in Boston, with more hospitals, and New Haven, with fewer, provided suggestive evidence when it found much higher hospitalization rates in Boston [32, 33]. Fisher and colleagues studied the relationship between area hospital capacity and hospital use in the Medicare program in 1989 and reported that the odds a Medicare patient is hospitalized were 20 to 30 percent higher in areas with the greatest availability of hospital beds compared to the areas with the lowest availability, and that the relationship between beds and hospitalization rates was strongest for medical, as opposed to surgical, hospitalizations [34]. Other recent studies concur. Variations in hospital bed supply have been reported to be positively correlated with changes

![Figure 5: Distribution of Generalist-to-Population Ratios 200 Largest Metropolitan Statistical Areas, U.S., 2004](image-url)

Note: Figure omits Rochester, MN (4.30)
Source: AMA Annual Physician Survey Data as reported on the ARF.
in hospital bed use (e.g., [35]), and 2003 analyses by MedPAC showed that the per capita supply of hospital beds was a significant predictor of variations across areas in Medicare service use [36].

**Other Types of Capacity.** Beyond physicians and hospital beds, analyses of the supply of specific services also produce evidence of linkages. For example, Baker and colleagues looked at the relationship between growth in the availability of different medical technologies in different areas in the United States and changes in procedure use, considering CT and MRI scanners, cardiac care services such as cardiac catheterization facilities and bypass surgery (CABG) capabilities, cancer care services like radiation oncology facilities, and neonatal intensive care services for high-risk newborns [37]. They found that where there were increases in the availability of diagnostic imaging and cardiac care services, there were also increases in use over time. They found less clear evidence of relationships between capacity and use for cancer care and neonatal intensive care, though those services were difficult to study since there had been relatively limited changes over time in their capacity. Other evidence generally supports a link between availability and use for imaging equipment [38, 39].

**Better Understanding These Relationships**

Though literature supports the existence of a link between capacity and utilization in many cases, there are a number of important nuances in these findings.

**Impact of Medical Discretion.** Relationships are more clearly observed for some types of services than for others. Most notably, conditions for which there is significant discretion in treatment choice appear to be more “supply sensitive” and have stronger associations with capacity than conditions for which there is less discretion [7]. For example, the supply of hospital beds is essentially unrelated to the use of hospitalization for hip fracture patients, where there is little discretion about appropriate care, but is closely related to the use of hospitalization for a wide range of medical (as opposed to surgical) conditions, where there is frequently much more discretion about the amount and intensity of medical care to provide. Similarly, Baker and colleagues found that diagnostic imaging utilization, a service that may often be discretionary, was more strongly related to capacity than cancer care, which may be less discretionary [37].

**Importance of Other Factors.** Other studies have emphasized that variations in capacity are not the only factors associated with variations in medical care use. In some circumstances, variations seem to be associated more with underlying physician or population preferences about treatments than with the supply of services. The 1998 Dartmouth Atlas, for example, points out that there are marked variations in surgery rates even across south Florida communities that have generally similar population characteristics and similar supplies of surgeons, positing unobserved variations in preferences as a likely explanation [7].

A related issue is the extent to which the researchers were able to control for other potentially confounding factors, such as area patient characteristics, the presence of skilled nursing facilities, or any of a wide range of other factors that could affect health care use. Studies vary in how they deal with these issues. Perhaps the most successful studies are those that link changes in capacity to changes in use over time within areas (e.g., [37]), which provides a natural control for fixed underlying characteristics of areas and their populations. At the same time, the fact that many studies using different data and approaches find essentially the same results provides a level of comfort in concluding that a relationship exists.

**Relationships Between Different Types of Capacity.** Different types of capacity may interact as they influence utilization, but the circumstances in which this happens and the importance of the effects are not well understood. Some recent work by Wennberg, Fisher and colleagues suggests the importance of relationships between the number of specialists and the number of hospital beds as influences of the use of specialist and hospital care. It is possible that high levels of both types of capacity act together to exert an even stronger influence on utilization than might otherwise have been observed. This could occur, for example, because areas with more specialists can be characterized by more “fragmented” care patterns in which patients can more easily end up in the hospital.

**Border Crossing.** One might also wonder how border crossing could affect study findings. For example, if one area had many resources and an adjacent area
had few, people from the underserved area might frequently travel to receive care in the better served area. If studies were conducted using only the location where services were received, one might expect to see disproportionate use in the higher availability area. However, the most common approach in the studies cited, particularly the more recent ones, is to focus on the patient’s place of residence, not on where they receive services, so border crossing should not be a substantial source of bias in the results.

Interpreting Findings for Policy Decisions
While there does not seem to be strong debate about the existence of relationships between expanding capacity and increasing utilization in many areas in medicine, there remains considerable debate about how these relationships should be interpreted from a policy perspective. An old debate in health economics concerns the extent to which physicians can “induce demand” for their services and, perhaps more importantly, whether they actually do. If physicians can induce demand – convince patients that they need services that the patient would not want but for the doctor’s action – then it is possible to interpret an increase in physician supply as causing increases in utilization of physician services. More generally, if physicians adapt their recommendations to reflect the availability of services in their area and patients follow their recommendations, adding physician capacity could increase use of physician resources and building additional hospital beds could cause an increase in hospitalization rates.

But the ability to induce demand is not the only possible explanation for a relationship. The main alternate possibility is that there are other factors that lead to both the existence of more capacity and more utilization. For example, if the populations of some areas have stronger preferences for using health care, then these preferences could both cause health care providers to locate in the area and cause higher utilization. While most studies attempt to control for factors that might be associated with preferences, such as population education and income levels, there often remains the possibility that important aspects of preferences are not captured by available measures. The distinction between these two interpretations is important since they imply different policy conclusions. If changes in capacity cause changes in utilization, then controlling capacity could help to control utilization, and may be an effective policy lever. If both capacity and utilization are driven by other forces, then there is no such policy opportunity.

Debates about which interpretation is superior have ranged across many years and involved many people (e.g., [40-43]). It is possible that this debate may never be fully resolved, but it does seem that the ability of changes in capacity to create demand for services in a causal way, in at least some circumstances, is increasingly accepted. Variations in preferences have not been able to explain all of the variations in care availability and utilization when researchers have attempted to address the role of preferences directly [44]. Moreover, many capacity variations appear too large to be easily explained by variations in residents’ preferences. For example, it seems implausible that the population of Dubuque, IA, which had 44 MRI scanners per million persons in 2004, has more than three times the desire for MRI services as the population of Davenport, IA, just 70 miles away, with its 14 MRI scanners per million persons, or more than five times the desire as Sioux City, IA with eight scanners per million.

It is also not difficult to believe that physician practice patterns can adapt to the surrounding environment, including the availability of infrastructure. Studies do suggest that physicians respond to their colleagues’ beliefs when forming their own practice patterns [45]. In areas where there are many hospital beds available, practice patterns could quite plausibly come to reflect that, as perhaps they can when there are more MRI machines or cardiac catheterization labs around. Where there is more infrastructure, it may easily become the norm to make use of it.

3.2 Effects on Spending
Health economists routinely link expanding technological capabilities in medicine with the rapid increases in health care spending over the past several decades [46-48]. Where mechanisms such as fee-for-service (FFS) physician payments, hospital per-diems, or even hospital DRG payments are used, links between capacity and spending derive directly from the effects of capacity on the number of services used and on the prices paid for each service. Under other arrangements, such as capitation, the effects will tend to be less direct.
In a FFS payment system, the impact on spending depends on how prices are determined and the relative magnitude of changes in price versus changes in use.

- If FFS prices are determined competitively, increased capacity could lead to lower prices. Overall spending could fall even if use increases.
- In administered FFS pricing systems, prices do not easily respond to capacity growth and increases in utilization will be more directly passed through to higher spending.

When payment is capitated, the link between capacity change and payment rates is weaker and less direct. Capacity changes thus have much less impact on spending in these systems.

There is very little empirical work on how capacity ultimately affects spending.

- A few studies link higher Medicare spending with higher physician supply (particularly, specialty supply) or with higher hospital capacity.
- A couple of others suggest capacity growth has a smaller impact on spending for managed care plans or other insurers who can negotiate aggressively on price.

Capacity Change and Spending in Fee-For-Service and Related Systems

In fee-for-service systems, and even under hospital prospective payment, the effects of capacity increases on spending depend on both effects on utilization, discussed above, and effects on prices. Thus, to fully assess the impact of capacity change on spending in settings using fee-for-service mechanisms also requires incorporating the effects on prices. Expected effects on prices depend on the mechanisms by which prices are set.

Competitively-Determined Prices. In many cases, payers negotiate prices with health care providers. The precise circumstances of these negotiations can vary, but having a structure within which prices are negotiated and can be renegotiated enables competition among providers to influence prices. Purchasers of services, such as health insurers, who have choices and who can shop around can be quite demanding in their negotiations [49, 50].

In a truly competitive environment, increases in capacity could thus not only drive increases in utilization but also moderate prices, offsetting to at least some extent the impact of higher use on overall spending. Unfortunately, which force will be the more important, and by how much, is impossible to specify in general. But, the general principle that competitive effects could be important and will influence the net impact of capacity change on spending is clear.

Administered Prices. Systems in which prices are administratively set, such as those used by Medicare and other payers that use Medicare-like payment systems, can face a quite different situation. Medicare pays for many services using fee schedules and DRG-based pricing systems that are, to a large extent, fixed from one area to another. These systems respond to overall charges (often with a lag of several years) and other factors, but do not respond directly to local competitive conditions. There is thus little chance for market conditions, such as the number of providers of a given service, to influence the allowed payments per service, and certainly not in any timely manner. Here, a capacity expansion that led to higher utilization would only drive up spending since there is little or no opportunity for competition to lower prices [51].

Systems with administratively set prices can face particular challenges with new and higher-tech services [51]. In cases of very new products, payment levels are often set to match the prices charged by the initial manufacturers or producers. Even when cost information might be used to set payment rates, costs early in the life cycle of a new procedure or product can be quite high. As providers

4 The extent to which economic relationships of the type normally posited in economic arguments actually exist in health care is a matter of some debate. In this case, it is not difficult to believe that health insurers or other payers could act as reasonably informed purchasers of services, and market interactions may discipline prices to at least some extent. Of course, one would likely not want to assume that patients would always themselves be thought of as informed consumers in a position to negotiate for lower prices.

5 Other nuances in the response of prices could also modify the main effects of competition described here, and possibly change the direction of the expected effects. For example, if physicians adapt their practices to meet “target incomes,” expansions in the number of physicians may induce physicians to raise their fees to maintain incomes as the number of patients available per doctor fall [26].
become more adept at new services, the methods for providing them become more standardized, and fixed costs are spread over a higher volume, per-service costs often fall substantially. In competitively priced situations, prices will tend to follow. In administrative pricing systems, however, there are no mechanisms by which this would happen naturally, and some interested parties can have strong incentives to use political processes or other means to ensure that prices remain high. Not only are systems with administratively set prices more acutely faced with the potential for capacity expansion to drive higher spending, but these effects can also be magnified for new, expensive services where the administrative prices often start and then remain relatively high. These misaligned prices exceed the cost of rendering the service, providing continued incentives to produce more services and to invest in additional capacity.

Capacity Change and Spending in Non–Fee-For-Service Systems
Where payments are made using mechanisms other than fee-for-service, links between capacity change and spending are less direct. In systems using capitated payments for physician services, for example, increases in the number of physicians need not directly change spending. Over time, if adding physicians led physicians to spend more time with patients and provide more services, the costs of providing care might rise and capitation rates could rise in response. Compared to fee-for-service systems, though, these effects might be expected to be slower to arise, and might also be less tightly linked. In fact, it is often argued that capitated systems can limit the cost impact of capacity growth because responding to increased capacity by providing more services will reduce capitated providers’ profits. Capitated providers also have less incentive to increase capacity since their payments are not closely linked to capacity change.

The Evidence Regarding Capacity and Spending
Though there is relatively little empirical work on how capacity ultimately affects spending, some literature supports the existence of differential responses based on market and payment structure, as posited above. In their analysis of the effects of capacity on utilization and spending, Baker and colleagues noted that expanding MRI capacity had strong effects on MRI utilization. The effects were passed through relatively directly to Medicare spending for MRI services, but there was a much smaller impact on private insurer spending, perhaps because private insurers could use the increasing capacity to bargain for lower per-service rates even as total utilization was increasing [37]. Making a similar argument, the Institute of Medicine has suggested that changing capacity might affect spending by managed care plans differently than spending by more conventional insurers, on the assumption that managed care plans would be more likely to negotiate aggressively to drive down payment rates in places where there was more physician capacity [52].

Evidence also links changes in physician supply and other types of capacity with increases in Medicare spending. Writing in the early 1980s, Sloan and Schwartz concluded that a 10 percent increase in the supply of physicians would be associated with a 4 percent increase in spending for physician services [53]. Studying the Medicare fee-for-service population more recently, Fisher and colleagues showed that areas with more specialists tend to have higher Medicare spending than other areas [27, 28]. Welch and colleagues showed that areas with a higher share of physicians who are specialists have higher Medicare spending [54]. Work by MedPAC has linked variations in hospital capacity to variations in Medicare spending [36].

3.3 Effects on Quality
Even if it does drive up spending, expanding capacity in medicine may be worthwhile if it produces better health outcomes or other things of value. Some evidence suggests that expanding care delivery has often produced benefits sufficient to justify its costs (e.g., [55]). However, other recent evidence cautions that expanding use of medical care is probably not always worth it. Fisher and colleagues, studying the Medicare program, argue that areas with higher levels of spending did not reap benefits in the form of better health outcomes and, in fact, often performed worse on quality measures [27, 28]. Baicker and Chandra have also documented a significant negative relationship between state-level Medicare spending and quality of care [56].

Investigations of the ways that adding capacity and using more health care resources influence quality have occupied quite a few analysts over the years. Even as part of John Bunker’s 1970 study of surgery in the U.S., England and Wales, he reflected on the possibility that some of the additional surgical utilization in the U.S. is
Literature examining the direct relationship between physician capacity and outcomes generally indicates that a higher supply of generalist physicians is beneficial, while a higher supply of specialists has negative impact.

- Attributing causality is difficult with the cross-sectional study design.
- Not all studies find a correlation between physician supply and outcomes.
- There may also be "non-linearities" in the capacity/outcome relationship: increasing physician supply will have a positive impact on quality up to a point (especially in locations with physician shortages), with diminishing marginal returns thereafter.

There is some limited evidence on the indirect ways that capacity might affect quality:

- Capacity growth might lead to lower quality of care by reducing the volume of services rendered by any given provider; increasing the complexity of care; and increasing the risk that patients will be harmed by unnecessary services.
- Capacity growth might improve quality by making providers more accessible and permitting physicians to spend more time with patients, improving patient convenience and satisfaction and, perhaps, outcomes.

On the other hand, a number of studies provide reason to question the conclusion that higher spending is typically worth it. For example, analysis of patterns of spending and health care quality in the Medicare program indicate that important cross-area variations in spending are frequently not directly associated with variations in quality of care and, in fact, are more likely to suggest that higher spending is associated with lower quality of care than the other way around [27, 28, 56].

Studies Assessing the Direct Link Between Capacity and Quality

Physician Capacity and Outcomes. Most of the literature directly considering links between capacity (rather than spending) and quality focuses on physician supply. This literature draws a sharp distinction between supply of generalist physicians and the supply of specialist physicians, frequently finding that expanding the supply of generalist physicians is beneficial for the health of the population, but expanding specialist capacity has the opposite effect. Shi and colleagues compared physician capacity and outcomes across states and found that higher primary care capacity was correlated for "cases in which indications are borderline" and on the converse possibility that where utilization is lower "many procedures that are desirable but not essential may not be performed" [24]. In recent years the acuity of these questions has reached new levels, pushed by rising costs and our desire to achieve higher value for our health care spending.

The Relationship Between Spending and Outcomes

Much of the recent attention to questions about quality has focused on the links between health care spending and health benefits. While that question is of great importance, it is not exactly the question of interest here, where we wish to focus on capacity more precisely. It does, however, provide some valuable context. One of the great success stories of American medicine is the technological progress that has produced so many valuable, albeit expensive, medical advances. According to some analyses, expansions in health care technologies and the accompanying costs of developing and then disseminating them through expanded health care system capacity have easily been worthwhile. Cutler and colleagues, for example, have calculated that (discounted, real) lifetime spending for newborns went up by nearly $70,000 between 1960 and 2000, but life expectancy also went up by almost seven years. They conclude that even if only one half, or even one quarter, of the life expectancy gain could be directly attributable to medical care bought with the additional $70,000, the increased spending would be justifiable based on the health benefits it produced [57]. Cutler and McCabe have made similar arguments about progress in other areas of medicine, such as heart attack treatments and neonatal intensive care services [58], and these observations follow other authors who have suggested a positive correlation between health care spending and improved health outcomes such as lower mortality rates (e.g., [59, 60]).
with lower overall mortality rates, lower death rates due to heart disease and cancer, longer life expectancy, lower neonatal death rates, and lower rates of low-birth-weight births. Having more specialist physicians, however, was statistically significantly related to higher total mortality, more deaths due to heart disease and cancer, shorter life expectancy, higher neonatal mortality, and higher rates of low-weight births [61]. Starfield and colleagues reported a similar set of findings looking across counties in the U.S.[62] – higher primary care physician-to-population ratios were generally associated with lower all-cause and cause-specific mortality rates, while higher specialist-to-population ratios were generally associated with no change in outcomes or with higher mortality rates. Baicker and Chandra show that states with more specialists tend to rank lower in quality than states with fewer, and vice versa for generalists [56].

One criticism of these studies is that they rely heavily on variation across areas, a study design that can produce inaccurate results if other characteristics of areas that could influence both physician supply and health outcomes are not adequately controlled. In addition, not every study identifies clear relationships. In one of the earliest studies, Newhouse and Friedlander examined data from the 1950s and 1960s but did not find any relationship between physician supply and outcomes [63]. More recently, Perrin and Valvona studied physician activities according to physician density, mainly for generalists, and found some evidence that more supply was associated with more services used but could not conclude that there was evidence of any impact on quality [64]. Work on the relationship between physician supply and hospitalizations for ambulatory care sensitive conditions has also found only minimal relationships [65].

In addition to the methodological challenge of including adequate control variables, there are almost certainly important non-linearities in the relationship between physician supply and outcomes that must be dealt with in the empirical work. Areas with minimal access to physicians may well see improvements in health outcomes associated with increasing physician supply. But, once these benefits are realized, the margin for further improvements in health from further expansions in physician supply may become quite limited. Some research supports this view in the case of neonatologists [66] and for other types of physicians as well [65]. Based on these observations and other concerns, such as the significant geographic clustering of new physicians in areas that are already well served, some argue that further expanding the supply of physicians in the U.S. would be unlikely to produce substantial improvements in health outcomes [22].

Hospital Capacity and Outcomes. For hospital beds, evidence is more limited. Newhouse and Friedlander’s early study considered the link between expanding hospital capacity and outcomes and found only that areas with more beds had lower prevalence of varicose veins [63]. Analyses of differences between Boston and New Haven have argued that having more hospitals beds, and using more hospital days, is not associated with longer life spans or fewer readmissions [32, 33].

Evidence on the Indirect Ways that Capacity Change Might Affect Quality Volume-Outcome Relationships. Beyond the direct studies, there are a number of areas in which studies point to the potential for important effects of capacity changes on quality of care. One important consideration emphasizes the effect of expanding capacity on the number of procedures performed by individual providers. An extensive body of literature notes the importance of procedure volume as a driver of quality of care, with providers performing higher volumes of services typically achieving higher levels of proficiency and better outcomes (e.g., [67, 68]). One particularly strong example is the relationship between volume of cardiac care services such as angioplasty and cardiac care outcomes (e.g., [69-71]). Further, the research suggests that variations in capacity of cardiac care induced by things such as certificate of need regulation can drive variations in the volume of services performed at existing centers, which can in turn affect the quality of the care received. In one recent study, angioplasty centers in Florida were reported to be less prevalent than centers in California, and as a result had higher volumes per center with associated better outcomes [72, 73].

Changes in the Distribution of Patients Across Provider Types. Expanding capacity can also lead to changes in the distribution of patients across providers.
Work by investigators at Dartmouth sheds some light on the possible relationships between capacity, complexity of care, spending and outcomes. While not offering definitive proof, data in the Dartmouth Atlas suggest that patients living in areas with more physicians and hospitals see a larger number of different physicians in the last two years of life, pointing to possible problems with complex and fragmented care. Furthermore, areas where patients see ten or more physicians in the last two years of life also appear to have higher spending rates and use more health care. Higher spending in many areas is often not clearly associated with better outcomes [27, 28].

**Patients Harmed by Receiving Unnecessary Services.** The higher use that often accompanies capacity expansion also leads to the risk that services will increasingly be provided to patients who are less clearly good candidates for the services. In some cases, these services may have risks for patients that could begin to outweigh the benefits. Areas with many surgeons, for example, may perform more surgeries, even for patients who are marginal candidates who might have been better treated through medical management. Similarly, higher use of CT scans in areas with many scanners runs the risk that some patients will be subjected to unnecessary radiation when the scan is not needed or only marginally indicated [77].

**Other Quality Considerations.** Beyond the relationships considered above, other effects of capacity change also may be important. Changes in capacity may signal changes in accessibility. Putting services physically closer to some populations, or in more accessible settings like outpatient clinics, may create benefits to patients in terms of convenience and satisfaction. Changing capacity could affect the characteristics of services delivered, such as physicians spending more time with patients when there are higher physician-to-patient ratios, which could affect clinical outcomes as well as patient satisfaction [78]. Quality implications might also arise as a result of shifts in service availability when health care systems expand in some areas at the expense of others, such as by de-emphasizing less lucrative service lines.

Ultimately, the strongest approaches to managing health care capacity will require attention to both the
costs and benefits of adding new capacity and will assess the tradeoff between costs and benefits. As we face these challenges, we need to be cognizant of the longstanding norm that more care implies better care. In a number of ways, research identifies a series of important concerns about the impacts of ever expanding capacity on quality of care. Balancing the potential for supply expansions to improve quality against their potential to drive unneeded, or even harmful, changes in utilization is one of the key challenges we face.

4. Determinants of Changes in Capacity

Capacity changes in modern medicine are driven by a number of important forces. In the background, advances in basic science, translated into advances in clinical understanding and techniques, drive changes in the landscape of medicine. These advances give rise to pressures for capacity change, as maturing technologies make it possible to deliver newer treatments more widely, and as patient and physician expectations about appropriate treatments change. These pressures can be related to the drive to improve quality, which can sometimes stress the use of the most up-to-date approaches. At the same time, there are also other forces that shape the way that the health care system responds to changes in science, technology, and expectations. One such factor, which appears to play a central role in many aspects of health care system change, is profitability. Most medical care is delivered in private sector entities, which have incentives to pursue the implementation of services that will produce economic advantages. Research repeatedly suggests that financial incentives, while not the only factor, can have important influences on health care delivery. In fact, one might go so far as to say that capacity change in medicine is driven and shaped primarily by two forces – the desire to improve health care and health outcomes, and economic forces, including the profitability of new services.

The idea that profitability could be an important factor in driving capacity growth gains support from many quarters. Economic research clearly outlines the logic of technological change and service adoption responding to economic incentives (for example the technological change literature, e.g., [79], and literatures specific to health care, e.g., [80]).

Studies investigating the relationship between financial incentives and changes in health care capacity are difficult to come by, but observers of health care have often noted the importance of financial incentives (e.g., [51]). Anecdotal evidence frequently suggests responses to financial changes, such as the nearly three-fold expansion in the use of implantable defibrillators after Medicare became willing to pay for these devices in a broader range of patients. Research on other aspects of health care also clearly indicates the potential for economic incentives to influence the behavior of health care providers.

The organization of the payment and delivery systems can also play a role in capacity expansions by affecting profitability for specific types of equipment and services. Analyses by Baker and colleagues relate the adoption of MRI and neonatal intensive care units to the presence of managed care in the area, and similar analyses by Cutler and Sheiner link adoption of various hospital-based technologies to HMO activity [38, 75, 90-92]. One prime reason that less new technology adoption would be associated with higher levels of managed care activity is managed care plans' efforts to reduce costs and benefits of adding new capacity and will assess the tradeoff between costs and benefits. As we face these challenges, we need to be cognizant of the longstanding norm that more care implies better care. In a number of ways, research identifies a series of important concerns about the impacts of ever expanding capacity on quality of care. Balancing the potential for supply expansions to improve quality against their potential to drive unneeded, or even harmful, changes in utilization is one of the key challenges we face.

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- The relative profitability of certain new services appears to be a key driver of expanding capacity of these services.
- There are many examples of cases where financial incentives appear associated with important changes in capacity. These include the growth of physician-owned specialty hospitals and development of higher-profit lines of business within hospitals and by other providers.
- Other factors, such as improving quality of care, can also be important in driving capacity growth.

6 In this section, I focus mainly on the relationship between the profitability of a given service and changes in capacity for that service. However, literature also makes clear that other factors could be important. Many theories of capacity change support the view that one should also consider substitutable and complementary services. If, for example, the profitability of orthopedic surgery is high, and orthopedic surgeries are easier to do with more MRI imaging availability, one might expect increased adoption of advanced imaging.

7 There is extensive literature supporting the view that health care providers respond to financial incentives in a wide range of contexts. For example, see work by Gruber and colleagues on cesarean deliveries [81, 82]. Work on the effects of changes in Medicare fees also frequently finds responses by physicians [40, 83-88] though this literature is not unanimous [43, 89].
demand for advanced, costly services and to drive down the reimbursement for services when possible.

In her study of the adoption of the Medicare program in the 1960s, Finkelstein investigated the changes in hospital capacity that followed the expansion of insurance to a group that was to become a huge consumer of hospital care. She finds that expanding coverage to the elderly, and thus increasing the profitability of expanding hospital services, was associated with substantial expansion in the hospital sector, including both hospital beds and new hospital technologies [93].

More recently, the growth of specialty hospitals provides a valuable window into the forces responsible for health care capacity expansion, highlighting both the push for higher quality and the ways that this trend intersects with profitability. As described by Iglehart, the growth of specialty hospitals has been driven by the emergence of new technologies and capabilities that increasingly make it possible to treat patients outside of traditional hospital settings and by a desire on the part of many physicians for more autonomy in their activities and/or a larger voice in the decisions of hospitals [94]. In addition, it is clear that financial incentives have played an important role. Of specialty hospitals opened between 1990 and 2005, more than 90 percent were for-profit entities. Specialty hospitals also tended to earn higher margins than general hospitals, to the benefit of their (often physician) owners [94]. MedPAC’s investigation of specialty hospitals provides some notable insights into the role of financial incentives. A Commission staffer who had participated in site visits to several cities in which specialty hospitals had become an issue testified at a MedPAC public meeting that “the physicians we spoke with told us they set up specialty hospitals for two reasons: governance and opportunities to increase their income...” [95].

To some extent these opportunities for increased income come from differences in Medicare payments across and within DRGs that can be exploited by specialty hospitals. Cardiac surgery, often a service emphasized by specialty hospitals, is much more profitable than cardiac medical patients and the average Medicare discharge [96, 97].

Perhaps because of the powerful financial incentives for establishing this type of facility, the number of specialty hospitals has continued to grow despite considerable debate about the extent to which these facilities create true improvements in health outcomes. Specialty hospitals argue that they can produce better outcomes by standardizing practices and focusing on a narrow range of procedures performed in high volume [98]. Other observers are less convinced of the benefits. Some argue that expanding the number of specialty cardiac hospitals drives up utilization of revascularization, but largely in patients without acute myocardial infarction who are not strong candidates for the procedure [99]. This pattern raises concerns about driving up costs and utilization without producing strong benefits [100], and cardiac hospitals may not clearly produce substantial improvements in clinical outcomes when compared with general hospitals having similar procedural volumes [101].

Alongside the development of specialty hospitals is the expansion of focused service lines in community hospitals. Particularly in the case of cardiac services, these too appear to be related to financial incentives. Anecdotal reports suggest very strong profitability for cardiac surgery cases. One analyst, quoted in a New York Times examination of service line expansion, says that at the high end some hospitals may make as much as $20,000 on a coronary bypass. In the same article, another hospital reports making $1500 per bypass under Medicare, but losing $1800 treating a simple pneumonia case [103].

“Mark Wietecha, who directs health care consulting for Kurt Salmon Associates, estimates that the profit margin for surgery, including cardiovascular cases, is about 15 percent for some hospitals, compared to just 2 percent for gastrointestinal care. ‘People build their business plans and facilities on these profitabilities,’ he said.” [103]

The Center for Studying Health Systems Change has also tracked the development of specific service lines and specialty hospitals in their study areas around the country [104]. Though they note that profitability is not the only force driving capacity change – many hospitals, for example, are developing women’s centers and children’s centers, which may themselves be

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8 In other work, specialty hospitals had slightly better outcomes than other hospitals, but also healthier patients, and there was considerable variation across specialty hospitals [102].
unprofitable but are beneficial for the community and the hospital's reputation – it is clear that profitability drives many aspects of capacity change. Hospital administrators describe development of new specific lines of service as a way of improving emphasis on their most profitable services. They state, "A CEO of a prominent academic health center commented, 'we are going to focus on the tertiary and quaternary services that are high margin where we perform well and have the possibility of gaining market share. This is not a very hard decision.'" [104]

Similar forces seem related to shifts of services from inpatient to outpatient settings. A variety of factors promote growth in outpatient facilities, including advances in technology that make safe outpatient procedures possible [105–107], an increasing focus on patient convenience [108], and economic incentives that often favor the provision of services in the outpatient setting and lead to further development of outpatient facilities [109–111]. Cardiac imaging and stress tests are examples of services that have been differentially reimbursed, with more revenue for services provided in physicians' offices than in other settings. Not surprisingly, the growth in these procedures has occurred in physicians' offices [96]. Medicare also pays generously for the purchase of equipment like gamma cameras for myocardial perfusion imaging and echocardiography, perhaps contributing to their fast growth in physician office settings [96]. Similar trends are also evident outside of cardiac services. Profitable GI endoscopies and CT scans, among other things, have increasingly moved to outpatient settings [104] as outpatient capacity has increased.

Clearly, capacity change in medicine is driven by many forces. Competition among providers leads people to innovate, expand and adopt new services. Changes in patients' and doctors' expectations about care can lead to changes in capacity. But we cannot ignore the power of economic forces to influence where and to what extent capacity is adopted.

5. Policy Implications

Capacity is an important driver of utilization and spending. While some capacity expansions undoubtedly produce benefits that exceed their costs, we must also be alert to the potential for overuse of expensive goods and services for which the reverse is true. Addressing capacity challenges will require multi-faceted approaches, aiming both to encourage more efficient use of existing capacity and to provide a more rational basis for decisions about future capacity growth. A detailed discussion of the various policy approaches that have been proposed over time is beyond the scope of this paper, but this section outlines a range of possible general approaches.

Information-Based Approaches

Comparative Effectiveness. Improving information could contribute in a variety of ways to efforts to better manage capacity and improve the efficiency of the health care system. Strengthening the base of evidence about the effectiveness and cost effectiveness of different medical activities and interventions could improve the foundation for decisions about capacity expansions (e.g., [112]). Improving processes to collect the data needed to support comparative effectiveness analyses may thus be valuable. Further efforts by the FDA and CMS to require the gathering of data on new technologies as they are introduced into mainstream usage, such as under the recent carotid stent system coverage expansion enacted as part of a program to collect effectiveness evidence, could be valuable components of such a strategy.

The value of better comparative effectiveness information would be enhanced by efforts to disseminate and use the information. In the hands of payers, better effectiveness and cost-effectiveness information could help shape improved payment strategies, which could ultimately influence the economic incentives associated with capacity change and exert pressures toward more efficient systems. In the hands of providers, better information could influence utilization patterns with similar potential downstream effects on capacity change. Information might also influence patients' decisions about particular providers and utilization of specific services.

Quality Information. Beyond the particular treatments that would be the focus of improved comparative effectiveness research, information about the value of medical care generally could also be used to influence consumer opinions about health care use and
The Challenges of Health System Capacity Growth

Especially in administered pricing systems, distortions between payments and costs of offering services can create profit opportunities that we should expect will be detected and acted upon by health care providers, with important implications for the development and use of capacity [51]. Challenges can be particularly acute for new technologies, where initial prices are often set at high levels and do not decline with costs over time. More attention by Medicare and private insurers to the distortions arising from differential profitability in administered prices could remove one of the strong driving forces behind capacity growth.

Emphasizing competitive pricing mechanisms seems advantageous. However, particularly for Medicare, this seems difficult to accomplish, as is evident from the challenges faced by the program in its attempts to implement competitive bidding for durable medical equipment, clinical laboratory services, and other services.

Constraining Financial Rewards from Capacity Investments. Attention to the potential for financial rewards arising from physician ownership of facilities, which seems to be a potent driver of capacity change in some areas in recent years, may also be valuable. Regulations already directed at these incentives exclude some types of arrangements, such as allowing self-referral to physician-owned imaging services located in a doctor’s own office. Further efforts to manage physician ownership and self-referral could contribute to better capacity management, but recent Congressional battles over proposals to limit self-referral to physician-owned specialty hospitals illustrate the political difficulties of this approach.

Changes in Benefit Design. Somewhat less directly, insurance plan design could incorporate changes that would affect the financial incentives facing potential adopters of new capacity. For example, strengthened prior authorization activities could restrict utilization and influence the profitability of targeted services. The development of tiered provider networks could reward providers who adopt and use capacity in efficient ways by directing patients to them on a preferential basis. Movements toward consumer directed health plans, coupled with much stronger information about costs and quality of providers, could also provide incentives favoring the efficient adoption and use of medical infrastructure.

Relationships between Capacity and Use. Some public policy activities may also benefit from a stronger understanding of relationships between capacity, use and costs. For example, in many cases, efforts to expand capacity are based on the amount of health care consumed in the past, but in cases where the supply of providers may have had a hand in creating demand for its own services, past utilization can be a poor indicator of actual benefit or of the need for new services. The existence of full hospitals and busy clinicians now, for example, need not imply the necessity of having more. Public policy processes that operated with a more complete understanding of these dynamics might produce better policies.

Approaches Centered on Financial Incentives Better Managing Differential Profitability. A variety of approaches would use financial incentives to affect markets for infrastructure and capacity. Perhaps the most direct would focus on the payments that providers receive for different services. To the extent that current payment methodologies create situations in which some types of capacity are much more profitable than others, there are incentives for disproportionate capacity growth and use. Efforts to rationalize these payments could lead to greater efficiency.

encourage efficiency. The American public and physicians have a long-held view that more medicine is usually better medicine, but it appears that this belief is all too frequently not true. Increases in capacity can drive increases in utilization that push us toward the “flat of the curve,” yielding little or no added benefit and perhaps even resulting in harm. Nonetheless, consumers and providers often view greater use positively as an indication of better access and an improved chance for high quality health care. More attempts to educate consumers and providers about relationships between capacity, area variations, quality and outcomes of care could help create an environment that is more receptive to efforts to manage capacity. Implicit in this approach is attention to improving metrics for quality and value and the public reporting of these measures. Convincing the public that quality could actually be better if less care is consumed will be a tough sell if the outcome measures are suspect or not salient to consumers. Poor measures will also do little to influence patient and provider behavior.
Organizational Changes in the Delivery System

Integrated Delivery Systems. To some extent, the challenges of capacity change are inherent in a system in which there are many, at least quasi-competing, providers who are frequently paid on a per-service basis. This system emphasizes the pursuit of economic rewards for each provider, potentially in ways that work at odds with larger system goals to rationalize the availability and use of capacity. One solution is to develop payment mechanisms that emphasize the formation of larger entities that can take responsibility for the delivery of care to population groups, such as by expanding resources focused on the development of more integrated delivery systems. Current examples of activities in this direction, such as the development of shared savings models and proposals for Accountable Care Organizations, could provide a valuable base for future discussions.

Centers of Excellence and Accreditation. On perhaps a more limited scale, other organizational changes could also contribute to more efficient capacity changes. Furthering the development of centers of excellence, for example, would concentrate certain types of services in fewer facilities, eliminating duplicative capacity in the long run, and capitalizing on the potential to improve quality through higher volume for the best providers. Stronger accreditation programs could encourage the formation of efficient delivery structures by signaling to patients and providers which providers give the highest value care. Many activities of this type could also interact in potentially useful ways with efforts to rationalize financial incentives.

More Explicit Capacity Management: Certificate of Need and Health Planning

The history of capacity management in the U.S. is largely focused around certificate of need (CON) programs. These programs have mixed histories as mechanisms for capacity control – most studies do not find strong effects of CON on overall hospital size and costs (see good summaries in [113-116]), though other recent work has examined the relationship between CON and nursing homes and finds some effects [117, 118]. Work has also recently linked CON programs to the growth in the availability and quality of some services like open heart surgery programs [72, 73, 119] and suggests a lack of effective review was a factor in growth of specialty hospitals and ambulatory surgery centers (e.g., [111, 119, 120]). While the overall history of CON in the U.S. is mixed at best, there may be effective state CON programs that could offer lessons or identify situations in which regulatory approaches could be effective.

Beyond returning to broad CON, there may be specific instances in which discussions with particular groups could help the U.S. achieve health care goals. Recognizing that public policy much more easily supports expansions than reductions in capacity, private or public efforts to consider widespread efforts to expand or replace capacity could provide a setting for focused discussions that incorporate information about the broader impacts of the anticipated capacity change. Examples of these opportunities would be the growing number of calls for deliberate expansion of physician capacity, efforts by California to support the rebuilding of its hospitals for earthquake safety, and initiatives by many critical access hospitals and other older hospitals to replace their aging plants. Failure to take a comprehensive look at how changes like these will affect overall system capacity represents a lost opportunity to control capacity growth.

Managing capacity change to improve the efficiency of the U.S. health care system may well require actions across many of these, and possibly other, areas. While making significant changes to the way our system approaches capacity may be difficult, it is also clear that this is an issue that deserves focused attention and a challenge that is increasingly important to face.
REFERENCES


The Challenges of Health System Capacity Growth

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