

Factors substantively influencing numbers of surgical cases performed at a research hospital

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In this brief article, I review prior research on the relative quantitative importance of different factors that influence the numbers of surgical cases performed at research hospitals.

1st procedure, 2nd insurance (payer), and 3rd absolute distance

First, consideration should be made for the surgical procedure (1). Hepatic transplantation is not performed at ambulatory surgery centers (1).

Second, insurance plans of patients can influence caseload (1). For example, in the United States of America (US), many military veterans receive nearly fully paid healthcare at the hospitals of the US Department of Veterans Affairs. Some of these hospitals have extensive research programs. Their caseloads are dependent on not only the types of procedures performed, but also the numbers of veterans in the US state (analogous to province) and county. Quantitative analysis of the caseload at the sole research hospital in a US state found that, among multiple insurers, for major surgical procedures, insurance could not be neglected when predicting the effect of non-research hospitals' surgical programs on the caseload of the research hospital (1).

Third, the distance of patients from the research hospital matters. Caseloads for different procedures could not be predicted accurately by relative distances (i.e., patients choosing the closer non-research hospital performing the procedure; $P < 0.00001$) (1). For example, following the

highway system, many patients drove from one portion of a US state to a research hospital, bypassing a city 2 hours closer to their homes and with hospitals performing the procedure (1). On the other hand, it was not that the patients drove 1,000's of kilometers across the county. Thus, absolute distance was the important factor, not relative distances among hospitals. [Note that because geographic barriers like the US Great Lakes matter too (2), the important factor is the absolute travel time]. Another important result was that regions, counties, cities, townships, and villages were not predictive of the effect of the non-research hospitals on the caseload of the studied research hospital, once insurance was controlled (1). Consequently, to quantify the degree of "competition" affecting the surgical caseload of the research hospital, the number of hospitals in a region such as a city was likely inaccurate (1).

4th: other hospitals and/or ambulatory surgery centers

Without having first specified procedures, insurance of the patients undergoing the procedures, and numbers of patients with residences different absolute distances (time) from a hospital, it is not feasible to consider the effects of other hospitals on the research hospital's surgical caseload (1). Thus, the 4th most important factor is the other hospitals. Simply put, if a province has a large city far from the border of the province, and no other hospital in the province

performs a procedure other than a research hospital in the city, then the research hospital will perform nearly all cases of that procedure. The perspectives of patients (e.g., reputation) will have little quantitative influence on the research hospital's caseload for the procedure.

Ambulatory surgery centers decrease the outpatient caseload of research hospitals. For example, a research hospital was studied with no other such hospital for many hundreds of kilometers. With the opening of two outpatient surgery centers within 10-minute drives from the research hospital, the annual number of cases decreased markedly over a couple of years (20%) (3). Analyzing US nationwide data, outpatient surgery centers decreased hospitals' (but all hospitals, not just research hospitals) caseloads, but when the outpatient surgery center distance was within several kilometers, and even then only by a few percent (4). For urological surgery throughout the US, among patients with the US Medicare (elderly) insurance, a small decrease in caseload also was detected (5). That small decrease represented, though, a large decline from the overall rate of growth in the outpatient surgical caseload nationwide (5). Among all US Medicare specialties, the opening of the only outpatient surgery center in a region resulted in 7% decrease in caseloads at hospitals (6).

Non-research hospitals can decrease the caseloads of research hospitals, and the effects can be quantified by using discharge abstract data (7-10). In the US, nearly every state collects data on hospital discharges. These data are publically available at no or very minimal cost; national summaries are available at <https://hcupnet.ahrq.gov/>. The data required for the analyses are just two columns, but with many records: hospital and type of procedure. Each record is a procedure (e.g., if a patient undergoes bilateral knee arthroplasty, the single surgical case will have two records, each of the procedure code for knee arthroplasty). A similarity coefficient is like a correlation coefficient for the relative distributions of the different types of procedures performed between two hospitals. The following are examples of questions that are answered using similarity analyses (8-10):

- ❖ Do other hospitals in the primary market area of the research hospital perform the same types of procedures as the research hospital? (Note, not a list of procedures, but quantitatively weighted by caseload).
- ❖ What opportunities for growth in surgery can be identified by the research hospital? What types of procedures are being performed in large numbers by other hospitals in the primary and secondary market

areas that could then be performed at the research hospital?

- ❖ For what types of procedures are patients leaving the research hospital's primary or secondary referral areas to have their surgery elsewhere but still within the province or county?
- ❖ Which hospitals located outside the research hospital's primary or secondary referral areas are performing surgery on patients who live in the research hospital's province or county?

In the US, similarity analyses are performed using ICD-9-CM procedure codes, Current Procedural Codes as used for physician billing, and soon using the ICD-10-PCS procedure codes.

From similarity analyses, two broad generalizations can be made about research hospitals. First, at least in the US, research hospitals do not perform most surgical cases. What sets research hospitals apart surgically from other large hospitals is that research hospitals have large diversities of procedures, 3-4 times greater than non-research hospitals (7,10). Diversity can be quantified, just like done by ecological statisticians (7,10). Diversity can be showed graphically (i.e., easy to show to different stakeholders) (10). Second, administrators and physicians at research hospitals often do not appreciate the quantitative influence of other hospitals on the caseload of the research hospital (9,10). Perceptions are often qualitative (e.g., lists of other hospitals, their specialties, and sizes based on beds) (9,10). For example, at one research hospital, leadership perceived that the hospital was losing patients undergoing the same procedures to a small local community hospital (9,10). Quantitative analysis of similarity showed that the two hospitals were highly dissimilar in their distributions of procedures (9,10). Being close, the hospitals had evolved different mixes of procedures (i.e., different niches). For example, a small research hospital was located in a relatively small city within 1.5 hours of a city with internationally known specialty, research hospitals (9,10). The research hospital sought quantitative analysis to determine what subspecialties to target during planned recruitment of a few new surgeons (9,10). The research hospital's similarity was compared to all of the other hospitals in its (large) US state. The hospital had the greatest similarity to a community hospital nearby (9,10). The executives at the small research hospital had envisioned their main competition as being the hospitals in the nearby large city (9,10). However, the surgeons at the research hospital were also operating at the community hospital (9,10). Consequently, the distribution of procedures

was similar, resulting in competition. The other hospital lacked the reputation and prestige of the research hospital, but it was nonetheless having a large quantitative effect on caseload.

5th: waiting time

Waiting time data may provide some useful context to the subsequent research results. Among parents in the US arranging for their children's surgery, the 25th, 50th, and 75th percentiles of the "ideal waiting time" were 2, 3, and 4 weeks, respectively (11). The percentiles of the "longest acceptable waiting" time were 4, 6, and 10 weeks, respectively (11). Among a mixture of adult patients and parents at a different hospital in the US, the 25th, 50th, and 75th percentiles for the longest acceptable waiting time were 1, 2, and 4 weeks, respectively (12). Among adults in Germany, waiting times of 1 week were preferred to 2 weeks, and waiting time of 4 weeks was associated with reduced chance of choosing that facility for surgery (13).

There are three types of data indicating that waiting times are more important to most patients than the choice of surgeon and/or hospital.

First, from section #1, the most important factor influencing where a patient has elective surgery is the procedure. However, from patients' perspectives, the service provided is not the procedure. This is not apparent in reading reference (1), because greater understanding was learned afterward (14). Consider an airline flying direct between two cities (e.g., Iowa City, where my university is located, to Chicago, another city in the middle of the US) (14). This city pairing would be like a surgical procedure. Customers (i.e., patients) do not consider the service to be a flight from Iowa City to Chicago, but such a flight on a date of the patient/customer's choosing (e.g., January 1). This also applies to cataract surgery. All patients studied were on the same insurance plan (14). The median additional driving time that patients who underwent cataract surgery would have been "willing to travel" was 60 minutes so that they "can choose the day" of surgery (14). The study design was feasible based on the previous finding that absolute rather than relative travel distance matters (1).

Second, 143 patients in Australia waiting for cholecystectomy, inguinal herniorrhaphy, etc., chose to have their procedure sooner with another surgeon, while 92 patients opted for their original surgeon. The ratio equaled 60.9%, significantly greater than half ($P=0.0005$) (15).

Third, most patients do not have a substantive relationship

with their surgeon before surgery (e.g., not multiple ambulatory clinic visits). At a US research hospital, both among patients undergoing outpatient surgery and among all patients who were outpatient preoperatively, the median number of visits at the surgeon's clinic before surgery was 2, including when calculations were weighted by the payment to the anesthesiologists (16). There had been zero (0) previous surgical procedures for patients newly being scheduled for 76% of cases, and 78% weighted by expected payments (16). Patients who had more than one previous surgery at the hospital's outpatient surgery center or more than one previous hospitalization accounted for only 6% of cases, and 6% of expected payments (16). At another US research hospital, 82% of cases were for patients with zero previous surgical procedures at the hospital (17).

Therefore, when considering numbers of patients having surgery at a research hospital, focus on: (I) type of procedure; (II) cost to the patient; (III) absolute distance; (IV) quantitative distribution of procedures performed by other nearby hospitals; and (V) waiting time and choice of the waiting time. To the extent that surgeon and/or hospital influence the decision, it is not so based on personal experience (i.e., not based on quality or satisfaction), but perception based on marketing including (potentially) publically available quality data.

Surgeon factor and/or hospital factor

Discrete choice experiments that include distance and waiting time also find the importance of complication rates on hospital choice (18). The complication rates (e.g., cataract capsular rupture) are not, however, distinguishable to patients between surgeon and hospital.

Surveys and qualitative studies indicate that patients focus on the surgeon. In one study of inpatient surgery, 78% of patients reported that "surgeon reputation" "would influence their" decision of the hospital "a lot", followed by the hospital having nationally recognized surgeons (63%) (19). In another study of patients undergoing major surgery, "42% of patients said they decided equally with their physician about where to have surgery; 22% of patients said they were the main decision maker;" "5% indicated that the role belonged to a family member," and "the remaining 31% of patients said the physician was the main decision maker of where they would have surgery" (20). Third, focus groups were used with patients who had undergone cataract surgery or joint arthroplasty (21). The participants viewed websites (21). "The need to compare medical specialists

instead of hospitals was a recurring topic discussed in all four groups. Most participants wanted to choose a particular specialist instead of a hospital” (21). These results are relevant to marketing materials, websites, etc. There are not data indicating that marketing “the hospital” without highlighting the surgeons is an effective approach.

Conclusions

Understanding the role of hospital/surgeon communication with patients (e.g., websites) is important, in part because of the desire for quality information to be used in patient choice. However, research hospital administrators and physicians should be realistic that for predicting total caseload, other factors are hierarchically more or equally important than quality data: type of procedures, insurance, absolute distance to patient populations and other hospitals performing similar distributions of procedures, expected waiting times, and how the date of surgery will be chosen.

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