Original Contribution

Lack of a substantive effect of insurance and the national US payment system on the relative distribution of surgical cases among hospitals in the State of Iowa: A retrospective, observational, cohort study

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ABSTRACT

Study objective: Our aim was to quantify the extent to which the distribution of
patients among payers and changes to the payers' policies has influenced the market of surgery among hospitals in a relatively rural state.
Design: Retrospective cohort study.
Setting: Iowa Hospital Association data analyzed were from 2007 through 2016 for the N = 121 hospitals with at least one case performed that included a major therapeutic procedure.
Measurements: We used five categories of payer (e.g., Medicare), five categories of patient age (e.g., 18 to 64 years), and three categories of patient residence location (e.g., neither from the county of the hospital nor from a county contiguous to the county of the hospital).
Main results: Sorting hospitals in descending sequence of numbers of surgical cases, depending on year, the top 10% of hospitals performed 58.4% to 59.2% of the cases. Increases in numbers of cases among patients with commercial insurance increased the heterogeneity among hospitals in numbers of surgical cases (P < 0.0001). However, the magnitude of the effect was very small, with an estimated relative marginal effect on the overall Gini index of only 0.9% ± 0.2% (SE). Increases in numbers of cases of patients with Medicare insurance reduced the heterogeneity in numbers of cases among hospitals (P < 0.0001), but also with very small magnitude (−0.9% ± 0.2%). In contrast, factors encouraging patient travel contributed to larger hospitals becoming larger, and smaller hospitals becoming smaller (3.9% ± 0.7%, P < 0.0001).
Conclusions: We found the absence of a substantive effect of insurance and national US payment systems on the relative distribution of surgical cases among hospitals. Anesthesia groups should focus on payer and payment reform in terms of their effects on payment rates (e.g., average payment per relative value guide unit), not on their potential effects on hospital caseloads.

1. Introduction

Surgical caseloads at hospitals are weakly predicted by county population [1–3].[4] Surgical caseloads over a decade can even be *inversely* correlated to change in county population [4]. Some surgical facilities in large metropolitan areas perform relatively few surgical cases (e.g., 340 cases per year) [5].[5] Some hospitals in small metropolitan areas perform many surgical cases (e.g., 34,000 cases per year). The comparison of 340 cases per year versus 34,000 cases per year is an example of an inequality in caseloads between two facilities. The size of the inequalities in surgical caseloads among hospitals within states is unknown.

If large inequalities are, indeed, present, the reasons are unknown. Heterogeneity of hospital bed counts among facilities cannot explain

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the inequality of surgical caseloads statewide, because most (≅66%) hospital-based surgery is ambulatory [6], and median hospital occupancy (≅64%) [7] is far too low to limit elective surgery (i.e., the number of beds follows the number of cases, not vice-versa). Some surgical facilities provide care only for patients of specific ages (e.g., children), but whether these specialized facilities are sufficiently commonplace to account for overall heterogeneity in cases per year per facility is unknown. Some surgical facilities may not accept assignment from all insurance payers (e.g., based on case counts, some may not be Medicaid participating providers). However, again, it is unknown whether such facilities are sufficiently commonplace to account for the overall inequality of cases per facility statewide. The focus of our paper is on payer (e.g., Medicare or commercial insurance) because, if payer is an important cause of the highly unequal distribution of surgical cases among hospital facilities, then anesthesiologists working primarily in operating rooms need to consider how payment reform will affect surgical caseloads.

Over the past two decades, substantial progress has been made in understanding how an individual hospital can predict its caseload for the following year, choose numbers of anesthesia providers, forecast market opportunity for individual surgical specialties, identify types of procedures performed less often than similar hospitals, etc. [4,8,9]. For example, data envelopment analysis methods are used to predict growth opportunities of individual specialties at individual hospitals based on the number of cases of other specialties at hospitals [1–3,10,11]. The premise is that a reliable criterion to evaluate the potential for growth in orthopedic surgery is to compare the current number of hip replacement cases to the hospital's number of colorectal resections, nephrectomies, and other common procedures.[6] Differently, similarity analyses use the individual procedure codes of all surgical cases at a hospital, not just common procedures, to examine procedures more often performed at peer institutions and for which patients often leave the region [12–15]. These methods are designed to help managers at individual hospitals [1–3,10–15]. Consequently, these methods are not suitable to understand why some facilities have grown to perform so many surgical cases while others have not (i.e., why there is large inequality of caseloads among hospitals). Whether the inequality, if present, is beneficial or harmful for patient access to surgical care also is unclear.

In the current paper, our primary aim was to quantify the extent to which the distribution of patients among payers and changes to the payers' policies has influenced the market of surgery among hospitals in a relatively rural state. During the past decade, there has been a major US recession (2007–2009) [16], federal payment reform (the Affordable Care Act in 2010) [17], and in some states such as Iowa multiple state insurance reforms [18]. At public hospitals such as the University of Iowa, there have been initiatives to keep aligned with and to respond to these federal and state payment program reforms [19–21]. Nevertheless, our hypothesis was that there would be at most a very small effect of payer on the quantitative distribution of surgical cases among hospital facilities (see Discussion). We expected payer not to substantively influence the heterogeneity among hospitals in surgical caseloads, because each Canadian province has a single payer. Nevertheless, there is inequality of surgical caseloads among hospitals in Canadian cities.

Our secondary aim was to examine the quantitative importance of another factor on the relative numbers of cases performed at hospitals: whether patients travel substantively for surgery. We hypothesized that if nearly all patients had surgery at a hospital close to their residence,

specifically within their county, there would be less inequality of numbers of surgical cases among hospitals. In contrast, we hypothesized that if more patients traveled beyond their county or a contiguous county for surgery, then a few large hospitals would become even larger. We based our hypothesis on the results of the previous studies for individual hospitals [1,4,9,14]. The focus of our secondary aim was to learn the quantitative importance on inequity in numbers of cases *statewide* due to whether patients travel for surgery beyond their local area.

2. Methods

The University of Iowa Institutional Review Board determined on June 5, 2018 that this project (#201805852) did not meet the regulatory definition of human subjects research. This retrospective observational study cohort was performed using de-identified data.

The cases studied were those performed at all non-federal hospital-owned surgical facilities in Iowa with at least one case performed that included a major therapeutic procedure [22]. Each case was attributed to the hospital owning the facility where the case was performed, although most facilities are close to the hospital (see Section 2.4) [23]. We henceforth refer to all the studied facilities as "hospitals."

Both inpatient and outpatient cases were studied that included at least one major therapeutic procedure. Inpatient procedures were counted as major therapeutic if their International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) or Tenth Revision, Procedure Coding System (ICD-10-PCS) codes had corresponding categories of "procedures that are considered valid operating room procedures by the Medicare Severity Diagnosis Related Group grouper and that are performed for therapeutic reasons" [24,25]. Outpatient surgery procedures were counted as major therapeutic if the Healthcare Common Procedure Coding System (HCPCS) code had corresponding surgery flag code = 2, representing "invasive therapeutic surgical procedure" [26]. We did not study the so-called minor therapeutic procedures because many such procedures are inconsistently performed with an anesthesia provider (e.g., simple incision and removal of subcutaneous foreign body) [26]; our main interest related to implications for anesthesiologists caring for operating room patients. No distinction was made between whether a case was listed in the inpatient or outpatient database because the study was based on the surgical procedures performed, not the patients' hospital length of stay. What makes our study unique is the inclusion in the dataset of all surgical patients, regardless of payer (i.e., not restricted to Medicare), of all hospital facilities statewide (i.e., not a study of one network), and including both inpatients and outpatients.

The date of each procedure was known for every hospital and patient. If the same patient underwent more than one major therapeutic type of procedure on the same date and at the same hospital, then those procedures were considered to have been performed during the same case. The time series of 10-years was segmented into 5 two-year periods (Table 1); the statistical method, below, uses categories [27,31]. We used five categories of payer (Table 2 column 1), five categories of patient age (Table 3 column 1), and three categories of patient residence location (Table 4 column 1).

2.1. Description of percentile shares of cases among hospitals

To examine the effect of payers on inequality of caseloads statewide (i.e., our primary aim), we used longstanding econometric methods for the investigation of inequality (e.g., decomposition of the relative impact of different income sources such as governmental payments versus investments on the inequality in household annual income; Fig. 1 and Table 1) [28–33].

Two analyses were performed to quantify the heterogeneity of cases among hospitals within each of the 5 two-year periods. One was calculation of the percentile shares of surgical cases among the hospitals in

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[6] A hospital's ratio of lung resection cases to hysterectomy cases is compared with the ratios of many other hospitals. The data envelopment analysis considers input variables to scale the ratios into numbers of cases. The data envelopment analysis also considers that some hospitals have no general thoracic surgery procedures, which reflects specialization, not being small.