ORIGINAL RESEARCH

Effect of US State Certificate of Need regulation of operating rooms on surgical resident training

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Abstract

Purpose: Government regulation of health care services helps prevent costs associated with expansion and duplication of services in the United States. Certificate of Need (CON) helps restrict construction of ambulatory surgery facilities and hence controls delivery of surgical intervention, but concern exists about whether this affects resident exposure to an appropriate caseload. This study investigated how CON laws impact on surgical caseload as an index of resident surgical training.

Methods: This retrospective study used State Inpatient Data compiled by the Health Care Utilization Project. Mean per capita rates of 26 diverse surgical procedures were evaluated in 21 states with CON laws and 5 states without between 2004 and 2006. The proportion of procedures performed in teaching facilities was also assessed. Student's t-tests were used to evaluate differences in these parameters between regulated and non-regulated states ($\alpha = 0.05$). Multivariate analysis of variance permitted evaluation of the types of procedures that underwent shift in location performed.

Results: States with CON laws did not differ significantly in procedural rates for any of the investigated surgical procedures; however, such regulation was associated with different trends in teaching center caseload, depending on the type of procedure. Complex procedures, such as Whipple operations ($p = 0.14$) or resection of acoustic neuroma ($p = 0.37$), underwent no redistribution. Conversely, common procedures that might have previously been performed in

private settings, such as total hip replacement ($p = 0.003$) or mastectomy ($p = 0.01$), did occur more commonly in teaching facilities under CON regulation. CON law did not result in relocation of surgical procedures away from teaching institutions.

Conclusions: These results suggest that government regulations do not discriminate against teaching facilities. Surgical residents in states with such regulation gain similar or superior exposure to procedures as residents in states without such laws.

Excessive consumption of medical resources has been implicated as a source of unnecessary health care costs. As health care services are largely driven by supply, they are not subject to standard economic market theory. This bias exists more clearly with privatized health care, where neither providers nor consumers of health care resources are responsible any incurred costs, leading to consequent unnecessary use of health care resources and commensurately increased costs. With scarcity of health care resources, excessive wait times and increased patient morbidity ensue.

As the largest third-party payer of health care services, the U.S. federal government is motivated to

enact legislation that would reduce costs. Consequently, The Health Planning Resources and Development Act of 1974 was instituted to address this concern. This federal government initiative would provide funding to individual states that actively regulated health care services to help eliminate unnecessary health care consumption and thus reduce costs. One method of such regulation has taken the form of Certificate of Need (CON) laws whereby the state Department of Health and Human Services (DHHS) authorizes the construction, expansion, and purchase of health resources ranging from long-term care facilities, imaging equipment and operating rooms (ORs).¹ Although federal CON funds were repealed in 1987, 36 states still have some form of CON law.²

Under a CON law, a facility wishing to acquire or replace an OR would first have to submit an application to the DHHS which would, in turn, assess the need for such an OR prior to approving or denying the application. The methodology for determining OR need varies between the different states with CON laws, and often the number of applications for ORs exceeds the amount for the state as perceived by the DHHS. In such cases, state health planning agencies may distribute certificates based on other factors such as facility type (for-profit, non-profit, or governmental), geographic location and single- versus multi-specialty clinic.¹ The impact of government regulation on rates of various surgical procedures has previously been investigated, with the suggestion that access to common elective procedures is unaffected in those states where surgical resources are externally limited.³

In a facility committed both to teaching and to patient care, procedures are commonly more time-consuming when performed by trainees.⁴⁻⁶ A study by Khuri and colleagues⁷ showed patients in teaching hospitals had a greater prevalence of risk factors, had more complex operations, as well as longer operating times. The participation of resident physicians in patient care also reduces the efficiency of hospital care.⁸ Khuri *et al.*⁷ also showed comparable 30-day risk adjusted mortality among surgical cases between teach-

ing and non-teaching centers. Despite these challenges, studies tend to suggest that teaching hospitals provide a higher quality of care: a recent literature review by Kupersmith⁹ revealed that major teaching hospitals out-performed non-teaching centers in process of care and risk-adjusted mortality. Nevertheless, these longer operating times and higher morbidity rates may be deemed unfavorable by state health planning agencies, resulting in preferential distribution of certificates to non-teaching facilities. Potential impacts of CON regulation on surgical training could include decreased case volumes and unequal allocation of surgical attendings.¹ It remains unclear whether, and to what extent, operating room regulation affects surgical resident education.

Methods

Data were collected for 26 elective surgical procedures across a variety of surgical sub-specialties (Table 1) in 25 different states. This data were obtained online from the State Inpatient Database (SID) of the Health Care Utilization Project (HCUP), which is a collection of health care databases sponsored by the Agency for Healthcare Research and Quality (AHRQ). SID contains approximately 90% of all inpatient discharge abstracts from 39 participating states, which includes clinical and non-clinical information regardless of payer, from both community and specialty hospitals.¹⁰ Furthermore, the database is subject to quality checks resulting in improved data accuracy and completeness.

Procedure information on the SID database is classified according to ICD-9 procedure codes. Variables investigated in this study included procedure rate per capita and proportion of procedures performed at teaching and non-teaching facilities. States were grouped by whether they had CON regulation of health care, and data were collected for years 2004-2006. State populations for the years 2004-2006 were obtained from the U.S. Census Bureau. Statistical analysis involved Student's t-test with Bonferroni

TABLE 1. Rates of representative surgical specialty procedures, stratified by certificate of need regulation

Procedure	No CON	CON	p-value*
Lumbar discectomy	69.8	67.2	0.73
Carpal tunnel release	1.4	1.1	0.11
Acoustic neuroma	1.1	0.6	<0.01
MVD for trigeminal neuralgia	0.55	0.35	0.06
Cataract	0.46	0.46	0.97
Carotid endarterectomy	25	42.2	<0.01
Laparoscopic appendectomy	61	46.3	<0.01
Appendectomy	50.3	47	0.43
Cholecystectomy	20.3	24.6	0.02
Laparoscopic cholecystectomy	110	101	0.23
Hemicolectomy	25.2	31.3	<0.01
Hernia repair	2.16	2.38	0.4
Mastectomy	10.9	12.5	0.13
Pancreaticoduodenectomy	2	2	0.94
CABG	74.8	113.2	0.01
MVR – mechanical	3.47	3.55	0.85
MVR – tissue	2.03	2.54	0.11
AVR – mechanical	8.7	8.12	0.45
AVR – tissue	8.9	10.7	0.15
Cardiac transplant	0.84	0.4	<0.01
Total hip arthroplasty	79.6	78.4	0.79
Total knee arthroplasty	167	160	0.57
Rotator cuff repair	8.5	6.3	0.04
Caesarian section	395	352	0.07
Hysterectomy	88.7	109	0.02
Tonsillectomy / adenoidectomy	4.1	2.9	0.01

CON = certificate of need, MVD = microvascular decompression, CABG = coronary artery bypass grafting, AVR = aortic valve replacement, MVR = mitral valve replacement

* = hypothesis testing significant at 0.05 level of significance by Student's t-test

correction for multiple comparisons ($\alpha = 0.05$) evaluating impact of CON status on overall procedure rates in each state and proportion of procedures occurring in teaching centres.

Results

Data were obtained from the SID for 21 states with CON legislation and five states without such regulation. Examination of overall per capita rates of each procedure revealed no statistically significant differ-

TABLE 2. Rates of representative surgical specialty procedures performed at teaching centres, stratified by certificate of need regulation

Procedure	No CON	CON	p-value*
Lumbar discectomy	35.00	37.11	0.74
Carpal tunnel release	0.70	0.60	0.39
Acoustic neuroma	0.90	0.54	0.5
MVD for trigeminal neuralgia	0.43	0.27	0.84
Cataract	0.20	0.18	0.79
Carotid endarterectomy	8.20	19.10	<0.01
Laparoscopic appendectomy	19.50	18.50	0.71
Appendectomy	16.80	19.40	0.42
Cholecystectomy	7.00	11.10	<0.01
Laparoscopic cholecystectomy	28.50	35.20	0.13
Hemicolectomy	7.90	13.40	<0.01
Hernia repair	0.73	0.96	0.15
Mastectomy	3.35	5.70	<0.01
Pancreaticoduodenectomy	1.47	1.61	0.5
CABG	30.00	68.00	<0.01
MVR – mechanical	1.70	2.40	0.03
MVR – tissue	1.10	1.74	0.048
AVR – mechanical	4.08	5.24	0.06
AVR – tissue	4.58	7.39	0.048
Cardiac transplant	0.83	0.40	<0.01
Total hip arthroplasty	27.30	36.60	<0.01
Total knee arthroplasty	47.30	66.50	<0.01
Rotator cuff repair	2.81	2.17	0.33
Caesarian section	118.00	160.8	0.03
Hysterectomy	26.35	46.60	<0.01
Tonsillectomy / adenoidectomy	2.67	1.95	0.07

CON = certificate of need, MVD = microvascular decompression, CABG = coronary artery bypass grafting, AVR = aortic valve replacement, MVR = mitral valve replacement

* = hypothesis testing significant at 0.05 level of significance by Student's t-test

ence between states with and without CON regulation for most of the procedures evaluated in this study (Table 1). Of the 26 diverse surgical procedures investigated, lower per capita rates in states with CON regulation were seen in only three procedures: resection of acoustic neuromas (0.6 versus 1.1 per 100,000; $p < 0.001$), laparoscopic appendectomy (46 versus 61 per 100,000; $p < 0.01$) and rotator cuff repair (6.2 versus 8.5 per 100,000; $p < 0.01$), while higher per capita rates were observed for four procedures: coronary ar-

tery bypass graft (113 versus 74 per 100,000; $p<0.01$), carotid endarterectomy (42 versus 25 per 100,000; $p<0.01$), cholecystectomy (24 versus 20 per 100,000; $p<0.01$), and hysterectomy (109 versus 88 per 100,000; $p=0.02$). There were no significant differences for procedure rates between states with and without CON regulation in the remaining 16 procedures examined. These results suggest that access to care is not consistently and predictably adversely affected by CON regulation.

When procedure rates at teaching facilities were analyzed as a function of CON status, substantial differences were observed (Table 2). Specifically, there were differences and trends towards *higher* rates at teaching facilities in states with CON regulation. Of the 26 procedures analyzed, a higher rate for teaching facilities in CON states occurred in 13 procedures. The most considerable increases occurred for orthopedic and cardiac surgical cases. Increased rates in both total hip arthroplasty (36.6 versus 27.3 per 100,000; $p<0.01$) and total knee arthroplasty (66.5 versus 47.3 per 100,000; $p<0.01$) were observed in teaching facilities in states with CON regulation. Similarly, increased rates were also observed in many cardiac procedures such as: coronary artery bypass graft (30 versus 68 per 100,000; $p<0.01$), carotid endarterectomy (8.2 versus 19.1 per 100,000; $p<0.01$), prosthetic mitral valve replacement (1.7 versus 2.4 per 100,000; $p<0.05$), and tissue mitral valve replacement (1.1 versus 1.7 per 100,000; $p<0.05$).

The majority of investigated procedures exhibited higher per capita rates at teaching centres in states with CON legislation than those without such legislation. Further analysis of the data reveals similar trends that fractions of statewide procedures occurring at teaching centres are higher in the presence of CON legislation. Figure 1 depicts this for representative procedures from each subspecialty, with the greatest difference observed for common cardiac surgical procedures such as CABG and valve replacement. Conversely, highly specialized procedures such as transplant occur predominantly at teaching institutions re-

gardless of government OR regulation, and hence no such difference is seen.

Discussion

Impact of CON regulation on surgical training was measured indirectly by evaluating the rates of common surgical procedures performed in teaching facilities. We specifically chose procedures from a wide range of surgical specialties that include general, orthopedic, cardiac, neurosurgery and obstetrical to evaluate if OR rationing had an effect on residents performing a wide range of elective and non-elective surgeries.

Our results show that for 26 diverse surgical procedures, overall access to care was not affected by state CON status as assessed by case procedure rate. This result supports the findings of a recent similar study that showed that CON legislation does not affect the rates of common, elective, surgical procedures.³ Our investigation also includes many non-elective and less common procedures as well, further supporting the theory that CON laws do not affect patient access to surgical care. For half of the procedures investigated there was a significantly increased procedure rate for teaching facilities in states with CON regulation versus states without, and for the remaining procedures there was no difference. These results suggest that CON regulation does not negatively affect surgical caseloads at teaching facilities; in fact, it appears that CON regulation actually preserves the teaching mission in these states as measured by exposure to surgical cases.

These results may reflect preferential certificate distribution, with an underlying intent of state health planning agencies being to preserve health care services to indigent populations. Medical facilities often absorb the cost of servicing non-paying, uninsured patients through internally-generated surpluses.¹¹ Although these cases are less costly in smaller, single-specialty clinics such as an Ambulatory Surgical Center (ASC), their preservation in a large, multi-specialty

FIGURE 1. Difference in fraction of selected representative surgical procedures performed at teaching institutions between states with and states without certificate of need (CON) legislation. Positive values represent a greater fraction of cases at teaching centers in states with CON legislation. Negative values represent a greater fraction of cases at non-teaching centers in states with CON legislation. Most procedures are performed with greater frequency at teaching centers under CON rulings, with financially rewarding cardiac surgery and orthopedic surgery cases most prominent. Resource intensive procedures (cardiac transplant) and routine orthopedic procedures (rotator cuff repair) exhibit no differences based on legislation, suggesting that other factors such as locoregional expertise and the need for rapid patient throughput may be more significant.

facility such as a teaching hospital would greatly facilitate health care services to a lower socio-demographic. An analysis of the American Hospital Association Annual Survey from 2000-2007 showed that teaching centers provide a significant and growing amount of uncompensated care.¹² Teaching hospitals account for 55% of uncompensated health care costs¹³ and half of all Medicaid admissions¹⁴. In our study, the increased procedure rates in teaching facilities occurred mainly in the orthopedic and cardiac surgeries, as well as common procedures such as cholecystectomy and hemicolectomy: indeed, these

two subspecialty procedures have been demonstrated by the American Hospital Association to be relatively profitable for the treating institution,¹⁵ with cardiac surgery covered under most insurance plans, including Medicare, and having generous reimbursement rates.¹⁶

Our study examined only the number of cases performed in states with and without CON regulation, there was no qualitative evaluation of surgical training. Surgical residents rely on sufficient case exposure to develop skills, and as such we used case-loads as an indirect measurement of resident surgical training. We have no information on what proportion of these cases

actually involved resident training, but one can assume that procedures occurring in a teaching hospital would engage residents. Furthermore, the goal of our study was to investigate if CON regulatory status negatively affects surgical training via decreased surgical case volumes; an increase in surgical cases would support the conclusion that such regulation does not negatively affect surgical training and in fact, may support the teaching missions of these hospitals.

Several assumptions were made in this study; for instance, we assumed that there was no travel between different states for surgical care. An investigation of interstate inpatient flow rates of Medicare beneficiaries by Buczko and coworkers reveals that there is an interstate flow of inpatient care, largely between adjacent states, with seasonal migration and availability of specialty care determining inflow and outflow rates.¹⁷ We also assumed that there were no regional variations in surgical cases, although this is contentious, with Weinstein and coworkers illustrating geographic bias in back surgery, with as high as eight-fold variation in regional rates of lumbar discectomy and laminectomy.¹⁸ Lastly, we assumed a direct relationship between surgical caseload and resident exposure to surgery.

Investigations such as this provide insight into the unique mechanisms in which government regulation can impact on both patient accessibility to health care delivery as well as trainee exposure to stable case volumes. The direct impact and applicability of such findings to other models of health care delivery are uncertain. Nevertheless, the conclusions that are drawn may find substantial relevance at times when nations and governments are examining more cost-effective modes of health care delivery while satisfying the need to guarantee adequate resident training.

Conclusion

This work yields important results concerning how state-based regulation of operating rooms construction impacts on surgical resident training. Overall access to

surgical care is maintained in states with CON regulation, and procedural rates of common surgical cases are not only preserved in teaching facilities, but often exceed the rates of teaching hospitals in states without CON legislation. Increased procedural rates were seen in more profitable surgeries, such as cardiac and orthopedic, whose surpluses may then be used to fund medical care to the poor and uninsured. These results suggest that health care planning agencies may be strategically granting certificates to teaching facilities as a means of preserving uncompensated health care.

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