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Trends in Regionalization of Inpatient Care for Urological Malignancies, 1988 to 2002

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Purpose: Higher hospital and clinician volumes may be associated with improved patient outcomes for complex surgical and medical care, although the strength and consistency of this association varies markedly across specific conditions and procedures. Pressures from payors and policymakers exist to move complex care to high volume hospitals. The net effect of these pressures may be the regionalization of care. We quantified trends in the regionalization of inpatient care for urological oncology in a national administrative database.

Materials and Methods: The Nationwide Inpatient Sample, a 20% stratified sample of United States community hospital admissions, was queried for surgical and nonsurgical admissions for bladder, renal and prostate cancer care between 1988 and 2002. Hospitals were grouped into tertiles by annual surgical volume. Trends over time in the annual discharge rate by hospital volume tertile, geographic region and insurance status were analyzed.

Results: High volume hospitals were defined by at least 22, 12 and 26 cases per year for bladder, renal and prostate cancer, respectively. High volume hospital discharges increased significantly as a proportion of all discharges for bladder (67% to 70%) and renal (67% to 73%) cancer surgery, and they were essentially constant for prostate surgery (76%). Trends were similar for Medicare and Medicaid patients except high volume hospital discharges for prostate cancer decreased during the study period. Significant regional variation was observed for the regionalization of surgical and nonsurgical care.

Conclusions: Nationwide Inpatient Sample data demonstrate the ongoing regionalization of urological oncology care. The policy implications of this trend are complex with potentially important benefits and risks in terms of access to and quality of care.

Key Words: kidney neoplasms, prostate neoplasms, bladder neoplasms, quality of health care, health care surveys

A significant relationship between higher hospital surgical volume and better health outcomes was first noted in 1979.¹ Since then, it has been extensively explored in a number of areas in surgery and medicine with rapidly increasing interest in recent years. Surgical volume is positively associated with outcomes in the setting of major cancer surgery² and this was noted with respect to radical prostatectomy, radical cystectomy and radical nephrectomy.^{3,4} Evidence for and against the volume-quality association was recently reviewed.⁵ Although the strength and importance of associations between volume and quality remain subject to varying degrees of controversy depending on the procedure, some evidence exists that the migration of care to HVHs and high volume surgeons is already occurring, with some hospitals abandoning high risk procedures altogether.^{6,7} We examined data from a large national hospital admissions database to analyze trends during a 15-year period in the concentration of inpatient surgical and nonsurgical care at HVHs for bladder, renal and prostate cancer.

METHODS

The NIS data set of the Health Care Utilization Project is a 20% stratified sample of all hospital admissions in the United States based on administrative discharge abstract data. The NIS includes 5 to 8 million records from a total of 1,000 hospitals in 35 states. NIS data on 1988 to 2002 were used for this analysis. Patient records for bladder, renal and prostate cancer admissions were selected for analysis from the NIS data set based on Clinical Classification Software Principal Diagnosis and ICD-9-CM codes (see Appendix).

The study population of all patients with a principal diagnosis of bladder cancer, renal cancer or prostate cancer was divided into 2 subsets for analysis, that is a surgical admission subset and a nonsurgical admission subset. The surgical admission subset included those with a renal, bladder or prostate cancer principal diagnosis and a principal cancer specific procedure. The nonsurgical admission subsets included those with a renal, bladder or prostate cancer diagnosis who did not undergo any major cancer specific procedure during that admission. Hospitals were ranked according to the number of discharges per year for each cancer type and then they were divided into tertiles for each year. Based on tertile ranking of hospital discharges the hospitals were categorized as high, moderate or low volume for each year. A given hospital could move from 1 tertile to another from 1 year to the next.

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The Cochran-Mantel-Haenszel trend test was used to analyze trends with time in the average number of discharges per year per hospital at hospitals in each volume category by geographic region of the United States (Northeast, Midwest, South and West). Trend lines were plotted using linear regression. The study period was then divided into 3 groups (1988 to 1992, 1993 to 1997 and 1998 to 2002) and a trend test was performed to assess trends in hospital discharges by volume category, as distributed by the primary expected payer (Medicare and Medicaid, private insurance and uninsured or other) across these groups of years. Significance was considered at $p < 0.05$. SAS®, version 9.0 was used for all analyses.

RESULTS

In the NIS data set 26,770 patients were admitted to a total of 1,764 hospitals for a diagnosis of bladder cancer and they underwent radical cystectomy between 1988 and 2002. A total of 134,713 patients were admitted for bladder cancer management but they did not undergo radical cystectomy. They were treated at a total of 2,645 hospitals. Another 64,857 patients underwent nephrectomy at a total of 2,182 hospitals and 21,415 were treated nonoperatively for renal cancer at a total of 2,288 hospitals. Also, 178,210 men underwent radical prostatectomy at a total of 2,065 hospitals and 146,311 were admitted for nonoperative management at a total of 2,775 hospitals.

Table 1 shows the low end of the range with the time of tertile discharge volumes that were used to categorize hospitals as low, moderate or high volume. Annual surgical case volumes used to define high tertile volume hospitals were at least 22, 12 and 26 cases for bladder, renal and prostate cancer surgery, respectively. Table 2 lists the results of the trend test for the percent of discharges in groups of years (1988 to 1992, 1993 to 1997 and 1998 to 2002) for the different volume categories. Surgical and nonsurgical discharges for bladder and renal cancer from HVHs increased significantly during the period. For bladder cancer the relative increases in HVH discharges were modest at 67% to 70% of surgical discharges and 70% to 72% of nonsurgical discharges. For renal cancer increases were larger at 67% to 73% of surgical discharges and 63% to 68% of nonsurgical discharges. The percent of prostate cancer surgical cases discharged from HVHs was essentially constant during the study period at 76%, while the percent of nonsurgical prostate cancer cases discharged from HVHs decreased slightly.

Table 3 lists the results of the trend test for the percent of discharges by hospital volume with time for patients with Medicare/Medicaid as the primary expected payer type. Surgical and nonsurgical discharges from HVHs for bladder and renal cancer increased significantly during the entire period

TABLE 2. Admissions in all regions

Hospital Type	Trend Test		
	1988–1992	1993–1997	1998–2002
<i>Bladder Ca</i>			
Surgical vol:			
High	67.0	67.2	70.0
Moderate/low	33.0	32.8	30.0
p Value			<0.0001
Nonsurgical vol:			
High	70.3	72.4	71.8
Moderate/low	29.7	27.6	28.2
p Value			0.0001
<i>Renal Ca</i>			
Surgical vol:			
High	67.4	71.7	73.2
Moderate/low	32.6	28.3	26.8
p Value			<0.0001
Nonsurgical vol:			
High	62.5	69.1	68.3
Moderate/low	37.5	31.0	31.7
p Value			<0.0001
<i>Prostate Ca</i>			
Surgical vol:			
High	76.1	75.7	76.5
Moderate/low	23.9	24.3	23.5
p Value			0.029
Nonsurgical vol:			
High	71.0	70.0	69.2
Moderate/low	29.0	30.0	30.8
p Value			0.0001

($p < 0.05$). A corresponding decrease in surgical and nonsurgical discharges from low and moderate volume hospitals for bladder and renal cancers was observed. Surgical and nonsurgical admissions for prostate cancer decreased significantly at HVHs ($p < 0.05$), accompanied by a corresponding increase at lower volume hospitals.

Figures 1 to 3 show annual trends in the percent of HVH discharges for surgical and nonsurgical admissions for patients with bladder, prostate and renal cancer, respectively, divided by region. In the Northeast region the trend for the percent of discharges from HVHs increased significantly from 1988 to 2002 for surgical and nonsurgical admissions for bladder and prostate cancer ($p < 0.0001$), whereas the trend decreased significantly for surgical admissions for renal cancer. The decrease in the trend was not significant for nonsurgical admissions for renal cancer (0.089). In the Midwest and West regions there was a statistically significant increasing trend from 1988 to 2002 in the percent of discharges from HVHs for surgical and nonsurgical admissions for each urological cancer ($p < 0.0001$). In the South the trend for the percent of discharges from HVHs increased significantly from 1988 to 2002 for surgical admissions for bladder cancer and nonsurgical admissions for renal cancer ($p < 0.0001$). The trend decreased significantly for surgical admissions for renal cancer and prostate cancer, and for

TABLE 1

	Bladder Ca		Renal Ca		Prostate Ca	
	Surgery	No Surgery	Surgery	No Surgery	Surgery	No Surgery
No. cases	26,770	134,713	64,857	21,415	178,210	146,311
No. hospitals	1764	2645	2182	2288	2065	2775
Vol (No. cases/yr):						
Low	<4	<12	<6	<3	<8	<9
Moderate	4–5	12–21	6–11	3–4	8–25	9–26
High	>5	>21	>11	>4	>25	>26

TABLE 3. Medicare/Medicaid admissions only

Hospital Type	Trend Test		
	1988–1992	1993–1997	1998–2002
<i>Bladder Ca</i>			
Surgical vol:			
High	65.7	66.1	68.5
Moderate/low	34.3	33.9	31.5
p Value			0.003
Nonsurgical vol:			
High	69.8	71.7	71.4
Moderate/low	30.2	28.3	28.6
p Value			0.0001
<i>Renal Ca</i>			
Surgical vol:			
High	66.1	69.8	71.1
Moderate/low	33.9	31.2	28.9
p Value			0.0001
Nonsurgical vol:			
High	59.5	65.9	64.5
Moderate/low	40.5	34.1	35.5
p Value			0.0004
<i>Prostate Ca</i>			
Surgical vol:			
High	77.0	73.7	74.4
Moderate/low	23.0	26.3	25.6
p Value			<0.0001
Nonsurgical vol:			
High	71.0	69.6	68.7
Moderate/low	29.0	30.4	31.3
p Value			<0.0001

nonsurgical admissions for bladder and prostate cancer (p <0.0001).

DISCUSSION

This analysis of a large, population based administrative database shows that overall approximately two-thirds of patients with bladder, renal and prostate cancer received care at HVHs during the study period. The relative increase in surgical discharges from HVHs was 4.5% for bladder cancer and 8.9% for renal cancer. There was no increase in the HVH concentration for prostate cancer care, although the concentration of care at HVHs was higher for prostate cancer throughout the study period than for bladder or renal

cancer. There was significant geographic regional variation in terms of HVH concentration trends but no single region demonstrated consistently greater trends than the others.

Hollenbeck et al observed similar results when analyzing hospital discharges for cystectomy using the same data set.⁸ Analyzing data from 1988 to 2000 they found that cystectomy was increasingly being performed at large urban teaching hospitals with high discharge volumes in general and at HVHs for cystectomy in particular. These trends in the current analysis appear to be similar for renal cancer but different for prostate cancer. Furthermore, they show that surgical and nonsurgical care for bladder cancer and renal cancer is moving to HVHs.

The regionalization of medical and surgical care, which is synonymous with the concentration of care at HVHs, is the subject of much attention in the recent literature. Begg al reported the first major study to focus on cancer care.² They analyzed 5 major cancer operations in the Surveillance, Epidemiology and End Results Medicare database, and found a significant association between increased surgical volume and improved outcomes for 4 of the 5 operations.² In terms of urological oncology several recently reviewed studies demonstrated improved outcomes at HVHs for cancer surgery.⁵ Volume-outcomes relationships have been least explored for renal cancer surgery, which interestingly demonstrated the greatest regionalization in the current study.

The assertion of a positive hospital volume-outcome association is not without controversy and the strength of the association varies significantly across specific operations. The Institute of Medicine commissioned a systematic review of the literature of the United States and Europe that was published in 2002, analyzing 135 studies involving 27 diagnoses and procedures.⁹ The investigators found that in general higher volume is associated with better outcomes but the magnitude of the relationship varies widely, as did the methodological quality of the studies. Some studies showed that hospital surgical volume per se is less important than surgeon volume¹⁰ or the volume effect is attenuated by adjustment for other hospital characteristics, such as bed size, urban location, teaching mission, capacity, staffing and the

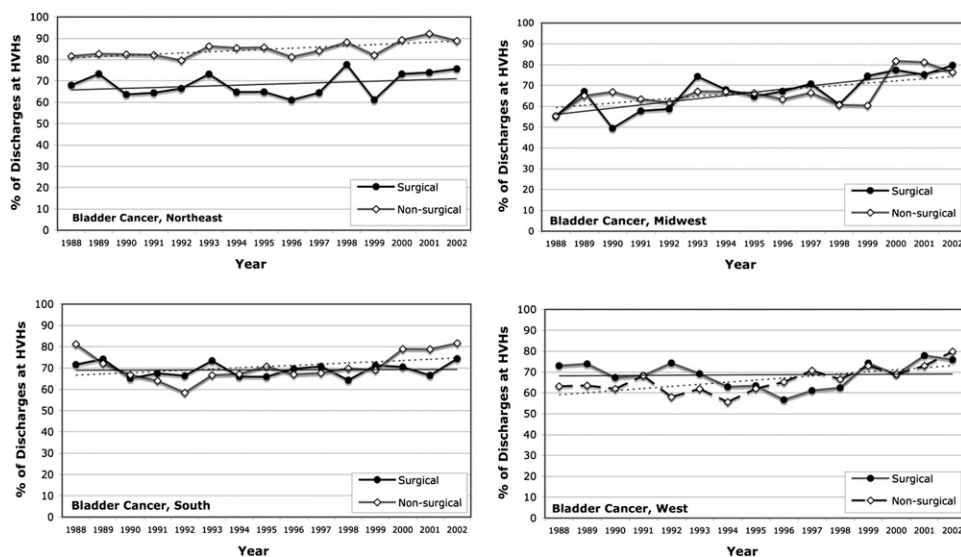


FIG. 1. Regional trends in HVH discharges for surgical and nonsurgical bladder cancer care in Northeast, Midwest, South and West regions. Trend lines were calculated by linear regression.

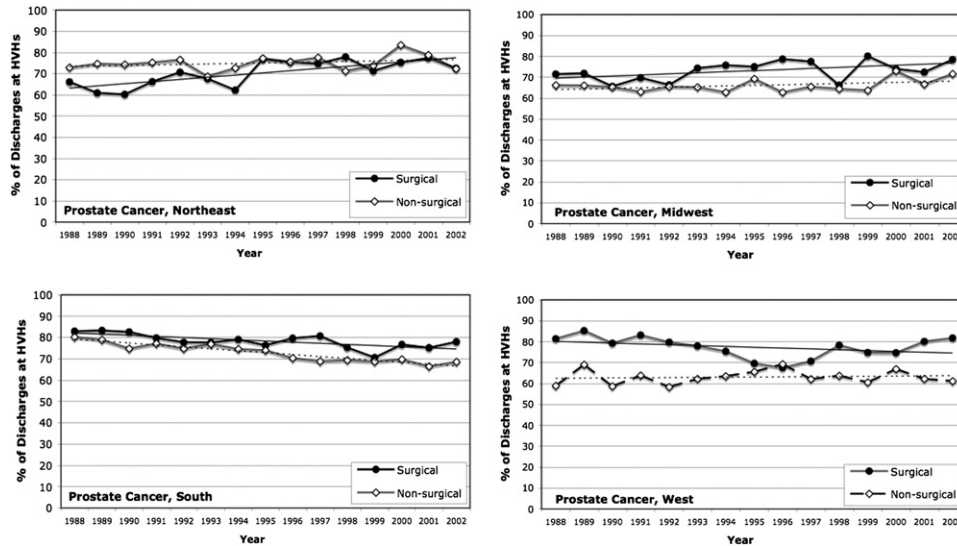


FIG. 2. Regional trends in HVH discharges for surgical and nonsurgical prostate cancer care in Northeast, Midwest, South and West regions. Trend lines were calculated by linear regression.

range of services offered.^{11,12} Others questioned whether claims based administrative data could adequately control for variations in patient variables, which may drive outcomes to a greater extent than hospital volume.^{13,14}

An analysis of the Health Care Utilization Project data showed that hospitals meeting standards set by the Leapfrog Group, a coalition of 160 large payors that purchase insurance for more than 34 million Americans,¹⁵ for volume for 5 tracked procedures (coronary artery bypass graft, percutaneous coronary intervention, pancreatic resection, esophageal cancer surgery and abdominal aortic aneurysm repair) did not have substantially different in-hospital mortality rates than those not meeting the standards, while applying volume standards would significantly impact the revenue of low volume hospitals and substantially increase patient travel time.¹⁶ Indeed, many rural areas simply lack the referral base to support even a single high volume center for some procedures.⁷ Furthermore, multiple studies have

now demonstrated that in patients with radical cystectomy a delay of greater than 3 months between diagnosis and surgery (a problem that is almost certain to be exacerbated by regionalization, especially in rural areas) is associated with significantly worse oncological outcomes.^{17,18}

To whatever extent, if any, the association between volume and outcomes in urological oncology is true, the perception of the association may be enough to drive regionalization by patient selection and by referral patterns. The proportion of hospitals in the United States where cystectomy is performed varied up and down between 45% and 50% from 1988 to 1996 but between 1996 and 2000 it decreased to 39%.⁶ Nonwhite patients and those with Medicaid or no insurance are already significantly less likely to receive health care in general¹⁹ and undergo radical cystectomy in particular²⁰ at HVHs. Policies that potentiate trends toward regionalization run the risk of worsening existing disparities in health care access and quality across sociodemographic groups.

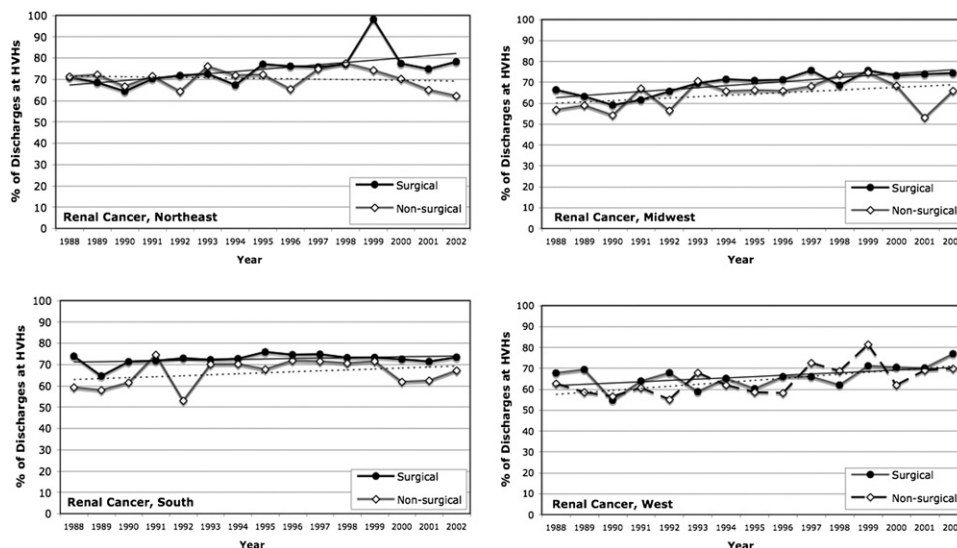


FIG. 3. Regional trends in HVH discharges for surgical and nonsurgical renal cancer care in Northeast, Midwest, South and West regions. Trend lines were calculated by linear regression.

Perioperative cancer care can be resource intensive and expensive. Medical and private insurance payments have decreased significantly in the last decade and cancer surgery is generally perceived to be under reimbursed compared to other urological procedures, particularly in the case of cystectomy.²¹ This fact would tend to increase further referrals from smaller community centers to referral centers. However, as a result, HVHs in general and in particular high volume, nonprofit medical centers, where patients are treated regardless of insurance status, face the prospect of increasing levels of nonreimbursed or under reimbursed care despite providing relatively cost-efficient care compared to that at lower volume centers.¹¹ A similar phenomenon may be driving the regionalization of nonsurgical cancer care. Most patients in this category are admitted to manage complications of prior treatments or sequelae of advanced disease. Such care is similarly resource intensive and costly, again providing an incentive to low volume centers to refer patients to higher volume centers, which shoulder a yet greater burden of poorly compensated care.

The absence of regionalization trends for prostate cancer and, indeed, a reverse trend among Medicare patients may reflect the fact that prostate cancer care was more heavily regionalized at the start of the observation period than care for the other tumors. The difference may reflect different sociodemographic and/or health seeking characteristics of patients with prostate cancer as well as specific variations between those who are and are not covered by Medicare. Another possibility is that HVHs were associated with early adopters of prostate specific antigen screening and, thus, they came to treat a large proportion of cases, while now with the wider prevalence of screening this concentration of care may be decreasing. It will be interesting to monitor these trends as new disease management modalities in urological oncology, such as active surveillance for low risk prostate cancers, percutaneous ablation of renal tumors and robotic surgical assistance for advanced laparoscopy, are disseminated throughout the country.

This study has limitations, particularly related to the administrative rather than the clinical nature of the data source. HVH tertiles for surgical care were defined using hospitals where at least 1 operation was performed and not all hospitals in the NIS. As providers at hospitals stop performing a procedure altogether, as noted,⁶ the volume defining a high volume tertile would tend to increase and the HVH tertile would account for a larger percent of cases. Furthermore, given the large sample size in this and other large administrative data sources, results should be interpreted cautiously. For example, while the trends in the percent of HVH prostate cancer discharges are statistically significant, the absolute changes of a 0.4% increase in HVH surgical care and a 1.8% decrease in HVH nonsurgical care during a 15-year period are relatively unremarkable. These data allow a description of trends in care but possible explanations for these trends are by nature speculative. It is possible that trends among hospital characteristics other than volume that are not measured in the NIS may partially explain the observed regionalization trends.

We defined tertiles by hospitals rather than by patients, as other have done in similar analyses.¹² By nature far fewer than a third of the hospitals would account for a third of patient discharges and result in a more narrow definition of HVH with more discharges per HVH than the thresholds in

this study. Finally, the last year of observation was 2002. The intensity of attention to issues of surgical volume and quality of care has increased since that time in urological oncology, as assessed by the number of articles on the subject. It is possible that the trends observed have already been altered since 2002, likely in the direction of an increasing concentration at HVHs. Even absent explicit policies by government agencies or private insurance companies encouraging that urological oncology care should be given at HVHs, increased self-referral by patients or referral by other physicians to tertiary centers may accelerate the trends.

CONCLUSIONS

Our analysis of NIS data confirms that regionalization is an ongoing trend for urological oncology patients treated surgically and nonsurgically. The concentration at HVHs is greatest for prostate cancer care but it has been essentially stable. The trend toward regionalization is the most prominent in the setting of radical nephrectomy, the procedure for which the least evidence exists for a significant volume-outcome association. Developing policies by public and private insurers are likely to increase regionalization. It is important that these policies should focus on diseases and procedures for which higher volumes have been proved to produce better outcomes and attention should be given to the potential impact of regionalization on access to care.

APPENDIX

	Clinical Classification Software Principal Diagnosis codes	ICD-9-CM codes
Bladder cancer	32 (bladder cancer)	5771 (radical cystectomy) 577 (total cystectomy) 5779 (other total cystectomy) 576 (partial cystectomy) 4059 (radical excision of other lymph nodes) 4053 (radical excision of iliac lymph nodes) 403 (regional lymph node excision) 4011 (biopsy of lymphatic structure)
Renal cancer	33 (renal cancer)	554 (partial nephrectomy) 5551 (nephroureterectomy) 5554 (bilateral nephrectomy) 5552 (nephrectomy of remaining kidney)
Bladder cancer	29 (prostate cancer)	605 (radical prostatectomy) 6062 (perineal prostatectomy) 4059 (radical excision of other lymph nodes) 4053 (radical excision of iliac lymph nodes) 403 (regional lymph node excision) 4011 (biopsy of lymphatic structure) 604 (retropubic prostatectomy) 6099 (other operations of prostate) 9227 (implantation/insertion of radioactive elements) 6082 (excision of periprostatic cancer)

Abbreviations and Acronyms

HVH	=	high volume hospital
NIS	=	Nationwide Inpatient Sample

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EDITORIAL COMMENT

This study confirms and augments the prior study by Hollenbeck et al documenting the regionalization of bladder and now kidney cancer care (reference 8 in article). Given the ongoing focus on the relationship of surgical volume and outcomes, it is not surprising that the medical care of these complicated urological malignancies is becoming more centered at HVHs. What is surprising is the reverse trend noted in prostate cancer with low and moderate volume hospitals increasing discharges during the study period. This observation seems counterintuitive and it begs explanation. The authors propose a number of reasonable explanations, including the possibility that prostate cancer care was already highly regionalized due to the early adoption of prostate specific antigen screening at certain centers, or to unique sociodemographic or health seeking behaviors by patients with prostate cancer. Another possibility is that the sheer volume of new prostate cancer cases during the study period did not allow further regionalization because high volume centers were already operating at capacity and could not take on the additional load.

Regardless of the cause, the observation that prostate cancer care is not regionalizing at the rate of other urological malignancies poses an interesting health policy problem. If it is true that higher surgical volumes are associated with better outcomes, how do we improve prostate cancer care if lower volume centers are increasing the number of patients that they care for? A solution is to find some way to route patients to higher volume centers. This strikes me as infeasible, given that patients are naturally resistant to traveling long distances for care, and providers at high and low volume centers would likely be opposed to this, although for different reasons. The second and more thoughtful solution to this problem is to "get under the hood" (reference 12 in article) of the volume-outcomes relationship, that is find out what is being done right at high volume centers and teach this approach at low volume centers. By doing this we would not overwhelm the capacity of high volume centers but we would improve outcomes at low volume centers and maximize patient satisfaction.

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