

Specialist urological cancer centres

The clinical evidence

INTRODUCTION

The purpose of this paper is to summarise the clinical evidence base that supports the case for change being made for urological cancer services in north central and north east London. The case for change can be found on [London Cancer's website here](#). Whilst it is by no means an exhaustive search of the literature, it does show that there is a broad evidence base in support of the changes to services that are being proposed, that demonstrates improved outcomes related to both higher surgeon as well as higher hospital volumes. Abstracts from the journals are attached, with a summary of their key findings in the paragraphs below. These have been organised to show:

- A general volume-outcome relationship in surgery
- A volume-outcome relationship in cancer surgery
- A volume-outcome relationship in urological surgery, renal and bladder
- A volume-outcome relationship in prostate cancer surgery, both for robotic assisted radical prostatectomy and open radical prostatectomy.

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1. The volume-outcome relationship

Since the 1970s studies have been examining the effect that the number of procedures that surgeons carry out has on the risk of death of the patients that they operate on. One study from 1979 noted that the mortality rates associated with some surgical procedures decreased with increasing number of operations and suggested that the data supported the value of centralisation by region for certain operations¹. Since then the relationship between the number of patients operated on by a surgeon each year ('surgical volumes'), the number of patients operated on at a hospital each year ('hospital volumes'), and the outcomes of operations for the patients has been a rich vein of research.

2. The volume-outcome relationship in cancer

A study from the late 1990s supported the hypothesis that when complex cancer operations are provided by surgical teams in hospitals with specialty expertise, mortality rates are lower².

A 2000 review of the literature in this area shows that most support a positive volume outcome relationship in initial cancer treatment³. It concluded that the literature suggests that, for all forms of cancer, efforts to concentrate its care would be appropriate.

A systematic review from 2002 concluded that high hospital and surgeon volumes are associated with better outcomes across a wide range of procedures, including cancer surgery⁵.

Another review of the literature, this time in 2005, noted that high-volume providers have significantly better outcomes for complex cancer surgery⁸.

A US analysis of trends concluded that increasing hospital and surgeon volumes explain much of the decline over time in inpatient mortality for five of the six cancer operations studied⁹. This study recommended that concentrating cancer resections among high-volume providers should lead to further reduction in inpatient mortality.

A 2008 study, again from the US, revealed large disparities in perioperative mortality between lowest- and highest-volume centers¹¹. It concluded that there were a large number of potentially avoidable deaths each year, if outcomes at low-volume hospitals were improved to the level of highest volume centres. The study concluded that there were significant lessons to be learned from the way that high-volume hospitals care for patients in the perioperative period but did not advocate consolidation into high volume centres.

A recent study on the effect of volume on survival concluded that, after adjusting for differences in the case mix, cancer patients treated by low-volume surgeons in low-volume hospitals had poorer 5-year survival rates²⁹.

3. The volume-outcome relationship in urological cancer

A 2004 systematic review concluded that outcomes after radical prostatectomy and cystectomy are on average likely to be better if these procedures are performed by and at high volume providers⁶. This review found the evidence for a similar effect in radical nephrectomy unclear.

A separate review in 2004 stated that the evidence that high volume hospitals have better outcomes from various types of urological cancer surgery was increasing⁷. It concluded that the ultimate implication of these studies was that centralising health care may yield better outcomes from urological cancer operations. It noted that this would be controversial and suggested that another approach would be to determine key factors that are the drivers behind better outcomes at high-volume centres and attempt to transfer those characteristics to lower-volume centres.

A recent study from 2012 concluded that higher volume surgeons perform partial nephrectomy more often, show a lower complication rate and may have a lower in-hospital mortality rate than lower volume surgeons²⁴.

Another study from last year, this time into bladder cancer, concluded that ninety-day cumulative mortality after cystectomy for bladder cancer was significant and may be associated with hospital cystectomy volume²¹.

A further study from 2012 stated that after adjustment for patient and disease characteristics, the relationship between surgeon volume and survival after radical cystectomy is accounted for by hospital volume²⁵. It concluded that, in contrast, hospital volume remained an independent predictor of survival, suggesting that structure and process characteristics of high volume hospitals drive long-term outcomes after radical cystectomy.

The overwhelming majority of the literature on the effect of the volume-outcome relationship in urological cancer is with regard to radical prostatectomy.

4. The volume-outcome relationship in radical prostatectomy (RP)

A 2000 US study concluded that hospital volumes are inversely related to in-hospital mortality, length of stay and total hospital charges after radical prostatectomy⁴.

A study from 2007 noted that as a surgeon's experience increases, cancer control after radical prostatectomy improves, and speculated that this was because of improved surgical technique¹⁰.

A study the following year concluded that increasing hospital and surgeon volume were associated with a decreased risk of most complications after radical prostatectomy¹².

A review of the literature published in 2008 stated that higher provider volumes are associated with better outcomes after radical prostatectomy¹³. It advocated a greater understanding of factors leading to this volume-outcome relationship, and research into the potential benefits and harms of increased regionalisation.

In 2009, a study was published that concluded that increasing surgical experience was associated with substantial reductions in cancer recurrence after laparoscopic radical prostatectomy, but that improvements in outcome seemed to accrue more slowly than for open surgery¹⁴.

An international multicentre study concluded that the learning curve for surgical margins after laparoscopic radical prostatectomy reaches a plateau at approximately 200 to 250 cases¹⁶. It also noted that prior open experience and surgeon generation did not improve the margin rate, suggesting that the rate was primarily a function of specifically laparoscopic training and experience.

An English study from 2010 showed a significant inverse correlation between provider volume (hospital and surgeon) and outcome (in-hospital mortality and hospital stay) for radical prostatectomy¹⁷. It concluded that this supported the centralisation of care for complex radical procedures, including radical prostatectomy.

A 2010 review concluded that, across multiple outcome metrics, there is a pervasive association between higher hospital radical prostatectomy case volume and improved outcomes¹⁸. It suggested that increasing individual surgeon volume may also portend better outcomes, not only perioperatively, but even with respect to long-term cancer control and urinary function. The authors noted that the studies reviewed showed an impressive magnitude of effect and demonstrated an impact on outcome that was proportional to surgical volume.

A study in a single hospital institution showed that significant heterogeneity in functional outcomes existed between surgeons after RP¹⁹. It showed that, contrary to hypothesis, functional preservation does not appear to come at the expense of cancer control; rather, both are related to surgical quality.

A study of RP at academic versus non-academic institutions showed that, even after adjusting for annual hospital caseload, radical prostatectomy performed at academic institutions is associated with better outcomes than radical prostatectomy performed at non-academic institutions²⁰.

A European study from 2012 showed that patients undergoing robotic assisted RP compared with open RP were less likely to receive a blood transfusion, to experience an intraoperative complication or a postoperative complication, or have a prolonged length of stay²².

A head to head comparison of the effect of hospital volume versus surgeon volume on outcomes following RP showed that both are strongly correlated with postoperative outcomes following RP²³. The study suggested however that hospital volume matters more than surgical volume, especially for older and sicker individuals, who are at high-risk of complications.

A US comparison of robotic assisted RP (RARP) versus open RP (ORP) showed that overall robotic assisted RP patients experienced lower rates of adverse outcomes than open RP patients²⁶. It concluded that across equivalent volume quartiles, robotic assisted RP outcomes were generally favourable. Nonetheless, it also concluded that low volume institutions (average 26.2 RARP and 5 ORP cases) experienced inferior outcomes relative to very high volume centres (average 579 RARP and 151 ORP cases) irrespective of approach.

A 2012 study on the effect of surgeon and hospital volume on RP costs showed that selective referral to high volume radical prostatectomy surgeons operating at intermediate and high volume hospitals nets significant cost savings²⁷. However, higher radical prostatectomy hospital volume was associated with greater costs for low and intermediate volume radical prostatectomy surgeons.

In addition, a further 2012 US study concluded that higher volume hospitals showed fewer complications and lower costs than low volume hospitals on a national basis²⁸. It concluded that these findings supported referral to high volume centres for robot-assisted laparoscopic radical prostatectomy to decrease complications and costs.

1	Should Operations be Regionalized? The Empirical Relation between Surgical Volume and Mortality
Author(s)	Harold S. Luft, PhD, John P. Bunker, MD, and Alain C. Enthoven, PhD
Journal	The New England Journal of Medicine 1979;301:1364–1369
Filename	1979_NEJM_Luft et al
Abstract	<p>This study examines mortality rates for 12 surgical procedures of varying complexity in 1498 hospitals to determine whether there is a relation between a hospital's surgical volume and its surgical mortality. The mortality of open-heart surgery, vascular surgery, transurethral resection of the prostate, and coronary bypass decreased with increasing number of operations. Hospitals in which 200 or more of these operations were done annually had death rates, adjusted for case mix, 25 to 41 per cent lower than hospitals with lower volumes. For other procedures, the mortality curve flattened at lower volumes. For example, hospitals doing 50 to 100 total hip replacements attained a mortality rate for this procedure almost as low as that of hospitals doing 200 or more. Some procedures, such as cholecystectomy, showed no relation between volume and mortality. The results may reflect the effect of volume or experience on mortality, or referrals to institutions with better outcomes, as well as a number of other factors, such as patient selection. Regardless of the explanation, these data support the value of regionalization for certain operations.</p>

2	Impact of hospital volume on operative mortality for major cancer surgery
Author(s)	Begg CB, Cramer LD, Hoskins WJ, Brennan MF
Journal	The Journal of the American Medical Association, November 25, 1998 – Vol 280, No. 20
Filename	1998_JAMA_Begg et al
Abstract	<p>Context: Hospitals that treat a relatively high volume of patients for selected surgical oncology procedures report lower surgical in-hospital mortality rates than hospitals with a low volume of the procedures, but the reports do not take into account length of stay or adjust for case mix.</p> <p>Objective: To determine whether hospital volume was inversely associated with 30-day operative mortality, after adjusting for case mix.</p> <p>Design AND SETTING: Retrospective cohort study using the Surveillance, Epidemiology, and End Results (SEER)-Medicare linked database in which the hypothesis was prospectively specified. Surgeons determined in advance the surgical oncology procedures for which the experience of treating a larger volume of patients was most likely to lead to the knowledge or technical expertise that might offset surgical fatalities.</p> <p>Patients: All 5013 patients in the SEER registry aged 65 years or older at cancer diagnosis who underwent pancreatectomy, esophagectomy, pneumonectomy, liver resection, or pelvic exenteration, using incident cancers of the pancreas, esophagus, lung, colon, and rectum, and various genitourinary cancers diagnosed between 1984 and 1993.</p> <p>Main outcome measure: Thirty-day mortality in relation to procedure volume, adjusted for comorbidity, patient age, and cancer stage.</p> <p>Results: Higher volume was linked with lower mortality for pancreatectomy (P=.004), esophagectomy (P<.001), liver resection (P=.04), and pelvic exenteration (P=.04), but not for pneumonectomy (P=.32). The most striking results were for esophagectomy, for which the operative mortality rose to 17.3% in low-volume hospitals, compared with 3.4% in high-volume hospitals, and for pancreatectomy, for which the corresponding rates were 12.9% vs 5.8%. Adjustments for case mix and other patient factors did not change the finding that low volume was strongly associated with excess mortality.</p> <p>Conclusions: These data support the hypothesis that when complex surgical oncologic procedures are provided by surgical teams in hospitals with specialty expertise, mortality rates are lower.</p>

3	Hospital and Physician Volume or Specialization and Outcomes in Cancer Treatment: Importance in Quality of Cancer Care
Author(s)	Bruce E. Hillner, Thomas J. Smith, and Christopher E. Desch
Journal	Journal of Clinical Oncology, Vol 18, No 11 (June), 2000: pp 2327-2340
Filename	2000_JCO_Hillner et al
Abstract	<p>Purpose: To conduct a comprehensive review of the health services literature to search for evidence that hospital or physician volume or specialty affects the outcome of cancer care.</p> <p>Methods: We reviewed the 1988 to 1999 MEDLINE literature that considered the hypothesis that higher volume or specialization equals better outcome in processes or outcomes of cancer treatments.</p> <p>Results: An extensive, consistent literature that supported a volume-outcome relationship was found for cancers treated with technologically complex surgical procedures, eg, most intra-abdominal and lung cancers. These studies predominantly measured in-hospital or 30-day mortality and used the hospital as the unit of analysis. For cancer primarily treated with low-risk surgery, there were fewer studies. An association with hospital and surgeon volume in colon cancer varied with the volume threshold. For breast cancer, British studies found that physician specialty and volume were associated with improved long-term outcomes, and the single American report showed an association between hospital volume of initial surgery and better 5-year survival. Studies of nonsurgical cancers, principally lymphomas and testicular cancer, were few but consistently showed better long-term outcomes associated with larger hospital volume or specialty focus. Studies in recurrent or metastatic cancer were absent. Across studies, the absolute benefit from care at high-volume centers exceeds the benefit from break-through treatments.</p> <p>Conclusion: Although these reports are all retrospective, rely on registries with dated data, rarely have predefined hypotheses, and may have publication and self-interest biases, most support a positive volume outcome relationship in initial cancer treatment. Given the public fear of cancer, its well-defined first identification, and the tumor-node-metastasis taxonomy, actual cancer care should and can be prospectively measured, assessed, and benchmarked. The literature suggests that, for all forms of cancer, efforts to concentrate its initial care would be appropriate.</p>

4	The Effect of Hospital Volume on Mortality and Resource Use After Radical Prostatectomy
Author(s)	Lars M. Ellison, John A. Heaney and John D. Birkmeyer
Journal	The Journal of Urology Vol. 163, 867–869, March 2000
Filename	2000_JUrol_Ellison et al
Abstract	<p>Purpose: The value of radical prostatectomy for patients with prostate cancer depends on low morbidity and mortality. We assessed whether patient outcome is associated with how many of these procedures are performed at hospitals yearly.</p> <p>Materials and Methods: Using the Nationwide Inpatient Sample, which is a stratified probability sample of American hospitals, we identified 66,693 men who underwent radical prostatectomy between 1989 and 1995. Cases were categorized into volume groups according to hospital annual rate of radical prostatectomies performed, including low—fewer than 25, medium—25 to 54 and high—greater than 54. We performed multivariate logistic regression to control for patient characteristics when assessing the associations of hospital volume, in-hospital mortality and resource use.</p> <p>Results: Overall adjusted in-hospital mortality after radical prostatectomy was relatively low (0.25%). However, patients at low volume centers were 78% more likely to have in-hospital mortality than those at high volume centers (adjusted odds ratio 1.78, 95% confidence interval 1.7 to 2.6). Overall length of stay decreased at all hospitals between 1989 and 1995. However, average length of stay was longer and total hospital charges were higher at low than at high volume centers (7.3 versus 6.1 days, $p < 0.0001$, and \$15,600 versus \$13,500, $p < 0.0001$, respectively).</p> <p>Conclusions: Hospital volumes inversely related to in-hospital mortality, length of stay and total hospital charges after radical prostatectomy. Further study is necessary to examine the association of hospital volume with other important outcomes, including incontinence, impotence and long-term patient survival after radical prostatectomy.</p>

5	Is Volume Related to Outcome in Health Care? A Systematic Review and Methodologic Critique of the Literature
Author(s)	Ethan A. Halm, MD, MPH; Clara Lee, MD, MPP; and Mark R. Chassin, MD, MPP, MPH
Journal	Annals of Internal Medicine 2002;137:511-520
Filename	2002_AIM_Halm et al
Abstract	<p>Purpose: To systematically review the methodologic rigor of the research on volume and outcomes and to summarize the magnitude and significance of the association between them.</p> <p>Data Sources: The authors searched MEDLINE from January 1980 to December 2000 for English-language, population-based studies examining the independent relationship between hospital or physician volume and clinical outcomes. Bibliographies were reviewed to identify other articles of interest, and experts were contacted about missing or unpublished studies.</p> <p>Study Selection: Of 272 studies reviewed, 135 met inclusion criteria and covered 27 procedures and clinical conditions.</p> <p>Data Extraction: Two investigators independently reviewed each article, using a standard form to abstract information on key study characteristics and results.</p> <p>Data Synthesis: The methodologic rigor of the primary studies varied. Few studies used clinical data for risk adjustment or examined effects of hospital and physician volume simultaneously. Overall, 71% of all studies of hospital volume and 69% of studies of physician volume reported statistically significant associations between higher volume and better outcomes. The strongest associations were found for AIDS treatment and for surgery on pancreatic cancer, esophageal cancer, abdominal aortic aneurysms, and pediatric cardiac problems (a median of 3.3 to 13 excess deaths per 100 cases were attributed to low volume). Although statistically significant, the volume–outcome relationship for coronary artery bypass surgery, coronary angioplasty, carotid endarterectomy, other cancer surgery, and orthopedic procedures was of much smaller magnitude. Hospital volume–outcome studies that performed risk adjustment by using clinical data were less likely to report significant associations than were studies that adjusted for risk by using administrative data.</p> <p>Conclusions: High volume is associated with better outcomes across a wide range of procedures and conditions, but the magnitude of the association varies greatly. The clinical and policy significance of these findings is complicated by the methodologic shortcomings of many studies. Differences in case mix and processes of care between high- and low-volume providers may explain part of the observed relationship between volume and outcome.</p>

6	A Systematic Review and Critique of the Literature Relating Hospital or Surgeon Volume to Health Outcomes for 3 Urological Cancer Procedures
Author(s)	Martin Nuttall, Jan Van Der Meulen, Nirree Phillips, Carlos Sharpin, David Gillatt, Gregor McIntosh and Mark Emberton
Journal	The Journal of Urology Vol. 172, 2145–2152, December 2004
Filename	2004_JUrol_Nuttall et al
Abstract	<p>Purpose: We performed a systematic review and critique of the literature of the relationship between hospital or surgeon volume and health outcomes in patients undergoing radical surgery for cancer of the bladder, kidney or prostate.</p> <p>Materials and Methods: Four electronic databases were searched to identify studies that describe the relationship between hospital or surgeon volume and health outcomes.</p> <p>Results: All included studies were performed in North America. A total of 12 studies were found that related hospital volume to outcomes. For radical prostatectomy and cystectomy all 8 included studies showed improvement in at least 1 outcome measure with increasing volume and never deterioration. For nephrectomy the 4 included studies produced conflicting results. Four studies were found that related surgeon volume to outcomes. All radical prostatectomy and cystectomy studies showed that some outcomes were better with higher surgeon volume and never deterioration. We did not find any studies of the effect of surgeon volume on outcomes after nephrectomy. The 3 studies of the combined effect of hospital and surgeon volume on outcomes after radical prostatectomy or cystectomy suggest that high volume hospitals have better outcomes, in part because of the effect of surgeon volume and vice versa.</p> <p>Conclusions: Outcomes after radical prostatectomy and cystectomy are on average likely to be better if these procedures are performed by and at high volume providers. For radical nephrectomy the evidence is unclear. The impact of volume based policies (increasing volume to improve outcomes) depends on the extent to which “practice makes perfect” explains the observed results. Further studies should explicitly address selective referral and confounding as alternative explanations. Longitudinal studies should be performed to evaluate the impact of volume based policies</p>

7	The Volume/Outcome Relationship in Urologic Cancer Surgery
Author(s)	Fadi N. Joudi, Badrinath R. Konety
Journal	Supportive Cancer Therapy, Volume 2, Number 1 , October 2004
Filename	2004_SCT_Joudi & Konety
Abstract	<p>There is growing evidence in the literature of the association between higher hospital and surgeon volume and better outcomes from high-risk surgical procedures. A Medline search of the literature from 1966 to 2004 was performed using the keywords "outcome," "urology," "neoplasms," "volume," "hospital volume," "surgeon volume," "prostatectomy," "cystectomy," "nephrectomy," "prostate cancer," "bladder cancer," "kidney cancer," and "testis cancer." The relevant articles were reviewed and discussed in reference to each urologic cancer. Several studies have shown that higher hospital volume is associated with better outcomes for all urologic cancer surgeries. An association between postoperative mortality/morbidity and hospital and surgeon volumes was established. Individual surgeon volume is also a predictor of the quality and completeness of certain procedures such as radical prostatectomy. Long-term survival from cancer such as testicular cancer can be impacted by provider and institution volume. The evidence that high volume hospitals have better outcomes from various types of urologic cancer surgery is increasing. The ultimate implication of these studies is that centralizing health care may yield better outcomes from urologic cancer surgeries. This is controversial and will have major health policy implications. Another approach would be to determine key factors that are the drivers behind better outcomes at high-volume centers and attempt to transfer those characteristics to lower-volume centers, thereby improving outcomes globally across all volume levels.</p>

8	Provider volume and outcomes for oncological procedures
Author(s)	S.D. Killeen, M. J.O’Sullivan, J. C. Coffey, W.O. Kirwan and H. P. Redmond
Journal	British Journal of Surgery 2005; 92: 389–402
Filename	2005_BJS_Killeen et al
Abstract	<p>Background: Oncological procedures may have better outcomes if performed by high-volume providers.</p> <p>Methods: A review of the English language literature incorporating searches of the Medline, Embase and Cochrane collaboration databases was performed. Studies were included if they involved a patient cohort from 1984 onwards, were community or population based, and assessed health outcome as a dependent variable and volume as an independent variable. The studies were also scored quantifiably to assess generalizability with respect to any observed volume–outcome relationship and analysed according to organ system; numbers needed to treat were estimated where possible.</p> <p>Results: Sixty-eight relevant studies were identified and a total of 41 were included, of which 13 were based on clinical data. All showed either an inverse relationship, of variable magnitude, between provider volume and mortality, or no volume–outcome effect. All but two clinical reports revealed a statistically significant positive relationship between volume and outcome; none demonstrated the opposite.</p> <p>Conclusion: High-volume providers have a significantly better outcome for complex cancer surgery, specifically for pancreatectomy, oesophagectomy, gastrectomy and rectal resection.</p>

9	Trends in Hospital and Surgeon Volume and Operative Mortality for Cancer Surgery
Author(s)	Vivian Ho, PhD, Martin J. Heslin, MD, Huifeng Yun, MSc, and Lee Howard, BS
Journal	Annals of Surgical Oncology, 13(6): 851)858
Filename	2006_ASO_Ho et al
Abstract	<p>Background: We measured 13-year trends in operative mortality for six cancer resections. We then examined whether these trends are driven by changes in hospital and surgeon volume or by changes that occurred among all providers, regardless of volume.</p> <p>Methods: We analyzed administrative discharge data on patients who received one of six cancer resections in Florida, New Jersey, and New York for three time periods: 1988 to 1991, 1992 to 1996, and 1997 to 2000. Descriptive statistics and nested regression models were used to test for changes in the association between inpatient mortality and annual hospital and annual surgeon volume over time, adjusting for patient and hospital characteristics.</p> <p>Results: Unadjusted inpatient mortality rates for the six cancer resections declined between .8 and 4.0 percentage points between the time periods 1988 to 1991 and 1997 to 2000. Over this time period, annual hospital and surgeon volumes for the six cancer operations increased an average of 24.3% and 24.2%, respectively. The logistic regressions indicated a relatively stable relationship over time between both increased hospital and surgeon volume and lower inpatient mortality. Simulations suggest that increases in hospital and surgeon procedure volume over time led to a reduction in inpatient mortality ranging from .1 percentage points for rectal cancer to 2.3 percentage points for pneumonectomy.</p> <p>Conclusions: Persistence of the volume-outcome relation and increasing hospital and surgeon volumes explain much of the decline over time in inpatient mortality for five of the six cancer operations studied. Concentrating cancer resections among high-volume providers should lead to further reduced inpatient mortality.</p>

10	The Surgical Learning Curve for Prostate Cancer Control After Radical Prostatectomy
Author(s)	Andrew J . Vickers , Fernando J . Bianco , Angel M . Serio , James A . Eastham , Deborah Schrag , Eric A . Klein , Alwyn M . Reuther , Michael W . Kattan , J. Edson Pontes , Peter T . Scardino
Journal	Journal of the National Cancer Institute Vol. 99, Issue 15, August 1, 2007
Filename	2007_JNCI_Vickers et al
Abstract	<p>Background: The learning curve for surgery — i.e., improvement in surgical outcomes with increasing surgeon experience — remains primarily a theoretical concept; actual curves based on surgical outcome data are rarely presented. We analyzed the surgical learning curve for prostate cancer recurrence after radical prostatectomy.</p> <p>Methods: The study cohort included 7765 prostate cancer patients who were treated with radical prostatectomy by one of 72 surgeons at four major US academic medical centers between 1987 and 2003. For each patient, surgeon experience was coded as the total number of radical prostatectomies performed by the surgeon before the patient ' s operation. Multivariable survival – time regression models were used to evaluate the association between surgeon experience and prostate cancer recurrence, defined as a serum prostate specific antigen (PSA) of more than 0.4 ng/mL followed by a subsequent higher PSA level (i.e., bio - chemical recurrence), with adjustment for established clinical and tumor characteristics. All P values are two-sided.</p> <p>Results: The learning curve for prostate cancer recurrence after radical prostatectomy was steep and did not start to plateau until a surgeon had completed approximately 250 prior operations. The predicted probabilities of recurrence at 5 years were 17.9% (95% confidence interval [CI] = 12.1% to 25.6%) for patients treated by surgeons with 10 prior operations and 10.7% (95% CI = 7.1% to 15.9%) for patients treated by surgeons with 250 prior operations (difference = 7.2%, 95% CI = 4.6% to 10.1%; P <.001). This finding was robust to sensitivity analysis; in particular, the results were unaffected if we restricted the sample to patients treated after 1995, when stage migration related to the advent of PSA screening appeared largely complete.</p> <p>Conclusions: As a surgeon's experience increases, cancer control after radical prostatectomy improves, presumably because of improved surgical technique. Further research is needed to examine the specific techniques used by experienced surgeons that are associated with improved outcomes.</p>

11	Directing Surgical Quality Improvement Initiatives: Comparison of Perioperative Mortality and Long-Term Survival for Cancer Surgery
Author(s)	Karl Y. Bilimoria, David J. Bentrem, Joseph M. Feinglass, Andrew K. Stewart, David P. Winchester, Mark S. Talamonti, and Clifford Y. Ko
Journal	Journal of Clinical Oncology 26:4626-4633, 2008
Filename	2008_JClinOnc_Bilimoria et al
Main conclusion	<p>Purpose: Quality-improvement initiatives are being developed to decrease volume-based variability in surgical outcomes. Resources for national and hospital quality-improvement initiatives are limited. It is unclear whether quality initiatives in surgical oncology should focus on factors affecting perioperative mortality or long-term survival. Our objective was to determine whether differences in hospital surgical volume have a larger effect on perioperative mortality or long-term survival using two methods.</p> <p>Patients and Methods: From the National Cancer Data Base, 243,103 patients who underwent surgery for nonmetastatic colon, esophageal, gastric, liver, lung, pancreatic, or rectal cancer were identified. Multivariable modeling was used to evaluate 60-day mortality and 5-year conditional survival (excluding perioperative deaths) across hospital volume strata. The number of potentially avoidable perioperative and long-term deaths were calculated if outcomes at low-volume hospitals were improved to those of the highest-volume hospitals.</p> <p>Results: Risk-adjusted perioperative mortality and long-term conditional survival worsened as hospital surgical volume decreased for all cancer sites, except for liver resections where there was no difference in survival. When comparing low- with high-volume hospitals, the hazard ratios for perioperative mortality were substantially larger than for long-term survival. However, the number of potentially avoidable deaths each year in the United States, if outcomes at low-volume hospitals were improved to the level of highest volume centers, was significantly larger for long-term survival.</p> <p>Conclusion: Although the magnitude of the hazard ratios implies that quality-improvement efforts should focus on perioperative mortality, a larger number of deaths could be avoided by focusing quality initiatives on factors associated with long-term survival.</p>
Other conclusions	<p>There are large disparities in perioperative mortality between lowest- and highest-volume centers. This implies that there are significant lessons that can be learned from the way high-volume hospitals care for patients in the perioperative period. The differences in long-term survival between high- and low-volume hospitals may appear marginal when examining the hazard ratios; however, we found that the absolute number of potentially avoidable deaths was considerably larger long-term. Thus, small improvements in factors affecting long term outcomes will potentially affect a larger number of patients and save more lives.</p> <p>Rather than regionalizing or centralizing care for all complex cancer resections, identifying hospital structural characteristics and processes of care affecting outcomes and transference to low-volume centers represents a mechanism to improve outcomes for most cancer resections at lower-volume hospitals</p>

12	Impact of hospital and surgeon volume on mortality and complications after prostatectomy
Author(s)	Alibhai SM, Leach M, Tomlinson G.
Journal	The Journal of Urology 2008 Jul;180(1):155-62
Filename	2008_JUrol_Alibhai et al
Abstract	<p>Purpose: It remains controversial whether short-term surgical complications after radical prostatectomy can be decreased by increasing surgeon or hospital procedural volume. We determined whether hospital or surgeon volumes impacted various short-term surgical complications.</p> <p>Materials and methods: We examined in-hospital mortality and complications following radical prostatectomy in all 25,404 men who underwent this surgery across 8 provinces in Canada between 1990 and 2001. Bayesian multilevel logistic regression models were used, adjusting for patient age, comorbidity, surgery year, and hospital and surgeon volume, while accounting for clustering by surgeon and hospital.</p> <p>Results: Overall 50 men (0.2%) died and 5,087 (20.0%) had 1 or more in-hospital complications following surgery. In models adjusted for age, comorbidity and surgery year hospital volume was associated with in-hospital mortality ($p = 0.037$). In adjusted models doubling hospital volume was associated with a decreased risk of any, cardiac, respiratory, vascular, genitourinary, miscellaneous medical and miscellaneous surgical complications (each $p < 0.001$), although not wound/bleeding complications ($p = 0.40$). Similarly doubling surgical volume was associated with a decreased risk of any, respiratory, wound/bleeding, genitourinary, miscellaneous medical and miscellaneous surgical complications (each $p < 0.01$), although not cardiac and vascular complications ($p = 0.58$ and 0.17, respectively). Adjustment for clustering led to nonsignificant effects of hospital volume on miscellaneous surgical complications, and of surgeon volume on miscellaneous medical and miscellaneous surgical complications. However, this did not alter other findings.</p> <p>Conclusions: Increasing hospital and surgeon volume are associated with a decreased risk of most complications after radical prostatectomy even after adjusting for the effects of clustering.</p>

13	Association Between Hospital and Surgeon Radical Prostatectomy Volume and Patient Outcomes: A Systematic Review
Author(s)	Timothy J. Wilt, Tatyana A. Shamliyan, Brent C. Taylor, Roderick MacDonald and Robert L. Kane
Journal	The Journal of Urology Vol. 180, 820-829, September 2008
Filename	2008_JUrol_Wilt et al
Abstract	<p>Purpose: We examined the association between hospital and surgeon volume, and patient outcomes after radical prostatectomy.</p> <p>Materials and Methods: Databases were searched from 1980 to November 2007 to identify controlled studies published in English. Information on study design, hospital and surgeon annual radical prostatectomy volume, hospital status and patient outcome rates were abstracted using a standardized protocol. Data were pooled with random effects models.</p> <p>Results: A total of 17 original investigations reported patient outcomes in categories of hospital and/or surgeon annual number of radical prostatectomies, and met inclusion criteria. Hospitals with volumes above the mean (43 radical prostatectomies per year) had lower surgery related mortality (rate of difference 0.62, 95% CI 0.47–0.81) and morbidity (rate difference 9.7%, 95% CI 15.8, 3.6). Teaching hospitals had an 18% (95% CI 26, 9) lower rate of surgery related complications. Surgeon volume was not significantly associated with surgery related mortality or positive surgical margins. However, the rate of late urinary complications was 2.4% lower (95% CI 5, 0.1) and the rate of long-term incontinence was 1.2% lower (95% CI 2.5, 0.1) for each 10 additional radical prostatectomies performed by the surgeon annually. Length of stay was lower, corresponding to surgeon volume.</p> <p>Conclusions: Higher provider volumes are associated with better outcomes after radical prostatectomy. Greater understanding of factors leading to this volume-outcome relationship, and the potential benefits and harms of increased regionalization is needed.</p>

14	The surgical learning curve for laparoscopic radical prostatectomy: a retrospective cohort study
Author(s)	Andrew J Vickers, Caroline J Savage, Marcel Hruza, Ingolf Tuerk, Philippe Koenig, Luis Martínez-Piñeiro, Gunther Janetschek, Bertrand Guillonneau
Journal	Lancet Oncology 2009; 10: 475–80
Filename	2009_LancetOnc_Vickers et al
Abstract	<p>Background: We previously reported the learning curve for open radical prostatectomy, reporting large decreases in recurrence rates with increasing surgeon experience. Here we aim to characterise the learning curve for laparoscopic radical prostatectomy.</p> <p>Methods: We did a retrospective cohort study of 4702 patients with prostate cancer treated laparoscopically by one of 29 surgeons from seven institutions in Europe and North America between January, 1998, and June, 2007. Multivariable models were used to assess the association between surgeon experience at the time of each patient’s operation and prostate-cancer recurrence, with adjustment for established predictors.</p> <p>Findings: After adjusting for case mix, greater surgeon experience was associated with a lower risk of recurrence ($p=0.0053$). The 5-year risk of recurrence decreased from 17% to 16% to 9% for a patient treated by a surgeon with 10, 250, and 750 prior laparoscopic procedures, respectively (risk difference between 10 and 750 procedures 8.0%, 95% CI 4.4–12.0). The learning curve for laparoscopic radical prostatectomy was slower than the previously reported learning curve for open surgery ($p<0.001$). Surgeons with previous experience of open radical prostatectomy had significantly poorer results than those whose first operation was laparoscopic (risk difference 12.3%, 95% CI 8.8–15.7).</p> <p>Interpretation: Increasing surgical experience is associated with substantial reductions in cancer recurrence after laparoscopic radical prostatectomy, but improvements in outcome seem to accrue more slowly than for open surgery. Laparoscopic radical prostatectomy seems to involve skills that do not translate well from open radical prostatectomy.</p>

15	Variation in Hospital Mortality Associated with Inpatient Surgery
Author(s)	Amir A. Ghaferi, M.D., John D. Birkmeyer, M.D., and Justin B. Dimick, M.D., M.P.H.
Journal	The New England Journal of Medicine 2009;361:1368-75
Filename	2009_NEJM_Ghaferi et al
Abstract	<p>Background: Hospital mortality that is associated with inpatient surgery varies widely. Reducing rates of postoperative complications, the current focus of payers and regulators, may be one approach to reducing mortality. However, effective management of complications once they have occurred may be equally important.</p> <p>Methods: We studied 84,730 patients who had undergone inpatient general and vascular surgery from 2005 through 2007, using data from the American College of Surgeons National Surgical Quality Improvement Program. We first ranked hospitals according to their risk-adjusted overall rate of death and divided them into five groups. For hospitals in each overall mortality quintile, we then assessed the incidence of overall and major complications and the rate of death among patients with major complications.</p> <p>Results: Rates of death varied widely across hospital quintiles, from 3.5% in very-low-mortality hospitals to 6.9% in very-high-mortality hospitals. Hospitals with either very high mortality or very low mortality had similar rates of overall complications (24.6% and 26.9%, respectively) and of major complications (18.2% and 16.2%, respectively). Rates of individual complications did not vary significantly across hospital mortality quintiles. In contrast, mortality in patients with major complications was almost twice as high in hospitals with very high overall mortality as in those with very low overall mortality (21.4% vs. 12.5%, $P < 0.001$). Differences in rates of death among patients with major complications were also the primary determinant of variation in overall mortality with individual operations.</p> <p>Conclusions: In addition to efforts aimed at avoiding complications in the first place, reducing mortality associated with inpatient surgery will require greater attention to the timely recognition and management of complications once they occur.</p>
Other conclusions	The ability to effectively rescue a patient from a complication relies on two distinct points of intervention: the timely recognition of a complication and the effective management of that complication. The former relies on an efficient, collaborative team with established and effective systems of communication. In addition to timely recognition, the effective management of complications is also crucial. This management includes multiple complex processes, including the timely administration of antibiotics in patients with sepsis, the rapid transfer of a patient to an intensive care unit (ICU), and the availability of interventional cardiologists during an acute myocardial infarction.

16	The Learning Curve for Laparoscopic Radical Prostatectomy: An International Multicenter Study
Author(s)	Fernando P. Secin, Caroline Savage, Claude Abbou, Alexandre de La Taille, Laurent Salomon, Jens Rassweiler, Marcel Hruza, François Rozet, Xavier Cathelineau, Gunther Janetschek, Faissal Nassar, Ingolf Turk, Alex J. Vanni, Inderbir S. Gill, Philippe Koenig, Jihad H. Kaouk, Luis Martinez Pineiro, Vito Pansadoro, Paolo Emiliozzi, Anders Bjartell, Thomas Jiborn, Christopher Eden, Andrew J. Richards, Roland Van Velthoven, Jens-Uwe Stolzenburg, Robert Rabenalt, Li-Ming Su, Christian P. Pavlovich, Adam W. Levinson, Karim A. Touijer, Andrew Vickers and Bertrand Guillonneau
Journal	The Journal of Urology, Vol. 184, 2291-2296, December 2010
Filename	2010_JUrol_Secin et al
Abstract	<p>Purpose: It is not yet possible to estimate the number of cases required for a beginner to become expert in laparoscopic radical prostatectomy. We estimated the learning curve of laparoscopic radical prostatectomy for positive surgical margins compared to a published learning curve for open radical prostatectomy.</p> <p>Materials and Methods: We reviewed records from 8,544 consecutive patients with prostate cancer treated laparoscopically by 51 surgeons at 14 academic institutions in Europe and the United States. The probability of a positive surgical margin was calculated as a function of surgeon experience with adjustment for pathological stage, Gleason score and prostate specific antigen. A second model incorporated prior experience with open radical prostatectomy and surgeon generation.</p> <p>Results: Positive surgical margins occurred in 1,862 patients (22%). There was an apparent improvement in surgical margin rates up to a plateau at 200 to 250 surgeries. Changes in margin rates once this plateau was reached were relatively minimal relative to the CIs. The absolute risk difference for 10 vs 250 prior surgeries was 4.8% (95% CI 1.5, 8.5). Neither surgeon generation nor prior open radical prostatectomy experience was statistically significant when added to the model. The rate of decrease in positive surgical margins was more rapid in the open vs laparoscopic learning curve.</p> <p>Conclusions: The learning curve for surgical margins after laparoscopic radical prostatectomy plateaus at approximately 200 to 250 cases. Prior open experience and surgeon generation do not improve the margin rate, suggesting that the rate is primarily a function of specifically laparoscopic training and experience.</p>

17	Radical Prostatectomy Practice in England
Author(s)	Vishwanath S Hanchanale, John E McCabe, Pradip Javlé
Journal	Urology Journal 2010;7:243-8
Filename	2010_UroIJ_Hanchanale et al
Abstract	<p>Purpose: As there is paucity of data on radical prostatectomy (RP) as a primary treatment for patients with localized prostate cancer, we analysed the trends in the RP practice in England.</p> <p>Materials and Methods: This study was carried out on 14 300 patients who underwent RP for carcinoma of the prostate. Database was prepared from hospital episode statistics of the Department of Health in England. National trends in RP practice were summarized as well as volume outcome analysis.</p> <p>Results: Annual number of RPs exponentially increased from 972 (1998 to 1999) to 3092 (2004 to 2005). Laparoscopic RPs increased from 2 to 257 over the study period. Median waiting duration increased by more than 10 days (13 days). Significant decrease in median length of hospital stay from 8 (range, 7 to 10) days to 6 (range, 5 to 8) days was observed ($P < .001$). More than 90% mortality was seen in patients of ≥ 60 years of age. Significant inverse correlation was found between the hospital volume (Odds Ratio: 0.40) and in-hospital mortality rate following RP. High volume surgeons (≥ 16) and high volume hospitals (≥ 26) had significantly lower mortality (Odds Ratio: 0.32) and shorter in-hospital stay in comparison to low volume surgeons and hospitals.</p> <p>Conclusion: There is an exponential increase in the number of RPs with an increasing trend towards laparoscopic RP in England. This study showed a significant inverse correlation between provider volume (hospital and surgeon) and outcome (in-hospital mortality and hospital stay) for RP in England; thus, supporting the recommendations for centralization of care for complex radical procedures, including RP.</p>

18	Impact of surgeon and hospital volume on outcomes of radical prostatectomy
Author(s)	Daniel A. Barocas, M.D., Robert Mitchell, M.D., Sam S. Chang, M.D., Michael S. Cookson, M.D.
Journal	Urologic Oncology 28 (2010) 243–250
Filename	2010_UrolOnc_Barocas et al
Abstract	<p>An emerging body of literature has established a relationship between case volume and outcomes after radical prostatectomy (RP). Such findings come in the context of an already well-established association between both surgeon and hospital case volume in the field of cardiovascular surgery and for several high-risk cancer operations. The purpose of this review is to identify and summarize the seminal studies to date that investigate the impact of RP volume on patient outcomes.</p> <p>We performed a literature search of the English language studies available through PubMed that pertain to this topic. Thirteen original studies and a meta-analysis were found, which focus on the impact of hospital RP volume on surgical outcomes (including length of stay, perioperative complication rate, perioperative mortality, readmission rate, and several long term measures of treatment effect). Eight studies were identified that interrogated the relationship between individual surgeon case volume and outcomes.</p> <p>Across multiple outcome metrics, there is a pervasive association between higher hospital RP case volume and improved outcomes. Increasing individual surgeon volume may also portend better outcomes, not only perioperatively, but even with respect to long-term cancer control and urinary function. While most data arise from retrospective cohort studies, these studies, for the most part, are of sound design, show an impressive magnitude of effect, and demonstrate an impact on outcome that is proportional to surgical volume.</p> <p>Further research should focus on finding a means by which to translate these observations into improvements in the quality of prostate cancer care. To address differences in outcome between low volume and high volume surgeons, some have proposed and implemented subspecialization within practice groups, while others have looked toward subspecialty certification for urologic oncologists. With regard to differences in hospital volume, regionalization of care has been proposed as a solution, but is fraught with pitfalls. It may be more pragmatic and, ultimately more beneficial to patients, however, to identify processes of care that are already in place at high volume hospitals and implement them at lower volume centers. Similarly, we advocate careful studies to identify successful surgical techniques of high volume surgeons and efforts to disseminate these techniques.</p>

19	Cancer Control and Functional Outcomes After Radical Prostatectomy as Markers of Surgical Quality: Analysis of Heterogeneity Between Surgeons at a Single Cancer Center
Author(s)	Andrew Vickers , Caroline Savage , Fernando Bianco , John Mulhall , Jaspreet Sandhu , Bertrand Guillonneau , Angel Cronin , Peter Scardino
Journal	European Urology 59 (2011) 317–322
Filename	2011_EUrol_Vickers et al
Abstract	<p>Background: Previous studies have shown that complications and biochemical recurrence rates after radical prostatectomy (RP) vary between different surgeons to a greater extent than might be expected by chance. Data on urinary and erectile outcomes, however, are lacking.</p> <p>Objective: In this study, we examined whether between-surgeon variation, known as heterogeneity, exists for urinary and erectile outcomes after RP.</p> <p>Design, setting, and participants: Our study consisted of 1910 RP patients who were treated by 1 of 11 surgeons between January 1999 and July 2007.</p> <p>Intervention: All patients underwent RP at Memorial Sloan-Kettering Cancer Center. Measurements: Patients were evaluated for functional outcome 1 yr after surgery. Multivariable random effects models were used to evaluate the heterogeneity in erectile or urinary outcome between surgeons, after adjustment for case mix (age, prostate-specific antigen, pathologic stage and grade, comorbidities) and year of surgery.</p> <p>Results and limitations: We found significant heterogeneity in functional outcomes after RP ($p < 0.001$ for both urinary and erectile function). Four surgeons had adjusted rates of full continence $<75\%$, whereas three had rates $>85\%$. For erectile function, two surgeons in our series had adjusted rates $<20\%$; another two had rates $>45\%$. We found some evidence suggesting that surgeons' erectile and urinary outcomes were correlated. Contrary to the hypothesis that surgeons "trade off" functional outcomes and cancer control, better rates of functional preservation were associated with lower biochemical recurrence rates.</p> <p>Conclusions: A patient's likelihood of recovering erectile and urinary function may differ depending on which of two surgeons performs his RP. Functional preservation does not appear to come at the expense of cancer control; rather, both are related to surgical quality.</p>
Other conclusions	We found an association between surgeons' annual volumes and patient outcomes. Surgeons with higher volumes had significantly better functional preservation than those with lower volumes ($p = 0.005$). For a patient with the mean level of all covariates, the predicted probability of experiencing recovery of both erectile and urinary function at 1 yr was 21% if treated by a surgeon with an annual volume of 25 cases; this probability increased to 47% if the surgeon had an annual volume of 100.

20	Radical Prostatectomy at Academic Versus Nonacademic Institutions: A Population Based Analysis
Author(s)	Quoc-Dien Trinh, Jan Schmitges, Maxine Sun, Shahrokh F. Shariat, Shyam Sukumar, Marco Bianchi, Zhe Tian, Claudio Jeldres, Jesse Sammon, Paul Perrotte, Markus Graefen, James O. Peabody, Mani Menon and Pierre I. Karakiewicz
Journal	The Journal of Urology Vol. 186, 1849-1854, November 2011
Filename	2011_JUrol_Trinh et al
Abstract	<p>Purpose: Radical prostatectomy outcomes may be better at academic institutions than at nonacademic centers. We examined the effect of academic status on 5 short-term radical prostatectomy outcomes.</p> <p>Materials and Methods: In the Health Care Utilization Project Nationwide Inpatient Sample we focused on radical prostatectomy performed within the 7 most contemporary years (2001 to 2007). We tested the rates of homologous blood transfusions and extended length of stay, as well as intraoperative and postoperative complications stratified according to institutional academic status. Multivariable logistic regression analyses further adjusted for confounding variables.</p> <p>Results: Overall 89,965 radical prostatectomies were identified, yielding a weighted national estimate of 442,811. Of those procedures 58.2% were recorded at academic institutions. Patients at academic institutions had a lower Charlson comorbidity index and more frequently had private insurance ($p < 0.001$). Radical prostatectomy at academic institutions was associated with fewer blood transfusions (5.4% vs 7.4%), fewer postoperative complications (10.1% vs 12.9%) and lower rates of hospital stay above the median (18.0% vs 28.2%). On multivariable analyses institutional academic status exerted a protective effect on postoperative complication rates (OR 0.93, $p = 0.02$) and on rates of hospital stay in excess of the median (OR 0.91, $p < 0.001$). Similarly radical prostatectomy performed at hospitals with a high annual caseload were less frequently associated with intraoperative (OR 0.8, $p = 0.01$) and postoperative (OR 0.63, $p < 0.001$) complications, length of stay beyond the median (OR 0.19, $p < 0.001$) and homologous blood transfusions (OR 0.35, $p < 0.001$).</p> <p>Conclusions: Even after adjusting for annual hospital caseload, radical prostatectomy performed at academic institutions is associated with better outcomes than radical prostatectomy performed at nonacademic institutions. This relationship illustrates averages and does not imply that academic institutions invariably offer better care.</p>

21	Hospital volume and 90-day mortality risk after radical cystectomy: a population-based cohort study
Author(s)	Michael P. Porter, John L. Gore, Jonathan L. Wright
Journal	World Journal of Urology (2011) 29:73–77
Filename	2011_WJUrol_Porter et al
Abstract	<p>Background: Hospital cystectomy volume has been associated with in-hospital perioperative mortality in previous studies. In this study, we examine the relationship between hospital cystectomy volume and 90-day mortality in a population-based cohort of patients undergoing cystectomy for bladder cancer.</p> <p>Methods: We performed a retrospective cohort study using population from the State of Washington Comprehensive Hospital Abstract Reporting System (CHARS) database. We examined the association between hospital cystectomy volume (categorized into volume tertiles) and cumulative 90-day mortality in patients undergoing cystectomy for bladder cancer. Multivariate regression was used to adjust for patient age, comorbid disease, year of surgery, and gender. Standard errors were clustered by discharge hospital.</p> <p>Results: We identified 823 patients who underwent cystectomy for bladder cancer at 39 unique hospitals in 2003–2007. The unadjusted cumulative 90-day cumulative mortality was 5.4, 6.9, and 8.4% for patients discharged from hospitals in the high, medium, and low volume tertiles, respectively (P = 0.35). In the multivariate analysis, the patients undergoing cystectomy who were discharged from hospitals in the highest volume tertile had a lower risk of death in the first 90 days postoperatively compared to patients discharged from hospitals in the low volume tertile, though the finding was not statistically significant (OR = 0.68, 95% CI 0.29–1.56).</p> <p>Conclusions: Ninety-day cumulative mortality after cystectomy for bladder cancer is significant and may be associated with hospital cystectomy volume.</p>

22	Perioperative Outcomes of Robot-Assisted Radical Prostatectomy Compared With Open Radical Prostatectomy: Results From the Nationwide Inpatient Sample
Author(s)	Quoc-Dien Trinh, Jesse Sammona, Maxine Sun, Praful Ravi, Khurshid R. Ghani, Marco Bianchi, Wooju Jeong, Shahrokh F. Shariat, Jens Hansen, Jan Schmitges, Claudio Jeldres, Craig G. Rogers, James O. Peabody, Francesco Montorsi, Mani Menon, Pierre I. Karakiewicz
Journal	European Urology 61 (2012) 679–685
Filename	2012_EUrol_Trinh et al
Abstract	<p>Background: Prior to the introduction and dissemination of robot-assisted radical prostatectomy (RARP), population-based studies comparing open radical prostatectomy (ORP) and minimally invasive radical prostatectomy (MIRP) found no clinically significant difference in perioperative complication rates.</p> <p>Objective: Assess the rate of RARP utilization and reexamine the difference in perioperative complication rates between RARP and ORP in light of RARP’s supplanting laparoscopic radical prostatectomy (LRP) as the most common MIRP technique.</p> <p>Design, setting, and participants: As of October 2008, a robot-assisted modifier was introduced to denote robot-assisted procedures. Relying on the Nationwide Inpatient Sample between October 2008 and December 2009, patients treated with radical prostatectomy (RP) were identified. The robot-assisted modifier (17.4x) was used to identify RARP (n = 11 889). Patients with the minimally invasive modifier code (54.21) without the robot-assisted modifier were classified as having undergone LRP and were removed from further analyses. The remainder were classified as ORP patients (n = 7389).</p> <p>Intervention: All patients underwent RARP or ORP.</p> <p>Measurements: We compared the rates of blood transfusions, intraoperative and postoperative complications, prolonged length of stay (pLOS), and in-hospital mortality. Multivariable logistic regression analyses of propensity score–matched populations, fitted with general estimation equations for clustering among hospitals, further adjusted for confounding factors.</p> <p>Results and limitations: Of 19 462 RPs, 61.1% were RARPs, 38.0% were ORPs, and 0.9% were LRPs. In multivariable analyses of propensity score–matched populations, patients undergoing RARP were less likely to receive a blood transfusion (odds ratio [OR]: 0.34; 95% confidence interval [CI], 0.28–0.40), to experience an intraoperative complication (OR: 0.47; 95% CI, 0.31–0.71) or a postoperative complication (OR: 0.86; 95% CI, 0.77–0.96), and to experience a pLOS (OR: 0.28; 95% CI, 0.26–0.30). Limitations of this study include lack of adjustment for tumor characteristics, surgeon volume, learning curve effect, and longitudinal follow-up.</p>

23	The Effect of Hospital Vs. Surgical Volume on Outcomes After Radical Prostatectomy: A Head-To-head Comparison Using Decision-Curve Analyses ASU abstract
Author(s)	Quoc-Dien Trinh; Maxine Sun; Shahrokh F Shariat; Jesse D Sammon; Marco Bianchi; Wooju Jeong; Jan Schmitges; Khurshid R Ghani; Jens Hansen; Jay Jhaveri, Shyam Sukumar; Paul Perrotte; Piyush K Agarwal, Craig G Rogers, James O Peabody, Mani Menon; Pierre I Karakiewicz
Journal	The Journal of Urology Vol. 187, No. 4S, Supplement, Sunday, May 20, 2012
Filename	2012_JUrol ASU abstract 688_Trinh et al
Abstract	<p>Introduction and objectives: Surgical (SV) and hospital volume (HV) are established determinants of postoperative outcomes after radical prostatectomy (RP). However, a head-to-head comparison between SV and HV has not yet been performed. We assess and compare the effect of SV and HV on postoperative and long-term functional outcomes in a large national series.</p> <p>Methods: A total of 19225 Medicare patients with prostate cancer who underwent RP were identified within the Surveillance, Epidemiology, and End Results Medicare-linked database (1995–2005). First, logistic regression analyses were fitted to assess the predictive effect of SV/HV on postoperative complications within 30-days after RP, blood transfusion, anastomotic stricture, long-term incontinence, and erectile dysfunction. All models were adjusted for patient age, race, comorbidity, marital and socioeconomic status, population density, surgical approach, clinical stage and grade. Second, the discriminant ability of SV and HV for prediction of the examined outcomes was assessed using the concordance index derived from the area under the curve (AUC). Finally, decision-curve analyses (DCA) were used to compare both SV and HV in a head-to-head fashion.</p> <p>Results: In multivariable analyses increasing HV and SV were associated with lower rates of overall complication (HV-OR: 0.99, P=0.003; SV-OR:0.98, P=0.009). In specific complications, SV and HV were independently associated with lower rates of respiratory (P ≤0.003) and vascular complications (P ≤0.01). Higher SV portended lower rates of blood transfusion (OR:0.91, P<0.001). Both HV and/or SV were associated with lower rates of anastomotic stricture (HV-OR:0.98, P<0.001; SV-OR:0.96, P<0.001), urinary incontinence (HV-OR:0.99, P=0.03; SV-OR: 0.98, P<0.001), and erectile dysfunction (HV-OR:0.99, P=0.7; SV-OR:0.98, P<0.001). HV slightly increased the AUC for prediction of complications (65 vs. 64%) and postoperative mortality (72 vs. 69%); SV did not. In DCA, HV achieved higher net benefit relative to SV when a threshold probability ranging from 16–18% was considered.</p> <p>Conclusions: HV and SV are strongly correlated with postoperative outcomes following RP. DCA suggest that hospital volume matters more than surgical volume, especially for older and sicker individuals, who are at high-risk of complications.</p>

24	Volume-Outcome Relationships in the Treatment of Renal Tumors
Author(s)	Robert Abouassaly, Antonio Finelli, George A. Tomlinson, David R. Urbach and Shabbir M. H. Alibhai
Journal	The Journal of Urology Vol. 187, 1984-1988, June 2012
Filename	2012_JUrol_Abouassaly et al
Abstract	<p>Purpose: Outcomes of complex surgical procedures tend to be better for high volume providers, although this has not been clearly established for renal cell carcinoma. We determined the relationship of provider volume with partial nephrectomy and morbidity for renal cell carcinoma treatment.</p> <p>Materials and Methods: We performed a population based, observational study using data on 24,579 patients treated surgically for a renal mass from April 1998 to March 2008. Surgeon and hospital volume quartiles were created using the total number of nephrectomies during the 10-year observation period. The effect of provider volume on partial nephrectomy use, complications and mortality was determined by multivariable logistic regression adjusted for covariates.</p> <p>Results: Partial nephrectomy was done by 10.9% of low vs 24.7% of very high volume surgeons ($p < 0.0001$). A modest decrease in complications was observed with increasing surgeon volume (low vs very high 37.6% vs 34.5%, $p < 0.0001$). The effect of in-hospital mortality was more dramatic with a 1.71%, 1.20%, 0.97% and 0.92% rate for low, intermediate, high and very high volume surgeons, respectively ($p < 0.0001$). After adjusting for covariates, compared to low volume surgeons patients treated by very high volume surgeons had 1.54 times the odds of undergoing partial nephrectomy (95% CI 1.37–1.72, $p < 0.0001$), 0.84 times the odds of an in-hospital complication (95% CI 0.77–0.92, $p < 0.0001$) and 0.69 times the odds of in-hospital death (95% CI 0.47–1.01, $p = 0.16$).</p> <p>Conclusions: Higher volume surgeons perform partial nephrectomy more often, show a lower complication rate and may have a lower in-hospital mortality rate than lower volume surgeons.</p>

25	Volume Outcomes of Cystectomy—Is it the Surgeon or the Setting?
Author(s)	Todd M. Morgan, Daniel A. Barocas, Kirk A. Keegan, Michael S. Cookson, Sam S. Chang, Shenghua Ni, Peter E. Clark, Joseph A. Smith, Jr. and David F. Penson
Journal	The Journal of Urology Vol. 188, 2139-2144, December 2012
Filename	2012_JUrol_Morgan et al
Abstract	<p>Purpose: Hospital volume and surgeon volume are each associated with outcomes after complex oncological surgery. However, the interplay between hospital and surgeon volume, and their impact on these outcomes has not been well characterized. We studied the relationship between surgeon and hospital volume, and overall mortality after radical cystectomy.</p> <p>Materials and Methods: The SEER (Surveillance, Epidemiology and End Results)- Medicare linked database was used to identify 7,127 patients with Urothelial carcinoma of the bladder who underwent radical cystectomy from 1992 to 2006. Hospital volume and surgeon volume were expressed by tertile. The primary outcome measure was overall survival. Covariates included age, Charlson comorbidity index, stage, grade, node count, node density, number of positive nodes, urinary diversion and year of surgery. Multivariate analyses using generalized linear multilevel models were used to determine the independent association between hospital and surgeon volume and survival.</p> <p>Results: When hospital volume or surgeon volume was included in the multivariate model, a significant volume-survival relationship was observed for each. However, when both were in the model, hospital volume attenuated the impact of surgeon volume on mortality while the significant hospital volume-mortality relationship persisted (HR 1.18, 95% CI 1.08–1.30, p <0.01). In addition, the adjusted 3-year probability of survival was significantly correlated with hospital volume in each distinct surgeon volume stratum while survival was not correlated with surgeon volume in each hospital volume stratum.</p> <p>Conclusions: After adjustment for patient and disease characteristics, the relationship between surgeon volume and survival after radical cystectomy is accounted for by hospital volume. In contrast, hospital volume remained an independent predictor of survival, suggesting that structure and process characteristics of high volume hospitals drive long-term outcomes after radical cystectomy.</p>

26	Robot-assisted vs. Open radical prostatectomy: The differential effect of regionalization, procedure volume and operative approach
Author(s)	Jesse D. Sammon, Pierre I. Karakiewicz, Maxine Sun, Shyam Sukumar, Praful Ravi, Khurshid R. Ghani, Marco Bianchi, James O. Peabody, Shahrokh F. Shariat, Paul Perrotte, Jim C. Hu, Mani Menon, Quoc-Dien Trinh
Journal	The Journal of Urology (2012), doi: 10.1016/j.juro.2012.10.028
Filename	2012_JUrol_Sammon et al
Abstract	<p>Background: Utilization of robot-assisted radical prostatectomy (RARP) has increased rapidly, despite the absence of randomized controlled trials demonstrating the superiority of this approach. While recent studies suggest an advantage in perioperative complication rates, they fail to account for the volume-outcome relationship. We sought to compare perioperative outcomes after RARP vs. ORP, whilst fully considering the impact of this established relationship.</p> <p>Methods: Using the Nationwide Inpatient Sample, patients undergoing RP in 2009 were abstracted. Univariable and multivariable logistic regression analyses compared rates of blood transfusions, intraoperative and postoperative complications, prolonged length of stay (pLOS), elevated hospital charges (EHC), and mortality between RARP and ORP, overall and across volume quartiles.</p> <p>Results: An estimated 77616 men underwent RP (RARP: 63.9%, ORP: 36.1%). Low-volume centers averaged 26.2 (RARP) and 5.2 (ORP) cases, very high-volume centers averaged 578.8 (RARP) and 150.2 (ORP) cases. Overall, RARP-treated patients experienced lower rates of adverse outcomes than ORP patients, in all measured categories. Across equivalent volume quartiles, RARP outcomes were generally favorable; however ORP at very high-volume centers produced lower rates of postoperative complications (OR: 0.59 (95%CI: 0.46-0.75)), EHC (0.75 (0.64-0.87)) and comparable rates of blood transfusions (1.38 (0.93-2.02)) relative to RARP at low-volume centers.</p> <p>Conclusion: Regionalization has occurred to a greater extent for RARP than ORP, with an associated benefit in overall outcomes. Nonetheless, low volume institutions experienced inferior outcomes relative to the highest volume centers irrespective of approach. These findings demonstrate the importance of accounting for hospital volume when examining the benefit of a surgical technique.</p>

27	Influence of Surgeon and Hospital Volume on Radical Prostatectomy Costs
Author(s)	Stephen B. Williams, Channa A. Amarasekera, Xiangmei Gu, Stuart R. Lipsitz, Paul L. Nguyen, Nathanael D. Hevelone, Keith J. Kowalczyk and Jim C. Hu
Journal	The Journal of Urology Vol. 188, 2198-2204, December 2012
Filename	2012_JUrol_Williams et al
Abstract	<p>Purpose: While higher radical prostatectomy hospital and surgeon volume are associated with better outcomes, the effect of provider volume on health care costs remains unclear. We performed a population based study to characterize the effect of surgeon and hospital volume on radical prostatectomy costs.</p> <p>Materials and Methods: We used SEER (Surveillance, Epidemiology and End Results)-Medicare linked data to identify 11,048 men who underwent radical prostatectomy from 2003 to 2009. We categorized hospital and surgeon radical prostatectomy volume into tertiles (low, intermediate, high) and assessed costs from radical prostatectomy until 90 days postoperatively using propensity adjusted analyses.</p> <p>Results: Higher surgeon volume at intermediate volume hospitals (surgeon volume low \$9,915; intermediate \$10,068; high \$9,451; p = 0.021) and high volume hospitals (surgeon volume low \$11,271; intermediate \$10,638; high \$9,529; p = 0.002) was associated with lower radical prostatectomy costs. Extrapolating nationally, selective referral to high volume radical prostatectomy surgeons at high and intermediate volume hospitals netted more than \$28.7 million in cost savings. Conversely, higher hospital volume was associated with greater radical prostatectomy costs for low volume surgeons (hospital volume low \$9,685; intermediate \$9,915; high \$11,271; p = 0.010) and intermediate volume surgeons (hospital volume low \$9,605; intermediate \$10,068; high \$10,638; p = 0.029). High volume radical prostatectomy surgeon costs were not affected by varying hospital volume, and among low volume hospitals radical prostatectomy costs did not differ by surgeon volume.</p> <p>Conclusions: Selective referral to high volume radical prostatectomy surgeons operating at intermediate and high volume hospitals nets significant cost savings. However, higher radical prostatectomy hospital volume was associated with greater costs for low and intermediate volume radical prostatectomy surgeons.</p>

28	Hospital Volume, Utilization, Costs and Outcomes of Robot-Assisted Laparoscopic Radical Prostatectomy
Author(s)	Hua-yin Yu, Nathanael D. Hevelone, Stuart R. Lipsitz, Keith J. Kowalczyk, Paul L. Nguyen and Jim C. Hu
Journal	The Journal of Urology Vol. 187, 1632-1638, May 2012
Filename	2012_JUrol_Yu et al
Abstract	<p>Purpose: Although robot-assisted laparoscopic radical prostatectomy has been aggressively marketed and rapidly adopted, there is a paucity of population based utilization, outcome and cost data. High vs low volume hospitals have better outcomes for open and minimally invasive radical prostatectomy (robotic or laparoscopic) but to our knowledge volume outcomes effects for robot-assisted laparoscopic radical prostatectomy alone have not been studied.</p> <p>Materials and Methods: We characterized robot-assisted laparoscopic radical prostatectomy outcome by hospital volume using the Nationwide Inpatient Sample during the last quarter of 2008. Propensity scoring methods were used to assess outcomes and costs.</p> <p>Results: At high volume hospitals robot-assisted laparoscopic radical prostatectomy was more likely to be done on men who were white with an income in the highest quartile and age less than 50 years than at low volume hospitals (each $p < 0.01$). Hospitals at above the 50th volume percentile were less likely to show miscellaneous medical and overall complications ($p = 0.01$). Low vs high volume hospitals had longer mean length of stay (1.9 vs 1.6 days) and incurred higher median costs (\$12,754 vs \$8,623, each $p < 0.01$).</p> <p>Conclusions: Demographic differences exist in robot-assisted laparoscopic radical prostatectomy patient populations between high and low volume hospitals. Higher volume hospitals showed fewer complications and lower costs than low volume hospitals on a national basis. These findings support referral to high volume centers for robot-assisted laparoscopic radical prostatectomy to decrease complications and costs.</p>

29	Multivariate Analyses to Assess the Effects of Surgeon and Hospital Volume on Cancer Survival Rates: A Nationwide Population-Based Study in Taiwan
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Journal	PLoS ONE July 2012, Volume 7, Issue 7, e40590
Filename	2012_PLoS ONE_Chang et al
Abstract	<p>Background: Positive results between caseloads and outcomes have been validated in several procedures and cancer treatments. However, there is limited information available on the combined effects of surgeon and hospital caseloads. We used nationwide population-based data to explore the association between surgeon and hospital caseloads and survival rates for major cancers.</p> <p>Methodology: A total of 11677 patients with incident cancer diagnosed in 2002 were identified from the Taiwan National Health Insurance Research Database. Survival analysis, the Cox proportional hazards model, and propensity scores were used to assess the relationship between 5-year survival rates and different caseload combinations.</p> <p>Results: Based on the Cox proportional hazard model, cancer patients treated by low-volume surgeons in low-volume hospitals had poorer survival rates, and hazard ratios ranged from 1.3 in head and neck cancer to 1.8 in lung cancer after adjusting for patients' demographic variables, co-morbidities, and treatment modality. When analyzed using the propensity scores, the adjusted 5-year survival rates were poorer for patients treated by low-volume surgeons in low-volume hospitals, compared to those treated by high-volume surgeons in high-volume hospitals (P,0.005).</p> <p>Conclusions: After adjusting for differences in the case mix, cancer patients treated by low-volume surgeons in low-volume hospitals had poorer 5-year survival rates. Payers may implement quality care improvement in low-volume surgeons.</p>