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Anticipating the impact of insurance expansion on inpatient urological surgery

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Abstract

PURPOSE—The Affordable Care Act (ACA) is expected to provide coverage for nearly twenty-five million previously uninsured individuals. Because the potential impact of the ACA for urological care remains unknown, we estimated the impact of insurance expansion on the utilization of inpatient urological surgeries using Massachusetts (MA) healthcare reform as a natural experiment.

METHODS—We identified nonelderly patients who underwent inpatient urological surgery from 2003 through 2010 using inpatient databases from MA and two control states. Using July 2007 as the transition point between pre- and post-reform periods, we performed a difference-in-differences (DID) analysis to estimate the effect of insurance expansion on overall and procedure-specific rates of inpatient urological surgery. We also performed subgroup analyses according to race, income and insurance status.

RESULTS—We identified 1.4 million surgeries performed during the study interval. We observed no change in the overall rate of inpatient urological surgery for the MA population as a whole, but an increase in the rate of inpatient urological surgery for non-white and low income patients. Our DID analysis confirmed these results (all 1.0%, $p=0.668$; non-whites 9.9%, $p=0.006$; low income 6.6%, $p=0.041$). At a procedure level, insurance expansion caused increased rates of inpatient BPH procedures, but had no effect on rates of prostatectomy, cystectomy, nephrectomy, pyeloplasty or PCNL.

CONCLUSIONS—Insurance expansion in Massachusetts increased the overall rate of inpatient urological surgery only for non-whites and low income patients. These data inform key

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CONFLICTS OF INTEREST:

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stakeholders about the potential impact of national insurance expansion for a large segment of urological care.

INTRODUCTION

If the insurance expansion plan outlined in the Affordable Care Act (ACA) is fully implemented, twenty-five million previously uninsured individuals will gain coverage by 2017.¹ As the government, payers, physicians, and professional organizations prepare for the presumed influx of new patients, the impact of insurance expansion on the use of inpatient urological surgery remains undefined.

It is widely assumed that, as a consequence of the ACA, previously uninsured patients will have new access to specialists leading to a downstream increase in utilization of surgical services. This paradigm implies that there is an unmet need for urological care, and that insurance expansion will grant patients access to necessary services. An alternative scenario, however, is that because patients undergoing inpatient urological surgery tend to be elderly (and the beneficiaries of insurance expansion are primarily the nonelderly) rates of inpatient surgery will actually not change in an appreciable manner. Accordingly, a better understanding of the effect of insurance expansion on urological care delivery is important for policymakers, urologists and patients as they anticipate expenditures, workforce issues, access challenges, and other consequences of ACA.

In 2006, an insurance expansion law akin to the ACA was passed in Massachusetts; previous investigators have used the Massachusetts experience as a natural experiment to forecast the ACA's impact on a number of different health services.^{2–6} For inpatient surgery, investigators have focused on racial disparities and broad aspects of surgical care. However, little is known about the implications of this reform for urological care. In this context, we examined the impact of the Massachusetts insurance expansion on utilization of inpatient urological procedures. We specifically compared the pre- and post-reform rates of all inpatient urological surgeries in Massachusetts to those of two control states where no similar reform was implemented. In addition, we assessed whether the impact of insurance expansion varies across individual procedures or across patient subgroups that differed in their baseline (i.e., pre-reform) risk of being uninsured. Our findings will provide urologists and other stakeholders with nuanced insight regarding the potential impact of national insurance expansion in the field of urology.

METHODS

Data sources

We used all-payer State Inpatient Databases (SID) for Massachusetts and two Northeastern control states (New York and New Jersey) as our primary dataset.⁷ We selected New Jersey and New York as controls because both states: 1) are in close geographic proximity to Massachusetts; 2) had a steady nonelderly uninsured rate during the study period; 3) had data available in the SID before and after implementation of health care reform in Massachusetts; and 4) like Massachusetts, had large surgical volumes compared to other Northeastern states. We also used data from the U.S. Census to account for population

growth during the study interval, and to obtain county level measures of insurance status and household income.^{8–10} This study was deemed exempt from review by the University of Michigan Institutional Research Board.

Study population

Our study population included all nonelderly patients (ages 19–64) who underwent any inpatient urological procedure from January 1, 2003 through December 31, 2010. We used Clinical Classifications Software (CCS) categories developed by HCUP to identify inpatient urological procedures.⁷ The CCS contains *International Classification of Diseases*, 9th Revision, Clinical Modification (ICD-9-CM) diagnosis and procedure codes that have been grouped into broad categories. We used the CCS categories because they incorporate a wide range of codes and therefore include most urological procedures performed in the inpatient setting.^{11–13} We selected categories that were most relevant to urology including endoscopic procedures, transurethral procedures, oncologic procedures, incontinence procedures, diagnostic procedures on the urinary tract (Appendix I). We excluded patients who did not reside in Massachusetts or the control states. Our outcome of interest was the rate of inpatient urological procedures in Massachusetts and in control states before and after insurance expansion.

Reform period

We assigned July 2007 as the transition point between the pre- and post-reform eras in Massachusetts. This date was selected, rather than the date when the law was enacted (April 2006), for several reasons. First, the provisions of the law were implemented in a staggered fashion from July 2006 through July 2007. Second, the number of uninsured individuals did not decline significantly until 2007 because key components of the reform (e.g., the individual and employer mandates) did not take effect until July 2007.^{8,14} Finally, this approach is consistent with that used by other investigators evaluating the impact of health care reform in Massachusetts.^{14–16}

Statistical Analyses

In our first analytic step, we compared the characteristics of all adult patients (>19 years old) who underwent inpatient urological surgery in Massachusetts versus control states. Next, we calculated the mean (unadjusted) rates of all inpatient urological procedures for nonelderly adults in Massachusetts and control states before and after July 2007. We then performed a difference-in-differences (DID) analysis to estimate the effect of healthcare reform. DID analysis is a widely used technique that allows investigators to isolate the effect of a policy by accounting for secular changes in care delivery.^{2,3,5,17,18} For example, it is known that in the last decade there has been a national trend to substitute partial nephrectomy for radical nephrectomy. While in an unadjusted analysis an investigator may observe this phenomena in Massachusetts, the use of DID analysis would prevent her from falsely attributing the increase in partial nephrectomy to insurance expansion. We implemented the DID analysis by fitting separate ordinary least square regression models for each investigation we performed. The dependent variable in all regression models was the total number of surgeries in each state per quarter per 100,000 individuals. In each model, we included a

state variable, a variable for reform status (i.e., whether the surgery was performed before or after July 2007), and an interaction term for the state and reform status variables (i.e., difference-in-differences estimator). Using previously published DID analyses as a guide, we also included an unemployment variable to account for economic recession and a seasonal variable to account for differences in rates of surgery at different times of the year.^{16,18}

Subgroup Analyses

To gain a better understanding of the effect of reform, we performed two subgroup analyses. First, because the implications of insurance expansion may vary across patient populations, we decided a priori to perform separate analyses for the following patient subgroups: 1) whites; 2) non-whites; 3) low income; and 4) newly insured. The non-white category included blacks and patients of Hispanic origin. We identified low-income patients as those who lived in the tertile of counties in Massachusetts with the lowest median income. For our last demographic subgroup, we identified patients with the greatest likelihood of being newly-insured after the implementation of healthcare reform. This group included patients living in the five Massachusetts counties with the greatest number of individuals who insurance from 2006 through 2008.⁸

In the second subgroup analysis, we examined the effect of insurance expansion on individual inpatient urological surgeries. Specifically, we identified patients who underwent radical prostatectomy, radical cystectomy, radical nephrectomy, pyeloplasty, percutaneous nephrolithotomy (PCNL), partial nephrectomy, inpatient benign prostatic hyperplasia (BPH) procedures. (Appendix Table 1)

Sensitivity Analyses

We also performed two sensitivity analyses to examine the robustness of our findings to key assumptions. First, we excluded patients who had surgery during the entire reform implementation period (i.e., from January 2006 through June 2007). This step removed from analysis newly insured patients who had surgery after parts of the reform were enacted, but prior to our transition point (July 2007). Including such patients may attenuate the effects of reform. Second, we repeated our analyses after excluding patients who were aged 19–64 and covered by Medicare (e.g., disabled, end stage renal disease) since these individuals should have not experienced a substantive change in their insurance status during the reform period. All analyses were performed using computerized software (STATA 13/SE, College Station, TX), and at the 5% significance level.

RESULTS

We identified 1.4 million cases in all three states (19% MA, 54% NY, 27% NJ) from January 1, 2003 through December 31, 2010. Adult patients (>19 years old) in Massachusetts were slightly older (mean 64.6 years, median 66 years) than control states (mean 62.8 years, median 65 years, $p < 0.001$). Table 1 presents the pre- and post-reform characteristics of nonelderly adult patients (19–64) from Massachusetts and control states.

In Massachusetts, the unadjusted mean rate of inpatient urological surgery decreased by 0.1% from before (39.43 cases/quarter/100,000 individuals) to after (39.39 cases/quarter/100,000 individuals) implementation of health care reform (Figure 1). In control states, the mean rate of urological surgeries decreased by 1.1%. Difference-in-differences analysis demonstrated that, after adjusting for secular changes, insurance expansion in Massachusetts was associated with no net change (1.0%, $p=0.668$) in the rate of inpatient urological surgery.

Subgroup analyses

In our first subgroup analysis, we observed a statistically significant net increase in rates of urological surgery for non-white (9.9%, $p=0.006$) and low income (6.5%, $p=0.043$) individuals after reform (Figure 2). No net change was noted for white patients (1.0%, $p=0.465$) and those from counties with high numbers of newly insured (−2.0%, $p=0.433$).

In our second subgroup analysis, we noted an unadjusted increase in the rate of radical prostatectomy (8.8%), partial nephrectomy (47.3%), PCNL (5.4%) and pyeloplasty (1.6%) performed in Massachusetts during the post-reform period. However, our difference-in-differences analysis revealed no net change in the overall rate of any individual procedures except for inpatient BPH procedures (11.4%, $p=0.041$). This net increase, however, was only relative to control states and there was actually a decrease in inpatient BPH procedures performed in Massachusetts from before (10.9 cases/quarter/100,000 individuals) to after (9.5 cases/quarter/100,000 individuals) reform. When we further stratified individual procedures by patient demographics we found net increases in rates of partial nephrectomy performed in Massachusetts for non-whites (43%, $p=0.04$) and low income (35%, $p=0.03$) patients compared to control states.

Our sensitivity analyses revealed only a marginally significant increase in overall rates of urological surgery for low income individuals when nonelderly Medicare patients were removed from the analysis (5.6%, $p=0.08$), but otherwise revealed no substantive changes in the principal findings (Appendix Table 2).

DISCUSSION

Insurance expansion in Massachusetts was not associated with an overall increase in the utilization of inpatient urological surgery. However, we did observe an increase the rate of inpatient urological surgery for patients who had a high pre-reform risk of being uninsured, including non-whites and low-income patients.

It is well established that the utilization of healthcare services increases when previously uncovered patients acquire health insurance.^{19–25} The current study suggests that for inpatient urological care, the effect of policies aimed at increasing coverage is not uniform. Instead, for inpatient urological surgery, insurance expansion was not associated with a sudden increase in utilization. Given that the median age of adult patients undergoing urological surgery was above 65 (i.e., age of Medicare eligibility), it is possible that most of these patients were not affected by insurance expansion.

Our finding that the non-white and low income population was most strongly impacted by insurance expansion is also consistent with findings reported by other investigators.^{2,3,26} Compared to the white population, the nonelderly non-white population in Massachusetts had greater decrease in the rate of uninsured individuals from before to after reform.⁸ Therefore, these individuals are expected to benefit most from insurance expansion. In addition, many of the provisions in the 2006 legislation (e.g., Medicaid expansion, subsidized private insurance) were targeted towards low income individuals. These data suggest that insurance expansion may achieve an intended consequence of attenuating racial and socioeconomic disparities in access to care. It is beyond the scope of this study, however, to know whether the increased utilization of inpatient urological procedures will ultimately close existing gaps between white and non-white populations with respect to overall health status.

This study has several limitations. First, we only looked at utilization rates and we do not know whether insurance expansion affected other important factors such as the timing or quality of surgery.^{27–30} Second, our analysis did not include outpatient urological procedures or office visits. Procedures such as office cystoscopy may be particularly sensitive to changes in insurance status.^{31,32} Third, because our outcome was a state-level rate, we did not adjust for patient-level variables in our regression models. Nonetheless, while there were some baseline differences in age, race, and payer mix between patients in the control states and Massachusetts, at the statelevel these demographic differences were stable at over time and therefore unlikely to affect our estimates. Finally, there are some inherent limitations to generalizing from the Massachusetts experience. Healthcare reform in Massachusetts was not a discrete event and steps toward improving access occurred as early as 1985 when a “free care pool” was established. As a result, the effect of insurance expansion may be underestimated in this study because, compared to most other states, Massachusetts had lower baseline rates of uninsured, a superior safety-net foundation and high rates of healthcare utilization prior to the 2006 reform. Nonetheless, the Massachusetts experience is the most reasonable natural experiment of broad insurance expansion and has been a widely used to forecast effects of the ACA.^{2,3,5,6,15,17,18,33}

These limitations notwithstanding, our findings may help multiple stakeholders as they anticipate the effects of national insurance expansion through the ACA. For policymakers and payers, our observation that expanding coverage in Massachusetts did not change the rate of inpatient urological surgery suggests that national insurance expansion may not uniformly change the demand for surgical procedures. Instead, it is more likely that procedures more common among younger individuals (e.g., orthopedic procedures) will increase while the rates of other inpatient surgeries will remain about the same. This information is important to know when decision-makers estimate the potential health benefits and economic impact of the policy. In addition, our study provides evidence that one of the intended consequences of the ACA—a reduction in socioeconomic disparities—may be achieved to some extent for urological surgery. It is not known, however, whether the increased utilization is truly a consequence of unmet need.

For urologists and professional societies, the finding that Massachusetts insurance expansion did not yield a rapid growth in demand for inpatient urological surgery suggests that the

national reform with the ACA may not cause an undue burden on the urologic workforce. This finding, however, does not invalidate other evidence that urologists could face a labor shortage in the future. Factors such as the aging and growing population, reductions in Graduate Medical Education funding, and the age of the current urological workforce will likely contribute to a growing need for urologists.^{34–37} Finally for patients, the finding that insurance expansion did not lead to an influx of surgical demand offers solace that the newly insured will not “crowd out” and reduce access to surgery for the currently insured.¹⁸

Moving forward, research on the impact of insurance expansion should focus on the ambulatory setting and whether insurance expansion leads to earlier diagnoses (e.g., lower stage presentation for urological malignancies). It will also be important to know if increased patient volumes result in unintended consequences such as prolonged appointment wait times. Overall, the value of insurance expansion in urology will depend on the measurable health benefits derived from greater access to urological care in all settings.

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Appendix

Appendix Table 1

Diagnostic and procedure codes used to identify procedures

Category name	ICD-9-CM Procedure code	Diagnosis code (if applicable)
Endoscopy and endoscopic biopsy of the urinary tract*	5521 5522 5631 5633 5732 5733 5822 5823	
Transurethral excision; drainage; or removal urinary obstruction*	560 570 5741 5749	
Nephrotomy and nephrostomy*	5501 5502 5503 5504 5511 5512	
Nephrectomy; partial or complete*	554 5551 5552 5553 5554	
Genitourinary incontinence procedures*	593 594 595 596 5971 5972 5979	
Extracorporeal lithotripsy; urinary*	5995 5996 9851	
Procedures on the urethra*	5523 5524 5529 5632 5634 5635 5639 5731 5734 5739 5821 5824 5829 5921 5929	
Other diagnostic procedures of urinary tract*	526 527 525.1 525.2 525.3 524.9	
Other non-OR therapeutic procedures of urinary tract*	5592 5593 5594 5595 5596 5691 5711 5717 5792 5795 5993 5994 5999 9625 9645 9646 9647 9648 9649 9761 9762 9763 9764 9765 9769	
Other OR therapeutic procedures of urinary tract*	5531 5532 5533 5534 5535 5539 557 5581 5582 5583 5584 5585 5586 5587 5589 5591 5597 5598 5599 561 562 5640 5641 5642 5651 5652 5661 5662 5671 5672 5673 5674 5675 5679 5681 5682 5683 5684 5685 5686	

Category name	ICD-9-CM Procedure code	Diagnosis code (if applicable)
	5689 5692 5693 5694 5695 5699 5712 5718 5719 5721 5722 5751 5759 576 5771 5779 5781 5782 5783 5784 5785 5786 5787 5788 5789 5791 5793 5796 5797 5798 5799 5900 5901 5902 5903 5909 5911 5912 5919 5991 5992	
Transurethral resection of prostate (TURP) *	602 6021 6029 6096 6097	
Open prostatectomy *	603 604 605 6061 6062 6069	
Circumcision *	640	
Diagnostic procedures male genital *	6011 6012 6013 6014 6015 6018 6019 6111 6119 6211 6212 6219 6301 6309 6411 6419	
Other non-OR therapeutic procedures; male genital *	6071 6091 6092 6095 610 613 6141 6191 6291 6292 6352 636 6370 6371 6372 6373 6384 6391 6491 6494 9994 9995 9996	
Other OR therapeutic procedures; male genital *	600 6072 6073 6079 6081 6082 6093 6094 6099 612 6142 6149 6192 6199 620 622 623 6241 6242 625 6261 6269 627 6299 631 632 633 634 6351 6353 6359 6381 6382 6383 6385 6389 6392 6393 6394 6395 6399 642 643 6441 6442 6443 6444 6445 6449 645 6492 6493 6495 6496 6497 6498 6499	
Radical prostatectomy †	604 605	185
Radical cystectomy †	5771 576 579	188 1880–1889
Nephrectomy †	555 5551 5552	189 1890 1891 1898 1899
Partial Nephrectomy †	554	189 1890 1891 1898 1899
Pyeloplasty †	5587	
Percutaneous Nephrolithotomy (PCNL) †	5503 5504	
Inpatient BPH procedures †	602 6029 6021 6096 6097 603	(Exclude) 185

* Represents Clinical Classifications Software (CCS) categories developed by Healthcare Cost and Utilization Project.
<http://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp#download>

† Represents procedures that were tested individually. All other procedures were grouped together for the analysis.

Net change in the rate of all inpatient urological surgeries after insurance expansion in Massachusetts sensitivity analyses

Appendix Table 2

	Sensitivity Analysis 1			Sensitivity Analysis 2		
	Coefficient	p-value	Net change	Coefficient	p-value	Net change
All	1.2	0.255	3.0%	-0.1	0.937	-0.2%
White	0.4	0.596	1.1%	0.0	0.975	0.1%
Non-white	2.2	0.053	6.3%	2.7	0.021	9.3%
Low Income	3.5	0.013	8.8%	2.0	0.083	5.6%
High Uninsured	-0.2	0.872	-0.4%	-0.9	0.273	-2.7%

Table shows results of two sensitivity analyses performed using multivariable difference-in-differences (DID). In the first sensitivity analysis observations from the entire reform period (January 2006–July 2007) were removed. In the second sensitivity analysis nonelderly Medicare patients were removed from the analysis. Outcome variable for DID analysis was rate of all inpatient urological surgeries per quarter per 100,000 individuals. Coefficient is DID estimator and net change refers to the change in the rate of surgery in Massachusetts that is attributable to healthcare reform after adjusting for secular changes. In this analysis the pre and post-reform transition point is defined as July 2007 and control states are New Jersey and New York.

References

1. Congressional Budget Office. www.cbo.gov/sites/default/files/cbofiles/attachments/44190_EffectsAffordableCareActHealthInsuranceCoverage_2.pdf. Accessed December 4, 2013
2. Hanchate AD, Lasser KE, Kapoor A, et al. Massachusetts reform and disparities in inpatient care utilization. *Med Care*. 2012; 50(7):569–77. Available at: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3374150&tool=pmcentrez&rendertype=abstract>. Accessed September 10, 2013. [PubMed: 22683590]
3. Loehrer AP, Song Z, Auchincloss HG, Hutter MM. Massachusetts Health Care Reform and Reduced Racial Disparities in Minimally Invasive Surgery. *JAMA Surg*. 2013; 02114:1–7. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/24089326>. Accessed October 19, 2013.
4. Miller S. Findings from Massachusetts Health Reform: Lessons for Other States. The Effect of the Massachusetts Reform on Health Care Utilization. 2013; 000:1–10.
5. Miller S. The Impact of the Massachusetts Health Care Reform on Health Care Use Among Children. *Am Econ Rev*. 2012; 102(3):502–507. Available at: <http://pubs.aeaweb.org/doi/abs/10.1257/aer.102.3.502>.
6. Miller S. The effect of insurance on emergency room visits: An analysis of the 2006 Massachusetts health reform. *J Public Econ*. 2012; 96(11–12):893–908. Available at: <http://linkinghub.elsevier.com/retrieve/pii/S0047272712000850>. Accessed August 16, 2013.
7. Healthcare Cost and Utilization Project. <http://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp#download>. Accessed 11/22/2013
8. United States Census Bureau. Small Area Health Insurance Estimates. <http://www.census.gov/did/www/sahie/>. Accessed October 1, 2013
9. United States Census Bureau. Small Area Income and Poverty Estimates. <http://www.census.gov/did/www/saipe>. Accessed October 1, 2013
10. United States Census Bureau. Population Estimates. <http://www.census.gov/popest/data/intercensal>. Accessed October 1, 2013
11. Davies BJ, Allareddy V, Konety BR. Effect of postcystectomy infectious complications on cost, length of stay, and mortality. *Urology*. 2009; 73(3):598–602. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/19167035>. Accessed January 2, 2014. [PubMed: 19167035]
12. Wang MC, Shivakoti M, Sparapani RA, Guo C, Laud PW, Nattinger AB. Thirty-day readmissions after elective spine surgery for degenerative conditions among US Medicare beneficiaries. *Spine J*. 2012; 12(10):902–11. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/23098615>. Accessed January 2, 2014. [PubMed: 23098615]
13. Thompson DA, Makary MA, Dorman T, Pronovost PJ. Clinical and economic outcomes of hospital acquired pneumonia in intra-abdominal surgery patients. *Ann Surg*. 2006; 243(4):547–52. Available at: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1448956&tool=pmcentrez&rendertype=abstract>. Accessed January 2, 2014. [PubMed: 16552208]
14. Long SK. On the road to universal coverage: impacts of reform in massachusetts at one year. *Health Aff (Millwood)*. 2008; 27(4):w270–84. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/18522948>. Accessed August 16, 2013. [PubMed: 18522948]
15. Kolstad JT, Kowalski AE. The Impact of Health Care Reform on Hospital and Preventive Care: Evidence from Massachusetts(☆). *J Public Econ*. 2012; 96(11–12):909–929. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/23180894>. Accessed September 9, 2013. [PubMed: 23180894]
16. Long SK, Stockley K. Sustaining health reform in a recession: an update on Massachusetts as of fall 2009. *Health Aff (Millwood)*. 2010; 29(6):1234–41. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/20530362>. Accessed October 15, 2013. [PubMed: 20530362]
17. Long BSK, Stockley K, Yemane A. Another Look at the Impacts of Health Reform in Massachusetts: Evidence Using New Data and a Stronger Model. *Am Econ Rev Pap Proc*. 2009; 20037:508–511.
18. Joynt KE, Chan D, Orav EJ, Jha AK. Insurance expansion in Massachusetts did not reduce access among previously insured Medicare patients. *Health Aff (Millwood)*. 2013; 32(3):571–8.

Available at: <http://www.ncbi.nlm.nih.gov/pubmed/23459737>. Accessed August 16, 2013. [PubMed: 23459737]

19. Card D, Dobkin C, Maestas N. The Impact of Nearly Universal Insurance Coverage on Health Care Utilization: Evidence from Medicare. *Am Econ Rev*. 2008; 98(5):2242–2258. Available at: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2600774&tool=pmcentrez&rendertype=abstract>. [PubMed: 19079738]
20. McWilliams JM, Meara E, Zaslavsky AM, Ayanian JZ. Use of health services by previously uninsured Medicare beneficiaries. *N Engl J Med*. 2007; 357(2):143–53. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/17625126>. [PubMed: 17625126]
21. Baicker K, Finkelstein A. The effects of Medicaid coverage—learning from the Oregon experiment. *N Engl J Med*. 2011; 365(8):683–5. Available at: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3321578&tool=pmcentrez&rendertype=abstract>. [PubMed: 21774703]
22. Hadley J. Sicker and Poorer—The Consequences of Being Uninsured: A Review of the Research on the Relationship between Health Insurance, Medical Care Use, Health, Work, and Income. *Med Care Res Rev*. 2003; 60(2):3–75. Available at: <http://mcr.sagepub.com/cgi/doi/10.1177/1077558703254101>. Accessed November 13, 2013. [PubMed: 12674018]
23. McWilliams JM, Meara E, Zaslavsky AM, Ayanian JZ. Medicare spending for previously uninsured adults. *Ann Intern Med*. 2009; 151(11):757–66. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/19949141>. Accessed December 19, 2013. [PubMed: 19949141]
24. Finkelstein A, Taubman S, Wright B, et al. THE OREGON HEALTH INSURANCE EXPERIMENT: EVIDENCE FROM THE FIRST YEAR. *Q J Econ*. 2012; 127(3):1057–1106. Available at: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3535298&tool=pmcentrez&rendertype=abstract>. Accessed January 22, 2014. [PubMed: 23293397]
25. Baicker K, Taubman SL, Allen HL, et al. The Oregon experiment—effects of Medicaid on clinical outcomes. *N Engl J Med*. 2013; 368(18):1713–22. Available at: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3701298&tool=pmcentrez&rendertype=abstract>. Accessed January 21, 2014. [PubMed: 23635051]
26. Courtemanche, Charles; Zapata, Daniela. Does Universal Coverage Improve Health? The Massachusetts Experience. Andrew Young School of Policy Studies Research. Jul 1.2012 Paper Series No. 12–19
27. Ayanian JZ, Kohler BA, Abe T, Epstein AM. The relation between health insurance coverage and clinical outcomes among women with breast cancer. *N Engl J Med*. 1993; 329(5):326–31. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/8321261>. Accessed November 13, 2013. [PubMed: 8321261]
28. Billmeier SE, Ayanian JZ, Zaslavsky AM, Nerenz DR, Jaklitsch MT, Rogers SO. Predictors and outcomes of limited resection for early-stage non-small cell lung cancer. *J Natl Cancer Inst*. 2011; 103(21):1621–9. Available at: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3206042&tool=pmcentrez&rendertype=abstract>. Accessed November 13, 2013. [PubMed: 21960708]
29. Optenberg SA, Thompson IM, Friedrichs P, Wojcik B, Stein CR, Kramer B. Race, treatment, and long-term survival from prostate cancer in an equal-access medical care delivery system. *JAMA*. 2013; 307(20):1599–605. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/24742444>. Accessed December 26, 2013. [PubMed: 24742444]
30. Smith, JK.; Ng, SC.; Zhou, Z., et al. Does increasing insurance improve outcomes for US cancer patients?; *J Surg Res*. 2013. p. 1-6. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/23773721>. Accessed August 15, 2013
31. Hollingsworth JM, Krein SL, Ye Z, Kim HM, Hollenbeck BK. Opening of ambulatory surgery centers and procedure use in elderly patients: data from Florida. *Arch Surg*. 2011; 146(2):187–93. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/21339431>. Accessed October 15, 2013. [PubMed: 21339431]
32. Hollenbeck BK, Hollingsworth JM, Dunn RL, Zaojun Ye, Birkmeyer JD. Ambulatory surgery center market share and rates of outpatient surgery in the elderly. *Surg Innov*. 2010; 17(4):340–5.

Available at: <http://www.ncbi.nlm.nih.gov/pubmed/20688772>. Accessed October 15, 2013. [PubMed: 20688772]

33. Pande AH, Ross-Degnan D, Zaslavsky AM, Salomon JA. Effects of healthcare reforms on coverage, access, and disparities: quasi-experimental analysis of evidence from Massachusetts. *Am J Prev Med*. 2011; 41(1):1–8. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/21665057>. Accessed August 16, 2013. [PubMed: 21665057]
34. Gonzalez CM, McKenna P. Challenges facing academic urology training programs: an impending crisis. *Urology*. 2013; 81(3):475–9. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/23452802>. Accessed November 26, 2013. [PubMed: 23452802]
35. Pruthi RS, Neuwahl S, Nielsen ME, Fraher E. Recent trends in the urology workforce in the United States. *Urology*. 2013; 82(5):987–94. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/24055244>. Accessed November 26, 2013. [PubMed: 24055244]
36. See, Wa. A manpower calculus: The implications of SUO fellowship expansion on oncologic surgeon case volumes. *Urol Oncol*. 2013; im:1–6. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/23911685>. Accessed November 26, 2013.
37. Williams TE, Satiani B, Thomas A, Ellison EC. The impending shortage and the estimated cost of training the future surgical workforce. *Ann Surg*. 2009; 250(4):590–7. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/19730238>. Accessed November 26, 2013. [PubMed: 19730238]

Figure 1. Change in inpatient urological surgery after insurance expansion in Massachusetts
 Bar graphs represent percent change in the mean rate of all inpatient urological surgery from before to after Massachusetts healthcare reform (July 2007). Control states are New Jersey and New York. Net change in Massachusetts due to insurance expansion was determined using multivariable difference-in-differences analysis and represents change in rate of surgery attributed to healthcare reform.

Figure 2. Change in inpatient urological surgery after insurance expansion in Massachusetts, by subgroups

Bar graphs represent percent change in the mean rate of discretionary surgery from before to after Massachusetts healthcare reform (July 2007). Non-white population includes blacks and patients of Hispanic origin. Low Income refers to patients residing in Massachusetts counties with low median income. High Uninsured refers to patients residing in Massachusetts counties with high numbers of newly insured. Control states are New Jersey and New York. Percent change in Massachusetts due insurance expansion was determined using multivariable difference-in-differences analysis and represents the change in rate of surgery attributable to healthcare reform.

Demographics of patients undergoing surgery before and after Massachusetts healthcare reform

Table 1

		Massachusetts		Control	
		Pre-reform	Post-reform	Pre-reform	Post-reform
Age (%)	19–40	20.2	19.4	25.9	24.5
	40–64	79.8	80.6	74.2	75.5
Female (%)		35.8	34.4	38.4	38.0
Race (%)	White	82.3	80.4	62.4	61.2
	Black	6.4	7.3	15.1	15.5
	Hispanic	7.1	8.9	13.2	13.5
	Other	4.1	3.5	9.3	9.8
Payer (%)	Medicare	12.0	14.0	10.6	11.5
	Medicaid	10.3	12.8	15.4	17.5
	Private	70.7	64.9	64.6	60.8
	Self-pay	1.4	0.8	7.1	7.7
	Free care	3.6	1.5	0.1	0.1
	Other	2.0	6.0	2.2	2.3

Patients undergoing surgery during pre and post-reform periods in Massachusetts and control periods are compared. The pre and post-reform transition point is defined as July 2007. In the payer categories, “Other” includes worker’s compensation, Health Safety Net, other government payment, other non-managed care plans, and CommCare (a free or subsidized health care insurance program)

Table 2

Change in the annual rates of selected inpatient urological surgeries

	Massachusetts			Control			DID Analysis	
	Pre Reform	Post Reform	Observed change	Pre Reform	Post Reform	Observed change (%)	Net change (%)	p-value
Prostatectomy	33.1	36.0	8.8%	20.1	24.5	21.9%	-4.4%	0.391
Cystectomy	1.6	1.6	0.0%	1.3	1.2	-9.1%	6.2%	0.589
Nephrectomy	7.9	7.2	-9.2%	6.9	6.6	-4.8%	-5.1%	0.322
Partial Nephrectomy	3.3	4.9	47.3%	2.6	3.7	43.8%	13.3%	0.386
BPH procedures	10.9	9.5	-12.6%	10.4	7.8	-24.6%	11.4%	0.041
PCNL	10.0	10.5	5.4%	11.5	12.9	11.8%	-8.5%	0.116
Pyeloplasty	1.8	1.8	1.6%	1.4	1.4	0.8%	0.9%	0.920

Pre-reform and post-reform values represent unadjusted mean rates of selected inpatient urological surgeries per year per 100,000 individuals. DID analysis refers multivariable difference-in-differences analysis and net change refers to the change in the rate of surgery in Massachusetts that is attributable to healthcare reform after adjusting for secular changes. In this analysis, the pre and post-reform transition point is defined as July 2007. Control states are New Jersey and New York.