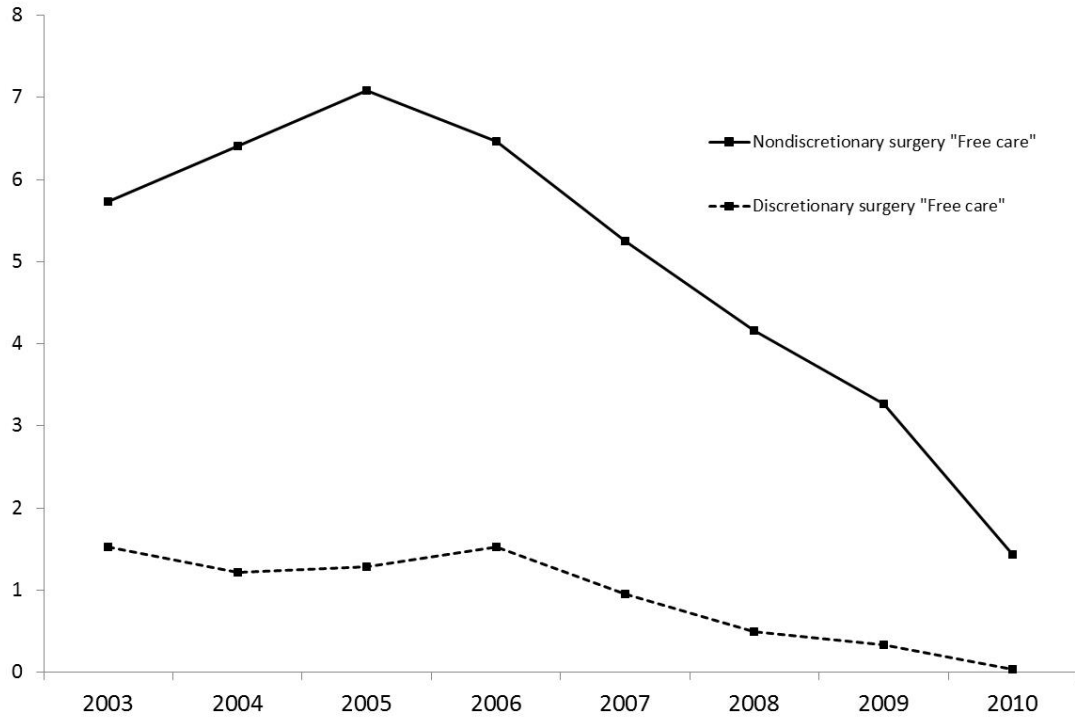


1 **eFIGURE 1: Percent of patients in Massachusetts who obtained free care for discretionary**
2 **and non-discretionary surgery, 2003-2010**



24 Figure shows the percent of patients in Massachusetts who underwent discretionary and non-
25 discretionary surgery whose primary payer was listed as “no charge” in the Massachusetts State
26 Inpatient Database.

27 **eTABLE 1: Diagnostic and procedure codes used to identify discretionary and non-**
 28 **discretionary surgeries**
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	ICD-9-CM Procedure code	ICD-9-CM Diagnosis code (if applicable)	Reference (if applicable)
<i>Discretionary</i>			
Knee replacement*	81.54, 81.55	N/A	Birkmeyer
Inguinal hernia repair*	53.0, 53.1, 53.17	N/A	N/A
Transurethral resection prostate*	60.2, 60.29	N/A	N/A
Hip replacement*	79.10, 79.15, 79.30, 79.35, 78.55, 81.51, 81.52	(Excluding) 820, 820.3, 820.31, 820.32, 820.8 820.9	Birkmeyer
Back surgery*	03.0, 03.1, 03.2, 03.21, 03.4 03.5, 80.5, 80.50,81.0, 03.01-03.09, 80.50 -80.59, 81.00- 81.08	N/A	Birkmeyer
<i>Non-discretionary</i>			
Hip fracture repair	79.10, 79.15, 79.30, 79.35, 78.55, 81.51, 81.52	820, 820.3, 820.31, 820.32, 820.8 820.9	Birkmeyer
Appendectomy	47.0, 47.01, 47.09	N/A	Livingston
Radical cystectomy	57.71	188, 1880-1889	Begg
Esophagectomy	424, 424.0, 424.1, 424.2	150, 150.0-150.9	Begg
Nephrectomy, Partial Nephrectomy	554 , 555, 555.1, 555.2	189, 189.0, 189.1, 189.8, 189.9	Begg
Pancreatectomy	526, 527, 525.1, 525.2, 525.3, 524.9	157, 1570-1579	Begg
Colectomy	457, 458, 485, 486, 4571-4583, 4861-4869	153, 154, 1530-1539, 1540-1548	Begg
Lung surgery	32, 322-325, 3220-3259	162, 1620-1629	Begg
Uterine surgery	683, 689, 6830-6879	182, 1820-1828	N/A

30 *Emergent cases excluded.

31 **References**

- 32 1. Birkmeyer JD, Sharp SM, Finlayson SR, Fisher ES, Wennberg JE. Variation profiles of
 33 common surgical procedures. *Surgery*. 1998;124(5):917–23
 34 2. Begg CB, Cramer LD, Hoskins WJ, Brennan MF. Impact of hospital volume on operative
 35 mortality for major cancer surgery. *JAMA*. 1998;280(20):1747–51.
 36 3. Livingston EH, Fairlie RW. Little effect of insurance status or socioeconomic condition
 37 on disparities in minority appendicitis perforation rates. *Arch. Surg*. 2012;147(1):11–7.

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eTable 2: Net change in the rates of discretionary and non-discretionary surgery resulting from Massachusetts healthcare reform

	All			White			Non-white		
	coefficient	p-value	%change	coefficient	p-value	%change	coefficient	p-value	%change
Discretionary	0.83	0.02	9.3%	0.95	0.003	10.6%	0.87	<0.001	19.9%
Non-discretionary	-0.21	0.01	-4.5%	-0.09	0.14	-2.2%	0.15	0.40	3.9%
	Low income			Newly insured					
	coefficient	p-value	%change	coefficient	p-value	%change			
Discretionary	0.60	0.004	6.7%	0.86	0.02	10.6%			
Non-discretionary	-0.36	<0.001	-6.3%	-0.32	<0.001	-6.9%			

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Results of the multivariable difference-in-differences (DID) analysis showing change in rates of discretionary and non-discretionary surgery in Massachusetts compared to control states. Reform transition point is defined as July 2007. Coefficient refers to the DID estimator and % change refers to coefficient divided by pre-reform rate. Low income refers to patients residing in Massachusetts counties with low median income. Newly insured refers to patients residing in Massachusetts counties with high numbers of individuals gaining insurance from 2006-2008.

49 **eTABLE 3: Net change in rate of discretionary and non-discretionary surgery, sensitivity**
 50 **analysis with entire reform period removed**
 51

	All			White			Non-white		
	coefficient	p-value	%change	coefficient	p-value	%change	coefficient	p-value	%change
Discretionary	0.91	0.02	10%	0.93	0.005	10%	0.78	<0.001	18%
Non-discretionary	-0.19	0.03	-4%	-0.17	0.01	-4%	-0.07	0.71	-2%
	Low income			Newly insured					
	coefficient	p-value	%change	coefficient	p-value	%change			
Discretionary	0.74	0.001	8%	1.05	0.006	13%			
Non-discretionary	-0.41	<0.001	-7%	-0.34	0.001	-6%			

52 Results of the multivariable difference-in-differences analysis showing change in rates of
 53 discretionary and non-discretionary surgery in Massachusetts compared to control states. In this
 54 sensitivity analysis, we removed the entire reform period from January 2006 through June 2007.
 55 Coefficient refers to the DID estimator and % change refers to coefficient divided by pre-reform
 56 rate. Low income refers to patients residing in Massachusetts counties with low median income.
 57 Newly insured refers to patients residing in Massachusetts counties with high numbers of
 58 individuals gaining insurance from 2006-2008.
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62 **eTABLE 4: Net change in rate of discretionary and non-discretionary surgery, sensitivity**
 63 **analysis with nonelderly Medicare patients removed**
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	All			White			Non-white		
	coefficient	p-value	%change	coefficient	p-value	%change	coefficient	p-value	%change
Discretionary	0.67	0.03	8.3%	0.80	0.004	9.8%	0.65	0.001	17.8%
Non-discretionary	-0.23	0.002	-5.1%	-0.12	0.07	-3.0%	0.13	0.43	3.6%
	Low income			Newly insured					
	coefficient	p-value	%change	coefficient	p-value	%change			
Discretionary	0.36	0.05	4.6%	0.72	0.02	9.7%			
Non-discretionary	-0.39	<0.001	-7.3%	-0.33	<0.001	-7.5%			

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 66 Results of the multivariable difference-in-differences analysis showing change in rates of
 67 discretionary and non-discretionary surgery in Massachusetts compared to control states. In this
 68 sensitivity analysis, we removed all non-elderly patients who were still covered by Medicare.
 69 Reform transition point is defined as July 2007. Coefficient refers to the DID estimator and %
 70 change refers to coefficient/pre-reform rate. Low income refers to patients residing in
 71 Massachusetts counties with low median income. Newly insured refers to patients residing in
 72 Massachusetts counties with high numbers of individuals gaining insurance from 2006-2008.
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eTABLE 5: Net change in rate of discretionary surgery, sensitivity analysis with inguinal hernia repair removed

	All			White			Non-white		
	coefficient	p-value	%change	coefficient	p-value	%change	coefficient	p-value	%change
Discretionary, no IHR	0.77	0.03	8.7%	0.92	0.006	10.4%	0.82	<0.001	19.1%
	Low income			Newly insured					
	coefficient	p-value	%change	coefficient	p-value	%change			
Discretionary, no IHR	0.54	0.008	6.1%	0.81	0.03	10.1%			

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Results of the multivariable difference-in-differences analysis showing change in rates of discretionary in Massachusetts compared to control states. In this sensitivity analysis, we removed inguinal hernia repair (IHR). From 2003-2010, there was a decline in the absolute number of inpatient surgeries performed, likely representing a secular shift towards the use of the outpatient setting for this procedure. Reform transition point is defined as July 2007. Coefficient refers to the DID estimator and % change refers to coefficient/pre-reform rate. Low income refers to patients residing in Massachusetts counties with low median income. Newly insured refers to patients residing in Massachusetts counties with high numbers of individuals gaining insurance from 2006-2008.

90 **eTABLE 6: Net change in rates of discretionary and non-discretionary surgery in each**
 91 **year from 2004-2010**
 92

	Discretionary		Non-discretionary	
	coefficient	p-value	coefficient	p-value
July 2004	-0.17	0.81	0.19	0.32
July 2005	-0.20	0.78	0.10	0.60
July 2006	-0.18	0.80	-0.02	0.94
July 2007	0.13	0.85	-0.11	0.59
July 2008	0.65	0.37	-0.14	0.49
July 2009	0.85	0.24	0.04	0.83
July 2010	0.91	0.21	-0.12	0.54

93
 94 Results of the multivariable difference-in-differences (DID) analysis showing change in rates of
 95 discretionary and non-discretionary surgery in Massachusetts compared to control states. For this
 96 sensitivity analysis, we performed a DID analysis for each individual year regardless of reform
 97 status (placebo analysis). Using 2003 as the reference year, we estimated the change in surgery
 98 rates in Massachusetts relative to the control states for each year.

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102 **eTABLE 7: Estimated number of additional discretionary procedures with national**
 103 **insurance expansion**
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Number of newly insured (%)	Estimated number of additional discretionary surgeries
25,000,000 (100)	465,934
18,750,000 (75)	349,451
12,500,000 (50)	232,967
6,250,000 (25)	116,484
2,500,000 (10)	46,493
1,250,000 (5)	23,297
250,000 (1)	4,659

105
 106 Number of newly insured is based on Congressional Budget Office (CBO) estimates. Estimated
 107 number of additional discretionary surgeries is based on increase in discretionary surgeries
 108 observed in Massachusetts after insurance expansion. To arrive at national estimates we first
 109 calculated the number of additional discretionary procedures that were performed in
 110 Massachusetts using the coefficient from our difference-in-differences analysis (eTable 2).

111
 112 $((\text{DID coefficient}) \times (4 \text{ quarters})) / 10,000 = \text{number of new procedures per person (NPP)}$
 113 $(0.83 \times 4) / 10,000 = 0.000332$
 114

115 We then multiplied the NPP by the total population of Massachusetts to arrive at the total
 116 number of new procedures.

117
 118 $\text{NPP} \times \text{population of MA} = \text{number of procedures (NP)}$
 119 $0.000332 \times 6,634,906 = 2,203$
 120

121 We then used the Census Small Area Insurance Estimates to identify the number of individuals
 122 who gained insurance from 2006 to 2008 (n=118,192). We made the assumption that 100% of
 123 the additional procedures were due to newly insured individuals (i.e., no change in rate of
 124 surgery for those who already had insurance). Using this assumption, we calculated the
 125 percentage of newly insured patients who received a discretionary surgery.

126
 127 $\text{NP} / \text{number of newly insured} = \% \text{ of newly insured patients undergoing discretionary surgery}$
 128 $2,203 / 118,192 = 1.86\%$
 129

130 We used this figure and the CBO estimate of number of individuals who will gain insurance if
 131 the insurance expansion provisions are fully implemented to arrive at our national estimates.
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