Supplemental Methods

National Inpatient Sample

The National Inpatient Sample (NIS) is an inpatient database in the US[1] developed by the Agency for Healthcare Research and Quality (AHRQ). It is comprised of a 20% nationwide sample of all inpatient discharges from US hospitals, excluding patients admitted for observation status, short-term rehabilitation hospitals, long-term non–acute care hospitals, psychiatric hospitals, and alcohol or chemical dependency units. This dataset contains de-identified information regarding each hospitalization, including demographic characteristics, co-morbidities, discharge diagnoses, procedures, outcomes, and total cost of the admission. The design of the NIS changed twice during the study[2]. Between 2003 and 2011, the NIS comprised all inpatient discharges from a 20% nationwide random sample of acute-care hospitals in the US. However, in 2012, instead of including all discharges from the 20% nationwide sample, the database was constructed using a systematic sampling of 20% of discharges from the hospitals stratified by hospital, census division, ownership status, location, teaching status, and bed size, as well as patient diagnosis-related group and admission month. To facilitate patient-level trend analysis, a new set of weights called "trendwt" was developed for data from previous years (1993-2011)[1, 3]. The trend weights replaced the original NIS discharge weights for trend. We used trend weights for all patient and hospital level analyses[3]. In 2015, NIS moved to the International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) format of data collection, and hence, data was available only through September 2015[4]. Data collection methodology was unchanged compared to 2012.

Propensity Model

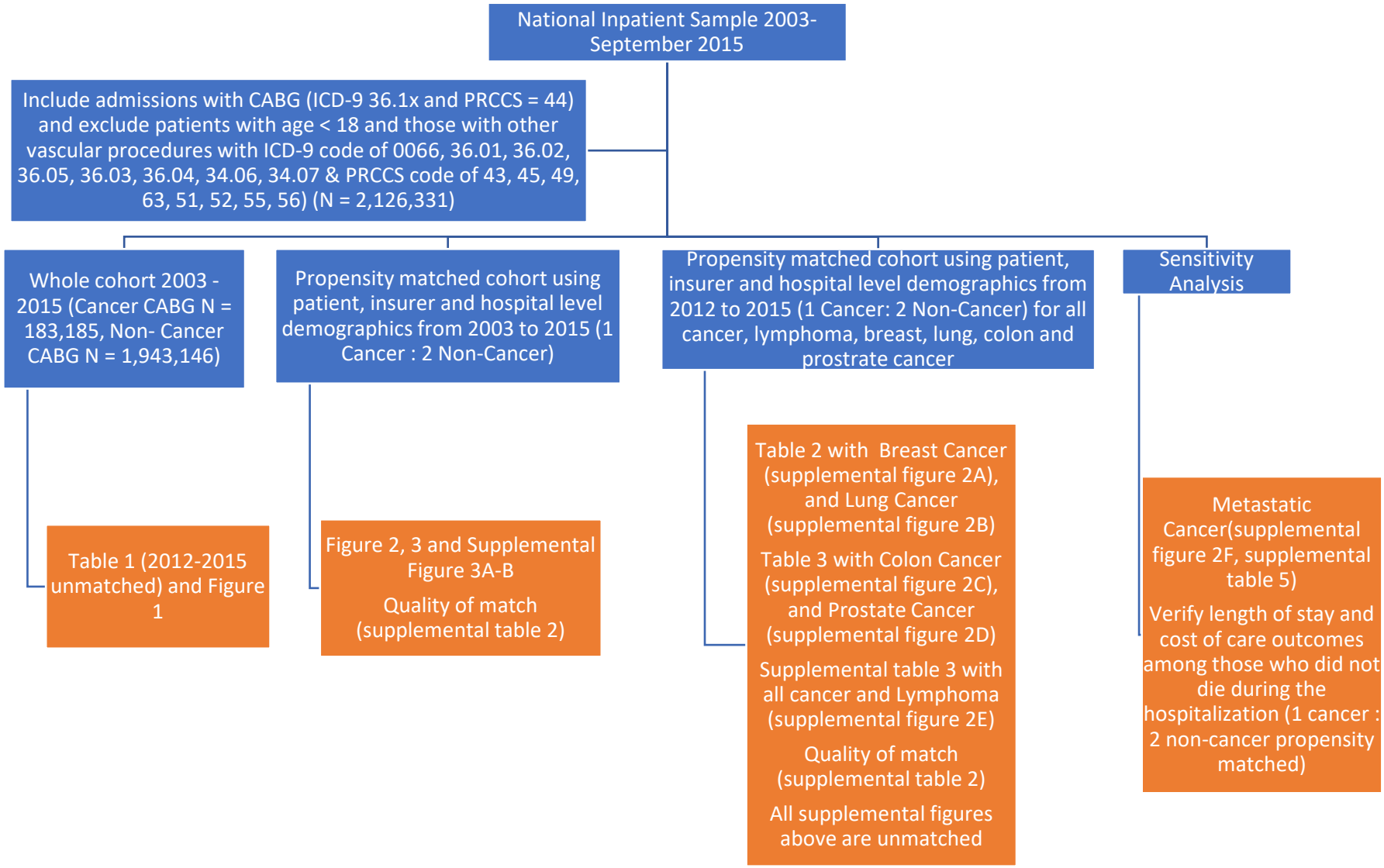
The propensity score was calculated using Parson's 8®1 Digit Match algorithm (DGM)[5]. This algorithm matches a case to control at the 8th, 7th, 6th … decimal point, using a greedy matching algorithm. This methodology requires one to measure the closeness of match by performing univariable statistics across the matching variable. This data is presented in supplemental table 2 below. As far

as the technique of matching is considered, this technique was compared to Mayo Clinic Caliper matching[6]. The closeness of match using these two techniques are shown in the following table:

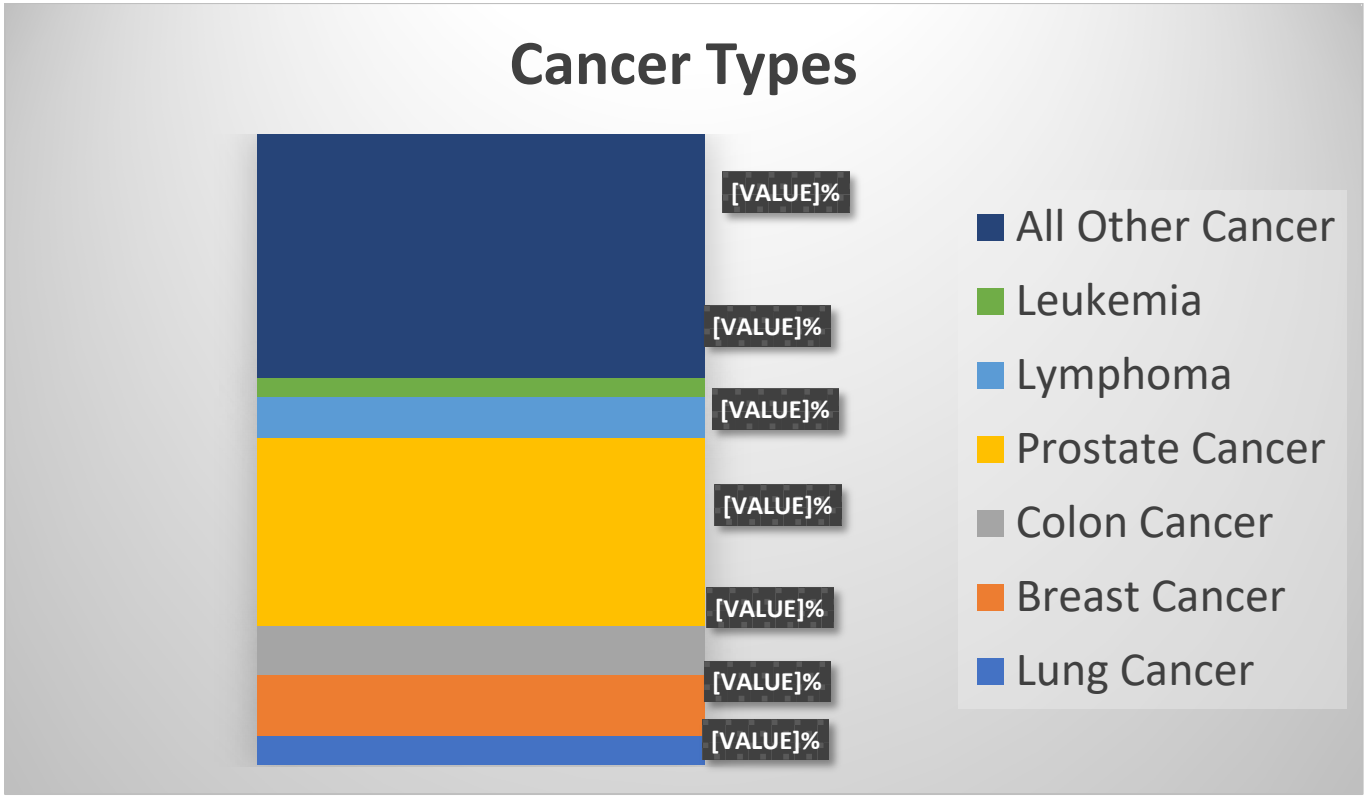
Variable	**Parson's DGM**	**Caliper Match using Mayo Clinic Algorithm**
≥ 65 years	.64	.81
Women	.60	<.001
Race	.02	.06
Income quartiles	.60	.71
Payment source	.29	.57
Comorbidities		
Atrial Fibrillation	.12	.18
Hypertension	.02	.03
Diabetes	.59	.48
Anemia	.17	.33
Chronic renal disease	.86	.34
Coagulation disorder	.38	.27
Total Elixhauser's comorbidities	.84	.83
Bed size	.98	.82
Geographic region	.32	.63
Discharge weight	.64	.78

Since we see that both methods give reasonable match, we decided to keep the DGM methodology.

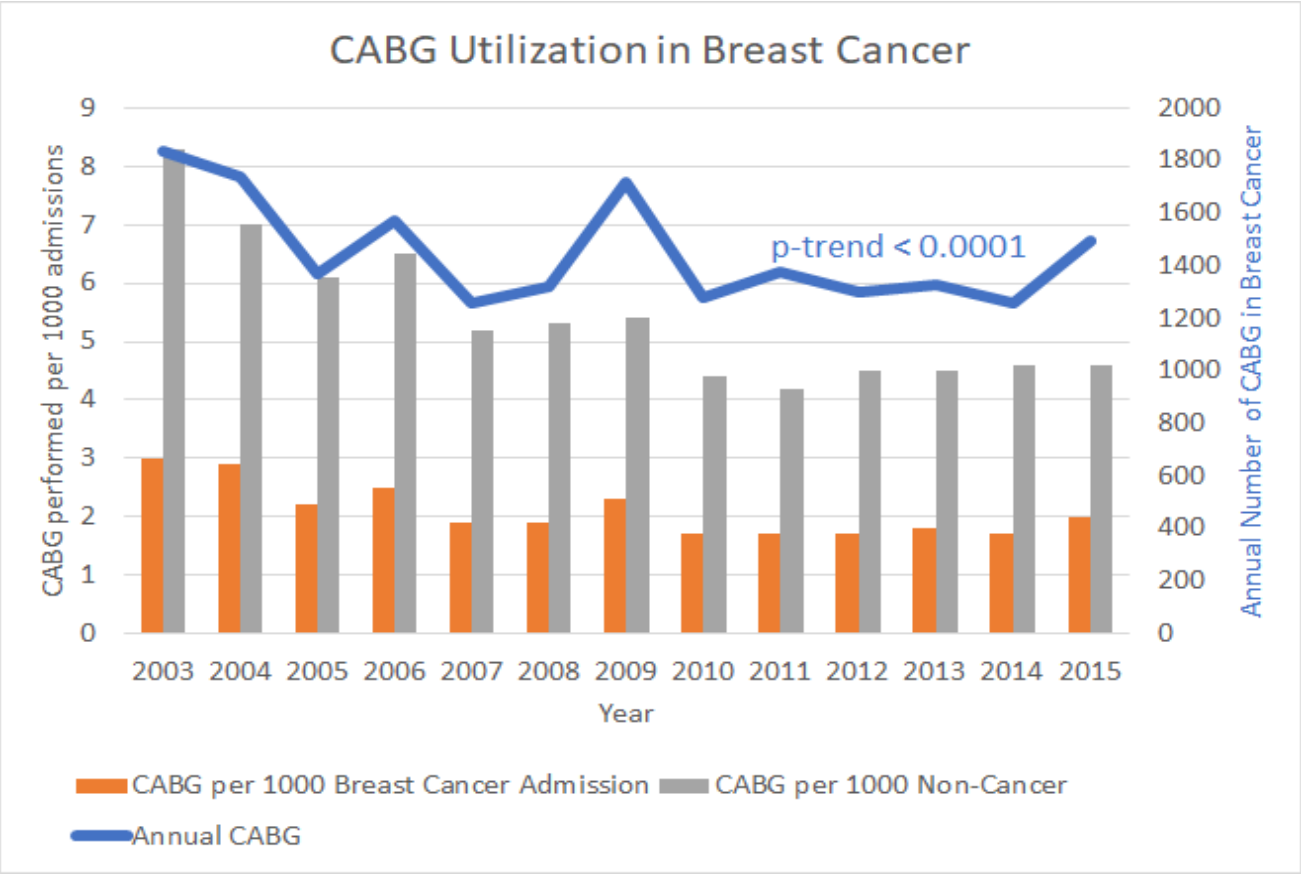
Supplemental Figure1A Flow chart showing inclusion and exclusion criteria for tables and figures used in the manuscript.



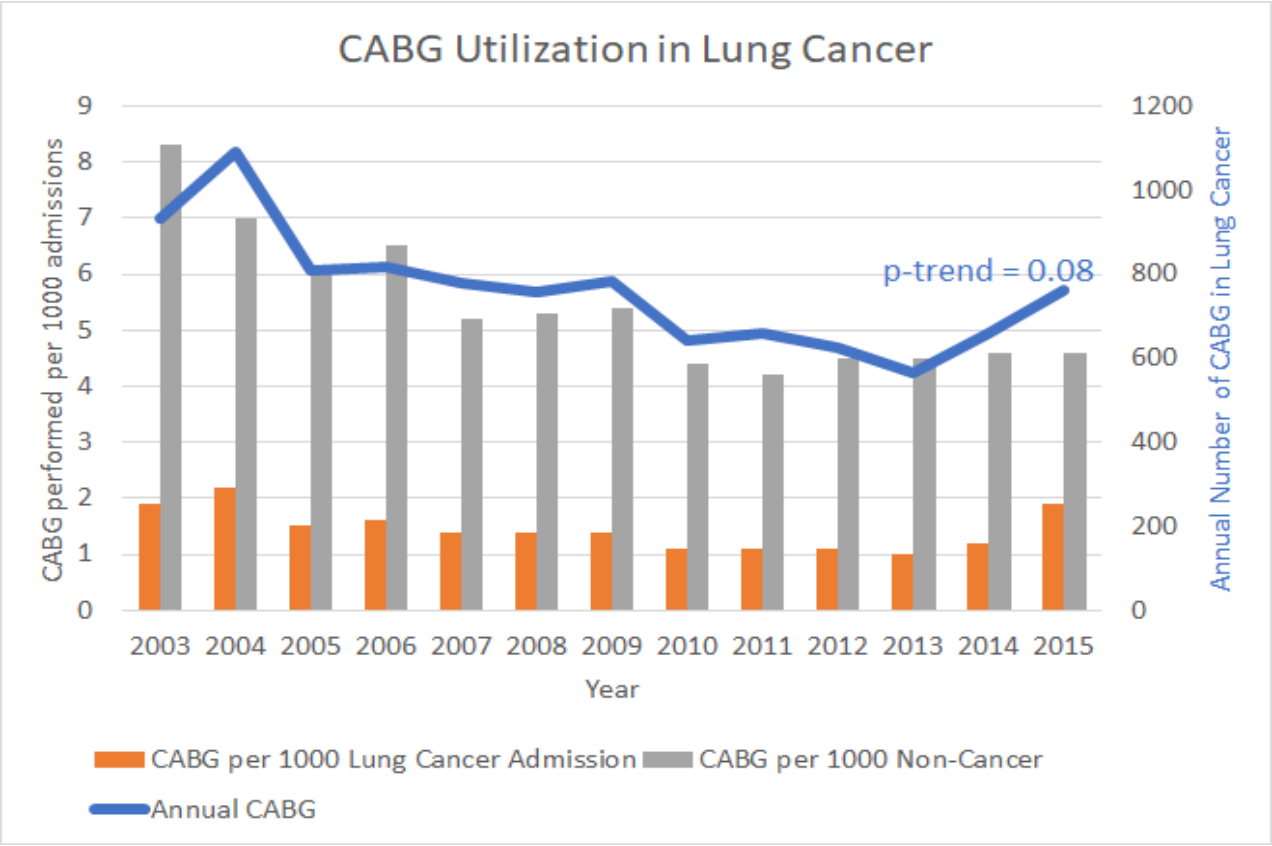
Supplemental Figure 1B Type of cancers and their prevalence.



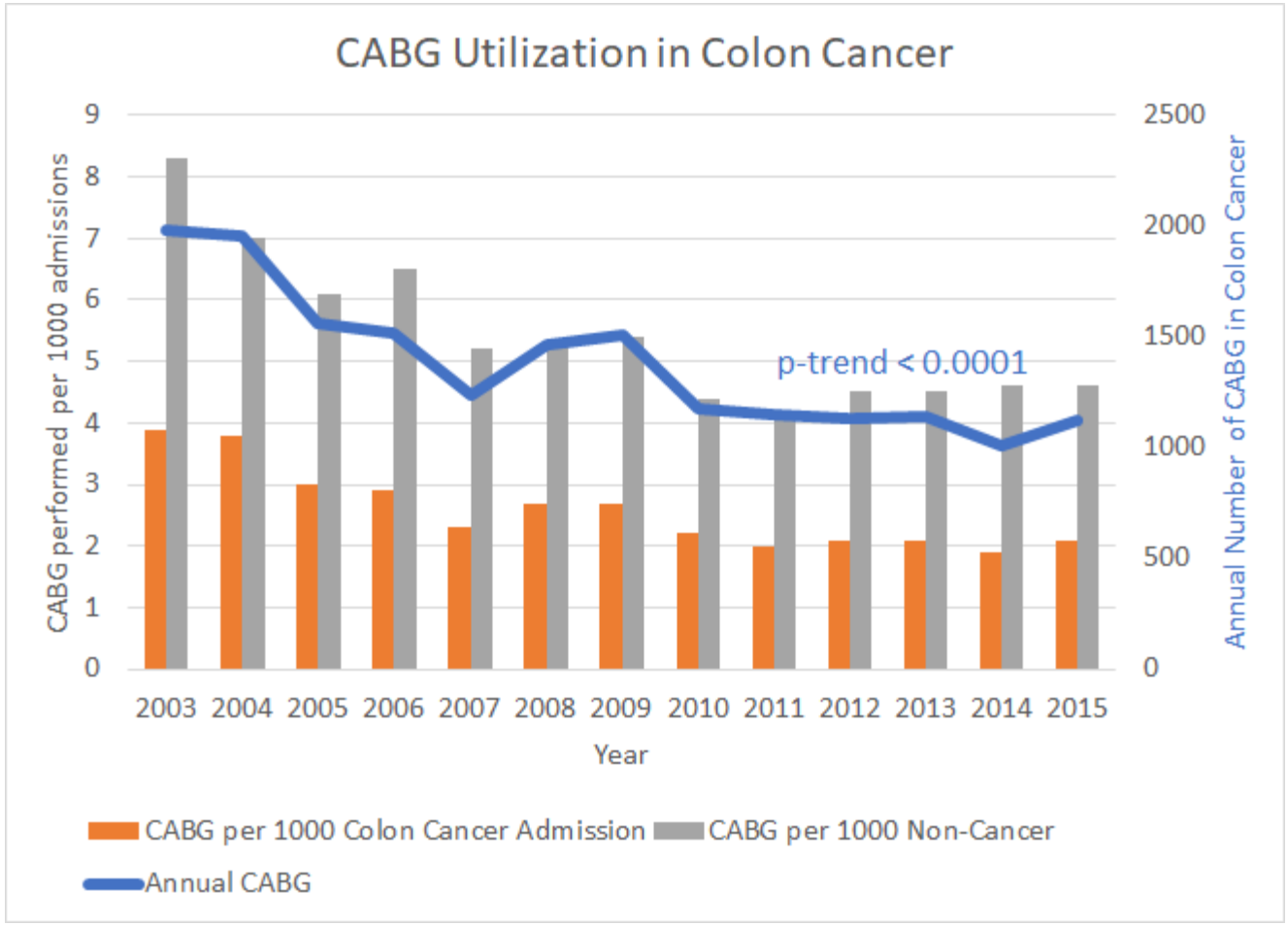
Supplemental Figure 2A Trends in coronary artery bypass graft utilizations in breast cancer vs non-cancer patients from 2003-2015.



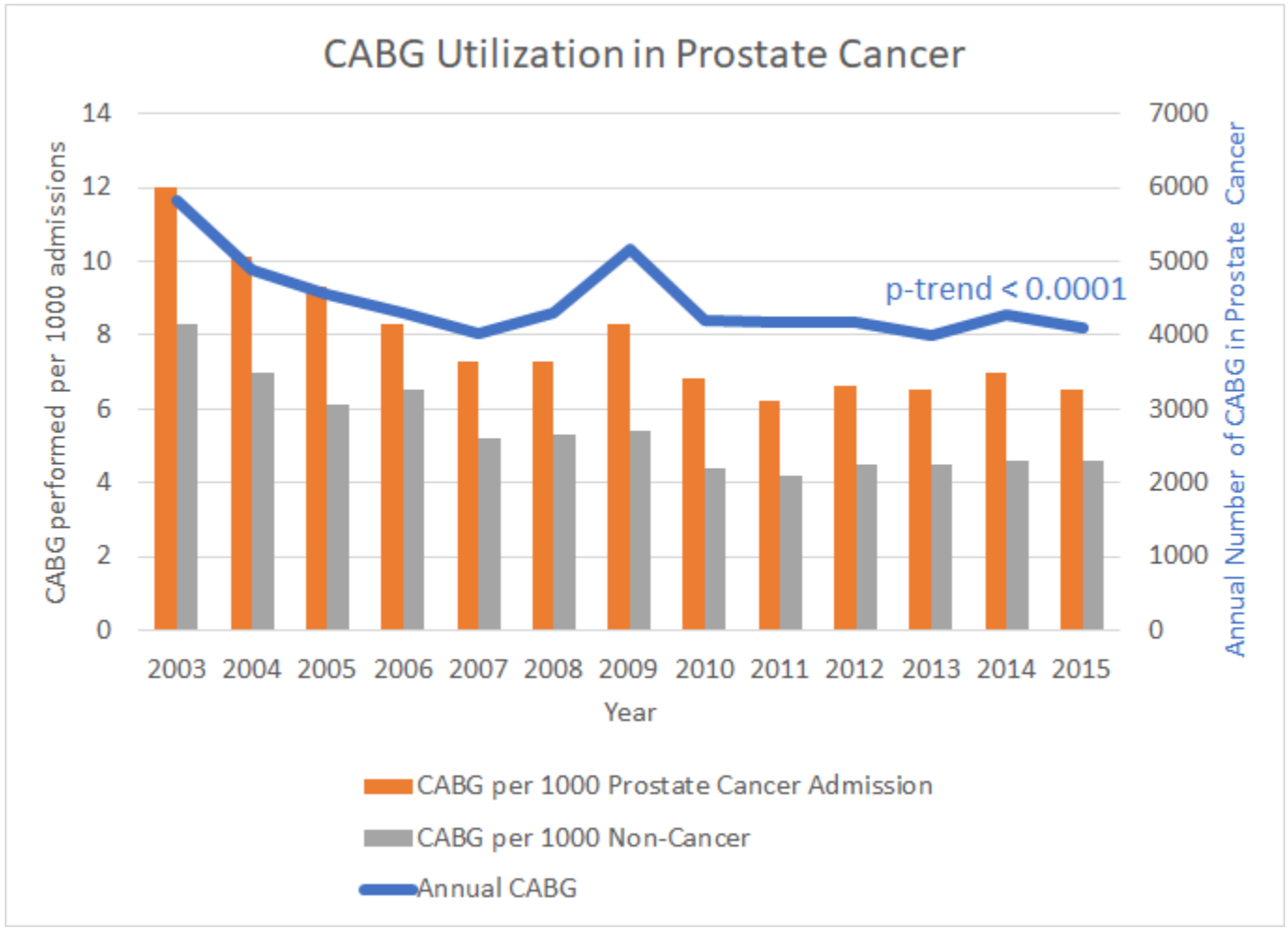
Supplemental Figure 2B Trends in coronary artery bypass graft utilizations in lung cancer vs non-cancer patients from 2003-2015.



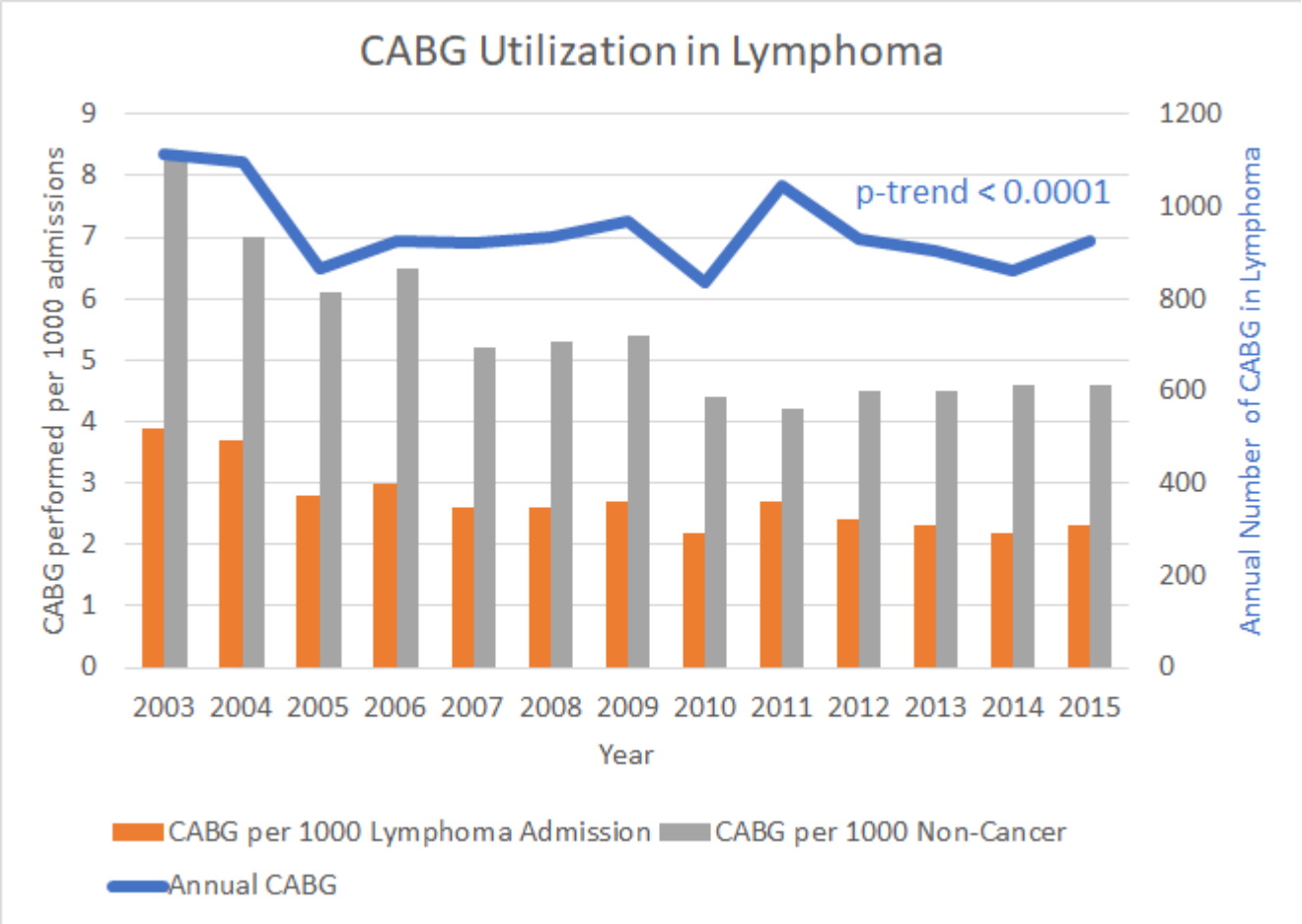
Supplemental Figure 2C Trends in coronary artery bypass graft utilizations in colon cancer vs non-cancer patients from 2003-2015.



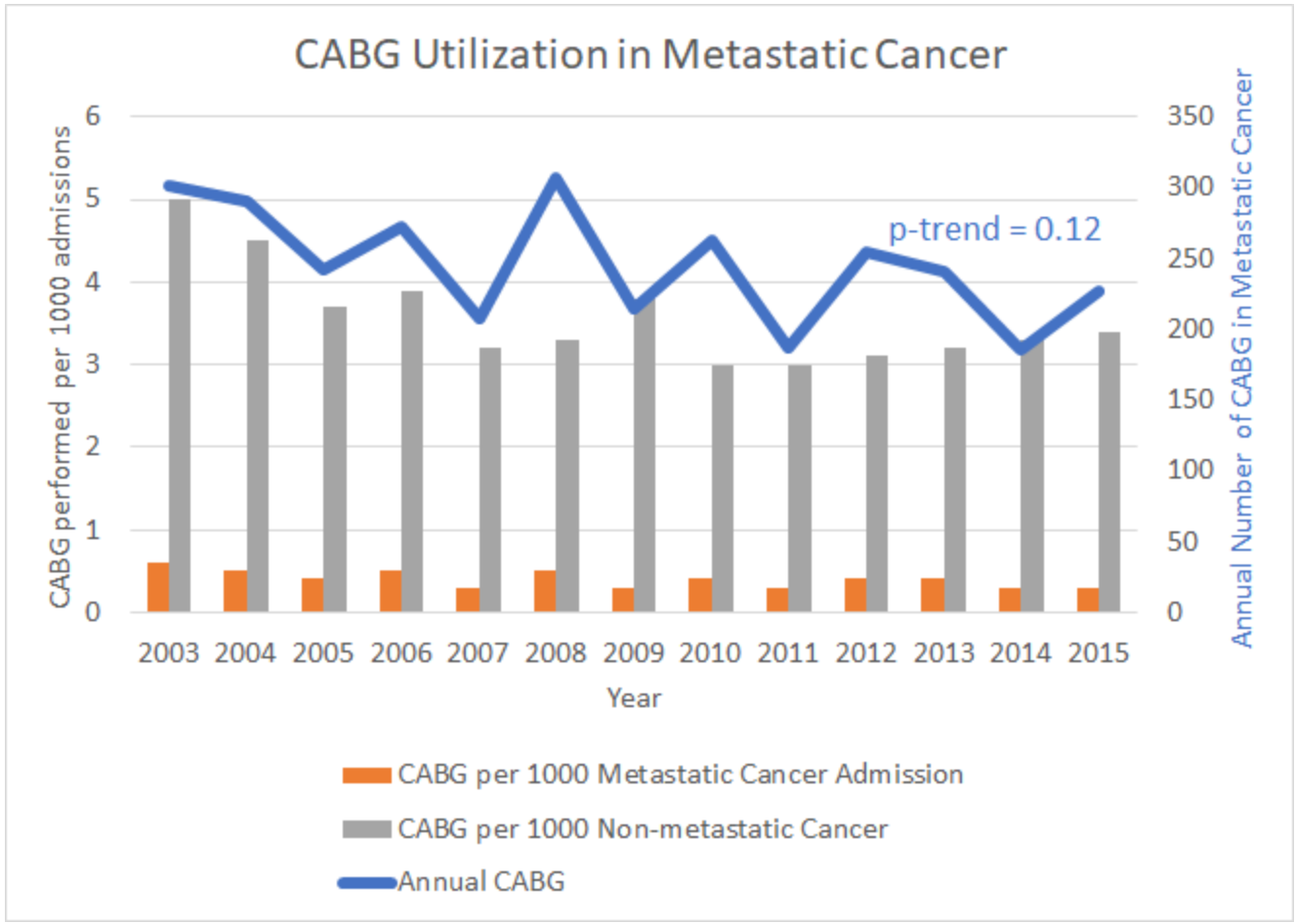
Supplemental Figure 2D Trends in coronary artery bypass graft utilizations in prostate cancer vs non-cancer patients from 2003-2015.



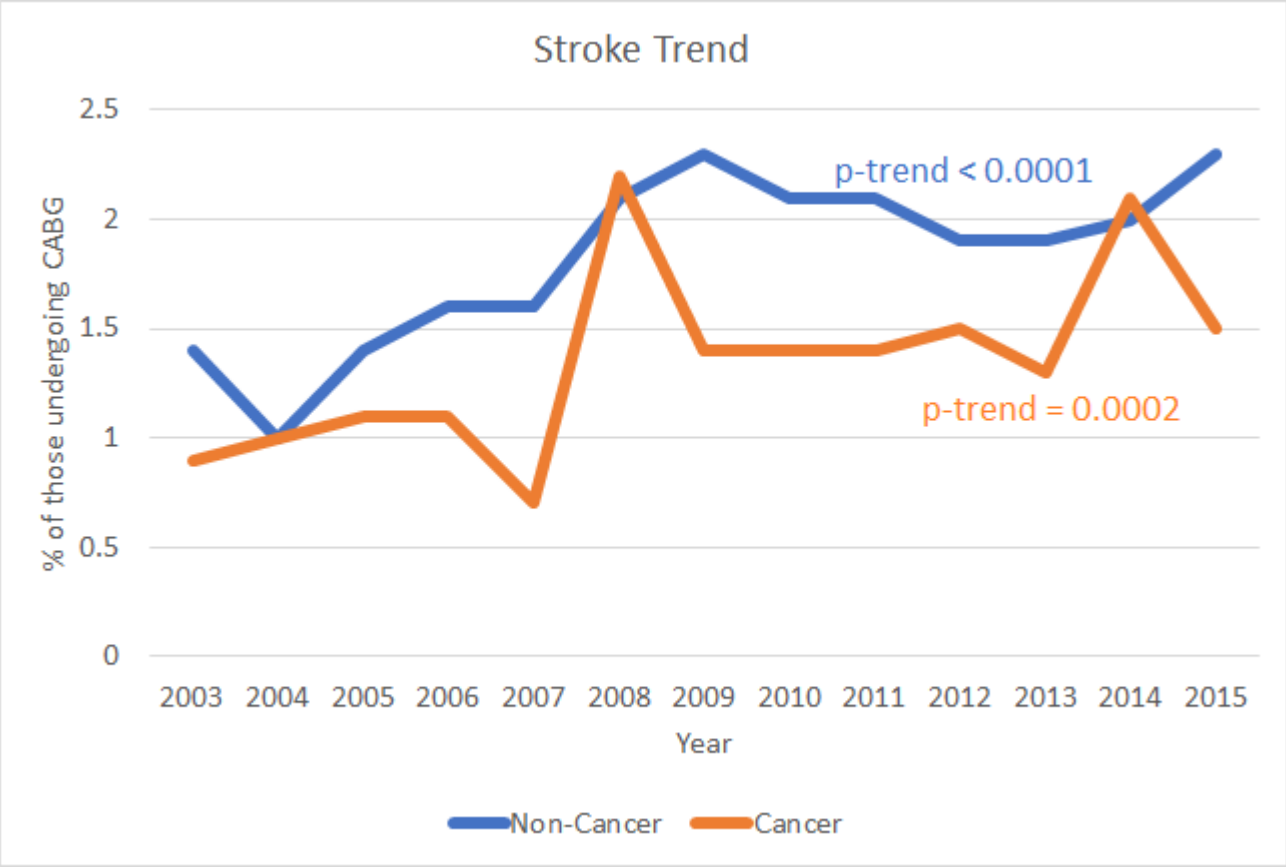
Supplemental Figure 2E Trends in coronary artery bypass graft utilizations in lymphoma vs non-cancer patients from 2003-2015.



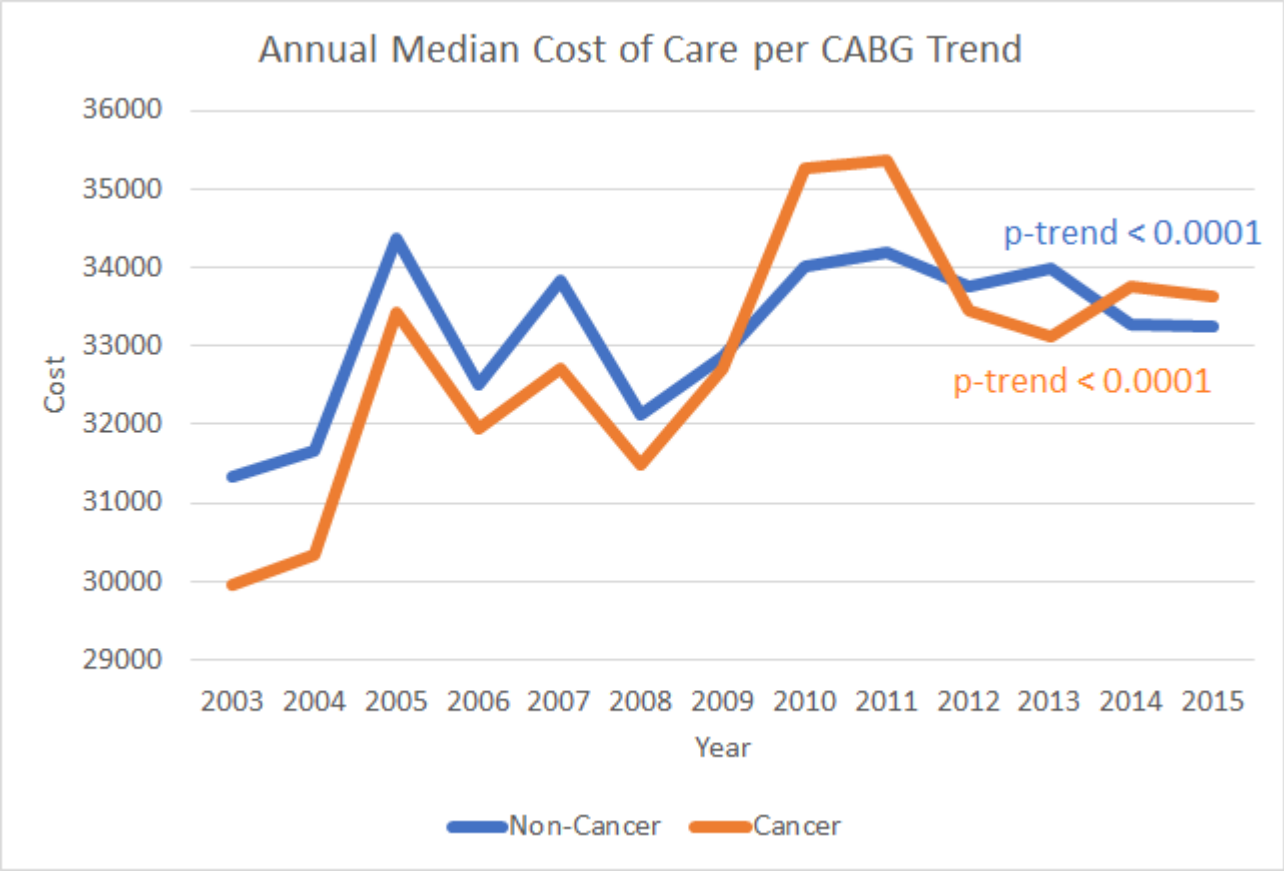
Supplemental Figure 2F Trends in coronary artery bypass graft utilizations in metastatic cancer vs non-cancer patients from 2003-2015.



Supplemental Figure 3A Trends in stroke rate associated with coronary artery bypass graft utilizations in cancer and non-cancer patients from 2003-2015.



Supplemental Figure 3B Trends in annual median cost of care associated with coronary artery bypass graft utilizations in cancer and non-cancer patients from 2003-2015.



Supplemental Table 1: Diagnosis codes used in the study

	ICD-9 code	CCS code	Comorbidity field from NIS
Cohort Creation			
Cancer	162.xx,174.xx,175.xx,153.xx,154.xx,185.xx,182.xx,183.xx,188.xx,189.xx,200.xx,201.xx,202.xx,204.xx,205.xx,206.xx,207.xx,208.xx,155.xx,156.xx,172.xx,193.xx,157.xx	11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45	CM_LYMPH,CM_TUMOR CM_METS
Metastatic Cancer			CM_METS
Comorbities			
Cardiomyopathy	425.xx		CM_CHF
Known Coronary Artery Disease	414.00, 414.01, 414.02, 414.03, 414.04, 414.05, 414.06, 414.07		
Prior Myocardial Infarction	412.xx		

Prior Percutaneous Coronary Intervention	V45.82		
Prior Coronary Bypass Grafting	V45.81		
Carotid Disease	433.10		
Prior TIA/Stroke	438.xx,V12.54		
Atrial Fibrillation	427.31		
Hypertension		98,99	CM_HTN_C
Diabetes		49,50	CM_DX,CM_DMCX
Obesity	278.xx		CM_OBESE
Chronic Kidney Disease		158	CM_RENLFAIL
Hyperlipidemia		53	
Peripheral Vascular Disease		114	CM_PERIVASC
Smoking	305.1x, V158.2		
Weight Loss			CM_WGHTLOSS
Anemia			CM_ANEMDEF,

			CM_BLDLOSS
Arthritis and Collagen Vascular disease			CM_ARTH
Chronic liver disease			CM_LIVER
Chronic renal disease		158	CM_RENLFAIL
Chronic lung disease			CM_CHRNLUNG
Hypothyroidism			CM_HYPOTHY
Neurologic			CM_NEURO, CM_PARA
Psychiatric			CM_DEPRESS
Fluid/electrolyte disorder			CM_LYTES
Coagulation disorder			CM_COAG
Substance abuse			CM_ALCOHOL CM_DRUG
Radiation Therapy	E926.xx, 909.2, 990.xx, V15.3		
In-Hospital Complications			

Stroke	431.xx, 435.0x, 435.1x, 435.2x, 435.3x, 435.8x, 435.9x, 433.01, 433.11, 433.21, 433.31, 433.81, 433.91, 434.01, 434.11, 434.91, 997.01, 344.60, 344.61		
Pulmonary embolism	415.1x		
Pneumonia	481.xx, 482.xx, 483.xx, 484.xx, 485.xx, 486.xx, 487.xx, 507.xx		
Iatrogenic respiratory complications	997.3		
Pneumothorax	512.1		
Thoracic complications	Any of the prior 4 rows of complication		
Gastrointestinal bleed	578.xx, 456.0x, 531.0, 531.2x, 531.4x, 531.6x, 532.0x, 532.2 ,532.4x, 532.6x, 533.0x, 533.2x, 533.4x,533.6x, 534.0x, 534.2x, 534.4x, 534.6x, 569.3x, 456.20 , 530.82, 535.01, 535.11, 535.21, 535.31,		

	535.41, 535.51, 535.61, 537.83, 562.02, 562.03, 562.12, 562.13, 568.81, 569.85		
Endoscopy for gastrointestinal bleed	44.43		
Blood Transfusion	99.00, 99.01, 99.02, 99.03, 99.04		
Other bleeding	360.43, 362.43, 362.81, 363.61, 363.62, 363.72, 364.41, 372.72, 374.81, 376.32, 377.42, 379.23, 997.02, 998.11 285.1x, 423.0x, 596.7x, 599.7x, 602.1x, 620.1x, 621.4x, 626.2x, 626.5x, 626.7x, 626.8x, 626.9x, 719.1x, 782.7x, 784.7x, 784.8x, 786.3x, 958.2x		
Major bleeding	Gastrointestinal bleeding requiring endoscopy or any bleeding requiring transfusion or cerebral bleed (430.xx, 431.xx, 432.0x, 432.1x ,432.9x, 852.0x,		

	852.2x, 852.4x, 853.0x)		
Iatrogenic post procedural cardiac complications	997.1		
Pericardial Complication (hemopericardium, cardiac tamponade)	423.0, 423.3		
Pericardial tap	37.0 (only after the day of CABG)		
Cardiac complication	Any of prior 3 rows of complications		
Additional Codes			
One vessel bypass	36.11		
Two vessel bypass	36.12		
Three vessel bypass	36.13		
Four vessel bypass	36.14		
One internal mammary artery use	36.15		
Two internal	36.16		

mammary artery use			

Supplemental Table 2: Completeness of match propensity matching using Parson's digit-based greedy matching for all models. Only *P*-value and c-statistic for each match presented. All matched pairs are matched 1 cancer: 2 non-cancer. All propensity matching was done on variables of age, gender, race, income quartiles, insurance, total Elixhauser's comorbidities, hospital size and geographic region, discharge weight and comorbidities of atrial fibrillation, hypertension, diabetes, anemia, chronic renal disease and coagulation disorder. In case of breast cancer and prostate cancer gender was not used.

Variable	**All-cancer (2003-2015, model 1) [c = 0.7]**	**All-cancer (2012-2015, model 2) [c = 0.7]**	**Breast Cancer (2012-2015) [c = 0.7]**	**Lung Cancer (2012-2015) [c = 0.7]**	**Colon Cancer (2012-2015) [c = 0.7]**	**Prostate Cancer (2012-2015) [c = 0.7]**	**Lymphoma (2012-2015) [c = 0.7]**
≥ 65 years	.33	.64	>.99	.96	>.99	>.99	.92
Women	.07	.60	-	.24	.59	-	.61
Race	.23	.02	.13	>.99	.98	.99	.99
Income quartiles	.47	.60	.64	.76	.046	>.99	>.99
Payment source	.12	.29	>.99	.99	>.99	<.001	.005
Comorbidities							
Atrial Fibrillation	.44	.12	.31	.59	.95	.73	.97
Hypertension	.06	.02	.97	.96	.26	.13	.94
Diabetes	.81	.59	.33	.97	.93	.92	>.99
Anemia	.48	.17	.52	>.99	>.99	.77	.97
Chronic renal	.89	.86	>.99	.59	.97	.81	.87

disease							
Coagulation disorder	.05	.38	>.99	.92	.34	.46	.79
Total Elixhauser's comorbidities	.50	.84	>.99	>.99	>.99	.23	>.99
Bed size	.22	.98	.35	.16	.48	.93	.15
Geographic region	.06	.32	>.99	.88	>.99	>.99	.41
Discharge weight	.56	.64	.09	.29	.78	.001	.87

Supplemental Table 3: Propensity matched (1 cancer: 2 non-cancer, model 2) in-hospital and disposition outcome from the years 2012- September 2015 stratified by cancer and among those with Lymphoma. The propensity matching was done on variables of age, gender, race, income quartiles, insurance, total Elixhauser's comorbidities, hospital size and geographic region, discharge weight and comorbidities of atrial fibrillation, hypertension, diabetes, anemia, chronic renal disease and coagulation disorder. C-statistic for propensity fit was 0.7 indicative of good match.

Variable	**Cancer (n=48,115)**	**Non-Cancer (n=96,230)**	***P*-value**	**Lymphoma (n = 3,150)**	**Matched non-cancer (n = 6,290)**	***P*-value**
In-Hospital Outcomes (%)						
In-hospital mortality	.8	.9	.59	1.6	1.1	.37
Major bleeding	15.8	14.3	.001	15.1	13.4	.34
Ischemic Stroke	1.6	1.8	.18	2.1	1.4	.31
Pulmonary complications	8.5	9.4	.01	9.4	11.6	.15
Cardiac complications	10.9	10.9	.92	10.3	10.5	.92
Length of stay (median ± confidence interval, days)	7.0±0.04	7.1±0.04	.06[a]	7.1±0.2	7.3±0.1	.19[a]
Total hospital costs (median ± confidence interval, US$) [b]	33,588±277	33,636±242	.08[a]	34,681±584	35,281±613	.75[a]

Disposition (%)			.30			.95
Home	38.0	39.2		40.6	39.9	
Short term hospital	.6	.6		1.2	1.3	
Skilled care facility	22.7	22.1		21.5	20.6	
Home health care	37.7	37.1		36.7	38.2	

[a]Log transformed means were compared using Survey specific linear regression due to skewed nature of data

[b] Using HCUP cost-to-charge, wage index adjustment along with inflation adjustment

Supplemental Table 4: In-hospital and disposition outcome of those undergoing CABG from the years 2012- September 2015 in metastatic cancer and those undergoing radiotherapy. Adjusted odds ratio of the outcomes presented where metastatic cancer is compared to non-metastatic cancer as well as those receiving radiation therapy is compared with those who did not receive radiation therapy. Adjustment made for age, gender, race, income quartiles, insurance, total Elixhauser's comorbidities, hospital size and geographic region, and comorbidities of atrial fibrillation, hypertension, diabetes, anemia, chronic renal disease and coagulation disorder.

Variable	**Metastatic Cancer (n=850)**	**Adjusted odds ratio (OR (confidence interval); *P*-value)[a]**	**Radiotherapy (n = 3,465)**	**Adjusted odds ratio (OR ± confidence interval; *P*-value)[a]**
In-Hospital Outcomes (%)				
In-hospital mortality	.6	.65 (.09 – 4.8); .68	.6	.72 (.26 – 2.01); .53
Major bleeding	20.6	1.58 (1.04 – 2.38); .03	17.2	1.10 (.88 – 1.37); .41
Ischemic Stroke	2.4	.68 (.17 – 2.78); .59	1.7	1.17 (.64 – 2.13); .62
Pulmonary complications	11.2	1.10 (.66 – 1.83); .71	6.3	.76 (.55 – 1.05); .10
Cardiac complications	7.1	.68 (.37 – 1.24); .21	10.2	.97 (.72 – 1.29); .82
Length of stay (median ± confidence interval, days)	8.1±.3	1.2 (1.1 – 1.3); <.001	6.8±.1	- .96 (-.94 – -.99); .001
Total hospital costs (median ± confidence interval, US$) [b]	37,707±1,752	5,668 (2,733 – 8,603); .001	35,278±779	522 (292 – 2,340); .01
Disposition (%)[c]		.004		.30

Home	30.6		36.4	
Short term hospital	2.4		2.9	
Skilled care facility	25.8		22.9	
Home health care	41.2		37.8	

[a] Presented as β (confidence interval), *P*-value

[b] Using HCUP cost-to-charge, wage index adjustment along with inflation adjustment

[c] Only p-value presented since the subcategories are not separated into individual components

References

1. CPI Inflation Calculator. Vol 2018. Online2018.
2. Houchens RL, Ross DN, Elixhauser A, Jiang J. Nationwide Inpatient Sample Redesign: Final Report. Vol 2018. Rockville, MD2014.
3. Marzolini S, Blanchard C, Alter DA, Grace SL, Oh PI. Delays in Referral and Enrolment Are Associated With Mitigated Benefits of Cardiac Rehabilitation After Coronary Artery Bypass Surgery. *Circ Cardiovasc Qual Outcomes.* 2015;8:608-620.
4. Barrett ML. 2015 Healthcare Cost and Utilization Project (HCUP) National Inpatient Sample: Change in Structure and Data Elements Caused by Transition to ICD-10-CM/PCS. Vol 2018. Online, Rockville, MD: U.S. Agency for Healthcare Research and Quality; 2017.
5. Parsons LS. Performing a 1: N case-control match on propensity score. *proceedings of the 29th Annual SAS users group international conference*: SAS Institute; 2004:165-129.
6. Bergstralh E, Kosanke J. GMATCH. Vol 20202007.