12-12-2022

Thoracic Aortic Aneurysm Patients' Diagnosis, Treatments, and Outcomes: The New York Experience

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TITLE: Trends over Time in Thoracic Aortic Aneurysm Patients' Diagnosis, Treatment and Outcomes: A Review From The New York State SPARCS Database

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PURPOSE AND SPECIFIC AIMS:

THIS TAA MAIN STUDY IS REQUESTING A "NOT HUMAN SUBJECTS RESEARCH DETERMINATION".

Using **de-identified** reports from the Statewide Planning and Research Cooperative System (SPARCS) data, this descriptive study will identify the New York State (NYS)-based rates for hospital admissions with an index diagnosis of a thoracic aortic aneurysm (TAA). These patients will be further subclassified as either non-ruptured thoracic aortic aneurysm (nrTAA) or ruptured/dissected thoracic aortic aneurysm (rTAA). The exclusion criteria for this study includes patient records with an unknown UPID, patients under the age of 18, non-NYS residents, patients with a bicuspid aortic valve (BAV) diagnosis code, and/or any other TAA-related chromosomal abnormality. For the included patients, their risk profiles, treatment rates, and short-term outcome rates will be evaluated. Moreover, for patients receiving surgical treatment during our study period, propensity-adjusted emergent/urgent surgery and elective surgery rates will be reported. For our short-term outcomes, the risk-adjusted operative mortality (i.e., combined in-hospital mortality and mortality within 30 days of discharge) and 30-day readmission rates will be evaluated.

Additionally, the following hypotheses will be tested:

H(0): There will be no trends over time in the overall TAA diagnosis/incidence rates for New York State between the time range 2005-2018.

- H(0): There will be no trends over time, when comparing the nrTAA subgroup versus the rTAA subgroup, in diagnosis/incidence rates for New York State between the time range 2005-2018.

H(0): There will be no trends over time in the overall TAA population propensity adjusted treatment rates for New York State between the time range 2005-2018.

- H(0): There will be no trends over time, when comparing the nrTAA subgroup versus the rTAA subgroup, in propensity adjusted treatment rates for New York State between the time range 2005-2018.

H(0): There will be no trends over time in the overall TAA population risk-adjusted short-term outcome rates for New York State between the time range 2005-2018.

- H(0): There will be no trends over time, when comparing the nrTAA subgroup versus the rTAA subgroup, in risk adjusted short-term outcome rates for New York State between the time range 2005-2018.

Please note, the SPARCS database de-identified reports will be used. Additionally, a not human subject's research (NHSR) determination is requested.

BACKGROUND AND SIGNIFICANCE:

Complications of thoracic aortic aneurysms (TAA) are usually fatal. This potentially lethal disease is generally silent and indolent, most often discovered incidentally when reviewing images obtained for other clinical indications. The true TAA incidence is unknown as many patients are asymptomatic and until urgent/emergent symptoms arise. A 1994 Mayo Clinic study estimated that 10.4 persons out of 100,000 will have a TAA. Given the advent of increased imaging such as CT screening of smokers for lung cancer as well as the increased use of CT angiography for transcatheter aortic valve replacements (TAVR), the diagnosis of asymptomatic TAA is rising. Hence this 1994 estimate is likely too low, dramatically underestimating the current incidence of the disease.

Recent studies have shown evidence to support the increasing diagnosis of these asymptomatic TAA's. A recent England-Wales study determined the total TAA admission to increase over 2-fold from 4.4/100,000 in 1999 to 9.0/100,000 in 2010. Furthermore, a study in Sweden found that TAA admission rate increased for men from 10.7/100,000 to 16.7/100,000 and for women from 7.1/100,000 to 9.1/100,000 in the years from 1987-2002. Additionally, a more recent study identified decreasing US national trends of TAA rupture between the years 1999-2016. To-date, there are no US-based studies that provide reliable overall TAA incidence rates.

TAA complication rate is linked to increased aortic diameter, as well as familial and genetic contributors. Guidelines exist for procedural intervention when size criteria are met. But little is known about optimal management for patients with moderately enlarged TAA in terms of optimal surveillance or screening. To begin addressing this insufficiency, it is necessary to first understand the scope of the problem. We therefore propose, using the New York State SPARCS data set, to obtain hospital data that will help inform the incidence of this disease.

RESEARCH DESIGN AND METHODS:

This retrospective observational cohort study will be done using the SPARCS Health Facts dataset. With the help of the SBU SOM Bioinformatics Department and Biostatistics Core Lab, the SPARCS database will be matched/merged to the enclosed coding listings to create a

study-specific de-identified TAA database. Furthermore, the Bioinformatics and Biostatistics team members will be responsible for providing the descriptive statistics listed below as well as providing a study-database for future analyses. For this study's primary hypothesis related to diagnosis, propensity-adjusted treatment, and risk-adjusted outcome rates, a p-value of <0.001 will be used (however, all p-values will be reported by separate interpretation by readers). All secondary and tertiary analyses, as well as all exploratory analyses, will use a p-value of < 0.01. SAS version 9.4 will be used to complete all the necessary statistical tests.

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TAA Codes:

Disease		ICD10	ICD9
Thoracic Aortic Aneurysm (TAA)-non rupture		I71.2	441.2
TAA-ruptured		I71.1	441.1
TAA-dissection		I71.01	441.01
Bicuspid Aortic Valve Dx		Q23.1	746.4
	Marfan Syndrome	Q87.40	759.82
	Marfan Syndrome-CV manifestations	Q87.41, Q87.410, Q87.418	NA
	Marfan Syndrome-Aortic Dilation	Q87.418	NA
	Ehler-Danlos Syndrome	Q79.6 (Q79.60, Q79.61, Q79.62, Q79.63, Q79.69 were used instead)	756.83
	Turner Syndrome	Q96.0, Q96.9	758.6 (includes> than Turner syndrome)
	Ehler-Danlos Syndrome-Vascular	Q79.63	NA
Other			

Risk Factor Codes:

Risk Factor	**ICD-10**	**ICD-9**	**CPT**
Atherosclerotic Disease of Aorta	I70.0	440.0	
Carotid Disease	I77.71, I65.21, I65.22, I65.23, I65.29, G45.1,	433.0-433.3, 435.8, 443.21	

	I65.1 I65.01 I65.02 I65.03 I65.09		
Coronary Artery Disease	I25-I25.4, I25.6-I25.9	414-414.9	
Congestive Heart Failure	I50-I50.9, I09.9 I11.0 I13.0 I13.2 I25.5 I42.0 I42.5 - I42.9 I43 P29.0	428.0-428.9, 398.91 402.01 402.11 402.91 404.01 404.03 404.11 404.13 404.91 404.93 425.4 - 425.99, 414.8	
Hypertension	I10, I11.0, I11.9, I12.0, I12.9, I13.0, I13.1, I13.10, I13.11, I13.2, I15, I15.0, I15.1, I15.2, I15.8, I15.9 I16, I16.0, I16.1, I16.9	401.0, 401.1, 401.9, 402.01, 402.11, 402.91, 402.00, 402.10, 402.90, 403.01, 403.11, 403.91, 403.00, 403.10, 403.90, 404.01, 404.11, 404.91, 404.00, 404.10, 404.90, 404.02, 404.12, 404.92, 404.03, 404.13, 404.93, 405.01, 405.11, 405.91, 405.91, 405.99, 405.09, 405.19, 405.99	
Myocardial Infarction	I25.2, I21-I21.9, I21.A1, I21.A9, I22.0-I22.9	412, 410.00-410.92	
Aortic Valve Disease	I06.0, I06.2, I08.0, I08.2, I08.3, I35.0, I35.2, I06.1, I35.1, I35.8, I35.9	395.0, 395.2, 424.1, 396.3, 396.1	
Aortic Coarctation	Q25.1	747.1	
Diabetes mellitus	E08.00-E13.9	249.00-249.91, 250-250.03, 250.1-250.13, 250.2-250.23, 250.3-250.33, 250.4-250.43, 250.5-250.53, 250.6-250.63, 250.7-250.73, 250.8-250.83, 250.9,250.93	
Chronic Obstructive Pulmonary Disease	J41.0, J41.1, J41.8, J42, J43.0, J43.1, J43.2, J43.8, J43.9, J44.0, J44.1, J44.9 *Asthma and Bronchiectasis were not counted as a chronic	491.0, 491.1, 491.20, 491.21, 491.22, 491.8, 491.9, 492.0, 492.8, 496 *Asthma and Bronchiectasis were not counted as a chronic obstructive pulmonary disease	

	obstructive pulmonary disease		
Tobacco/Smoking	Z72.0, F17.21-F17.299, Z87.891	V15.82, 305.1	
Cerebrovascular Disease	I60-I69.998, Z86.73, G46.0-G46.8, G45.0-G45.9	430-438.9, V12.54	
Peripheral Vascular Disease	I73.00, I73.01, I73.1, I73.81, I73.89, I73.9, I70.20-I70.25, I70.8, I70.92	443.0, 443.1, 443.21, 443.22, 443.23, 443.24, 443.29, 443.81, 443.82, 443.89, 443.9	
Prior Percutaneous Coronary Intervention	Z98.61	V45.82	
Dialysis	Z99.2	V45.11	
Hyperlipidemia	E78.00, E78.01, E78.1, E78.2, E78.3, E78.41, E78.49, E78.5	272.0, 272.1, 272.2, 272.3, 272.4,	
Dyslipidemia- Literature Codes	E78.0-E78.9	272.0-272.5, 272.8, 272.9	
Dyslipidemia- Dr. Bilfinger Codes	E78.00, E78.01, E78.5, E78.79, E78.9	272.0, 272.4, 272.8, 272.9	
BMI: < 19.9 20-29 30-39 ³ 40.0	Z68.1 Z68.20-Z68.29 Z68.30-Z68.39 Z68.41-Z68.45	< 19: V85.0 19-24: V85.1 25.0-29.9: V85.21-V85.25 30.0-39.9: V85.30-V85.39 ³ 40.0: V85.41-V85.44	
Acute Renal Failure	N17.0-N17.9	584.5-584.9	
Chronic kidney disease Stage I Stage II Stage III Stage IV Stage V ESRD CKD, with dialysis CKD, without dialysis CKD + Hypertension	 N18.1 N18.2 N18.3 N18.4 N18.5 N18.6 Z99.2 N18.1-N18.9 I12.0, I12.9, I13.0, I13.1, I13.10, I13.11, I13.2	 585.1 585.2 585.3 585.4 585.5 585.6 V45.11 585.1-585.9 403.00-403.91, 404.00-404.93	
Obesity	E66-E66.9	278-278.3	
Resuscitation	5A12012, 5A19054	93.93, 99.60	92950

Arrhythmia	R00.0-R00.1, R00.8-R00.9 I44-I44.7, I45-I45.9, I47.0-I47.9, I48-I48.92, I49-I49.9,	426.0-426.9, 427.0-427.9, 785.0	
Hypovolemic Shock	R57.1	785.59	
Cardiogenic Shock	R57.0	785.51	
Hypotension	I95.0-I95.3, I95.89, I95.9	458.0-458.1, 458.29-458.9	
Aortic Valve Replacement	02RF07Z, 02RF0JZ, 02RF08Z, 02RF0KZ, 02RF37H, 02RF38H, 02RF3JH, 02RF3KH, 02RF37Z, 02RF38Z, 02RF3JZ, 02RF3KZ, 02RF47Z, 02RF48Z, 02RF4JZ, 02RF4KZ, Z95.2- Z95.4	35.21, 35.22, 35.05, 35.06, V43.3, V42.2	33405 33406 33410 33361 33362 33363 33364 33365 33366 33367 33368 33369
Chest Pain	I20.0-I20.9	413.1, 413.9, 411.1	
Liver dysfunction	K76.0-K76.9, K70-K70.9, K71.0-K71.9, K72.0-K74.9, B18.0-B18.9	570, 571.0-571.9, 572.2-572.8, 573.3-573.9, 070.22, 070.23, 070.32, 070.33, 070.44, 070.54, 070.59, 070.6, 070.9	
Immunosupression	Z79.51-Z79.52 D80.0-D89.9	V58.65, 279.00-279.9	
Cardiopulmonary Bypass Time	5A1221Z	39.61, 39.66	33367, 33368, 33369, 33390, 33391, 33405, 33406, 33410, 33858, 33859, 33863, 33864, 33871, 33870
Neurological Deficit (hemiplagia, paraplagia)	G81.00-G81.94, G82.2-G82.22	342.00-342.92, 344.1	

Atrial Fibrillation	Paroxysmal: I48.0 Persistent: I48.11-I48.19 Chronic: I48.20-I48.21 Unspecified: I48.91	427.31	
Atrial Flutter	Typical: I48.3 Atypical: I48.4 Unspecified: I48.92	427.32	
Use of Anticoagulants	Z79.01-Z79.02	V58.61, V58.63	
Use of Systemic Steroids	Z79.51-Z79.52	V58.65	
Acute Visceral/Mesenteric Ischemia	K55.0-K55.069	557.0	
Coma at Admission	R40.20	780.01	
Vasopressor Use	3E030XZ, 3E033XZ, 3E040XZ, 3E043XZ	00.17	

Aneurysm Repair/Treatment Codes

Open Approach ICD-10		**Open Approach ICD-9**	
Replacement of Thoracic Aorta, Ascending/Arch with Autologous Tissue Substitute, Open Approach	02RX07Z	Resection of vessel with anastomosis, other thoracic vessels	38.35
Replacement of Thoracic Aorta, Ascending/Arch with Zooplastic Tissue, Open Approach	02RX08Z	Resection of vessel with replacement, thoracic vessels	38.45
Replacement of Thoracic Aorta, Ascending/Arch with Synthetic Substitute, Open Approach	02RX0JZ		
Replacement of Thoracic Aorta, Ascending/Arch with Nonautologous Tissue Substitute, Open Approach	02RX0KZ		
Replacement of Thoracic Aorta, Descending with Autologous Tissue Substitute, Open Approach	02RW07Z		
Replacement of Thoracic Aorta, Descending with Zooplastic Tissue, Open Approach	02RW08Z		
Replacement of Thoracic Aorta, Descending with Synthetic Substitute, Open Approach	02RW0JZ		
Replacement of Thoracic Aorta, Descending with Nonautologous Tissue Substitute, Open Approach	02RW0KZ		

Supplement Thoracic Aorta, Descending with Autologous Tissue Substitute, Open Approach	02UW07Z		
Supplement Thoracic Aorta, Descending with Zooplastic Tissue, Open Approach	02UW08Z		
Supplement Thoracic Aorta, Descending with Synthetic Substitute, Open Approach	02UW0JZ		
Supplement Thoracic Aorta, Descending with Nonautologous Tissue Substitute, Open Approach	02UW0KZ		
Supplement Thoracic Aorta, Ascending/Arch with Autologous Tissue Substitute, Open Approach	02UX07Z		
Supplement Thoracic Aorta, Ascending/Arch with Zooplastic Tissue, Open Approach	02UX08Z		
Supplement Thoracic Aorta, Ascending/Arch with Synthetic Substitute, Open Approach	02UX0JZ		
Supplement Thoracic Aorta, Ascending/Arch with Nonautologous Tissue Substitute, Open Approach	02UX0KZ		
Restriction of Thoracic Aorta, Descending with Intraluminal Device, Open Approach	02VW0DZ		
Restriction of Thoracic Aorta, Ascending/Arch with Intraluminal Device, Open Approach	02VX0DZ		
Repair Thoracic Aorta, Descending, Open Approach	02QW0ZZ		
Repair Thoracic Aorta, Ascending/Arch, Open Approach	02QX0ZZ		
Percutaneous Approach ICD-10		**Percutaneous/Hybrid Approach ICD-9**	
Replacement of Thoracic Aorta, Ascending/Arch with Autologous Tissue Substitute, Percutaneous Endoscopic Approach	02RX47Z	Endovascular implantation of graft in thoracic aorta	39.73
Replacement of Thoracic Aorta, Ascending/Arch with Zooplastic Tissue, Percutaneous Endoscopic Approach	02RX48Z		
Replacement of Thoracic Aorta, Ascending/Arch with Synthetic Substitute, Percutaneous Endoscopic Approach	02RX4JZ		
Replacement of Thoracic Aorta, Ascending/Arch with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach	02RX4KZ		

Replacement of Thoracic Aorta, Descending with Autologous Tissue Substitute, Percutaneous Endoscopic Approach	02RW47Z		
Replacement of Thoracic Aorta, Descending with Zooplastic Tissue, Percutaneous Endoscopic Approach	02RW48Z		
Replacement of Thoracic Aorta, Descending with Synthetic Substitute, Percutaneous Endoscopic Approach	02RW4JZ		
Replacement of Thoracic Aorta, Descending with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach	02RW4KZ		
Supplement Thoracic Aorta, Descending with Autologous Tissue Substitute, Percutaneous Approach	02UW37Z		
Supplement Thoracic Aorta, Descending with Zooplastic Tissue, Percutaneous Approach	02UW38Z		
Supplement Thoracic Aorta, Descending with Synthetic Substitute, Percutaneous Approach	02UW3JZ		
Supplement Thoracic Aorta, Descending with Nonautologous Tissue Substitute, Percutaneous Approach	02UW3KZ		
Supplement Thoracic Aorta, Descending with Autologous Tissue Substitute, Percutaneous Endoscopic Approach	02UW47Z		
Supplement Thoracic Aorta, Descending with Zooplastic Tissue, Percutaneous Endoscopic Approach	02UW48Z		
Supplement Thoracic Aorta, Descending with Synthetic Substitute, Percutaneous Endoscopic Approach	02UW4JZ		
Supplement Thoracic Aorta, Descending with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach	02UW4KZ		
Supplement Thoracic Aorta, Ascending/Arch with Autologous Tissue Substitute, Percutaneous Approach	02UX37Z		
Supplement Thoracic Aorta, Ascending/Arch with Zooplastic Tissue, Percutaneous Approach	02UX38Z		
Supplement Thoracic Aorta, Ascending/Arch with Synthetic Substitute, Percutaneous Approach	02UX3JZ		

Supplement Thoracic Aorta, Ascending/Arch with Nonautologous Tissue Substitute, Percutaneous Approach	02UX3KZ		
Supplement Thoracic Aorta, Ascending/Arch with Autologous Tissue Substitute, Percutaneous Endoscopic Approach	02UX47Z		
Supplement Thoracic Aorta, Ascending/Arch with Zooplastic Tissue, Percutaneous Endoscopic Approach	02UX48Z		
Supplement Thoracic Aorta, Ascending/Arch with Synthetic Substitute, Percutaneous Endoscopic Approach	02UX4JZ		
Supplement Thoracic Aorta, Ascending/Arch with Nonautologous Tissue Substitute, Percutaneous Endoscopic Approach	02UX4KZ		
Restriction of Thoracic Aorta, Ascending/Arch with Intraluminal Device, Percutaneous Approach	02VX3DZ		
Restriction of Thoracic Aorta, Ascending/Arch with Intraluminal Device, Percutaneous Endoscopic Approach	02VX4DZ		
Repair Thoracic Aorta, Ascending/Arch, Percutaneous Approach	02QX3ZZ		
Repair Thoracic Aorta, Ascending/Arch, Percutaneous Endoscopic Approach	02QX4ZZ		
Restriction of Thoracic Aorta, Descending with Intraluminal Device, Percutaneous Approach	02VW3DZ		
Restriction of Thoracic Aorta, Descending with Intraluminal Device, Percutaneous Endoscopic Approach	02VW4DZ		
Repair Thoracic Aorta, Descending, Percutaneous Approach	02QW3ZZ		
Repair Thoracic Aorta, Descending, Percutaneous Endoscopic Approach	02QW4ZZ		

Outcome Codes	**ICD-10**
Post-procedural CVA following Cardiac Surgery	97.820
Post-procedural Visceral Mesentery Ischemia	K55.059
Post-procedural Renal Failure	N99.0
Post-procedural Cardiac Surgery Functional Decline	97.190
Post-procedural Unspecified Complication	T81.9xxA

CPT Description	CPT Code
TAA repair-sternotomy	33859, 33860, 33863, 33864, 33866, 33870, 33871, 33875
Ascending aorta graft, with cardiopulmonary bypass, includes valve suspension, when performed; for aortic dissection	33858
Ascending aorta graft, with cardiopulmonary bypass, includes valve suspension, when performed; for aortic disease other than dissection (eg, aneurysm)	33859
Ascending aorta graft, with cardiopulmonary bypass, includes valve suspension, when performed	33860
Ascending aorta graft, with cardiopulmonary bypass, with aortic root replacement using valved conduit and coronary reconstruction (eg, Bentall)	33863
Ascending aorta graft, with cardiopulmonary bypass with valve suspension, with coronary reconstruction and valve-sparing aortic root remodeling (eg, David Procedure, Yacoub Procedure)	33864
Aortic hemiarch graft including isolation and control of the arch vessels, beveled open distal aortic anastomosis extending under one or more of the arch vessels, and total circulatory arrest or isolated cerebral perfusion (List separately in addition to code for primary procedure)	33866
Transverse arch graft, with cardiopulmonary bypass	33870
Repair Procedures for Thoracic Aortic Aneurysm	33871
Descending thoracic aorta graft, with or without bypass	33875
TEVAR- Ascending & Arch-Not present	NO CODE
TEVAR-Descending	33880, 33881, 33883, 33884, 33886, 33889, 33891
Endovascular repair of descending thoracic aorta (eg, aneurysm, pseudoaneurysm, dissection, penetrating ulcer, intramural hematoma, or traumatic disruption); involving coverage of left subclavian artery origin, initial endoprosthesis plus descending thoracic aortic extension(s), if required, to level of celiac artery origin	33880
Endovascular repair of descending thoracic aorta (eg, aneurysm, pseudoaneurysm, dissection, penetrating ulcer, intramural hematoma, or traumatic disruption); not involving coverage of left subclavian artery origin, initial endoprosthesis plus descending thoracic aortic extension(s), if required, to level of celiac artery origin	33881
Placement of proximal extension prosthesis for endovascular repair of descending thoracic aorta (eg, aneurysm, pseudoaneurysm, dissection, penetrating ulcer, intramural hematoma, or traumatic disruption); initial extension	33883

Placement of proximal extension prosthesis for endovascular repair of descending thoracic aorta (eg, aneurysm, pseudoaneurysm, dissection, penetrating ulcer, intramural hematoma, or traumatic disruption); each additional proximal extension	33884
Placement of distal extension prosthesis(s) delayed after endovascular repair of descending thoracic aorta	33886
Open subclavian to carotid artery transposition performed in conjunction with endovascular repair of descending thoracic aorta, by neck incision, unilateral	33889
Bypass graft, with other than vein, transcervical retropharyngeal carotid, performed in conjunction with endovascular repair of descending thoracic aorta, by neck incision	33891

SAMPLE TABLES

SAMPLE TABLE 1: Descriptive statistics for overall TAA, nrTAA, and rTAA populations

Variable	Total (n=XXXXX)	TAA non-rupture (n=XXXXX)	TAA ruptured/ dissection (n=XXXX)	P-value[a]
Patient Characteristics				
Surgery Type				
Elective				
No Surgery				
Urgent/Emergent				
Any Surgery				
Gender (Female)				
Age				
Age Group				
<80				
>=80				
Race 1				
Black				
Other				
White				
Race 2				
Asian				
Other				
Insurance 1- Dr. M				
Commercial				
Government				
Other				

Season				
Fall				
Spring				
Summer				
Winter				
Year Group				
<2014				
>=2014				
Elderly Women				
Elderly Women with Government Insurance				
Year				
2005				
2006				
2007				
2008				
2009				
2010				
2011				
2012				
2013				
2014				
2015				
2016				
2017				
2018				
Race SPARCS				
Asian				
Black				
Missing				
Multi-racial				
Native American or Alaskan Native				
Native Hawaiian or Other Pacific Islander				
Other Race				
Unknown				
White				
Ethnicity SPARCS				
Missing				
Multi-ethnic				
Not of Spanish/Hispanic Origin				
Spanish/Hispanic Origin				
Unknown				

Insurance SPARCS				
Blue Cross				
CHAMPUS				
Disability				
Insurance Company				
Medicaid				
Medicare				
Missing				
Other Federal Program				
Other Non-Federal Program				
Self-Pay				
Unknown				
Workers Compensation				
Risk Factors				
Admission Type				
Elective				
Urgent/Emergent				
Atherosclerotic Disease of Aorta				
Carotid Disease				
Coronary Artery Disease				
Congestive Heart Failure				
Hypertension				
Myocardial Infarction				
Aortic Valve Disease				
Aortic Coarctation				
Diabetes mellitus				
Chronic Obstructive Pulmonary Disease				
Tobacco/Smoking				
Cerebrovascular Disease				
Peripheral Vascular Disease				
Prior Percutaneous Coronary Intervention				
Dialysis				
Hyperlipidemia				
Chronic Kidney Disease				
Obesity				
Arrhythmia				
Cardiogenic Shock				
Hypotension				
Chest Pain				
Liver dysfunction				
Immunosupression				

Neurological Deficit				
Resuscitation				
Aortic Valve Replacement				
Atrial Fibrillation				
Atrial Flutter				
Chronic Renal Disease				
Non-Rheumatic Aortic Regurgitation				
Non-Rheumatic Aortic Stenosis				
Dyslipidemia				
Comorbidity Score				
Elixhauser Comorbidity Index				
Elixhauser Score Comorbidities				
Obesity				
Congestive Heart Failure				
Valvular Disease				
Pulmonary Circulation Disease				
Peripheral Vascular Disease				
Hypertension (uncomplicated/complicated)				
Paralysis				
Neurodegenerative disorders				
Chronic pulmonary disease				
Diabetes (uncomplicated)				
Diabetes (complicated)				
Hypothyroidism				
Renal Failure				
Liver Disease				
Peptic Ulcer Disease, excluding bleeding				
AIDS/HIV				
Lymphoma				
Metastatic cancer				
Solid tumor w/out metastasis				
Rheumatoid arthritis/collagen vascular disease				
Coagulopathy				
Weight loss				
Fluid and electrolyte disorders				
Blood loss anemia				

Deficiency Anemia				
Alcohol abuse				
Drug abuse				
Psychoses				
Depression				
[a]For categorical variables, p-values were based on Chi-squared test with exact p-value from Monte Carlo simulation; for continuous variable, p-value was based on Wilcoxon rank sum test. Note: For continuous variable, median+/-IQR were reported.				

SAMPLE TABLE 2: Estimated two trends and their changes for TAA patients' rates per 100,000 NYS residents

	Trend before 2014		**Trend after 2014**		**Trend change**	
Patients	**Estimate (95% CI)**	**P-value[a]**	**Estimate (95% CI)**	**P-value[a]**	**Estimate (95% CI)**	**P-value[a]**
TAA ruptured/dissection						
TAA non-rupture						
TAA total						
[a]P-values were based on t tests from linear regression models.						

SAMPLE TABLE 3: Estimated coefficients and odds ratio (95% CI) of explanatory variables for emergent/urgent surgery among TAA patients based on a multivariable logistic regression model (Elixhauser comorbidity index)
*analyses will be conducted for elective surgery as well

Variable	**Level**	**Coefficient**	**Levels**	**Odds ratio (95% CI)**	**P-value**
Intercept					
Disease					
Race					
Year Group					

Variable	Level	Coefficient	Levels	Odds ratio (95% CI)	P-value
Elderly women Government-Dr. Shroyer					
Coronary Artery Disease					
Myocardial Infraction					
Aortic Valve Disease					
Tobacco/Smoking					
Cerebrovascular Disease					
Dyslipidemia-Dr. Bilfinger					
Elixhauser comorbidity index					
*: P-value was based on type 3 test of multivariable logistic regression. Note: C-index=0.8900; Hosmer and Lemeshow Goodness-of-Fit Test Statistic= 58.5952, df=8 and P-value<.0001.					

SAMPLE TABLE 3: Estimated coefficients and odds ratio (95% CI) of explanatory variables for 30-day operative death among TAA patients based on a multivariable logistic regression model (Elixhauser comorbidity index)
*analyses will be conducted for 30-day readmission as well

Variable	Level	Coefficient	Levels	Odds ratio (95% CI)	P-value*
Intercept					
Year Group					
Insurance					
Disease					
Race					
Admission type					
Elderly women					
Cerebrovascular Disease					
History of Myocardial Infraction					
Elixhauser comorbidity index					

Note: See attached files for the Elixhauser comorbidity codes planned to be used to calculate comorbidity scores.