

Selected Analytic Findings: Denominators, Resource Use, and Risk Adjustment

Low back pain, Asthma, CAD, COPD, and AMI

QASC Episodes Workgroup Meeting:
September 11, 2009

General Project Updates

- Rapid testing and validation of measures
 - Focus on measures likely to be included in NQF “call for measures”
- Continuous feedback loop with physician workgroups, TAC, and QASC to refine measures
- Preparing measures and analyses for submission to NQF in late 2009
- Working with CMS to test AMI on Medicare data sample; results expected in late 2009

Overview of Measure Testing and Validation Process

- Size of, and attrition from episode denominator
- “Level 1” Analyses of resource use
 - Total episode spending by type of service
 - Top 20 “condition-related” E&M, procedures, imaging, tests, inpatient admissions (by ICD-9 and DRG) and drugs, by service counts and dollar volume
 - Top 20 “non-condition-related” E&M, procedures, imaging, tests, inpatient admissions, and drugs by service counts and dollar volume
- “Level 2” Analyses of resource use
 - Incorporate risk adjustment
 - Identify specific drivers of resource use variation

***Note: analytic results are preliminary and subject to change*

Document for internal discussion purposes

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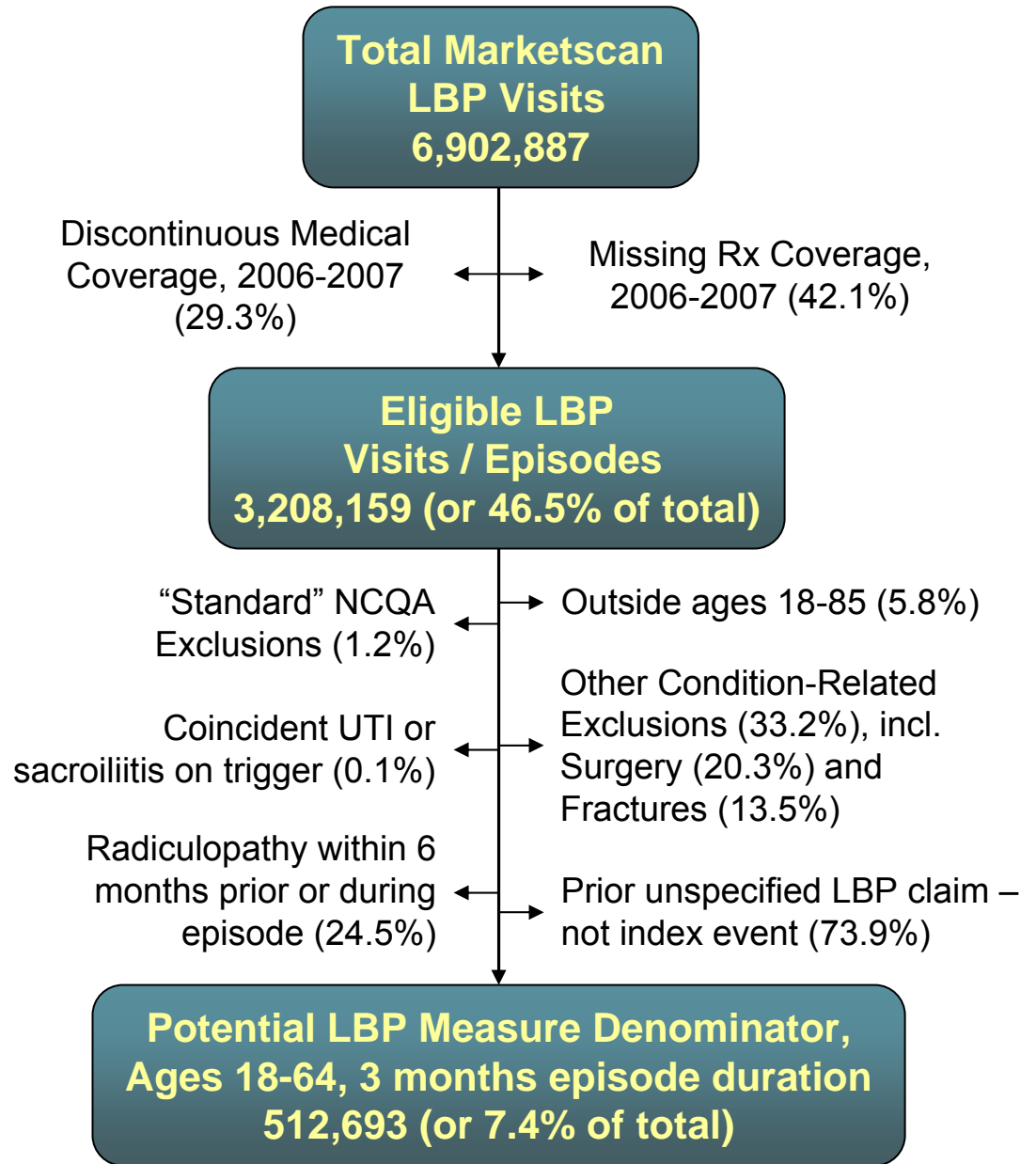
Initial Findings from Measure Testing and Validation

- Observed resource use generally meets ‘face validity’ thresholds for physician workgroups
- For several episodes (e.g., AMI, CHF, COPD), the MarketScan database contains only small samples
 - Continuous Medical and Rx coverage requirements have large impact on attrition from denominator
 - Medicare population will likely have larger samples
 - Permits only limited testing of attribution models (also impaired by missing physician/hospital IDs)

Unspecified LBP Measure Denominator

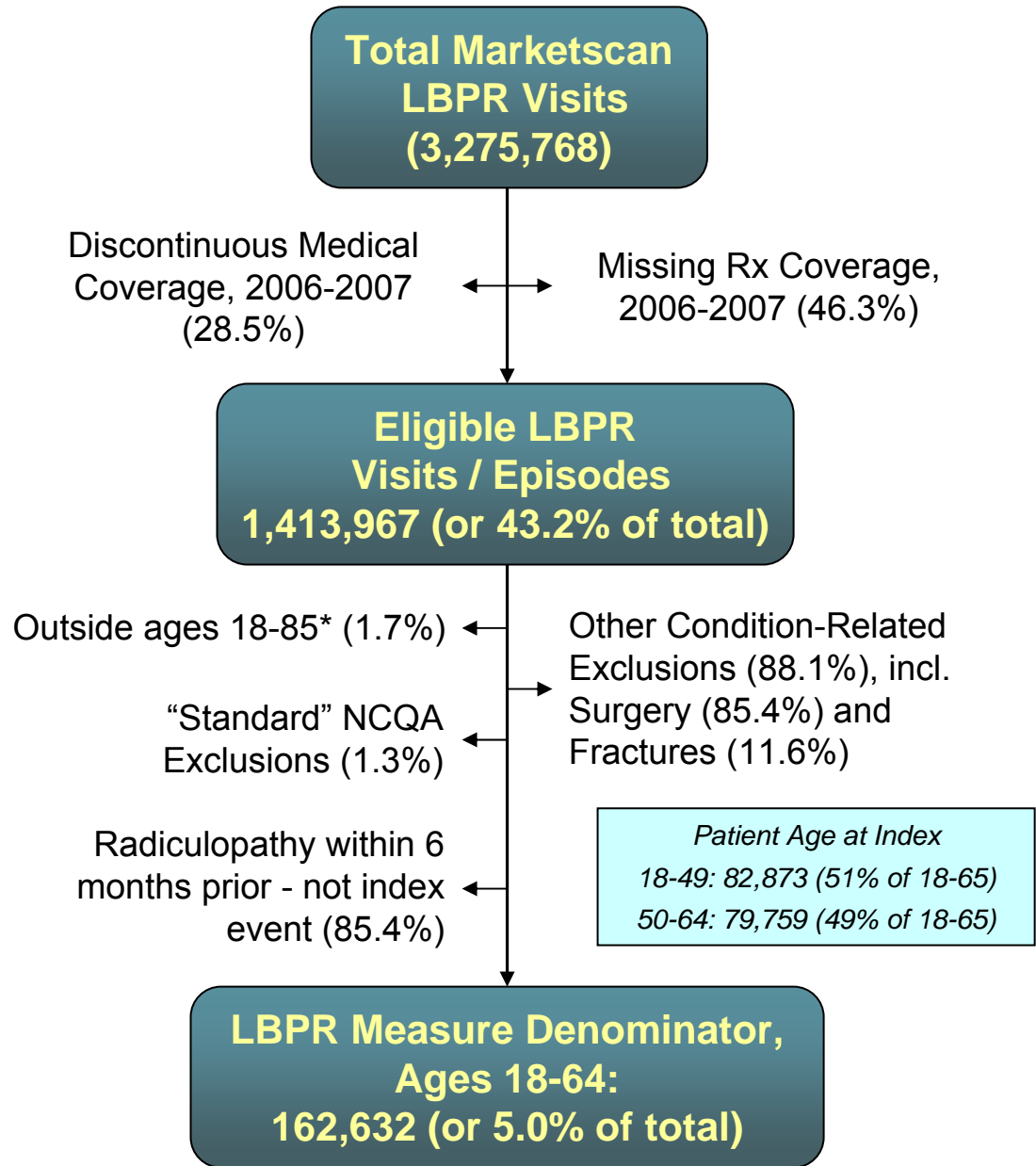
- 3 mos. (or 6 wks.) of care for patient with 1+ ambulatory care visits with non-specific LBP ICD-9 code (expanded list): 724.2, 724.5, 724.8, 724.9, 739.3, 739.4 or 847.2
- Ages 18-85*, to be stratified into elderly (65-85) and non-elderly (18-64) groups
- Episode triggers between July 1, 2006 and August 31, 2007
- Test data: Marketscan 2006-2007
- Note: exclusions are not additive (double-counting occurs often)

* Marketscan database contains data for non-elderly population only (under 65); as such, no data are presented for the elderly (65+) group



LBP Radiculopathy Measure Denominator

- 3 months of care for patient with 1+ ambulatory care visits with radiculopathy ICD-9 code: 721.3, 721.9, 722.1, 722.5, 724.3, or 724.4
- Ages 18-85*, to be stratified into elderly (65-85) and non-elderly (18-64) groups
- Episode triggers between July 1, 2006 and August 31, 2007
- Test data: Marketscan 2006-2007
- Note: exclusions are not additive (double-counting occurs often)

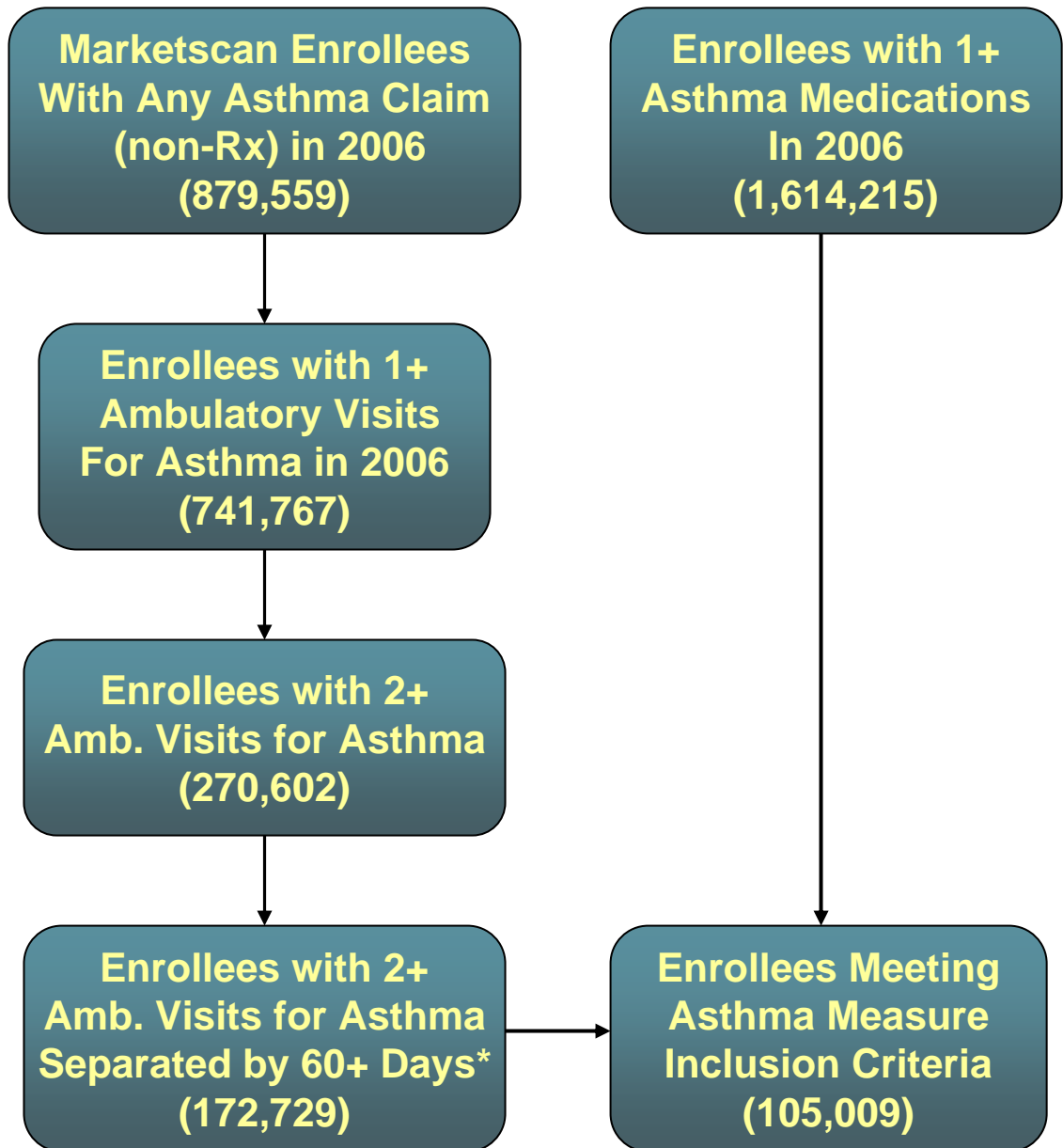


* Marketscan database contains data for non-elderly population only (under 65)

Asthma One-Year Measure Denominator

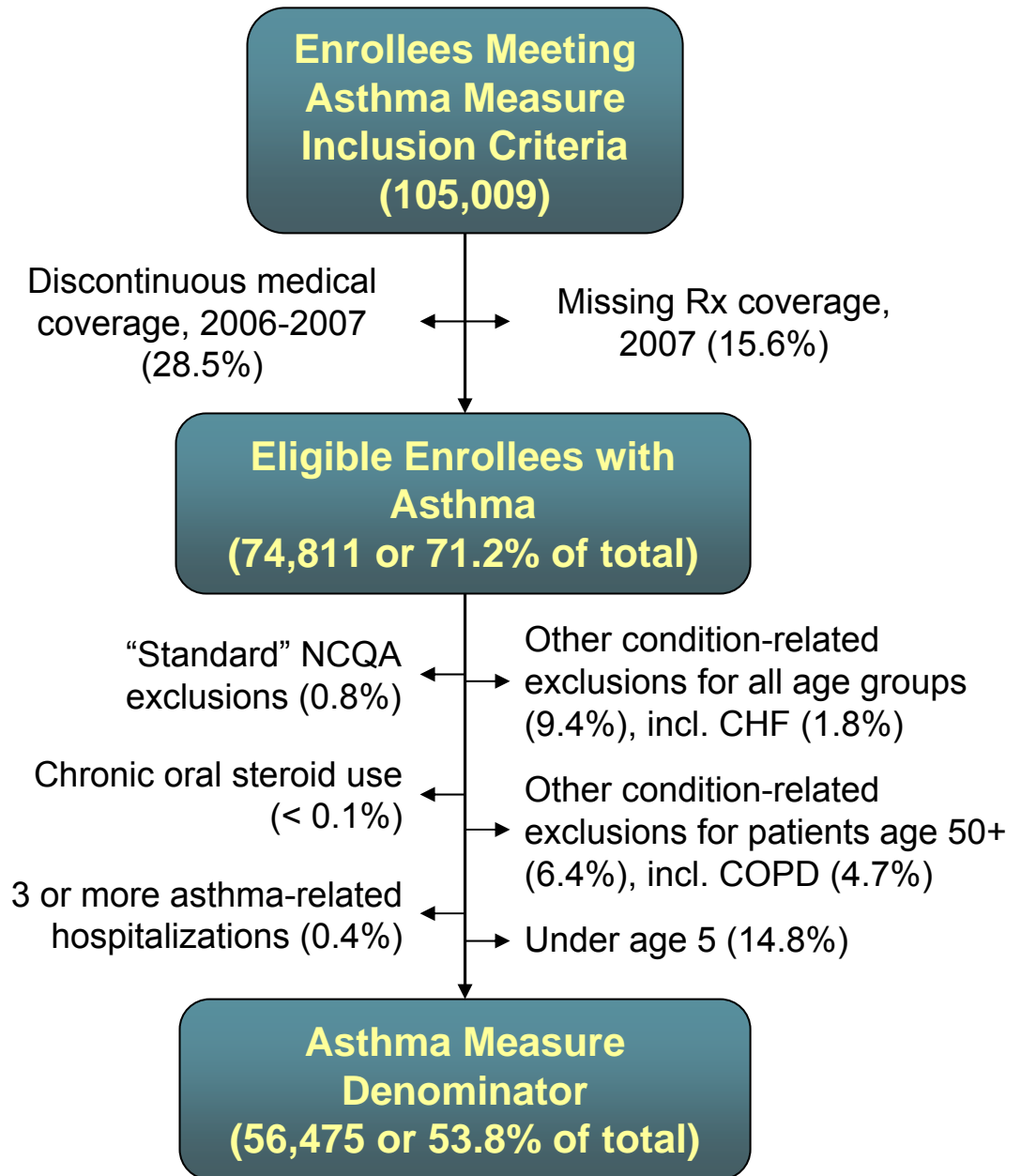
- At least two ambulatory visits with Dx of 493.x in 2006, separated by at least 60 days
- At least one asthma medication (see p.4, Table ASTHMA-B) in 2006
- Identification period: Jan. 1, 2006 – Dec. 31, 2006
- Measurement window: Jan. 1, 2007 – Dec. 31, 2007

* If requirement were reduced to 30+ days' separation, an additional ~15,000 episodes would meet measure inclusion criteria.



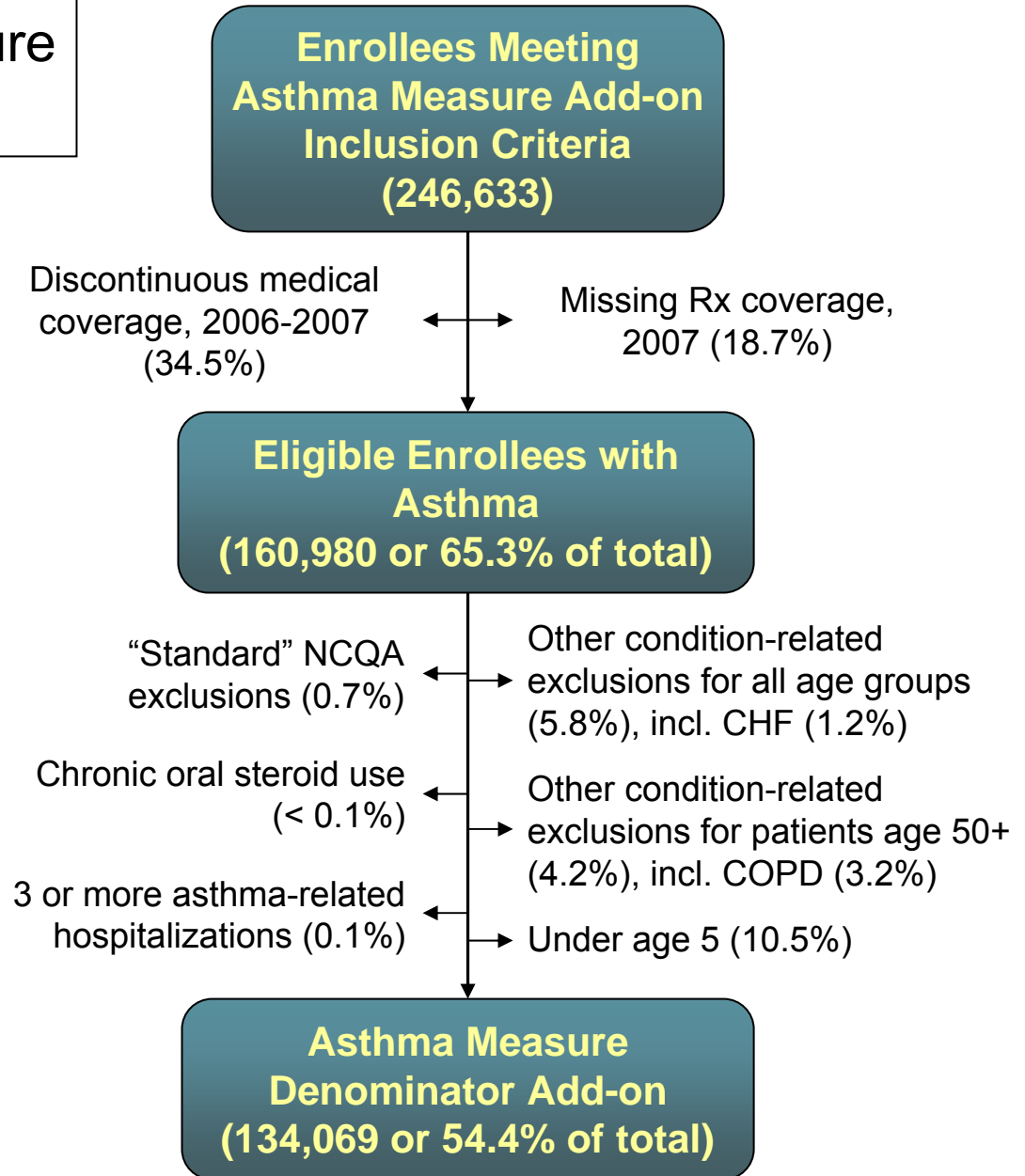
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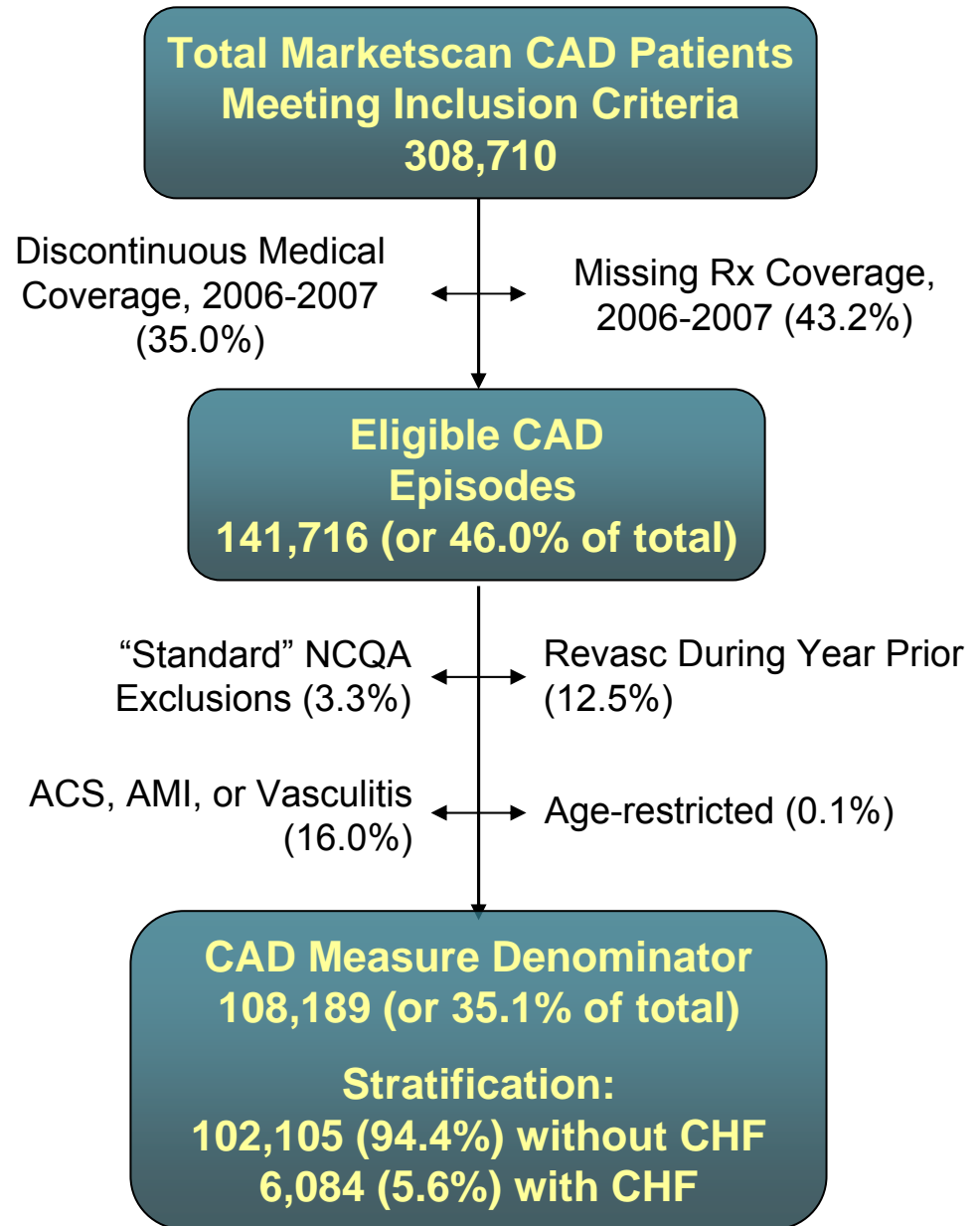
Asthma One-Year Measure Denominator Add-on

- Exactly one ambulatory visit with Dx of 493.x in 2006
- At least one asthma medication (see p.4, Table ASTHMA-B) in 2006
- Measurement window: Jan. 1, 2007 – Dec. 31, 2007
- Note: exclusions are not additive (double-counting occurs often)



CAD Chronic Measure Denominator

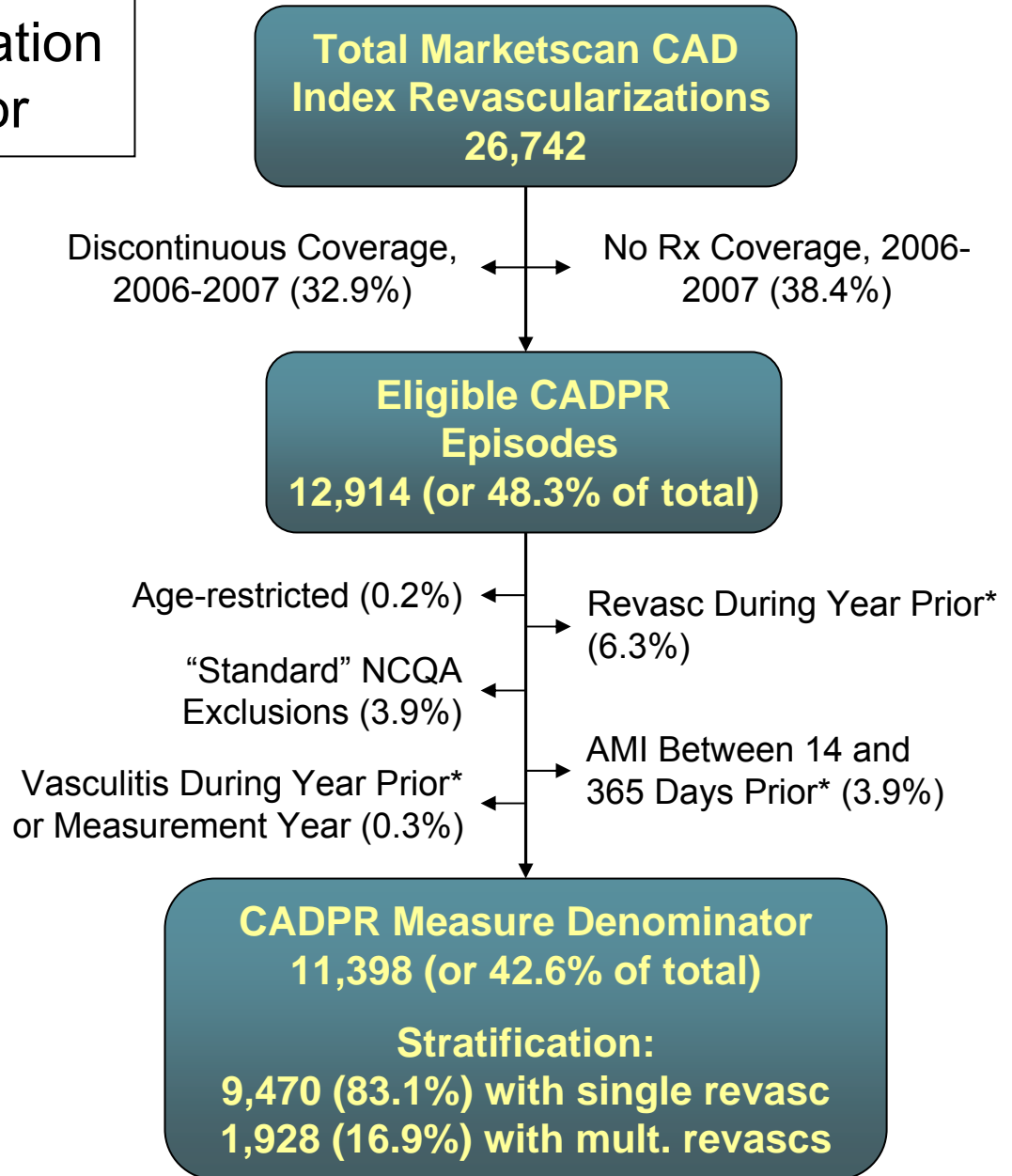
- 12 months of CAD management/care for patient with 1+ CAD ambulatory care visits during previous year
- Measurement window: January 1, 2007 – December 31, 2007
- Test data: Marketscan 2006-2007
- Note: exclusions are not additive (double-counting occurs often)



CAD Post-Revascularization Measure Denominator

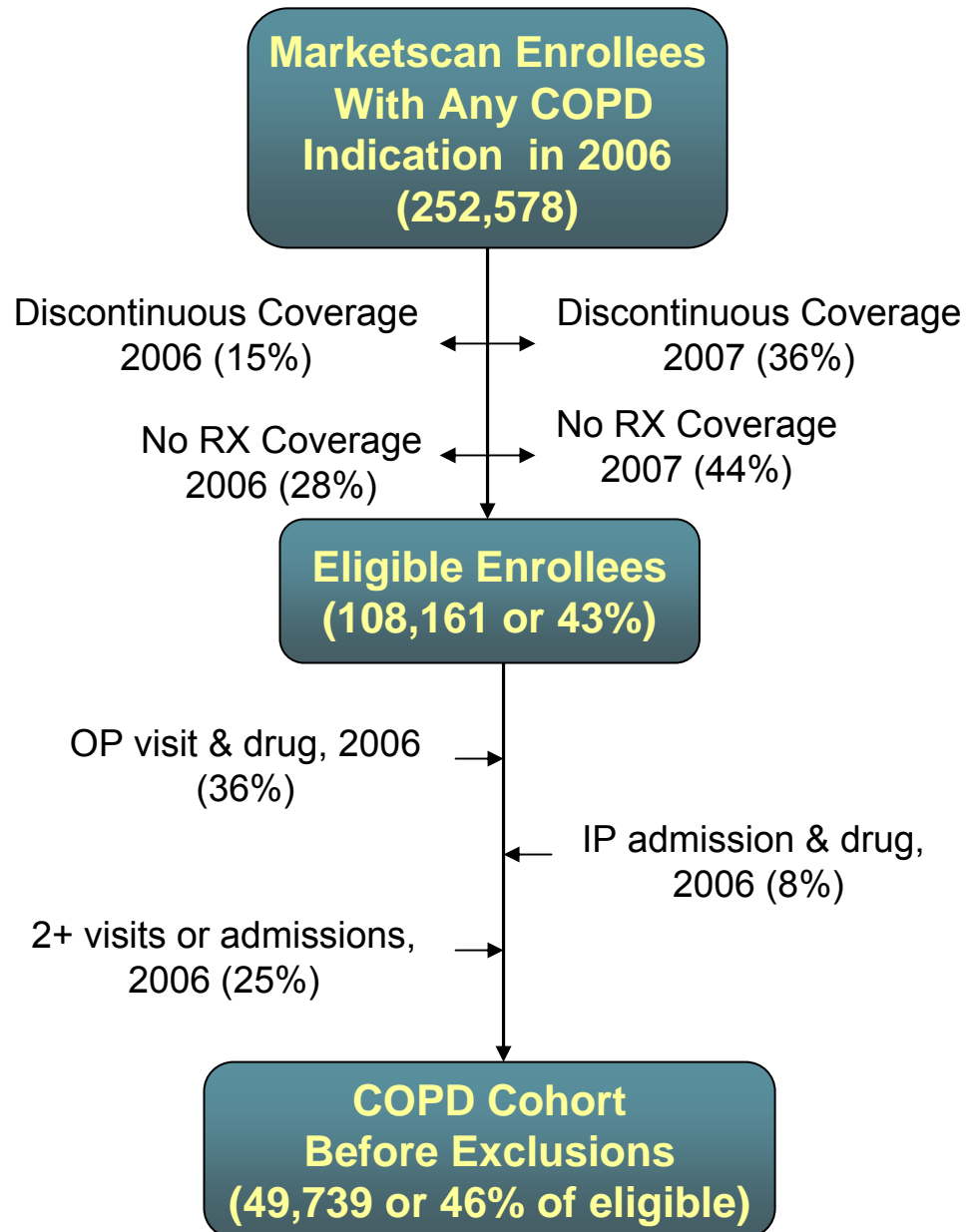
- 12 months of CAD management following revascularization (PCI or CABG)
- Index admissions during July 1, 2006 – December 31, 2006
- Test data: Marketscan 2006-2007
- Note: exclusions are not additive (double-counting occurs often)

* Exclusion applied to all available data for each episode – between 6 and 12 months look-back



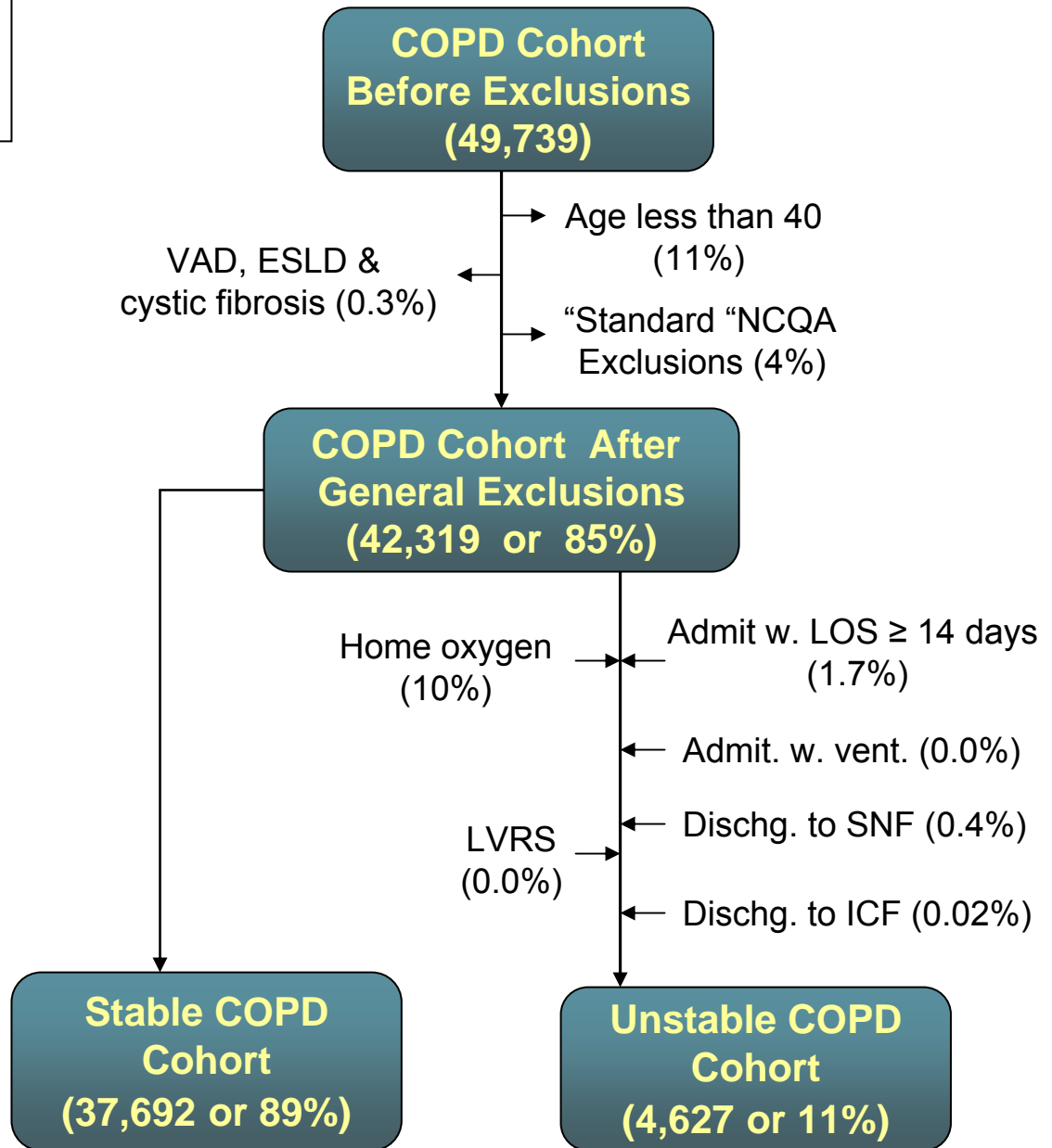
COPD Measure Denominators

- Identification: 2006
- Measurement: 2007
- Inclusion Criteria:
 - OP E&M claim & drug, or
 - IP claim & drug, or
 - 2+ claims (OP E&M and/or IP)
- Note: exclusions and inclusions are not additive (double-counting occurs often)



COPD Measure Denominators

- Standard NCQA exclusions
- Age, ventricular assist device, ESLD, cystic fibrosis
- Inclusion criteria for unstable COPD:
 - 2+ mo. Home Oxygen, or
 - Severe COPD hospitalization, or
 - Lung volume reduction surgery
- Note: exclusions are not additive (double-counting occurs often)



Coronary Artery Disease

- CAD Chronic Management: CAD-related care during the calendar year following a year with at least one ambulatory visit for CAD
 - Overall resource use by type of service
 - Common imaging procedures by CPT
 - CAD-related versus non-CAD-related
- CAD Management Post-Revascularization: 12 months of CAD-related care following a PCI or CABG procedure
 - Overall resource use by type of service

Key changes based on initial analyses: Include services with Chest Pain NEC and Chest Pain NOS ICD-9 codes, echocardiography CPT codes

Resource Use by Type of Service: Chronic CAD

Description	Mean	% of Total	5th %	25th %	50th %	75th %	95th %
Inpatient Facility Charge	\$1,297	33%	\$0	\$0	\$0	\$0	\$7,662
Evaluation & Management	\$364	9%	\$0	\$63	\$148	\$296	\$1,477
Procedures	\$228	6%	\$0	\$0	\$0	\$0	\$1,274
Imaging	\$386	10%	\$0	\$0	\$20	\$581	\$1,614
Tests	\$132	3%	\$0	\$0	\$64	\$184	\$464
Durable Medical Equip.	\$8	0%	\$0	\$0	\$0	\$0	\$0
Drug Charges	\$1,498	38%	\$0	\$599	\$1,331	\$2,203	\$3,635
Other Drugs and Services	\$33	1%	\$0	\$0	\$0	\$0	\$186
Unclassified	\$4	0%	\$0	\$0	\$0	\$0	\$0
Sum of Charges	\$3,951	100%	\$77	\$1,115	\$2,192	\$3,784	\$14,026

Top 20, CAD-related Imaging, Chronic Episode

- 10% of total episode costs

CPT	Svcs.	Cost	% of Svcs	% of Cost	Description
78465	27,724	\$13,294,933	9.4%	31.9%	Myocardial perfusion imaging; tomographic (SPECT)
93307	17,366	\$3,376,897	5.9%	8.1%	Echocardiography, transthoracic
A9500	13,588	\$2,711,984	4.6%	6.5%	Technetium tc-99m sestamibi, diagnostic
78478	27,281	\$2,493,771	9.3%	6.0%	Myocardial perfusion study with wall motion
78480	27,055	\$2,417,520	9.2%	5.8%	Myocardial perfusion study with ejection fraction
A9502	8,973	\$2,048,146	3.1%	4.9%	Technetium tc-99m tetrofosmin, diagnostic
93325	18,361	\$1,829,501	6.2%	4.4%	Doppler echocardiography color flow velocity mapping
93320	18,565	\$1,663,500	6.3%	4.0%	Doppler echocardiography, pulsed wave
93880	8,231	\$1,493,352	2.8%	3.6%	Duplex scan of extracranial arteries
71020	32,737	\$1,085,895	11.1%	2.6%	Radiologic examination, chest, two views
A9505	4,739	\$858,503	1.6%	2.1%	Thallium tl-201 thallos chloride, diagnostic
93556	8,335	\$763,788	2.8%	1.8%	Imaging supervision; pulmonary angiography, aortography
93555	7,486	\$584,064	2.5%	1.4%	Imaging supervision; ventricular and/or atrial angiography
71010	22,134	\$544,266	7.5%	1.3%	Radiologic examination, chest; single view
93545	8,140	\$493,554	2.8%	1.2%	Injection for coronary angiography
71275	1,306	\$296,348	0.4%	0.7%	CT angiography, chest (noncoronary)
36245	671	\$284,558	0.2%	0.7%	Selective catheter placement, arterial system
93543	7,062	\$279,757	2.4%	0.7%	Injection for selective left ventricular or left atrial angiography
93925	1,294	\$260,713	0.4%	0.6%	Duplex scan of lower extremity arteries or bypass grafts
70553	439	\$191,044	0.1%	0.5%	Magnetic resonance (eg, proton) imaging, brain
Total	294,007	\$41,738,264	100.0%	100.0%	

Common non-CAD-related Imaging, Chronic Episode

CPT	Label	Related	Not Related	Related Costs	Non-Related Costs
72148	Magnetic resonance (eg, proton) imaging, spinal canal and contents,	64	3,206	\$14,471	\$1,302,267
73721	Magnetic resonance (eg, proton) imaging, any joint of lower extremi	54	2,837	\$11,810	\$1,143,875
70553	Magnetic resonance (eg, proton) imaging, brain (including brain sten	439	1,873	\$191,044	\$1,136,186
93307	Echocardiography, transthoracic, real-time with image documentatio	17,367	4,946	\$3,376,897	\$937,122
73221	Magnetic resonance (eg, proton) imaging, any joint of upper extrem	34	2,000	\$6,247	\$799,035
72193	Computed tomography, pelvis; with contrast material(s)	271	4,187	\$43,220	\$713,182
72141	Magnetic resonance (eg, proton) imaging, spinal canal and contents,	49	1,865	\$11,710	\$709,859
74160	Computed tomography, abdomen; with contrast material(s)	299	3,791	\$52,026	\$697,230
74170	Computed tomography, abdomen; without contrast material, follow	191	2,543	\$43,240	\$658,965
77057	Screening mammography, bilateral (2-view film study of each breast	72	8,353	\$3,261	\$586,946
72158	Magnetic resonance (eg, proton) imaging, spinal canal and contents,	12	829	\$3,991	\$506,618
74150	Computed tomography, abdomen; without contrast material	250	3,426	\$33,140	\$500,150
93325	Doppler echocardiography color flow velocity mapping (List separate	18,362	5,177	\$1,829,501	\$496,619
71260	Computed tomography, thorax; with contrast material(s)	676	2,603	\$114,830	\$493,017
72192	Computed tomography, pelvis; without contrast material	212	3,223	\$25,449	\$479,874
77080	Dual-energy X-ray absorptiometry (DXA), bone density study, 1 or m	119	4,614	\$9,304	\$457,285
93320	Doppler echocardiography, pulsed wave and/or continuous wave wi	18,566	5,206	\$1,663,500	\$451,458
70450	Computed tomography, head or brain; without contrast material	815	3,610	\$97,931	\$433,502
77003	Fluoroscopic guidance and localization of needle or catheter tip for s	101	4,930	\$6,170	\$364,288
71250	Computed tomography, thorax; without contrast material	234	1,787	\$42,294	\$344,906

Resource use by TOS, Post-revascularization CAD

Description	Mean	% of Total	5th %	25th %	50th %	75th %	95th %
Inpatient Facility Charge	\$2,010	16%	\$0	\$0	\$0	\$0	\$10,919
Evaluation and Management	\$1,822	14%	\$71	\$469	\$1,144	\$2,365	\$5,867
Procedures	\$4,160	33%	\$99	\$1,692	\$2,171	\$5,648	\$11,979
Imaging	\$868	7%	\$0	\$280	\$623	\$1,305	\$2,320
Tests	\$328	3%	\$0	\$88	\$221	\$421	\$994
Durable Medical Equipment	\$51	0%	\$0	\$0	\$0	\$0	\$174
Other Services	\$266	2%	\$0	\$0	\$0	\$18	\$1,223
Unclassified	\$49	0%	\$0	\$0	\$0	\$0	\$0
Drug Charges	\$3,095	24%	\$154	\$1,933	\$2,967	\$4,065	\$6,285
Sum of charges	\$12,649	100%	\$3,577	\$6,740	\$9,628	\$14,442	\$30,360

Chronic Obstructive Pulmonary Disease

- COPD - Stable Management: 12 months of COPD-related care following a year with any combination of E&M or inpatient care for COPD or a bronchodilator Rx
 - Overall resource use by type of service
 - Common durable medical equipment by CPT
 - COPD-related versus non-COPD-related
- COPD - Unstable Management: Stable Management episode PLUS patient received home O2 therapy, lung volume reduction surgery, or a severe COPD-related hospitalization during prior year
 - Overall resource use by type of service

Key changes based on initial analyses: Include oxygen concentrators, nebulizers, and heated humidifier DME charges and, for the unstable episode only, services with hypoxemia ICD-9 codes among related resource use

Resource Use by Type of Service: Stable COPD

Description	Mean	% of Total	5th %	25th %	50th %	75th %	95th %
Inpatient Facility Charge	\$1,434	28%	\$0	\$0	\$0	\$0	\$10,216
Evaluation & Management	\$758	15%	\$63	\$243	\$451	\$873	\$2,403
Procedures	\$279	5%	\$0	\$0	\$0	\$289	\$1,248
Imaging	\$420	8%	\$0	\$20	\$136	\$566	\$1,681
Tests	\$304	6%	\$0	\$63	\$187	\$410	\$982
Durable Medical Equip.	\$211	4%	\$0	\$0	\$0	\$3	\$924
Drug Charges	\$1,604	31%	\$7	\$246	\$804	\$2,350	\$5,500
Other Drugs and Services	\$148	3%	\$0	\$0	\$13	\$37	\$424
Unclassified	\$34	1%	\$0	\$0	\$0	\$0	\$0
Sum of charges	\$5,192	100%	\$410	\$1,285	\$2,825	\$5,653	\$17,867

Top 20, COPD-related DME, Stable Episode

- 4% of total episode costs

CPT	Svcs.	Cost	% of Svcs	% of Cost	Description
E1390	10,925	\$2,161,927	27%	56%	Oxygen concentrator, single delivery port
A7034	2,416	\$229,112	6%	6%	Nasal interface (mask or cannula type)
E0570	4,516	\$208,533	11%	5%	Nebulizer, with compressor
A7030	942	\$146,548	2%	4%	Full face mask used with positive airway pressure device
E0483	59	\$144,696	0%	4%	High frequency chest wall oscillation air-pulse generator system
A7037	2,839	\$97,682	7%	3%	Tubing used with positive airway pressure device
A7035	2,829	\$96,196	7%	2%	Headgear used with positive airway pressure device
E0443	747	\$83,566	2%	2%	Portable oxygen contents, gaseous
J7620	732	\$53,614	2%	1%	Albuterol, up to 2.5 mg and ipratropium bromide
J7626	275	\$44,842	1%	1%	Budesonide, inhalation solution
E1399	193	\$42,992	0%	1%	Durable medical equipment, miscellaneous
E0601	339	\$42,782	1%	1%	Continuous airway pressure (cpap) device
K0738	777	\$41,052	2%	1%	Portable gaseous oxygen system, rental
E1392	141	\$33,243	0%	1%	Portable oxygen concentrator, rental
A7038	2,811	\$29,037	7%	1%	Filter, disposable, used with positive airway pressure device
E0470	111	\$28,039	0%	1%	Respiratory assist device
A7032	534	\$25,358	1%	1%	Cushion for use on nasal mask interface
E0431	734	\$25,239	2%	1%	Portable gaseous oxygen system, rental
K0823	6	\$23,051	0%	1%	Power wheelchair
J7614	295	\$20,098	1%	1%	Levalbuterol, inhalation solution
Total	40,579	\$3,892,011	100%	100%	

Common non-COPD-related DME, Stable Episode

CPT	Label	Related	Not Related	Related Costs	Non-Related Costs
E1390	Oxygen concentrator, single delivery port, capable of delivering 85 p	10,925	5,588	\$2,161,927	\$1,107,899
E0601	Continuous airway pressure (cpap) device	339	6,835	\$42,782	\$941,391
E2402	Negative pressure wound therapy electrical pump, stationary or porta	0	119	\$0	\$358,493
A4253	Blood glucose test or reagent strips for home blood glucose monitor	12	2,906	\$1,585	\$354,898
E0470	Respiratory assist device, bi-level pressure capability, without backu	111	1,304	\$28,039	\$352,595
E0562	Humidifier, heated, used with positive airway pressure device	117	2,355	\$10,428	\$240,950
E0748	Osteogenesis stimulator, electrical, non-invasive, spinal applications	0	64	\$0	\$213,119
E0784	External ambulatory infusion pump, insulin	0	41	\$0	\$146,045
A4230	Infusion set for external insulin pump, non needle cannula type	0	201	\$0	\$123,157
E0935	Continuous passive motion exercise device for use on knee only	1	137	\$271	\$83,855
K0823	Power wheelchair, group 2 standard, captains chair, patient weight c	6	30	\$23,051	\$81,590
E0730	Transcutaneous electrical nerve stimulation (tens) device, four or mo	2	409	\$80	\$72,546
E1399	Durable medical equipment, miscellaneous	193	229	\$42,992	\$68,434
E0570	Nebulizer, with compressor	4,516	194	\$208,533	\$10,998

Resource use by TOS, Unstable COPD Episode

Description	Mean	% of Total	5th %	25th %	50th %	75th %	95th %
Inpatient Facility Charge	\$15,355	55%	\$0	\$0	\$0	\$16,592	\$69,821
Evaluation & Management	\$2,484	9%	\$188	\$627	\$1,409	\$2,912	\$8,258
Procedures	\$569	2%	\$0	\$0	\$45	\$575	\$2,484
Imaging	\$852	3%	\$0	\$148	\$546	\$1,189	\$2,791
Tests	\$501	2%	\$13	\$142	\$336	\$661	\$1,508
Durable Medical Equip.	\$4,332	15%	\$0	\$1,492	\$4,230	\$5,797	\$9,490
Drug Charges	\$3,299	12%	\$96	\$940	\$2,569	\$4,805	\$8,726
Other Drugs and Services	\$397	1%	\$0	\$0	\$31	\$217	\$1,779
Unclassified	\$284	1%	\$0	\$0	\$0	\$0	\$716
Sum of charges	\$28,073	100%	\$4,377	\$9,266	\$15,134	\$31,037	\$90,466

Acute Myocardial Infarction

- AMI Acute Episode: In-hospital and post-discharge care over the 30 days following admission for AMI
- AMI Post-acute Episode: For the same patients observed in AMI Acute Episode, AMI-related care over days 31-365 following admission

Acute Myocardial Infarction

- Risk Adjustment Modeling
 - Use modified CMS Hierarchical Condition Categories (HCC) Model
 - *Advantages*: non-proprietary, transparent, has been rigorously evaluated/tested by CMS and others (e.g., NCQA)
 - *Disadvantages*: Generally used to adjust for TOTAL costs of care. Comorbidities that affect total costs may not affect any given individual episodes costs
 - HVHC C3 approach: Use clinician judgment *a priori* to determine relevant comorbid conditions for each episode

Risk Adjustment Model Specification

- Test 6 different model specifications
 - Logged GLM model using gamma distribution
 - Full list of recommended comorbidities
 - Only recommended comorbidities that are statistically significant
 - Only recommended comorbidities that are statistically significant + additional comorbidities flagged for “empirical analysis”
 - Normal GLM model (estimates in dollars)
 - Same tweaks as above

Risk Adjustment Model Results

- Significant predictors of AMI costs
 - Age, sex, diabetes and cardiorespiratory failure and shock associated with higher AMI costs
- Non-significant predictors of AMI costs
 - COPD, Renal Failure, Major Complications of Trauma, Depressive Disorders, Heart Arrhythmias, Vascular Disease

AMI Acute Episode: Models Tested To Date Do Not Fit Data Well at Extremes

- Results for Models 1-6 presented below

<i>stats*</i>	Findings	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
<i>mean</i>	16,712	16,611	16,611	16,612	16,612	16,612	16,612
<i>sd</i>	12,461	1,492	1,470	1,478	1,509	1,481	1,488
<i>range</i>	57,012	12,269	11,186	11,785	12,614	10,972	11,711
<i>min</i>	6,180	12,863	14,044	13,431	12,260	13,910	13,158
<i>p1</i>	6,180	14,029	14,044	14,048	13,893	13,910	13,917
<i>p25</i>	9,407	15,710	15,736	15,747	15,651	15,760	15,756
<i>p50</i>	11,741	16,584	16,612	16,611	16,596	16,621	16,620
<i>p75</i>	18,053	17,339	17,361	17,356	17,378	17,394	17,395
<i>p99</i>	63,192	20,581	20,259	20,260	20,606	20,325	20,309
<i>max</i>	63,192	25,132	25,229	25,216	24,874	24,882	24,869

* Results presented without CHF

Next Steps

- Refine measure specifications informed by expert/public comment and data analysis
- Test/implement risk adjustment model(s) for additional episodes
- Identify “cost driver” services among high-cost episodes
- Limited test of attribution model
- Test on Medicare data