

Overview of the coronary artery bypass graft episode of care

State of Ohio

September 2016

Overview of the CABG episode of care

1. CLINICAL OVERVIEW AND RATIONALE FOR DEVELOPMENT OF THE CABG EPISODE

1.1 Rationale for development of the CABG episode of care

CABG is the most common operation performed by cardiac surgeons to treat patients with coronary artery disease (CAD).¹ Globally, CAD is the leading cause of mortality, causing over seven million deaths a year.² In the United States, CAD accounts for over 600,000 deaths a year and is responsible for one in every five deaths annually.³ To treat severe CAD patients, over 395,000 CABGs are performed each year in the U.S., or a rate of roughly 1,081 per million people.⁴ However, the rate of CABG procedures have actually declined since 2010 due to the rise of PCI procedures and to the improvements in medication management for CAD patients.⁵ In Ohio, there were over 900 CABG procedures among Medicaid beneficiaries in 2015, which accounts for approximately \$32 million in spend and a median cost of \$28,200 per CABG episode.⁶

Evidence-based clinical guidelines recommended by the American College of Cardiology (ACC) and the American Heart Association (AHA) outline several best practices for clinicians to improve quality of care and outcomes for patients.⁷ During the pre-procedural window guidelines indicate that antiplatelet medication should be discontinued to prevent major bleeding complications, statin therapy should be optimized to manage hyperlipidemia, and beta blockers should be administered to prevent incidence or clinical sequelae of postoperative atrial fibrillation.⁸

¹ Diodato M, Chedrawy EG. Coronary artery bypass graft surgery: The past, present and future of myocardial revascularization. *Surgery Research and Practice*. 2014.

² World Health Organization. Cardiovascular disease fact sheet. 2016. Accessed at <http://www.who.int/mediacentre/factsheets/fs317/en/>.

³ Cassar et al. Chronic coronary artery disease: Diagnosis and management. *Mayo Clin Proc*. 2009 Dec; 84(12): 1130–1146.

⁴ National Center for Health Statistics. National hospital discharge survey. 2010. Accessed at <http://www.cdc.gov/nchs/fastats/inpatient-surgery.htm>.

⁵ Culler SD, Kugelmass AD, Brown PP, et al. Trends in coronary revascularization procedures among Medicare beneficiaries between 2008 and 2012. *Circulation*. 2014;Epub ahead of print.

⁶ Analysis of Ohio Medicaid claims data for dates between October 1, 2014 and September 30, 2015.

⁷ Hillis et al. 2011 ACCF/AHA Guideline for Coronary Artery Bypass Graft Surgery: Executive Summary. *JACC* 2011.

⁸ Ibid.

Perioperatively, guidelines recommend aggressive control of hyperglycemia using intravenous insulin infusion to reduce short-term risk of wound infections.⁹ The provision of smoking cessation consultations (month before the procedure or afterwards) can have long-term benefits to prevent myocardial infarction and reoperation.¹⁰ Research has shown that adherence to guidelines yields clinical improvements when implemented in practice. For example, optimizing statin therapy led to a 19 percent reduction in risk of stroke¹¹ and controlling hyperglycemia has been shown to translate into a 50 percent decrease in perioperative CABG mortality.¹²

Despite these clinical guidelines, surgical and treatment practices during the operative and perioperative periods of a CABG vary widely from one provider to another. Unique patient needs will necessitate variation in surgical and treatment practice; however, practice variation due to reasons not related to the patient may lead to sub-optimal patient outcomes, higher than necessary costs, or both.

Implementing the CABG episode of care is intended to improve patient outcomes through reducing variation in care across providers. As part of a concerted effort aimed at improving overall cardiac care for Ohio Medicaid patients, the CABG episode is being deployed together with a suite of cardiovascular episodes (including episodes for percutaneous coronary intervention, cardiac valve replacement/repair, and congestive heart failure). Alongside these and other episodes of care and patient centered medical homes, the CABG episode will contribute to a model of care delivery that benefits patients through improved care quality and clinical outcomes with attention to overall cost of care.

1.2 Clinical overview and typical patient journey for a CABG procedure

A CABG is a surgical procedure involving the construction of one or more grafts between arterial and coronary circulations and can be performed using the traditional open-heart method or more minimally invasive methods (e.g. laparoscopically).¹³

9 Lazar et al. The Society of Thoracic Surgeons Practice Guideline Series: Blood Glucose Management During Adult Cardiac Surgery. Report from STS workforce on evidence based surgery. 2009.

10 Voors et al. Smoking and Cardiac Events After Venous Coronary Bypass Surgery. *Circulation of American Heart Association*. 1996.

11 The Society of Thoracic Surgeons. 2013.

12 Furnary AP, Gao G, Grunkemeier GL, et al. Continuous insulin infusion reduces mortality in patients with diabetes undergoing coronary artery bypass grafting. *J Thorac Cardiovasc Surg* 2003;125:1007–21.

13 Aroesty et al. Patient Information: Coronary artery bypass graft surgery (Beyond the Basics). UpToDate. 2016.

Both approaches are included in this episode due to the inability to separate out CABGs by approach with the current CPT procedure codes.

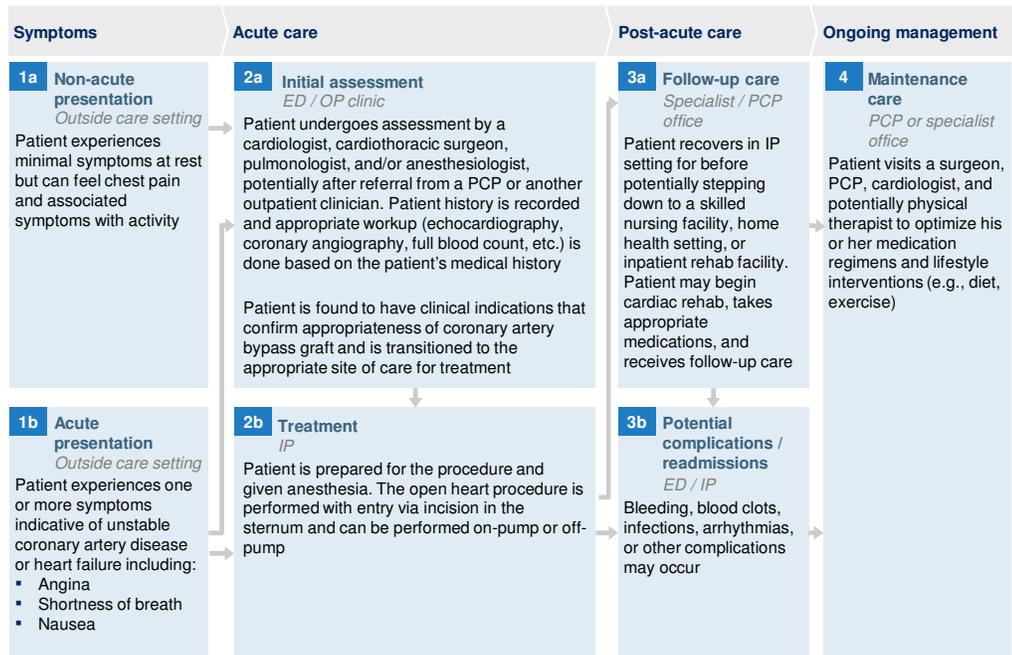
As depicted in Exhibit 1, a CABG episode is triggered by an inpatient (non-emergency department) CABG procedure with grafting of one to six veins or arteries. Up to a month before the planned procedure, patients who are candidates for the CABG procedure may experience activity-limiting symptoms despite maximum medical therapy. These may present in the form of obstructive CAD symptoms such as angina, shortness of breath, and nausea.¹⁴ The CABG procedure is planned after the patient's history is taken and the patient receives appropriate diagnostic testing. After the cardiologist works with the surgeon to schedule the surgery, the CABG episode of care is primarily under the responsibility of the operating cardiothoracic surgeon. The procedure is performed in an inpatient setting and, once complete, the patient receives follow-up inpatient care during a recovery period before being discharged. Patients may develop complications both during the procedure and afterwards (e.g., bleeding, blood clots, infections, arrhythmias).¹⁵ Some patients may require post-procedure admission and follow-ups while others may only receive follow-up visits after the CABG procedure.

The CABG episode will be complemented by a patient-centered medical home (PCMH) in Ohio to cover a broad spectrum of care delivery for Medicaid beneficiaries with CAD who require a CABG. PCMHs will focus on chronic management of CAD and other patient comorbidities before and after the CABG procedure and will handle patient referrals to cardiologists and other specialists as appropriate. To complement PCMHs, the CABG episode will focus on improving outcomes directly related to the 60-day window surrounding the CABG procedure.

¹⁴ Aroesty et al. Patient Information: Coronary artery bypass graft surgery (Beyond the Basics). UpToDate. 2016.

¹⁵ Ibid.

EXHIBIT 1 – CABG PATIENT JOURNEY



SOURCE: Clinical expert interviews; team analysis; main patient flows shown only

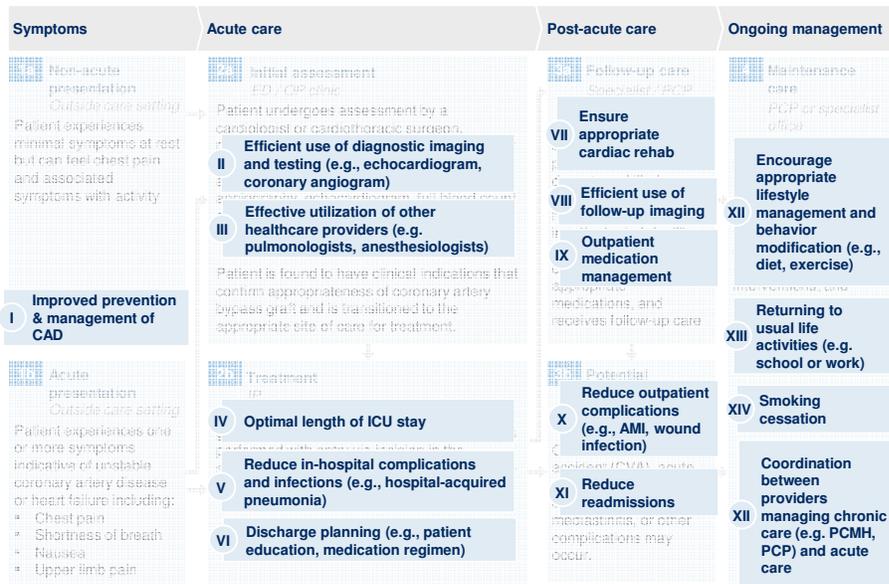
1.3 Potential sources of value within the CABG patient journey

Within the CABG episode, providers have several opportunities to improve quality of care and reduce unnecessary spend associated with the episode (see Exhibit 2). For example, providers can follow best practice clinical guidelines to reduce unnecessary variation during the diagnosis and pre-operative stages.¹⁶ This may require coordination between the cardiologist and the surgeon. Clinicians can ensure the length of stay and intensity of care during the admission is optimized, that follow-ups occur at an appropriate intervals, and that cardiac rehabilitation is initiated in a timely manner after the procedure.¹⁷ Finally, clinicians can encourage appropriate lifestyle management through exercise, diet, and smoking cessation consultations. In general, these practices can improve care quality and outcomes by reducing the likelihood of complications and post-procedure admissions, as well as reducing the overall spend for a CABG episode.

¹⁶ Ko et al. Myocardial Revascularization in New York State: Variations in the PCI-to-CABG Ratio and Their Implications. J Am Heart Assoc. 2012

¹⁷ Peterson ED et al. Hospital variability in length of stay after coronary artery bypass surgery: results from the Society of Thoracic Surgeon's National Cardiac Database. Ann Thorac Surg. 2002.

EXHIBIT 2 – CABG SOURCES OF VALUE



2. OVERVIEW OF THE CABG EPISODE DESIGN

2.1 Episode Trigger

The CABG episode is triggered by a planned (i.e. non-emergent) CABG procedure that occurs in an inpatient setting. Emergent CABGs are excluded because they represent a different patient journey. The range of procedure codes that trigger an episode include CPT codes for CABGs with one through six venous or arterial grafts. With the current procedure codes, it is not possible to distinguish between minimally invasive and conventional open heart approaches to surgery so both will be included within the scope of the episode. A complete list of trigger procedure codes is included in Table 1 in the Appendix.

2.2 Principal Accountable Provider

The principal accountable provider (PAP) is the person or entity best positioned to influence the patient journey and the clinical decisions made throughout the course of the episode. For the CABG episode the PAP is the surgeon who performs the CABG procedure. This is because the decisions regarding planning, execution, and follow-up of a CABG procedure should be under the primary purview of the surgeon.

2.3 Episode Duration

The CABG episode begins 30 days prior to the triggering procedure (called the “pre-trigger window”), includes the admission for the procedure and recovery in an inpatient setting (called the “trigger window”), and ends 30 days after discharge (called the “post-trigger window”). The 30-day pre-trigger window was deemed an appropriate period of time to capture the majority of pre-operative diagnostics, workup, and management. Similarly, the 30-day post-trigger window was an adequate time to capture readmissions, complications, follow-up care and other relevant included claims. The claims included in each window are described in more detail in section 2.4.

2.4 Included Services

The episode model is designed to address spend for care and services directly related to the diagnosis, treatment, and immediate recovery phases of the patient journey. Each period of the patient journey, or episode “window,” has a distinct claim inclusion logic derived from two major criteria: 1) that the type of included care and services must correspond to that period of the patient journey and 2) that the included care and services are understood to be directly or indirectly influenced by the PAP during that period.

The CABG episode is comprised of three distinct windows for the purpose of spend inclusions: a pre-trigger window, a trigger window, and a post-trigger window. During the pre-trigger window all diagnostic work-up (e.g., echocardiography, coronary angiography, full blood count) and pre-operative preparation (e.g., anesthesia, chest radiography) are included. During the trigger window—when the procedure and associated admission occurs—all spend is included (including medical and drug spend). During the post-trigger window (one through thirty days following discharge from the hospital), readmissions, immediate post-operative complications (e.g. myocardial infarction, renal failure, bleeding, or wound infection) and related follow up care (wound care, medication management, physical therapy, routine imaging) are included.

Throughout the episode window spend for transportation and vaccinations are excluded. Vaccination spend is excluded to prevent doctors from withholding procedures deemed beneficial for patients and transportation spend is excluded since there is variability in transportation costs among patients that falls outside of the purview of the PAP.

The total episode spend is calculated by adding up the spend amounts on all of the individual claims that were included in each of the episode windows.

2.5 Episode Exclusions and Risk Factors

To ensure that episodes are comparable across patient panels select risk factors and exclusions are applied before assessing PAP performance. Risk factors are applied to episodes to make spend more comparable across different patient severities, while episode exclusions are applied when a clinical factor deems the patient too severe (and too high spend) for risk adjustment to be possible.

In the context of episode design, risk factors are attributes (e.g., age) or underlying clinical conditions (e.g., white blood cell disease, autoimmune disease) that are likely to impact a patient's course of care and the spend associated with a given episode. Risk factors are selected via a standardized and iterative risk-adjustment process which gives due consideration to clinical relevance, statistical significance, and other contextual factors.¹⁸ Based on the selected risk factors, each episode is assigned a risk score. The total episode spend and the risk score are used to arrive at an adjusted episode spend, which is the spend by which providers are compared to each other. The final list of risk factors is detailed in Table 2 of the Appendix. Other risk factors were inputted into the model because they were clinically relevant to the CABG episode but did not come out of the model as statistically significant.¹⁹

By contrast, an episode is excluded from a patient panel when the patient has clinical factors that suggest she has experienced a distinct or different journey (e.g., pregnancy and delivery) and/or which drive significant increases in spend relative to the average patient (e.g., select cancers and HIV). In addition, there are several "business-related" exclusions. These exclusions are factors relating to reimbursement policy (e.g., whether a patient sought care out of state), the completeness of spend data for that patient (e.g., third party liability or dual eligibility), and other topics relating to episode design and implementation (e.g. overlapping episodes) during the comparison period. Episodes that have no exclusions are known as "valid" episodes and are the episodes that are used for provider comparisons. In contrast, episodes with one or more exclusions are "invalid" episodes.

For the CABG episode, both clinical and business exclusions apply. Several of the business and clinical exclusions (e.g., dual Medicare and Medicaid eligibility, patient left against medical advice, cancer diagnoses and treatment) are standard across most episodes while others are specific to this CABG episode. As the episode is intended

¹⁸ For a detailed description of the principles and process of risk adjustment for the episode-based payment model see the document, "Supporting documentation on episode risk adjustment." A current version of this document is available here:
<http://medicaid.ohio.gov/Portals/0/Providers/PaymentInnovation/Episode-Risk-Adjustment.pdf>

¹⁹ Some of these factors include diabetes, hypertension, age, and hyperlipidemia

to capture non-emergent CABGs, the episode-specific clinical exclusions (which are in addition to clinical exclusions that are standard across most episodes) are: claims with procedures or diagnoses indicating 1) resuscitation, 2) VAD, 3) pregnancy and delivery, and 4) diabetic ketoacidosis.

Additionally, in order to account for nesting and double counting of spend across implemented episodes, the CABG episode excludes any episodes that have concurrent valve repair/replacement during the trigger window or percutaneous coronary intervention (PCI) procedures two days prior to a CABG through the day of the CABG. Concurrent CABG/valve procedures are included in the valve episode and concurrent CABG/PCI will be included in the PCI episode. A detailed list of business and clinical exclusions is included in Table 3 in the Appendix.

2.6 Quality Metrics

To ensure the episode model incentivizes quality care, the CABG episode has select quality metrics. Quality metrics are calculated for each PAP meeting the minimum threshold for valid episodes. The CABG episode has six quality metrics. Three are linked to performance assessment, meaning that performance thresholds on these must be met in order for episodes to be eligible for positive incentive. The specific threshold amount will be determined during the informational reporting period. Three of the quality metrics are for informational purposes only.

The metrics tied to positive incentive payments are the 30-day follow-up care rate in the post-trigger window, beta blocker prescription fill rate, and ACE inhibitor prescription fill rate. Informational metrics include the 30-day readmission rate (excluding inpatient rehab) in the post-trigger window, rehabilitation initiation rate during the trigger and post-trigger windows, and major morbidity rate during the episode window. A complete list of quality metrics is provided in Table 4 in the Appendix.

3. APPENDIX: SUPPORTING INFORMATION AND ANALYSES

Table 1 – CABG episode triggers

Trigger group	Trigger codes (CPT codes)	Description
One venous graft	33510	Coronary Artery Bypass 1 Coronary Venous Graft
Two venous grafts	33511	Coronary Artery Bypass 2 Coronary Venous Grafts
Three venous grafts	33512	Coronary Artery Bypass 3 Coronary Venous Grafts
Four venous grafts	33513	Coronary Artery Bypass 4 Coronary Venous Grafts
Five venous grafts	33514	Coronary Artery Bypass 5 Coronary Venous Grafts
Six venous grafts	33516	Coronary Artery Bypass 6 Coronary Venous Grafts
One arterial graft	33533	Cabg W/Arterial Graft Single Arterial Graft
Two arterial grafts	33534	Cabg W/Arterial Graft Two Arterial Grafts
Three arterial grafts	33535	Cabg W/Arterial Graft Three Arterial Grafts
Four arterial grafts	33536	Cabg W/Arterial Graft Four/>Arterial Grafts

Table 2 –CABG episode risk factors

Risk factor	Description	Relevant time period
Acute Cerebrovascular Disease	Patient has diagnosis of acute cerebrovascular disease	During the episode window or during the 365 days before the episode window
Autoimmune and Connective Tissue Disease	Patient has diagnosis of autoimmune and connective tissue disease	During the episode window or during the 365 days before the episode window
Bacterial Infection	Patient has diagnosis of bacterial infection	365 days before the episode window
Coagulation and hemorrhagic disorders	Patient has diagnosis of coagulation and hemorrhagic disorders	During the episode window or during the 365 days before the episode window
Diseases of white blood cells	Patient has diagnosis of diseases of white blood cells	During the episode window or during the 365 days before the episode window
Diseases of veins and lymphatics	Patient has diagnosis of diseases of veins and lymphatics	During the episode window or during the 365 days before the episode window
Pacemaker and defibrillator	Patient has diagnosis of pacemaker and defibrillator	During the episode window or during the 365 days before the episode window

Table 3 – CABG episode exclusions

Exclusion type	Episode exclusion	Description	Relevant time period
Business Exclusions	Concurrent scope	Patient has a valve procedure or percutaneous coronary intervention	During the trigger window
	Dual	Patient had dual coverage by Medicare and Medicaid	During the episode window
	FQHC/RHC	PAP is classified as a federally qualified health center (FQHC) or a rural health clinic (RHC)	During the episode window
	Incomplete episode	Non-risk-adjusted episode spend is less than the incomplete episode threshold	During the episode window
	Inconsistent enrollment	Patient has gaps in full Medicaid coverage	During the episode window
	Long hospitalization	Hospitalization is longer than (>) 30 days	During the episode window
	Long-term care	Patient has one or more long-term care claim detail lines	During the episode window
	Missing APR-DRG	A DRG-paid inpatient claim is missing the APR-DRG and severity of illness	During the episode window
	Multiple payers	Patient changes enrollment between FFS and an MCP or between MCPs	During the episode window
	PAP out of state	The principle accountable provider operates out of state	During the episode window
No PAP	An episode's billing provider number is not available	During the episode window	

Exclusion type	Episode exclusion	Description	Relevant time period
Business Exclusions	Third-party liability	Third-party liability charges are present on any claim or claim detail line, or the patient has relevant third-party coverage at any time	During the episode window
Standard clinical exclusion	Cancer diagnoses and treatment	Patient is diagnosed with or received treatment for active cancer	During the episode or up to 90 days before the start of the episode
	Coma	Patient is diagnosed with coma	During the episode or up to 365 days before the start of the episode
	Cystic fibrosis	Patient is diagnosed with cystic fibrosis	During the episode or up to 365 days before the start of the episode
	Death	Patient had a discharge status of "expired" on any inpatient or outpatient claim during the episode window or has a date of death before the end of the episode window	During the episode window
	End stage renal disease	Patient has diagnosis or procedure for end stage renal disease	During the episode or up to 365 days before the start of the episode
	HIV	Patient is diagnosed with HIV	During the episode or up to 365 days before the start of the episode
	Left against medical advice	Patient has a discharge status of "left against medical advice or discontinued care"	During the episode window
	Multiple other comorbidities	Patient has too many risk factors to reliably risk adjust the episode spend	During the episode window
	Multiple sclerosis	Patient is diagnosed with multiple sclerosis	During the episode window or during the 365 days

Exclusion type	Episode exclusion	Description	Relevant time period
Standard clinical exclusion	Paralysis	Patient has diagnosis of paralysis	During the episode or up to 365 days before the start of the episode
	Transplant	Patient has an organ transplant	During the episode or up to 365 days before the start of the episode
Episode-specific clinical exclusion	Age	Patient is younger than eighteen (<18) or older than sixty-four (>64) years of age	During the episode window
	DKA or Hyperosmolarity	Patient is diagnosed with diabetes with ketoacidosis or hyperosmolarity	During the episode or up to 365 days before the start of the episode
	Emergent CABG	CABG procedure happens in an emergent setting	During the trigger window
	High-outlier exclusion	Risk-adjusted episode spend is greater than the high outlier threshold	During the episode window
	Low-outlier exclusion	Non-risk-adjusted episode spend is less than the low outlier threshold	During the episode
	Pneumonia	Patient is diagnosed with pre-existing pneumonia	During the first day of the trigger window
	Pregnancy and/or Delivery	Patient is pregnant or delivers	During the episode or up to 90 days before the start of the episode
	Resuscitation	Patient receives a resuscitation procedure	During the trigger window
	Ventricular Assistance Device	Patient receives a ventricular assistance device procedure	During the episode or up to 365 days before the start of the episode

Table 4 – CABG episode quality metrics (PAP level)

Metric type	Field name	Description	Relevant time period
Tied to incentive payments	Follow-up care rate within 30 days	Percent of valid episodes where patient receives relevant follow-up care	During the post-trigger window (30-days)
	Beta blocker prescription fill rate	Percent of valid episodes where patient fills a beta blocker prescription	During the episode window
	ACE inhibitor prescription fill rate	Percent of valid episodes where patient fills an ACE inhibitor prescription	During the episode window
Informational	Major morbidity rate	Percent of valid episodes where the patient has a major morbidity	During the episode window
	Readmission rate within 30 days	Percent of valid episodes with an included admission or relevant observation care (excluding inpatient rehab facilities)	During the post-trigger window (30-days)
	Rehabilitation rate post-procedure	Percent of episodes with initiation of rehabilitation	During the trigger and post-trigger windows

EXHIBIT 3 – CABG EPISODE TRIGGER GROUPS¹

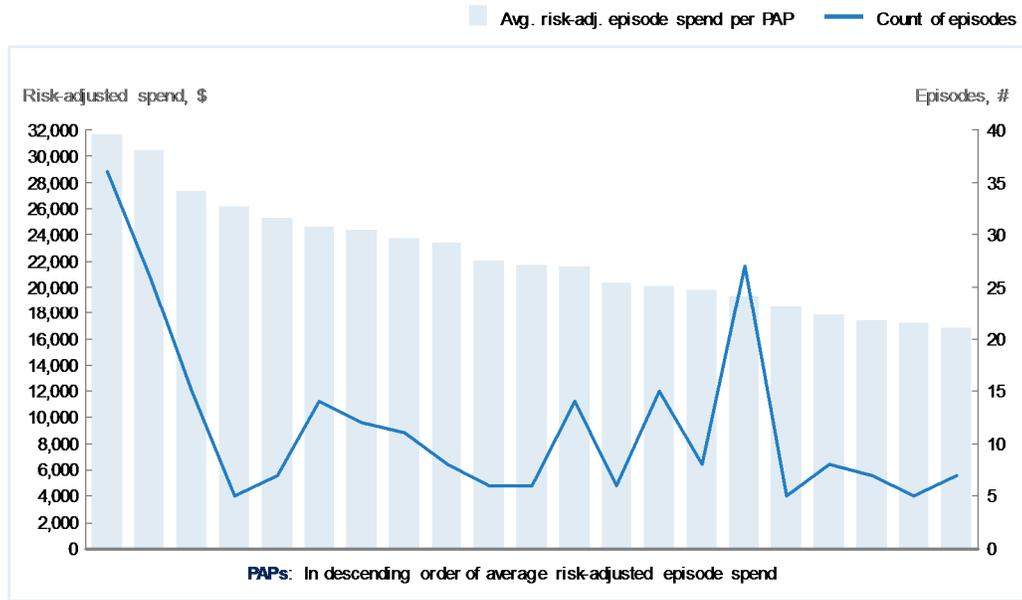
Trigger groups	Risk-adjusted median episode spend, \$	Count of episodes	Count of members	Total risk-adjusted spend, \$	Count of PAPs by episode volume ²
Total episodes	22,136	302	302	7,156,184	47
One arterial graft	22,112	235	235	5,508,385	43
Two arterial grafts	21,751	48	48	1,203,168	19
Three arterial grafts	22,831	5	5	108,380	4
Four arterial grafts	18,022	1	1	18,021	1
One venous graft	21,714	4	4	90,983	4
Two venous grafts	25,027	5	5	137,688	4
Three venous grafts	20,829	2	2	41,658	2
Four venous grafts	27,740	1	1	27,740	1
Five venous grafts	20,161	1	1	20,161	1

■ High (>20 valid episodes)
 ■ Medium (5 to 20 valid episodes)
 ■ Low (<5 valid episodes)

1. For valid episodes (309 episodes) across 47 PAPs; valid episodes do not include episodes with business (e.g., third-party liability, dual eligibility) or clinical exclusions (e.g., cancer, ESRD); count of PAPs includes valid PAPs (e.g. ≥ 5 valid episodes) and invalid PAPs (e.g. < 5 valid episodes)
2. Low volume is defined as PAPs with less than five valid episodes, Medium volume as PAPs with five to 20 valid episodes and High volume as PAPs with more than 20 valid episodes

SOURCE: OH claims data, episodes ending between 10/1/2014 and 9/30/2015

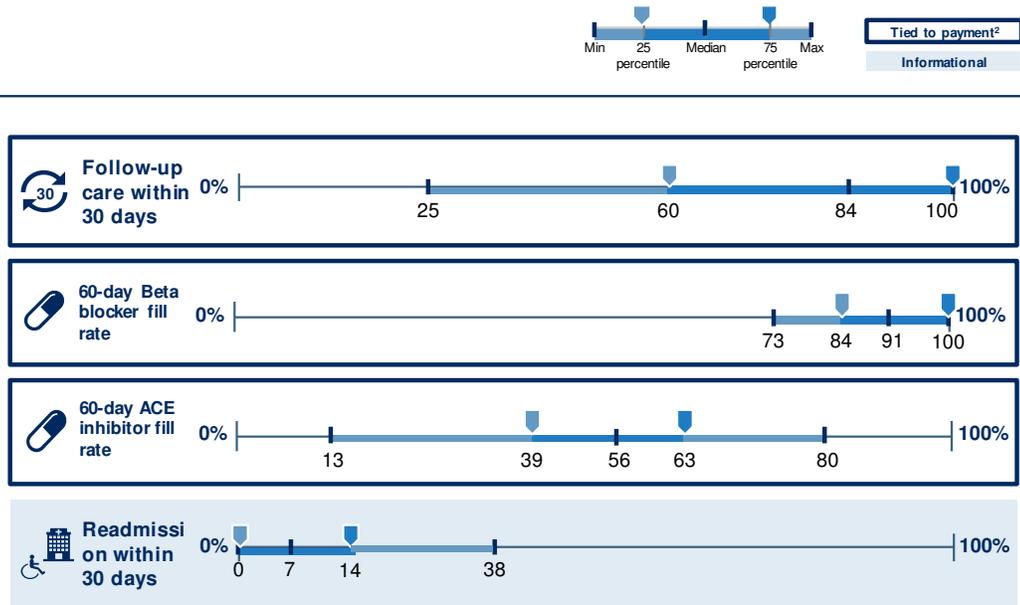
EXHIBIT 4 - DISTRIBUTION OF AVERAGE RISK-ADJUSTED EPISODE SPEND AND COUNT BY PAP¹



1. For valid episodes (309) across valid PAPs (21); valid episodes do not include episodes with business (e.g., third-party liability, dual eligibility) or clinical exclusions (e.g., cancer, ESRD); valid PAPs are physicians with five or more episodes.

SOURCE: OH claims data, episodes ending between 10/1/2014 and 9/30/2015

EXHIBIT 5 - PAP PERFORMANCE ON EPISODE QUALITY METRICS¹

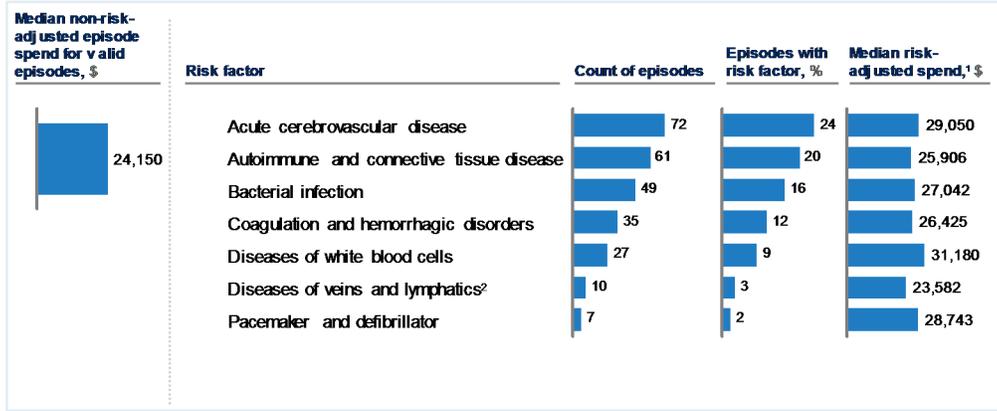


1. For valid episodes (309) across valid PAPs (21); valid episodes do not include episodes with business (e.g., third-party liability, dual eligibility) or clinical exclusions (e.g., cancer, ESRD); valid PAPs are physicians with five or more episodes. Valid episodes for invalid PAPs (those with less than five valid episodes) are not included in this analysis.

2. Metric is tied to positive incentive payments

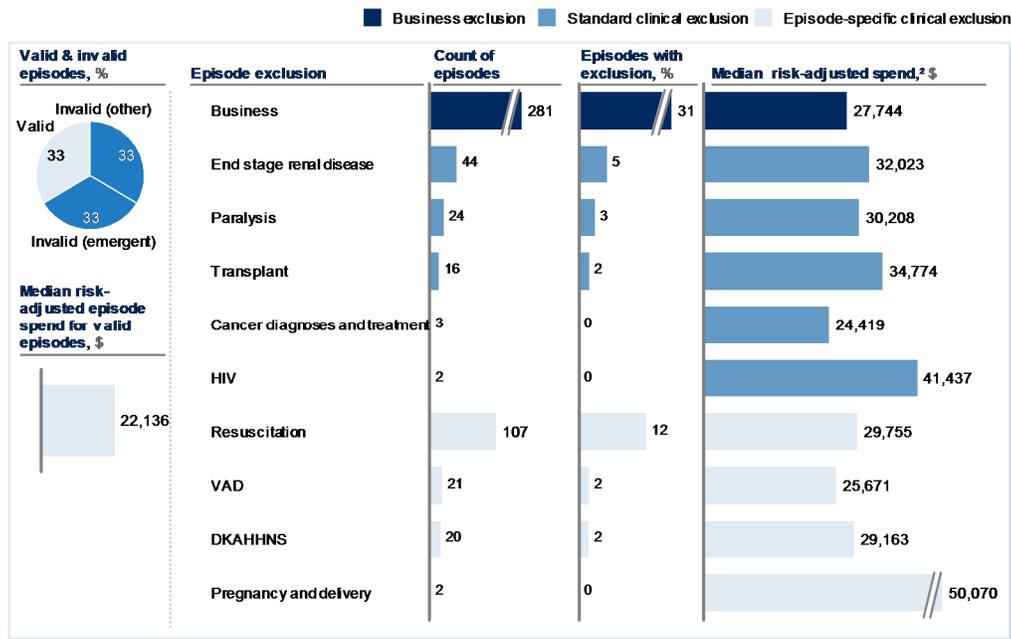
SOURCE: OH claims data, episodes ending between 10/1/2014 and 9/30/2015

EXHIBIT 6 - EPISODE COUNT AND SPEND BY RISK FACTORS



1. For episodes with this risk factor; one episode can have multiple risk factors
 2. Although median spend is lower than for all valid episodes, average spend is higher at 26,600
- SOURCE: OH claims data, episodes ending between 10/1/2014 and 9/30/2015

EXHIBIT 7 - EPISODE COUNT AND SPEND BY EXCLUSIONS¹



1. Showing top five (by volume) episode exclusions only for standard clinical and episode-specific exclusions
2. For episodes with this exclusion; one episode can have multiple exclusions

SOURCE: OH claims data, episodes ending between 10/1/2014 and 9/30/2015